

TENSION CONTROLLER  
MODEL LE-40MD  
INSTRUCTION MANUAL



- Read through this manual, and use the unit correctly.  
Make sure to understand “Cautions on safety” completely.
- Store this manual carefully, and make sure to send it to the end user.

# Cautions on Safety



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



To assure safety	
<ul style="list-style-type: none"> <li>· Make sure the user thoroughly read this instruction manual before using the unit , and pay attention in assuring safety while using the unit .</li> <li>· 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 .</li> </ul>	



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



	<b>Danger:</b> When the unit is handled incorrectly , a dangerous situation may occur and the possibility of death or serious injury is expected .
	<b>Caution:</b> 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 .



	<b>Danger</b> 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 .



	<b>Danger</b> 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 .


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



	<b>Danger</b> 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 .


	<b>Danger</b> 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 .



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


	<b>Danger</b> Never touch a switch with a wet hand .
	Never touch a switch with a wet hand , otherwise, electrical shock may occur .

	<b>Caution</b> 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 .

	<b>Danger</b> 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 .

	<b>Caution</b> 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 .

	<b>Danger</b> 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 .

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

## Caution

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

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# 1. Outline

## 1.1 Outline of unit

When used together with the tension controller LE-40MTB(-E), the diameter calculation unit LE-40MD can enhance the functions available while the reel is controlled.

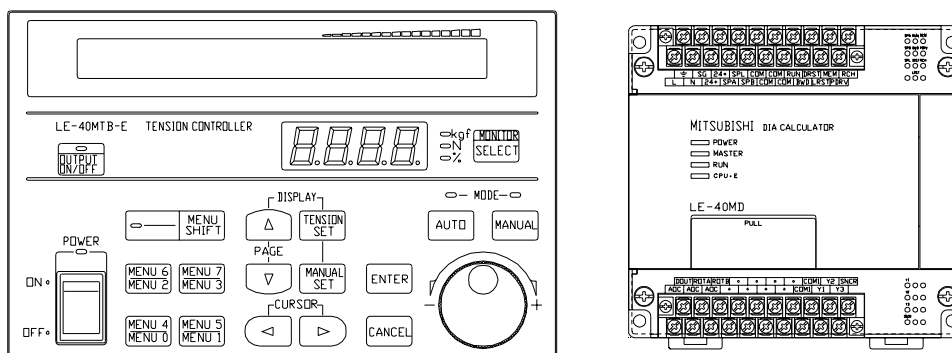
The diameter calculation unit LE-40MD detects the reel diameter on the non-contact basis using the ratio calculation method with the reel pulse and the measure roll pulse. In addition, the LE-40MD detects the line velocity and measures the length, and can output the reel rotation velocity command and the timing detection signal together with the reel diameter information.

- The taper tension control (straight / broken line taper tension control) of high precision in accordance with the reel diameter is enabled using the reel diameter data.
- The constant slip control of the winding powder clutch is enabled using the reel rotation velocity output.
- The two-reel changeover control is facilitated using the timing detection (reel diameter or measurement length) output for 4 points including the peripheral velocity synchronization and the new reel predrive output.
- The scope of selection of the measure pulse encoder is expanded due to the electronic gear function, so the degree of freedom of the mechanical design is also expanded.

(Note)

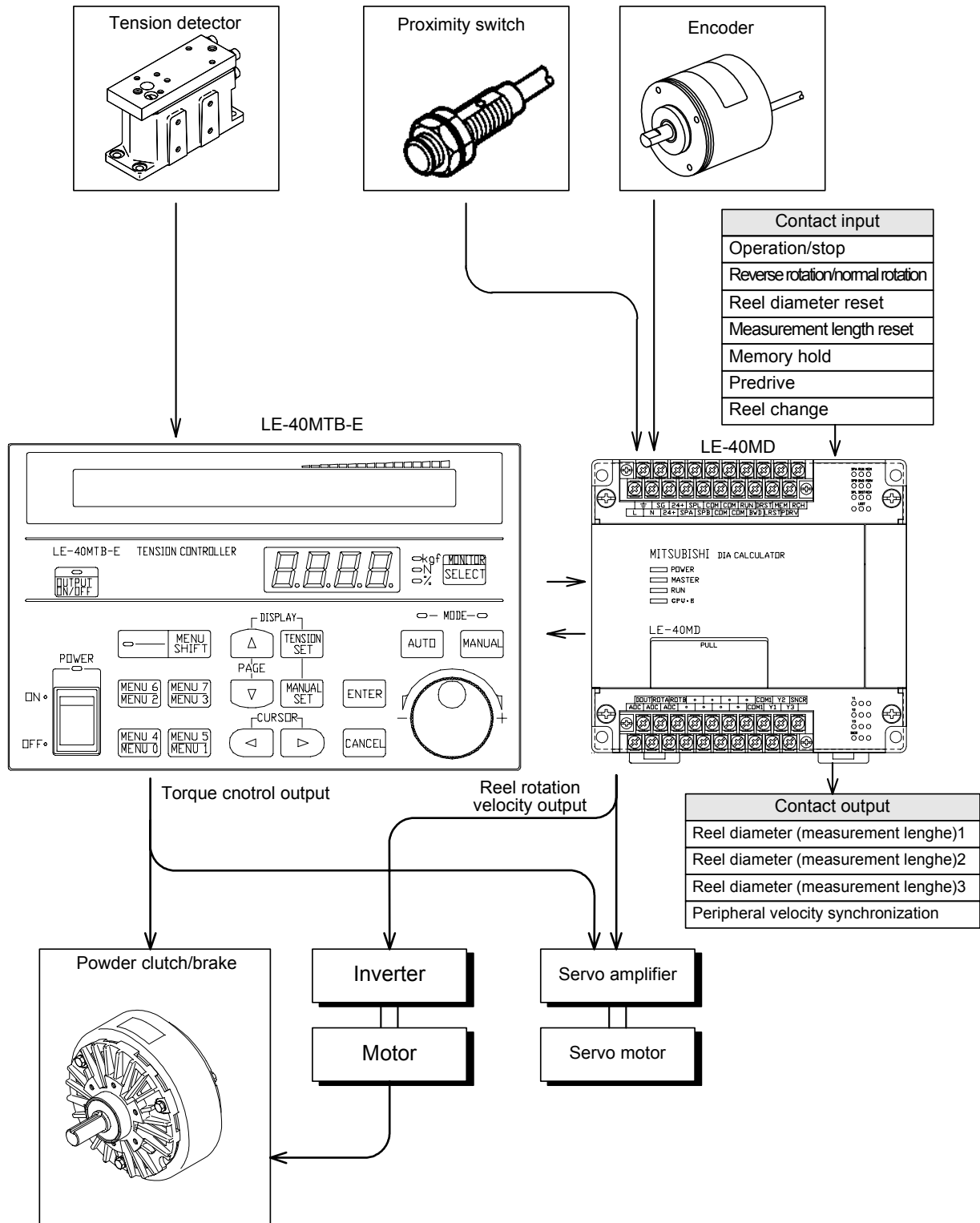
The tension controller LE-40MTB(-E) described in this instruction manual indicates both the LE-40MTB version 2.0 or newer and the LE-40MTB-E version 2.0 or newer.

Have in mind that the LE-40MTB whose version is less than 2.0 cannot be connected to the LE-40MD.



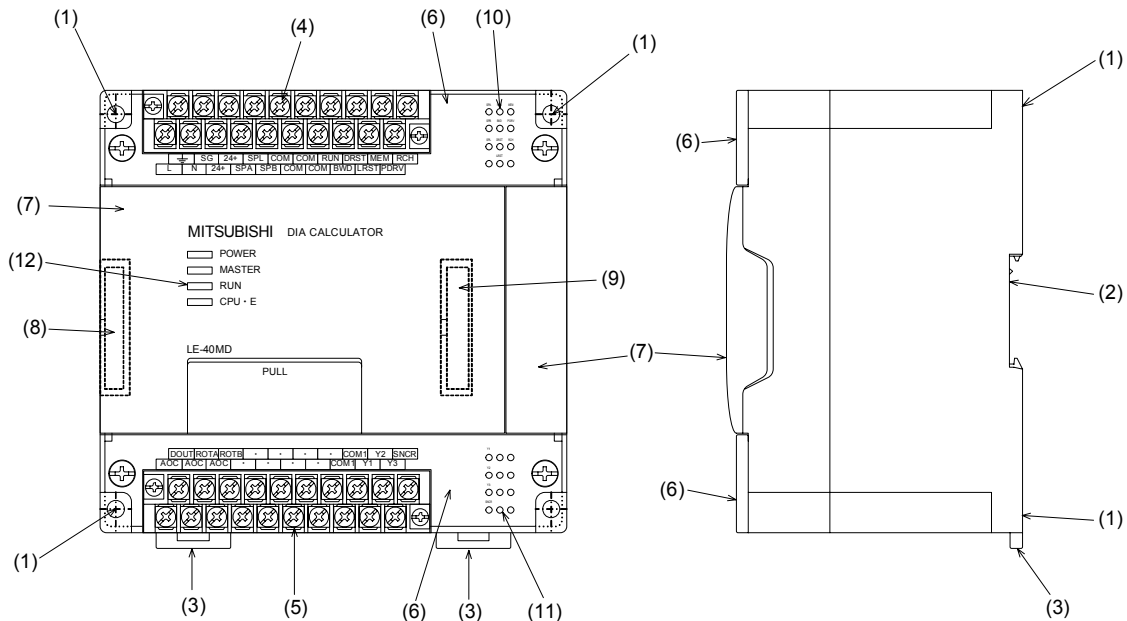
## 1.2 Panel configuration

The figure below shows the external units connected to the I/O terminals of the diameter calculation unit LE-40MD.



### 1.3 Configuration of main body

The name and the function of each portion of the diameter calculation unit LE-40MD main body are indicated below.

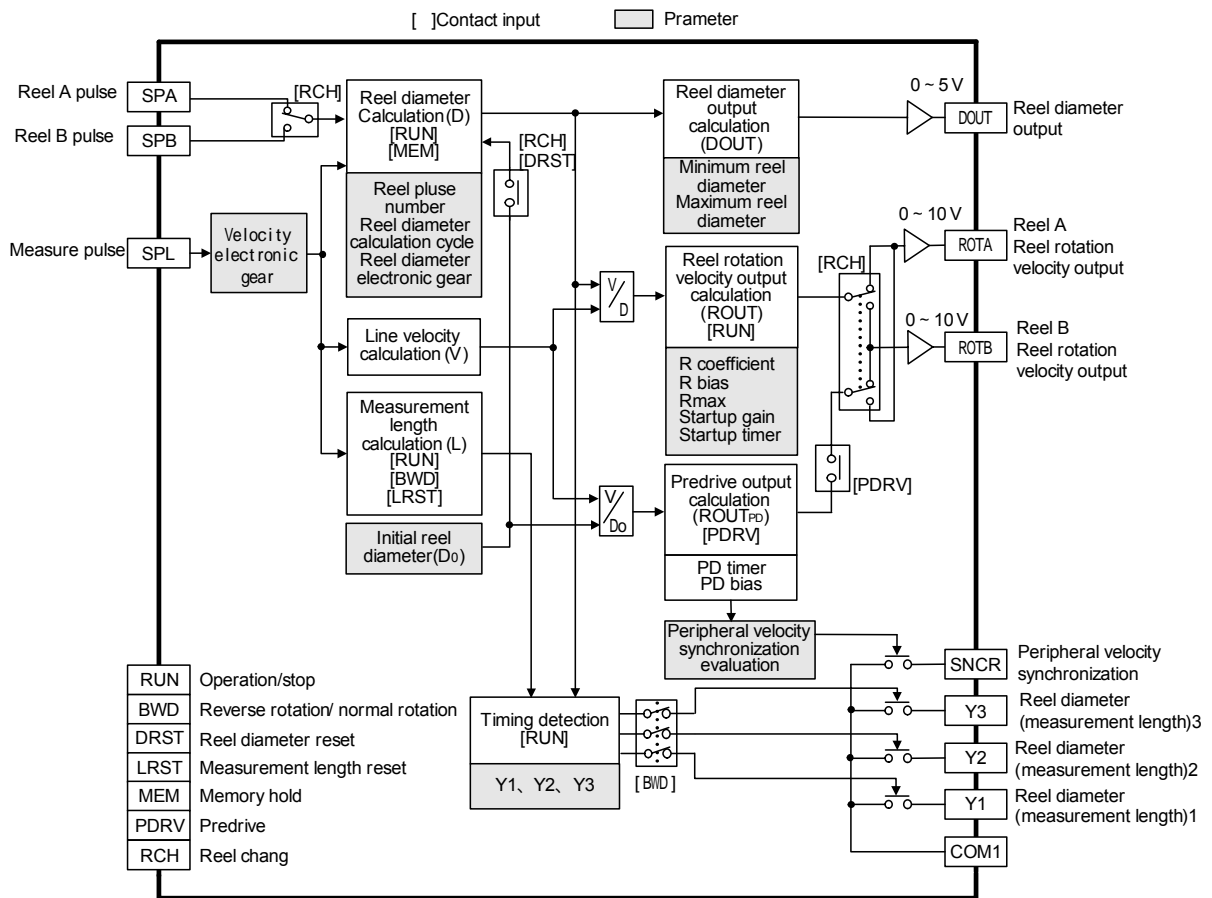


- (1) Main body mounting holes  
A mounting hole is provided at each of the four corners of the main body. These holes are not used when the DIN rail is used for mounting.
- (2) DIN rail mounting groove
- (3) DIN rail mounting hook  
Pull this hook downward to remove the LE-40MD from the DIN rail.
- (4) Input terminal block  
This terminal block is removable type, and can be removed when the fixing screws on the left and the right are loosened evenly.
- (5) Output terminal block  
This terminal block is removable type in the same way as the input terminal block.
- (6) Terminal block covers  
A transparent cover is attached to each of the input and output terminal blocks. Remove these covers before wiring.
- (7) Panel cover  
When this cover is open, the connector áG for connecting the tension controller LE-40MTB(-E) and the connector áH for connecting the interface block FX2N-32CCL can be seen.
- (8) Connector for connecting the tension controller LE-40MTB(-E)  
The tension controller LE-40MTB(-E) can be connected here using the extension cable offered as an accessory of the reel diameter calculation unit LE-40MD.
- (9) Connector for connecting the interface block FX2N-32CCL.
- (10) Input indication LEDs  
The input contact status can be monitored. A LED is not provided in a position without silk printing.
- (11) Output indication LEDs  
The output contact status can be monitored. A LED is not provided in a position without silk printing.
- (12) Status indication LEDs  
The power ON/OFF status, the operation/stop status and the CPU error in the LE-40MD and the power ON/OFF status in the LE-40MTB(-E) can be monitored.

## 1.4 Function of unit

The outline of the major functions of the diameter calculation unit LE-40MD are described below. (Refer to page 33.)

For the functions of the tension controller LE-40MTB(-E), refer to the instruction manual of the LE-40MTB(-E).



- The reel diameter is calculated using the ratio calculation method with the reel pulse and the measure pulse.  
The reel pulse can be entered separately for the reel A and the reel B. Though the reel pulse is basically set to "1 pulse per rotation of the reel", it can be modified by setting the parameter.  
Though the measure pulse is basically set to "1 pulse per 1 mm of the peripheral length of the measure roll", it can be corrected by the electronic gear. (For the electronic gear, refer to pages 21 to 22.)  
The reel diameter calculation data is transferred to the LE-40MTB(-E) and used for taper control.
- The line velocity is calculated using the frequency of the measure pulse.  
The reel rotation velocity is calculated using the reel diameter and the line velocity, then calculation is performed for the rotation velocity output for the constant slip of the winding powder clutch and the new reel predrive output.  
Note 1 : The parameter for the new reel diameter is required to be set for calculation of the predrive output.  
Note 2 : The new reel peripheral velocity synchronization contact output can be output during pre-drive.
- The measurement length is calculated using the integrated value of the measure pulse.  
Note 1 : As the measurement length, the material length which has passed the measure roll is detected. However, the remaining length is not calculated.
- Timing detection is enabled based on the reel diameter or the measurement length.

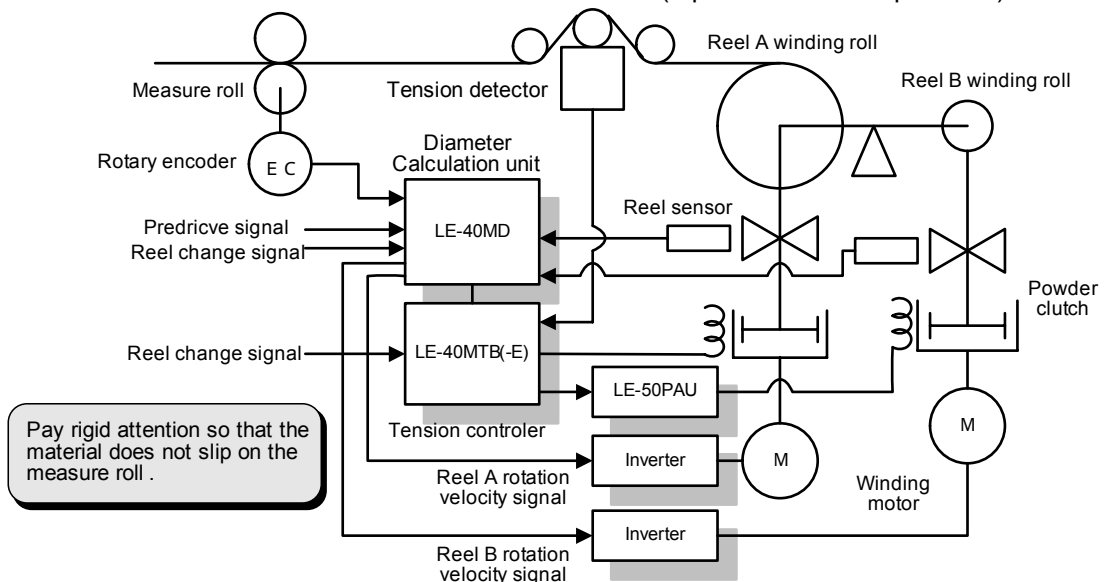
## 1.5 Applicable functions

The table below shows the functions applicable by combining the LE-40MTB and the LE-40MD in accordance with the control reel and the actuator.

	Control reel in LE-40MTB(-E)	Winding	Unwinding	Unwinding	Winding
	Control reel in LE-40MD	Winding	Unwinding	Winding	Unwinding
Actuator	Function	Applicability (○ : Applicable, × : Inapplicable)			
Powder clutch + Inverter	Reel diameter detection	○ (Winding diameter)	○ (Unwinding diameter)	○ (Winding diameter)	○ (Unwinding diameter)
	Measurement length	○ (Winding length)	○ (Unwinding length)	○ (Winding length)	○ (Unwinding length)
	Broken line taper	○	○	○ Broken line taper on unwinding side in accordance with winding diameter.	○ Broken line taper on winding side in accordance with unwinding diameter.
	Winding powder constant slip output	○	×	×	×
	Pre-drive output	○	○ Pre-drive by pre-drive motor	×	×
	Timing detection	○ (Winding side)	○ (Unwinding side)	○ (Winding side)	○ (Unwinding side)
Servo motor (torque control)	Reel diameter detection	○ (Winding diameter)	○ (Unwinding diameter)	○ (Winding diameter)	○ (Unwinding diameter)
	Measurement length	○ (Winding length)	○ (Unwinding length)	○ (Winding length)	○ (Unwinding length)
	Broken line taper	○	○	○ Broken line taper on unwinding side in accordance with winding diameter.	○ Broken line taper on winding side in accordance with unwinding diameter.
	Pre-drive output	○	○	×	×
	Timing detection	○ (Winding side)	○ (Unwinding side)	○ (Winding side)	○ (Unwinding side)
Remarks	When LE-40MTA (-E) is used together, broken line taper in LE-40MTA(-E) is enabled using DOUT output of LE-40MD	When LE-40MTA (-E) is used together on winding side, broken line taper on winding side is enabled in accordance with unwinding diameter.	When LE-40MTA (-E) is used together on unwinding side, broken line taper on unwinding side is enabled in accordance with winding diameter.	When LE-40MTA (-E) is used together on winding side, broken line taper on winding side is enabled in accordance with unwinding diameter.	When LE-40MTA (-E) is used together on unwinding side, broken line taper on unwinding side is enabled in accordance with winding diameter.

### Example of applicable system

Two-reel changeover, powder clutch winding .  
(taper + constant slip control)





## 2. Mounting and Wiring

### 2.1 Cautions

#### Caution on mounting



- Use the unit under the condition for the general environmental specifications described in this instruction manual (Refer to page 31.).  
Never install the unit in a place where dusts, soot, conductive dusts or corrosive gas is present or a place exposed to high temperature, condensation or wind and rain. Never install the unit directly in a place subject to vibration or impact.  
Otherwise, electrical shock or fire may occur or the unit may malfunction, be damaged or be deteriorated.
- Never drop cutting chips or wire chips into the ventilation window of the unit while screw holes are tapped or wiring is performed.  
Otherwise, fire may occur or the unit may become defective or malfunction.
- Connect the cable connecting the unit and other equipment used together such as an extension cable to the specified connector securely.  
Otherwise, imperfect contact may occur and the unit may malfunction.

#### Note

- Never install the unit on the floor, on the ceiling or in the vertical direction. Otherwise, the temperature of the unit may rise. Make sure to install the unit on the wall horizontally.
- Keep a space of 50 cm or more between the unit main body and other equipment or a structure. Separate the unit from the high voltage line, high voltage equipment and power equipment as much as possible.

#### Caution on wiring



- Make sure to shut down all the phases of the power supply from the outside before starting mounting or wiring.  
Otherwise, electrical shock may occur or the unit may be damaged.
- Make sure to attach the terminal covers supplied as accessories when turning on the power and operating the unit after mounting or wiring.  
Otherwise, electrical shock may occur.

#### Note

- Use shielded wires for the pulse input line and the analog output line.
- Never insert the signal input line and the signal output line of the LE-40MD into the same cable. Never insert the input line and the output line into the duct together with an other power line or output line. Never bind the input line and the output line together with an other power line or output line.
- Though problems caused by noise are hardly expected until the wiring length of the input and output lines of the contact system reaches approximately 50 to 60 m when the cautions described above are observed, it is recommended to keep the wiring length 20 m or less to assure safety.
- The extension cable is most susceptible to the effects of noise. Separate it from the input and output lines of the LE-40MD or other power lines by 50 mm or more.

## 2.2 General description on mounting and wiring

For the items with regard to the LE-40MTB(-E) and the FX2N-32CCL not described in this manual, refer to the instruction manual of each unit.

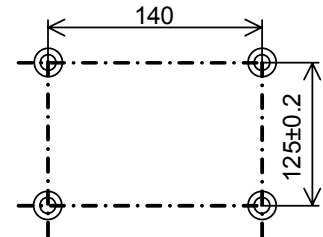
### 1. Mounting method

#### (1) DIN rail mounting method


The unit can be attached to the DIN rail DIN 46277 (Width: 35 mm) (The vibration resistance in this case is 0.5 G.). When removing the unit, pull out the DIN rail hook downward.

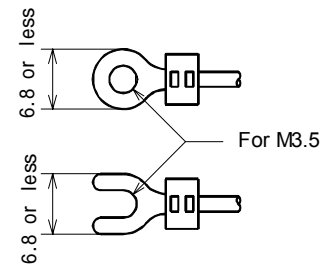
#### (2) Direct mounting method

The figure on the right shows the pitch of the mounting holes (M4) used for direct mounting.



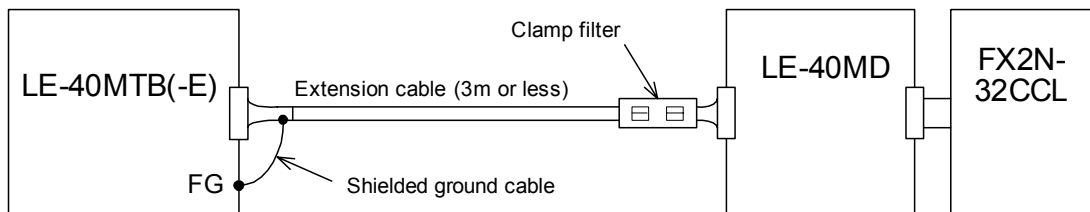
### 2. Wiring work

- Use the crimp-style terminals of the size shown in the figure on the right.
- The terminal tightening torque shall be 0.5 to 0.8 N•m (5 to 8 kgf•cm). Tighten the terminals securely to avoid malfunction.
- Never perform wiring to a spare terminal  from the outside.
- The terminal blocks in the unit can be removed. When the screws in the diagonal positions at the both ends are loosened evenly, the terminal block can be removed.



### 3. Connection of extension cable

- When connecting the extension cable for communication, insert it securely into the specified connector. The equipment used together and the extension cable shall be connected in the sequence as shown in the figure below. Insert the clamp filter connector to the LE-40MD. The extension cable (3 m) is offered as an accessory of the LE-40MD.



- Connect the shielded ground cable of the extension cable to the FG terminal (on the sheet metal) in the LE-40MTB. Never connect it to the LE-40MD. Or never connect it to the LE-40MTB(-E) nor the LE-40MD depending on the situation..

### Caution on mounting

### CAUTION

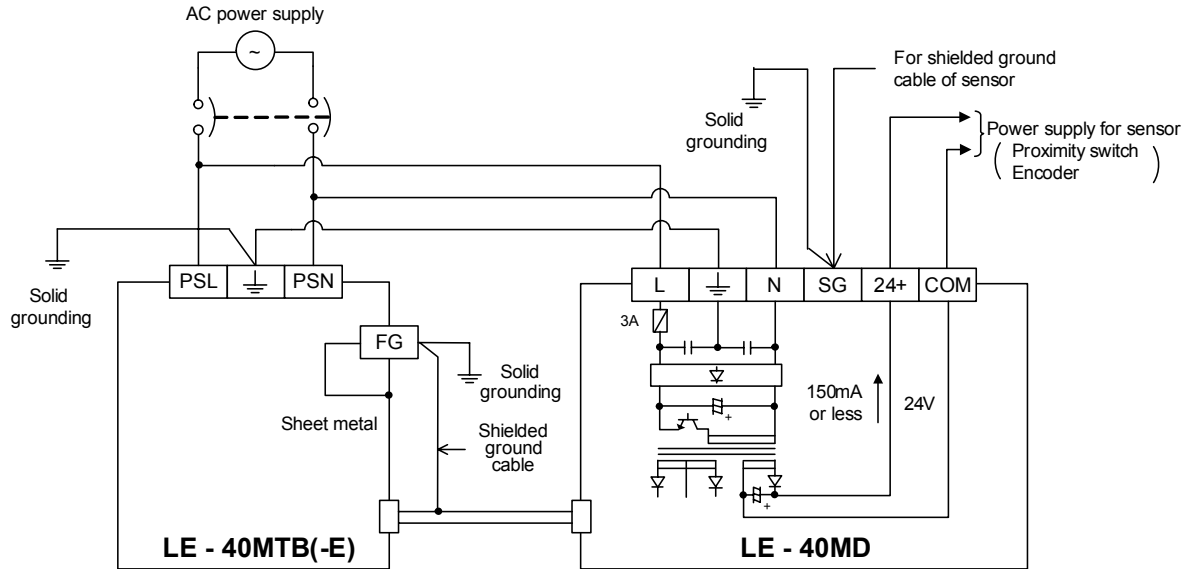
- UNever connect the shielded ground cable of the extension cable to the SG terminal in the LE-40MD. Otherwise, malfunction may occur
- Perform the insulation treatment to the shielded ground cable of the extension cable which is not connected.

## 2.3 Connection of power supplies and grounding

The figure below shows the power circuit configuration in the unit.

Connect the power supply of 100 to 240 VAC (+10% , -15%), 50/60 Hz between the power terminals L and N in the LE-40MD in parallel to the LE-40MTB(-E).

The power consumption of the unit is 40 VA or less (The power consumption of the LE-40MTB(-E) is 400 VA.).



### ⚠ DANGER

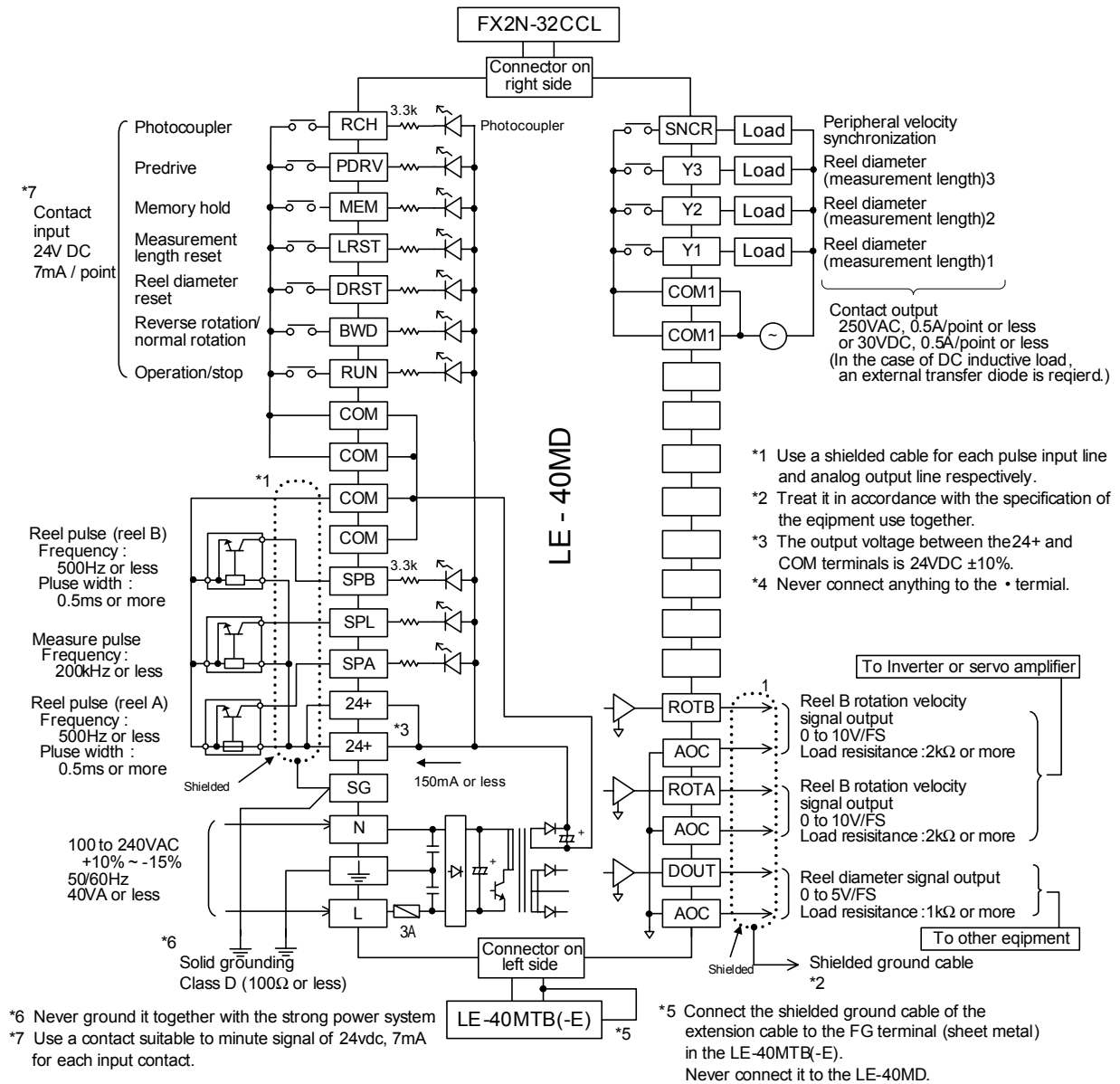
- Make sure to set the emergency stop circuit of the tension controller outside the unit without regard to the unit.  
Otherwise, the tension controller may become out of order or a serious accident may occur if misoperation or malfunction occurs in the unit.
- The unit is an electronic equipment in which the micro computer (CPU) is built in. The watch dog timer is actuated when a conductive foreign object enters inside or the CPU has run out of order caused by abnormal noise entered from the outside. At this time, the output is fixed and the CPU-E LED (red) is lighted.

### ⚠ CAUTION

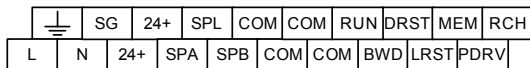
- Connect the AC power supply to the L and N terminals as shown in the figure above.  
If the AC power supply is connected to the DC I/O terminal or the DC supply terminal, the unit will be burn out. Use a wire of 2 mm<sup>2</sup> or more as the power line to avoid voltage drop.
- Turn on and off the AC power supply of the unit at the same time with the LE-40MTB(-E). Or turn it on earlier than the LE-40MTB(-E) and turn if off later than the LE-40MTB(-E). (Refer to page 13.)  
Otherwise, malfunction may occur.
- Even if an instantaneous power interruption of 10 ms or less has occurred in the power supply, the unit continues the operation.  
If a long interruption or abnormal voltage drop has occurred, the unit stops the operation and turns off the output.  
At this time, when the power supply is recovered, the unit restarts the operation automatically. Pay rigid attention.
- Perform the solid grounding to the ground terminal in this unit using a wire of 2 mm<sup>2</sup> or more.  
Never perform grounding together with the strong power system. Otherwise, malfunction may occur.  
Connect the ground terminals of the unit and of the LE-40MTB(-E) each other, and perform ground- ing on the LE-40MTB(-E) side.

## 2.4 I/O interface

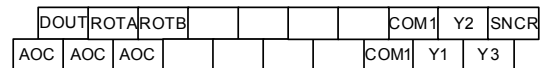
The figure below shows the I/O interface and the terminal layout of the unit.



Layout on the input (upper) side

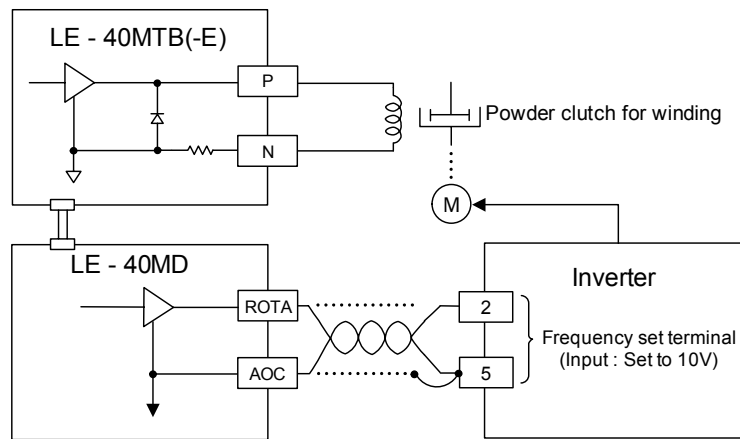


Layout on the output (lower) side

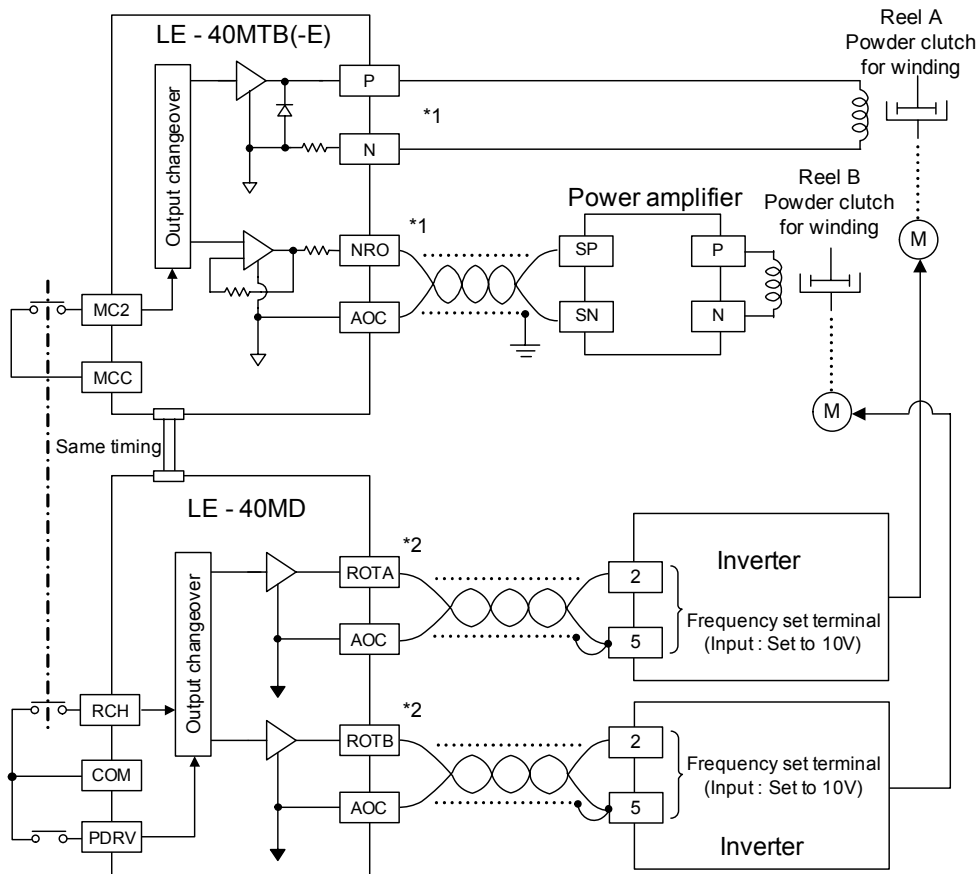


## 2.5 Connection example (powder clutch)

<< Connection example of one-reel powder winding, constant slip control >>



<< Connection example of two-reel changeover powder winding, constant slip control >>



\*1 The figure above shows an example in which the control output of the LE-40MTB(-E) is set to the internal two-reel changeover mode (Refer to page 39.).

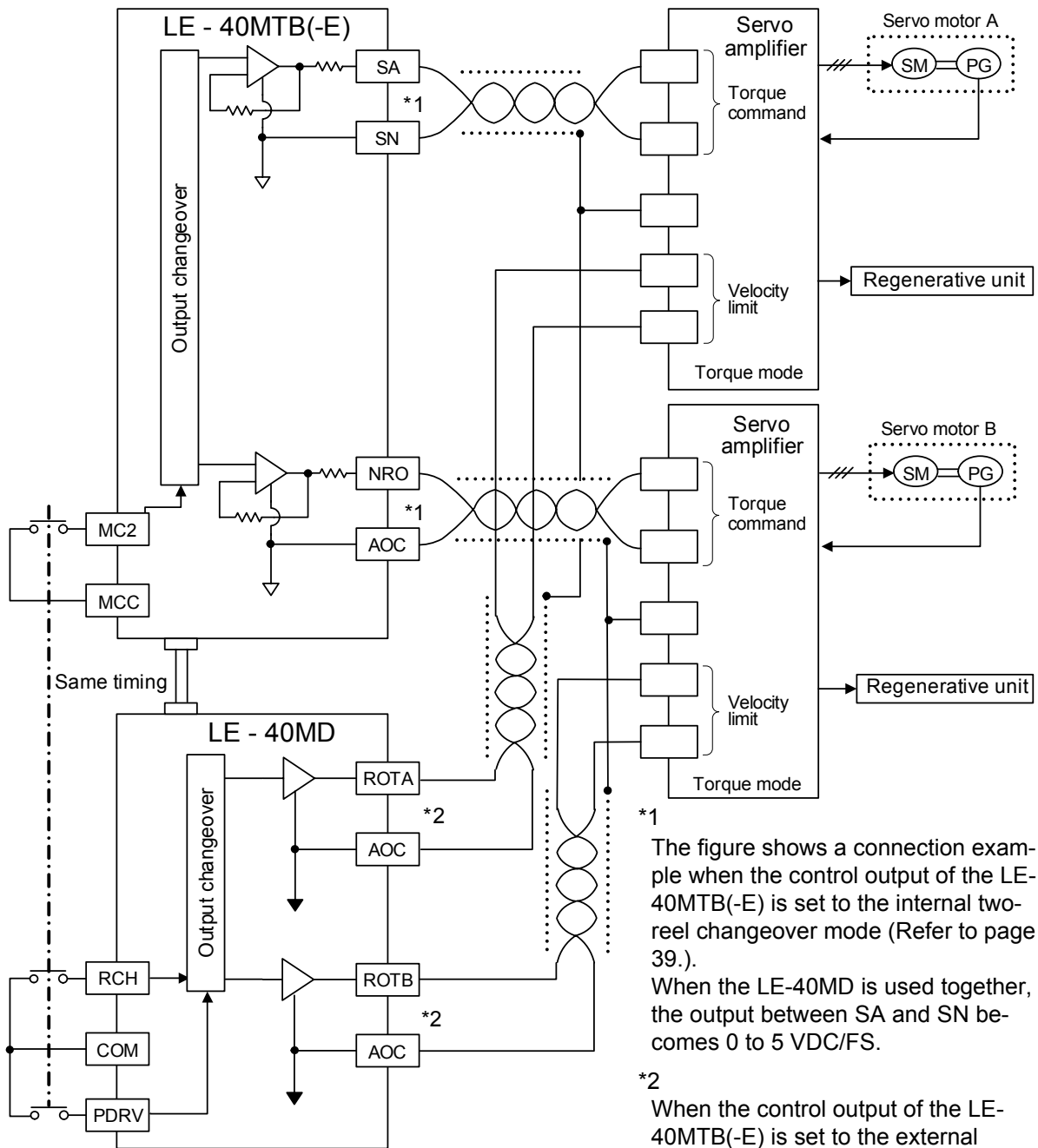
\*2 When the control output of the LE-40MTB(-E) is set to the external changeover mode (Refer to page 39.), **do not use** the ROTA and ROTB outputs in the LE-40MD **as the predrive outputs**.

### ⚠ DANGER

- The ROTA and ROTB outputs may increase and reach the maximum value when the independent reel operation is performed or when the material is ruptured because the relationship with regard to the ratio between the reel pulse and the measure pulse becomes invalid. As the result, the reel rotation velocity may increase and reach the maximum value. Take appropriate safety countermeasures outside the unit so that the reel does not run out of order when the independent reel operation is performed or when the material is ruptured.

## 2.6 Connection example (servo motor)

<< Connection example of one-reel powder winding, constant slip control >>



\*1 The figure shows a connection example when the control output of the LE-40MTB(-E) is set to the internal two-reel changeover mode (Refer to page 39.).

When the LE-40MD is used together, the output between SA and SN becomes 0 to 5 VDC/FS.

\*2 When the control output of the LE-40MTB(-E) is set to the external changeover mode (Refer to page 39.), never use the ROTA and ROTB outputs of the LE-40MD as the predrive outputs.

### ⚠ DANGER

- The ROTA and ROTB outputs may increase and reach the maximum value when the independent reel operation is performed or when the material is ruptured because the relationship with regard to the ratio between the reel pulse and the measure pulse becomes invalid. As the result, the reel rotation velocity may increase and reach the maximum value. Take appropriate safety countermeasures outside the unit so that the reel does not run out of order when the independent reel operation is performed or when the material is ruptured.

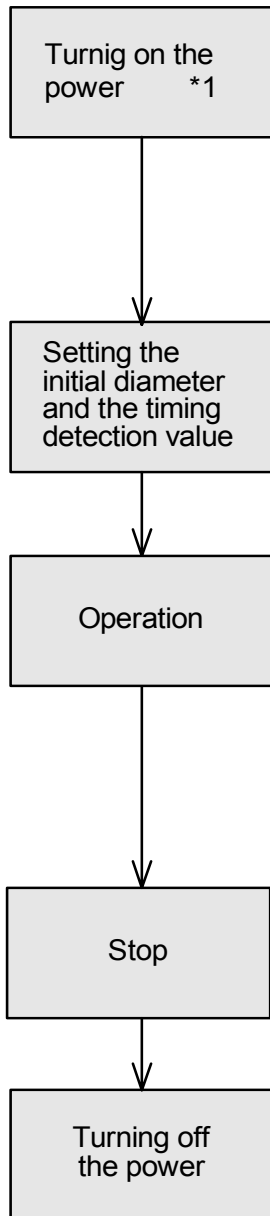
# 3. Basic operations

## 3.1 Basic operating procedures

Before operating the unit, set the system parameters and other operation parameters preliminarily and finish trial run and adjustment.

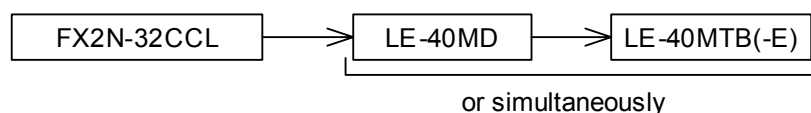
The basic operating procedures of the LE-40MD are described below.

For the operating procedures of the LE-40MTB and the FX-16NP/NT-S3, refer to the instruction manual of each unit.



- Turn on the AC power of the LE-40MTB and the LE-40MD.  
**Turn them on simultaneously or turn on the LE-40MD at first.**  
 If the LE-40MTB(-E) is turned on at first, the LE-40MTB(-E) does not recognize connection of the LE-40MD and does not display the monitor screen related to the LE-40MD.
- When the FX-16NP/NT-S3 is used together, **turn on the 24V power of the FX2N-32CCL at first before turning on the AC power supply of the LE-40MD and the LE-40MTB(-E).**
- Set the operation start diameter (initial diameter) and the timing detection value, and preset the reel diameter data to the initial diameter using the DRST input.
- When the timing detection is set to the length detection mode, reset the measurement length data using the LRST input.
- Perform the operation in accordance with the operating procedures (including the setting procedures) for the LE-40MD and the units used together including the LE-40MTB(-E).  
 However, turn on the RUN input when the material is started. -----\*2.
- During operation, the reel diameter, the measurement length, the line velocity, the contact I/O, the reel velocity command, etc. can be monitored.
- Before restarting the LE-40MD, modify the start diameter (initial diameter) and the timing detection value, preset the reel diameter and reset the measurement length upon necessity.
- Stop the operation in accordance with the operating procedures (including the setting procedures) for the LE-40MD and the units used together including the LE-40MTB(-E).
- However, turn off the RUN input when the material is started to be stopped. -----\*2.
- Turn off the AC power of the LE-40MTB and the LE-40MD.

\*1 Turning-on sequence



\*2 The LE-40MD can be used even if it does not synchronize with the ON/OFF timing of the operation/stop (MC1) contact input in the LE-40MTB(-E).

### 3.2 Screen display

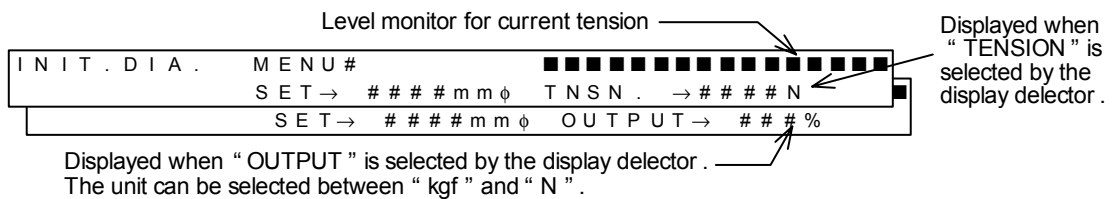
Setting of the initial diameter, setting of the timing detection value and each monitor screen are described below. (Refer to page 38.)

For the screen position, refer to "Overall flow of screen" (page 18). For the details of the screen operating/setting procedure, refer to the instruction manual of the LE-40MTB(-E).

Have in mind that the following items can be set on the menu, but that the set values are saved in the EE PROM exclusively when the ENTER key is pressed twice.

#### 1. Setting the initial diameter ----- Operator screen

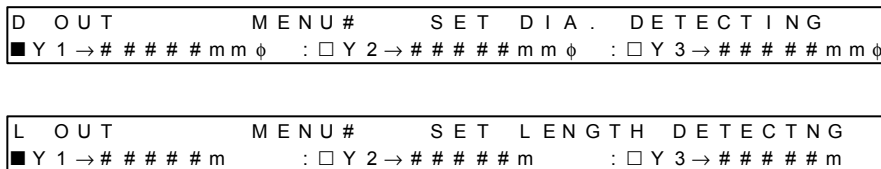
- On the following screen, set the start reel diameter when the material is started.



- When changing over the reel, preset the current reel diameter data to this initial diameter set value using the DRST input.
  - The initial diameter set value is treated also as the new reel diameter data during two-reel changeover. The predrive output is calculated while this initial diameter set value is regarded as the initial diameter of the new reel.
- And the current reel diameter data immediately after the reel is changed over is preset to this initial diameter set value using the RCH input.

#### 2. Setting the timing detection value ----- Engineer screen (menu screen [40MD])

- On the following screen, set the timing detection value for the contact output.



- Either "D OUT" or "L OUT" is displayed in accordance with the setting of the contact output detection operation mode.
  - When the detection operation mode is set to "reel diameter", the D OUT screen is displayed.
  - When the detection operation mode is set to "measurement length", the L OUT screen is displayed.
- When the detection operation mode is set to "reel diameter", the relationship with regard to the size between the timing detection set value and the calculation value becomes reversed depending on the setting of the detection position (winding / unwinding).
- For setting of Y1, Y2 and Y3, there is no limitation in the relationship with regard to the size each other.

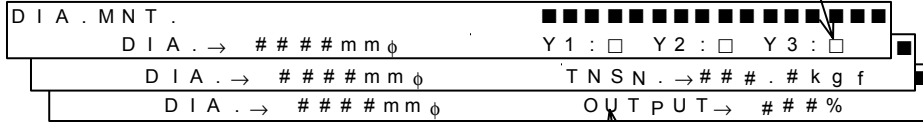


### 3. Monitor screen

(1) On the operator screen, the reel diameter, the measurement length and the line velocity can be monitored.

[1] Reel diameter monitor ----- The current reel diameter can be monitored.

When the contact output detection operation mode is set to "reel diameter", the contact output monitor is displayed (ON : ■).

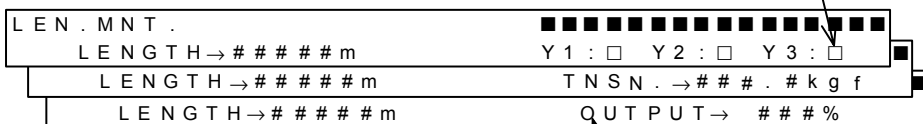


**(Note)**  
Though the reel diameter can be monitored with the range of 0 to 2,200 mm, the practical range is 0 to 2,000 mm.

When the contact output detection operation mode is set to "measurement length", the tension or the output is displayed. The relationship between the tension display and the output display is equivalent to that on the initial diameter setting screen.

[2] Measurement length monitor----- The current material travel can be monitored.

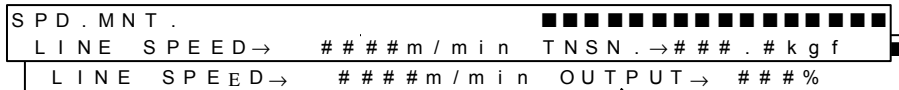
When the contact output detection operation mode is set to "measurement length", the contact output monitor is displayed (ON : ■).



**(Note)**  
Though the measurement length can be monitored within the range of -9999 to 32,767m, the practical range is 0 to 32,767m.

When the contact output detection operation mode is set to "reel diameter", the tension or the output is displayed. The relationship between the tension display and the output display is equivalent to that on the initial diameter setting screen.

[3] Line velocity monitor ----- The current line velocity can be monitored.



**(Note)**  
Though the line velocity can be monitored within the range of 0 to 1,100m/min., the practical range is 0 to 1,000m/min.

The relationship between the tension display and the output display is equivalent to that on the initial diameter setting screen.

(2) On the engineer screen ("OTHERS" on the menu screen), the contact I/O status and the reel rotation velocity command can be monitored.

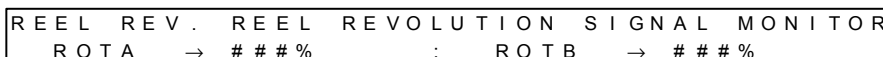
[1] Contact input monitor ----- The contact input status in the LE-40MD can be monitored. (ON : ■)



[2] Contact output monitor ----- The contact output status in the LE-40MD can be monitored. (ON : ■)



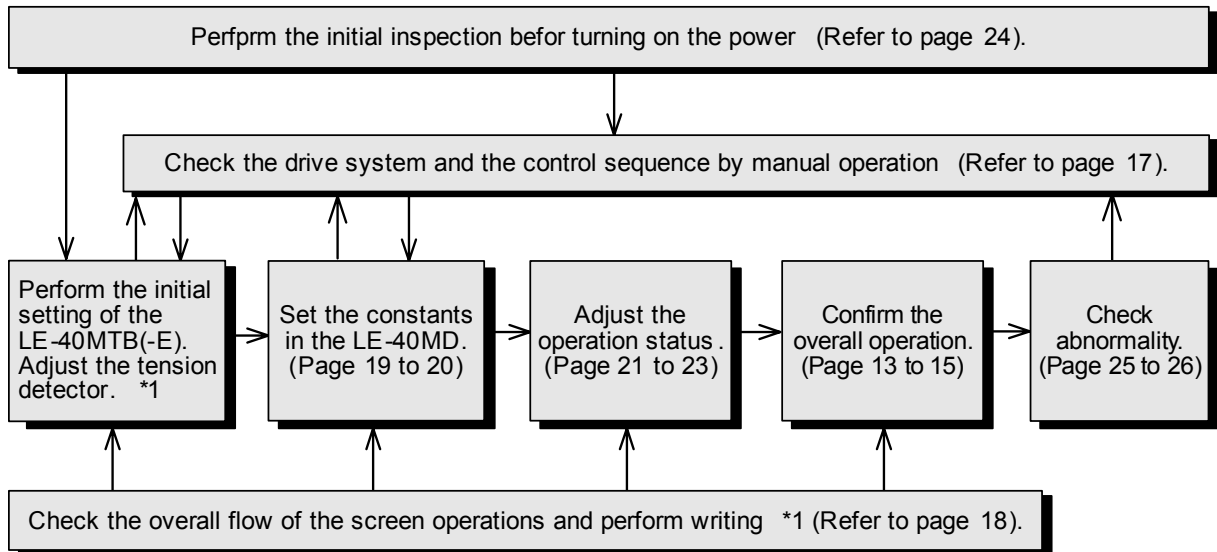
[3] Reel rotation velocity command monitor ----- The reel rotation velocity command value given to the actuator can be monitored.



## 4. Trial Run and Adjustment

### 4.1 Overall flow

As the preparation work before the actual operation, perform the startup adjustment and the trial run as follows.

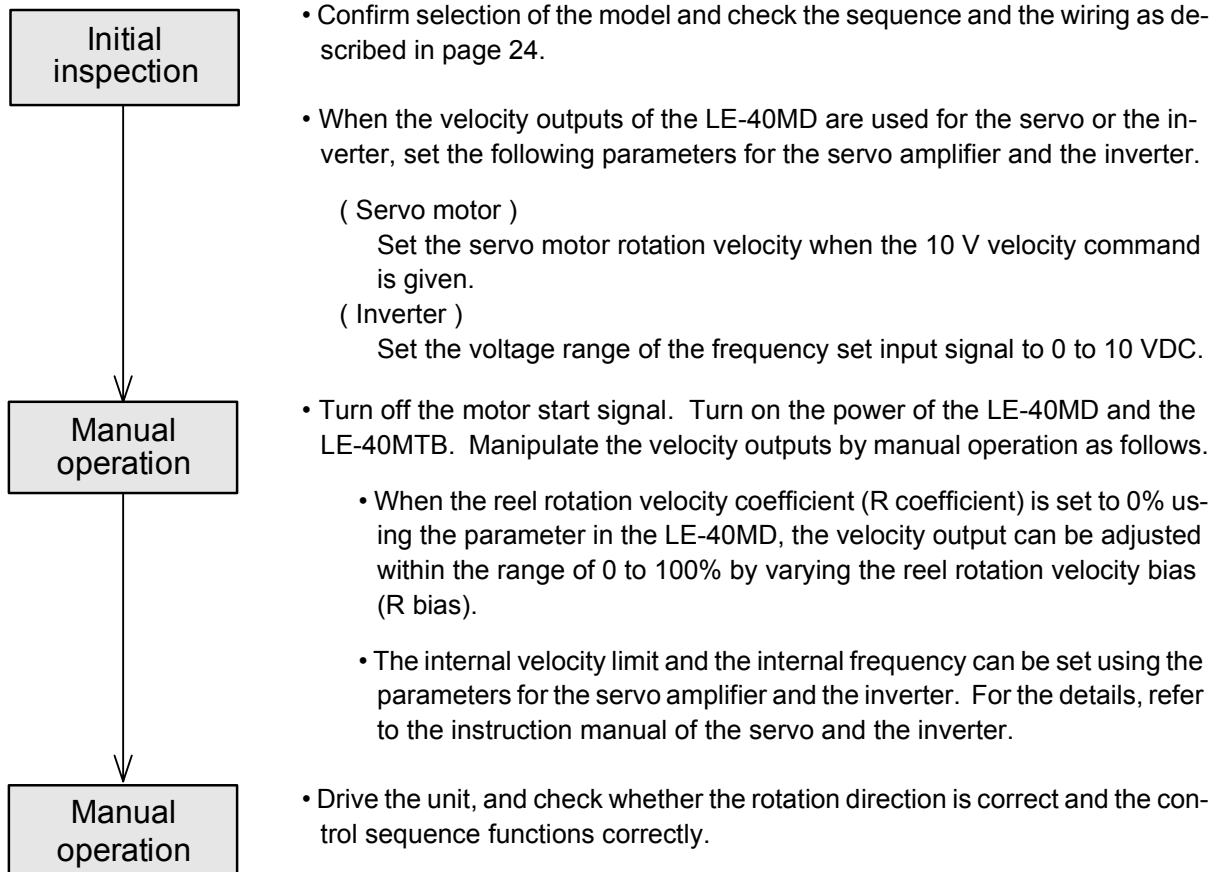


\*1 For the initial setting and the screen operations of the LE-40MTB(-E) as well as adjustment of the tension detector, refer to the instruction manual of the LE-40MTB(-E).

## 4.2 Inspection of drive system and control system

Check the drive system and the control sequence by manual operation using the following procedure. However, for setting related to the torque control and inspection of the drive system and the control system in the case where the velocity outputs (ROTA and ROTB outputs) of the LE-40MD are not used, follow the instruction manual of the LE-40MTB(-E) or each actuator.

**Even if the velocity outputs of the LE-40MD are not used, make sure to perform the initial inspection described in page 24.**

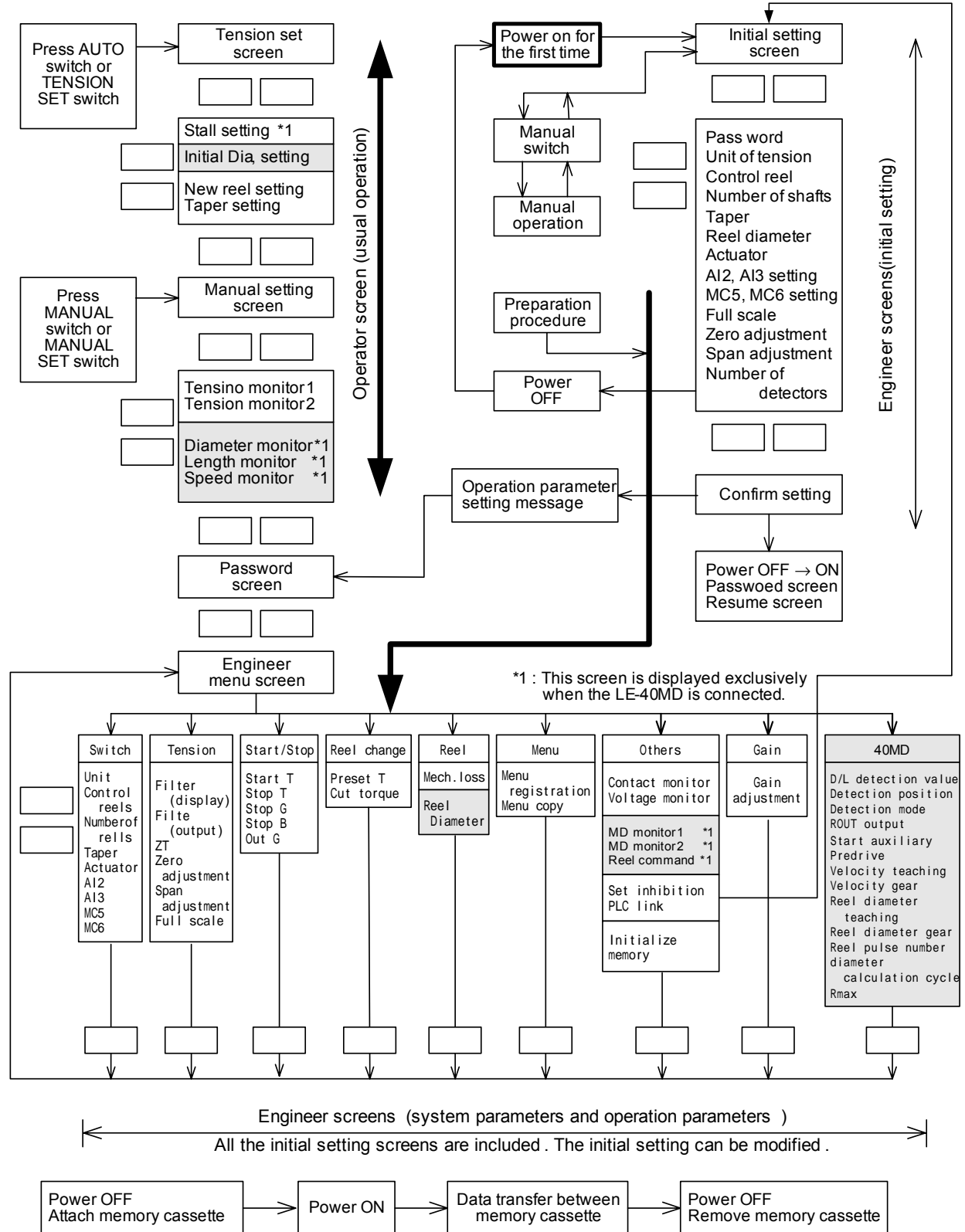


### 4.3 Overflow of screen

The screen configuration in the LE-40MTB(-E) is shown in the figure below. The data can be read in turn using the [▲] and [▼] keys.

For the operating procedure, refer to the instruction manual of the LE-40MTB(-E).

When the power is turned on from off, the version indication screen is displayed for only several seconds. The shaded portion in the figure below indicates the monitor screen or the setting screen related to the LE-40MD.



\*1 This screen is displayed exclusively when the LE-40MD is connected.

## 4.4 Setting of constants in LE-40MD

The figure below shows each set parameter in the LE-40MD (Refer to page 38.).

Refer to the next paragraph "Adjustment of operation status" also, and set each parameter in accordance with the function used.

Press AUTO switch or TENSION SET switch

□ □      Press 6 times

Password screen      Set the password

□ □

- The parameters on the setting screen marked with  $\diamond$  must be always set.
- The parameters on the setting screen marked with  $\star$  must be set in accordance with the system.
- The parameters on the setting screen marked with  $\diamond$  must be reconfirmed and fine-adjusted in the operation status .

( Engineer menu screen )

SETTING      SELECT MENU BY CURSOR

SWITCH    :  TENSION    :  STRT. STP :  REEL CHG :

▶ ----- ↓

SETTING      SELECT MENU BY CURSOR

MENU        :  OTHER        :  GAIN        :  4 0 M D

← -----

□ □      Select [40MD] and proceed to each setting screen

$\diamond$  Timing detection value setting screen( reel diameter)

D OUT      MENU#      SET DIA . DETECTING

■ Y 1 → # # # # m m  $\phi$     :  Y 2 → # # # # m m  $\phi$     :  Y 3 → # # # # m m  $\phi$

$\diamond$  Timing detection value setting screen( measurement length)

L OUT      MENU#      SET LENGTH DETECTNG

■ Y 1 → # # # # m        :  Y 2 → # # # # m        :  Y 3 → # # # # m

$\diamond \star$  Timing detection value setting screen( measurement length)

CAL . PART      SELECT DIA . CALCULATION PART

■ WIND        :  UNWIND

$\star$  ( Contact output detection operation mode setting screen )

Y MODE      SELECT DETECTING OUTPUT MODE

■ DIA .        :  LENGTH

$\diamond$  ( Reel rotation velocity output setting screen)

ROUT SET      SET ROUT PARAMETER

■ R CURR .    → # # # %        :  R BIAS    → # # # %

$\diamond$  ( Start auxiliary setting screen)

ROUT SUB      ROUT SUB PARAMETER

■ R GAIN      → # TIM . :  R TIMER    → # # Sec

$\diamond$  ( Predrive output setting screen)

PDRV SET      SET PREDRIVE PARAMETER

■ PD TIMER → # # # Sec :  PD BIAS    → # # # %

} Set the output timing for the contact output

Set whether the reel diameter detection position is set for winding or unwinding

The setting here does not necessarily correspond to the setting of the control reel in the LE-40MTB.  
( Refer to page 6 )

Set whether the contact output detection operation is performed for reel diameter or measurement length

Set the coefficient and the bias related to the reel rotation velocity output

Set the start gain and its effective duration for the reel rotation velocity output when RUN input is turned on

Set the bias value for fine adjustment for the predrive output change rate and its output

}

◇ ( Line velocity teaching setting screen )

```

SPD . TEACH LINE SPEED TEACHING
■ SPEED → ### m / min : □ TEACHING

```

Teaching can be performed by setting the teaching velocity of the line velocity electronic gear ratio.

◇★ ( Line velocity electronic gear setting screen )

```

SPD . GEAR SET ELECTRIC GEAR TO SPEED
SET → ### . ## % : SPEED → ### . # m / min

```

Set the line velocity electronic gear ratio. When teaching is performed, the result is displayed here.

◇ ( Reel diameter teaching setting screen )

```

DIA . TEACH REEL DIA . TEACHING
■ REEL DIA . → ### # mm φ : □ TEACHING

```

Teaching can be performed by setting the teaching reel diameter of the reel diameter electronic gear ratio.

◇ ( Reel diameter electronic gear setting screen )

```

DIA . GEAR SET ELECTRIC GEAR TO DIA .
SET → ### . ## %

```

Set the reel diameter electronic gear ratio ( usually 100% ). When teaching is performed, the result is displayed here.

◇★ ( Reel pulse number setting screen )

```

REEL PLS . SET REEL PULSE PAR 1 REV .
■ 1 : □ 2 : □ 4 : □ 8 : □ 16

```

Set the reel pulse number per rotation of the reel.

◇ ( Reel diameter calculation cycle setting screen )

```

REEL PLS . SET REEL PULSE PAR 1 REV .
■ 1 : □ 2 : □ 4 : □ 8 : □ 16

```

Set the update cycle for the reel diameter calculation data.

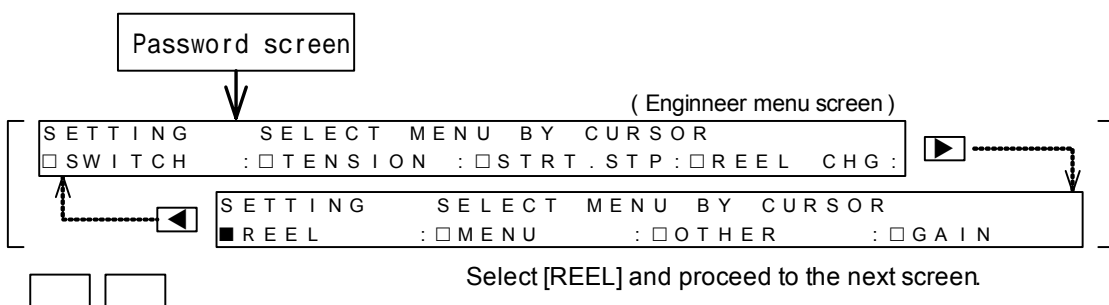
★◇ ( Maximum reel rotation velocity setting screen )

```

Rmax SET SET MAXIMUM REEL REVOLUTION
SET → ### # r / min

```

Set the maximum rotation velocity of the reel in the case of 10 V command.



◇★ ( Reel diameter use rangesetting screen )

```

DIA . SET SET DIAMETER
■ MIN . DIA → ### # mm φ : □ MAX . DIA → ### # mm φ

```

Set the minimum diameter and the maximum diameter of the reel diameter detection reel.

Initialization of the set data

When the set data is initialized it is required to initialize the data on the data initialization screen ( Refer to the instruction manual of the LE40MTB(-E) ), turn off the AC power of the LE-40MTB(-E), then turn it on again ( The AC power of the LE-40MD may remain turned on ) .

## 4.5 Adjustment of operation status

When inspection of the drive system and the control system is completed, adjust the operation status as follows.

### 1. Adjusting the electronic gear ratio

- The line velocity electronic gear is required to be adjusted to calculate correctly the reel diameter, the measurement length, the line velocity, etc.

The line velocity electronic gear converts the measure pulse rate as "1 pulse/1 mm of measure roll peripheral length", and used as a parameter to convert the calculated line velocity into the actual line velocity.

- Adjust the electronic gear ratio using the following procedure.
  - Set the reel pulse number in accordance with the system on the reel pulse number setting screen.
    - The reel pulse is usually set to "1 pulse/1 rotation of the reel" in principle. However, when the material thick, the resolution of the reel diameter calculation can be improved by increasing the pulse number per rotation of the reel. If the reel pulse number is increased too much when the material is thin, precision of calculation may be deteriorated.
    - If the set value is not appropriate to the mechanism, correct operation may not be realized. Make sure that the mechanism enables either of 2, 4, 8 and 16 pulses/1 rotation of the reel if the reel pulse is any other than 1 pulse/1 rotation of the reel.
  - Adjust the line velocity electronic gear as follows.
    - Obtain the electronic gear ratio required in the mechanism using the velocity electronic gear ratio calculation equation shown below, and set the obtained value on the line velocity electronic gear setting screen.
    - If the line velocity monitor value on the line velocity electronic gear setting screen is deviated from the actual line velocity measured using the velocity meter, etc. while the material is driven, fine-adjust the electronic gear set value so that the line velocity monitor value on that screen becomes equivalent to the actual line velocity.
      - \* When the velocity electronic gear set value is made larger, the calculation values of the line velocity, the reel diameter and the measurement length become smaller. On the contrary, when the velocity electronic gear set value is made smaller, the calculation values of the line velocity, the reel diameter and the measurement length become larger.
  - When adjustment of the velocity electronic gear is finished, drive the material continuously and confirm the reel diameter calculation value status on the reel diameter monitor screen. Adjust the reel diameter calculation cycle on the reel diameter calculation cycle setting screen depending on change in the reel diameter calculation value.
    - \* When the reel diameter calculation cycle is made longer, the reel diameter calculation is stabilized more. However, if the reel diameter calculation cycle is made too long when the material is thick, the variation of the reel diameter data becomes large.

#### Calculation of the electronic gear ratio

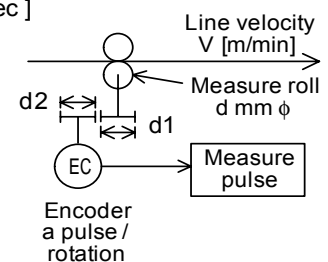
The relationship between the velocity electronic gear ratio and the line velocity /measure pulse rate is shown below .

$$\frac{\text{Measure pulse velocity [ pulses / sec ]}}{\text{Velocity electronic gear ratio}} = \frac{V \times 10^3}{60} \text{ [ pulse / sec ]}$$

$$\frac{\text{Measure pulse rate [ pulses / mm ]}}{\text{Velocity electronic gear ratio}} = 1 \text{ [ pulse / sec ]}$$

Accordingly, the velocity electronic gear required can be obtained from the following equation .

$$\text{Velocity electronic gear set value} = \frac{1}{\pi d} \times \frac{d1}{d2} \times a \times 100\%$$



---

• **Reel diameter electronic gear**

- The reel diameter electronic gear is the parameter to correct the calculated reel diameter into the actual reel diameter, and enables fine adjustment in the case where the calculated reel diameter is deviated from the actual reel diameter due to a mechanical cause, etc.
- When the reel diameter electronic gear set value is made larger, the reel diameter calculation value becomes smaller. On the contrary, when the reel diameter electronic gear set value is made smaller, the reel diameter calculation value becomes larger.
- However, adjustment is not required usually. Let the initial set value (100%) as it is.

• **Teaching of the electronic gear**

- The electronic gear can be adjusted by teaching.
  - (1) Teaching procedure for the velocity electronic gear.
    - [1] Set the velocity to be registered (teaching velocity) on the line velocity teaching setting screen.
    - [2] Drive the material at the teaching velocity.
    - [3] While the teaching velocity is realized, select "TEACHING EXECUTE" using the cursor control keys and press the ENTER key. Teaching will be completed in several seconds.
    - [4] When teaching is completed, the next velocity electronic gear setting screen will be automatically displayed, and the result of the velocity electronic gear ratio obtained by execution of teaching will be displayed on that screen.
  - (2) Teaching procedure for the reel diameter electronic gear.
    - [1] Set the reel diameter to be registered (teaching reel diameter) on the reel diameter teaching setting screen.
    - [2] Drive the material corresponding to the teaching reel diameter at a constant velocity.
    - [3] While the reel is rotating (by several rotations or more) at a constant velocity, select "TEACHING EXECUTE" using the cursor control keys and press the ENTER key. Teaching will be completed in several seconds.
    - [4] When teaching is completed, the next reel diameter electronic gear setting screen will be automatically displayed, and the result of the reel diameter electronic gear ratio obtained by execution of teaching will be displayed on that screen.

(Note)

- When performing teaching of the electronic gear, make sure that sag of the material is not detected between the reel and the measure roll and that the material velocity is maintained at a constant value.
- In teaching of the reel diameter, when the material is thick and the reel diameter is extremely changed by only several rotations of the reel, use the following material.  
Winding: Reel diameter a little smaller than the teaching reel diameter  
Unwinding: Reel diameter a little larger than the teaching reel diameter

• **Teaching error of the velocity electronic gear**

- When the teaching result of the velocity electronic gear becomes out of the electronic gear set range, the following error message is displayed on the velocity electronic gear setting screen. The teaching result of the electronic gear is displayed from 30.00% of the lower limit to 200.00% of the upper limit.

(Line velocity electronic gear setting screen (error indication) )

SPD . GEAR	SET ELECTRIC GEAR TO SPEED
SET →	### . ## %

(Note) If the electronic gear ratio is set to a value within the range of 90.0 to 180.0% on the electronic gear screen when the electronic gear ratio is set by teaching to a value outside the set range, a value outside the set range cannot be set after that.

- The electronic gear ratio at this time is out of the specifications and not practical. Confirm using the velocity electronic gear ratio calculation equation whether the electronic gear to be actually set is within the set range, then perform inspection and modification in conformance to the troubleshooting procedure related to the pulse.



---

## 2. Adjusting the reel diameter output

- When the reel diameter output (DOUT) is used, perform the following adjustment procedure.
  - (1) Set the minimum diameter and the maximum diameter within the applicable reel diameter range for the system on the applicable reel diameter range setting screen.

The minimum diameter and the maximum diameter are always required to be set for taper control using the reel diameter data in the LE-40MD.

- (2) By the setting above, 0 to 5 VDC can be output from the DOUT terminal in accordance with the current reel diameter within the range from the minimum diameter to the maximum diameter.

## 3. Adjusting the reel rotation velocity outputs

- When the reel rotation velocity outputs (ROTA and ROTB) are used to control the constant slip of the winding powder clutch and limit the torque servo velocity, perform this adjustment.
- Perform the following procedure.
  - (1) Set the reel conversion rated rotation velocity of the motor for the 10 V command on the maximum reel rotation velocity setting screen.
  - (2) Set the slip rotation velocity of the powder clutch converted into "R COEFFICIENT = 100% (normal)" and "R BIAS = reel" (or the velocity limit margin of the torque servo) on the reel rotation velocity output setting screen.
  - (3) Drive the material actually, and confirm the start status of the reel and fine-adjust the R bias at the steady state.
  - (4) If the reel rotation is delayed considerably at start, adjust the start gain and the start timer on the start auxiliary setting screen. Adjust the parameters also in the inverter and the servo when necessary.

## 4. Adjusting the predrive outputs

- When the reel rotation velocity outputs (ROTA and ROTB) are used for predrive outputs, perform this adjustment.
- Perform the following procedure.
  - (1) Set the reel conversion rated rotation velocity of the motor for the 10 V command on the maximum reel rotation velocity setting screen.

(This setting is not required when it is already set while the reel rotation velocity output is adjusted.)
  - (2) Set the rate of change of the output as the predrive time (PD timer) on the predrive output setting screen. When the inverter and the servo amplifier are tripped due to overload caused by the inertia of the reel material during predriving, such trip can be eliminated by setting a relatively long time.
    - \* Set the predrive time (PD timer) as the time in which the rotation velocity of the motor is changed from 0 to the rated rotation velocity (in the case of 10 V command) or from the rated rotation velocity to 0.
    - \* Accordingly, the time required to realize peripheral velocity synchronization varies depending on the new reel diameter (initial diameter) set value and the current line velocity.
  - (3) While confirming the rising time and the peripheral velocity synchronization contact output (SN-CR) by performing predrive actually, adjust the predrive time.

The bias of  $\pm 10\%$  can be added to the predrive output by the predrive bias (PD bias).

# 5. Inspection and Maintenance

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## 5.1 Initial inspection

### 1. Selection confirmation

- Before starting operation, confirm that the reel, the measure sensor, the actuator, etc. are correctly selected.

### 2. Operation sequence

- Check the operation sequence and the emergency stop sequence.
- Especially when the reel rotation velocity outputs (ROTA and ROTB) in the LE-40MD are used for the constant slip of the winding powder (inverter) and limitation of the velocity of the torque servo, the motor may become out of order if the material is cut. Take appropriate safety countermeasures outside the unit against cutting of the material using the material cut detection unit, etc.

### 3. Wiring check

- Incorrect connection (The phase sequence is also important in the motor system.) of the power terminal, contact between the DC I/O line and the power line, short-circuit of the output line, etc. may cause serious damages.  
Make sure that the power supply is correctly connected to the ground and that the I/O line is correctly wired before turning on the power.
- Never perform the megger test (measurement of the insulation resistance)

---

## 5.2 Abnormality inspection

### 1. Abnormality inspection using LEDs

(1) [ POWER ] LED ----- Indicates the AC power supply.

- This LED is lighted while the AC power is supplied to the LE-40MD.
- When this LED is not lighted even if the power is turned on, check whether the supply voltage between the L and N terminals is 100 to 240 VAC (+10%-15%), 50/60 Hz, and correct the wiring if necessary.
- When this LED is not lighted still, disconnect the wiring to the 24+ terminal in the LE-40MD. If this LED is correctly lighted, the protective function of the service power supply circuit is actuated caused by short-circuit of the load connected to the sensor power supply or by excessive load current.  
Correct the status on the load side, and correct the wiring.
- When conductive foreign objects enter inside the LE-40MD or an other failure occurs, the built-in fuse may be melted. In such a case, never replace the fuse by yourself. Make sure to contact our service center.

(2) [ MASTER ] LED ----- Indicates the power supply status in the LE-40MTB(-E)

- This LED is lighted while the AC power of the LE-40MTB(-E) is turned on.
- When this LED is not lighted even if the AC power of the LE-40MTB(-E) is turned on, check whether the connector of the extension cable between the LE-40MTB(-E) and the LE-40MD is securely connected.  
Turn off the AC power of the LE-40MTB(-E) and the LE-40MD before connecting or disconnecting the connector.  
[ Note ] Have in mind that failure or malfunction may occur if the connector is connected or disconnected while the power is turned on.
- When this LED is not lighted still even after the inspection described above, some damage may be generated in the internal circuit of the LE-40MTB(-E) or the LE-40MD or the extension cable. Contact our service center for inspection and repair.

(3) [ RUN ] LED ----- Indicates the operation/stop (RUN) signal input status and the material stop evaluation status.

- The CPU recognizes the ON/OFF status of the contact input signal at the RUN terminal and the status of the material stop evaluation (refer to page 31), and turns on/off this LED.
  - [1] This LED is lighted at the first turn on of the RUN terminal after the power is on .
  - [2] This LED is turn off when the RUN is turn off.
  - [3] During the RUN terminal is on, the line velocity exceeds the material stop evaluation level and then decrease the material stop evaluation level, this LED is turn off. This LED is turned on again when the line velocity exceeds the material stop evaluation level again.  
[ Note ] Lighting/extinguishing of this LED is slightly delayed from the ON/OFF timing at the RUN terminal.
- When this LED is not lighted even if the above condition of [1] or [3], some damage may be generated in the internal circuit of the LE-40MD.  
Contact our service center for inspection and repair.

(4) [ CPU-E ] LED ----- Indicates the CPU error.

- When the CPU runs out of order caused by conductive foreign objects entering inside the LE-40MD or abnormal noise coming from the outside, the watch dog time error occurs and this LED is lighted.
- When this LED is lighted, turn off the AC power of the LE-40MD once, then turn it on again. If the CPU is recovered to the normal status by this operation, check whether the abnormal noise source is present or conductive foreign objects may enter.
- When this LED is lighted even after the inspection described above, some damage may be generated in the internal circuit of the LE - 40MD.  
Contact our service center for inspection and repair.

## 2. Other abnormality inspection

Item	Problem	Disposal
Pulse input	Pulse input is abnormal.	<ul style="list-style-type: none"> <li>• Check whether the power supply for the sensor is correct. (Refer to page 28.)</li> <li>• Check whether the reel sensor and the measure sensor are compatible with the sensor specifications of the LE-40MD. (Refer to page 33.)</li> <li>• While turning on and off slowly the reel sensor and the measure sensor, check whether the input indication LEDs (SPA, SPB and SPL) provided on the main body flash. These LEDs are lighted dimly during high velocity operation.</li> <li>• Check whether the voltage level, the frequency and the ON/OFF time of each pulse are within the allowable input range for the LE-40MD. (Refer to page 28.)</li> <li>• When the pulse input is still abnormal, check whether abnormal noise is not mixed with the pulse input.</li> </ul>
Contact input	Contact input is disabled.	<ul style="list-style-type: none"> <li>• Compare the actual ON/OFF status with the monitor status of the input contact using the contact input monitor screen of the LE-40MTB(-E) and the input indication LEDs (RUN, BWD, DRST, LRST, MEM, PDRV and RCH). Do not turn them on at the same time. Check them one by one.</li> <li>• Check whether imperfect contact is not detected in the input contact.</li> <li>• When the monitor status is not compatible even if the input is securely turned on or off, the LE-40MD is defective.</li> </ul>
Reel diameter calculation Measurement length calculation	Reel diameter display does not change even during operation.	<ul style="list-style-type: none"> <li>• Check the reel pulse and the measure pulse in accordance with the troubleshooting described above.</li> <li>• Check whether the reel pulse input terminal corresponds to the reel diameter detection reel.</li> <li>• Make sure that the RUN input is turned on and that the MEM and DRST inputs are turned off.</li> </ul> <p>When the reel diameter display does not change still, the LE-40MD is defective.</p>
	Reel diameter display and measurement length display are considerably different from actual diameter and actual length.	<ul style="list-style-type: none"> <li>• Check the reel pulse and the measure pulse in accordance with the troubleshooting described above.</li> <li>• Check whether the material does not slip considerably on the measure roll.</li> <li>• When no abnormality is detected by inspection described above, check whether the velocity electronic gear set value and the reel diameter electronic gear set value are not considerably different from the electronic gear ratio required in accordance with the mechanism. If they are considerably different, adjust each electronic gear again. (Refer to pages 21 to 22.)</li> <li>• When the displayed value is still considerably different from the actual value, check whether abnormal noise is not mixed with the pulse input.</li> </ul>
Contact output	Contact output is disabled.	<ul style="list-style-type: none"> <li>• Check whether the condition to turn on the contact output is satisfied. (Refer to page 30.)</li> <li>• When the output is not turned on even if the required condition is satisfied, the LE-40MD is defective.</li> </ul>
Analog output	Reel diameter output is disabled.	<ul style="list-style-type: none"> <li>• Check whether the output is not short-circuited.</li> <li>• Reset the diameter to the initial value around the center between the minimum diameter and the maximum diameter (parameters), and check whether the reel diameter output is enabled.</li> <li>• When the reel diameter output is disabled still, the LE-40MD is defective.</li> </ul>
	Reel rotation velocity output is disabled.	<ul style="list-style-type: none"> <li>• Check whether the output is not short-circuited.</li> <li>• Check whether the output is enabled when the motor is stopped, the RUN input is turned off and the reel rotation velocity bias (parameter) is set to around 50%.</li> <li>• When the reel rotation velocity output is disabled still, the LE-40MD is defective.</li> </ul>

## 5.3 Maintenance

- Consumable parts which may become the cause of short service life are not built in the unit.
- However, the service life of the output relay must be checked when it is operated at abnormally high frequency or when a large capacity of load is turned on and off.

### [ Service life of the relay output contact (for Y1, Y2, Y3 and SNCR outputs) ]

The rated service life of the contactor, the solenoid valve, etc. against the inductive AC load is set to 500,000 times against load of 35 VA. The table below shows the guideline of the service life of the relay based on the service life test specified by our company.

Test condition: ON for 1 sec and OFF for 1 sec

Load capacity		Service life of contact	Representative applicable loads ( electromagnetic switch of our company)
35VA	0.35A / AC100V	3,000,000 times	S-K10~S-K150 S-K10~S-N35
	0.17A / AC200V		
80VA	0.8A / AC100V	1,000,000 times	S-K180~S-K400
	0.4A / AC200V		
120VA	1.2A / AC100V	200,000 times	S-K600, S-K800
	0.6A / AC200V		

Have in mind that the service life of the relay contact is considerably deteriorated even under the condition above if the rush overcurrent is shut down.

- Pay rigid attention to the following points in addition to inspection of other equipment.
  - Whether the temperature inside the panel is not abnormally high caused by other heat generating body or direct sunlight.
  - Whether dusts and conductive dusts do not enter inside the panel.
  - Whether looseness of the wiring/terminal and other abnormality are not detected.
- When the power fuse is melted, inspection is required to confirm that conductive cutting chips are not mixed, secondary damages are not generated in the unit, etc. Replacement of the melted fuse exclusively is not sufficient.  
In such a case, never replace the fuse by yourself. Make sure to contact our service center.

# 6. Specifications

## 6.1 I/O specifications list

Item		Terminal name	Specifications	Ref. page	
AC Power supply	Input	L	100 to 240 VAC (+10%-15%), 50/60 Hz Power consumption : 40 VA or less	9	
		N	Power fuse : 250 V, 3 A, $\phi$ 5 x 20 mm Allowable instantaneous power interruption duration : 10 ms		
Power supply for sensor	Output	24+	24 VDC $\pm$ 10%, 150 mA or less	10	
		COM	Common terminal of 24V power supply output and contact / pulse input.		
Pulse signal	Input	SPA	Reel pulse input for reel A Response frequency: 500 Hz or less <ul style="list-style-type: none"> <li>1 pulse per rotation of the reel is basic. However, the pulse number can be increased to 2, 4, 8 or 16 by setting the parameter to improve the resolution of the reel diameter calculation when the material is thick.</li> <li>The signal becomes as follows by the reel change signal. <ul style="list-style-type: none"> <li>When RCH is OFF : SPA = For detection of the reel A diameter</li> <li>SPB = Neglected</li> <li>When RCH is ON : SPA = Neglected</li> <li>SPB = For detection of the reel B diameter</li> </ul> </li> </ul>	24 VDC, 7 mA/point (internal power supply)  Input voltage at H level = 21 V or more  Input voltage at L level = 3 V or less  LED is lighted while the input is turned on.  The sensor is NPN type.	10 21 22 23
		SPB	Reel pulse input for reel B Response frequency: 500Hz or less <ul style="list-style-type: none"> <li>Ditto</li> </ul>		
		SPL	Measure pulse input Response frequency :20kHz or less. <ul style="list-style-type: none"> <li>1 pulse per 1 mm of the peripheral length of the measure roll is basic. However, it can be corrected within the rage of 90 to 180% by the electronic gear function.</li> </ul>		
		COM	Common terminal of 24 V power output and contact/pulse input.		
		SG	Shielded ground relay terminal of pulse signal.		
Contact signal	Input	RUN	Operation/stop----- ON : Operation, OFF : Stop <ul style="list-style-type: none"> <li>The signal at this terminal is used as the condition for start/stop of the reel diameter/measurement length/reel rotation velocity output calculation or for output control. <ul style="list-style-type: none"> <li>Turn it ON when the material is started.</li> <li>Turn it OFF when stop of the material is started.</li> </ul> </li> <li>When the signal at the RUN terminal is turned on from off, calculation is started.</li> <li>After calculation is started, calculation is stopped by the material stop evaluation (Refer to page 31.) by detecting the line velocity. When calculation is stopped, the reel diameter/measurement length calculation data is held and the reel rotation velocity output is fixed to the bias velocity.</li> <li>After calculation is stopped, calculation is restarted when the signal at the RUN terminal is turned on from off or when the material stop evaluation is released while the signal at the RUN terminal is turned on. However, when calculation is stopped by the material stop evaluation while the signal at the RUN terminal is turned off, calculation is not restarted even if the material stop evaluation is released until the signal at the RUN terminal is turned on from off.</li> <li>Exclusively when the signal at the RUN terminal is turned on from off, the start gain (set value) can be applied on the R bias (set value) of the reel rotation velocity output during the start timer (set value) duration exclusively. However, the upper limit of the output shall be 30%.</li> </ul>	24 VDC, 7mA/point (internal power supply)  Input response time = Approx. 10 ms  LED is lighted while the input is turned on.	31 35

Item	Terminal name	Specifications	Ref. page	
Contact signal	Input	Reverse rotation / normal rotation -----ON : Reverse operation, OFF : Normal rotation <ul style="list-style-type: none"> <li>In the ON period, the measurement length calculation data by as much as reverse feed of the material is automatically corrected. The measurement length calculation can be corrected in temporary operation with reverse rotation in the reversible rewinder, etc.</li> <li>In the ON period, the timing detection contact outputs at the Y1, Y2 and Y3 terminals are turned off. However, these contact outputs are turned on when the ON condition is satisfied after the signal at the BWD terminal is turned off.</li> <li>The signal changeover at the BWD terminal is valid exclusively while the signal at the RUN terminal is turned off.</li> </ul>	24 VDC, 7mA/ point (internal power supply)  Input response time = Approx. 10 ms  LED is lighted while the input is turned on.	—
		Reel diameter reset <ul style="list-style-type: none"> <li>When the signal at this terminal is turned on, the reel diameter calculation data is preset to the initial value. And the timing detection contact outputs at the Y1, Y2 and Y3 terminals are also reset.</li> </ul>		—
		Measurement length reset <ul style="list-style-type: none"> <li>When the signal at this terminal is turned on, the measurement length calculation data is reset to 0. The timing detection contact outputs at the Y1, Y2 and Y3 terminals are also reset.</li> </ul>		—
		Memory hold <ul style="list-style-type: none"> <li>In the ON period, the reel diameter calculation data is temporarily held.  <b>(Note)</b> This function has nothing to do with the measurement length calculation.</li> <li>While the turret is turning, the reel pulse cycle becomes unstable and correct detection of the reel diameter is disabled. Turn on this input. This input is also useful when the reel diameter calculation data is required to be temporarily held.</li> <li>The DRST terminal has the priority over this terminal.</li> </ul>		—
		Predrive <ul style="list-style-type: none"> <li>When the signal at this terminal is turned on, the velocity command for predrive is output to the new reel.</li> <li>After the reel is changed, the predrive output is not restarted until the input at this terminal is turned off. Be careful.</li> </ul>		
		Reel change----- OFF : Reel A, ON : Reel B <ul style="list-style-type: none"> <li>When the signal at this terminal is turned on from off or off from on, the target reel for reel diameter calculation, reel rotation velocity output, etc. is changed over.  <b>(Note)</b> Enter the signal to the RCH terminal at the same timing with the input (reel change signal) to the MC2 terminal in the LE-40MTB(-E).</li> <li>When the signal at this terminal is turned on from off or off from on, the reel diameter calculation data is preset to the initial value and the measurement length calculation data is reset to 0. And the timing detection contact outputs at the Y1, Y2, Y3 and SNCR terminals are also reset.</li> </ul>		11 12 36 37
		COM		Common terminal of 24 V power output and contact/pulse input.

Item		Terminal name	Specifications	Ref. page	
Pulse signal	Output	Y1	Reel diameter / measurement length 1 <ul style="list-style-type: none"> <li>When the reel diameter/measurement length calculation value reaches the timing detection set value while the signal at the RUN terminal is turned on, the signal at this terminal is turned on. This contact output is held ON after it is turned on once (It is held ON even if the signal at the RUN terminal is turned off.).</li> </ul> <ON condition> <ul style="list-style-type: none"> <li>When the timing detection operation mode is set to "reel diameter"               <ul style="list-style-type: none"> <li>When the detection position is "winding", Reel diameter calculation data <math>\geq</math> Reel diameter detection set value</li> <li>When the detection position is "unwinding", Reel diameter calculation data <math>\leq</math> Reel diameter detection set value</li> </ul> </li> <li>When the timing detection operation mode is set to "measurement length"               <ul style="list-style-type: none"> <li>Without regard to the detection position, Measurement length calculation data <math>\geq</math> Measurement length detection set value</li> </ul> </li> </ul> <ul style="list-style-type: none"> <li>The signal at this terminal is reset when the signal is entered to the DRST (or LRST) and RCH terminals. The signal at this terminal is turned off while the signal at the BWD terminal is turned on.</li> </ul>	250 VAC, 0.5A/point or 30VDC, 0.5A/point (In the case of DC inductive load, a transfer diode is required.)  ON/OFF response time :Approx.10ms  LED is lighted while the output is turned on .	-
		Y2	Reel diameter/measurement length 2 <ul style="list-style-type: none"> <li>Ditto</li> </ul>		
		Y3	Reel diameter/measurement length 3 <ul style="list-style-type: none"> <li>Ditto</li> </ul>		
		SNCR	Peripheral velocity synchronization <ul style="list-style-type: none"> <li>The signal at this terminal is turned on when the predrive output (command value) reaches the rotation velocity target value of the new reel synchronizing with the current line velocity while the signal at the PDRV terminal is turned on. (The same operation is realized also when the target value is changed during predriving.)</li> <li>However, the signal at this terminal is turned off when the command value is deviated from the target value by more than <math>\pm 5\%</math>.</li> <li>The signal at this terminal is turned off also when the signal is entered to the RCH terminal or the signal at the PDRV terminal is turned off.</li> </ul>		
		COM1	Common terminal of contact output		
Analog signal	Output	DOUT	Reel diameter output 0 to 5 VDC (12 bits), Load resistance :1 k $\Omega$ or more	34 35 36 37	
		ROTA	Reel A rotation velocity output 0 to 10 VDC (12 bits), Load resistance: 2 k $\Omega$ or more		
		ROTB	Reel B rotation velocity output 0 to 10 VDC (12 bits), Load resistance: 2 k $\Omega$ or more		
		AOC	Common terminal of analog output		
Special signal (connector)		CN2	To connect the tension controller LE-40MTB(-E)	8	
		CN3	To connect the interface block FX2N-32CCL		



## 6.2 External specifications

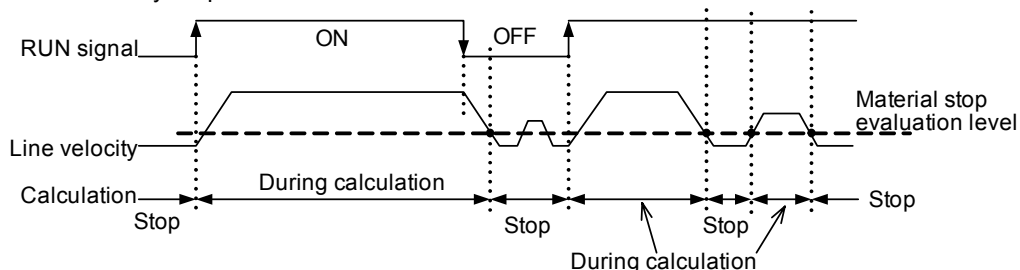
Line velocity	V = 5 to 1,000 / min. * However, Vmin = ( Vmax / 200 ) × ( Dmax / Dmin)
Accelerating / decelerating acceleration	( V / t ) = 2 to 20 m / min / sec t : Accelerating / dedelerating time [sec]
Reel diameter	D = 0.05 ~ 2mφ
Measurement length	L = 0 ~ 32767m
Material thickness	T = 2μm ~ 10mm
Reel rotation velocity	N = 0 ~ 3600r / min
Measure roll diameter	d = 0.05 ~ 1mφ

## 6.3 General and environmental specifications

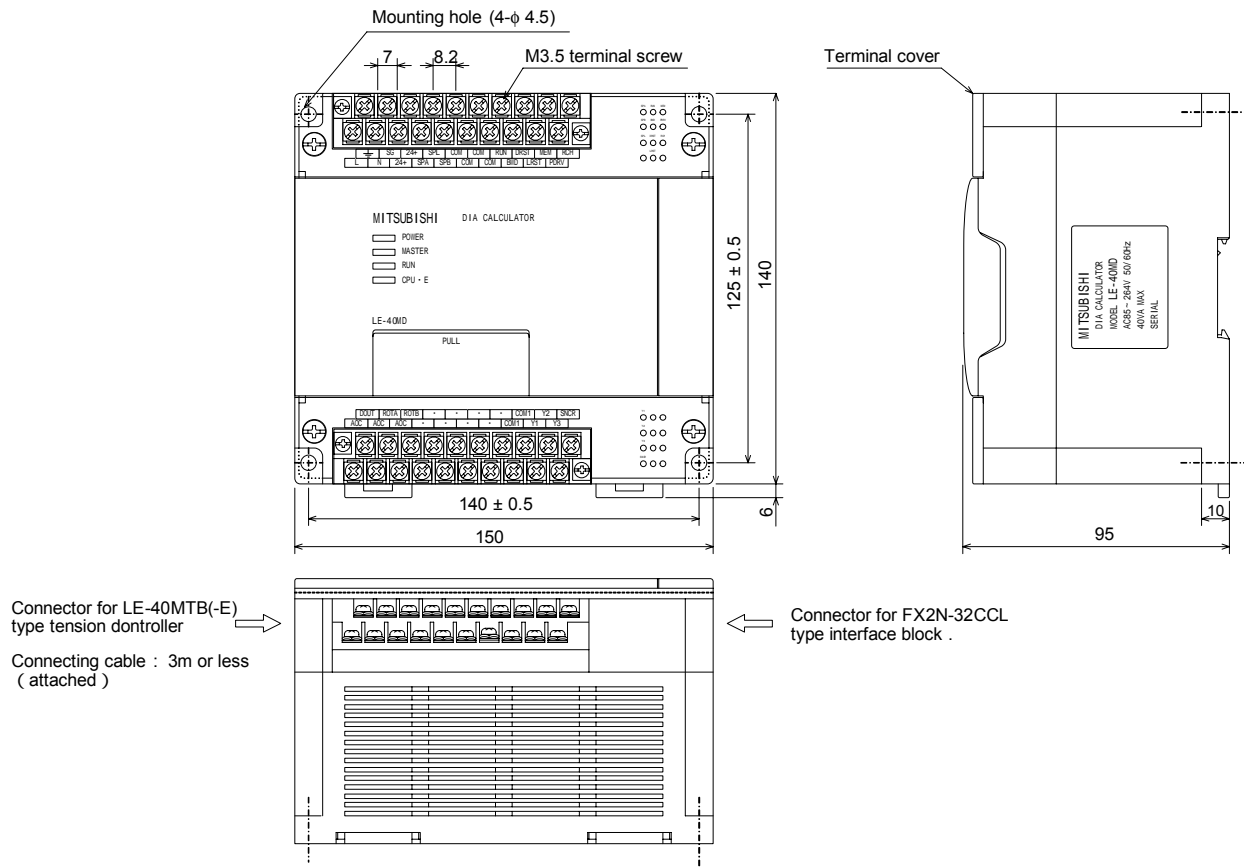
Ambient temperatute	0 to +55 °C-----during operation	
Ambient humidity	35 to 85% RH ( no condensation )----- during operation	
Vibration resistance	In conformance to JIS C0911 10 to 55Hz, 0.5mm (19.6m/s <sup>2</sup> maximum)* 2 hours in each of 3 axis directions. ( * 4.9m/s <sup>2</sup> when mounted on DIN rail )	
Impact resistance	In conformance to JIS C0912 98m/s <sup>2</sup> , 3 times in each of 3axis directions.	
Noise resistance	By noise simulator with noise voltage of 1,000 Vp-p, noise width of 1 μs and cycle of 30 to 100 Hz.	
Withstand voltage	1,500 VAC 1min	Between entire terminals as a whole and ground terminal.
Insulation resistance	5MΩ or more by 500 VDC megger	
Grounding	Solid grounding ( 100Ω or less )	
Operating atmosphere	No corrosive gas and little dusts	

### RUN signal (operation/stop) and material stop evaluation

This unit performs the material stop evaluation (Threshold: Approximately 0.5 m/min.) by detecting the line velocity to avoid erroneous calculation caused by chattering of the pulse signal while the material is stopped. Together with the RUN signal, the material stop evaluation is used as the condition to start/stop the reel diameter /measurement length /reel rotation velocity output calculation.



## 6.4 Outside dimensions



Connector for LE-40MTB(-E)  
type tension controller  
Connecting cable : 3m or less  
( attached )

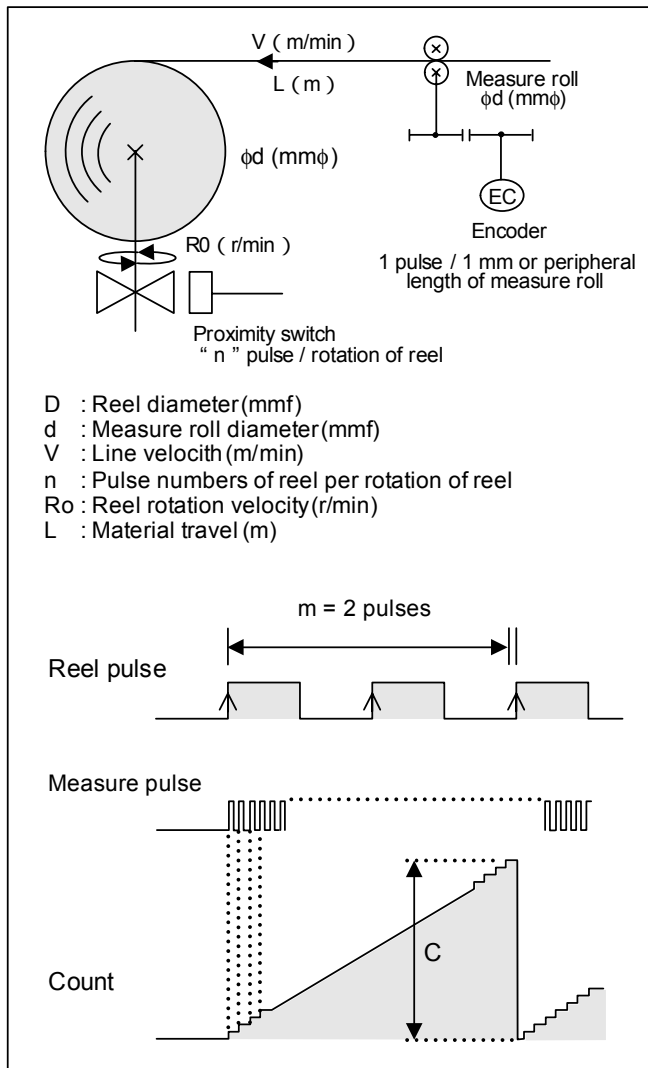
Connector for FX2N-32CCL  
type interface block .

Weight : Approx. 1.2 kg  
Color : Munsell 7.5Y 7.5/1

Accessories : Extension cable ( 3m ) × 1

## 6.5 Principle of detection

The LE-40MD detects the reel diameter, the line velocity, the reel rotation velocity and the measurement length based on the following principles.



### Reel pulse :

"n" pulses (n = 1 usually) are generated per rotation of the reel by the proximity switch.

### Measure pulse :

The guide roll nearest the reel is regarded as the measure roll, and the encoder is driven so that 1 measure pulse is generated per 1 mm of the peripheral length of the measure roll.

### Reel diameter detection value :

When the maximum value C of the measure pulse is obtained per "m" reel pulses as shown in the figure on the left, the reel diameter D can be calculated using the following equation.

$$C = \frac{\pi D m}{n} \quad \therefore D = \frac{n}{\pi m} C$$

### Line velocity detection value :

When the output pulse frequency of the encoder is obtained, the line velocity V can be calculated using the following equation.

$$f = \frac{V \times 10^3}{60} \quad \therefore V = 60f / 10^3$$

### Reel rotation velocity detection value :

The reel rotation velocity R0 can be calculated using the following equation based on the reel diameter D and the line velocity V mentioned above.

$$R_0 = \frac{V}{\pi D \times 10^{-3}}$$

### Measurement length detection value :

The measurement length L can be calculated using the following equation based on the integrated value M (obtained by adding the calculated value C at each time) of the measure pulse C.

$$L = M \times 10^{-3}$$

- Use the reel sensor and the measure sensor having the following specifications.
- As the power supply of each sensor, use the service power supply for the 24 VDC sensor provided on the unit. (In the case of the open collector output, the external power supply is also available.) For the specifications of the service power supply, refer to the list of I/O specifications.

#### Reel sensor

Power supply : 24 VDC $\pm$ 10%  
 Current consumption : 20 mA or less  
 Output type : NPN transistor output  
 Output current : 10 mA or more  
 Recommended product : Manufactured by SUNX Proximity switch GX-N18M  
 Responsibility : The ON time and the OFF time of the reel pulse shall be 0.5 ms or more respectively, and the frequency shall be 500 Hz or less.

#### Measure sensor

Power supply : 24 VDC $\pm$ 10%  
 Current consumption : 90 mA or less  
 Output type : NPN transistor output  
 Output current : 10 mA or more  
 Recommended product : Manufactured by KOYO Rotary encoder TRD-J $\square$ -S $\square$   
 Responsibility : The ON time and the OFF time of the measure pulse shall be 20  $\mu$ s or more respectively, and the frequency shall be 20 Hz or less.

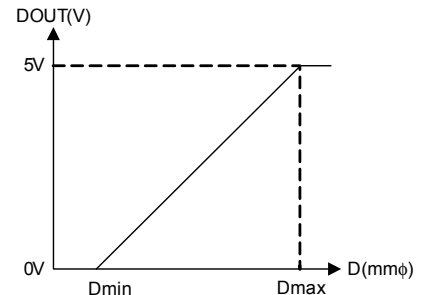
## 6.6 Analog output signal

1. Reel diameter output ----- Terminal name : [ DOUT ] DC0 to 5V / FS ( 12 bit )  
Load resistance : 1kΩ or more.

- This output can be used for reel diameter display or other external control signals.
- This output is an analog signal of 0 to 5 VDC in proportion to the calculated reel diameter corresponding to the minimum to maximum diameter. However, the upper limit and the lower limit are saturated.
- The DOUT output is calculated using the following equation.

$$DOUT = \frac{D - D_{min}}{D_{max} - D_{min}} \times 5 [V]$$

Dmin : Minimum diameter (Set value: 0 to 2,000 mmφ)  
Dmax : Maximum diameter (Set value: Dmin to 2,000 mmφ)  
D : Current diameter (calculation value: mmφ)  
-----Refer to page 33.  
\* Dmin shall be smaller than Dmax.



**(Note)** This output is valid while the power of the unit is turned on.

When this output is not used, perform appropriate treatment outside the unit by omitting the wiring, disconnecting at the external contact, etc.

2. Reel rotation velocity output ----- Terminal name : [ ROTA ], [ ROTB ] DC0 to 10 / FS ( 12 bit )  
Load resistance : 2kΩ or more.

- The reel rotation velocity output is classified into two types, one for constant slip control of the winding powder clutch and the other for predriving of the new reel. The functions of the ROTA and ROTB terminals vary as follows depending on the RCH and PDRV input status.

RCH status	PDRV status	ROTA	ROTB
ON	ON	Constant slip output	Predrive output
	OFF		Invalid output
OFF	ON	Predrive output	Constant slip output
	OFF	Invalid output	

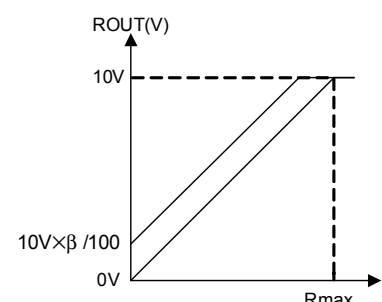
### (1) In the cases of constant slip control of the winding powder clutch

The reel rotation velocity outputs ROTA and ROTB as the constant slip outputs shall be referred to as ROUT output.

- The current reel rotation velocity is calculated based on the calculated reel diameter and the calculated line velocity, the bias corresponding to the slip rotation velocity of the power clutch is added to the calculated reel rotation velocity, then the obtained result is converted into the rotation velocity command and outputted as the ROUT output.
- The signal of 0 to 10 VDC is output in accordance with the calculated reel rotation velocity of 0 to Rmax (set by the parameter). The upper and lower limits are saturated.

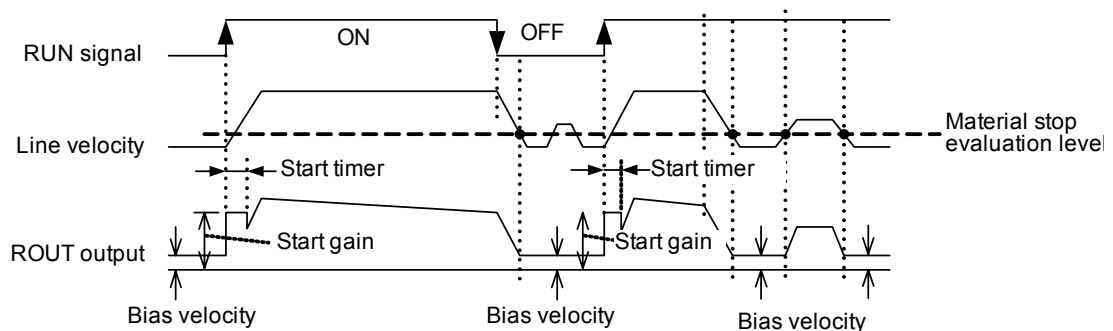
$$ROUT = \left( \alpha \times \frac{R0}{R_{max}} + \beta \right) \times \frac{10}{100} [V]$$

α : R coefficient (Set value: 0 to 150%)  
β : R bias (Set value: 0 to 100%)  
Rmax : Rated rotation velocity of motor converted into reel rotation velocity for 10 V command when powder clutch is completely connected (Set value : 1 to 3,600r/min.)  
R0 : Reel rotation velocity (calculation value: r/min.)  
(Refer to page 33.)



- $\alpha$  (R coefficient) is usually set to 100%. When  $\alpha$  is set to 0% while the material is stopped and the RUN input is turned off, the output is fixed by the R bias and manual operation is enabled.
- $\beta$  (R bias) is the parameter to set the slip rotation velocity of the powder clutch, and the following equation is available.  

$$\beta = (\text{Slip rotation velocity of powder clutch converted into reel rotation velocity}) / R_{\text{max}} \times 100\%$$
 $\beta$  shall be 3% or more and the allowable minimum slip rotation velocity or more.
- Though the ROUT output shall become as described above while the RUN input is turned on and the material is not evaluated as stopped, it is fixed to the bias velocity while the material is evaluated as stopped and calculation is stopped.
- When the RUN input is turned on from off, the start gain (set to  $\times 1$  to  $\times 5$  by the parameter) can be applied on the R bias exclusively during the start timer period (set to 0 to 10 sec by the parameter). However, the upper limit of the output is limited to 30% or less.



## ⚠ DANGER

- The ROUT output may increase and reach the maximum value while the single reel operation is performed or when the material is ruptured because the relationship with regard to the ratio between the reel pulse and the measure pulse is not satisfied. As the result, the reel rotation velocity may increase and reach the maximum rotation velocity.  
 The ROUT output can be used as the velocity limit input (velocity input required to rotate the servo motor in the torque mode) while winding or unwinding is performed using the torque servo, but it cannot be used to prevent the motor from running out of order while the single reel operation is performed or when the material is ruptured.  
 Take appropriate safety countermeasures outside the unit to prevent the reel from running out of order.

### (Note)

1. The ROUT output is always valid and output while the power of the unit is turned on.  
 When this output is not used, perform appropriate treatment outside the unit by omitting the wiring, disconnecting at the external contact, etc.
2. Never use the ROUT output when the powder clutch is used for unwinding.  
 When the winding reel is temporarily used for unwinding in the rewinder, etc., disconnect the ROUT output from the motor and control the motor using a different system.
3. Stop the motor in the inverter when stopping the motor to replace the winding material, etc.

## (2) In the case of predrive control

The rotation velocity outputs ROTA and ROTB as the predrive outputs are referred to as the ROUTPD output.

- The ROUTPD output is the reel rotation velocity command used to predrive the new reel during two-reel changeover operation, and is valid exclusively while the PDRV input is turned on.
- The reel rotation velocity required for peripheral velocity synchronization is calculated based on the set new reel diameter (initial value set by the parameter) and the current line velocity (calculated value), converted into the rotation velocity command, and outputted as the ROUTPD output.
- The signal of 0 to 10 VDC is output in accordance with the calculated reel rotation velocity of 0 to Rmax (set by the parameter). However, the upper and lower limits are saturated.
- The ROUTPD output can be calculated using the following equation. The ROUTPD output is in proportion to the calculated reel rotation velocity, but it is in proportion to the calculated line velocity and in reverse proportion to the set new reel diameter.

$$\text{ROUT}_{PD} = \left( \frac{R_P}{R_{\max}} + \frac{\beta_P}{100} \right) \times 100$$

$\beta_P$  : Predrive bias (Set value: -10 to +10%)

$R_{\max}$  : Rated rotation velocity of motor converted into reel rotation velocity for 10 V command (when powder clutch is completely connected) (Set value: 1 to 3,600 r/min.)

$R_P$  : Rotation velocity of new reel (Calculated value, r/min.)

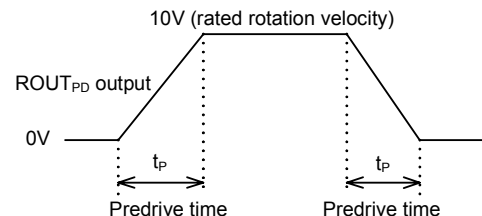
The  $R_P$  value can be calculated using the following equation.

$$R_P = \frac{V}{\pi \times D_0 \times 10^{-3}}$$

$V$  : Line velocity ( Calculated value, m/min.)----- Refer to page 33.

$D_0$  : New reel diameter ( Set value : 0 to 2,000 mm $\phi$  ) Equivalent to initial value

- The change rate ( inclination ) of the  $\text{ROUT}_{PD}$  output depends on the predrive time  $t_P$  (parameter to set the accelerating / decelerating time between 0 and the rated rotation velocity, 0 to 200 sec ), but the time required to reach the target calculation value varies depending on the line velocity and the predrive bias set value. The actual time required for the reel to reach the peripheral velocity varies also depending on the mechanical condition.



- $\beta_P$  is the parameter to set the bias velocity for fine adjustment during predriving. Adjust it upon necessity during trial run, etc.
- When the ROUTPD output reaches the target rotation velocity value of the new reel synchronizing with the current line velocity, the SNCR (peripheral velocity synchronization) contact output is turned on.  
(The same operation is performed when the target value is modified during predriving.)
- When the reel change signal RCH is given (ON  $\leftrightarrow$  OFF), the rotation velocity command is changed from the ROUTPD output to the ROUT output described above.  
At this time, the rotation velocity command for the old reel becomes as follows.
  - a) When the RCH is given while the PDRV is turned on  
The output immediately before the reel is changed is kept until the PDRV is turned off, then becomes 0 with the inclination of the predrive time setting after the PDRV is turned off.
  - b) When the RCH is given while the PDRV is turned off  
The cushion stop is actuated with the inclination of the predrive time setting.

### (Note)

When the RCH input is given without predrive while the material is fed, the reel rotation velocity command calculated from the initial diameter and the current line velocity is immediately output for the new reel if the RUN input is turned on. Be careful.

- When the PDRV input is turned off before the reel change signal is given due to stop during predriving, etc., the cushion stop is actuated in the ROUTH output with the inclination of the predrive time setting. Accordingly, the PDRV input must be turned on until reel changeover is finished to realize correct reel change.
- The SNCR contact output is turned off when the reel change signal RCH is given, the predrive input PDRV is turned off, or the new reel peripheral velocity becomes out of the synchronization evaluation range ( $\pm 5\%$  of the line velocity).

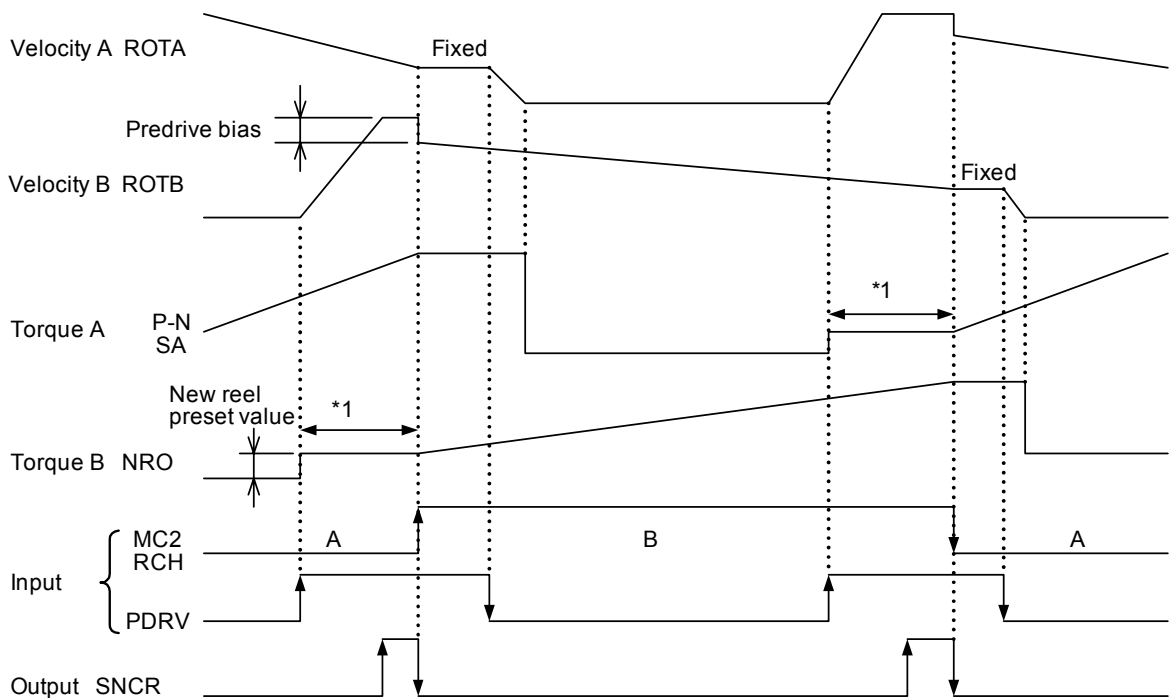
**(Note)**

Though the ROUTH output follows up the line velocity, it is turned off when the calculated peripheral velocity becomes out of the synchronization evaluation range if the line velocity is changed even if the peripheral synchronization contact output SNCR is turned on once. Change over the reel while the line velocity is kept constant.

**(Note)**

The ROUTH output is expected to be used for center driving in the new reel motor. Accordingly, when the ROUTH output is used for predriving by surface driving in a different motor, scale adjustment in the velocity command is required between the ROUTH output and the predrive motor.

**(3) Example of two-reel changeover, winding.**



\*1 The new reel preset output is not offered in this period when the parameters in the LE-40MTB(-E) are set to "control reel = unwinding" and "actuator = powder".

## 6.7 Set / monitor item list

### 1. Setting parameters

	Set / selection items	Set value	Unit	Set / selection range		Initial Value	Memory *1		Setting during RUN=ON
				Minimum Value	Maximum value		Menu	System	
Variable setting	Initial diameter	INIT.DIA	mmφ	0	2000	1000	○		Enabled
	Reel diameter 1	DOUT Y1	mmφ	0	2000	0	○		Enabled
	Reel diameter 2	DOUT Y2	mmφ	0	2000	0	○		Enabled
	Reel diameter 3	DOUT Y3	mmφ	0	2000	0	○		Enabled
	Measurement length 1	LOUT L1	m	0	32767	0	○		Enabled
	Measurement length 2	LOUT L2	m	0	32767	0	○		Enabled
	Measurement length 3	LOUT L3	m	0	32767	0	○		Enabled
System setting	Winding / unwinding	CAL.PART	—	Either winding or unwinding is selected.		Winding		○	Disabled
	Reel diameter / measurement length	Y MODE	—	Either reel diameter or measurement length is selected.		Reel diameter		○	Disabled
	Reel rotation velocity coefficient	R CURR.	%	0	150	100		○	Enabled
	Reel rotation velocity bias	R BIAS	%	0	100	0		○	Enabled
	Start gain	R GAIN		1	5	3		○	Enabled
	Start timer	ER	sec	0	10	2		○	Enabled
	Predrive time	PD TIMER	sec	0	200	0		○	Enabled
	Predrive bias	D BIAS	%	-10	10	0		○	Enabled
	Teaching velocity	SPEED	m/min	1	1000	100		○	Enabled
	Velocity electronic gear	SPD.GEAR	%	90	180	100		○	Enabled
	Teaching reel diameter	REEL DIA.	mmφ	1	2000	100		○	Enabled
	Reel diameter electronic gear	DIA.GEAR	%	90	110	100		○	Enabled
	Reel pulse number	REEL PLS.	pulse /rev	1,2,4,8 or 16 is selected.		1		○	Disabled
	Reel diameter calculation cycle	D CYCLR	pulse	1,2,4,8 or 16 is selected.		1		○	Enabled
	Maximum reel rotation velocity	R MAX	r/min	1	3600	1800		○	Disabled
Minimum diameter	MIN.DIA	mmφ	0	2000	100		○	Disabled	
Maximum diameter	MAX.DIA	mmφ	Minimum set diameter	2000	1000		○	Disabled	

\*1 Memory type in the LE-40MTB(-E)

- “Menu” is the data saved in the menu table memory.
- “System” is the data saved as the common data in the system memory.

### 2. Monitor items

Monitor items	Description	Monitor range *2	Practical range	Minimum unit
Reel diameter monitor	Current reel diameter ( mmφ )	0~2200	0~2000	1
Measurement length monitor	Current length of material passing through measure roll ( m )	-9999~32767	0~32767	1
Velocity monitor	Current line velocity ( m / min )	0~1100	0~1000	1
MD monitor 1	ON / OFF status of contact input	—	—	—
MD monitor 2	ON / OFF status of contact output	—	—	—
Reel command monitor	Current rotation velocity output ( % )	0~100	0~100	1

\*2 Make sure to use the reel diameter, the measurement length and the velocity within the practical range respectively. Have in mind that operation of the unit is not assured outside the practical range.



# 7. Supplement

## 7.1 Change in functions of 40MTB (-E)

When the LE-40MD is used together with the LE-40MTB(-E), the functions of the LE-40MTB(-E) become different as follows compared with the case where the LE-40MD is not used together.

### 1. Control output changeover mode in LE-40MTB(-E)

- When the LE-40MD is not used together, the control output in the LE-40MTB(-E) is SA-SN(or P-N)exclusively.  
When two reels are changed over, the control output is required to be changed over from the outside. (The NRO-SN output is a fixed output which can be varied as the predrive output.)
- However, when the LE-40MD is used together, the control output can be changed over as follows for two reels inside the LE-40MTB(-E) by setting the parameter "Number of reels" in the LE-40MTB(-E) and the parameter "Predrive time (PD timer)" in the LE-40MD.  
When "Number of reels" is set to "REELS(multiple)" and "PD timer" is set to a numeric other than 0, the internal two-reel changeover mode is selected, and the SA-SN output becomes 0 to 5 VDC/FS.

With any other setting, the control output is set to the external changeover mode.

- The table below shows the output operation. (Refer to page 37.)

Output for LE-40MTB(-E)	MC2 = OFF	MC2 = ON
SA – SN ( or P – N )	Control output	New reel present output
NRO – AOC	New reel present output	Control output

### 2. Taper control in LE-40MTB

- The reel diameter for taper control in the LE-40MTB can be set among three types, internal, external and link. When the LE-40MD is connected, however, the following operation is offered.

Taper reel diameter	LE-40MD connected	LE-40MD not connected
Internal reel diameter	Internal taper control	Internal taper control
External reel diameter	Taper control based on reel diameter calculation data from LE-40MD. * Reel diameter data from AI2 and AI3 inputs are neglected.	Taper control based on reel diameter data from AI2 and AI3 inputs.
Link reel diameter	Taper control based on reel diameter calculation data from LE-40MD. * Link reel diameter cannot be set.	Taper control based on link reel diameter. * Case where link reel diameter is selected before LE-40MD is connected is also included.

