ZEF005510404

VRtension®

Tension amplifier

TMA-A20NAN

Specifications and Instruction Manual

Applicable tension sensor: TMS-ST[ ]
TMS-SS[ ]
TMS-S[ ]
TMS-A[ ]
TMS-B[ ]

CE

CONTENTS

INTRODUCTION

Thank you very much for purchasing our product.
Before operating this product, be sure to carefully read this manual so that you may fully understand the product, safety instructions and precautions.
- Please submit this manual to the operators actually involved in operation.
- Please keep this manual in a handy place.

GENERAL SAFETY RULES

● Application Limitation

This product is not designed to be used under any situation affecting human life. When you are considering using this product for special purposes such as medical equipment, aerospace equipment, nuclear power control systems, traffic systems, and etc., please consult with NSD.

This product is designed to be used under the industrial environments categorized in Class A device.
The supplier and user may be required to take appropriate measures.

● Signal Words

Safety precautions in this guide are classified into DANGER and CAUTION.

Symbol	Meaning
⚠ DANGER	Incorrect handling may cause a hazardous situation that will result in death or serious injury.
⚠ CAUTION	Incorrect handling may cause a hazardous situation that will result in moderate injury or physical damage.

Instructions accompanied by a symbol ⚠ CAUTION may also result in serious damage or injury. Be sure to follow the all instructions accompanied by the symbol.

● Graphic Symbols

Symbol	Meaning
⃠	Indicates prohibited items.
❗	Indicates items that must be performed to.

1. Handling Precautions

⚠ DANGER	
⃠	- Do not touch components inside of the tension amplifier; otherwise, it will cause electric shock. - Do not damage the cable by applying excessive load, placing heavy objects on it, or clamping; otherwise, it will cause electric shock or fire.
❗	- Turn the power supply OFF before wiring, transporting, and inspecting the tension amplifier; otherwise, it may cause electric shock. - Provide an external safety circuit so that the entire system functions safely even when the tension amplifier is faulty. - Connect the grounding terminal of the tension amplifier r; otherwise, it may cause electric shock or malfunction.

⚠ CAUTION	
⃠	- Do not use the tension amplifier in the following places; water splashes, the atmosphere of the corrosion, the atmosphere of the flammable vapor, and the side of the combustibility. Doing so may result in fire or the tension amplifier may become faulty.
❗	- Be sure to use the tension amplifier and sensor in the environment designated by the general specifications in the manual. Failure to do so may result in electric shock, fire, malfunction or unit failure. - Be sure to use the specified combination of the tension sensor, amplifier, and sensor cable; otherwise, it may cause fire or the tension amplifier malfunction.

2. Storage

⚠ CAUTION	
⊘	- Do not store the tension amplifier in a place exposed to water, or toxic gas and liquid.
❗	- Be sure to store the tension amplifier in designed temperature and humidity range, and do not exposed to direct sunlight. - Be sure to consult with NSD when the tension amplifier is stored for long periods.

3. Transport

⚠ DANGER	
⊘	- Do not hold the cable of the tension sensor during transport; otherwise, it will cause injury or malfunction.

4. Installation

⚠ CAUTION	
⊘	- Do not step on the tension sensor or place heavy objects on the tension amplifier; otherwise, it will cause injury or malfunction. - Do not block the exhaust port or allow any foreign matter to enter the tension amplifier; otherwise, it will cause fire or the tension amplifier failure.
❗	- Be sure to secure the tension amplifier and sensor with the provided brackets; otherwise, it may cause malfunction, injury, or drop. - Be sure to secure the specified distance between the tension amplifier and the control panel or other equipment; otherwise, it may cause malfunction.

5. Wiring

⚠ DANGER	
❗	- Be sure to secure the terminal block firmly; otherwise, it will cause fire. - Be sure to mount the terminal cover provided with the tension amplifier, before supplying the power, starting operation after the installation, and wiring; otherwise, it may cause electric shock.

⚠ CAUTION	
❗	- Be sure to keep the sensor cable, control cable, and communication cable at least 300 mm away from the main circuit and power line; otherwise it may cause injury or malfunction. - Be sure to connect all cables correctly; otherwise, it may cause injury or malfunction. - Be sure to firmly connect the external I/O connectors and the tension sensor connectors; otherwise, it may cause incorrect inputs and outputs or injury.

6. Operation

⚠ CAUTION	
⊘	- Do not change the tension amplifier's function switch settings during the operation; otherwise, it will cause injury.
❗	- Be sure to check that the power supply specifications are correct; otherwise, it may cause the tension amplifier failure. - Be sure to conduct independent trial runs for the tension amplifier before mounting the tension sensor to the machine; otherwise, it may cause injury. - When an error occurs, be sure to eliminate the cause, ensure safety, and reset the error before restarting operation; otherwise, it may cause injury.

7. Maintenance and Inspection

⚠ CAUTION	
⊘	- Do not disassemble, remodel, or repair the unit; otherwise, it will cause electric shock, fire, and unit malfunction.
❗	- The capacitor of the power line deteriorates through prolonged use. We recommended that the capacitor be replaced every five years to prevent secondary damage.

8. Disposal

⚠ CAUTION	
⊘	- Be sure to handle the tension amplifier and sensor as industrial waste while disposing of it.

REVISION HISTORY

The Document No. appears at the upper right of this manual's cover page.

Document No.	Date	Revision Description
ZEF005510400	29, May., 2014	1st Edition Japanese document: ZEF005510100
ZEF005510401	10, Mar., 2016	2nd Edition Japanese document: ZEF005510101
ZEF005510402	07, Aug., 2017	3rd Edition Japanese document: ZEF005510102
ZEF005510403	06, Apr., 2020	4th Edition Japanese document: ZEF005510103
ZEF005510404	01, Nov., 2021	5th Edition Japanese document: ZEF005510104

1. OVERVIEW

The VR TENSION system is a combination of a tension sensor and a tension amplifier and can be used for measuring the web load (tension).
The tension amplifier displays the load value measured by the tension sensor. At the same time, an analog voltage or current corresponding to the load will be output to external devices (recorder, PLC, or tension controller etc.).

1-1. Features

(1) Two axes tension sensor can connect
The tension for two axes can be detected by one tension amplifier. The space-saving in the control panel can be conducted.

(2) Compact design
The tension amplifier's outside dimensions (39(W) x 155(H) x 93(D)) were miniaturized. DIN rail can be used, so mounting is much easier.

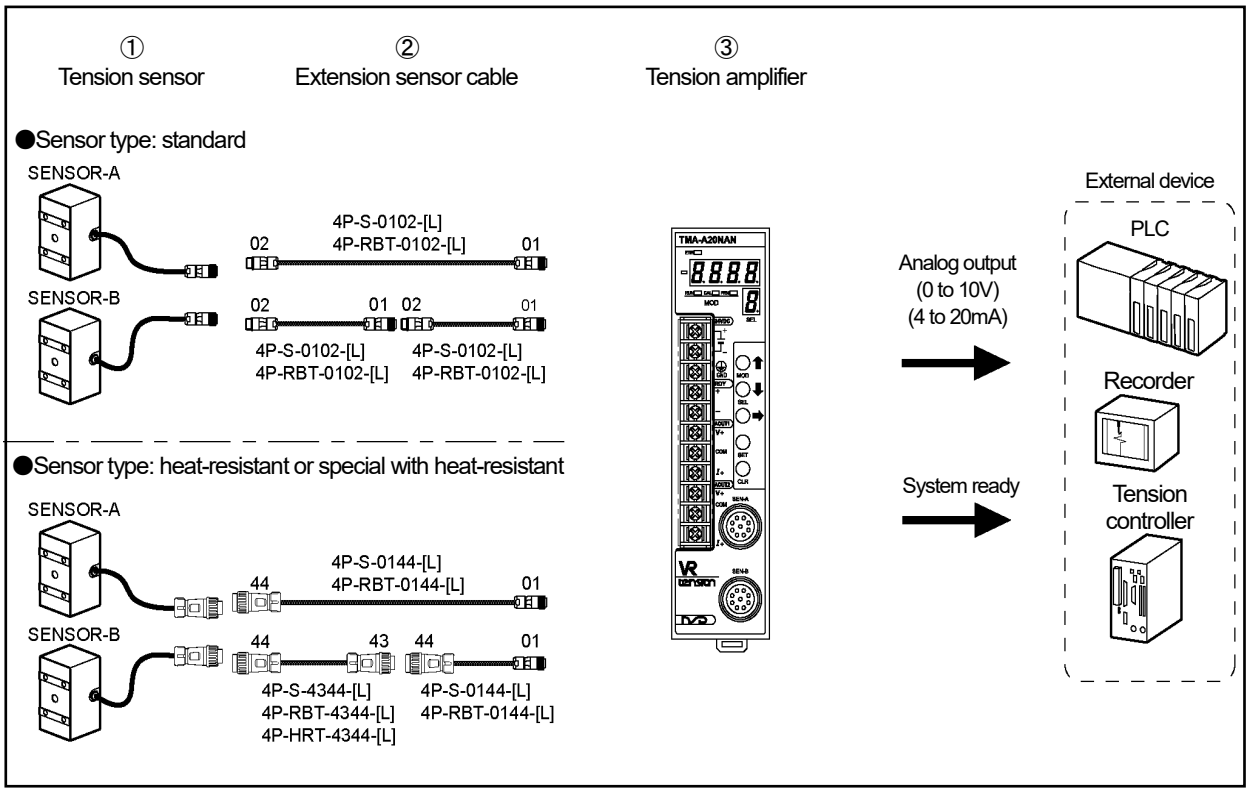
(3) Analog voltage/current output function
The analog voltage or current which is corresponding to the tension is output to the external device. The output point is 2-point.

(4) Compliance with CE standards
The tension amplifier complies with CE (EMC Directive) standards.

2. MODEL SELECTION WHEN ORDERING

The following figure indicates the system configuration of VR TENSION.
Before ordering, refer to the system configuration and model list. Please prepare by customer except 1 to 3 in the system configuration.

●System Configuration



● Model list

No.	Name	Model	Description
①	Tension sensor	TMS-[*1][*2][*3][*4]	*1: Model *2: Sensor type *3: Connector type *4:Interconnecting cable length For more information, refer to 3-2.
②	Extension sensor cable	4P-S-0102-[L]	Standard cable [L]: Cable length (m) 2, 3, 5, 8, 10, 15, 20, 25, 30, 35, 40, 45, 50 (Cables over 50 m are available in 10 m increments).
		4P-RBT-0102-[L]	Robotic cable [L]: Cable length (m) 2, 3, 5, 8, 10, 15, 20, 25, 30, 35, 40, 45, 50 (Cables over 50 m are available in 10 m increments).
		4P-S-0144-[L]	Standard cable [L]: Cable length (m)
		4P-RBT-0144-[L] 4P-RBT-4344-[L]	Robotic cable [L]: Cable length (m)
		4P-HRT-4344-[L]	Heat-resistant robotic cable [L]: Cable length (m)
③	Tension amplifier	TMA-A20NAN	

3. SPECIFICATIONS

3-1. Tension Amplifier

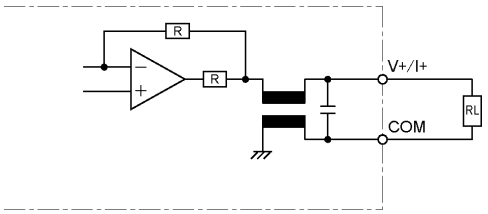
(1) General specification

Items	Specifications
Power supply voltage	24VDC±10% (including ripple)
Power consumption	10W or less
Insulation resistance	20 M-Ohms or more between external DC power terminals and ground (by 500 VDC insulation resistance tester)
Withstand voltage	500 VAC, 60Hz for 1 minute between external DC power terminals and ground
Vibration resistance	20m/s^2 10 to 500Hz, 10cycles of 5 minutes in 3 directions, conforms to JIS C 0040 standard
Ambient operating temperature	0 to +55°C (No freezing)
Ambient operating humidity	30 to 90 %RH (No condensation)
Ambient operating environment	Free from corrosive gases and excessive dust
Ambient storage temperature	-25 to +70°C
Grounding	Must be securely grounded (ground resistance of 100 ohm or less)
Construction	Book-shelf type within enclosure, DIN rail mountable
Outside dimension (mm)	39(W) ×155(H) × 93(D) Refer to dimensions for details.
Mass	Approx. 0.4kg

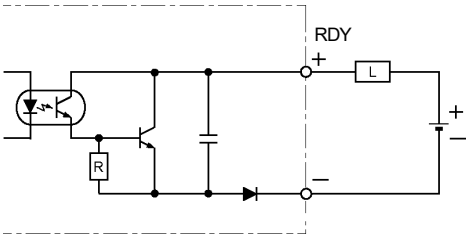
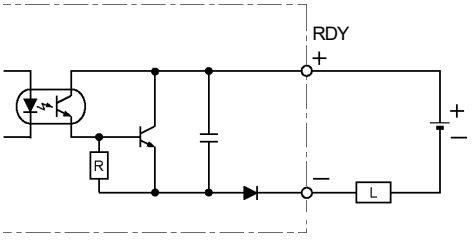
(2) Performance specification

Items	Specifications
No. of input sensors	2-axis
Display description	- Data display (7-segment, 4-digit of LED + sign): Setting value Tension data (A-axis, B-axis, A+B axes) Tension peak HOLD data (A-axis, B-axis, A+B axes) Sensor data (A-axis, B-axis) - State display: error, mode, select No.
Calibration	Zero preset Calibrating with the reference weight
Load direction	+ (Plus direction) or - (Minus direction) (Setting by the parameter)
Load rating	0.001～9999.999 (Setting by the parameter)
Error detection	Amplifier error, Internal power error, memory error, sensor disconnected error
Analog filter	12Hz
Sampling interval	0.2 to 20ms (The multiple numbers of 0.2ms is set by the parameter.)
Data filter	Moving average of 2 to 1000 data (The number of moving average is set by the parameter.)
Applicable standard	CE Marking (EMC directive)

(3) Analog output specification

Items	Specifications	
Output range	0 to +10VDC	4 to 20mADC
Output signal	2 points Select one of following signals; A-axis, B-axis, or A+B-axis by the parameter setting.	
Isolation format	Photo-coupler isolation (No isolation between output signals)	
Output resolution	Approx. 0.17mV (0 to +10V / Approx.60000 divisions)	Approx.0.27μA (4 to 20mA / Approx.60000 divisions)
Output load resistance	10kΩ or more	0 to 510Ω Recommendation value: 250Ω
Output impedance	Approx.30Ω	–
External connection	Terminal block connection	
Update cycle	0.2ms	
Output circuit		

(4)Digital output specification

Items	Specifications
Output signal	System ready (at normal operation: ON)
Isolation format	Photo-coupler isolation
Rated load voltage	24VDC (Max. 30VDC)
Max. load current	100 mA
Max. voltage drop when ON	2.0V (at 100mA)
Output circuit	Sink connection 
	Source connection 

3-2. Tension Sensor

Items		Specifications									
Sensor model		TMS- [*1] [*2] [*3] [*4]									
[*1] Model		ST002	SS005	S02	S05	A10	A20	A50	B100	B200	B300
Load rating (N) [kgf] Note 1		1.96 [0.2]	4.9 [0.5]	19.6 [2]	49 [5]	98 [10]	196 [20]	490 [50]	980 [100]	1960 [200]	2940 [300]
Largest measurable load (N) [kgf] Note 2		2.94 [0.3]	7.35 [0.75]	29.4 [3]	73.5 [7.5]	147 [15]	294 [30]	735 [75]	1470 [150]	2940 [300]	4410 [450]
Allowable load (Multiplying factor of load rating)	Measurement direction	20 times	20 times	20 times	10 times	20 times	20 times	10 times	10 times	7.5 times	5 times
	Perpendicular direction	20 times	20 times	20 times	10 times	20 times	20 times	10 times	10 times	7.5 times	5 times
Dimensions (mm)		55(W)×46(H) ×32(D)	65(W)×44(H) ×45(D)	85(W)×50(H) ×50(D)		124(W)×60(H)×64(D)			149(W)×75(H)×79(D)		
Mass/movable section mass (kg)		0.5 / 0.11 Note 5	0.75 / 0.25 Note 5	2.0 / 0.5		3.1 / 1.4			5.5 / 2.6		
Rated load distortion		Approx. 0.02mm									
Linearity error		±1%									
Vibration resistance Note 3		2×10^2 m/s^2 (20G)									
Shock resistance Note 3		1×10^3 m/s^2 (100G)									
[*2] Sensor type		A		B		C		L		M	N
Ambient temperature Note 4	Operating	−10 to +60℃		−10 to +120℃		−10 to +150℃		−10 to +60℃		−10 to +120℃	−10 to +150℃
	Storage	−30 to +90℃		−30 to +120℃		−30 to +150℃		−30 to +90℃		−30 to +120℃	−30 to +150℃
Protection rating		IP40						IP67			
[*3] Connector type		B: NJW-2012-PM8 (when selecting the sensor type B, C, M, or N) C: R04-PB9M-8.0A (when selecting the sensor type A or L)									
[*4] Interconnecting cable length		Blank: 2m (standard), 5: 5m, 10: 10m, 20: 20m									
Max. sensor cable length	Standard cable	4P-S	100m (The maximum total length of the interconnecting cable and extension cable is 100m.)								
	Robotic cable	4P-RBT 4P-HRT									

Notes

1: Load rating for one sensor unit.

2: The "largest measurable load" refers to the measurable limit over the load rating.

3: The vibration and shock resistance is indicated by the numeric value when testing the sensing part of the internal sensor.

4: The ambient operating temperature of the connector is in the range between −25 and +85℃.

5: ST002 and SS005 must be installed horizontally.
The sensor cannot detect the tension correctly if it is installed vertically or with leaning.

● Tension sensor code

TMS−[*1] [*2] [*3] [*4]

*1: Model (Load rating)
ST002, SS005, S02, S05, A10, A20, A50, B100, B200, B300

*2: Sensor type
A: Standard B: Heat-resistant C: Special with heat-resistant
L: Standard with water-resistant M: Heat-resistant and water-resistant
N: Special with heat-resistant and water-resistant

*3: Connector type
B: NJW-2012-PM8 (when selecting the sensor type B, C, M, or N)
C: R04-PB9M-8.0A (when selecting the sensor type A or L)

*4: Interconnecting cable length
Blank: 2m (standard), 5: 5m, 10: 10m, 20: 20m

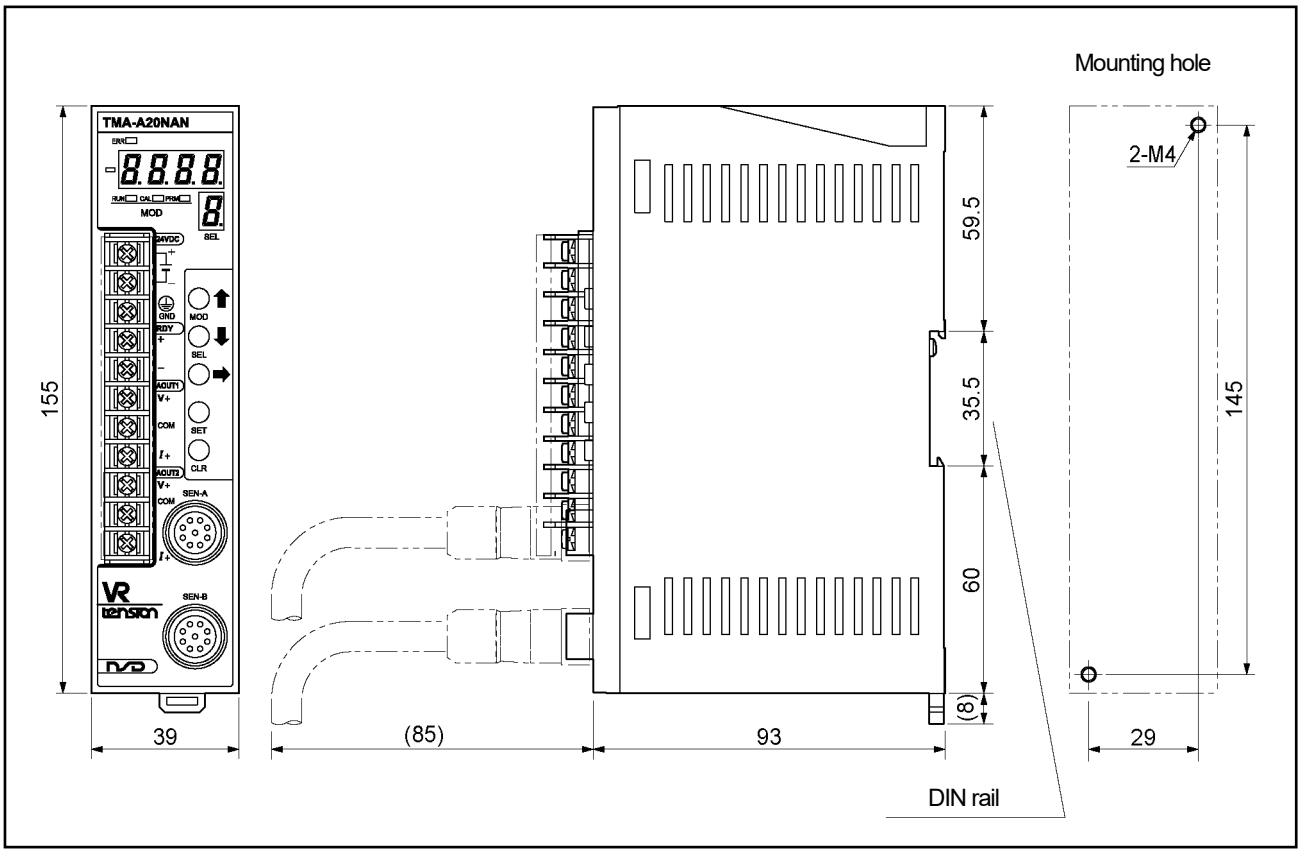
3-3. Extension Sensor Cable

Items	Specifications		
Model code	4P-S	4P-RBT	4P-HRT
Cable type	Standard cable	Robotic cable	Heat-resistant robotic cable
Diameter	ϕ8		
Ambient operating temperature	−5 to +60℃		0 to +150℃
Insulator	Irradiated cross linked formed polyethylene	ETFE plastic (resin)	
Sheath	Polyvinyl chloride mixture		Fluoro-rubber
Color of sheath	Gray	Black	
Advantage	—	Superior flexibility; ideal for moving place	Heat treatment and flexible; ideal for moving place

4. DIMENSIONS

4-1. Tension Amplifier

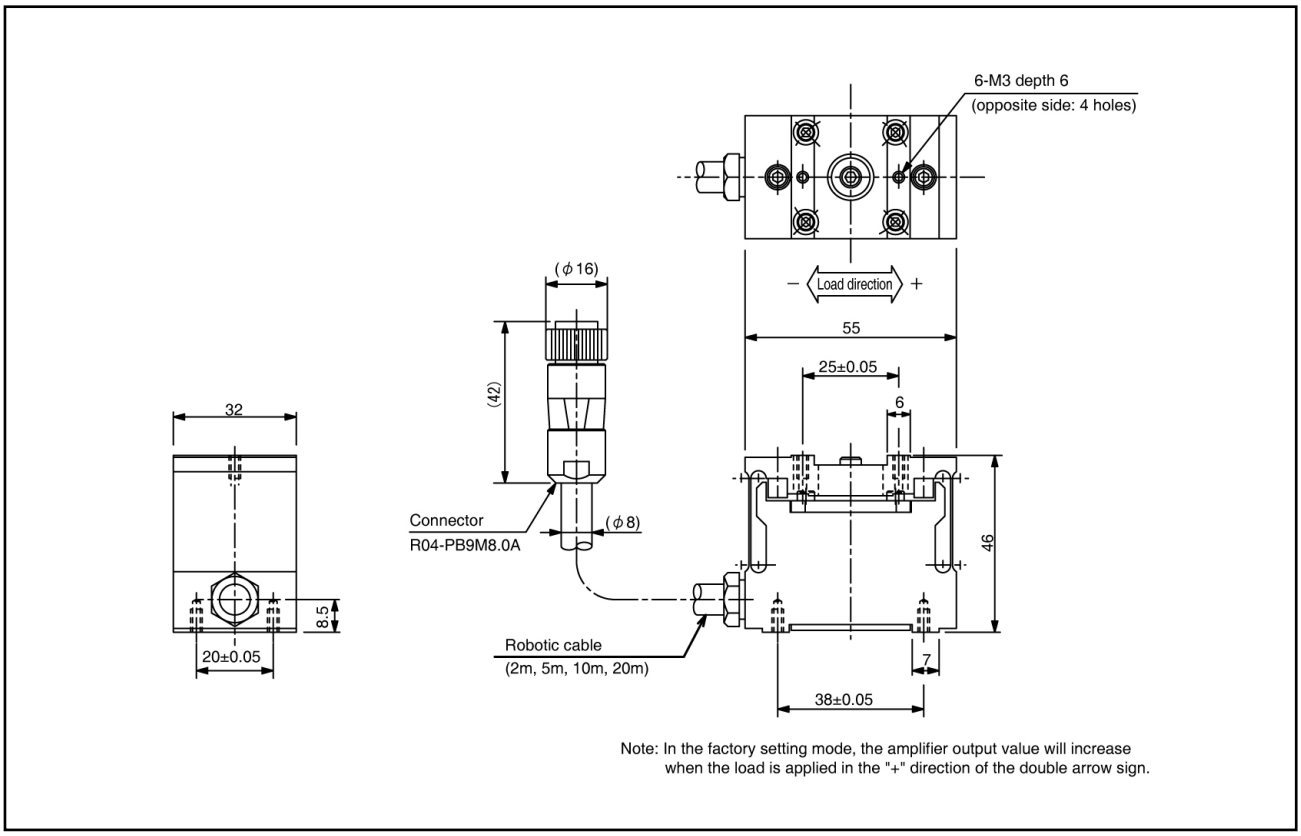
Units: mm



4-2. Tension Sensor

(1) TMS-ST (sensor type: A, L)

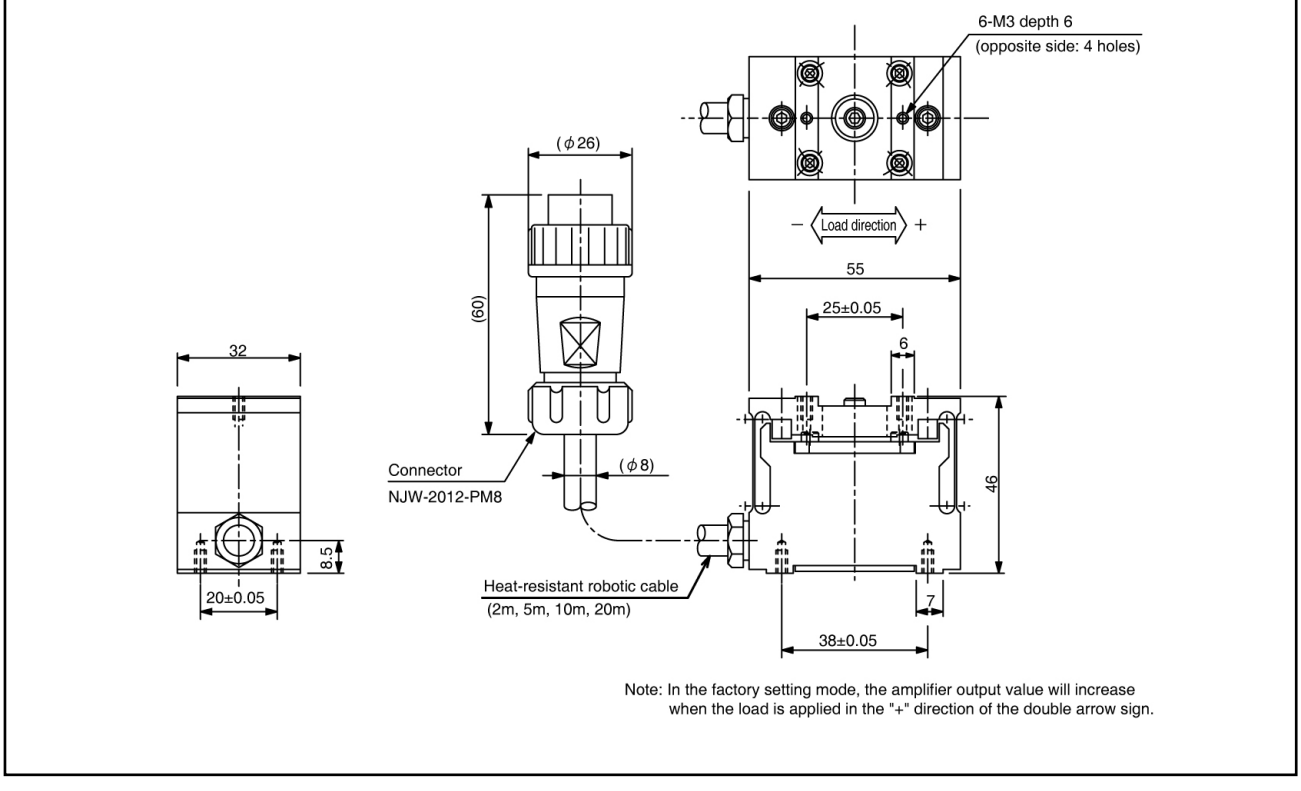
Units: mm



Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(2) TMS-ST (sensor type: B, C, M, N)

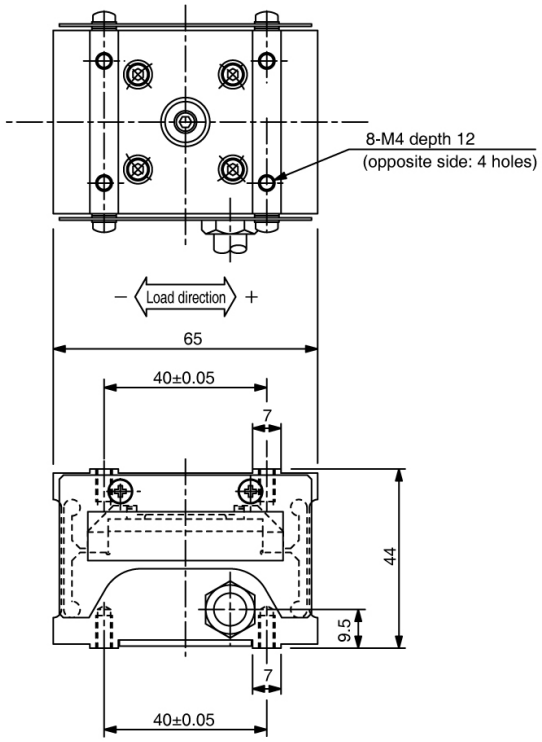
Units: mm

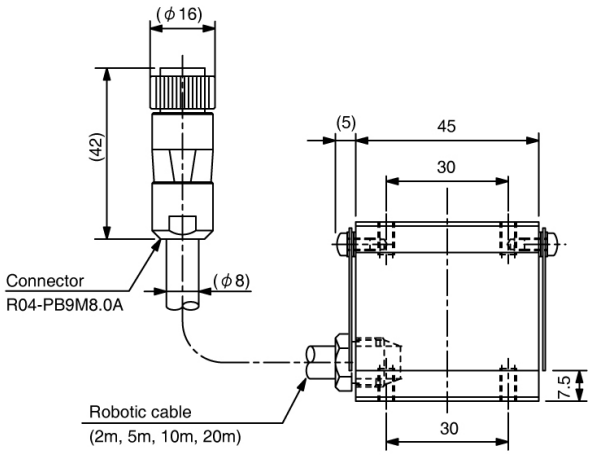


Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(3) TMS-SS (sensor type: A, L)

Units: mm

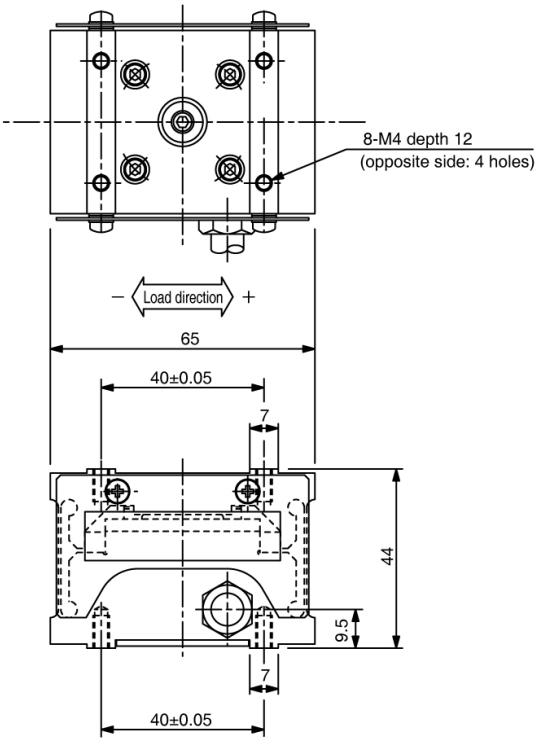


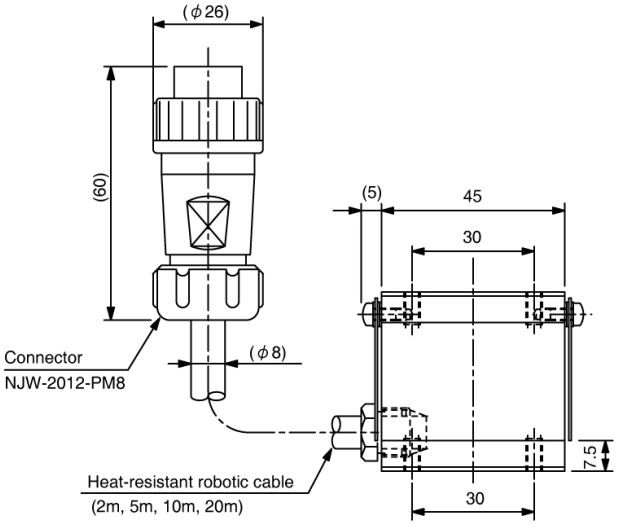


Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(4) TMS-SS (sensor type: B, C, M, N)

Units: mm

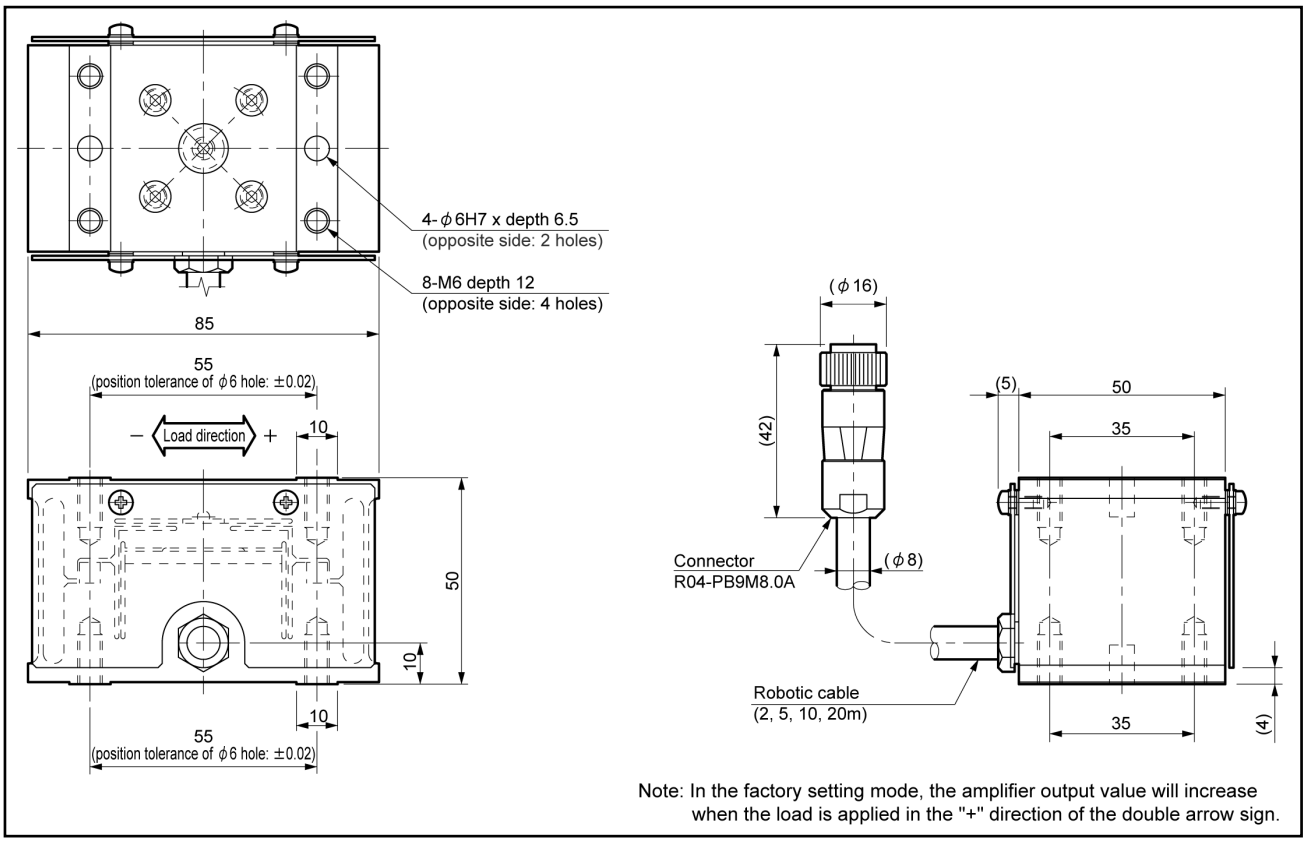




Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(5) TMS-S (sensor type: A, L)

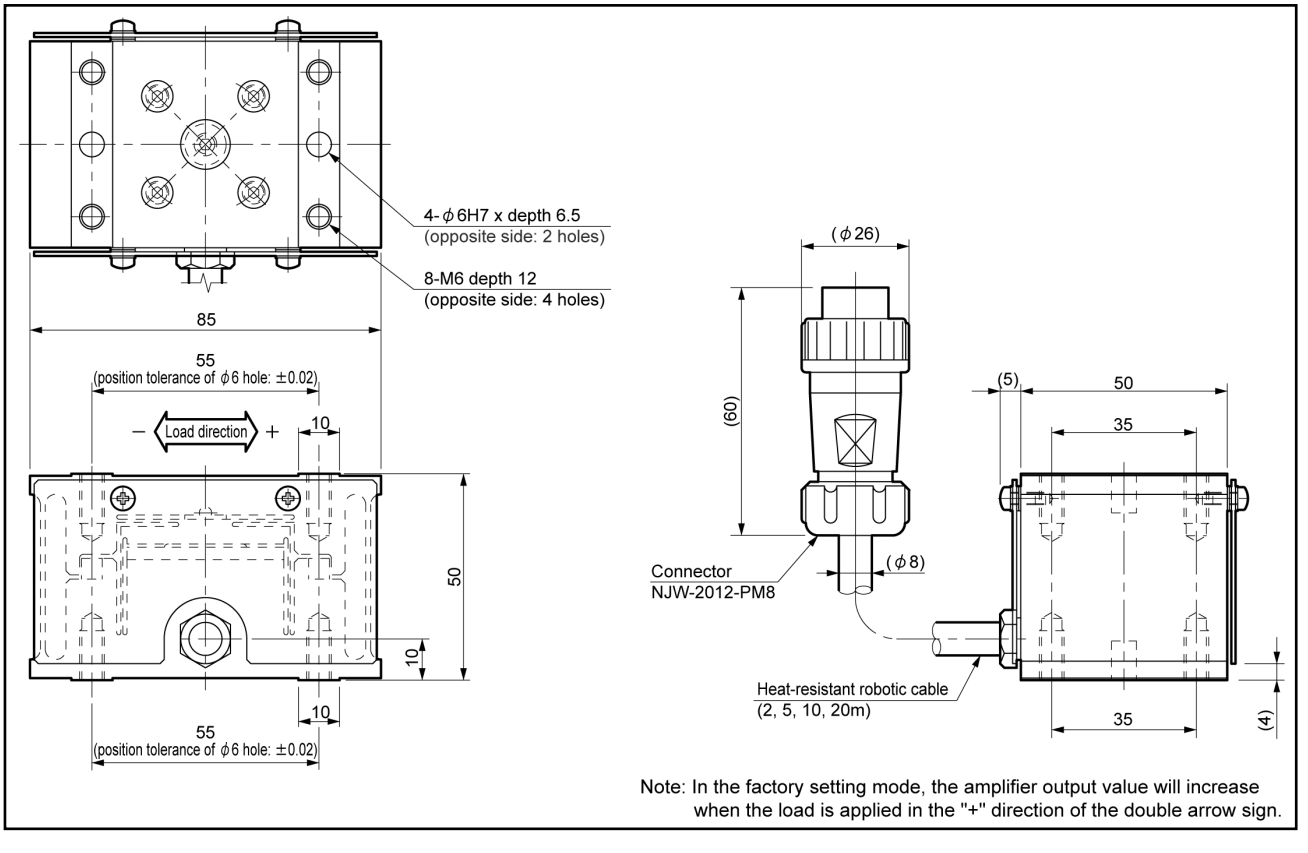
Units: mm



Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(6) TMS-S (sensor type: B, C, M, N)

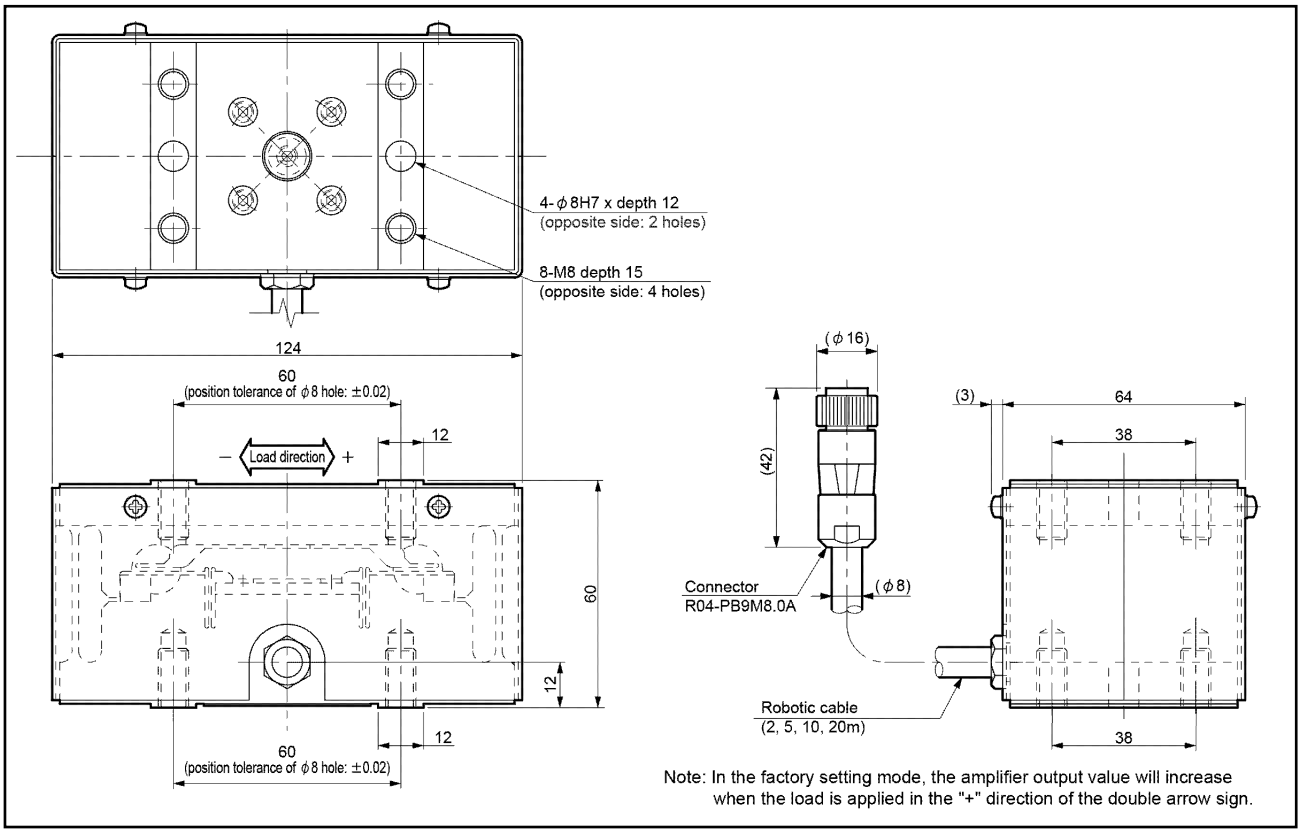
Units: mm



Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(7) TMS-A (sensor type: A, L)

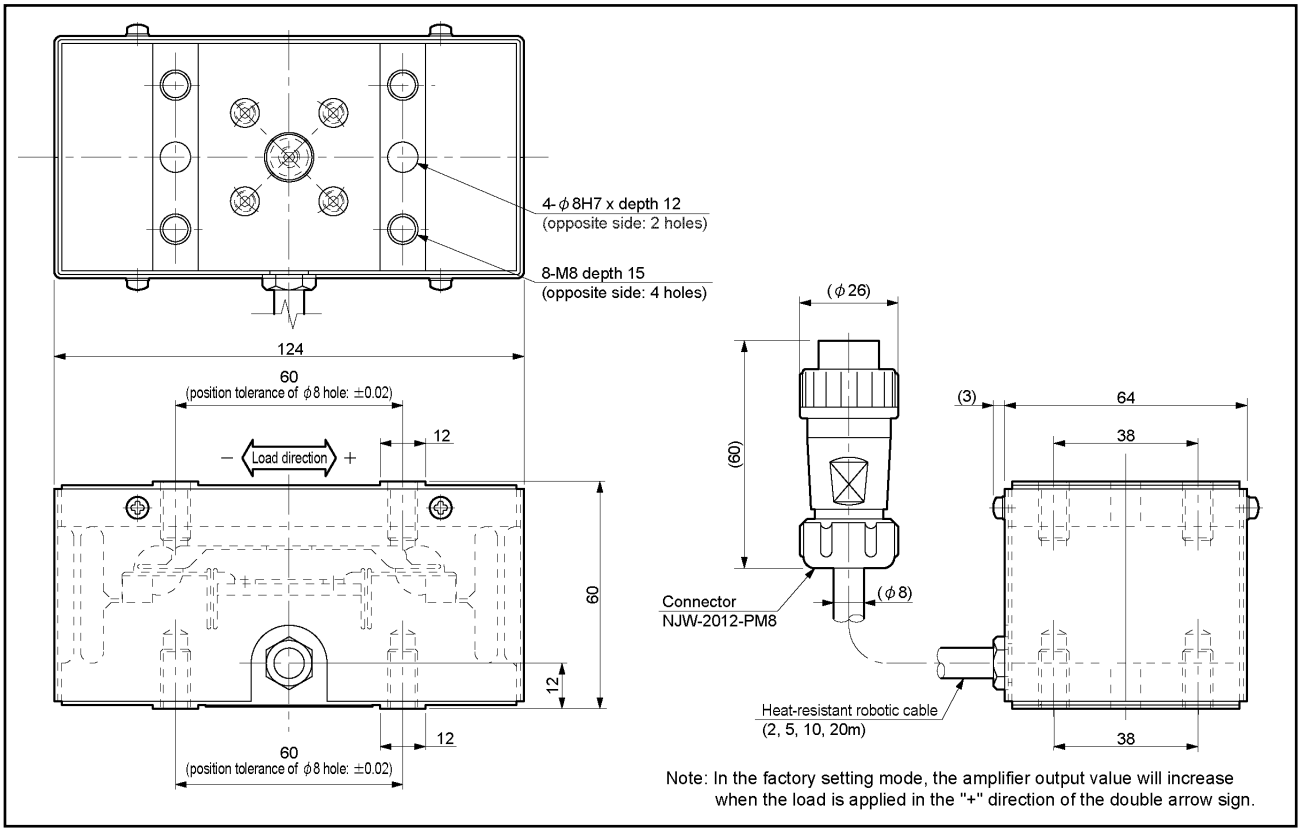
Units: mm



Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(8) TMS-A (sensor type: B, C, M, N)

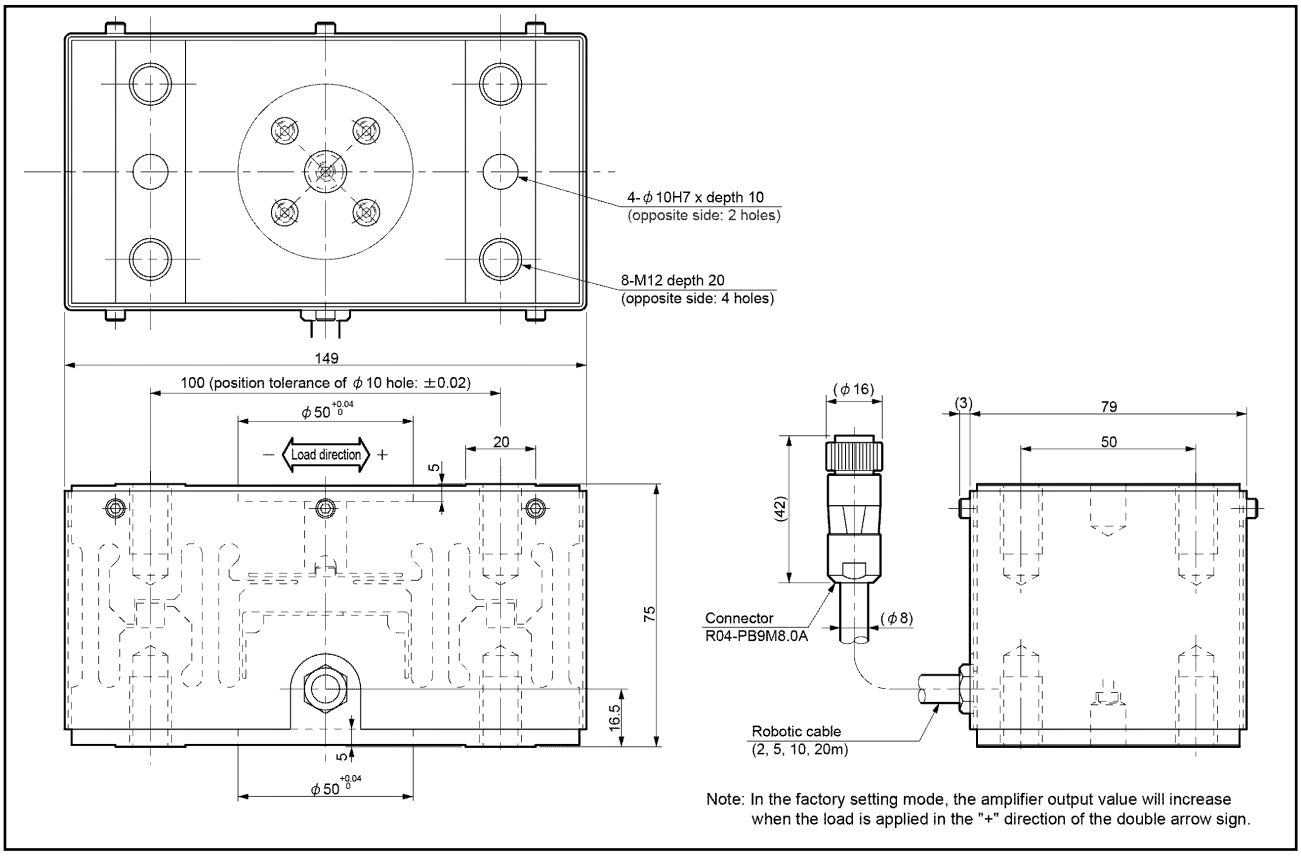
Units: mm



Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(9) TMS-B (sensor type: A, L)

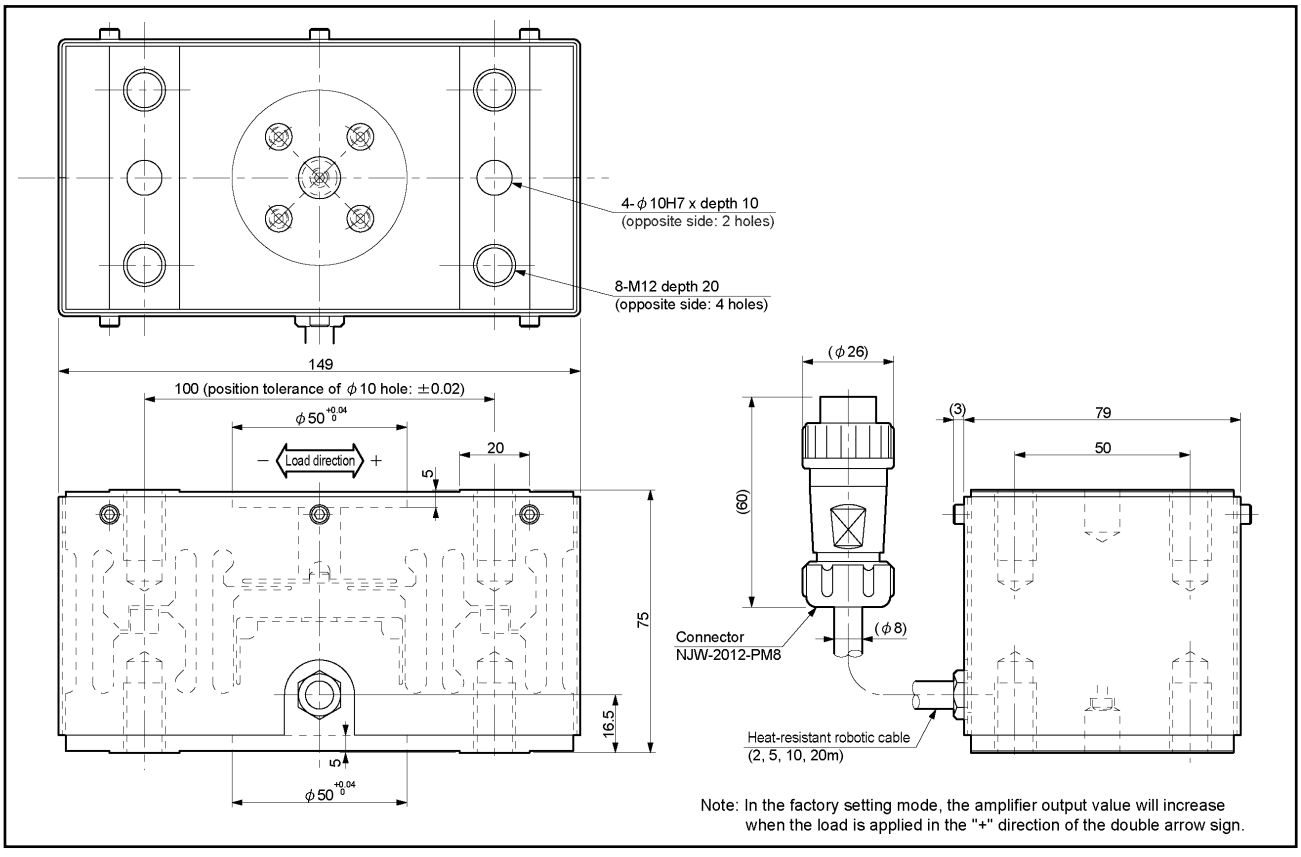
Units: mm



Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

(10) TMS-B (sensor type: B, C, M, N)

Units: mm

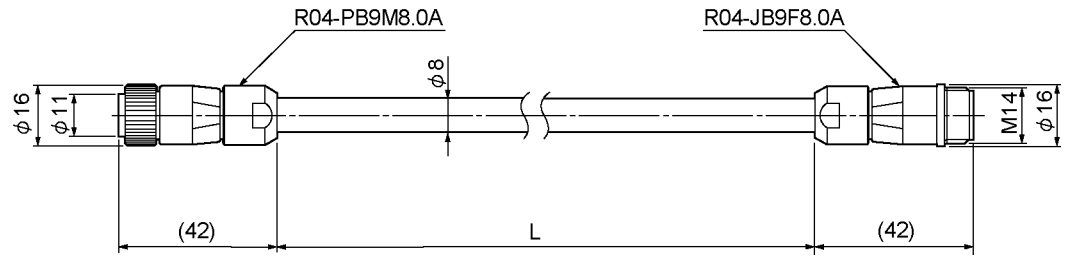


Note: In the factory setting mode, the amplifier output value will increase when the load is applied in the "+" direction of the double arrow sign.

4-3. Extension Sensor Cable

(1) 4P-S-0102-[L] / 4P-RBT-0102-[L]

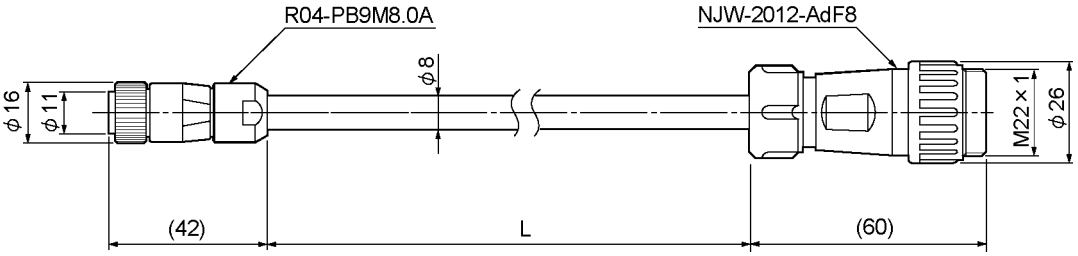
Units: mm



L: cable length
[L] is given in terms of meter.

(2) 4P-S-0144-[L] / 4P-RBT-0144-[L]

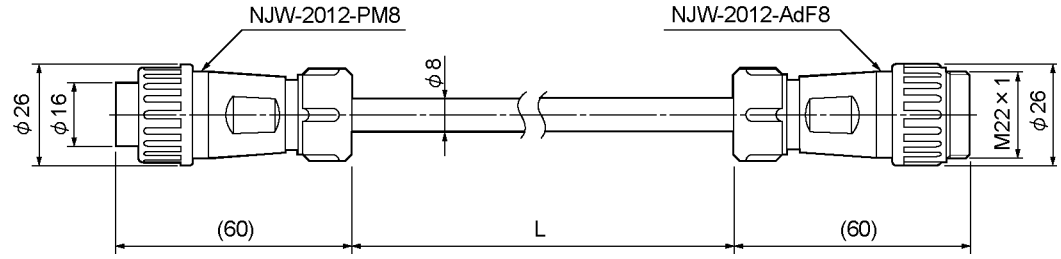
Units: mm



L: cable length
[L] is given in terms of meter.

(3) 4P-S-4344-[L] / 4P-RBT-4344-[L] / 4P-HRT-4344-[L]

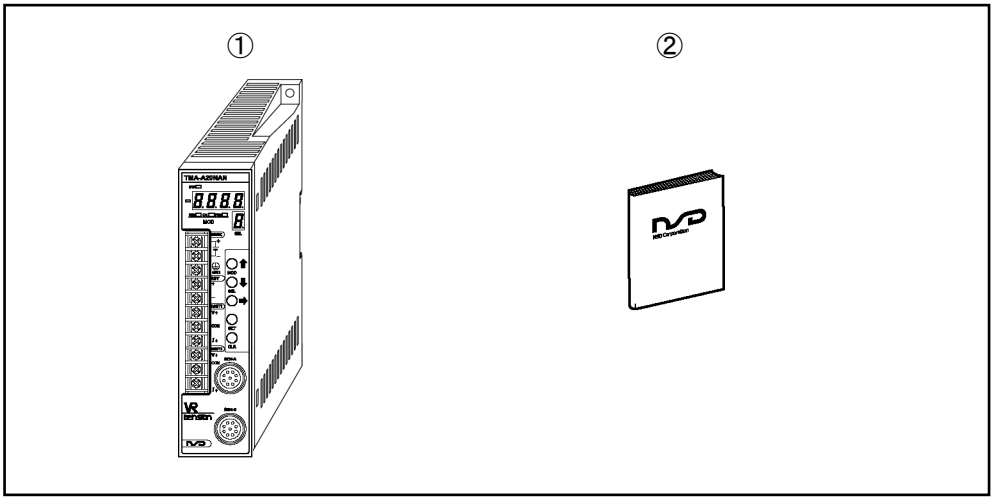
Units: mm



L: cable length
[L] is given in terms of meter.

5. CHECKING THE CONTENTS OF THE SHIPPING CASE

Open the packing case, and verify that all items are present.
When extension sensor cables are ordered, they are packed separately.



① Tension amplifier ····· 1 unit

② Manual ····· 1 piece

6. INSTALLATION

6-1. Tension Amplifier Installation

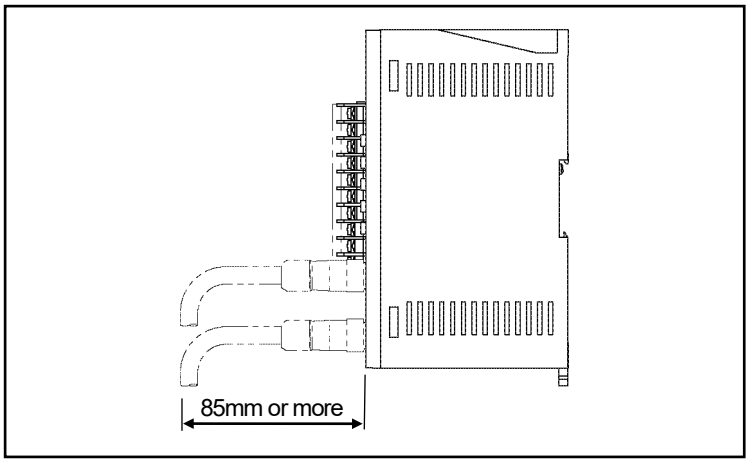
When installing the tension amplifier, the following conditions and precautions should be observed.

-Installation Site

(1) Avoid sites where the unit is exposed to direct sunlight.
(2) The ambient temperature should never exceed a 0 to 55°C range.
(3) The ambient humidity should never exceed a 30 to 90% RH range.
(4) Do not install the unit in areas where condensation is likely to occur (high humidity with extreme temperature changes).
(5) Avoid sites where dust is excessive.
(6) Do not install in areas with an excessive amount of salt and/or metal chips.
(7) Do not install in areas where flammable and / or corrosive gases are present.
(8) Avoid areas where splashing water, oil or chemicals are likely to occur.
(9) Avoid areas where vibration and shocks are excessive.

-Installation cautions

(1) Install inside the control cabinet.
(2) Install in a vertical direction so that the characters are visible.
(3) If a DIN rail mounting format is used, insert until the latch mechanism catches with an audible click. Secure between end plates at both sides.
(4) In high vibration areas, secure tightly with 2 M4 screws.
(5) Install as far from high voltage lines and power lines as possible in order to minimize noise influences.
(6) Allow 85mm or more space at the tension amplifier's front side for plugging in and unplugging the connector.
(7) Peripheral components should be arranged so as not to obstruct tension amplifier installation, removal, and connector plugging/unplugging.

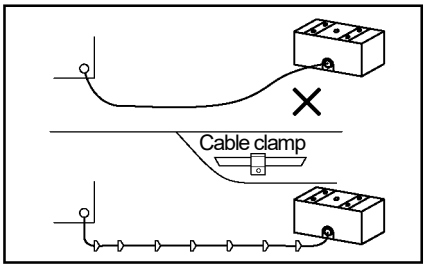


6-2. Connection between the Tension Amplifier and Sensor

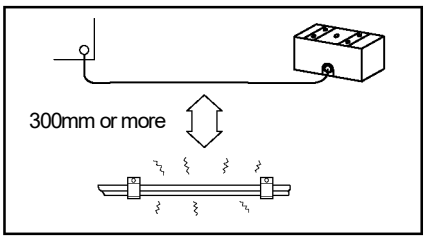
● **Wiring Precautions**

(1)The tension sensor is equipped with an interconnecting cable.
If the length of the interconnecting cable is not enough, use the dedicated extension sensor cable.

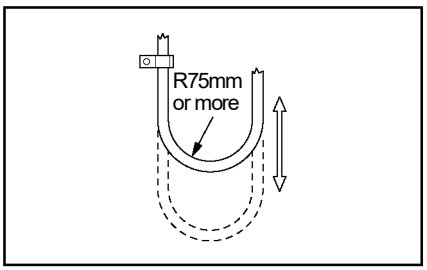
(2) The sensor cable should be clamped as shown in the right figure in order to prevent excessive tension from being applied to the cable connectors.



(3) The sensor cable should be located at least 300mm away from power and other lines which generate a high level of electrical noise.



(4) If the cable is moved under the state of bending like a horseshoe, a robotic cable should be used. The bend radius should never be less than 75mm.

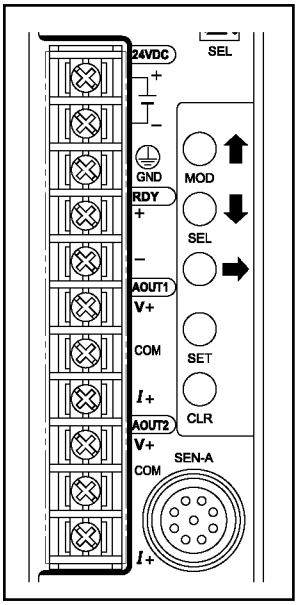


6-3. Connection between the Tension Amplifier and External Device

Connect the external device to the terminal block (M3 size) on the front side of the tension amplifier.

(1) Terminal block name and function

Name		Function
24VDC	+	Positive terminal for the power supply
	−	Negative terminal for the power supply
GND		Grounding terminal
RDY	+	Positive terminal for the system ready output
	−	Negative terminal for the system ready output
AOUT1 (Analog output 1)	V+	Positive terminal for the voltage output
	COM	Common (negative) terminal for the analog output 1
	I+	Positive terminal for the current output
AOUT2 (Analog output 2)	V+	Positive terminal for the voltage output
	COM	Common (negative) terminal for the analog output 2
	I+	Positive terminal for the current output



(2) Wiring

- Twist the power cable for preventing noises.
- The power cable should be as thick as possible to minimize voltage drops.

(3) Crimping terminal

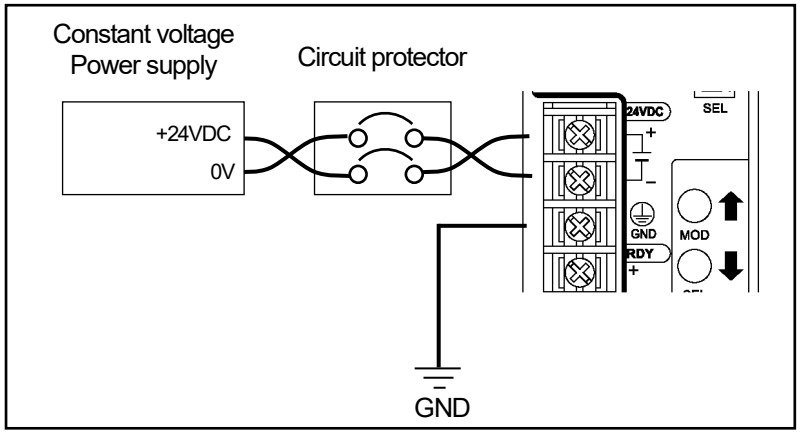
- Use M3 size crimp lug terminal. Recommended: R 1.25-3 (manufactured by NICHIFU Co.,Ltd.)
- The terminal block tightening torque is 0.6N·m (5.1Lb·In).
- After the connection, a terminal block cover should be placed to ensure safety.

(4) Power supply

- The power supply should be isolated from the commercial power supply.
- Choose the power supply capacity which is more than twice the power consumption of the tension amplifier. The power consumption of the tension amplifier is 10W or less.

(5) Ground

- The amplifier should be grounded (ground resistance of 100ohm or less) to prevent electrical shocks.



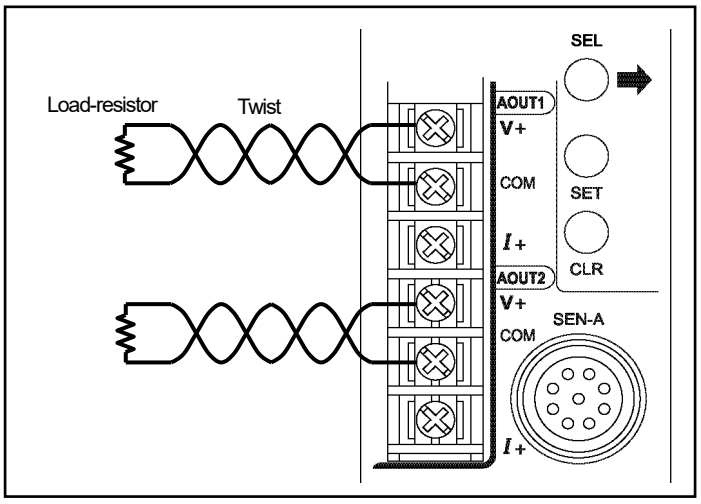
(6) System ready output

- Both sink and source connection types can use this output. Connect the wiring by referring to "3-1. (4)Digital output specification".

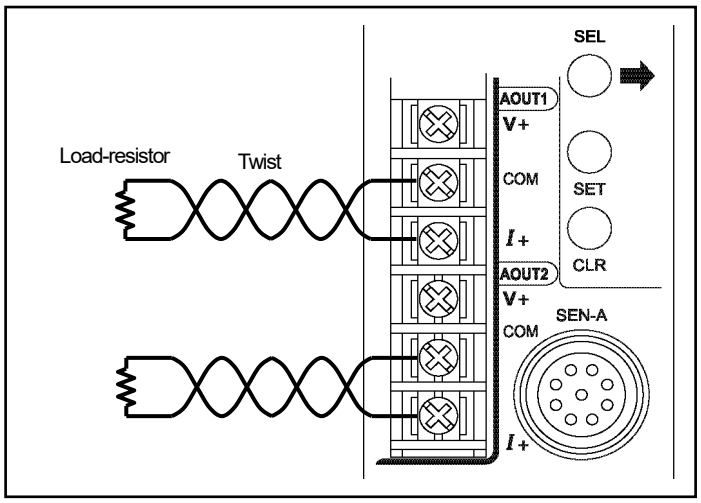
(7) Analog output

- Connect the wiring depending on the analog output type which would be used.

●Connection when using the voltage output

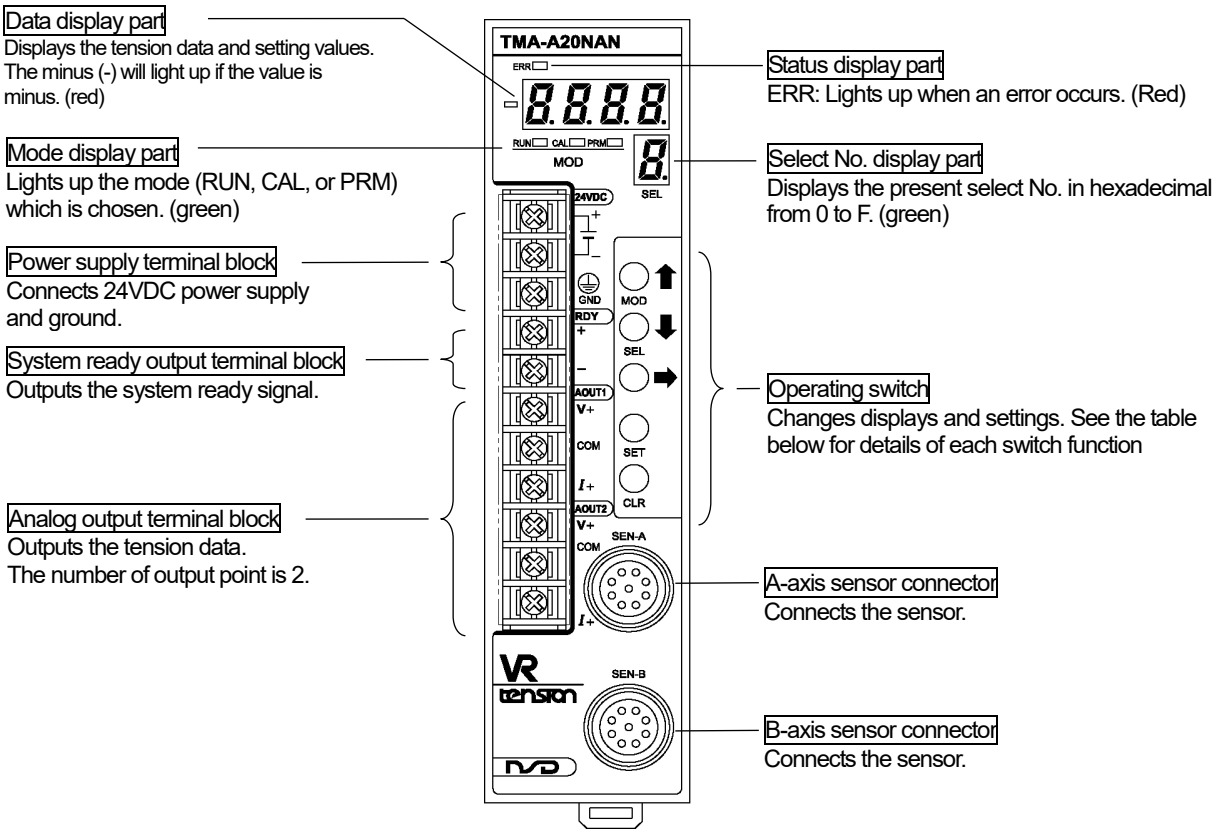


●Connection when using the current output



7. Operation Flows

7-1. Nomenclature

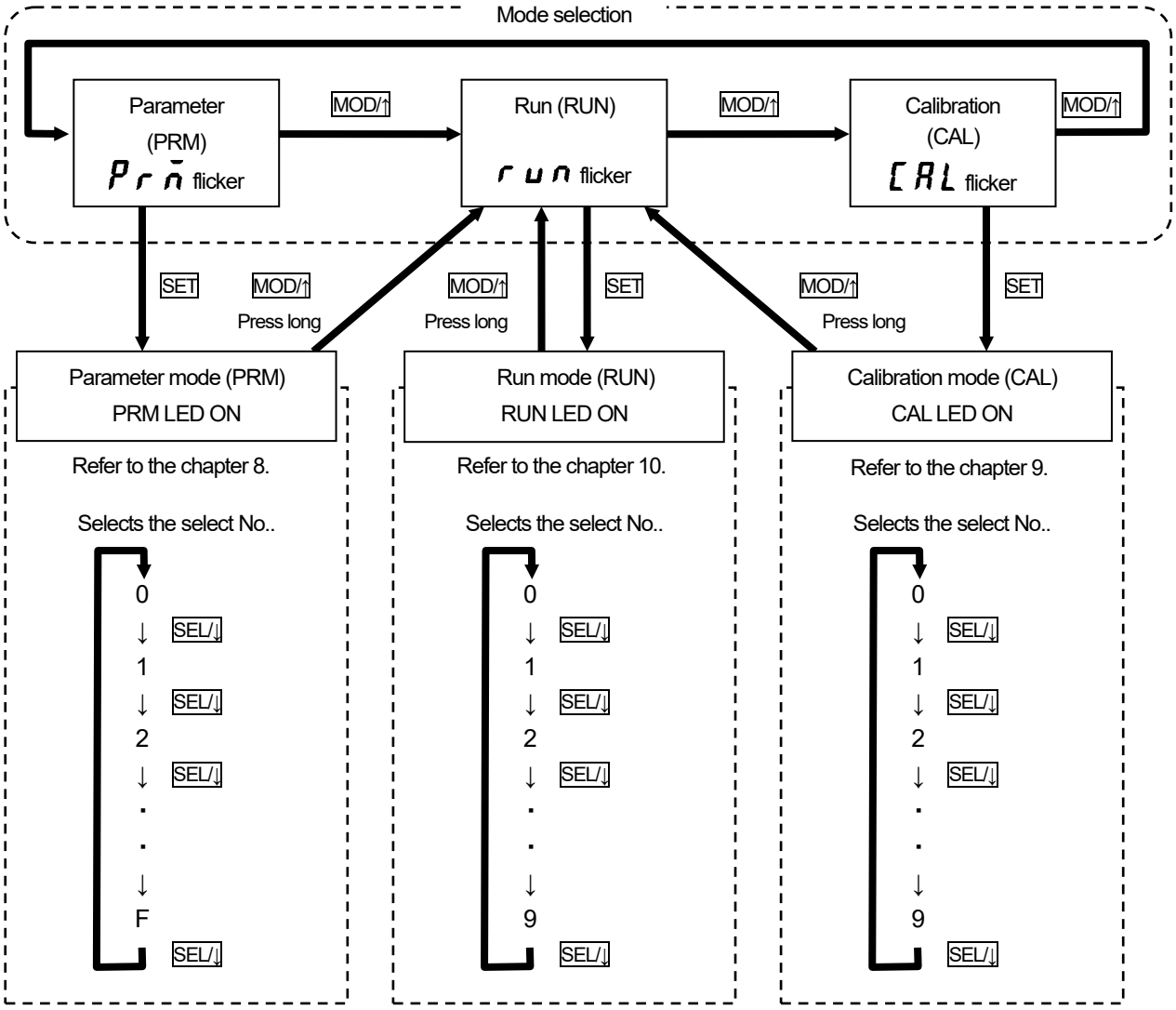


■Operating Switches

Switch	Name	Function
MOD/↑	Mode selection/ ↑button	Selects one of modes from RUN, CAL, or PRM. ・ RUN: Run…The tension data is indicated on the data display part. ・ CAL: Calibration… Calibrates or does the zero preset. ・ PRM: Parameter… Sets the parameter. Makes the numeric value increase when setting the value.
SEL/↓	Select No. selection/ ↓button	Selects the select No.. A function is allocated to each select No. (Note that the functions differ by each mode.) Makes the numeric value decrease when setting the value.
→	→ button	Scrolls the data display part. Selects the digit of the setting value during setting.
SET	SET button	Starts the operation such as setting. Confirm the operation.
CLR	CLR button	Cancels the operation. Clears the error.

7-2. Operation Flows in Different Mode

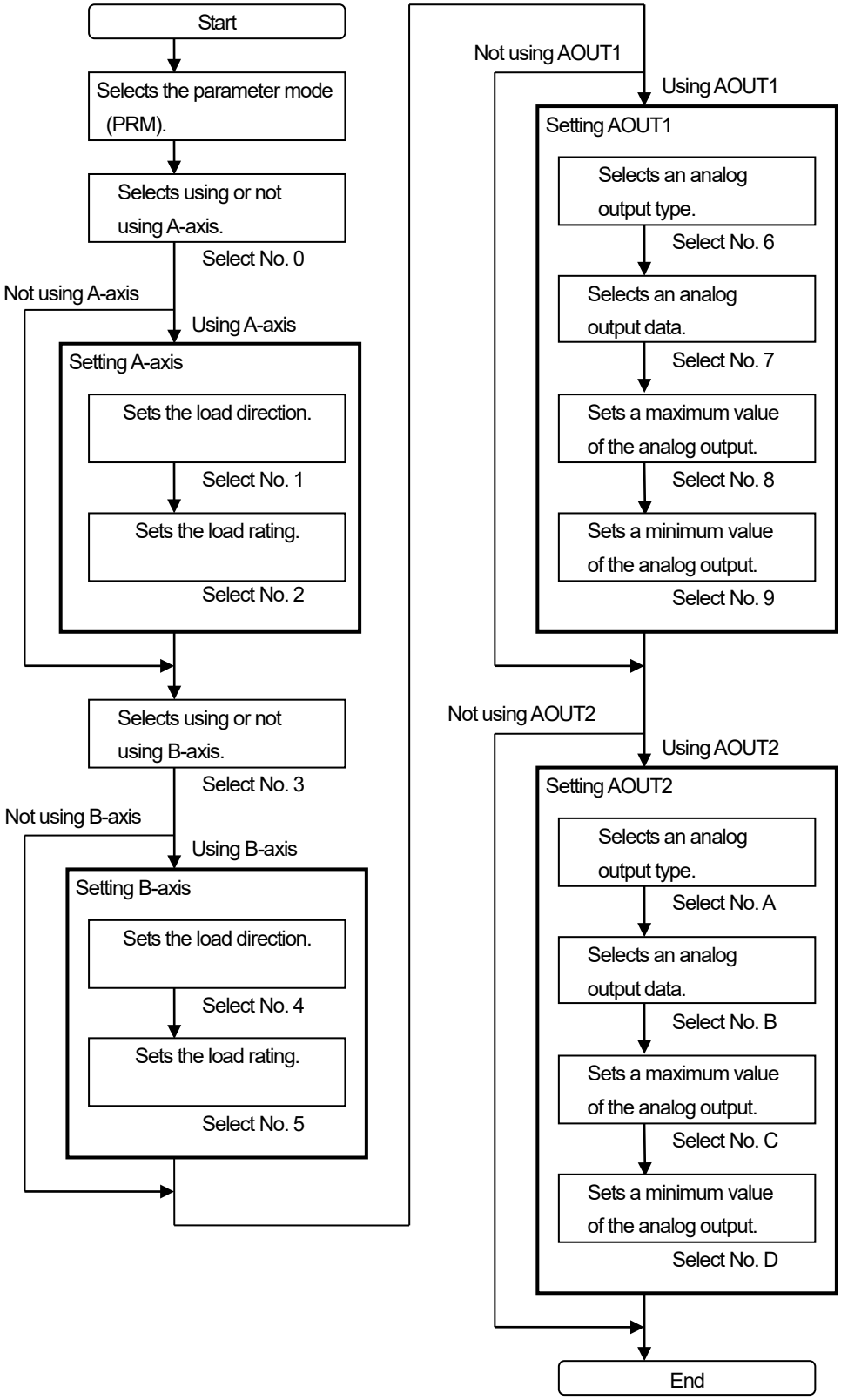
An operation flowchart is shown below.



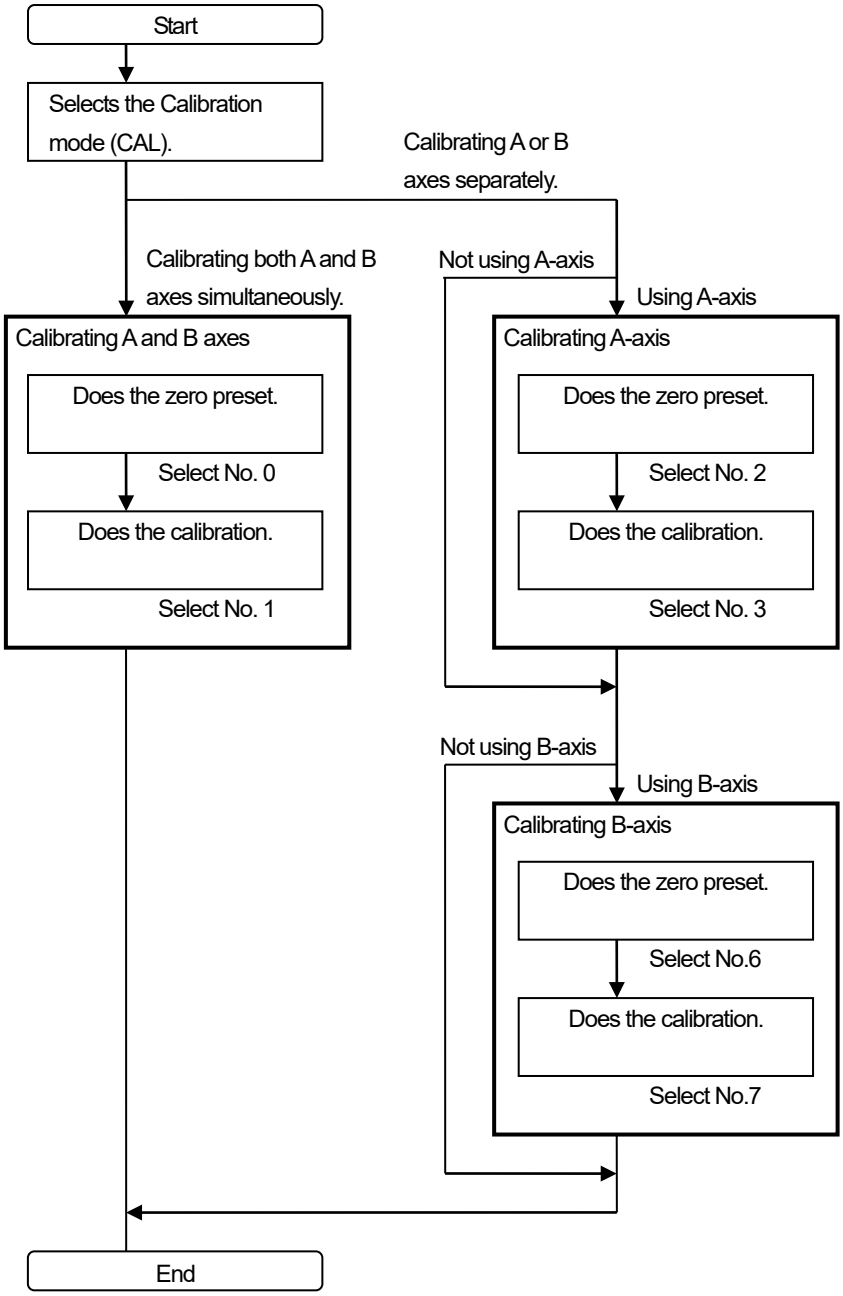
7-3. Procedure before the Operation

The following chart shows the steps before starting the tension amplifier operation.
Before the tension amplifier can be run, the initial parameter and calibration need to be set in advance.

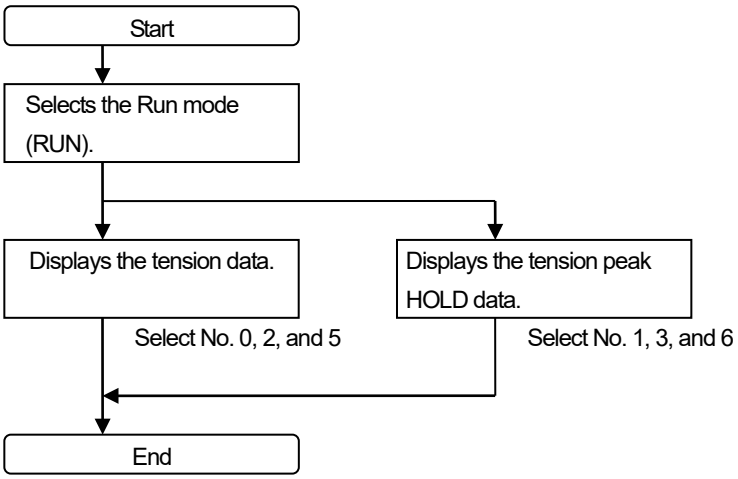
(1) Parameter setting



(2) Calibration



(3) Running the operation

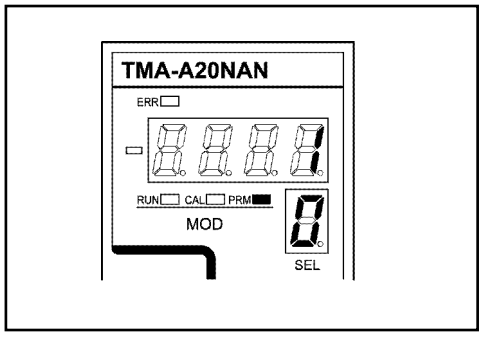


7-4. Turns ON the Power Supply

This tension amplifier doesn't have any power supply switch; therefore, please use external switch for turning ON / OFF the power supply.

The tension amplifier starts to operate with previous mode and select No. when turning ON the power supply.

The tension amplifier starts to operate with Parameter mode (PRM) and select No. 0 when turning ON the power supply first time after the purchase.



7-5. Basic Operation Procedure

(1) Mode selection method

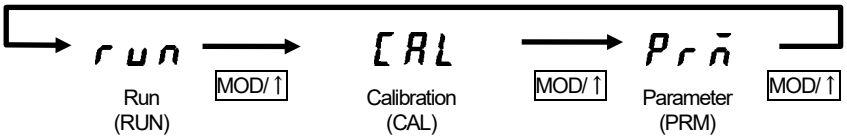
① Moves to the mode selection.

Press and hold down the MOD/↑ key (more than 1 second).

The r u n flickers on the data display, and the mode is able to select.

② Selects the mode.

Press MOD/↑ button. The mode will be changed by pressing the button.



The mode selection is canceled by pressing CLR button

③Confirm the mode

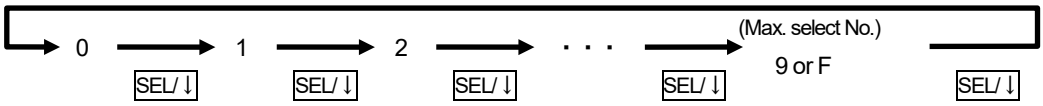
Press the SET key. The mode is now set.

Press SET key.

The mode is now confirmed.

(2) Select No. selection method

Press SEL/↓ button. The select No. increases one by one. Pressing and holding down the button will cause the value to be fast-forwarded.

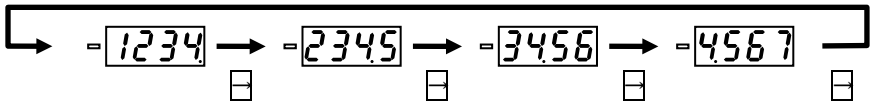


(3) Numeric value display method

The data display is indicated by 4 digit numbers. If the numeric value is more than 4 digits, the upper 4 digits will be displayed first

Press → button when displaying the lower digits, the digits are scrolled down to see hidden numbers.

In the case of displaying the number "1234.567"



(4) Numeric value setting method

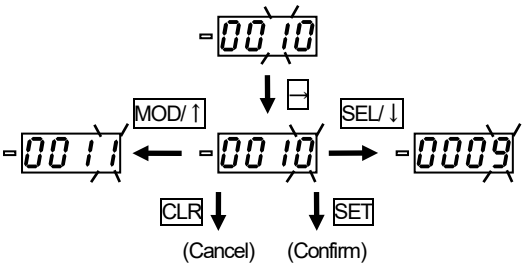
①Starts the setting.

Press and hold down the SET key (more than 1 second).
The highest digit in the setting range flickers.

②Inputs the setting value.

→: Selects the digit of the setting value. The selected digit flickers.

MOD/↑: The number of the selected digit is increased by pressing this button. Pressing and holding down the button will cause the value to be fast-forwarded.



SEL/↓: The number of the selected digit is decreased by pressing this button. Pressing and holding down the button will cause the value to be fast-forwarded.

The mode selection is canceled by pressing CLR button

③ Confirm the setting value.

Press the SET key. The data display part turns ON.

8. Parameter setting

The parameter setting is required in advance before running the operation.
Refer to "8-1" for the parameter description, and "7-5" for the basic operation procedure.

8-1. Parameter List

Select No.	Item		Description	Setting range	Initial value
0	A-axis	Used/Unused	Sets whether A-axis is used or unused.	0: Unused 1: Used	1
1		Load direction	Sets the A-axis load direction.	0: + (Plus direction) 1: − (Minus direction)	0
2		Load rating	Sets A-axis load rating. Inputs the load rating value of the unit (N or kgf) which you want to use.	0.001 to 9999.999	10.000
3	B-axis	Used/Unused	Sets whether B-axis is used or unused.	0: Unused 1: Used	1
4		Load direction	Sets the B-axis load direction.	0: + (Plus direction) 1: − (Minus direction)	0
5		Load rating	Sets B-axis load rating. Inputs the load rating value of the unit (N or kgf) which you want to use.	0.001 to 9999.999	10.000
6	AOUT1	Analog output type	Selects the output type of AOUT1.	0: Voltage (0 to 10V) 1: Current (4 to 20mA)	0
7		Analog output data	Selects the data which is output to AOUT1.	0: A-axis tension data 1: B-axis tension data 2 : A+B axes tension data	0
8		Max. analog output value	Sets the tension data when maximum voltage (current) output from AOUT1.	-9999.999 to 9999.999	10.000
9		Min. analog output value	Sets the tension data when minimum voltage (current) output from AOUT1.	-9999.999 to 9999.999	0.000
A	AOUT2	Analog output type	Selects the output type of AOUT2.	0: Voltage (0 to 10V) 1: Current (4 to 20mA)	0
b		Analog output data	Selects the data which is output to AOUT2.	0: A-axis tension data 1: B-axis tension data 2 : A+B axes tension data	1
C		Max. analog output value	Sets the tension data when maximum voltage (current) output from AOUT2.	-9999.999 to 9999.999	10.000
d		Min. analog output value	Sets the tension data when minimum voltage (current) output from AOUT2.	-9999.999 to 9999.999	0.000
E	Sensor filter		Sets the data number in order to calculate the moving average of the sensor data. *: The filter is not function when the setting data value is 0.	0 to 1000	0
F	Sampling interval		The interval which is read sensor data to the internal memory of the tension amplifier is set.	1 to 100 (×0.2ms)	1

8-2. Details of the Parameter

(1) Used / unused (select No.0, 3)

Sets whether each axis is used or unused.

Setting description

0: Unused The sensor disconnected error is not detected.

1: Used The sensor disconnected error is detected.

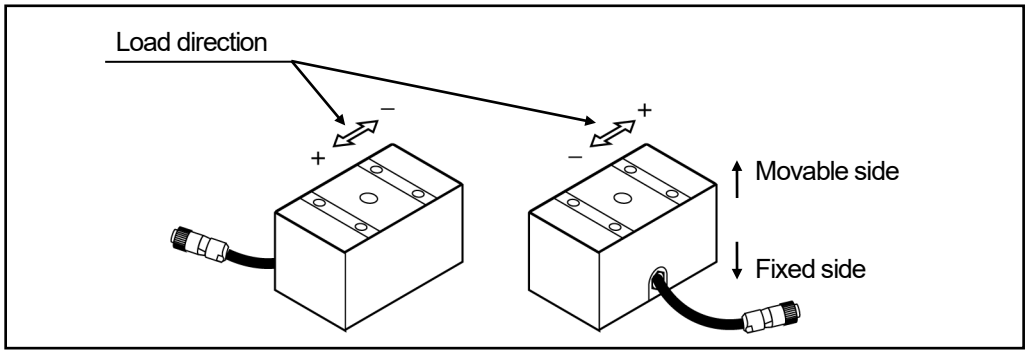
(2) Load direction (select No.1, 4)

Sets the load direction.

Setting description

0: + (Plus direction) The tension data is increased when the load is added to + direction.

1: − (Minus direction) The tension data is increased when the load is added to - direction.



NOTE

The load direction might be reversed depending on the mounting direction of the sensor. Change the settings of this parameter (select No.1, 4) when the direction needs to be reversed.

(3) Load rating (select No.2, 5)

Sets the load rating of the sensor.

Input the value of the unit (N or kgf) which you want to display on the tension amplifier.

The load rating values are indicated below.

Sensor model	TMS-ST002	TMS-SS005	TMS-S02	TMS-S05	TMS-A10	TMS-A20	TMS-A50	TMS-B100	TMS-B200	TMS-B300
Load rating N(kgf)	1.96 (0.2)	4.9 (0.5)	19.6 (2)	49 (5)	98 (10)	196 (20)	490 (50)	980 (100)	1960 (200)	2940 (300)

Setting example 1

When TMS-S02 is used and displays by N unit, sets the value as follows.

- Load rating parameter: 19.600

Setting example 2

When TMS-S02 is used and displays by kgf unit, sets the value as follows.

- Load rating parameter: 2.000

Point

The load rating setting should be input to three decimal places.

(4) Analog output type (Select No. 6, A)

Selects output type of the analog output.

0: Voltage output (0 to 10V)

1: Current output (4 to 20mA)

* The analog output terminal block has both a voltage and current outputs, but the tension amplifier cannot output both at the same time. Use the output type which is selected at this parameter.

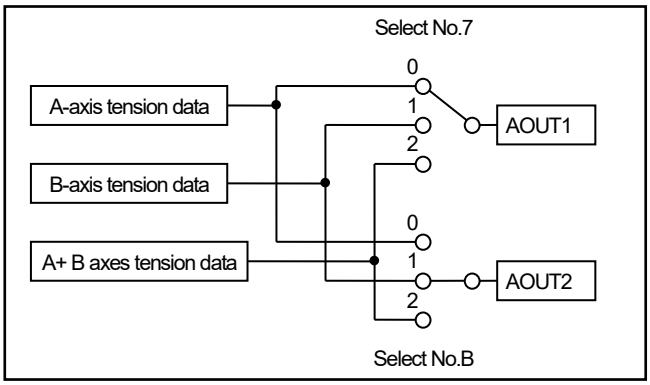
(5) Analog output data (Select No.7, B)

Selects the output data.

0: A-axis tension data

1: B-axis tension data

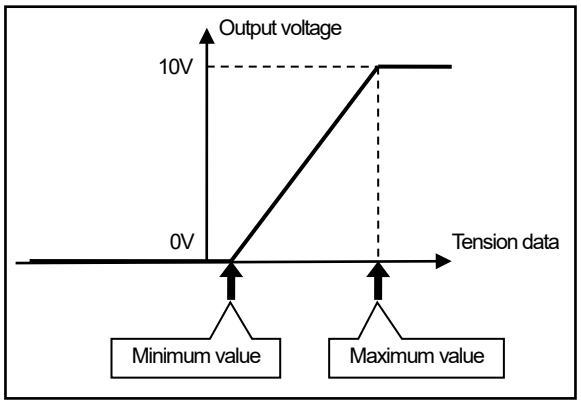
2: A+B axes tension data



(6) Maximum and Minimum analog output values (Select No. 8, 9, C, D)

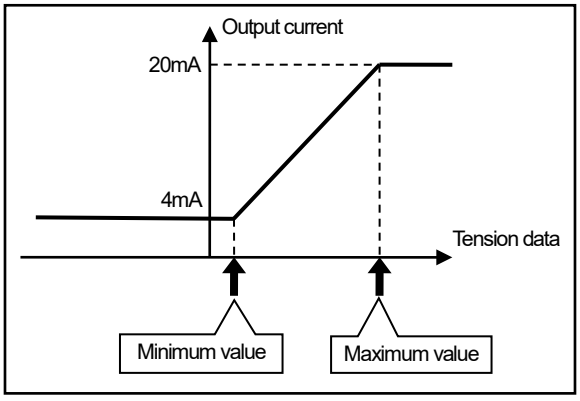
●In the case of the voltage output (0 to 10V)

- Maximum:
  The tension data is set when outputting 10V.
- Minimum:
  The tension data is set when outputting 0V.



● In the case of current output (4mA to 20mA)

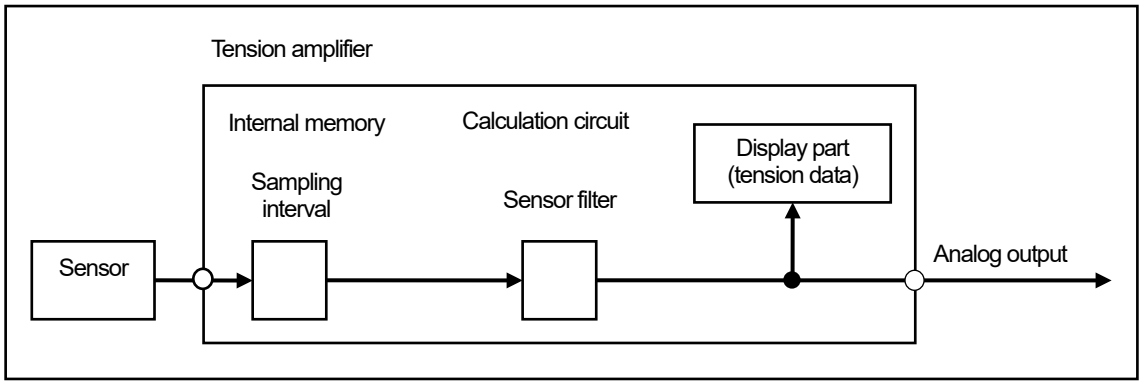
-Maximum:
  The tension data is set when outputting 20mA.
- Minimum:
  The tension data is set when outputting 4mA.



*The pattern of “Minimum value”>”Maximum” can be set.

(7) Sampling interval and sensor filter (Select No. E, F)

The sampling interval and the sensor filter parameters are used for the internal processing of sensor signals. Use them when tension data is not stable by vibration.



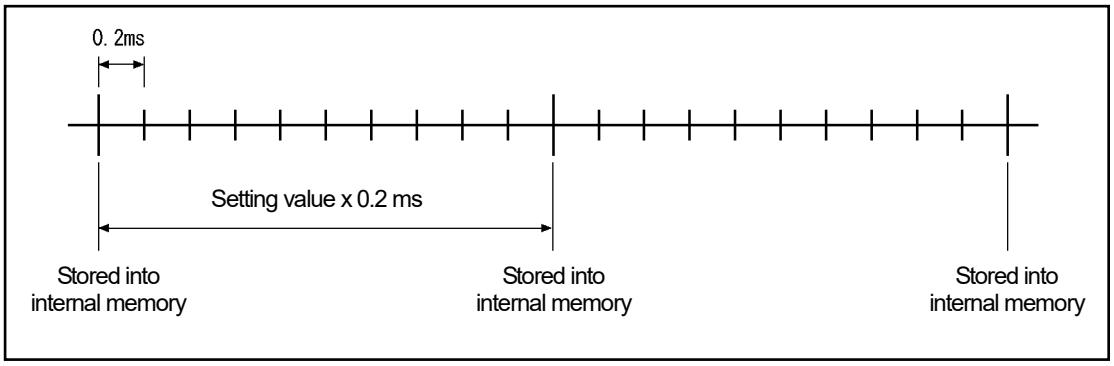
●Sampling interval

The Sampling interval parameter specifies the interval at which to store the sensor signal into the tension amplifier's internal memory.

Setting example

When the parameter is set to 1, the sensor signal will be stored into the internal memory every 0.2 ms.
When the parameter is set to 10, the signal will be stored into the internal memory 10×0.2ms= every 2ms.

The following figure is an example when the parameter is set 10.



●sensor filter

The sensor filter parameter specifies the number of data in order to calculate the moving average of the sensor data.

A: Moving average value
Dn: Data that has been stored into the internal memory
n: Data number

$$A = \frac{D_1 + D_2 + \ldots\ldots + D_n}{n}$$

9. Calibration

Before running the operation, the calibration must be executed in advance.
Refer to "9-1" for the calibration details. Also, refer to "7-5" for the basic operation procedure.

9-1. Calibration List

Select No.	Item		Description	Setting range	Initial value
0	A+B-axis	Zero preset	Executes the zero preset for A+B-axis. Displays the tension data for A+B-axis.	–	–
1		Calibration	Calibrate A+B-axis by using reference weight. Sets the reference weight.	0.001 to 9999.999	10.0
2	A-axis	Zero preset	Executes the zero preset for A-axis. Displays the tension data for A-axis.	–	–
3		Calibration	Calibrate A-axis by using reference weight. Sets the reference weight.	0.001 to 9999.999	10.0
4		Sensor data correction amount	Sets A-axis sensor data correction amount. (This is set automatically when executing the zero preset.)	-3276.7 to 3276.8	0.0
5		Sensor gain	Sets A-axis sensor gain. (This is set automatically when executing the calibration.)	0.1000 to 30.0000	1.0
6	B-axis	Zero preset	Executes the zero preset for B-axis. Displays the tension data for B-axis.	–	–
7		Calibration	Calibrate B-axis by using reference weight. Sets the reference weight.	0.001 to 9999.999	10.0
8		Sensor data correction amount	Sets B-axis sensor data correction amount. (This is set automatically when executing the zero preset.)	-3276.7 to 3276.8	0.0
9		Sensor gain	Sets B-axis sensor gain. (This is set automatically when executing the calibration.)	0.1000 to 30.0000	1.0

9-2. Details of the Calibration

(1) Zero preset (Select No. 0, 2, 6)

The tension data should be changed to "0" by canceling the tare mass such as a roller for detecting.

●Zero preset procedure

Zero preset is executed without the web after installing the tension sensor on the rollers for detecting.

① Select the CAL mode.

Select the calibration mode (CAL) by referring to the "7-5. (1)".

② Select the Select No..

Select the Select No. by referring to "7-5. (2)". The tension data is displayed on the data display part.

③ Change to the zero preset mode.

HOLD down the SET button 1 second or more. The data display part flickers.

The zero preset is canceled when pressing CLR button at this point.

④ Confirm to execute the zero preset.

Press SET button. The display part quickly flickers, and to execute the zero preset.

The zero preset is canceled when pressing CLR button at this point.

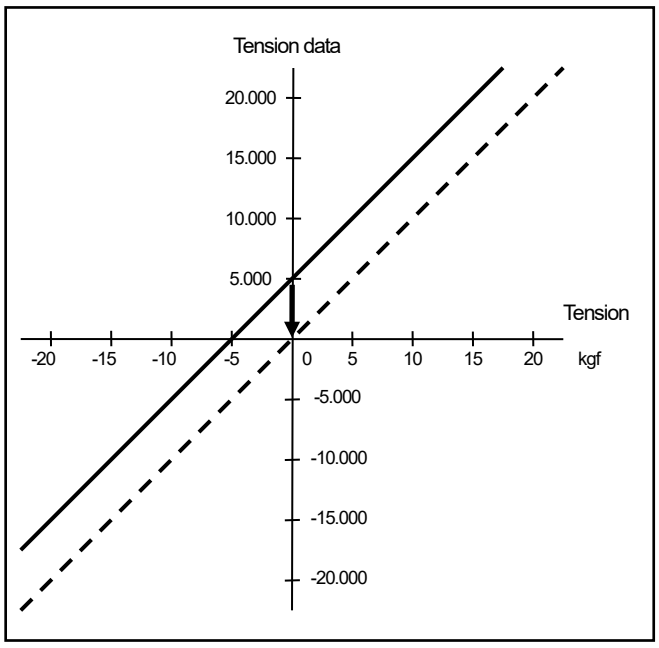
⑤ Execute the zero preset.

Press SET button again. The data display part turns ON, and the tension data is displayed "0.000".

●Example of the zero preset

Shown below is an example where a 5 kg roller set is installed.

The tension data indicates "5.000" before the zero preset. The tension data indicates "0.000" after the zero preset.



Solid line: Value before presetting
Dotted line: Value after presetting

(2) Calibration (Select No. 1, 3, 7)

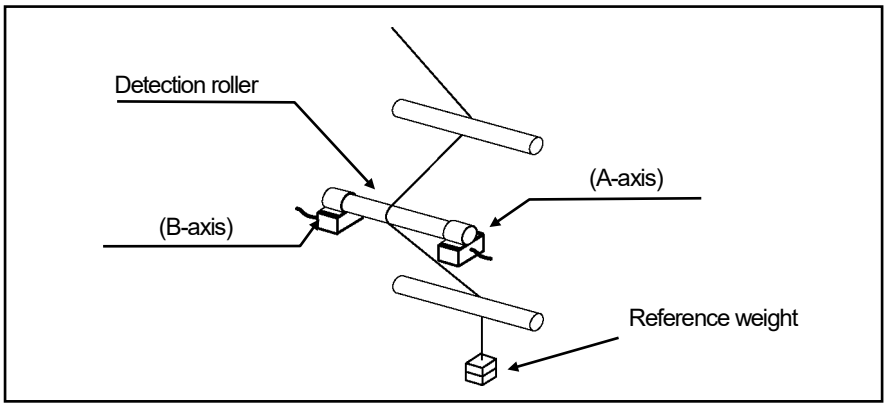
The load which is added to the sensor by the tension differs depending on conditions (such as the angle when the web touches a roller).

The tension amplifier can be adjusted by using reference weight in order to correct the error.

●Calibration procedures

When the calibration is done, the reference weight should be hanging.

Hang the reference weight from the center of the roller.



① Select the CAL mode.

Select the calibration mode (CAL) by referring to the "7-5. (1)".

② Slect the Select No..

Select the Select No. by referring to "7-5. (2)". The load setting value of the reference weight is displayed on the data display part.

③ Set the load of the reference weight.

Set the load of the reference weight by referring to "7-5. (4)". The calibration will be started.

* Set the same unit (N or kgf) between the load rating (Select NO. 2 and 5 in PRM mode) and reference weight.

NOTE

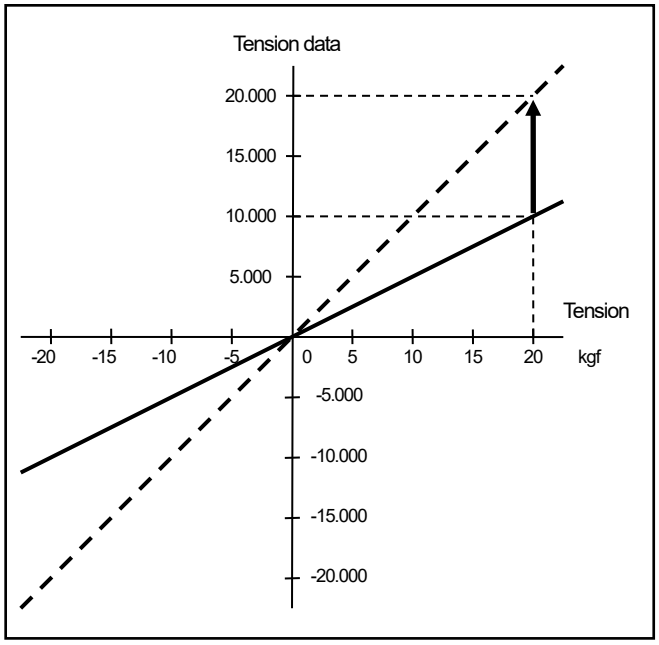
When pressing SET button, the calibration wouldn't be completed if amplifier beeps.
The presumed causes are the following when the calibration cannot be executed. Recalibrate after removing the causes.
(1) The reference weight is too light.
(2) The load direction of the reference weight differs from the load direction setting (Select No. 1 and 4 in PRM mode).
(3) The setting value is different from the reference weight.

●Calibration example

Shown below is an example that indicates "10.000" on the display when a 20 kg reference weight set is hanged.

In this case, the load of the reference weight is set to "20.000", and the calibration is done.

The tension data indicates "10.000" before the calibration. The tension data indicates "20.000" which is the same as reference weight after the calibration.



Solid line: Value before presetting

Dotted line: Value after presetting

(3) Sensor data correction amount (Select No. 4, 8)

This value is automatically set when executing the zero preset.

When replacing the amplifier, input both a sensor data correction (Select No. 4, 8) amount and sensor gain (Select No. 5, 9) which are before the replacement. The values are back to the state before the replacement without the zero preset and calibration.

(4) Sensor gain (Select No. 5, 9)

This value is automatically set when executing the calibration.

When replacing the amplifier, input both a sensor gain (Select No. 5, 9) and sensor data correction amount (Select No. 4, 8) which are before the replacement. The values are back to the state before the replacement without the zero preset and calibration.

10. RUN

Each data can be checked during the operation.
Refer to "10-1" for the display contents. Also, refer to "7-5" for the basic operation procedure.

10-1. List of the Display Contents

Select No	Item		Description	Display range	Initial value
0	A+B axes	Tension data	Displays the A+B axes tension data.	-9999.999 to 9999.999	–
1		Tension peak HOLD data	Displays the A+B axes tension peak HOLD data.	-9999.999 to 9999.999	–
2	A-axis	Tension data	Displays the A-axis tension data.	-9999.999 to 9999.999	–
3		Tension peak HOLD data	Displays the A-axis tension peak HOLD data.	-9999.999 to 9999.999	–
4		Sensor data	Displays the A-axis sensor raw data.	-3276.8 to 3276.7	–
5	B-axis	Tension data	Displays the B-axis tension data.	-9999.999 to 9999.999	–
6		Tension peak HOLD data	Displays the B-axis tension peak HOLD data.	-9999.999 to 9999.999	–
7		Sensor data	Displays the B-axis sensor raw data.	-3276.8 to 3276.7	–
8	Mode lock		Sets the mode lock or free.	LOCK: Lock FrEE: Free	FrEE
9	Product version		Displays the product version.	V 1.00 ~	–

10-2. Details of the Display Contents

(1) Tension data display (Select No. 0, 2, 5)

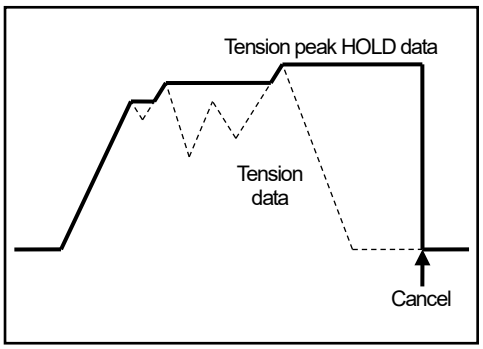
Displays tension data.

Even though the following operation finished, the scroll position of the data display part is memorized.

- Power supply is OFF.
- Switches other Select Nos. or modes.

(2) Tension peak HOLD data display (Select No 1, 3, 6)

Displays the tension peak HOLD data.



●Cancel the tension peak-HOLD procedures

① Change the mode to cancel.

Press and hold down the SET button (more than 1 second). The data display part flickers, and changes to the cancellation mode.

The tension peak-HOLD is not canceled when pressing CLR button at this point.

② Cancels the peak-HOLD.

Press SET button. The tension peak-HOLD is canceled.

(3) Sensor data display (Select No. 4, 7)

The sensor raw data is displayed.

(4) Mode lock (Select No. 8)

Sets the mode lock or free.

LOCK : Lock, The mode cannot be selected. It prevents the setting change by an erroneous operation.
FrEE : Free, The mode can be selected.

Sets by following procedures;

●Setting procedures

① Starts the setting.

Press and hold down the SET key (more than 1 second). The data display part flickers.

② Selects the Lock or Free.

Press MOD/↑ or SEL/↓. The display is switched by pressing the button. (FrEE → LOCK → FrEE)

The mode lock setting is canceled when pressing CLR button at this point.

③ Confirms the mode lock setting.

With pressing → button, press SET button. The data display part turns ON.

(5) Product version No. (Select No. 9)

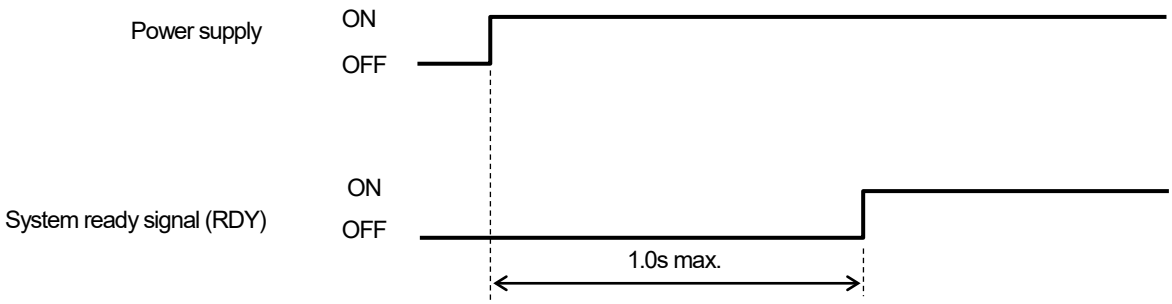
Displays the product version.

11. SYSTEM READY SIGNAL

The system ready signal indicates that the normal tension data is output from the tension amplifier.
The signal is ON when the tension sensor and amplifier operate normally.
For your safety, read the tension data when the system ready signal is ON.
The system ready signal is OFF in the following cases:
- The power supply is OFF.
- An error occurred.

For more details, refer to “13-2. Output State when Occurring an Error”.

●Timing when the power turns ON



12. INSPECTIONS

The inspection should be conducted once every 6 months to a year.
Any inspected items which do not satisfy the criteria shown below should be repaired.

Inspection Item	Inspection Description	Criteria	Remark
Power supply	Measure the voltage at the power supply terminal of the tension amplifier.	21.6V to 26.4VDC	Tester
Ambient conditions	Check the ambient temperature.	Tension sensor: Refer to the specification. Tension amplifier: 0 to +55°C	Thermometer
	There should be no accumulation of dust.	None	Visual Inspection
Mount conditions	Verify that the tension senor is securely mounted.	There should be no looseness.	
	Check for severed cables.	Cable should appear normal.	
	Verify that the sensor cable connector is plugged in all the way.	There should be no looseness.	
	The screws of the terminal block securely are tightened.	There should be no looseness.	

13. TROUBLESHOOTING

The causes and corrective actions for errors that may occur during the tension amplifier operation are described below.

13-1. Display and Countermeasure when an Error Occurred

The error No. is displayed on the data display part when an error occurs. Refer to the following list and implement appropriate countermeasures.

- "ERR" on the status display part turns red when an error occurs.
- The system ready output is OFF.
- The analog output is 0V or 4mA when an error occurs.

Error No.	Name		Probable cause	Error cancel procedures
All LED is OFF	Amplifier error		Tension amplifier failure	- Turn the power OFF and then ON again. - After that, replace the tension amplifier if an error still occurs.
Err1	Internal power error		Internal power supply failure of the tension amplifier	Replace the tension amplifier.
Err2	Memory error 1		System memory data has been changed due to external noise, etc.	- Turn the power OFF and then ON again. - After that, replace the tension amplifier if an error still occurs.
Err3	Memory error 2		User memory data has been changed due to external noise, etc.	- Turn the power OFF and then ON again. - After that, replace the tension amplifier if an error still occurs. *1
Err4 *2 *3	A-axis	Sensor disconnected error	Sensor connector is disconnected or loose.	After removing an error cause, press CLR button and cancel the error.
			Sensor cable is severed.	Replace the sensor cable.
Err5 *2 *3	B-axis		Tension sensor failure	Replace the tension sensor.
			Tension amplifier failure	Replace the tension amplifier.

*1: The amplifier can operate temporarily when hold down MOD/↑ button and then presses CLR button.
However, there is possibility that setting values are rewritten to anomalous values. Thus, check all setting values.

*2: Only "ERR LED" turns red in PRM mode when the sensor disconnected error occurs. (No indication on the data display part)

*3: The sensor disconnected error isn't detected when Select No.0 and 3 of PRM mode is set to "unused".

13-2. Output State when Occurring an Error

Indicates the state of output signal when occurring an error.

Item \ Output	Analog output	System ready output RDY
All OFF Amplifier error	0V or 4mA	OFF
Err1 Internal power error		
Err2 Memory error 1		
Err3 Memory error 2		
Err4 A-axis sensor disconnected error		
Err5 B-axis sensor disconnected error		

13-3. Procedure Contents after Replacing

Implement the following measures after replacing the tension sensor, tension amplifier, and sensor cable.

Replacing contents	Measure
Tension sensor	-Calibrate the tension amplifier by using the reference weight after the replacement. For the details, refer to “9-2”.
Tension amplifier	-Input the same value which was set to the previous amplifier to all parameters. -Carry out the zero preset when the sensor data correction amount is unknown. For the details, refer to “9-2”. -Calibrate the tension amplifier by using the reference weight when the sensor gain value of the calibration is unknown. For the details, refer to “9-2”.
Sensor cable	–

APPENDIX 1. CE MARKING

This product conforms to the EMC Directive.

APPENDIX 1-1. EMC Directives

It is necessary to do CE marking in the customer's responsibility in the state of a final product.
Confirm EMC compliance of the machine and the entire device by customer because EMC changes configuration of the control panel, wiring, and layout.

APPENDIX 1-2. EMC Directive and Standards

EMC consists of emission and immunity items.
It conforms to Table (see below) of EMC standards and Testing.

Class	Standard No.	Standard Name
Emission (EMI)	EN61000-6-4	Generic standards. Emission standard for industrial environments
Immunity (EMS)	EN61000-6-2	Generic standards. Immunity standard for industrial environments
	EN61000-4-2	Electrostatic Discharge
	EN61000-4-3	Radiated, Radio frequency, Electromagnetic Field
	EN61000-4-4	Electrical Fast Transient / Burst
	EN61000-4-5	Surge Immunity
	EN61000-4-6	Conducted Disturbances, Induced by Radio-Frequency Fields
	EN61000-4-8	Power Frequency Magnetic Field

APPENDIX 1-3. Low Voltage Directive

This product doesn't apply to low-voltage directive for the equipment of 24VDC power supply

APPENDIX 1-4. Restrictions

In this section, restrictions are described for conforming to the EMC Directive.

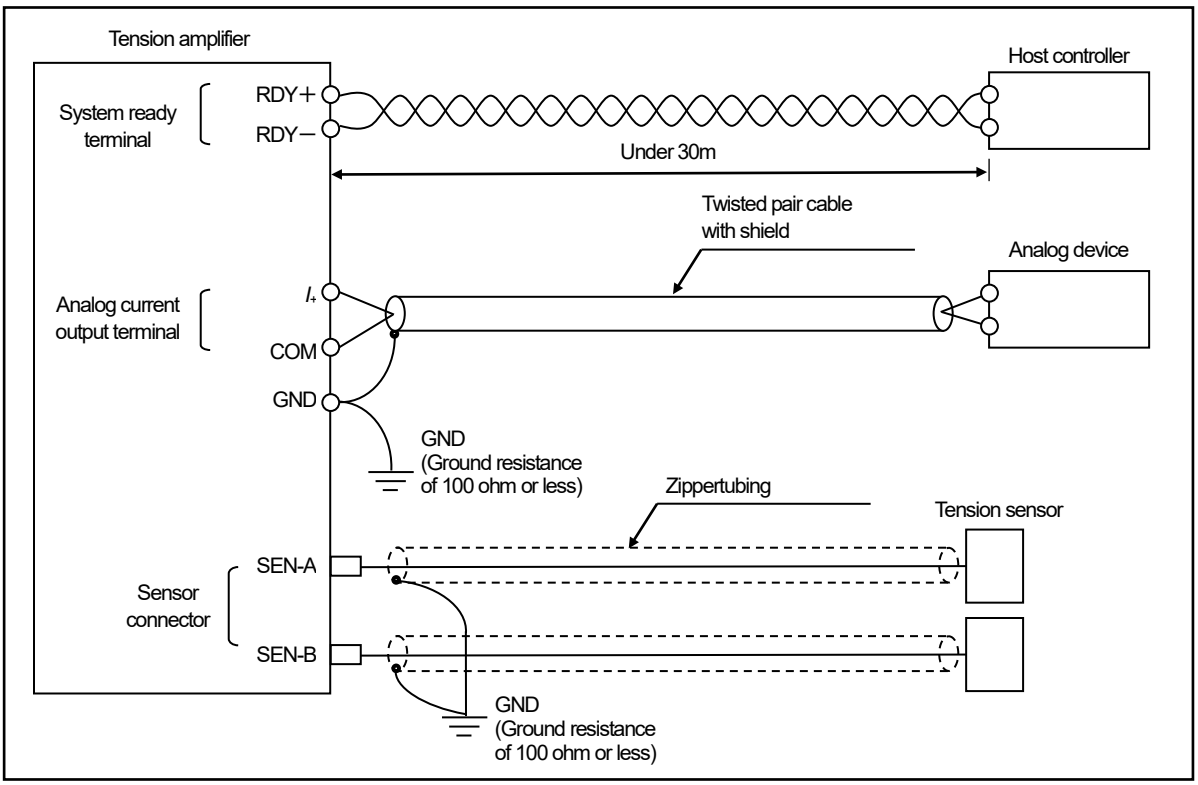
(1) Wire length of the system ready signal (RDY)
The wire length of the system ready signal must be under 30m.

(2) Wire for the analog output (current output: 4 to 20 mA only)
The twisted pair cable with a shield must be used when the wire length is 30m or more.
The shield of the cable has to be connected to the GND terminal of the tension amplifier.

(3) Sensor cable
The sensor cable should be covered by the zippertubing when the sensor cable length is 30m or more.
The shield of the zippertubing has to be grounded.

Recommended zipper tubing

Mounting location	Model	Manufacturer
Sensor cable	MTFS 20ϕ	ZIPPERTUBING(JAPAN), LTD.



[Reference]
It may be improved when clamp ferrite core is added to the sensor cable when it operates faultily by the influence from the peripheral device.

Recommendation Clamp Ferrite Core

Mounting location	Clamp ferrite core model	Manufacturer
Sensor cable	ZCAT2032-0930(Inner dimensions: ϕ9)	TDK

APPENDIX 2. DATA SHEET

●Parameter

Select No.	Item		Setting range The initial values are shown inside "□".	Setting value
0	A-axis	Used/Unused	0: Unused 1: Used	
1		Load direction	0: + (Plus direction) 1: − (Minus direction)	
2		Load rating	0.001 to 9999.999 10.000	
3	B-axis	Used/Unused	0: Unused 1: Used	
4		Load direction	0: + (Plus direction) 1: − (Minus direction)	
5		Load rating	0.001 to 9999.999 10.000	
6	AOUT1	Analog output type	0: Voltage (0 to 10V) 1: Current (4 to 20mA)	
7		Analog output data	0: A-axis tension data 1: B-axis tension data 2: A+B axes tension data	
8		Max. analog output value	-9999.999 to 9999.999 10.000	
9		Min. analog output value	-9999.999 to 9999.999 0.000	
A	AOUT2	Analog output type	0: Voltage (0 to 10V) 1: Current (4 to 20mA)	
b		Analog output data	0: A-axis tension data 1: B-axis tension data 2: A+B axes tension data	
C		Max. analog output value	-9999.999 to 9999.999 10.000	
d		Min. analog output value	-9999.999 to 9999.999 0.000	
E	Sensor filter		0 to 1000 0	
F	Sampling time		1 to 100 (×0.2ms) 1	

●Calibration

Select No.	Item		Setting range The initial values are shown inside "□".	Setting value
0	A+B axes	Zero preset	–	–
1		Calibration	0.001 to 9999.999 10.0	
2	A-axis	Zero preset	–	–
3		Calibration	0.001 to 9999.999 10.0	
4		Sensor data correction amount	-3276.7 to 3276.8 0.0	
5		Sensor gain	0.1000 to 30.0000 1.0	
6	B-axis	Zero preset	–	–
7		Calibration	0.001 to 9999.999 10.0	
8		Sensor data correction amount	-3276.7 to 3276.8 0.0	
9		Sensor gain	0.1000 to 30.0000 1.0	

NSD Group

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