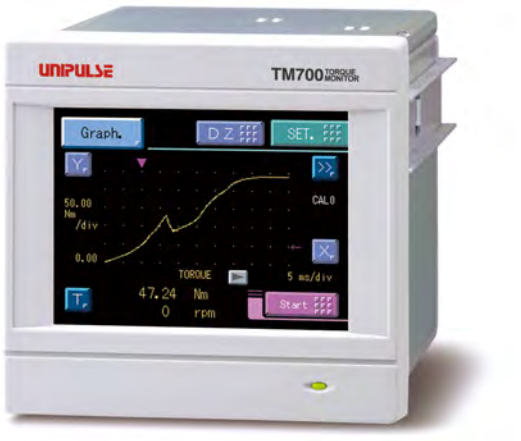

TM700

TORQUE MONITOR

OPERATION MANUAL

20MAY2021REV.1.08

UNIPULSE

INTRODUCTION

Thank you very much for purchasing our Torque Monitor TM700.

For good performance, and proper and safe use of the TM700, be sure to read this operation manual and properly understand the contents of it before use. Also, carefully keep this operation manual so that it can be referred to at any time.

SAFETY PRECAUTIONS

BE SURE TO READ FOR SAFETY

Installation, maintenance and inspection of the TM700 should be performed by personnel having technical knowledge of electricity.

In order to have an TM700 used safely, notes I would like you to surely follow divide into "⚠ WARNING" and "⚠ CAUTION", and are indicated by the following documents. Notes indicated here are the serious contents related to safely. Please use TM700 after understanding the contents well.

⚠ WARNING

This sign forewarns the presence of hazards that could result in serious injury or fatality when incorrectly handled.

⚠ CAUTION

This sign forewarns the presence of hazards that could result in personnel injury or property damage when incorrectly handled.

⚠ WARNING

This sign forewarns the presence of hazards that could result in serious injury or fatality when incorrectly handled.

Warning on design

- For the entire system to function safely when the TM700 becomes faulty or malfunctions, provide a safety circuit outside the TM700.
- Before using the TM700 as described below, make sure to consult with our sales personnel.
  - Use in environments not described in the operation manual.
  - Use greatly impacting human lives and assets, such as medical devices, transport devices entertainment devices, and safety devices.

Warning on installation

- Do not modify the TM700. Doing so may cause fire or electric shocks.
- Do not install in the following environments.
  - Places containing corrosive gas or flammable gas.
  - Where the product may be splashed with water, oil or chemicals.

Warning on wiring

- Do not connect a commercial power source directly to the signal input/output terminals.
- Be sure to ground the protective ground terminal.
- The attached AC cable is designed for domestic use in Japan, and its rating is 125V AC, 7A. For use at voltages exceeding the rating and for overseas use, have a separate AC cable prepared.
- Before performing the following, make sure that no power is applied.
  - Attachment/detachment of connectors of options, etc.
  - Wiring/connection of cables to the terminal blocks.
  - Connection of the earth cable.
- For connection to the signal input/output terminals, check the signal names and pin assignment numbers, and then carry out wiring properly.
- Be sure to use crimp contacts for connection to the terminal blocks, and do not to connect bare wires as they are.
- Be sure to install the attached terminal block cover after wiring to the power input terminals. Otherwise, electric shocks may result.
- Before applying power, carefully check the wiring, etc.

Warning during startup and maintenance

- Use at a proper power supply voltage.
- Do not damage the power cord. Doing so may cause fire or electric shocks.
- Do not touch any terminal while applying power. Doing so may cause electric shocks or malfunctions.
- If the cover of the main body is opened, it may cause an electric shock internally. Even if the power is off, the internal capacitor is charged. Contact us for internal inspection or repair.
- In the case of smoke, an abnormal smell or strange sound, immediately turn off the power, and disconnect the power cable.
- As for the batteries used in TM700, do not at any time dismantle the batteries, change the batteries shape by subjecting it to pressure or throw the batteries into fires as these may cause the batteries to explode, catch fire or leak.

⚠ CAUTION

This sign forewarns the presence of hazards that could result in personnel injury or property damage when incorrectly handled.

Caution on installation

- Use the TM700 as it is incorporated in a control panel, etc.
- Do not install in the following environments:
  - Locations where temperature or humidity exceeds specifications;
  - Locations subjected to drastic temperature fluctuations or icing and condensing;
  - Outdoors or locations above 2,000m;
  - Locations exposed to direct sunlight;
  - Locations subject to dust accumulation;
  - Locations with poor ventilation;
  - Locations with a lot of salt and metal powder;
  - Locations where the main unit is subject to direct vibration and shock.
- Take adequate shielding measures when using at the following locations.
  - Near a power line.
  - Where a strong electric field or magnetic field is formed.
  - Where static electricity, relay noise or the like is generated.
- Install the TM700 as far away from devices generating high frequency, high voltage, large current, surge, etc., as possible. Also, carry out wiring separately from their power lines. Do not carry out parallel wiring and common wiring.
- Do not use it, broken down.

Caution on wiring

- Tighten the screws for the power input terminals at the specified torque.
  If they are loose, shorts, fire or malfunctions may occur.
  Tightening torque: 0.5N•m
- For external inputs/outputs and options, use shielded cables.
- The temporary overvoltage applied to the power should not exceed 1500V.

Caution during startup and maintenance

- For turning on/off the power, be sure to keep intervals of 5 seconds or more.
- After power-on, make sure to warm up the TM700 for at least 30 minutes or more before use.
- If the TM700 is not used by the specified method, its protective performance may be impaired.
- Maintenance
  - When performing maintenance, disconnect the power.
  - Do not wipe with a wet rag, or with benzine, thinner, alcohol, etc. Doing so may cause discoloration or deformation of the TM700. In the case of heavy contamination, wipe off the contamination with a cloth after dipping it into a diluted neutral detergent and wringing it well, and then wipe with a soft, dry cloth.

⚠ CAUTION	**This sign forewarns the presence of hazards that could result in personnel injury or property damage when incorrectly handled.**

Caution during transportation

- When the TM700 is shipped, spacers made of corrugated cardboard are used as cushioning materials.
  Though it is factory-designed so that shocks can sufficiently be absorbed, breakage may result if shocks are applied when the spacers are reused for transportation. If you send the TM700 to us for repair, etc., take adequate measures against shocks by using polyurethane materials, etc., separately.

Caution during disposal

- If you dispose of the product, handle it as industrial waste.
- Remove the lithium batteries used in the TM700 and make sure to dispose them according to classification of waste collection.

PRODUCT COMPLIANT TO RoHS2 DIRECTIVE

The parts and attachments (including the instruction manual, packaging box, etc.) used for this unit are compliant with the RoHS2 Directive, restricting the use of hazardous substances with regard to adverse effects on the environment and human body.

RoHS2 Directive

It is based on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE). The Directive restricts the use of specific substances in electrical and electronic equipments that could harm environment and human body. The substances are lead, mercury, cadium, hexavalent chromium, PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers), DEHP (bis(2-ethylhexyl) phthalate), BBP (benzyl butyl phthalate), DBP (dibutyl phthalate), and DIBP (diisobutyl phthalate).

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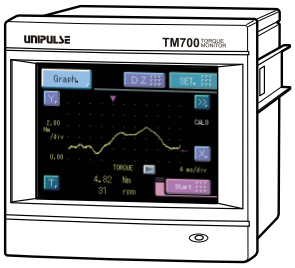
1 OUTLINE

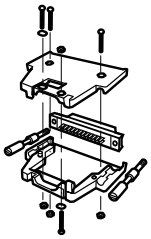
1-1. Contents of the Package

The packaging box contains the following.
Be sure to check them before use.

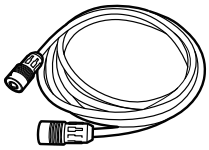


TM700 body…1

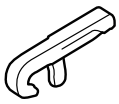
TM700 operation manual…1



External input/output connector…1set
[Connector: FCN-361J024-AU
Cover: FCN-360C024-B]



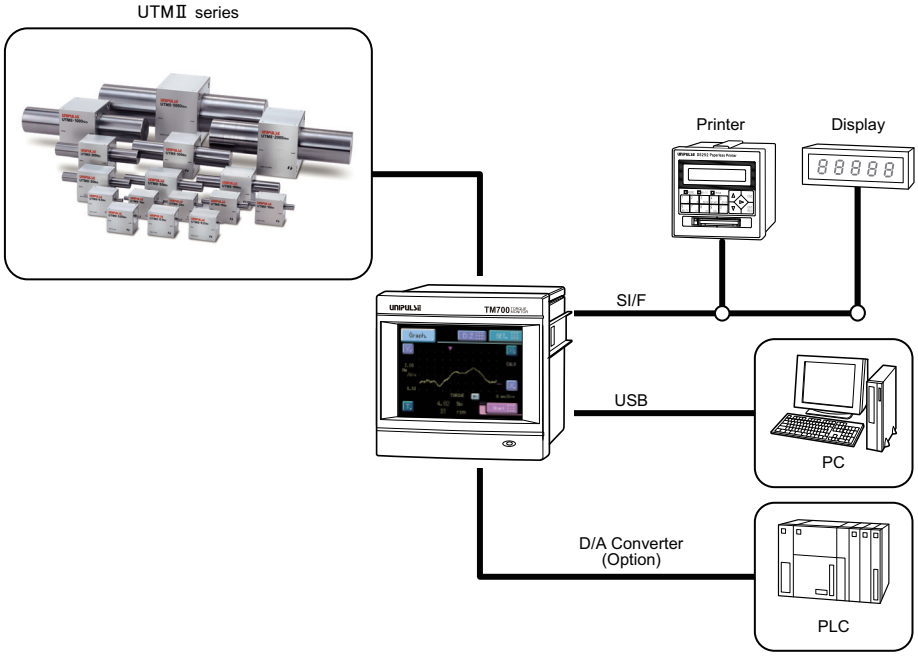
Cable for UTMⅡ connection (2m)…1
(with connector)



Operating tool…1
(with D/A converter (3ch) option)

* The D / A converter connector (with D/A converter (3ch) opution) is shipped on the option board already mounted.

1-2. About Connectable Devices

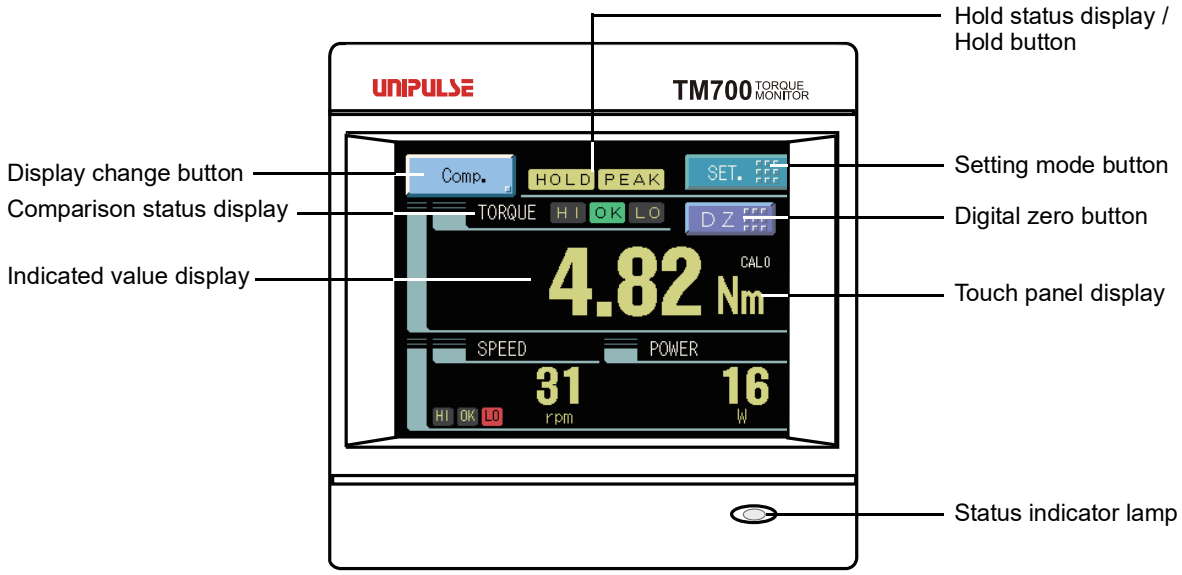


Chapter 1

OUTLINE

1-3. Appearance Description

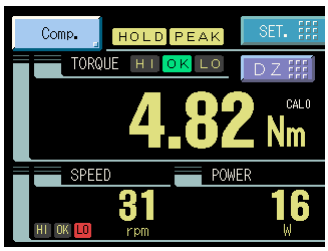
■Front panel



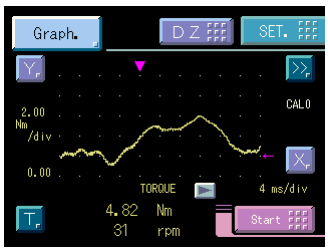
Touch panel display

This is the touch panel display for displaying an indicated value and graph set value and for setting various setting items of the TM700. During measurement, a comparison display and graph display can be selected according to the function in use.

Comparison display



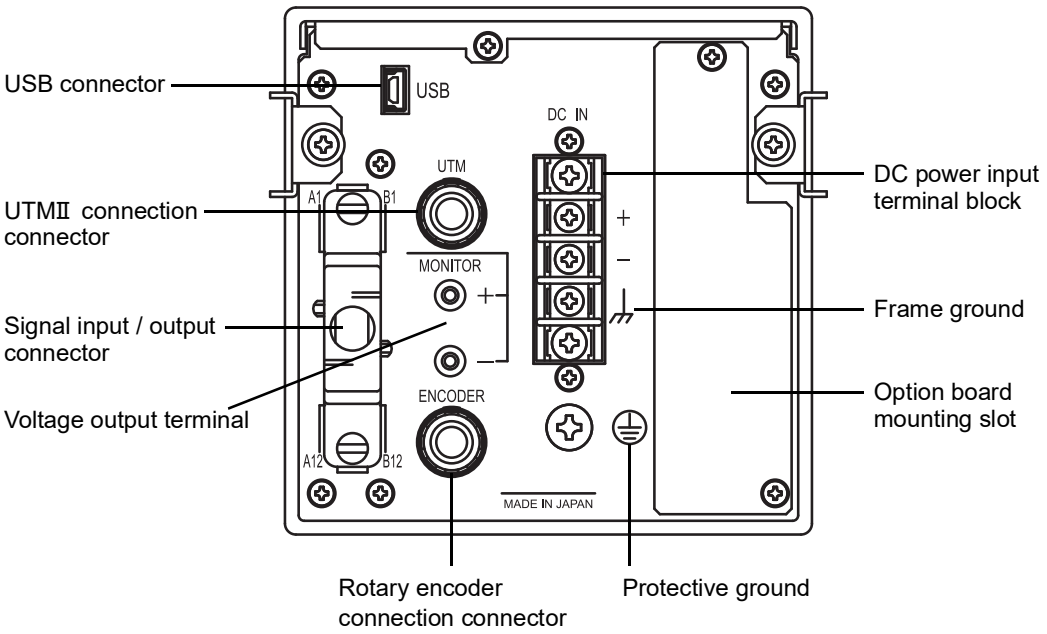
Graph display



Status indicator lamp

Lamp indication	Status
Green lighting	Steady state
Red lighting	Writing into internal NOVRAM. Do not turn off the power of the TM700.
Yellow blink	The voltage of the lithium battery for internal memory backup has dropped. The battery needs to be replaced. Ask us for replacement of the battery.

■Rear panel



UTMⅡ connection connector

Connect a UTMⅡ with a dedicated cable.

* For connection, see "■UTMⅡ connection" on page 7.

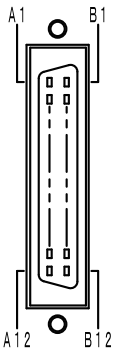
Rotary encoder connection connector

Connect a UTMⅡ rotary encoder with a dedicated cable.

* For connection, see "■Rotary encoder connection" on page 8.

Signal input / output connector

A1	*	COM1	B1	*	COM2
A2	out	HI (Torque)	B2	in	
A3	out	LO (Torque)	B3	in	
A4	out	ALM HI/LO (Torque)	B4	in	
A5	out	HI (Rotation speed)	B5	in	LOCK
A6	out	LO (Rotation speed)	B6	in	T/H
A7	*	COM1	B7	*	COM2
A8	out	ALM HI/LO (Rotation speed)	B8	in	SECTION
A9	out	RUN	B9	in	D/Z
A10	out	H/E	B10	in	START/STOP
A11	out	SI/F	B11	in	
A12	out	SI/F	B12	in	CAL



Adaptable plug FCN-361J024-AU (manufactured by FUJITSU COMPONENT or equivalent)
Connector cover FCN-360C024-B (manufactured by FUJITSU COMPONENT or equivalent)
(Connector & Cover optional type: CN50)

* For connection, see "■External I/O connection" on page 10.

DC power input terminal block

Connect the DC power cord. The power supply voltage is 24V DC (±15%).

Adaptable crimp terminal [TMEV1.25-3S]

Frame ground

Please ground the frame ground terminal to prevent failures due to static electricity.

(The frame and the frame ground terminal are conducted.)

It may be better to remove depending on the environment of the installation location.

Protective ground

Be sure to ground the protective ground terminal to prevent electric shocks.

Voltage output terminal

The approximate input voltage from UTMII can be confirmed (approx. 1V per sensor input voltage of 1V, with load resistance of 2kΩ or more).

* For connection, see "■Voltage output" on page 11.

USB connector

This connector is used to connect the product with a computer.

* For connection, see "■USB interface connection" on page 11.

Optional slot

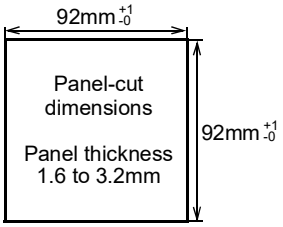
D/A converter voltage output (3ch) [D3V] can be installed.

2 INSTALLATION & CONNECTION

2-1. Installation

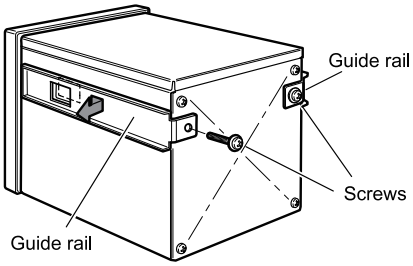
To install the TM700 into a control panel, use the following procedure.

1. Make a hole in the panel according to the panel-cut dimensions.

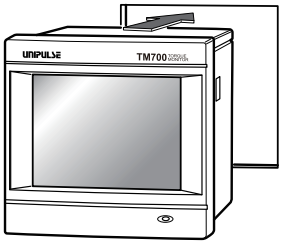


2. Remove the screws (two), and remove the guide rails from both sides.

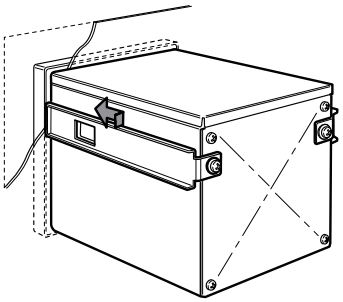
* Do not use other screws than those installed to the TM700 body.



3. Fit in the TM700 from the front of the panel.



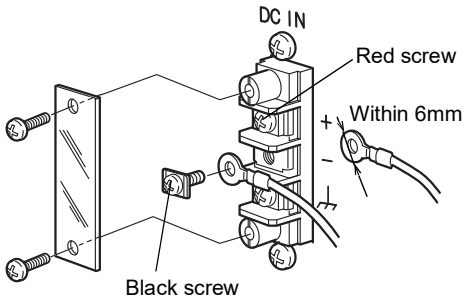
4. Install from the rear the guide rails having been removed from both sides in Step 2, and fix them with the screws (two).



2-2. Connection

■Power input connection

Connect the positive (+) side of the power source to the red screw side of the terminal block on the back of the TM700, and its negative (-) side to the black screw side. The input voltage is 24V DC(±15%).



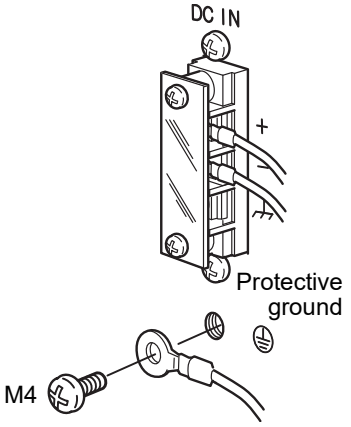
CAUTION

Be aware that the voltage drops depending on the wire thickness and length.
Also, never input an AC power source. Doing so will cause a failure.

■Protective ground connection

The grounding terminal is for prevention of electric shocks.
Use an approx. 0.75mm^2 thick wire, and be sure to ground.

1. Make sure that no power is applied.
2. Remove the screws(M4) at the protective ground.
3. Align the solderless terminals(M4) with the screw holes, and then tighten the screws.

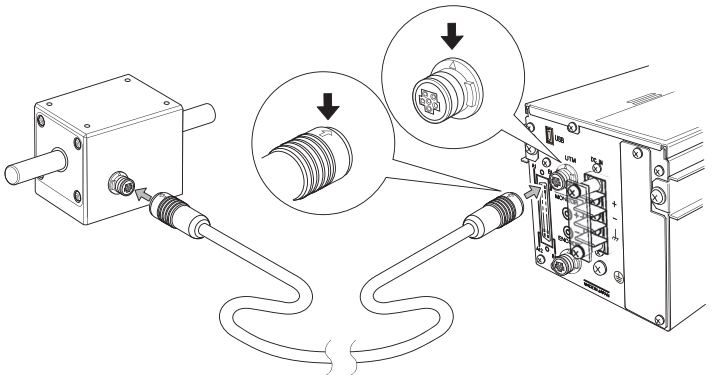


⚠ WARNING

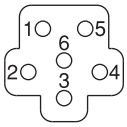
- Connect with no power applied because it may cause an electric shock.
- Since the TM700 has no power switch, install a breaker.
- Be sure to ground the protective ground terminal to prevent electric shocks. Do not use other screws than that attached to the main body.

■UTMⅡ connection

A UTMⅡ can easily be connected with the attached dedicated cable.
The cable is nonpolar. Connect paying attention to the orientation of the connector.



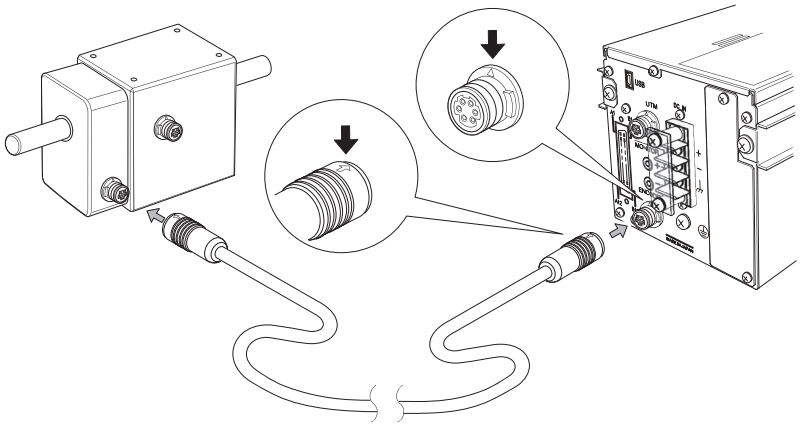
●Pin assignments

Pin arrangement	Pin No.	Cable color	Signal name
	1	Red	PWR+ (+24V)
	2	Black	PWR− (0V)
	3	Green	SIG IN (±5V DC)
	4	White	SIG GND
	5	Yellow	PULSE IN+
	6	Brown	PULSE IN−
	Shield	Braided wire	* The shield is not connected to the UTMⅡ housing.

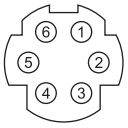
* The wiring colors are those of the cable attached to the UTMⅡ.
* Compatible connector: HR30-6P-6P (HIROSE) (connector optional type: CN90)

■Rotary encoder connection

A UTMⅡ rotary encoder can easily be connected with the dedicated cable.
The cable is nonpolar. Connect paying attention to the orientation of the connector.



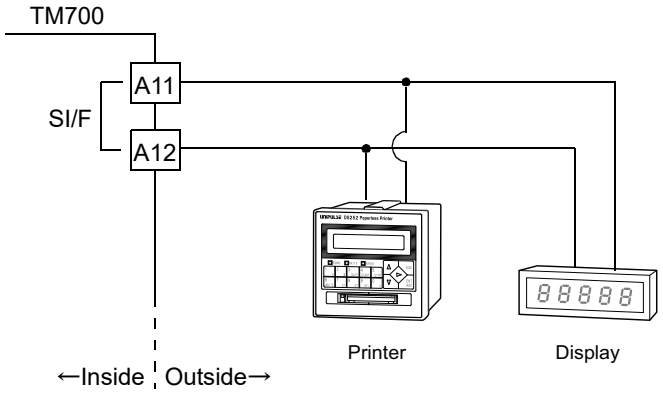
●Pin assignments

Pin arrangement	Pin No.	Cable color	Signal name
	1	—	NC
	2	Red	PWR＋ (+5V)
	3	Transparent	Z-phase (Unused)
	4	Black	B-phase (Unused)
	5	Blue	A-phase
	6	Shield (Green)	PWR GND

* The wiring colors are those of the cable attached to the UTMⅡ rotary encoder.
* Compatible connector: HR30-6P-6S (HIROSE) (connector optional type: CN91)

■SI/F interface connection

Two-wire serial interface (SI/F) for connecting printers and external display from UNIPULSE.
Connect from A11 and A12 of the external input/output connector.
The interface is nonpolarized and up to three external devices can be connected.
Wiring materials should use a two-core parallel cable, cabtyre cable (electric wire with covering thickened for construction), etc. When a two-core parallel cable or a cabtyre cable is used, the transmission distance is approximately 30m. When a two-core shielded twisted pair wire is used, the transmission distance is approximately 300m.
Do not parallel it with AC lines and high-voltage lines. Doing so will cause malfunction.



Point

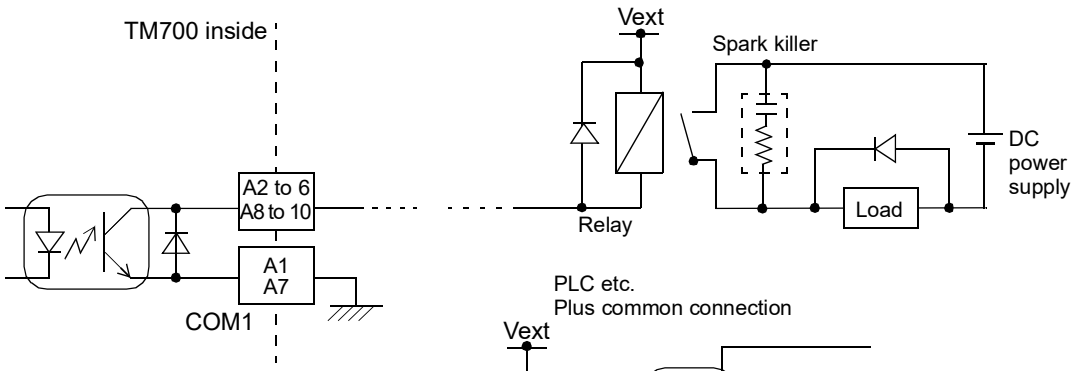
For purchasing peripheral devices, consult our sales department.

■External I/O connection

How to connect external output (Sink type)

The external output circuit is operated through an open collector. A1(A7) COM1 is the common terminal. The open collector output capacity is 30mA and the withstand voltage is up to 30V.

- Equivalent circuit



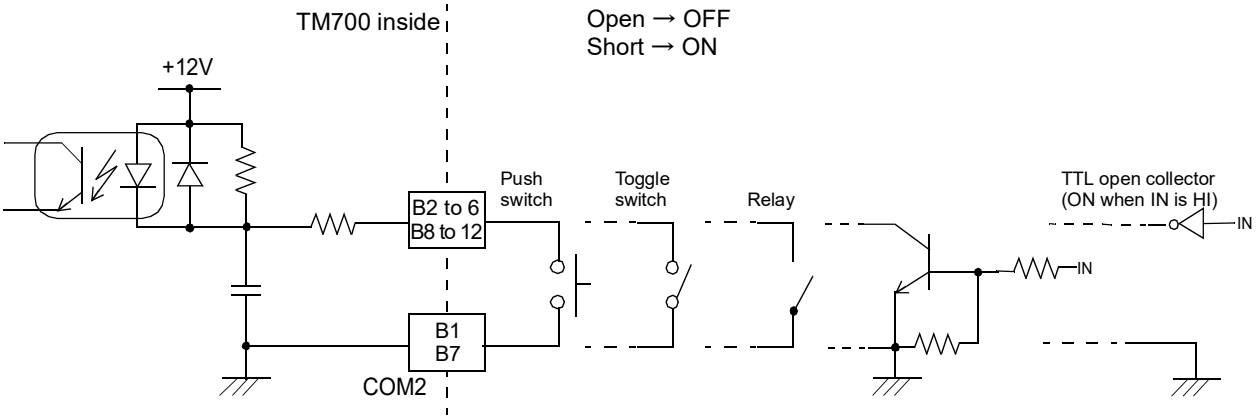
●Output transistor status

Output data	Tr
OFF	OFF
ON	ON

Supply an external power source for a relay drive power source (Vext).

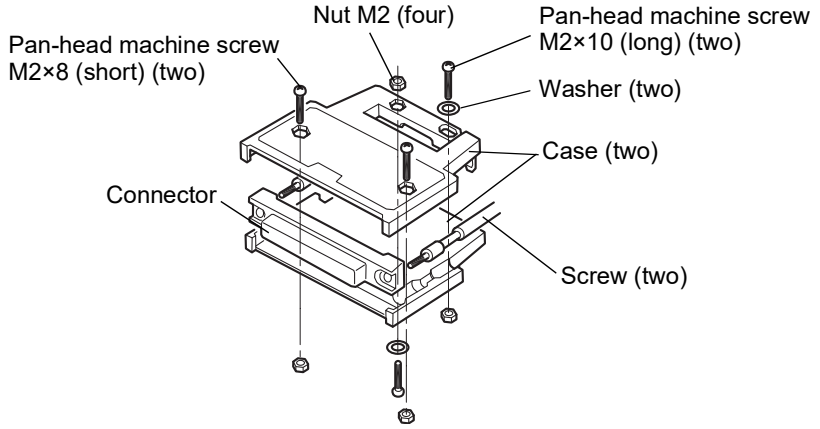
How to connect external input (minus common connection of no-voltage contact input type)

A signal is inputted to the signal input circuit by short-circuiting or opening the input terminal and the COM2 terminal. Short-circuiting is effected by means of a contact (such as a relay or a switch) or a noncontact (such as a transistor or an open-collector TTL).



- The external element is required to withstand Ic=10mA.
- Leakage from the external element is required to be 100μA or below.

How to assemble the connector



1. Set the connector and screws (two) into the grooves of the case (one side).

2. Cover with the other case, and fit the cases.

3. Tighten the M2×8 pan-head machine screws (two).
Tighten the M2×10 pan-head machine screws (two).
Be aware that washers should be set to the M2×10 pan-head machine screws (two).

■USB interface connection

This connector is used to connect USB.
A compatible connector is mini-B TYPE.

■Voltage output

Rough input voltage from the UTMII can be checked with voltmeter probe, etc.
Since the output voltage is taken out in a step prior to A/D conversion of the sensor input signal, it is not synchronized with indicated values processed digitally, such as Digital Zero and digital filter.
The ±MONITOR terminals are not insulated from the internal circuit.

Output level:	Approx. 1V per input voltage of 1V
Load resistance:	2kΩ or more
Use terminal:	PF-8-1-A (manufactured by MAC8 or an equivalent) ϕ 2, Depth: 6mm
Compatible terminal:	OP-7-1 (manufactured by MAC8 or an equivalent)

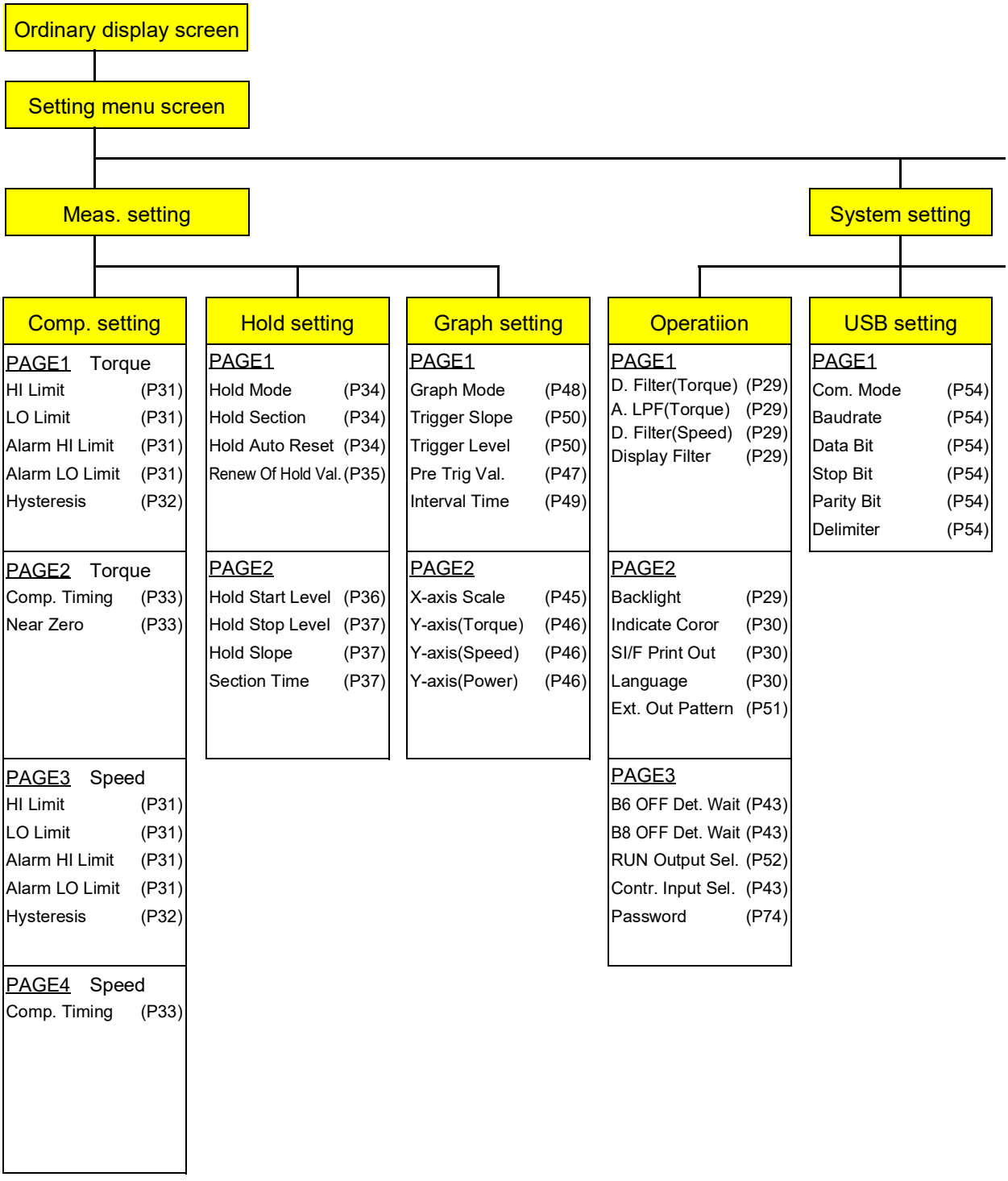
⚠ CAUTION

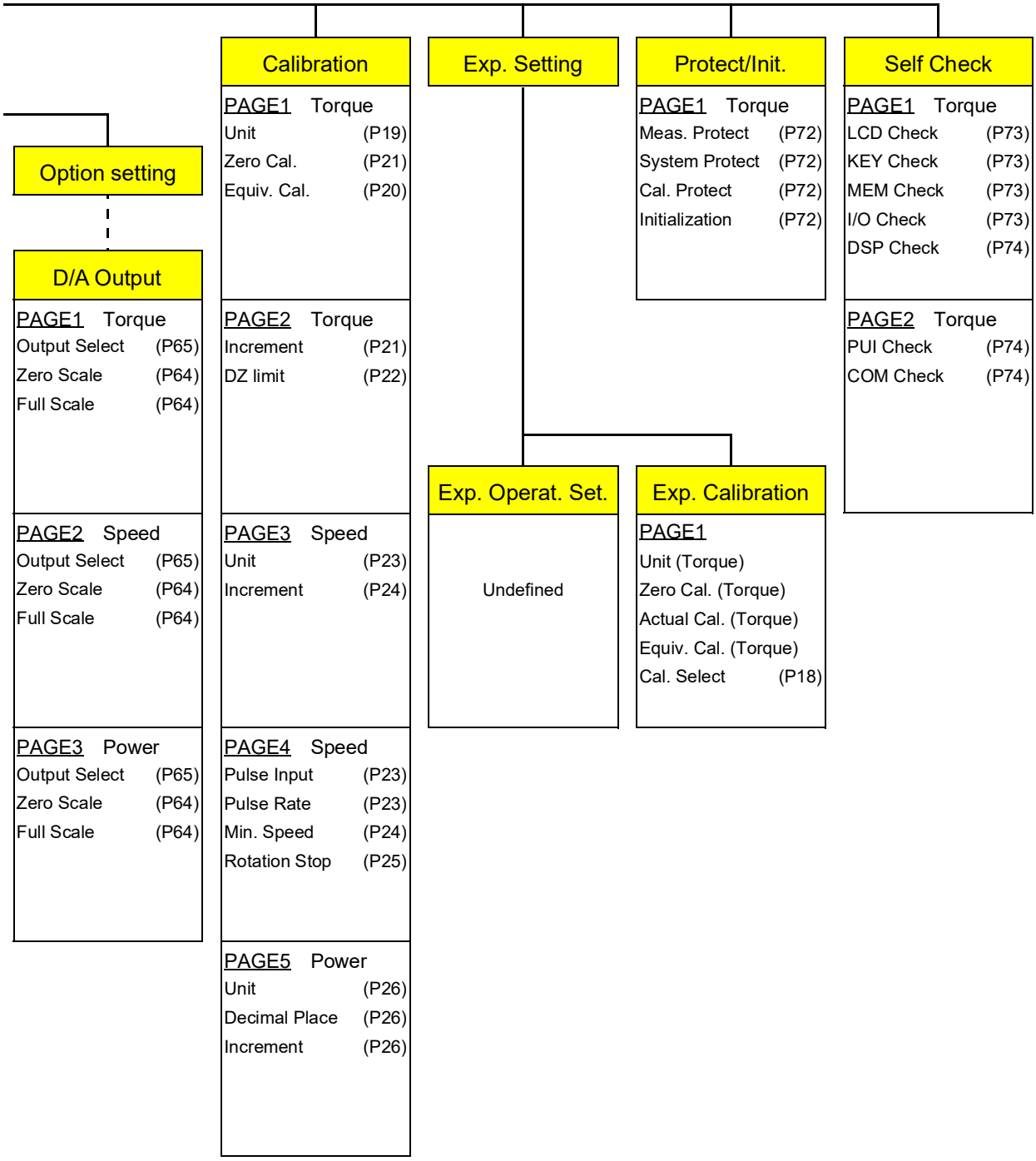
- Do not short-circuit. Doing so will cause a failure.
- Do not apply voltage externally. Doing so will cause breakage.

3 SETTING PROCEDURE

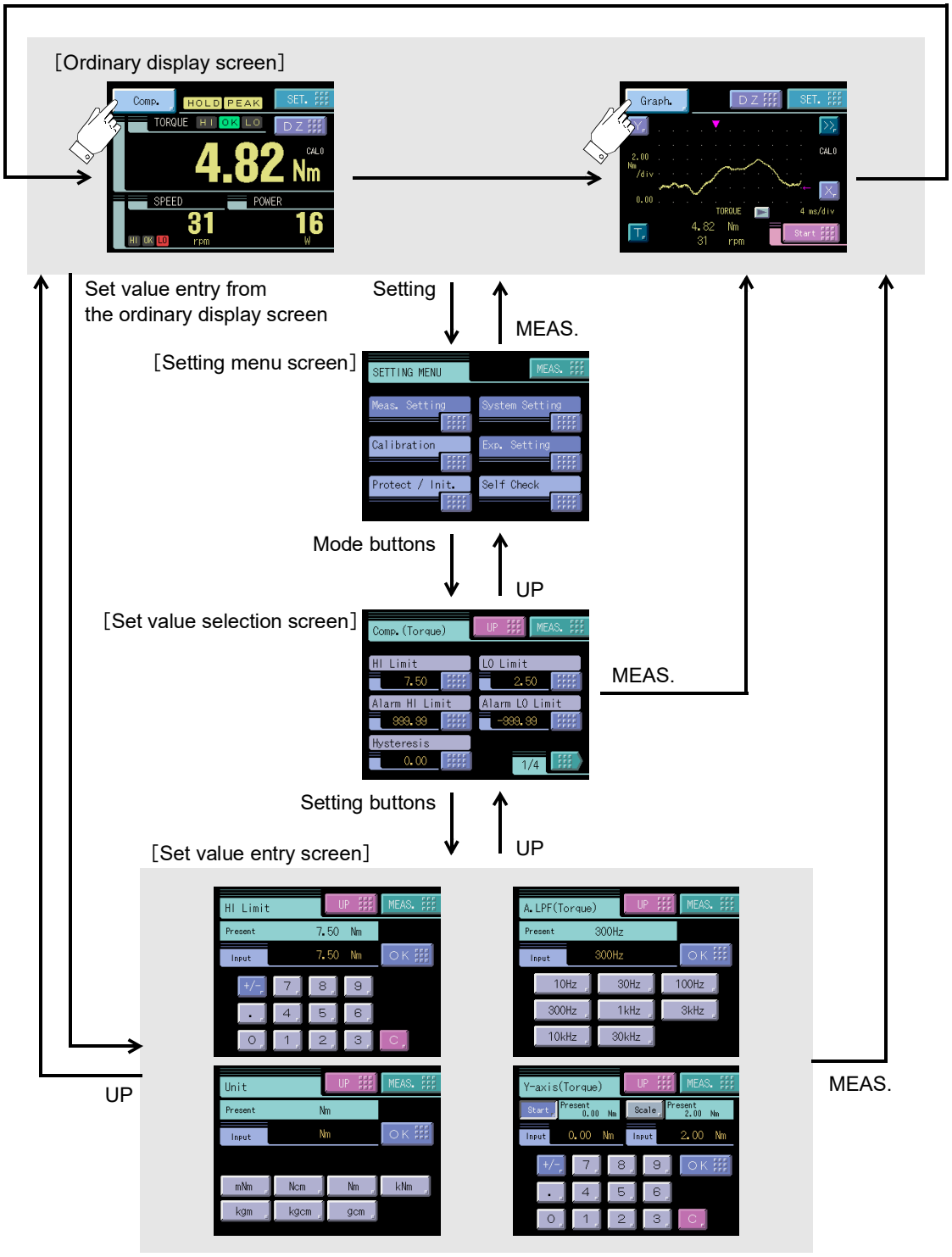
3-1. Screens and Operations

■Setting modes tree




Option setting
D/A Output
PAGE1 Torque
Output Select (P65)
Zero Scale (P64)
Full Scale (P64)
PAGE2 Speed
Output Select (P65)
Zero Scale (P64)
Full Scale (P64)
PAGE3 Power
Output Select (P65)
Zero Scale (P64)
Full Scale (P64)
Calibration
PAGE1 Torque
Unit (P19)
Zero Cal. (P21)
Equiv. Cal. (P20)
PAGE2 Torque
Increment (P21)
DZ limit (P22)
PAGE3 Speed
Unit (P23)
Increment (P24)
PAGE4 Speed
Pulse Input (P23)
Pulse Rate (P23)
Min. Speed (P24)
Rotation Stop (P25)
PAGE5 Power
Unit (P26)
Decimal Place (P26)
Increment (P26)
Exp. Setting
Exp. Operat. Set.
Undefined
Exp. Calibration
PAGE1
Unit (Torque)
Zero Cal. (Torque)
Actual Cal. (Torque)
Equiv. Cal. (Torque)
Cal. Select (P18)
Protect/Init.
PAGE1 Torque
Meas. Protect (P72)
System Protect (P72)
Cal. Protect (P72)
Initialization (P72)
Self Check
PAGE1 Torque
LCD Check (P73)
KEY Check (P73)
MEM Check (P73)
I/O Check (P73)
DSP Check (P74)
PAGE2 Torque
PUI Check (P74)
COM Check (P74)

■TM700 screen configuration



■About a setting call

In this manual, a setting function call is described as follows.

Example) HI limit(torque)

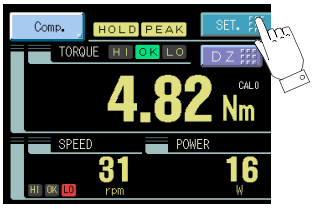
SET. → Meas. Setting → Comp. Setting → Page 1

↑ Setting menu ↑ Item classification ↑ Page

This call can be made by the following procedure.

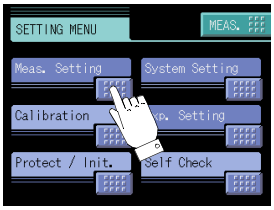
1. Press the [SET.] button on the ordinary display screen.

Setting call

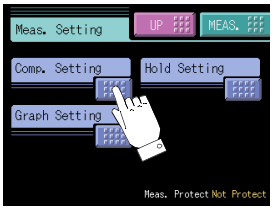


2. The setting menu screen appears. Select the item.

Setting menu

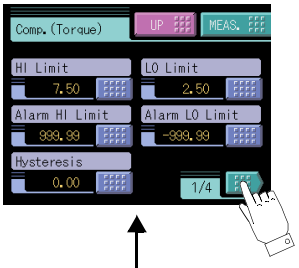


Item classification

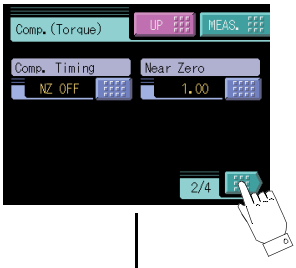


3. The setting function setting screen appears. Select the function.

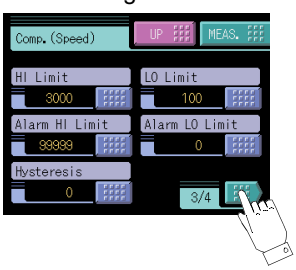
Page 1



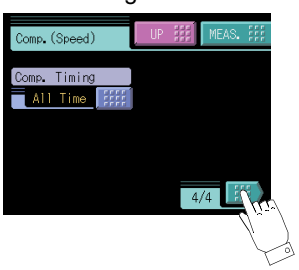
Page 2



Page 3



Page 4



4 CALIBRATION

About calibration

"Calibration" is performed for matching the TM700 to a sensor.
Check the UTMⅡ to be used.

● Equivalent input calibration

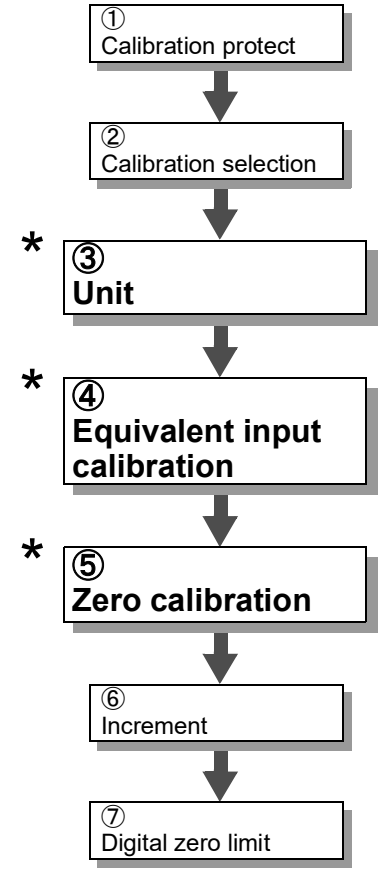
In this calibration procedure, only the rated capacity value (one to be displayed) of a sensor is input using the keys.

For example, for UTMⅡ-0.1Nm: 0.100Nm
100.0mNm
for UTMⅡ-100Nm: 100.0Nm
0.100kNm

The valid number of digits is 5, and the number of digits after the decimal place is up to 3.

For example, display settings such as
1000.00mNm (6 digits) and
0.1000Nm (4 digits after the decimal place)
are not allowed.

4-1. Calibration Procedure of the Torque



*…It is indispensable.

Release the calibration protection.

Set the calibration value No.
(Set "0" for use with only one selection.)
(optional if there is no change)

Set the unit of the values displayed.

Register the capacity of the sensor.
At this time, also input the decimal place.

Set the zero point of the sensor in no-load condition (with the sensor unloaded).

Set the minimum unit of torque such as scale interval and scale division. (optional if there is no change)

The load limit to which digital zero is enabled from the zero calibration point is set. (optional if there is no change)

4-2. Calibration Protect

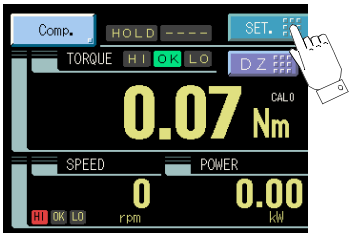
Calibration-related set values can be protected so that they will not be changed by misoperation. When cal. protect is ON, no change can be made while the alarm sounds.

≪Setting value≫ ON: Protected
OFF: Unprotected

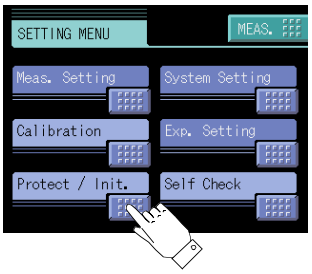
How to set

SET. → Protect / Init. → Page 1

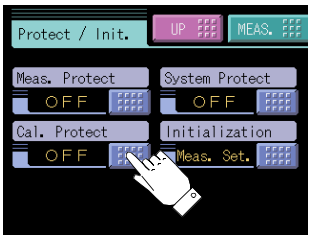
1. Press the [SET.] button.



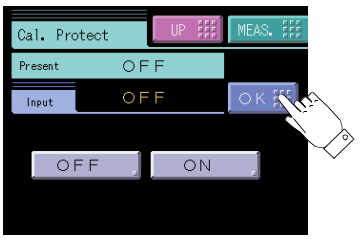
2. Press the [Protect / Init.] button.



3. Press the [Cal. Protect] button.



4. Select the ON/OFF and determine with the [OK] button.



4-3. Calibration Value Selection (optional if there is no change)

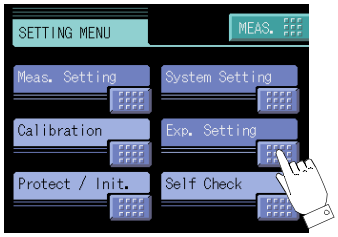
By storing up to two calibration values in the memory, the desired calibration value can be called to switch the indicated value. Setting values that can be switched are as follows:

≪Setting value≫ 0, 1, EXT* (* “EXT” stands for “External Signal”: OFF=0, ON=1)

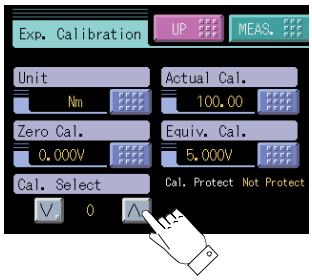
How to set

SET. → Exp. Setting → Exp. Calibration → Page 1

1. Press the [SET.] button. (see P.17)
2. Press the [Exp. Setting] button.
3. Press the [Exp. Calibration] button.



Calibration mode setting	
Unit (torque)	Unit (power)
Zero calibration (torque)	Increment (power)
Actual load calibration (torque)	Decimal place (power)
Equivalent input calibration (torque)	D/A setting (torque) Zero scale Full scale
Increment (torque)	
Decimal place (torque)	
Digital zero limit	D/A setting (speed) Zero scale Full scale
Decimal place (speed)	
Increment (speed)	
Pulse input	D/A setting (power) Zero scale Full scale
Pulse rate	
Minimum input rotation speed	
Rotation stop mode	



■Calibration value selection by touch panel

Select "0 - 1" by pressing the [∨ ∧] button on the Exp. Calibration screen.
When not using, set "0".

■Calibration value selection by external signal input

With this function, two types of calibration values can be selected with external selector signals CAL (when the calibration value selection setting is external).

Set "EXT" 0 by pressing the [∨ ∧] button on the Exp. Calibration screen. According to the input conditions of external signal inputs CAL, the display changes as EXT0 to EXT1. Normally, when there is no input to CAL (the terminals are open), calibration value 0 is selected.

4-4. Unit

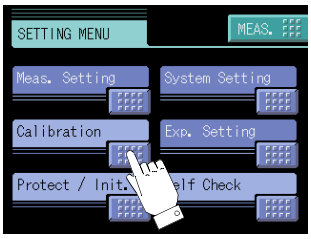
Set the unit for performing calibration.
After this setting, make sure to perform calibration.

≪Setting value≫ mNm, Ncm, Nm, kNm, kgm, kgcm, gcm

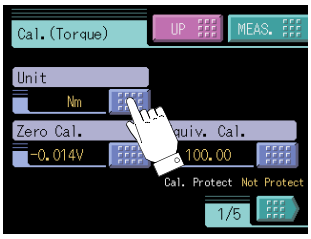
How to set

SET. → Calibration → Page 2

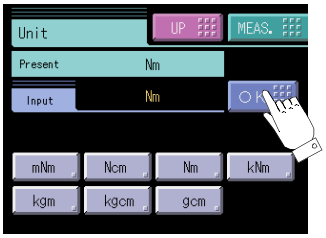
1. Press the [SET.] button. (see P.17)
2. Press the [Calibration] button.



3. Press the [Unit] button.



4. Select the unit and determine with the [OK] button.



* Even if the unit is changed, the display value (calibration value) will not change.

Point

Power is calculated by performing internal conversion based on the unit settings. Therefore, do not change these settings improperly after calibration. If they are changed, perform calibration again.
For unit conversion, see "4-12.Unit Conversion Table" on page 27.

4-5. Equivalent Input Calibration

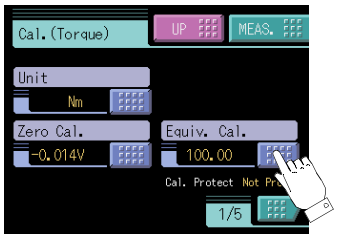
Set the capacity of UTMⅡ.

≪Setting value≫ -99999 to 99999 (0 is excluded.)

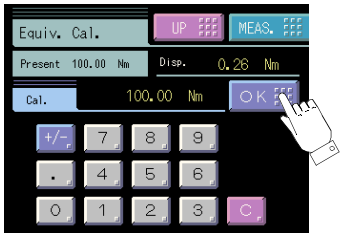
How to set

SET. → Calibration → Page 1

1. Press the [SET.] button. (see P.17)
2. Press the [Calibration] button. (see P.19)
3. Press the [Equiv.Cal.] button.



4. Input the capacity with the numerical keys. Set with a decimal place. Press the [OK] button to perform calibration.



■Registration method at decimal place

Example)

The indicated value is made "200.0" by equivalent input calibration.

It is a specification to which the decimal place is input with the numerical keys.
Please input it in the image that operates the calculator.

Press [2] → [0] → [0] → [.] → [0]

The display of the decimal place of the input value moves.

Please put it again from the start pushing the [C] button when you correct it.

Point

- Please put it again from the start pushing the [C] button when the decimal place is lost.
- All set values concerning the load synchronize with the decimal place of the indicated value (capacity).

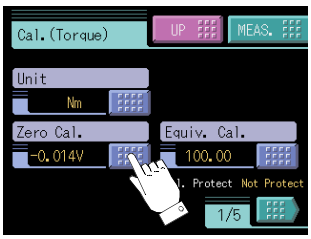
4-6. Zero Calibration

Register the zero point with the sensor unloaded. Also, if there is any initial load, such as a jig, for measurements, the zero point can be registered with the initial load applied, but the signal input range needs to be considered as the initial load is subtracted from it.

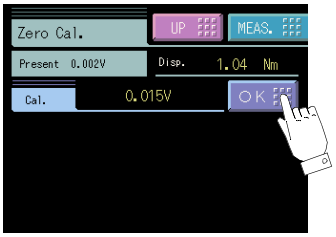
How to set

SET. → Calibration → Page 1

1. Press the [SET.] button. (see P.17)
2. Press the [Calibration] button. (see P.19)
3. Press the [Zero Cal.] button.



4. Press [OK] button after confirming no-load was applied to the sensor.



4-7. Increment (optional if there is no change)

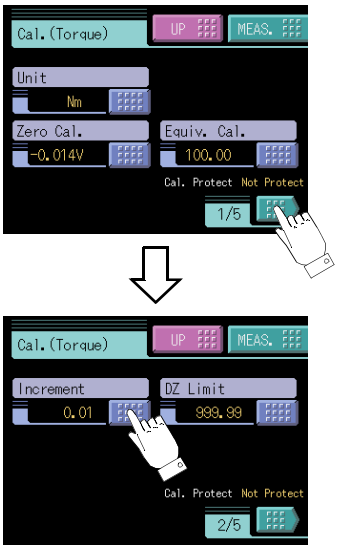
Set the minimum unit of torque such as scale interval and scale division.

≪Setting value≫ 1, 2, 5, 10, 20, 50, 100 (The display changes by the decimal place.)

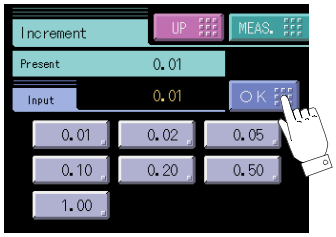
How to set

SET. → Calibration → Page 2

1. Press the [SET.] button. (see P.17)
2. Press the [Calibration] button. (see P.19)
3. Select page 2, and press the [Increment] button.



4. Select the increment and determine with the [OK] button.



4-8. Digital Zero Limit (optional if there is no change)

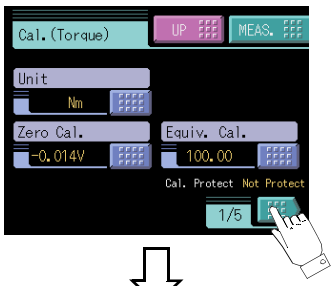
This is a load limit to allow digital zero.
When digital zero is executed, if the difference from the zero calibration point is larger than the setting value, an error will result, and the indicated value will not be zeroed.

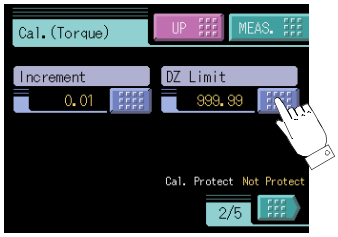
≪Setting value≫ 0 to 99999

How to set

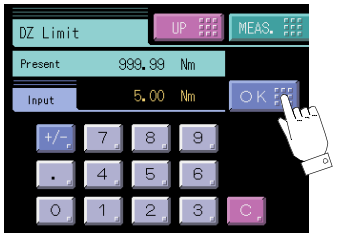
SET. → Calibration → Page 2

1. Press the [SET.] button. (see P.17)
2. Press the [Calibration] button. (see P.19)
3. Select page 2, and press the [DZ Limit] button.

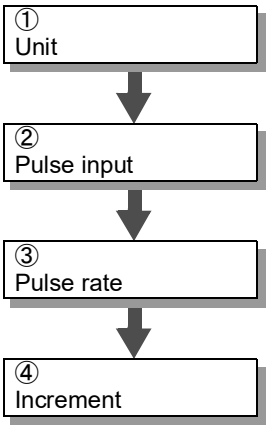




4. Enter the digital zero limit value by the numerical keys and determine with the [OK] button.



4-9. Rotation Speed Display Settings



Set the unit of the values displayed.

Select the connector used for pulse input.

Set the number of pulses per rotation.

Set the minimum unit of rotation speed such as scale interval and scale division.

■Unit

Set the unit of the values displayed.

≪Setting value≫ rpm, min^{-1}

How to set

SET. → Calibration → Page 3

■Pulse input

Select the connector used for pulse input.
It is convenient to use the UTM side mainly for high-speed rotation and the encoder side for low-speed rotation.

≪Setting value≫ UTM, ENCODER

How to set

SET. → Calibration → Page 4

■Pulse rate

Set the number of pulses per rotation.

Use	Number of pulses per rotation	
	High	Low
Low-speed rotation	○	△
High-speed rotation	△	○

≪Setting value≫ 1, 4 pulse (UTM selected)
1 to 4000 pulse (Encoder selected)

When the number of pulses is high, the resolution will be high, allowing to monitor low-speed rotation status.
Therefore, the display changes depending on the setting.

600 pulse or more: A value down to 1 digit after the decimal place is displayed.
Below 600 pulse: A value without the decimal place is displayed.

How to set

SET. → Calibration → Page 4

■Increment

Set the minimum unit of rotation speed such as scale interval and scale division.

≪Setting value≫ 1, 2, 5, 10, 20, 50, 100 (The display changes by the decimal place.)

How to set

SET. → Calibration → Page 3

4-10.Rotation Stop Settings for Rotation Speed

■Minimum input rotation speed

Minimum input rotation speed that can be displayed is selectable.
Enabled only when the pulse input is at UTM.
When the pulse input is at encoder, the minimum rotation speed will be the speed equivalent to the maximum detection time of 1 sec.

≪Setting value≫

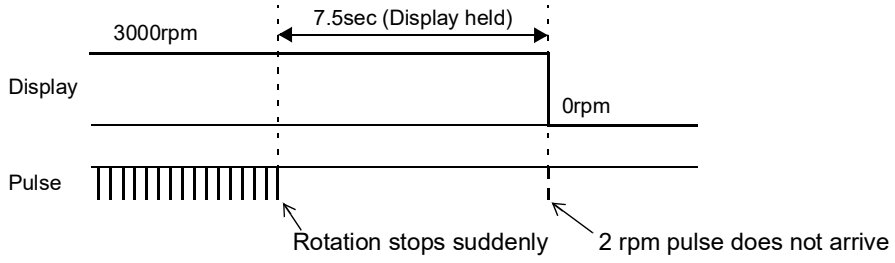
Pulse rate	Minimum input rotation speed (frequency)				
4 pulses	15 rpm	10 rpm	5 rpm	3 rpm	2 rpm
1 pulse	60 rpm	40 rpm	20 rpm	12 rpm	8 rpm
Max. detection time	1 sec	1.5 sec	3 sec	5 sec	7.5 sec

How to set

SET. → Calibration → Page 4

Example) When set at "2rpm"

Since waiting for pulse detection for the duration of maximum detection time is required when rotation stops suddenly from high speed state, the previous rotation speed is not updated; therefore, the display will become 0 rpm after the display of the rotation speed that was last detected has held for 7.5 seconds.



■Rotation stop mode

Cut-off looks unclear when the rotation stops suddenly due to the constraint of maximum detection time corresponding to the minimum input rotation speed. For this reason, 0 rpm display can be forcibly set with "the cycle of the rotation speed last detected × a certain multiple".

≪Setting value≫

OFF (invalid)

After detection is waited for the duration of the maximum detection time corresponding to the minimum input rotation speed, the display becomes 0 rpm.

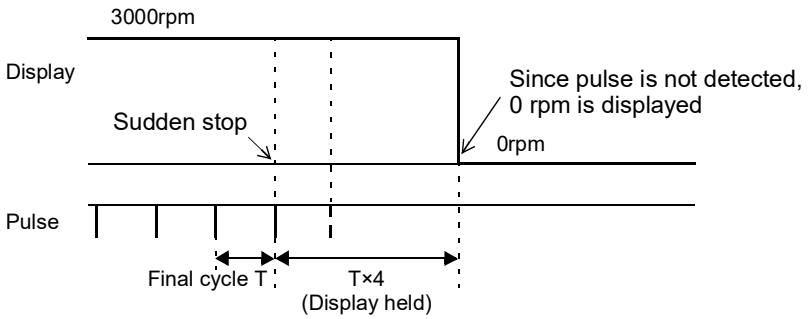
2, 4, 8 [times] (valid)

If pulse is not detected from the cycle of the rotation speed last detected to the cycle of the set multiple, the display becomes 0 rpm forcibly.

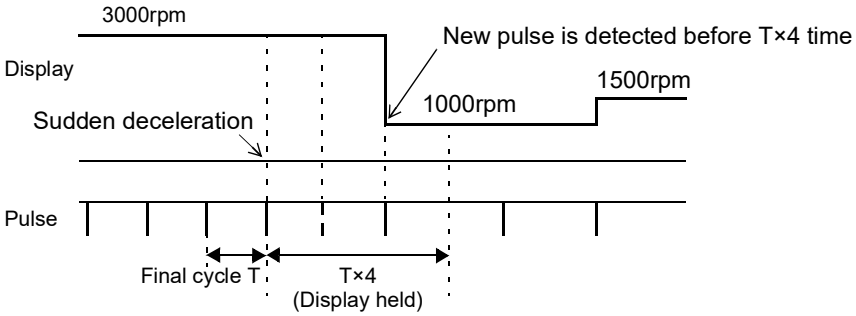
How to set

SET. → Calibration → Page 4

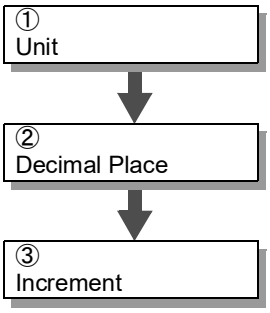
Example) When stopped suddenly with the setting of "4 times"



Example) When decelerated suddenly with the setting of "4 times"



4-11. Power Display Settings



Set the unit of the values displayed.

Sets the number of digits after the decimal place to be displayed.

Set the minimum unit of power such as scale interval and scale division.

■Unit

Set the unit of the values displayed.

≪Setting value≫ mW, W, kW, PS, HP

How to set

SET. → Calibration → Page 5

■Decimal place

Sets the number of digits after the decimal place to be displayed.

≪Setting value≫ None, 0.0, 0.00, 0.000

How to set

SET. → Calibration → Page 5

■Increment

Set the minimum unit of power such as scale interval and scale division.

≪Setting value≫ 1, 2, 5, 10, 20, 50, 100 (The display changes by the decimal place.)

How to set

SET. → Calibration → Page 5

4-12.Unit Conversion Table

Refer to the table for calibration of torque and power and unit setting.
Be sure to perform re-calibration after changing the unit.

■Torque unit conversion table

	mNm	Ncm	Nm	kNm	kgm	kgcm	gcm
mNm	1	0.1	10^{-3}	10^{-6}	1.0197×10^{-4}	1.0197×10^{-2}	10.197
Ncm	10	1	10^{-2}	10^{-5}	1.0197×10^{-3}	0.10197	1.0197×10^{2}
Nm	10^{3}	10^{2}	1	10^{-3}	0.10197	10.197	1.0197×10^{4}
kNm	10^{6}	10^{5}	10^{3}	1	1.0197×10^{2}	1.0197×10^{4}	1.0197×10^{7}
kgm	9.8067×10^{3}	9.8067×10^{2}	9.8067	9.8067×10^{-3}	1	10^{2}	10^{5}
kgcm	98.067	9.8067	9.8067×10^{-2}	9.8067×10^{-5}	10^{-2}	1	10^{3}
gcm	9.8067×10^{-2}	9.8067×10^{-3}	9.8067×10^{-5}	9.8067×10^{-8}	10^{-5}	10^{-3}	1

■Power unit conversion table

	mW	W	kW	PS	HP
mW	1	10^{-3}	10^{-6}	1.3596×10^{-6}	1.341×10^{-6}
W	10^{3}	1	10^{-3}	1.3596×10^{-3}	1.341×10^{-3}
kW	10^{6}	10^{3}	1	1.3596	1.341
PS	7.355×10^{5}	7.355×10^{2}	0.7355	1	0.9863
HP	7.457×10^{5}	7.457×10^{2}	0.7457	1.01387	1

5 SETTING OF FUNCTIONS

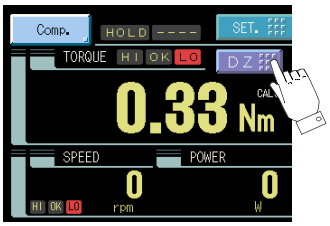
5-1. Digital Zero

The indicated values is forcedly zeroed.

■Digital zero / digital zero reset by means of keys

With respect to torque, digital zero can be executed. Digital zero reset can also be executed.

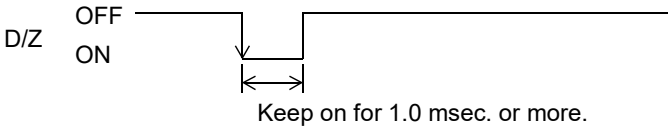
1. Press the [DZ] button in the ordinary display screen (COMP・GRAPH).



2. Press the [YES] button to perform the digital zero.
Press the [NO] button to go back to the previous screen without executing digital zero.
Press the [RESET] button to reset the digital zero.

■Digital zero by means of external I/O signal (D/Z input)

The digital zero may be performed by short circuiting the D/Z to the COM2 on the rear panel signal I/O terminal block, digital zero functions to zero torque.



CAUTION

- When digital zero is performed, if the difference from the zero calibration point exceeds the digital zero limit, the digital zero limit error (DZ Err) will result.
  Also, only the digital zero limit is subtracted.
- When digital zero reset is performed, the condition previous to correction by digital zero is restored.
- Digital zero is reseted in case of power failure.

5-2. Moving Average Filter (D. Filter)

The digital filter is a function for reducing drifts of the indicated value by means of a moving average of data converted from analog to digital. With an increase in the number of filterings, the indicated value becomes more stable, but the response to inputs becomes slower.
Torque and rotation speed can be individually set.

≪Setting value≫ OFF, 2 to 999 [times]

How to set

SET. → System Setting → Operation → Page 1

5-3. Analog Filter (A. LPF)

A low-pass filter is provided for filtering input signals from the sensor and canceling noise components.
With an increase in the cut-off frequency, the response becomes faster, but noise components may be indicated.

≪Setting value≫ 10, 30, 100, 300, 1k, 3k, 10k, 30k [Hz]

How to set

SET. → System Setting → Operation → Page 1

5-4. Display Filter

This is a function to display the values for torque, rotation speed and power in a way that is easy to see by averaging the display values. Only the displayed values are averaged. The data stored inside the TM700 (graphs, hold) are not averaged.

≪Setting value≫ OFF, L(0.5s), M(1.0s), H(2.0s)

How to set

SET. → System Setting → Operation → Page 1

5-5. Backlight

This function changes the brightness of the backlight when touch screen has not been used for certain period of time.

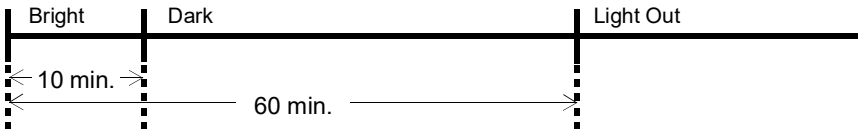
The ON time (lighting time of the backlight) and the low time (bright→dark switching time of the backlight) are set up.

When you use it in the state which a display is always in sight, set the ON time to 0 minutes.

When you want the backlight always bright, set 0 minutes for both the ON time and the low time.

The backlight is turned bright by touching the panel when the backlight is turned off or it is dark.

Example) Set 60 minutes to ON time, 10 minutes to low time.



≪Setting value≫ 00 to 99 [min.] (with both time)

How to set

SET. → System Setting → Operation → Page 2

5-6. Display Language Selection

The display language of the TM700 is selectable between japanese and english.

≪Setting value≫ JPN(日): Japanese, ENG(英): English

How to set

SET. → System Setting → Operation → Page 2

5-7. SI/F Print Out

- None: No print command is sent.
- Hold value: When hold is reset, a print command is sent to make the connected printer print the hold value automatically. (When the hold mode is OFF, turn on T/H or press the [HOLD] button.)

≪Setting value≫ None, Hold value

How to set

SET. → System Setting → Operation → Page 2

5-8. Indicate Color

The indicated value display color can be changed. By setting comp.(comparison result), the indicated value display color changes following the comparison status.

OK	green
HI, LO	red
Comparison OFF	yellow

* Power is linked to the color of torque.

≪Setting value≫ Yellow, Green, Comp.

How to set

SET. → System Setting → Operation → Page 2

5-9. Comparison Functions

Set the HI/LO limit of torque and rotation speed. (Hold synchronized)

≪Setting value≫
- Torque
  HI limit/LO limit: -99999 to 99999
- Rotation speed
  HI limit/LO limit: 0 to 99999

＜HI/OK/LO output conditions＞
- HI Indicated value ＞ HI limit
- LO Indicated value ＜ LO limit
- OK LO limit ≦ Indicated value ≦ HI limit

Point

With ±LOAD, OFL1, or OFL2 on torque, torque HI, LO is forcedly turned on.
With OFL2 on rotation speed, rotation speed HI, LO is forcedly turned on.

Overload of the torque and rotation speed is monitored. (Hold not synchronized)
When they exceed the alarm HI limit or fall below the alarm LO limit, the external output "ALM" turns ON.

≪Setting value≫
- Torque
  Alarm HI limit: -99999 to 99999 (invalid at 99999 (initial value))
  Alarm LO limit: -99999 to 99999 (invalid at -99999 (initial value))
- Rotation speed
  Alarm HI limit: 0 to 99999 (invalid at 99999 (initial value))
  Alarm LO limit: 0 to 99999 (invalid at 0 (initial value))

- For initial value, since both the alarm HI and LO limits are invalid as default settings, set them again for use.
- Since the alarm HI limit and LO limit are independent, simple use of either one of them is also possible.

■HI limit, LO limit, alarm HI limit, alarm LO limit

How to set

SET. → Meas. Setting → Comp. Setting → Page 1/Page 3

■Hysteresis

The hysteresis value may be determined so as to allow a margin for timing the turning off of the HI/LO limit comparison. Normally, it is turned on when the indicated value exceeds the HI limit and is turned off when the indicated value falls below it. However, by setting the hysteresis, it is turned off when the indicated value falls below the HI limit further lowered by the hysteresis value.
This function is effective to prevent chattering in such a case where signals fluctuate (vibrate) subtly.

≪Setting value≫ 0 to 9999

＜HI/LO output conditions＞

- HI

ON conditions　Indicated value ＞ HI limit setting value
OFF conditions　Indicated value ≦ (HI limit setting value－Hysteresis setting value)

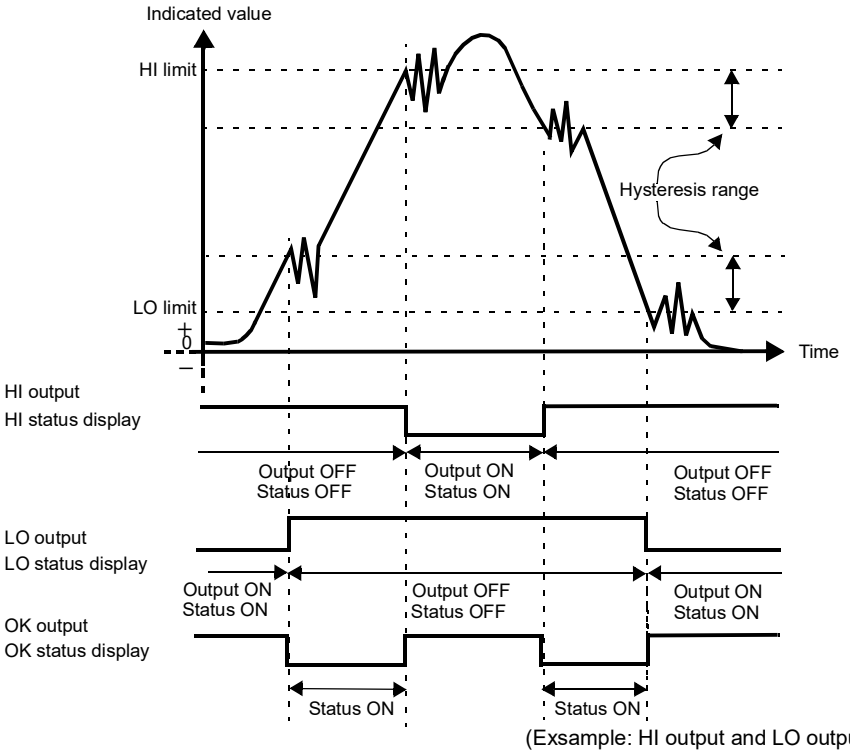
- LO

ON conditions　Indicated value ＜ LO limit setting value
OFF conditions　Indicated value ≧ (LO limit setting value－Hysteresis setting value)

How to set

SET. → Meas. Setting → Comp. Setting → Page 1/Page 3

- Hysteresis operation



(Exsample: HI output and LO output and OK output)

Point

Torque and rotation speed can be set to HI/LO limit comparison, respectively.
However, this does not apply to alarm HI and LO limits.

■Near zero

This function is to detect that the torque is near zero.

Near zero ON: |Torque| ≦ Setting value of near zero
Near zero OFFF: |Torque| ＞ Setting value of near zero

≪Setting value≫ 00000 to 99999

Point

Near zero ON/OFF is closely related to the comparison timing.
For details, see "Comparison timing" on page 33.

How to set

SET. → Meas. Setting → Comp. Setting → Page 2

■Comparison timing

Set the operating condition of HI/LO limit comparison(torque).
Select the conditions from the following.

ALL: HI/LO limit comparison is always performed.
NZ OFF: HI-LO limit comparison is performed when the indicated value is not near zero. Set the near zero parameters by the near zero operation.
HOLD: HI-LO limit comparison is performed when the indicated value is held.

Set the operating conditions of HI/LO limit comparison (Rotation speed).
Select the conditions from the following.

ALL: HI/LO limit comparison is always performed.
Torq. Sync. (Torque synchronized): HI/LO limit comparison is performed at the same timing as that of the torque comparison timing.

How to set

SET. → Meas. Setting → Comp. Setting → Page 2/Page 4

5-10.Hold Functions

By the hold function, a specific point is taken out for HI/LO limit comparison.
The operation of each hold will be described in detail.

■Hold mode

The TM700 includes six hold modes as shown in the table below.
In the sample, peak, valley, peak-to-peak and average modes, section setting is required. Select all section, external trigger section, external trigger + timer section, level trigger + timer section, level trigger section.
When not using any hold function, be sure to set the hold mode to OFF.
(In the OFF state, hold operation is not performed but input values are always displayed.)

Hold mode	Hold section
OFF (Always)	—
Sample (Sample hold)	- ALL (All sections) - EXT (External trigger section) - EXT+TM (External trigger + timer section) - LVL+TM (Level trigger + timer section) - LVL (Level trigger section)
Peak (Peak hold)	
Valley (Valley hold)	
P-P (Peak to peak hold)	
Average (Average hold)	

How to set

SET. → Meas. Setting → Hold Setting → Page 1

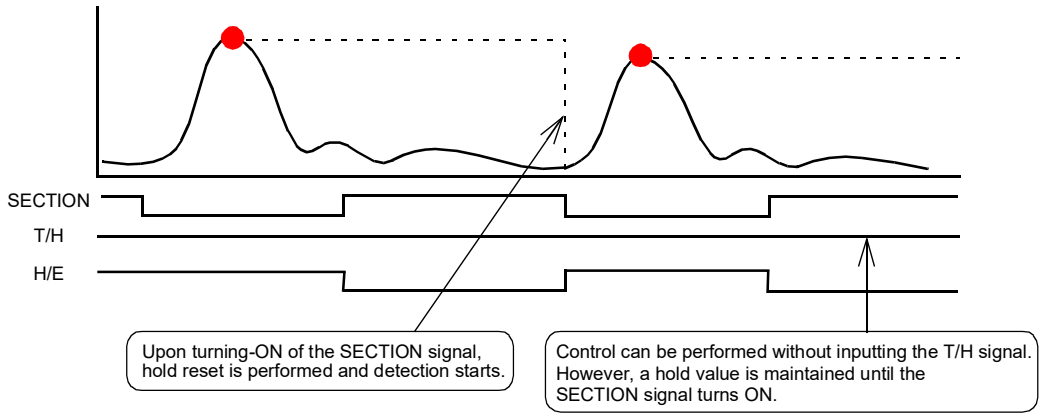
Point

Refer to "■Hold operation" on page 38 for operation of the hold mode, and "■How to specify the hold detection section" on page 40 for section settings.

■Hold auto reset function

It is factory-set that each hold is automatically reset at the start of the detection section, and therefore, simple control can be performed by one signal without releasing the hold.

Example) Hold auto reset in externally specified section peak hold



However, when the auto reset functions, if the signal causes chattering, the point that should be taken originally may deviate. Switching is provided so as to prevent the next detection from being performed until the T/H signal is turned on even if the SECTION signal is turned on again.

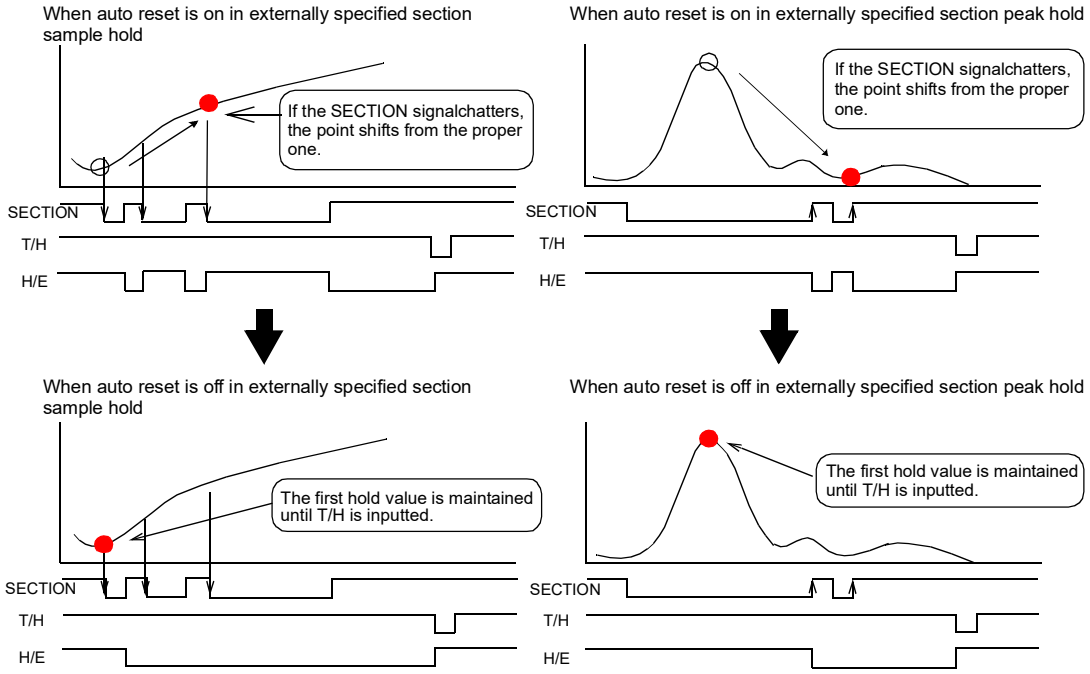
≪Setting value≫ ON, OFF

How to set

SET. → Meas. Setting → Hold Setting → Page 1

OFF: After a hold is decided, the next detection is not started until the T/H signal is turned on even if the SECTION signal is turned on.

ON: After a hold is decided, the next detection is started when the SECTION signal is turned on again even if the T/H signal is not turned on. This is the initial setting (factory default setting).



■Renew of hold value

You can change the operation of renewing the hold value display.

≪Setting value≫ All time, Detect end

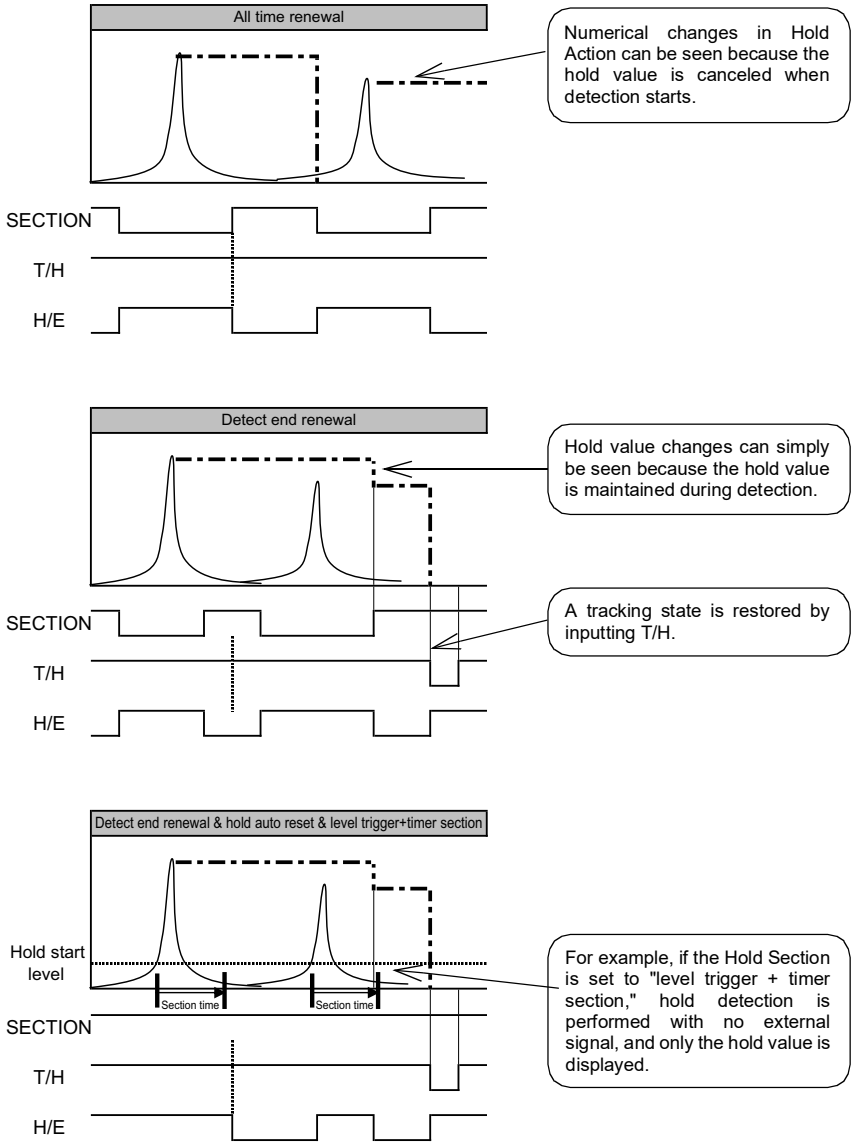
How to set

SET. → Meas. Setting → Hold Setting → Page 1

All time: When detection starts, the previous hold value is canceled and the indicated value is displayed by tracking. When the hold condition is met, the indicated value is held.

Detect end: When detection starts, the previous hold value is maintained, and no tracking state is displayed. If the hold condition is met when the hold section ends, the hold value is renewed. This is, however, effective only when hold auto reset is ON.

- In the case of peak hold



■Hold trigger start level

Set the hold trigger start level in the case where the section setting is "level trigger + timer section" or "level trigger section".

≪Setting value≫ -99999 to 99999

How to set

SET. → Meas. Setting → Hold Setting → Page 2

■Hold trigger stop level

Set the hold trigger stop level in the case where the section setting is "level trigger section".

≪Setting value≫ -99999 to 99999

How to set

SET. → Meas. Setting → Hold Setting → Page 2

■Hold trigger slope

Set the hold trigger slope conditions in the case where the section setting is "level trigger + timer section" or "level trigger section".

≪Setting value≫ Either Edge, Rising Edge, Falling Edge

- Either Edge: Detection starts when the indicated value passes hold trigger start level.
- Rising Edge: Detection starts when the indicated value passes hold trigger start level in the direction from smaller toward larger values.
- Falling Edge: Detection starts when the indicated value passes hold trigger start level in the direction from larger toward smaller values.

How to set

SET. → Meas. Setting → Hold Setting → Page 2

■Hold section time

If you set the hold section setting in the hold function setting to "external trigger + timer section" or "level trigger + timer section", set the time.

≪Setting value≫ 0.001 to 9.999 [sec.]

How to set

SET. → Meas. Setting → Hold Setting → Page 2

Point

Detection time for maximum average value in average value hold

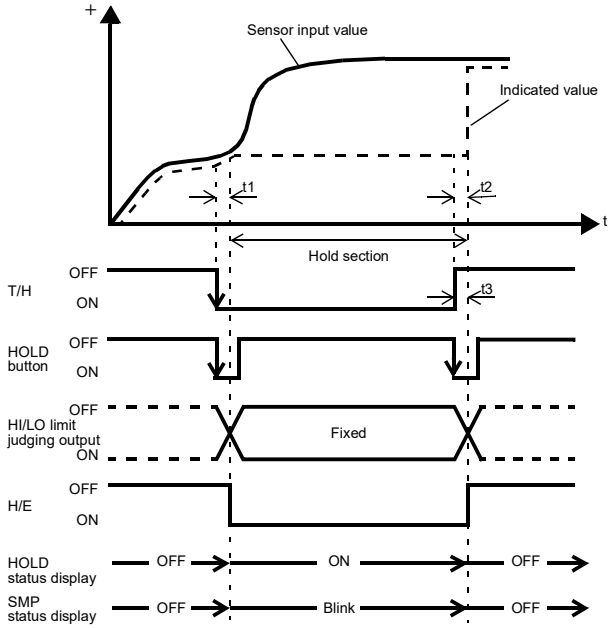
Although the detection section is specified by the SECTION signal, etc., detection cannot be carried out exceeding the maximum average value detection time. If the maximum average value detection time is exceeded, detection ends automatically, when the average value is held.

■Hold operation

Sample hold

The start point of the specified section is held.

Example) All section sample hold



t1: A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

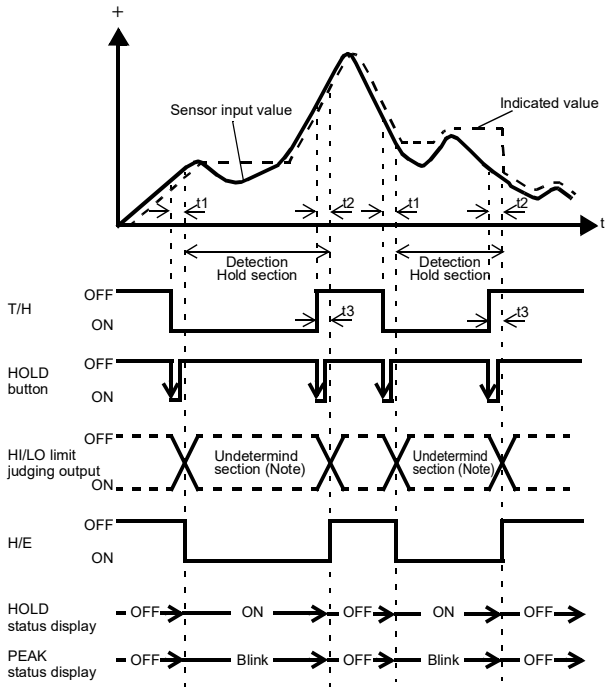
t2: A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Peak hold

The maximum value (peak) in the positive direction of the specified section is held.

Example) All section peak hold



t1: A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

t2: A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Note:
During the undetermined section, the judging output varies with fluctuations in the input waveform.
However, the H/E output remains on during the undetermined section.
Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

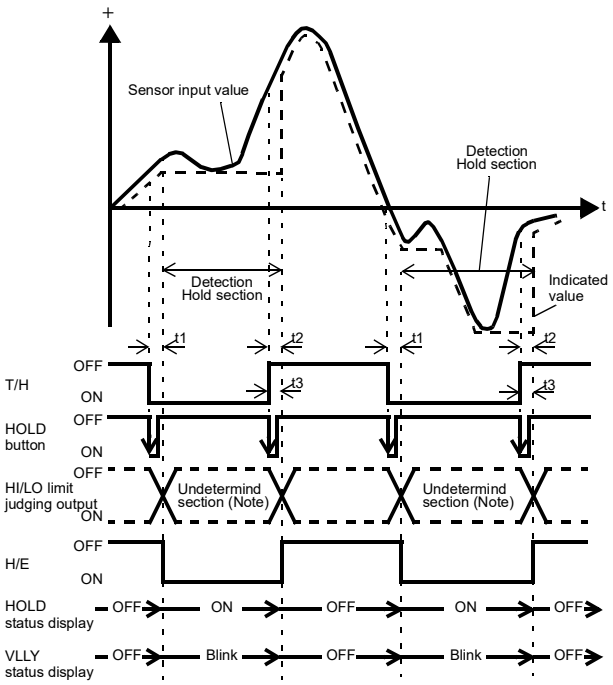
Chapter 5

SETTING OF FUNCTIONS

Valley hold

The maximum value (valley) in the negative direction of the specified section is held.

Example) All section valley hold



t1: A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

t2: A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

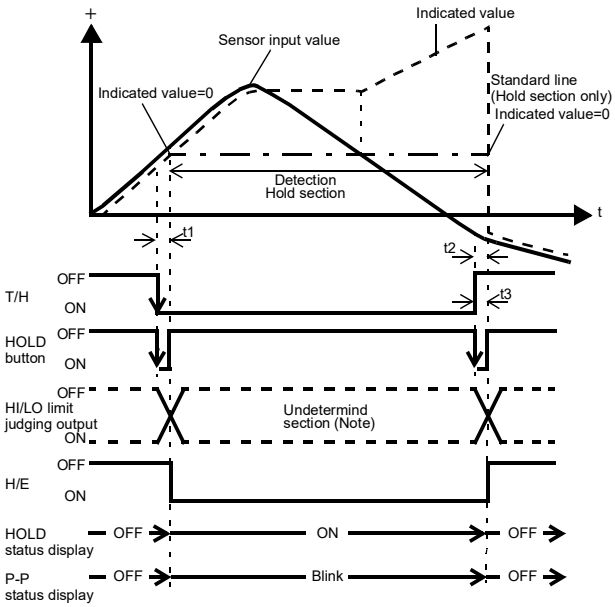
t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Note:
During the undetermined section, the judging output varies with fluctuations in the input waveform.
However, the H/E output remains on during the undetermined section.
Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

Peak-to-Peak (P-P) hold

The difference value between the peak and valley over the specified section is held.

Example) All section Peak-to-Peak (P-P) hold



t1: A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

t2: A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

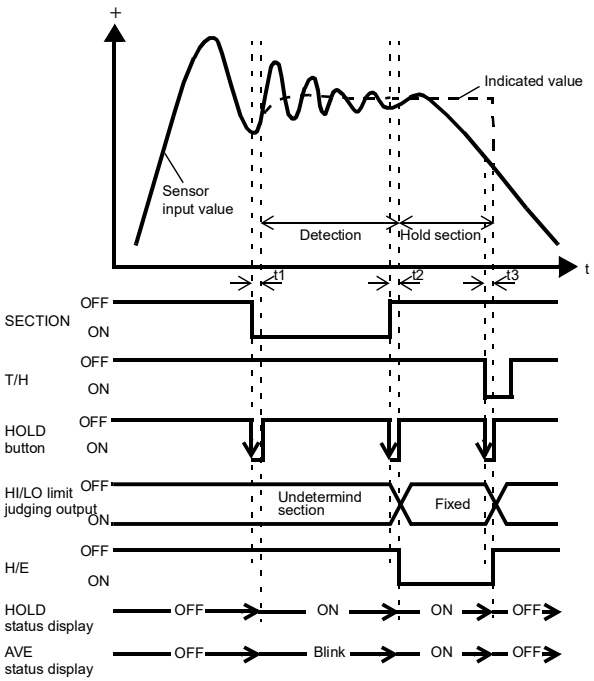
t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Note:
During the undetermined section, the judging output varies with fluctuations in the input waveform.
However, the H/E output remains on during the undetermined section.
Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

Average hold

The average value of the sampling values over the specified section is calculated and updated to perform comparison operation.

Example) Externally specified section average value hold



t1: A delay time between the instant when the SECTION signal is inputted and the instant when detection is performed.
1.0ms (max.)

t2: A delay time between the instant when the SECTION signal is released and the instant when the value to be held is determined
1.0ms (MAX.)

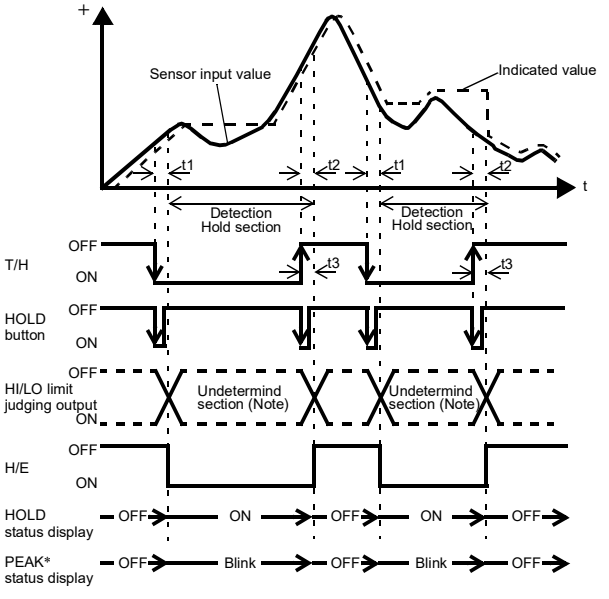
t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

■How to specify the hold detection section

All sections

By this method, the hold detection section is externally specified by the T/H signal. Detection starts with the T/H signal ON to perform each hold operation. According to the ON/OFF state of the T/H signal, detection and tracking are repeated. There is no fixed hold section.

Example) All sections peak hold



*The status display changes depending on the hold mode.

t1: A delay time between the instant when the T/H signal is inputted and the instant when the indicated value is held
1.0ms (max.)

t2: A delay time between the instant when the T/H signal is released and the instant when the indicated value returns to tracking
1.0ms (max.)

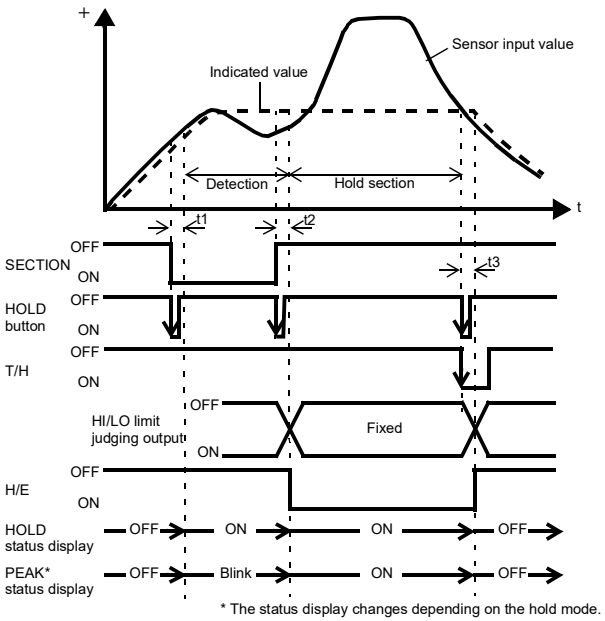
t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Note:
During the undetermined section, the judging output varies with fluctuations in the input waveform.
However, the H/E output remains on during the undetermined section.
Read the judging result when the indicated value becomes stable (immediately before the T/H signal rises).

External trigger section

By this method, the hold detection section is externally specified by the SECTION signal to maintain the hold value until the reset signal is turned on.The hold is released by turning on the T/H signal as a reset signal. The next detection is started when the SECTION signal is turned on again even if the T/H signal is not turned on.
The H/E output signal is on between the instant when the SECTION signal is turned off and the instant when the T/H signal is turned on.

Example) External trigger section specified section peak hold



t1: A delay time between the instant when the SECTION signal is inputted and the instant when the value to be held is detected
1.0ms (max.)

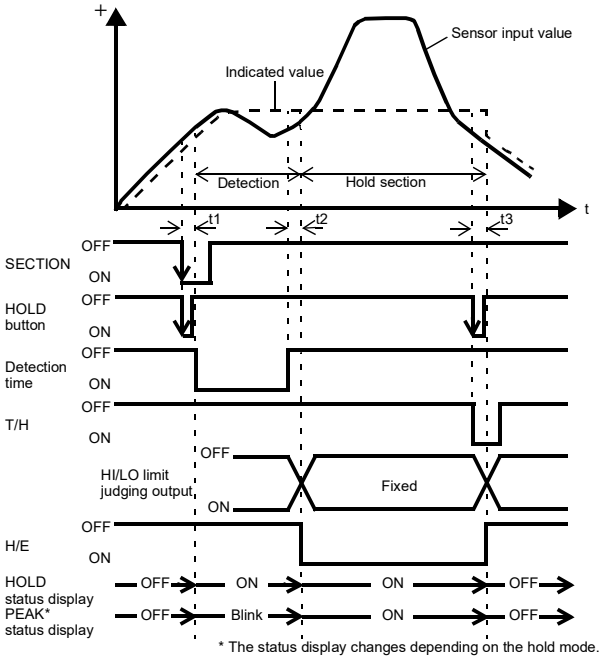
t2: A delay time between the instant when the SECTION signal is released and the instant when the value to be held is determined
1.0ms (max.)

t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

External trigger + timer section

Hold is detected during the predetermined time (hold section time) from the point in time when the SECTION signal is turned on. The hold is released by turning on the T/H signal as a reset signal. The next detection is started when the SECTION signal is turned on again even if the T/H signal is not turned on.
The H/E output signal is on between the instant when the SECTION signal is turned off and the instant when the T/H signal is turned on.

Example) External trigger + timer section specified section peak hold



t1: A delay time between the instant when the SECTION signal is inputted and the instant when the value to be held is detected
1.0ms (max.)

t2: A delay time between the instant when the hold section time is expired and the instant when the value to be held is determined
1.0ms (max.)

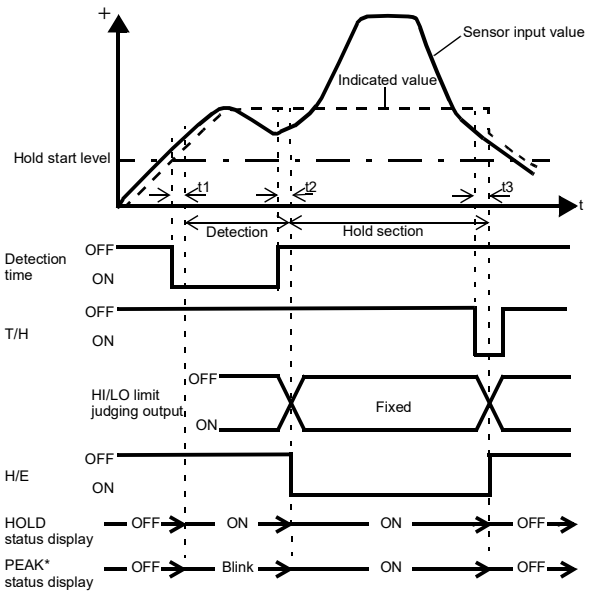
t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Level trigger + timer section

Hold is detected during the predetermined time (hold section time) from the point in time when the indicated value crosses the hold start level. The hold is released by turning on the T/H signal as a reset signal.

The H/E output signal is on between the instant when the hold section time ends and the instant when the T/H signal is turned on.

Example) Level trigger + timer section specified section peak hold



* The status display changes depending on the hold mode.

t1: A delay time between the instant when the indicated value exceeds the hold start level and the instant when the value to be held is detected
0.5ms (max.)

t2: A delay time between the instant when the hold section time is expired and the instant when the value to be held is determined
1.0ms (max.)

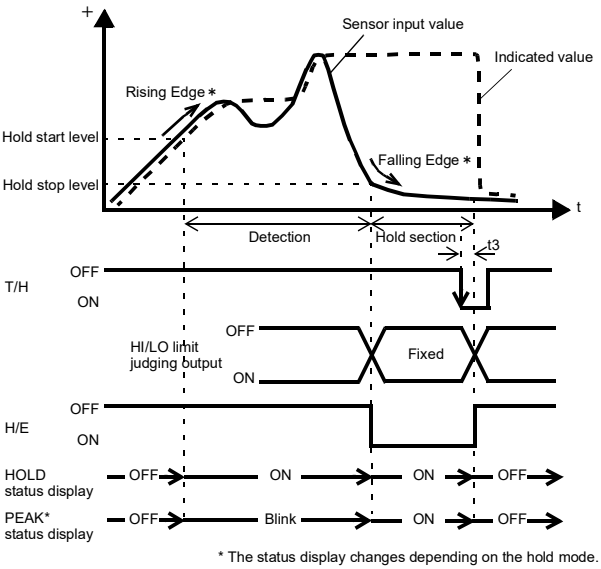
t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

Level trigger section

By this method, the hold detection section is from the point in time when the indicated value crosses the Hold Start Level until it crosses the Hold Stop Level. The hold is released by turning on the T/H signal as a reset signal. The H/E output signal is on between the instant when the hold section time ends and the instant when the T/H signal is turned on.

Detection will end in the opposite direction from the direction of slope at the start of detection.

Example) Level trigger section specified section peak hold



* The status display changes depending on the hold mode.

t3: A minimum reset signal width required for releasing the hold
1.0ms (min.)

* This is an example of detection starting with a rising slope and ending with a falling slope.

5-11. Control Input Select

Select the method for specifying the control (SECTION signal, T/H signal, or START/STOP signal) input.

COM.: Control by external input becomes ineffective, and only control by communication becomes effective.

EXT.: Control by communication becomes ineffective, and only control by external input becomes effective.

How to set

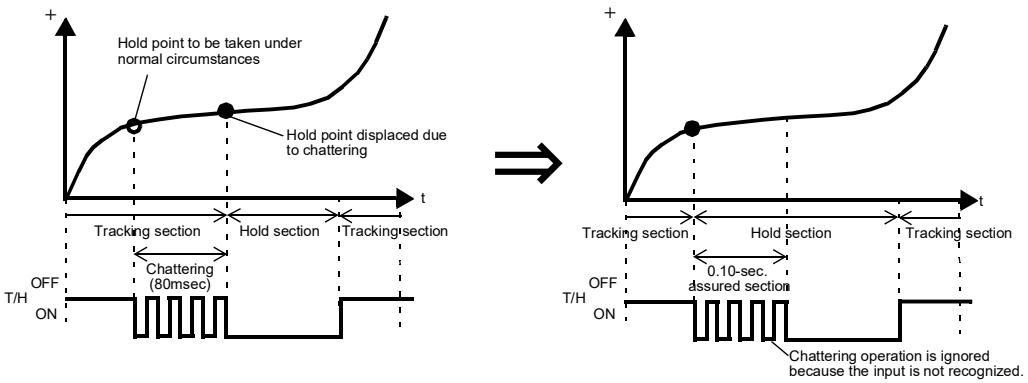
SET. → System Setting → Operation → Page 3

5-12. B6 OFF Detect Wait

In hold controlled by the T/H signal alone, detection/hold section is assured during the set waiting time. This is convenient for ignoring chattering parts.

≪Setting value≫ 0.00 to 1.00 [sec.]

Example) Sample hold



When the waiting time is 0.00 sec.

When the waiting time is 0.10 sec.

How to set

SET. → System Setting → Operation → Page 3

5-13. B8 OFF Detect Wait

This is convenient in hold controlled by the SECTION signal.
Operationally, detection/hold section is assured as in the case of B6 OFF detection wait.
The timer functions so as to also ignore chattering when the OFF edge is detected.

≪Setting value≫ 0.00 to 1.00 [sec.]

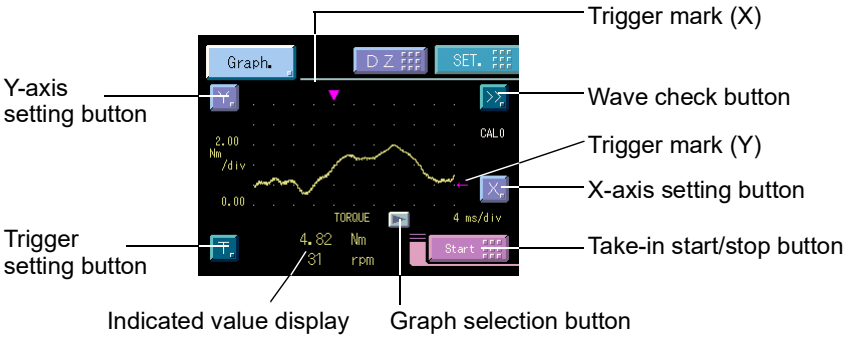
How to set

SET. → System Setting → Operation → Page 3

5-14.Waveform Display

■Graphic screen

Graph is updated while operating on the ordinary display screen (comparison, graph).
One of torque, rotation speed or power status is displayed as a graph. (Selection)
The status before and after triggering can be confirmed by the trigger setting.



Y-axis setting button: Sets the Y-axis scale.

Trigger setting button: Goes to the setting screen for trigger.

Indicated value display: The value specified by torque and graph selection is displayed.
Torque: Torque, Speed
Speed: Torque, Speed
Power: Torque, Power

Graph selection button: Selects the indicated value to be plotted on a graph.
Torque, Speed, Power

Take-in start/stop button: Starts/stops taking in a graph.

X-axis setting button: Sets the X-axis scale.

Wave check button: Goes to the wave check screen.

Trigger mark (X): The position of X-axis specified by the trigger setting or pre-trigger value is indicated.

Trigger mark (Y): The position of Y-axis specified by the trigger setting or trigger level is indicated.

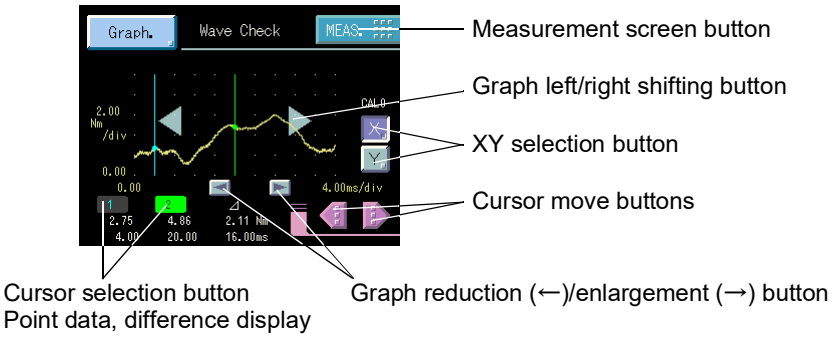
CAUTION
While the wave check, trigger setting screen or setting screen is opened, the graph will not be renewed.

■Wave check screen

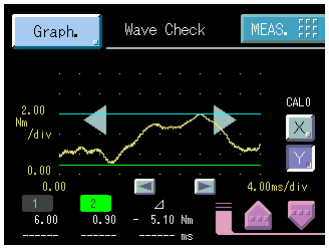
Each point can be confirmed using the cursor.

After selecting the cursor, touch the graph area and make fine adjustments to the cursor when necessary.

X-axis



Y-axis



■X-axis(time) end point

The number of data to take in is 2000 points for each waveform.

The number of data in the graph area is 200 points, with 20 points for each div.

The following relation is obtained from the setting of X-axis scale.

X-axis scale		Plotting time		Enlarge		Reduce		Resolution	
1	ms/div	100	ms	1	ms/div	10	ms/div	50	µs
2		100		1		10		50	
4		100		1		10		50	
5		100		1		10		50	
10		100		1		10		50	
20		200		2		20		0.1	ms
40		400		4		40		0.2	
50		500		5		50		0.25	
100		1	s	10		100		0.5	
200		2		20		200		1	
400		4		40		400		2	
500		5		50		500		2.5	
1	s/div	10		100		1	s/div	5	
2		20		200		2		10	
4		40		400		4		20	
5		50		500		5		25	
10		100		1	s/div	10		50	

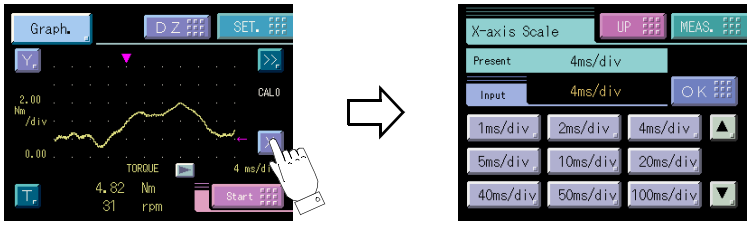
≪Setting value≫ 1, 2, 4, 5, 10, 20, 40, 50, 100, 200, 400, 500 [ms/div],
1, 2, 4, 5, 10 [s/div]

How to set

SET. → Meas. Setting → Graph Setting → Page 2

Simple setting call

When the X button under the X-axis of graph display is pressed, the display is directly transferred to the setting screen for X-axis scale.



■Y-axis start・scale (Torque/Speed/Power)

The number of data in the graph area is 100 points, with 20 points for each div. x 5 div.
Set the starting point and scale for torque, rotation speed and power, respectively.

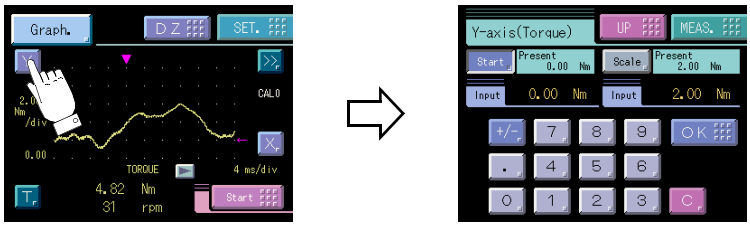
≪Setting value≫ Start: -99999 to 99999
Scale: 1 to 20000

How to set

SET. → Meas. Setting → Graph Setting → Page 2

Simple setting call

When the Y button under the Y-axis of graph display is pressed, the display is directly transferred to the setting screen for Y-axis.



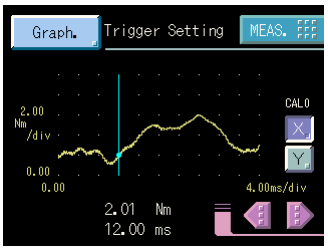
Point

When (starting point + scale x 5 div) > 100000,
the setting range of the starting point is up to "100000 - scale x 5 div".

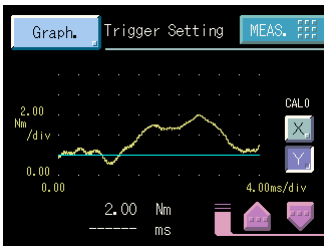
■Trigger setting screen

The triggering point for plotting can be specified with a cursor.
The cursor operation is same as for wave check.

X-axis



Y-axis



Setting using a numerical value as a pre-trigger value is also possible.

≪Setting value≫ 0 to 50 [%]

How to set

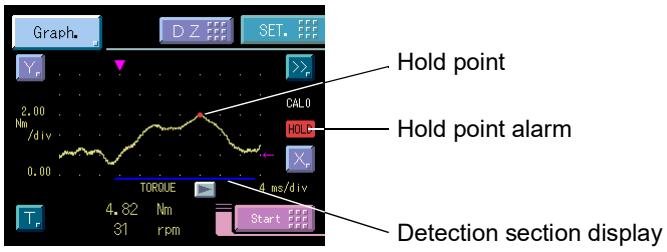
SET. → Meas. Setting → Graph Setting → Page 1

Point

- There will be no hold point within the display area before triggering.
- Plotting may not start promptly due to time needed to prepare data before triggering immediately after power on or when X-axis scale setting or trigger setting is changed.

■Hold point plotting

By using the hold function and the graph plotting function together, the held point (red) can be plotted.



Hold point: The hold point is displayed by a red point.
The latest hold point out of 2000 points is displayed.

Detection section display: A cobalt line indicating the detection section is displayed at the bottom of the X-axis.

Hold point alarm: Flashes when only the hold value is renewed without the graph plotting being renewed, and when the value differs from the hold point on the graph.

■Graph mode

Set the graph plotting mode.

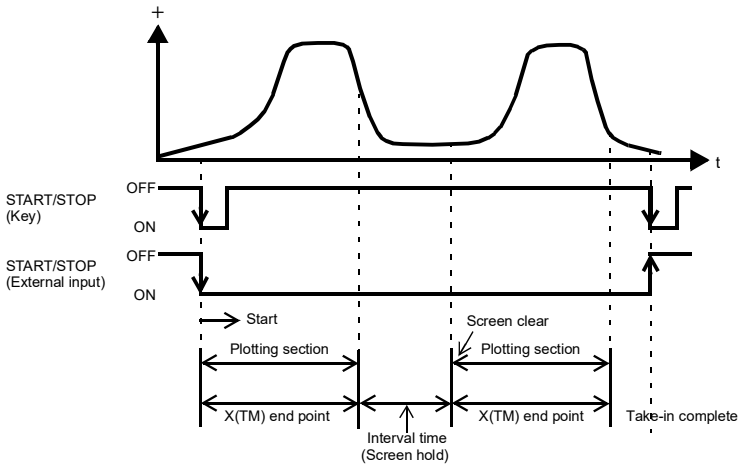
≪Setting value≫ Continued, Continued Trigger, Single, Single Trigger

How to set

SET. → Meas. Setting → Graph Setting → Page 1

Continued: Plots a graph continuously without using the trigger.

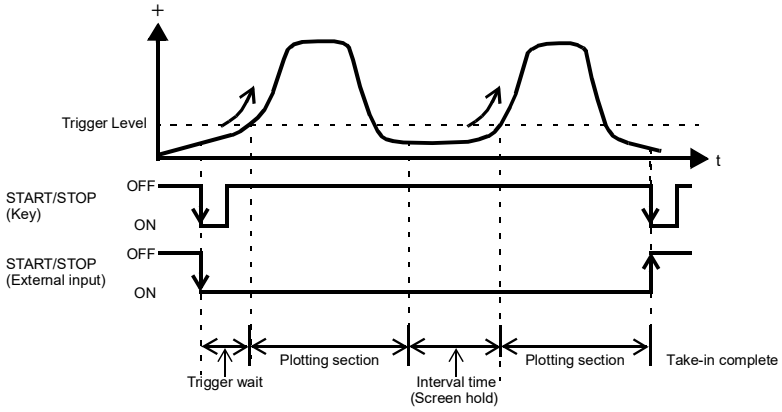
Starts take-in by start/stop key input or with START/STOP external input turned ON. When plotting is complete, the screen will be cleared after an interval time and the next plotting will start. Stops take-in by start/stop key input or with START/STOP external input turned OFF.



Continued Trigger: Plots a graph continuously using the trigger.

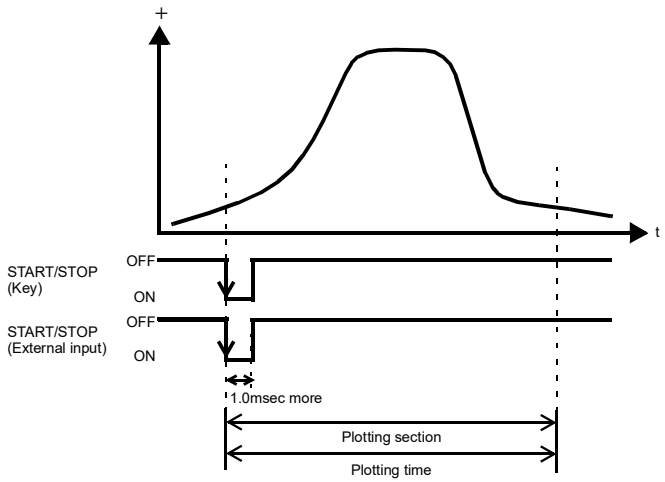
Starts take-in by start/stop key input or with START/STOP external input turned ON. Compares the trigger level and torque, and starts plotting a graph when the conditions for trigger slope are satisfied. When plotting is complete, it will be on trigger standby again after an interval time. Stops take-in by start/stop key input or with START/STOP external input turned OFF.

Example) Graph trigger slope → Rising edge



Single: Plots a graph only once without using the trigger.

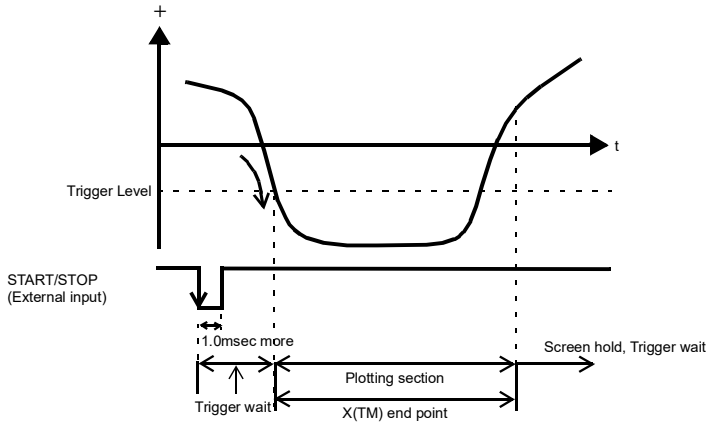
Starts take-in by start/stop key input or with START/STOP external input turned ON.
Take-in will also be completed after plotting a graph for once.



Single Trigger: Plots a graph only once using the trigger.

Starts take-in by start/stop key input or with START/STOP external input turned ON. Compares the trigger level and torque, and starts plotting a graph when the conditions for trigger slope are satisfied.
Take-in will also be completed after plotting a graph for once.

Example) Graph trigger slope → Falling edge



■Interval time

If you select "Continued" or "Continued trigger" in the graph function setting, set the graph plotting operation interrupting time from clearing the screen until moving to the next graph plotting operation. During this time, the graph screen is held.

≪Setting value≫ 0.1 to 99.9 [sec.]

How to set

SET. → Meas. Setting → Graph Setting → Page 1

■Graph trigger start level

If you select "Continued trigger" or "Single trigger" in the graph function setting, set the graph trigger start level.

≪Setting value≫ -99999 to 99999

How to set

SET. → Meas. Setting → Graph Setting → Page 1

■Graph trigger slope

If you select "Continued trigger" or "Single trigger" in the graph function setting, set the graph trigger slope conditions.

≪Setting value≫ Either, Rising, Falling, Beyond, Below

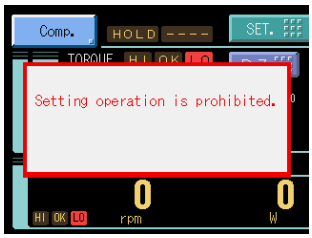
How to set

SET. → Meas. Setting → Graph Setting → Page 1

- Either: Starts plotting a graph when the torque crosses the trigger level.
- Rising: Starts plotting a graph when the torque crosses the trigger level from a lower value to an upper value.
- Falling: Starts plotting a graph when the torque crosses the trigger level from an upper value to a lower value.
- Beyond: Starts plotting a graph when the torque is greater than the trigger level.
- Below: Starts plotting a graph when the torque is less than the trigger level.

5-15.Key LOCK

Disables all key operation on the measurement screen (comparison, graph) while the external input B5 terminal is short-circuited.



5-16. External Output Pattern

The type of external output signal can be selected from three patterns.

≪Setting value≫ Pattern 1, Pattern 2, Pattern 3

How to set

SET. → System Setting → Operation → Page 2

Pattern 1

A1	*	COM1	B1	*	COM2
A2	out	HI (Torque)	B2	in	
A3	out	LO (Torque)	B3	in	
A4	out	ALM HI/LO (Torque)	B4	in	
A5	out	HI (Speed)	B5	in	LOCK
A6	out	LO (Speed)	B6	in	T/H
A7	*	COM1	B7	*	COM2
A8	out	ALM HI/LO (Speed)	B8	in	SECTION
A9	out	RUN	B9	in	D/Z
A10	out	H/E	B10	in	START/STOP
A11	out	SI/F	B11	in	
A12	out	SI/F	B12	in	CAL

Pattern 2

A1	*	COM1	B1	*	COM2
A2	out	HI (Torque)	B2	in	
A3	out	OK (Torque)	B3	in	
A4	out	LO (Torque)	B4	in	
A5	out	HI (Speed)	B5	in	LOCK
A6	out	OK (Speed)	B6	in	T/H
A7	*	COM1	B7	*	COM2
A8	out	LO (Speed)	B8	in	SECTION
A9	out	ALM HI/LO (Torque/Speed)	B9	in	D/Z
A10	out	H/E	B10	in	START/STOP
A11	out	SI/F	B11	in	
A12	out	SI/F	B12	in	CAL

Pattern 3

A1	*	COM1	B1	*	COM2
A2	out	HI (Torque)	B2	in	
A3	out	LO (Torque)	B3	in	
A4	out	ALM HI (Torque)	B4	in	
A5	out	ALM LO (Torque)	B5	in	LOCK
A6	out	HI (Speed)	B6	in	T/H
A7	*	COM1	B7	*	COM2
A8	out	LO (Speed)	B8	in	SECTION
A9	out	ALM HI (Speed)	B9	in	D/Z
A10	out	ALM LO (Speed)	B10	in	START/STOP
A11	out	SI/F	B11	in	
A12	out	SI/F	B12	in	CAL

5-17.RUN Output Select

External output "RUN" stops when abnormal state of indicated value is detected.
The conditions of stopping the output caused by abnormal state are as follows.

- ±LOAD (Sensor error)
- OFL (Overflow error)
- ALM HI/LO (Alarm HI/LO limits)
- cErr (Calibration error)
- DZ Err (Digital zero limit error)

See to "Error Display List" on page 71 about the contents of errors.

≪Setting value≫ Toggle, ON Level, OFF Level

How to set

SET. → System Setting → Operation → Page 3

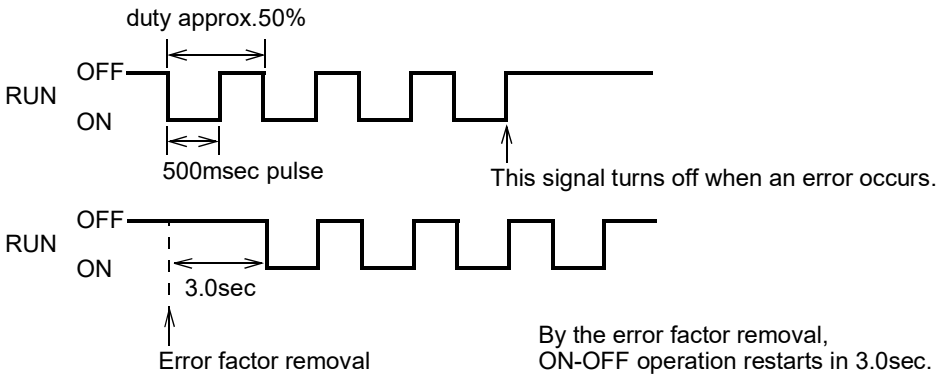
CAUTION

Be aware that judgment is difficult if a hardware error occurs (if the level is fixed for some reason) when the output is fixed.

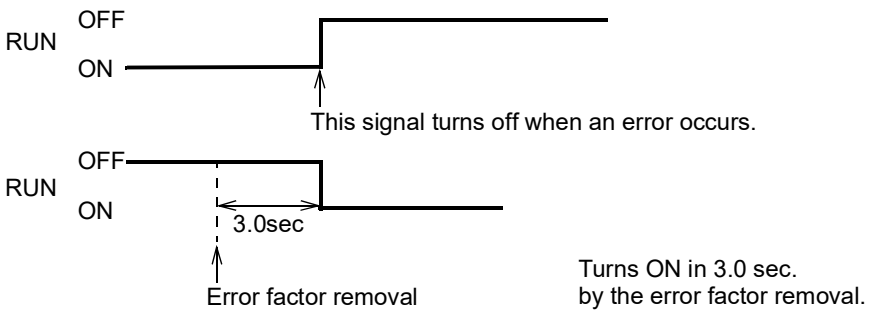
RUN out specifications are as follows.

RUN output spec.

- Toggled ON-OFF



- Fixed ON level



- Fixed OFF level The ON-OFF relationship is the inverse of the fixed ON level case.

5-18.USB interface

The USB is an interface to read the indicated value of the TM700 and to write parameters into the TM700. This interface is convenient to process controls, totals, records, etc., by connecting the TM700 to PC. Furthermore, reading and writing setting values, reading graph data and capturing screens are possible using a dedicated PC application.

■Communication specifications

Communication standard:	Compliant with USB Ver.2.0, Full speed (12Mbps)	
Class:	Communication device class	
Baud rate:	9600, 19200, 38400, 57600, 115.2k, 230.4k bps selectable	
Bit configuration:	Start bit:	1bit
	Character length:	7 or 8 bit selectable
	Stop bit:	1 or 2 bit selectable
	Parity:	none, odd or even selectable
	Delimiter:	CR, CR+LF selectable
Code:	ASCII	
Connector:	mini-B TYPE	

■PC hardware requirement (TM700 PC application software)

OS:	Windows7 Home Premium/Professional/Ultimate 32/64bit
Display:	1024×768 pixels (XGA) or more
USB port:	One empty port
USB driver:	Virtual COM Port(VCP) Drivers by FTDI Ltd.

■Installation of a USB driver

Please install a USB driver for connecting with USB of the TM700.
Please see the homepage of FTDI for details and perform download and installation of the driver according to a procedure.

* If the PC is already connected to the network, the driver may be automatically installed via the network when the v is connected to the PC.

Guide: http://www.ftdichip.com/Support/Documents/InstallGuides.htm
Driver: http://www.ftdichip.com/Drivers/VCP.htm

■Connection of USB

Connects a USB cable.
The USB connector of the TM700 is mini-B TYPE.

■The check of a virtual COM port

Please check the virtual COM port number which the TM700 is connected from the device manager of PC.

■USB interface setting

Set the USB communication conditions of the TM700.

Communication mode

≪Setting value≫

Normal:

This mode performs communication by a command from the host computer.
In this mode, you can read out the indicated value, status, set values and write in set values.
* Please be sure to use this setting in the case of use of the TM700 PC application software.

Cont. 1:

This mode continuously transmits the indicated values and the status.
Indicated value and status are synchronized with hold.

Print:

When the indicated value is printed (a print command is output to the SI/F),
the indicated value and status are sent from the TM700 to host.

Cont. 2:

This mode continuously transmits the indicated values and the status.
Only indicated value is not synchronized with hold.

How to set

SET. → System Setting → USB Setting → Page 1

Baudrate

≪Setting value≫ 9600, 19200, 38400, 57600, 115.2k, 230.4k [bps]

How to set

SET. → System Setting → USB Setting → Page 1

Data bit

≪Setting value≫ 7bit, 8bit

How to set

SET. → System Setting → USB Setting → Page 1

Stop bit

≪Setting value≫ 1bit, 2bit

How to set

SET. → System Setting → USB Setting → Page 1

Parity bit

≪Setting value≫ NONE, EVEN, ODD

How to set

SET. → System Setting → USB Setting → Page 1

Delimiter

≪Setting value≫ CR, CR＋LF

How to set

SET. → System Setting → USB Setting → Page 1

Point

Please be sure to use the following setting in the case of use of the TM700 PC application software.

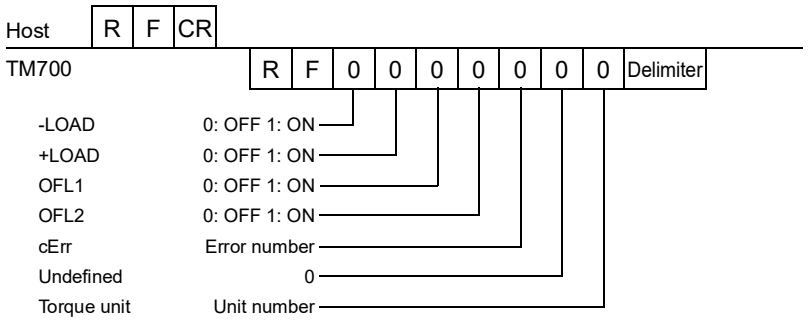
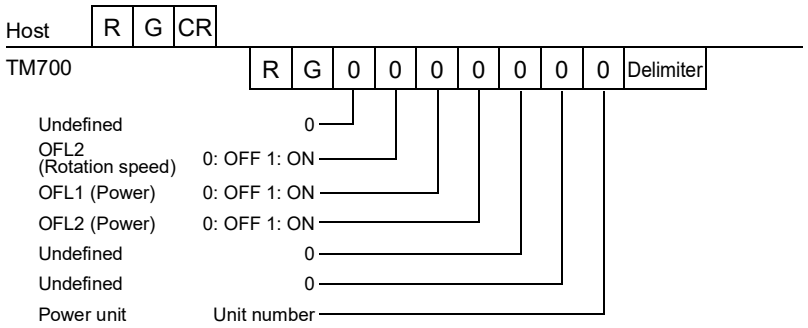
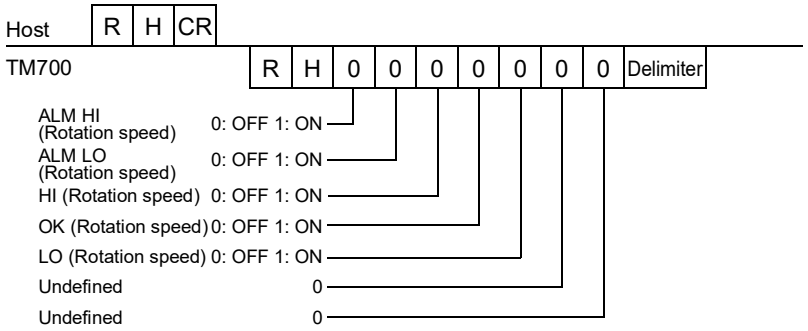
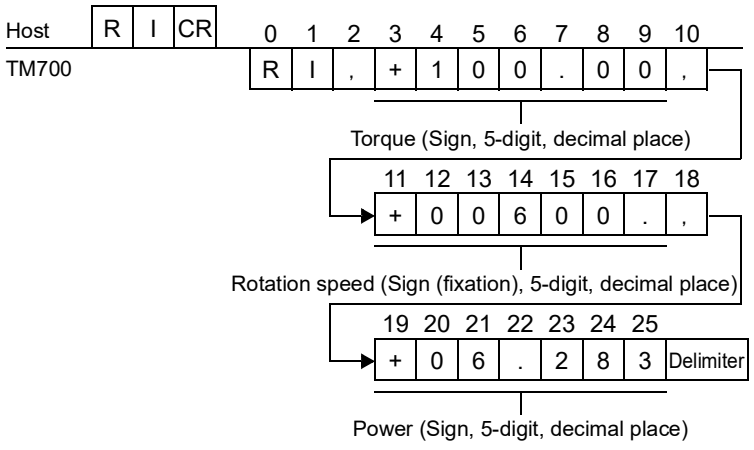
Communication mode: Send/receive
Baud rate: 230.4k bps
Delimiter: CR

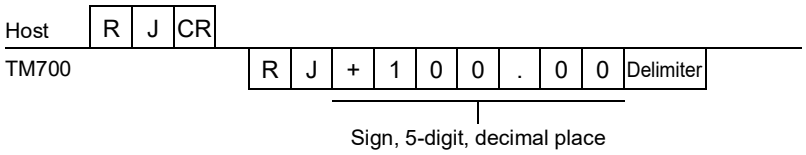
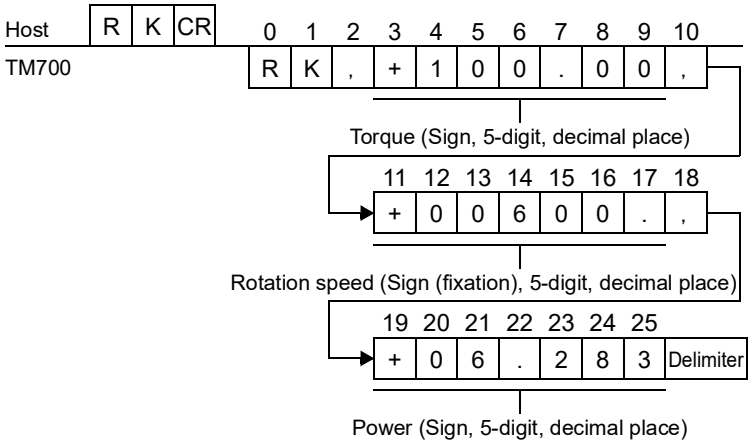
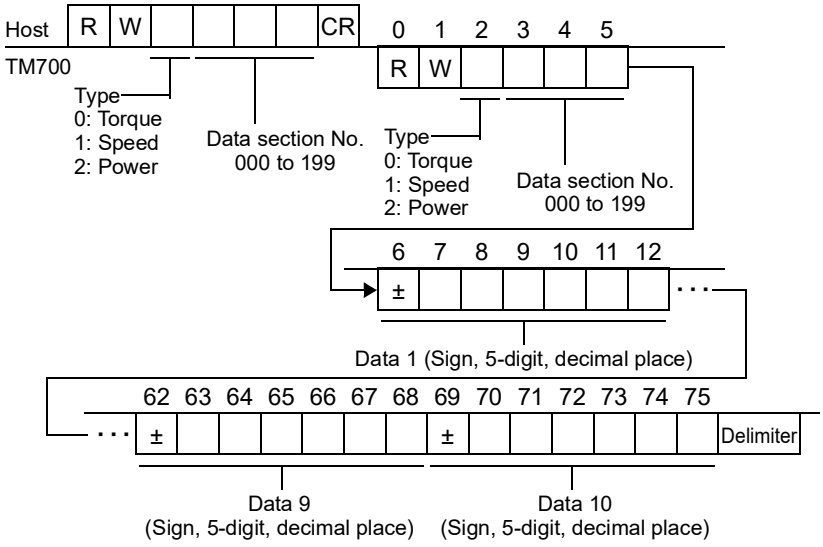
Character length, parity bit, and stop bit do not have specification.
The communication conditions can be united with PC application software.

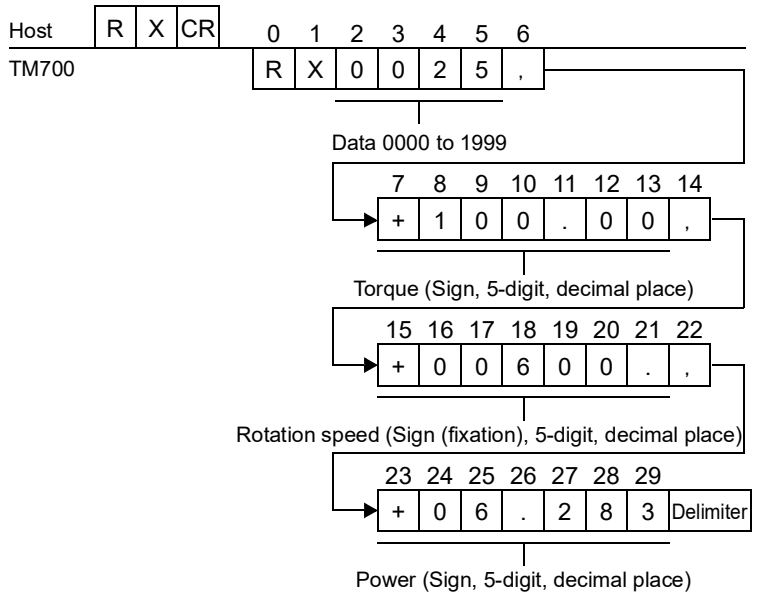
■Communication format

1. Normal [reading the indicated value/status]

Reading the indicated value/status			
Function	Header		Protocol
	Main	Sub	
Torque (Hold synchronized)	R	A	Host: R A CR TM700: R A + 1 0 0 . 0 0 Delimiter Sign, 5-digit, decimal place
Rotation speed	R	B	Host: R B CR TM700: R B + 0 0 6 0 0 . Delimiter Sign (fixation), 5-digit, decimal place
Power	R	C	Host: R C CR TM700: R C + 0 6 . 2 8 3 Delimiter Sign, 5-digit, decimal place
Status 1 (Torque)	R	D	Host: R D CR TM700: R D 0 0 0 0 0 0 0 0 Delimiter Hold 0: OFF 1: ON Undefined 0 Near zero 0: OFF 1: ON HI (Torque) 0: OFF 1: ON OK (Torque) 0: OFF 1: ON LO (Torque) 0: OFF 1: ON Undefined 0
Status 2 (Torque)	R	E	Host: R E CR TM700: R E 0 0 0 0 0 0 0 0 Delimiter ALM HI (Torque) 0: OFF 1: ON ALM LO (Torque) 0: OFF 1: ON Undefined 0 Undefined 0 Undefined 0 Undefined 0 Undefined 0

Reading the indicated value/status			
Function	Header		Protocol
	Main	Sub	
Status 3 (Torque)	R	F	
Status 4 (Rotation speed/ Power)	R	G	
Status 5 (Rotation speed)	R	H	
Read all (Hold synchronized)	R	I	

<table>
<tr><td colspan="4">Reading the indicated value/status</td></tr>
<tr><td rowspan="2">Function</td><td colspan="2">Header</td><td rowspan="2">Protocol</td></tr>
<tr><td>Main</td><td>Sub</td></tr>
<tr><td>Torque
(Hold not synchronized)</td><td>R</td><td>J</td><td> 
</td></tr>
<tr><td>Read all
(Hold not synchronized)</td><td>R</td><td>K</td><td> 
</td></tr>
<tr><td>Reading waveform data</td><td>R</td><td>W</td><td> 
</td></tr>
</table>

Reading the indicated value/status			
Function	Header		Protocol
	Main	Sub	
Wave form hold point data read-out	R	X	

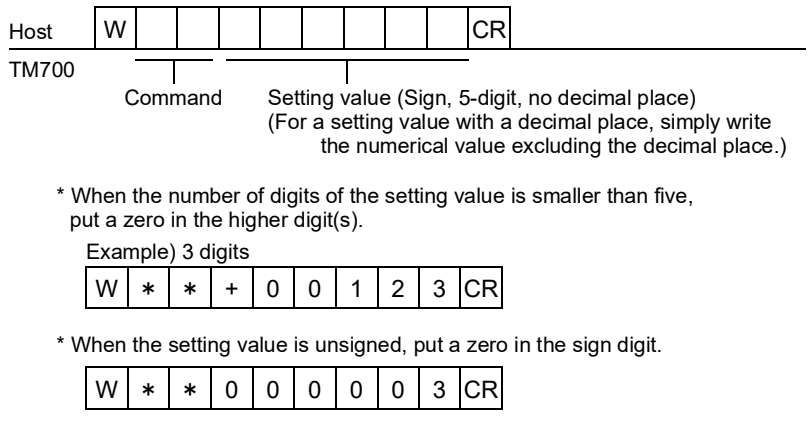
Point

Data section No. for waveform data reading

One graph plotting screen includes 2000 pieces of data. In reading waveform data, data can be read by being divided into 200 sections (by 10 pieces).

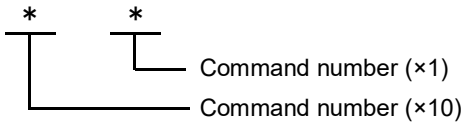
Section 000	Data 0000 to Data 0009
Section 001	Data 0010 to Data 0019
≀	≀
Section 099	Data 1990 to Data 1999

2. Normal [setting value writing/reading]

Setting value writing			
Function	Header		Protocol
	Main	Sub	
Various settings	W	–	

Setting value reading			
Function	Header		Protocol
	Main	Sub	
Various settings	W	–	Host: W □ □ CR TM700: Command W □ □ □ □ □ □ □ □ Delimiter Command Setting value (Sign, 5-digit, no decimal place) (A setting value with a decimal place results in the numerical value excluding the decimal place.)

* Command definition



* For command numbers, see "8-4.Setting Item List" on page 75.

Point

- "Initialize" and "password" cannot be either read or written.
- When the protect of the setting value you are going to write is ON, it cannot be written. Turn OFF the protect.
- If an output value is written in command 63 (zero calibration), simulated zero calibration is executed with the written value. Also, if an output value is written in command 64 (equivalent input calibration), equivalent input calibration is executed.

3. Normal [operation command]

Operation directive			
Function	Header		Protocol
	Main	Sub	
Zero calibration	C	Z	Host: C Z CR TM700
Equivalent input calibration	C	S	Host: C S CR TM700 * Set the rated capacity value with command 65 before sending a command for actual load calibration.
Digital zero	C	G	Host: C G CR TM700
Digital zero reset	C	H	Host: C H CR TM700

Operation directive			
Function	Header		Protocol
	Main	Sub	
Print command	C	I	Host C I CR TM700
SECTION ON	C	C	Host C C CR TM700
SECTION OFF	C	D	Host C D CR TM700
T/H ON	C	E	Host C E CR TM700
T/H OFF	C	F	Host C F CR TM700
Graph START	C	M	Host C M CR TM700
Graph STOP	C	N	Host C N CR TM700

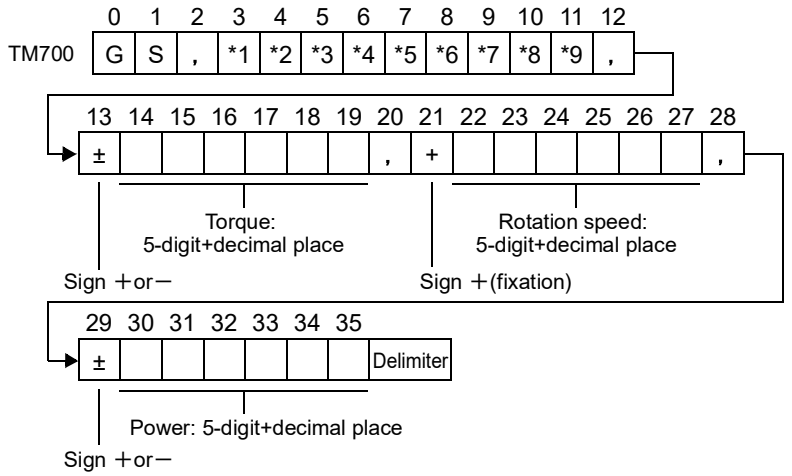
Point

If the calibration protect is ON, zero calibration and span calibration cannot be performed.

4. Normal [returning an error]

Returning an error			
Function	Header		Protocol
	Main	Sub	
Error occurrence (Normal)	E	R	Host Command TM700 E R * Delimiter 1: The command or message length is improper. 2: The protect of the setting value you are going to write is ON, or a calibration command is received while the calibration protect is ON. 3: The format errors of the setting value which tried to write in. 4: Other communication errors (parity error, frame error, etc.)

■Continuousness 1 / continuousness 2 / print send mode

<table>
<tr><th colspan="4">Continuousness 1 / continuousness 2 / print send</th></tr>
<tr><th rowspan="2">Function</th><th colspan="2">Header</th><th rowspan="2">Protocol</th></tr>
<tr><th>Main</th><th>Sub</th></tr>
<tr><td>Indicated value
&
Status</td><td>G</td><td>S</td><td>


* When communication mode is "Continuous 2 (hold not synchronized)", only indicated value is not synchronized with hold.
<table>
<tr><td>*1 O: Over load (LOAD, OFL)
M: Not stable
H: In holding
Priority: H ＞ O ＞ M</td><td>*6 H: ALM HI ON
L: ALM LO ON
G: ALM HI and ALM LO OFF
N: ALM HI and ALM LO ON
Torque
Priority: N ＞ (H or L) ＞ G</td></tr>
<tr><td>*2 0: Undefined</td><td>*7 N: Near zero OFF
Z: Near zero ON</td></tr>
<tr><td>*3 Torque unit
Set unit number</td><td rowspan="2">*8 H: HI limit ON
L: LO limit ON
G: HI limit and LO limit OFF
N: HI limit and LO limit ON
F: Comparison OFF
Rotation speed
Priority: F ＞ N ＞ (H or L) ＞G</td></tr>
<tr><td>*4 Power unit
Set unit number</td></tr>
<tr><td>*5 H: HI limit ON
L: LO limit ON
G: HI limit and LO limit OFF
N: HI limit and LO limit ON
F: Comparison OFF
Torque
Priority: F ＞ N ＞ (H or L) ＞ G</td><td>*9 H: ALM HI ON
L: ALM LO ON
G: ALM HIとALM LO OFF
N: ALM HIとALM LO ON
Rotation speed
Priority: N ＞ (H or L) ＞G</td></tr>
</table>
</td></tr>
</table>

Point

About the timing for continuous transmission

According to the communication baud rate setting, the continuous transmission intervals in the case where the communication modes “Continuous” is selected are as follows:

Communication baud rate	Continuous transmission interval
230.4k bps	200 times/sec.
115.2k bps	200 times/sec.
57600 bps	100 times/sec.
38400 bps	50 times/sec.
19200 bps	25 times/sec.
9600 bps	12 times/sec.

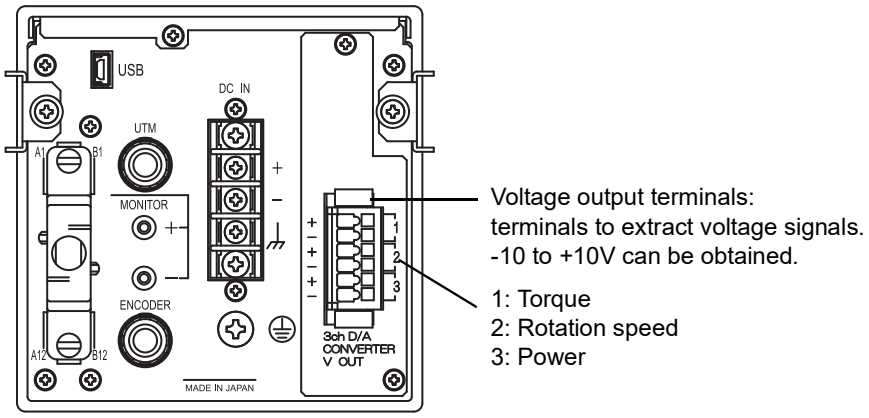
6 OPTION

6-1. D/A Converter (Option)

This converter is used for obtaining analog outputs linked with torque, rotation speed and power. The analog output ranges are -10 to +10V output.

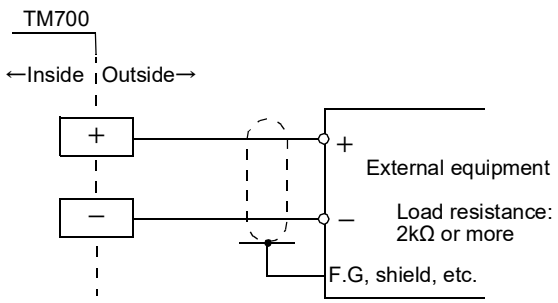
By using the D/A zero setting and D/A full scale setting functions, analog output can be obtained between zero (0V) and full scale (+10V) with respect to the predetermined digital value.

The output circuit and the main unit circuit are isolated. The resolution is 1/10000 with respect to the ranges of -10 to +10V, and the conversion rate is 10000 times/sec.. The maximum voltage output range are about ±11V.



- Taking voltage output signals

Connect external equipment (2kΩ or more load resistance) to + and - of the TM700.



- Resolution

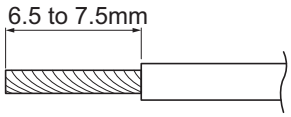
The D/A converter has a resolution of 1/10000 with respect to the ranges of -10 to +10V.

CAUTION

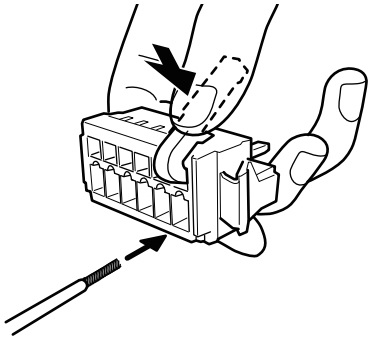
- The D/A converter is optional.
- Do not apply external voltage because it will break.
- Do not short-circuit the voltage output because a failure will occur.
  Also, connecting a capacitive load may cause oscillation.

■Connection

A two-piece terminal block is used. Perform wiring with the plug pulled out from the option.
Use of the operating tool included is recommended to facilitate wiring.



1. Strip the casing 6.5 to 7.5mm on the cable to be connected.
   Twist the bare wire to fit the terminal hole.
2. Press the operating tool attached to the operation slot at the upper part with a finger and push down the spring.
3. While pressing the operating tool, insert the electric wire into the insertion opening until it hits the wall.
4. The wire will be connected once the operating tool is released. For confirmation, tug the electric wire gently.



The wire can be connected likewise without the operating tool by using a tool such as a flathead screwdriver to press down the spring from the top.

⚠ CAUTION

- Cable can be from 28 to 14AWG (0.08 to 1.5mm^2).
- It is not necessary to solder the cable wires or to fix a solderless terminal.
- If several cables to be inserted to the same hole, twist those cable wires together and insert.
- Connect the cable with the power supply of the main body turned off without fail.
- For the protection from the damage, do not operate the lever without removing the plug.

■Zero scale value, full scale value

≪Setting value≫ -99999 to 99999 (where zero set value < full scale set value)

Zero scale value: Set the indicated value for the time of output of 0V.
full scale value: Set the indicated value for the time of output of 10V.
* Set torque, rotation speed and power, respectively.

How to set

SET. → System Setting → Option Setting (D/A Output) → Page 1

■Output data select

≪Setting value≫ Hold Sync., Hold Not Sync., Zero Scale, Full Scale

Hold Sync.:	Output is produced in synchronization with the indicated value.
Hold Not Sync.:	Outputs value without hold even when the indicated value is on hold.
Zero Scale:	Output is fixed at zero output (0V).
Full Scale:	Output is fixed at full scale (10V).

* Set torque, rotation speed and power, respectively.

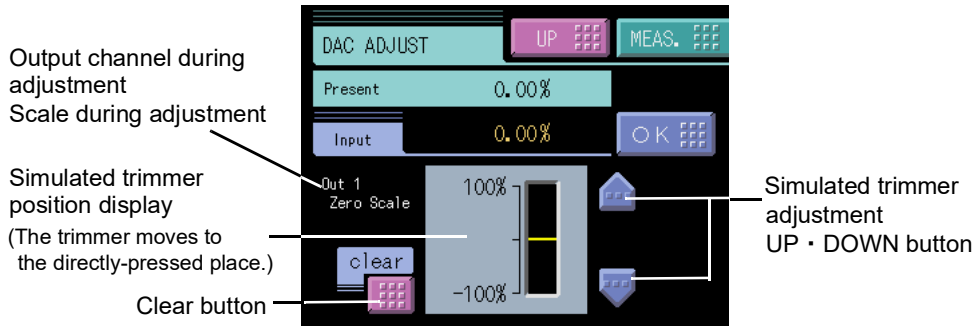
How to set

SET. → System Setting → Option Setting (D/A Output) → Page 1

How to output adjust

Select each fixed output in D/A output select, and press the OK button, and then use the simulated trimmer appearing on the adjustment screen to adjust the output.

While monitoring the output value, make fine adjustment of the output with the UP/DOWN button of the simulated trimmer, and determine by pressing the OK button, so that the trimmer position is entered.



* Pressing the simulated trimmer buttons continuously performs continuous operation.

* The trimmer adjusting ranges are as follows: voltage output; about ±2.0V.

* The [Clear] button resets the Simulated trimmer position to the trimmer center point (0%).

7 SPECIFICATIONS

7-1. Specifications

■Analog section

Sensor input for torque (voltage input)

Input resistance	1MΩ	
Signal input range	±5V	
Non-linearity	0.02%/F.S.±1digit	
Zero drift	Within 0.2mV/℃ RTI	
Gain drift	Within 0.01%/℃	
Analog filter	First-order low-pass filter (-6dB/oct) Selectable from 10, 30, 100, 300, 1k, 3k, 10k, 30k Hz.	
Sampling speed	20000 times/sec.	
A/D resolution	24bit binary Approx. 1/30000 with respect to 5V	
Voltage output	Output level:	Approx. 1V per 1V of input voltage
	Load resistance:	2kΩ or more
	Use terminal:	PF-8-1-A (manufactured by MAC8 or an equivalent) ϕ 2, Depth: 6mm
	Compatible terminal:	OP-7-1 (manufactured by MAC8 or an equivalent)

Pulse input for rotation speed (open collector input) *UTM connector

Maximum input rotation speed	In accordance with the output frequency of the UTMⅡ series
Minimum input rotation speed	15 rpm * Pulse rate: 4 pulses 60 rpm * Pulse rate: 1 pulse
Minimum detection pulse width	50μs
Circuit configuration	No-voltage contact input (minus common) Open collector connectable (Ic = Approx.10mA)

Drive power supply for UTMⅡ *UTM connector

Power supply voltag	DC24V * One UTMⅡ at the maximum

Pulse input for rotation speed (open collector input) *Encoder connector

Maximum input rotation speed	Approx. 1000 rpm
Minimum input rotation speed	0.1 rpm * Pulse rate: 2000 pulses
Minimum detection pulse width	5μs
Circuit configuration	No-voltage contact input (minus common) Open collector connectable (Ic = Approx.10mA)

Drive power supply for encoder *Encoder connector

Power supply voltag	DC5V * One encoder at the maximum

■Display section

Display	3.5 inch TFT color LCD module (display area: 71mm×53mm) 320×240 dots Indicated value: ±99999 (5-digit)
Display frequency	5 times/sec.

■Setting section

Setting method	Setting by touch panel operation.
Setting value	NOVRAM (non-volatile RAM) or lithium-battery-backed-up C-MOS RAM

■External input/output section

External input	Dry contact input circuit (minus common type) for hold control, etc. (internal circuit power supply voltage 12V)
External output	Open collector output circuit (sink type) for comparison output, etc. Rated voltage: 30V, driving current: 30mA or less

■Standard interfaces

SI/F (2-wire serial interface)

2-wire serial interface for connecting a UNIPULSE-manufactured printer, external display, etc.

Transmitting method	Asynchronous
Baud rate	600bps
Output data	Torque (GROSS area), Rotation speed (NET area), Power (TARE area)

USB interface

Communication standard	Compliant with USB Ver.2.0, Full speed (12Mbps) Communication device class
Baud rate	9600, 19200, 38400, 57600, 115.2k, 230.4k bps selectable
Connector	mini-B TYPE

■Options interfaces

D/A converter voltage output (3ch) [D3V]

The followings are common for each channel.

Output range	-10V to 10V, RL > 2kΩ Zero output and full scale output can be digitally adjusted.
Zero adjusting range	±10%FS
Gain adjusting range	±10%FS
Zero drift	Within 0.6mV/℃
Gain drift	Within 50ppm/℃
Non-linearity	0.05%FS
Conversion rate	10000 times/sec.

■General performance

Power source	DC spec.	DC24V (±15%)	
Power consumption	DC spec.	18W max	
Rush current (Typ)	55A, 1msec (ordinary temperature, at cold-start time)		
Operating conditions	Temperature:	Operation	-10℃ to +40℃
		Storage	-20℃ to +60℃
	Humidity:	85%RH or less (non-condensing)	
Warmup time	20 minutes		
Dimensions	96.0 (W) × 96.0 (H) × 138.0 (D) mm (excluding projected parts)		
Panel cutout size	92×92 $^{+1}_{-0}$ mm (board thickness: 1.6 to 3.2mm)		
Weight	Approx. 1.0kg		

■Attachment

Operation manual 1

External input/output connector 1

Cable for UTMⅡ connection (2m)..... 1

Operating tool (with D/A converter (3ch) option)..... 1

* The D / A converter connector (with D/A converter (3ch) oputon) is shipped on the option board already mounted.

■Options

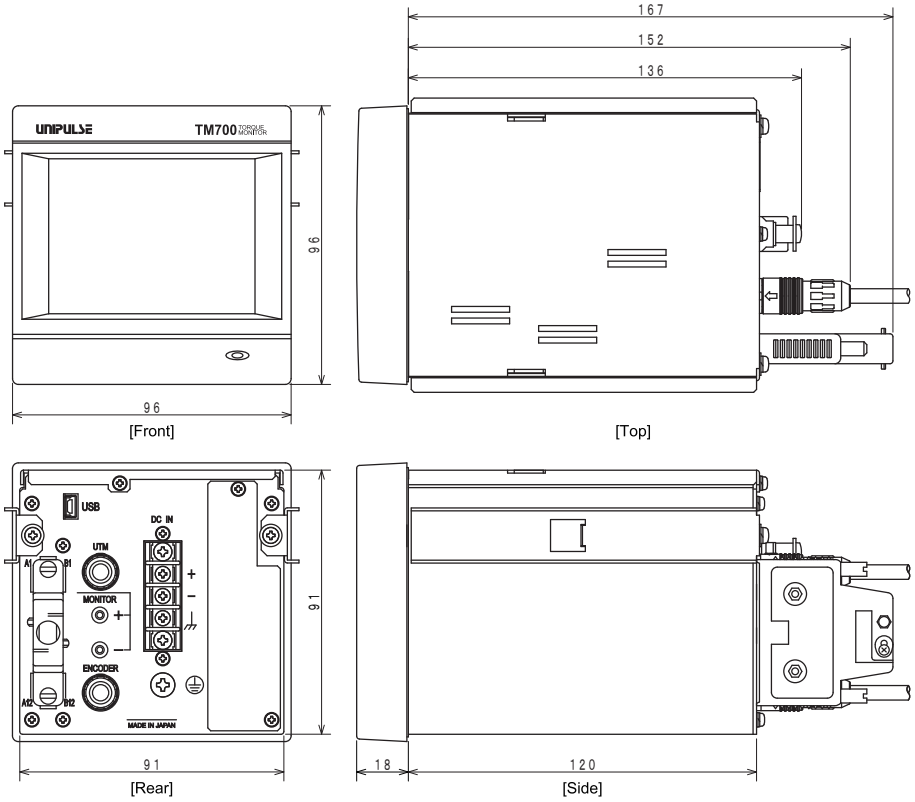
CN50: External input/output connector

CN73: D/A converter connector

7-2. Dimensions

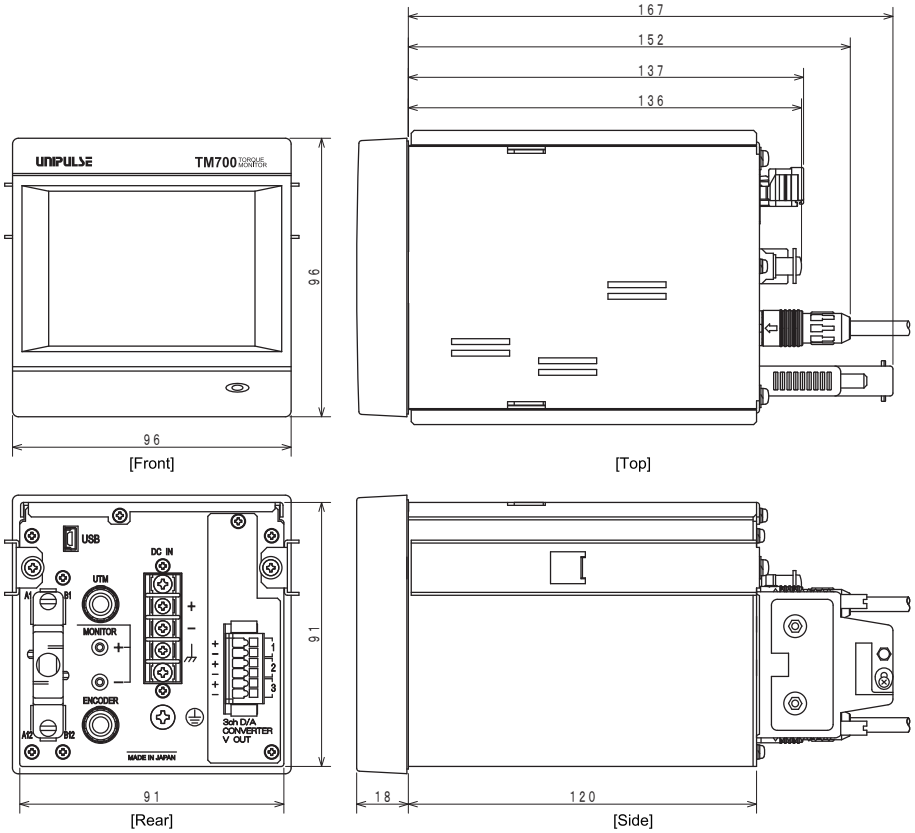
■Standard equipment

[Unit: mm]

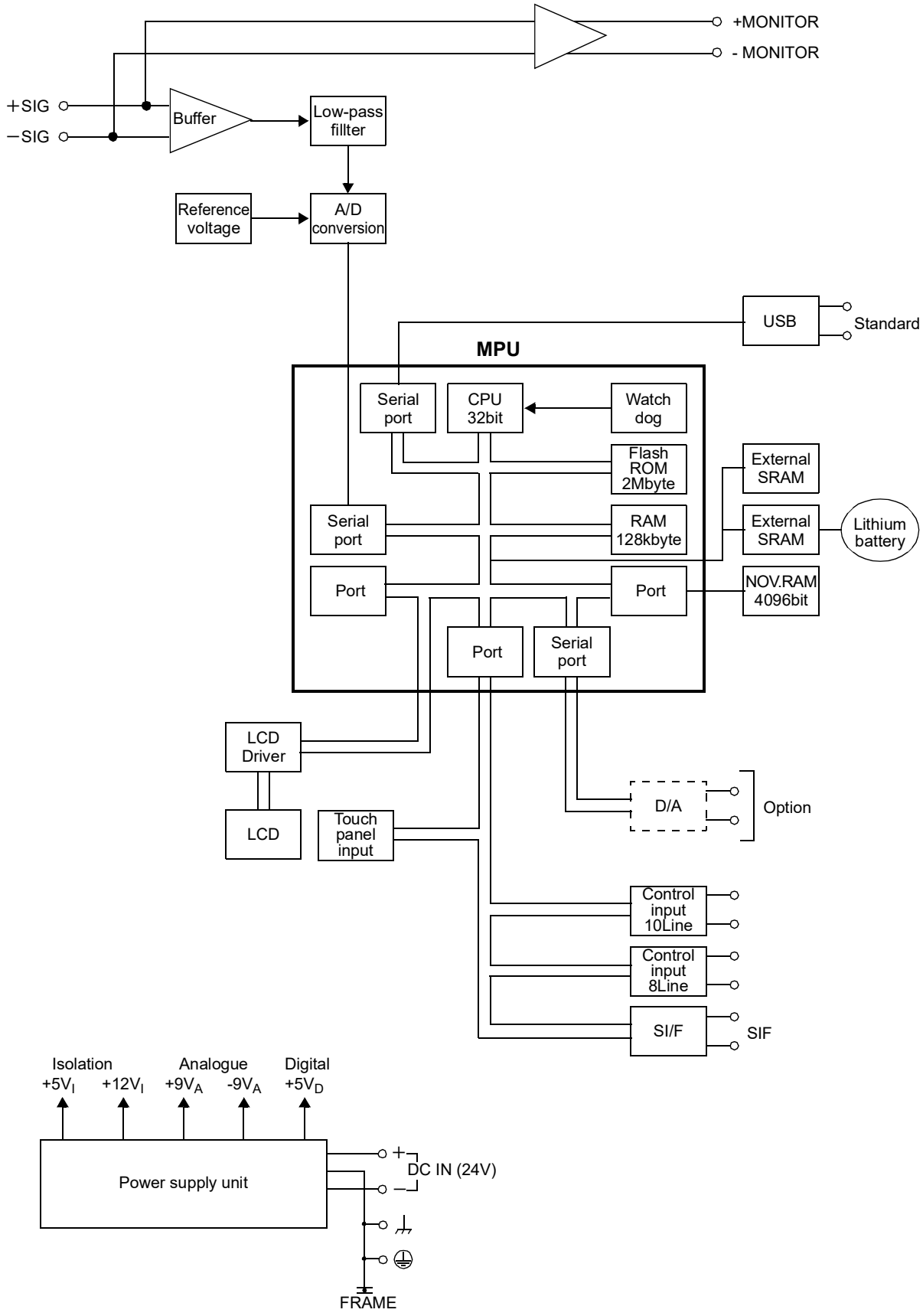


■Equipped with D/A converter (3ch) option

[Unit: mm]



7-3. TM700 block diagram



8 SUPPLEMENTS

8-1. Error Display List

When either of the following errors occur, the RUN signal of an external output is turned off.

■Torque display section

-LOAD	Below the signal input range -5V	The input electric signal greatly exceeds the signal input range. This also occurs when an excessive load is applied to the sensor or the input terminal is opened due to a break in the cabling, etc..
+LOAD	Beyond the signal input range +5V	
ALM HI	Beyond the alarm HI limit	This occurs when a larger load than expected is applied to the sensor or calibration is performed below the measurement range. Check the calibration and measuring object.
ALM LO	Below the alarm LO limit	
OFL1	Below -99999	This occurs when a larger load than expected is applied to the sensor or calibration is performed below the measurement range. Check the calibration and measuring object.
OFL2	Beyond 99999	
cErr2	Beyond the zero calibration range in the positive direction.	The signal input range is greatly exceeded when zero calibration is performed. Check for an excessive load applied to the sensor and for breaks.
cErr3	Below the zero calibration range in the negative direction.	
cErr4	Beyond the rated output value in the positive direction/ negative direction. Beyond the rated capacity value.	The signal input range is greatly exceeded when calibration is performed. In the case of equivalent input calibration, check the rated output value, and in the case of actual load calibration, check for an excessive load applied to the sensor and for breaks. Also, Check the setting of rated capacity value (display value) sets it exceeding "±99999".
cErr5	Rated capacity value = 0	Check the setting of rated capacity value (display value) for being "0" when calibration is performed.
cErr6	Rated output value 0.000V at the time of equivalent input calibration. Rated output value in the range of -0.010 to +0.010V at the time of actual load calibration.	Check the rated output value for being 0.000V when equivalent input calibration is performed, and the load for being too light in weight when actual load calibration is performed.
DZ Err	Digital zero limit error	When the range of zero point correction (deviation from the zero calibration registered point) by digital zero or zero tracking exceeds the setting value of digital zero limit, digital zero limit error occurs. Perform digital zero, etc., in a proper range.
LO BAT	Lithium battery backup voltage drop	The voltage of the lithium battery for internal memory backup has dropped. The battery needs to be replaced. Ask us for replacement of the battery.

■Speed/power display section

OFL1	Below -99999	The power exceeds the display range. Check the power unit and decimal place settings.
OFL2	Beyond +99999	The rotation speed or power exceeds the display range. On the rotation speed side, check the connection with the UTM Ⅱ, and on the power side, check the power unit and decimal place settings.
ALM HI	Beyond the alarm HI limit	Rotation speed is at a faster or slower speed than expected. Confirm that rated rotation speed and rotation are not locked and so forth.
ALM LO	Below the alarm LO limit	

8-2. Protect/Initialization

■Measurement setting parameter protection

Set whether to protect the set values in measurement setting from changing.

≪Setting value≫ ON, OFF

How to set

SET. → Protect / Init. → Page 1

■System setting parameter protection

Set whether to protect the set values in system setting from changing.

≪Setting value≫ ON, OFF

How to set

SET. → Protect / Init. → Page 1

■Calibration setting parameter protection

→See "Calibration Protect" on page 17.

How to set

SET. → Protect / Init. → Page 1

■Initialization

All the set values of each setting item are initialized to their factory defaults.
Select the setting item you want to initialize.

≪Setting value≫ MEAS. Set., System Set., Calibration Set.

* If the setting item on which you intend to execute initialization is protected, initialization cannot be executed.

How to set

SET. → Protect / Init. → Page 1

8-3. Self-Check

■Self-check

The self-check function includes a memory check to check the memory automatically for detecting problems, a visual check to check the display visually, a touch panel key input check and an external I/O check.

(1) LCD check

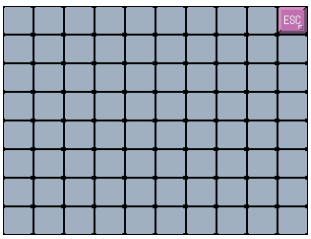
Check the display to see that it is free from color and display defects, etc. The screen changes from red, green, blue, horizontal stripes, to vertical stripes. Touching the screen restores the previous screen.

How to set

SET. → Self Check → LCD Check

(2) KEY check

Check the touch panel to see that it is free from unrecognized parts. One touched square turns yellow. Pressing the [ESC] button at the upper right of the screen restores the previous screen.

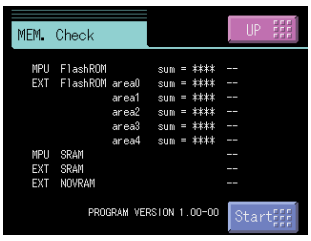


How to set

SET. → Self Check → KEY Check

(3) MEM check

Check the memory to see that it is free from defects. The result is displayed in a moment after the [Start] button at the lower right of the screen is pressed. Or, check the version here.

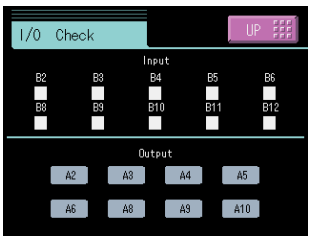


How to set

SET. → Self Check → MEM Check

(4) I/O check

Check the operations of the external input/output signals.
Each output turns on when the corresponding button is pressed.
Each input turns green when its ON state is recognized.



How to set

SET. → Self Check → I/O Check

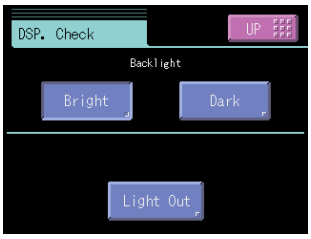
(5) DSP check

Check the backlight and status indicator lamp.

The backlight turns bright by pressing the [Bright] button, and turns dark by pressing the [Dark] button.

The backlight goes out when the [Light Out] button is pressed, and after that, it recovers when the screen is touched.

The status indicator lamp lights in green and red alternately.

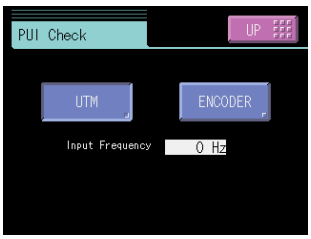


How to set

SET. → Self Check → DSP Check

(6) PUI check

The pulse input can be confirmed. Press the button of the connector being currently input. The pulse cycle is displayed.



How to set

SET. → Self Check → PUI Check

(7) COM check

The data displayed under "Transmit data" is sent by pressing the [Trns.] button.

Under "Receive data", externally transmitted data is displayed.

How to set

SET. → Self Check → COM Check

Please transmit something information sentence from connected equipment side to the check on the reception. The data received to "Receive data" is displayed. Please confirm the cable or the setting of communication condition when it is not correctly displayed, when "Parity" or "Frame" lights in red.

Please press the [Trns.] button to the check on the transmission. The data displayed in "Transmit data" is transmitted. It will be confirmed to receive it correctly on connected equipment side. Please confirm the cable or the setting of communication condition when it is not possible to confirm it.

■Password

This setting is for maintenance and inspection. Do not operate.

8-4. Setting Item List

Protect ○: Measurement setting protect, ◎: System setting protect, ●: Calibration protect
Memory S: SRAM, N: NOVRAM

■Measurement setting: Comparison setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	HI limit (torque)	750	-99999 to 99999	S	○	01
	2	LO limit (torque)	250	-99999 to 99999	S	○	02
	3	Alarm HI limit (torque)	99999	-99999 to 99999	S	○	03
	4	Alarm LO limit (torque)	-99999	-99999 to 99999	S	○	04
	5	Hysteresis (torque)	0	0 to 9999	S	○	05
2	1	Comparison timing (torque)	0: ALL	0: ALL, 1: NZ OFF, 2: HOLD	S	○	06
	2	Near zero (torque)	100	0 to 99999	S	○	07
	3						
	4						
	5						
3	1	HI limit (speed)	3000	0 to 99999	S	○	08
	2	LO limit (speed)	100	0 to 99999	S	○	09
	3	Alarm HI limit (speed)	99999	0 to 99999	S	○	11
	4	Alarm LO limit (speed)	0	0 to 99999	S	○	12
	5	Hysteresis (speed)	0	0 to 9999	S	○	13
4	1	Comparison timing (speed)	0: ALL	0: ALL, 1: Torq. Sync.	S	○	14
	2						
	3						
	4						
	5						

■Measurement setting: Hold setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Hold mode	0: OFF	0: OFF, 1: Sample, 2: Peak, 3: Valley, 4: P-P, 5: Average	S	○	16
	2	Hold section	0: ALL	0: ALL, 1: EXT, 2: EXT+TM, 3: LVL+TM, 4: LVL	S	○	17
	3	Hold auto reset	1: ON	0: OFF, 1: ON	S	○	18
	4	Renew of hold value	1: All Time	0: Detect End, 1: All Time	S	○	19
	5						
2	1	Hold trigger start level	100	-99999 to 99999	S	○	21
	2	Hold trigger stop level	50	-99999 to 99999	S	○	22
	3	Hold trigger slope	1: Rising	0: Either, 1: Rising, 2: Falling	S	○	23
	4	Hold section time	0.005 sec.	0.001 to 9.999 [sec.]	S	○	24
	5						

■Measurement setting: Graph setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Graph mode	1: Cont.Trg.	0: Continued, 1: Cont.Trg., 2: Single, 3: Single Trigger	S	○	26
	2	Graph trigger slope	1: Rising	0: Either, 1: Rising, 2: Falling, 3: Beyond, 4: Below	S	○	27
	3	Graph trigger start level	100	-99999 to 99999	S	○	28
	4	Pre trigger value	0 %	0 to 50 [%]	S	○	29
	5	Interval time	0.5 sec.	0.1 to 99.9 [sec.]	S	○	31
2	1	X-axis (time) end point	4: 10 ms/div	0: 1, 1: 2, 2: 4, 3: 5, 4: 10, 5: 20, 6: 40, 7: 50, 8: 100, 9: 200, 10: 400, 11: 500[ms/div] 12: 1, 13: 2, 14: 4, 15: 5, 16: 10 [s/div]	S	○	32
	2	Y-axis setting (torque)	Start: 0	-99999 to 99999	S	○	33
			Scale: 2000	1 to 20000			34
	3	Y-axis setting (speed)	Start: 0	-99999 to 99999	S	○	35
			Scale: 1000	1 to 20000			36
	4	Y-axis setting (power)	Start: 0	-99999 to 99999	S	○	37
			Scale: 5000	1 to 20000			38
	5						

■System setting: Operation setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Digital filter (torque)	0: OFF	0: OFF, 2 to 999 [times]	N	◎	41
	2	Analog filter (torque)	3: 300 Hz	0: 10, 1: 30, 2: 100, 3: 300, 4: 1k, 5: 3k, 6: 10k, 7: 30k [Hz]	N	◎	42
	3	Digital filter(speed)	0: OFF	0: OFF, 2 to 999 [times]	N	◎	43
	4	Display filter	1: L (0.5s)	0: OFF, 1: L (0.5s), 2: M (1.0s), 3: H (2.0s)	N	◎	55
	5						
2	1	Backlight	On time: 10 min. Low time: 0 min.	On time: 0 to 99 [min.] (Always ON time when "0".) Low time: 0 to 99 [min.] (Always bright when "0")	N	◎	44 / 45
	2	Indicate color	0: Yellow	0: Yellow, 1: Green, 2: Comp.	N	◎	46
	3	SI/F print out	0: OFF	0: OFF, 1: HOLD	N	◎	47
	4	Language	0: Japanese(日)	0: Japanese(日), 1: English(英)	N	◎	48
	5	External output pattern	0: Pattern 1	0: Pattern 1, 1: Pattern 2, 2: Pattern 3	N	◎	49
3	1	B6 OFF detect wait	0.00 sec.	0.00 to 1.00 [sec.]	N	◎	51
	2	B8 OFF detect wait	0.00 sec.	0.00 to 1.00 [sec.]	N	◎	52
	3	RUN output select	0: Toggle	0: Toggle, 1: ON Level, 2: OFF Level	N	◎	53
	4	Control input select	1: EXT.	0: COM., 1: EXT.	N	◎	54
	5	Password					

■System setting: USB I/F setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Communication mode	0: Normal	0: Normal 1: Cont. 1, 2: Print, Cont. 2	N	◎	—
	2	Baudrate	5: 230.4k bps	0: 9600, 1: 19200, 2: 38400, 3: 57600, 4: 115.2k, 5: 230.4k [bps]	N	◎	—
	3	Data bit	1: 8 bit	0: 7 bit, 1: 8 bit	N	◎	—
	4	Stop bit	0: 1 bit	0: 1 bit, 1: 2 bit	N	◎	—
	5	Parity bit	1: EVEN	0: NONE, 1: EVEN, 2: ODD	N	◎	—
	6	Delimiter	0: CR	0: CR, 1: CR+LF	N	◎	—

■System setting: Option I/F setting (D3V)

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Output data select (torque)	0: Hold Sync.	0: Hold Sync., 1: Hold Not Sync., 2: Zero Scale, 3: Full Scale	N	◎	81
	2	Zero scale value (torque)	0	-99999 to 99999	N	◎	82
	3	Full scale value (torque)	10000	-99999 to 99999	N	◎	83
	4						
	5						
2	1	Output data select (speed)	0: Hold Sync.	0: Hold Sync., 1: Hold Not Sync., 2: Zero Scale, 3: Full Scale	N	◎	84
	2	Zero scale value (speed)	0	-99999 to 99999	N	◎	85
	3	Full scale value (speed)	10000	-99999 to 99999	N	◎	86
	4						
	5						
3	1	Output data select (power)	0: Hold Sync.	0: Hold Sync., 1: Hold Not Sync., 2: Zero Scale, 3: Full Scale	N	◎	87
	2	Zero scale value (power)	0	-99999 to 99999	N	◎	88
	3	Full scale value (power)	10000	-99999 to 99999	N	◎	89
	4						
	5						

■Calibration setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Unit (torque)	2: Nm	0: mNm, 1: Ncm, 2: Nm, 3: kNm, 4: kgm, 5: kgcm, 6: gcm	N	●	61
	2	(Decimal place (torque))*	2: 0.00	0: NONE, 1: 0.0, 2: 0.00, 3: 0.000	N	●	62
	3	Zero calibration (torque)	0.000V	-5.000 to 5.000 [V]	N	●	63
	4						
	5	Equivalent input calibration (torque)	10000	-99999 to 99999	N	●	64
2	1	Increment (torque)	0: 1	0: 1, 1: 2, 2: 5, 3: 10, 4: 20, 5: 50, 6: 100	N	●	66
	2	Digital zero limit (torque)	99999	0 to 99999	N	●	67
	3						
	4						
	5						
3	1	Unit (speed)	0: rpm	0: rpm, 1: min^{-1}	N	●	68
	2	Increment (speed)	1	0: 1, 1: 2, 2: 5, 3: 10, 4: 20, 5: 50, 6: 100	N	●	69
	3						
	4						
	5						
4	1	Pulse input (speed)	0: UTM	0: UTM, 1: ENCODER	N	●	71
	2	Pulse rate (speed)	4 pulse	UTM selected 1, 4 [pulse] Encoder selected 1 to 4000 [pulse]	N	●	72
	3	Minimum input rotation speed	0: 15rpm	Pulse rate: 4 pulses 0: 15rpm, 1: 10rpm, 2: 5rpm, 3: 3rpm, 4: 2rpm Pulse rate: 1 pulse 0: 60rpm, 1: 40rpm, 2: 20rpm, 3: 12rpm, 4: 8rpm	N	●	78
	4	Rotation stop mode	0: OFF	0: OFF, 1: 2 times, 2: 4 times, 3: 8 times	N	●	79
	5						
5	1	Unit (power)	1: W	0: mW, 1: W, 2: kW, 3: PS, 4: HP	N	●	73
	2	Decimal place (power)	0: NONE	0: NONE, 1: 0.0, 2: 0.00, 3: 0.000	N	●	74
	3	Increment (power)	0: 1	0: 1, 1: 2, 2: 5, 3: 10, 4: 20, 5: 50, 6: 100	N	●	75
	4						
	5						

* For communication only

■Expansion setting: Expansion calibration setting

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Unit (torque)	2: Nm	0: mNm, 1: Ncm, 2: Nm, 3: kNm, 4: kgm, 5: kgcm, 6: gcm	N	●	61
	2	(Decimal place (torque))*	2: 0.00	0: NONE, 1: 0.0, 2: 0.00, 3: 0.000	N	●	62
	3	Zero calibration (torque)	0.000V	-5.000 to 5.000 [V]	N	●	63
	4	Actual load calibration (torque)	100.00	-99999 to 99999	N	●	—
	5	Equivalent input calibration (torque)					
		Rated output	5.000V	-5.000 to 5.000 [V]	N	●	64
		Display value	100.00	-99999 to 99999	N	●	65
	6	Calibration selection	0: 0	0: 0, 1: 1, 2: EXT	N	●	76

* For communication only

■Protect/initialization

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	Measurement setting parameter protection	0: OFF	0: OFF, 1: ON	N		91
	2	System setting parameter protection	0: OFF	0: OFF, 1: ON	N		92
	3	Calibration setting parameter protection	0: OFF	0: OFF, 1: ON	N		93
	4	Initialization	0: MEAS. Set.	0: MEAS. Set., 1: System Set., 2: Calibration Set.			—
	5						

■Self-Check

Page	No.	Item	Initial value	Setting range	Memory	Protect	Command No.
1	1	LCD check					—
	2	KEY check					—
	3	MEM check					—
	4	I/O check					—
	5	DSP check					—
2	1	PUI check					—
	2	COM check					—
	3						
	4						
	5						

8-5. Conformity with EC directives

The TM700 Torque Monitor is a CE-marked EC-Directive-conforming product (by the Council of the European Union).

- EMC Directives; EN61326-1
  EN55011
  EN61000-4-2
  EN61000-4-3
  EN61000-4-4
  EN61000-4-5
  EN61000-4-6
  EN61000-4-8

Point

EMC Directive EN61000-4-5 (Lightning Surge Immunity) is met by the TM700 body in combination with a lightning surge protector.

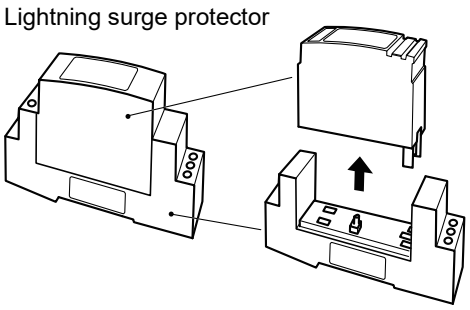
⚠ CAUTION

- Since the TM500 is defined as open type (built-in equipment), be sure to use it as installed and fixed to a panel, etc.
- Use shielded cables (for encoder, USB, external input/output, UTM, and option(s)).

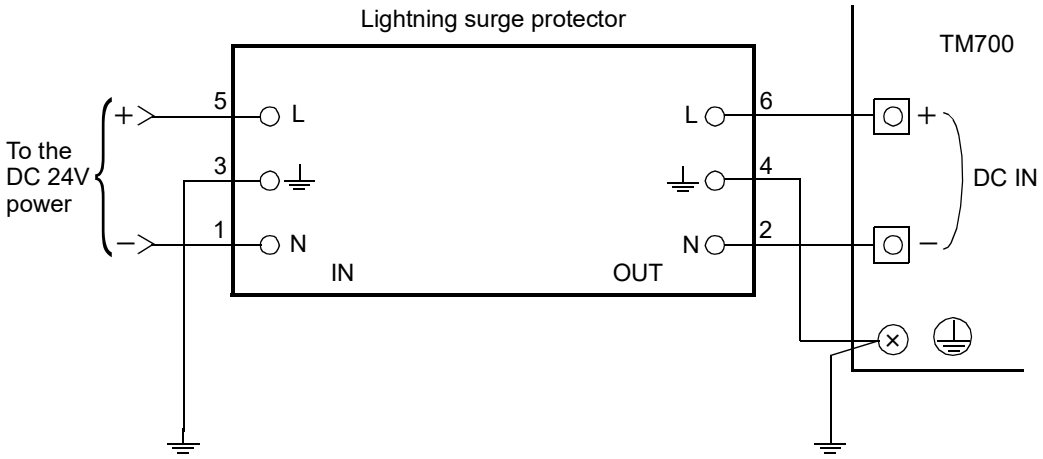
■Connection of a lightning surge protector

Attach a lightning surge protector against lightning surge.

EMC Directive EN61000-4-5 (Lightning Surge Immunity) is met by the TM700 body in combination with a lightning surge protector.



<Connect>



Attention

Be sure to ground ⏚ of the lightning surge protector.
Without grounding, it will not function as a lightning surge protector.

Point

No lightning surge protector is included as standard (optionally available).
Our company carries an optional lightning surge protector (TSU03).
Contact our sales department for details.

Unipulse Corporation

International Sales Department

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