TM400

PORTABLE TORQUE MONITOR

OPERATION MANUAL

01FEB2018REV.1.06

UNIPULSE

Introduction

Thank you for purchasing Portable Torque Monitor TM400 for UTMⅡ/UTMV. Read this manual and understand the contents prior to using in order to utilize the TM400 top caliber functions fully and safely. Keep this operation manual in a safe place to be used for further reference.

Usage precautions

● Power supply

Use a dedicated AC adapter for external power supply (accessory).

No warranty is offered if external power supply other than the dedicated AC adapter is used.

● Operation temperature, storing temperature, humidity

The operation temperature of this product is from -10°C to 40°C.

The reaction of LCD display unit may be sluggish at low temperatures (0°C or below); however, there is no effect in internal operation.

Charge the battery at a temperature from 10°C to 35°C.

When storing, keep the temperature ranging from -20°C to 60°C.

Avoid long-term storage at high temperatures.

The humidity should be kept at 85% RH or lower (no condensation or icing).

Safety precautions

Be sure to read for safety.

In this manual, precautions for safe use of the TM400 are described separately as ⚠ Warning and ⚠ Precautions in the following text. The precautions described in this text are important contents regarding safety. Use this product with accurate understanding of the contents.

⚠ Warning

Events that may cause death or severe injury to personnel in case of misuse.

⚠ Caution

Events that may cause injury to personnel or material damage in case of misuse.

⚠ Warning

Events that may cause death or severe injury to personnel in case of misuse.

- Using the product in an abnormal condition such as generation of smoke or abnormal smell may cause fire or electric shock.
  Turn off the power immediately, confirm that generation of smoke has stopped, and request the store for repair.
  Do not attempt to repair by yourself since it involves danger.
- In case the product was dropped or damaged, turn off the power.
  Using the product as is may cause fire or electric shock.
- Take caution not to touch the device with wet hands or spray water on the device.
  Doing so may cause fire or electric shock.
- Do not use AC adapters other than the dedicated adapter for external power supply. Doing so may cause fire.
- Do not insert or drop any foreign materials such as flammable substances or metals inside the device through openings. Doing so may cause fire, electric shock or failure.
- Do not disassemble or alter the device. Doing so may cause fire, electric shock or failure.
  (Repair of disassembled or altered devices may not be supported.)
- Do not place containers with liquid such as vases, flowerpots, cups, cosmetics and medicine on or beside the device.
  If the liquid is spilled on or gets in the device, it may cause fire, electric shock or failure.
- Do not damage, process, bend forcibly, stretch or twist the wiring of the device.
  Heating or placing heavy objects on the wiring may cause damages to the wires, causing fire or electric shock.

⚠ Precautions

Events that may cause injury to personnel or material damage in case of misuse.

- Do not place heavy objects on the device.
  If they fall due to imbalance, it may cause injury.
- Do not touch the connector terminal with hands wet of sweat and so forth.
  Doing so may cause failure such as faulty connection as well as electrical shock.
- Although the TM400 is considered to be sufficiently shock absorbing during delivery, reusing the same packaging materials may damage the product when a shock is encountered.
  When sending this product to us for repair and so on, pack it with sufficiently shock-absorbing materials.

Product supporting RoHS Directive

The parts and accessories used in this product (including the operation manual, package box and so on) support RoHS Directive, which regulates the use of toxic substances that may have adverse effects on the environment and the human body.

RoHS Directive

RoHS stands for Restriction on Hazardous Substances. This is an EU regulation regarding toxic substances. This directive prohibits the use of six specific substances in electrical/electronic equipment products sold in the EU region. The six substances include lead, mercury, cadmium, hexavalentchromium, PBB (polybrominated biphenyl) and PBDE (polybrominated diphenyl ether).

Contents

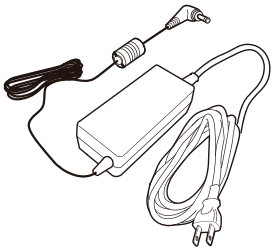
1 Outline

1-1. Package contents

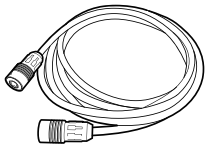
The following items are included in the package box.
Be sure to check the contents before use.

TM400 main unit
・・・One unit

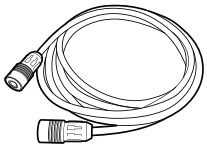
TM400 operation manual
・・・One copy



Dedicated AC adapter
・・・One piece



Cable for UTMⅡ connection (black, 2m)
(with connector) ・・・One piece

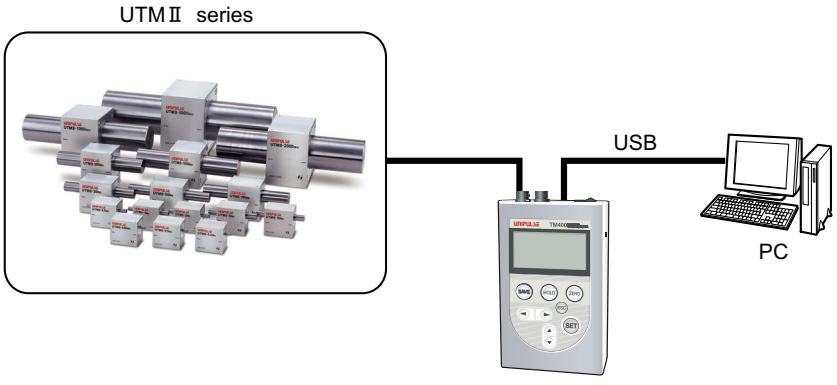


Cable for rotary encoder connection (gray, 2m)
(with connector) ・・・One piece

The item below is sold separately.

- USB cable

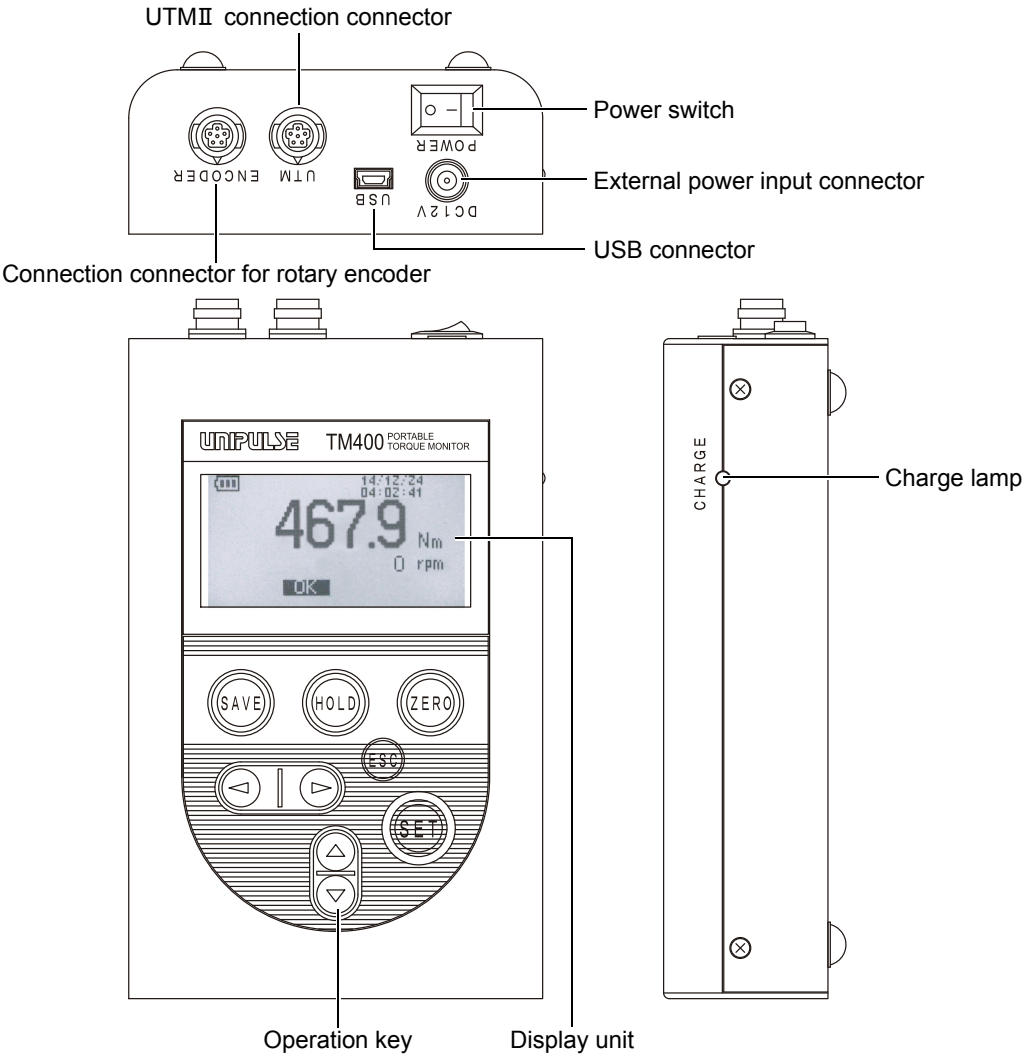
1-2. Connection with other devices



Chapter 1

Outline

1-3. Part names and functions



Display unit

The following three kinds of information are displayed.

1) Indicated value display (numerical value)
2) Graph display
3) Hold value display

Refer to P.4"1-5.Description and key operation for each screen" for details of each screen.

Operation keys

These keys are for commands of various settings and operations.

(SAVE): This key is used to plot graphs.

(HOLD): This key is used to hold displayed values.
Refer to P.26"6.Hold Function" for details.

(ZERO): This key is used to reset the indicated value to zero.

(◄) (►): These keys are used to change commands and setting values.

(▲) (▼): These keys are used to change commands and setting values.

(ESC): This key is used to stop operation or to return to indicated value display from the setting screen.

(SET): This key is used to switch to setting value display or to confirm setting values.

Power switch

This is a switch to turn ON/OFF the TM400 power supply.

UTMⅡ connection connector

UTMⅡ is connected with the dedicated cable.

Connection connector for rotary encoder

UTMⅡ rotary encoder is connected with the dedicated cable.

External power input connector

This is a jack to connect the AC adapter dedicated for the TM400.

USB connector

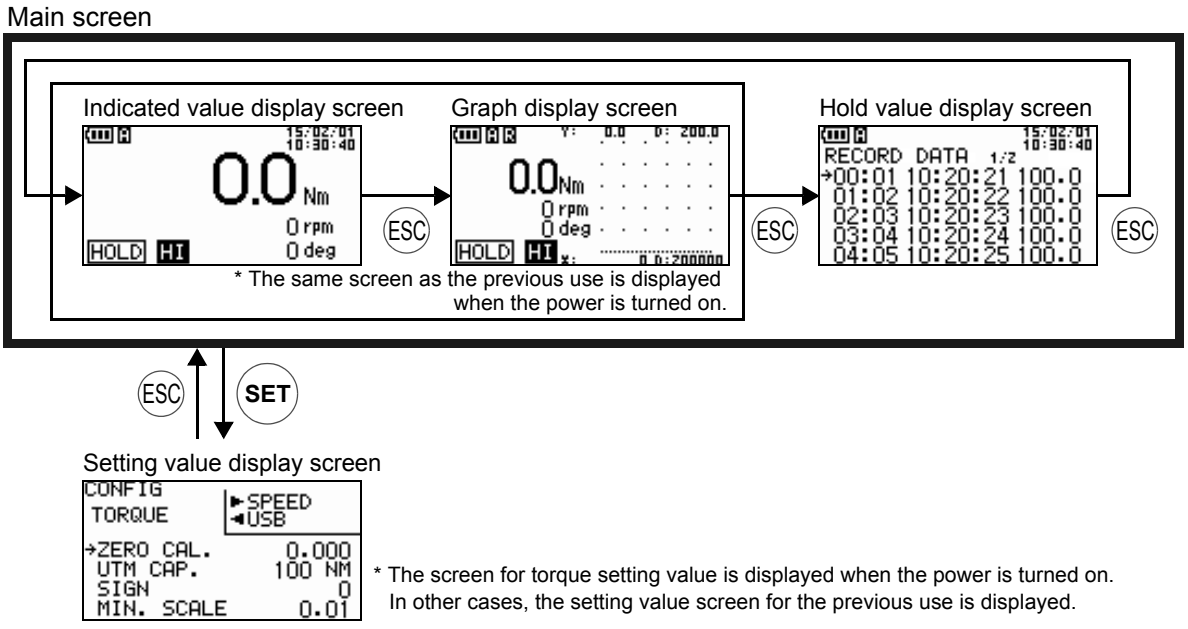
This connector is used to connect the product with a PC.
USB cable is sold separately.

Charge lamp

This lamp indicates the charge status of the battery. (Lighted on: charging, Flashing: error)

1-4. Screen configuration

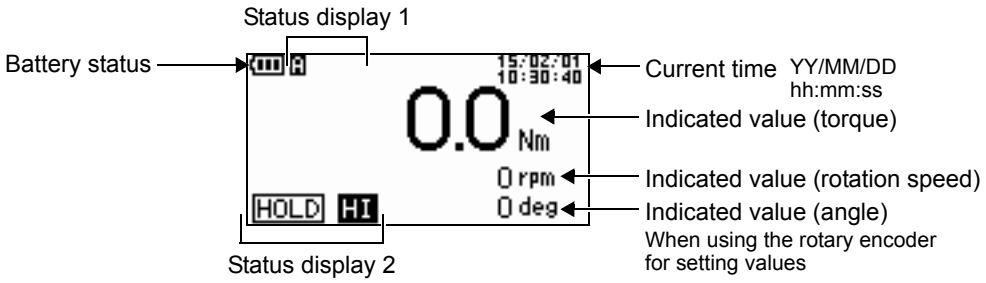
Main screen



* The screen for torque setting value is displayed when the power is turned on. In other cases, the setting value screen for the previous use is displayed.

1-5. Description and key operation for each screen

■Indicated value display screen



Status display 1

A: AC adapter is in use

M: Writing to nonvolatile memory (Do not turn off the power.)

B: Low battery for internal backup
The capacity for the backup battery is low. Replace the battery.

P: Buffering data for pretrigger
Graph taking will not start until buffering is completed.

R: Taking graphs

Status display 2

HI: Lights on when the indicated value is higher than the upper limit setting value.

OK: Lights on when the indicated value is at the upper or lower limit setting value or in between.

LO: Lights on when the indicated value is lower than the lower limit setting value.

HOLD: Flashes when detecting the indicated values, and lights on when holding (confirming).

Battery status

: Sufficient battery level.

: The battery level is lowering.

: No battery. Charge the battery.

Functions of operation keys

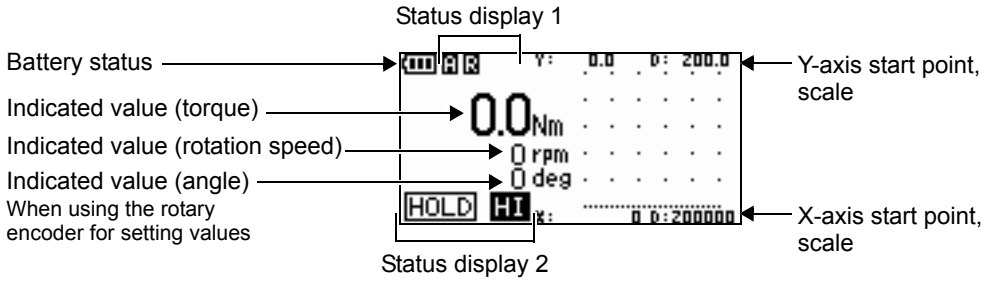
HOLD: Start/release hold

ZERO: One-touch zero

SET: Go to the setting screen

ESC: Go to the main screen (graph)

■Graph display screen



Functions of operation keys

◄ ►: Enlarge/reduce X-axis of a graph

▲ ▼: Enlarge/reduce Y-axis of a graph

HOLD: Start/release hold

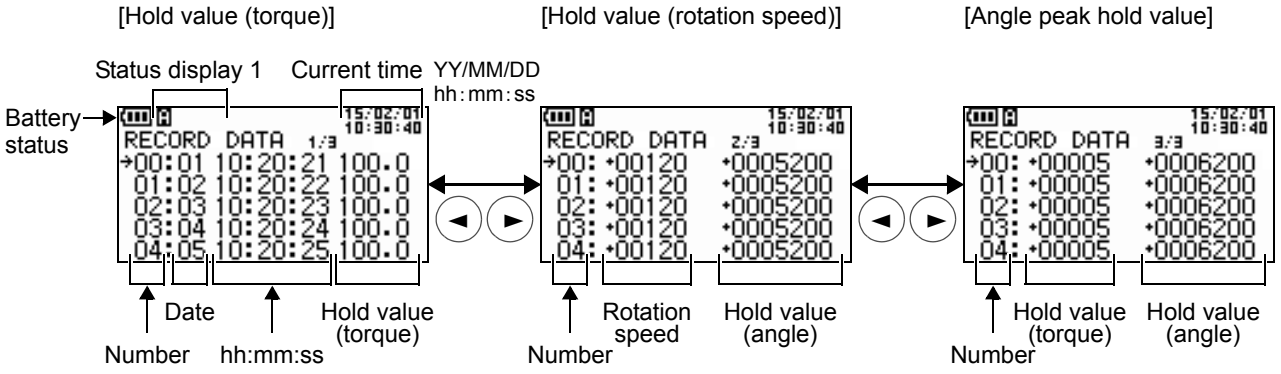
ZERO: One-touch zero

SET: Go to the setting screen

SAVE: Start/end graph taking

ESC: Go to the main screen (hold)

■Hold value display screen



* Angle peak hold value can only be shown when PEAK ANG is used in hold mode, and rotary encoder must be used.

Functions of operation keys

◄ ►: Switch display data

▲ ▼: Increase/decrease data display number

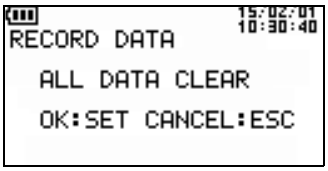
ZERO: Delete recorded data

SET: Go to the setting screen

ESC: Go to the main screen (indicated value)

Deleting recorded data

Recorded data can be deleted by pressing the (ZERO) key on the hold value display screen.
On the displayed confirmation screen, press the (SET) key to delete data or press the (ESC) key to reset (stop) deleting.



⚠ Precautions

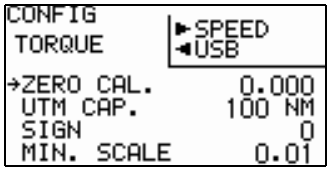
All data will be erased when data deletion is performed.
Pay due attention when deleting because erased data cannot be restored.

After changing the minimum scale and unit settings of encoder, please delete recorded data first.

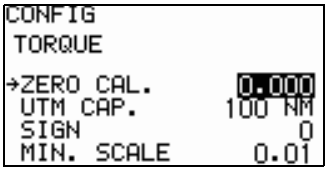
■Setting value display screen

In the setting value display screen, screens are displayed for each category. Confirm the current settings and press the (SET) key to change the settings.
Settings cannot be changed when it is locked, so be sure to release lock when changing the settings. Refer to P.24"5-6.Calibration protection (CAL. PROT.)/ setting protection (SET. PROT.)" for procedures to release lock.

When selecting item



During item input



Functions of operation keys

(◄) (►): Switch category

(▲) (▼): Switch setting item

(SET): To setting input status

(ESC): Go to the main screen

(◄) (►): Switch digit (not used when selecting item)
* The selected digit starts flashing.

(▲) (▼): Increase/decrease selected digit

(HOLD): Sign + ⇔ - (not used without sign)

(SET): Confirm input

(ESC): Cancel

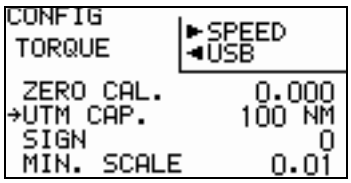
Setting value input screen

There are following two types for setting value input.

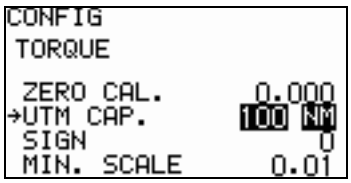
(1) Select from setting items (example: UTM capacity)

1. Press the (SET) key on the main screen and enter the setting value display screen.

2. Display the "CONFIG TORQUE" screen using the (◄) (►) keys.



3. Select UTM capacity (UTM CAP.) using the (▲) (▼) keys.
The arrow (→) moves to the left of the selected item.



4. Press the (SET) key to enter the changing mode.
The selected item flashes.

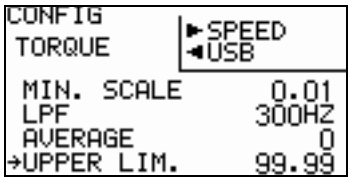
5. Change the selection using the (▲) (▼) keys.
0.03, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2, 3, 5, 10, 20, 30, 50, 100, 200, 300, 500, 1000, 2000, 3000, 5000, 10000 [Nm]

6. Confirm selection with the (SET) key.

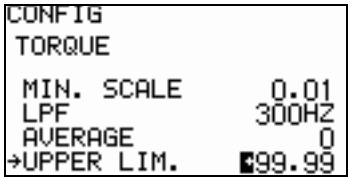
(2) Input value (example: upper limit)

1. Press the (SET) key on the main screen and enter the setting value display screen.

2. Display the "CONFIG TORQUE" screen using the (◄) (►) keys.



3. Select the upper limit (UPPER LIM.) using the (▲) (▼) keys.
The arrow (→) moves to the left of the selected item.



4. Press the (SET) keys to enter the changing mode.
The most significant digit flashes.

5. Change the numerical value using the (▲) (▼) keys, and shift digits using the (◄) (►) keys.

6. Confirm the value with the (SET) key.

2 Connection

2-1. Power supply

Connect the dedicated AC adapter for the TM400 to the power input connector of the main unit.
Battery is built in the TM400 (available duration for continuous use: approx. five hours).

Procedure to charge battery

1. Connect the dedicated AC adapter to the external power input connector and AC outlet.
2. Charging starts and the LED lights on. (The LED flashes in case of an error.)
3. When charging is complete, the LED lights off.

■Maintaining battery when not in use

The battery level lowers gradually due to dark current even when it is not used.
If it is left without maintenance, the output voltage will be lowered to near the overdischarge level, shortening the battery life.

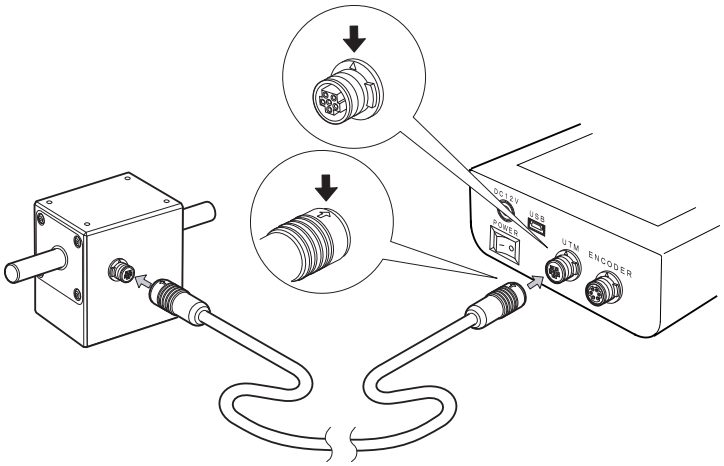
Attention

To protect the battery, charge it at a temperature from 10°C to 35°C.

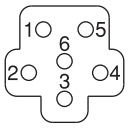
Charge the battery at least once in three months after full charging and recover the battery level even when it is not used for a long period.

2-2. UTMⅡ connection

The connection with UTMⅡ can be easily performed with the dedicated cable included. Both ends of the connector have the same shape, and the cable is connected straight. Since the cable has no directionality, either side of the connector may be connected to UTMⅡ and the TM400.
Connect UTMⅡ while paying attention to the direction of the arrow on the connector.



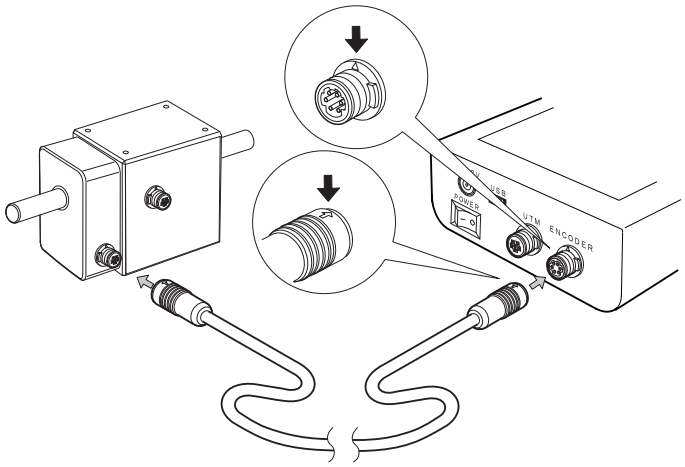
● Pin assignment

Pin-out	Pin number	Wire 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 case.

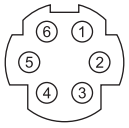
* The wire colors correspond with the color of cable included with UTMⅡ.
* Compatible connector: HR30-6P-6P manufactured by HIROSE ELECTRIC CO., LTD.
(Model without optional connector: CN90)

2-3. Rotary encoder connection

The UTMⅡ rotary encoder can be connected easily with a dedicated cable. The cable has no polarity. Connect UTMⅡ while paying attention to the direction of the connector.



● Pin assignment

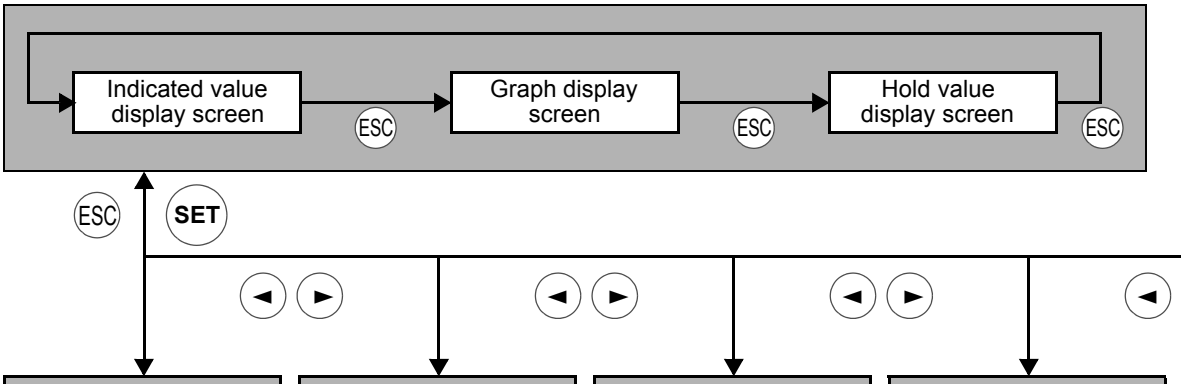
Pin-out	Pin number	Wire color	Signal name
	1	—	NC
	2	Red	PWR+ (+5V)
	3	Transparent	Z-phase output
	4	Black	B-phase output
	5	Blue	A-phase output
	6	Shield (green)	PWR GND

* The wire colors correspond with the color of cable included with UTMⅡ rotary encoder.
* Compatible connector: HR30-6P-6S manufactured by HIROSE ELECTRIC CO., LTD.
(Model without optional connector: CN91)

3 Setting Procedures

3-1. Setting configuration

Main screen



TORQUE		
0	Zero calibration ZERO CAL.	(P17)
1	UTM capacity UTM CAP.	(P16)
2	Sign SIGN	(P17)
3	Minimum scale MIN. SCALE	(P17)
4	Low-pass filter LPF	(P22)
5	Moving average AVERAGE	(P22)
6	Upper limit UPPER LIM.	(P22)
7	Lower limit LOWER LIM.	(P22)
8	Other capacity * OTHER CAP.	(P16)
9	Unit * UNIT	(P16)
10	Decimal point * DECIMAL P.	(P17)

Setting items having * mark
are displayed when the UTM capacity
is set to OTHER

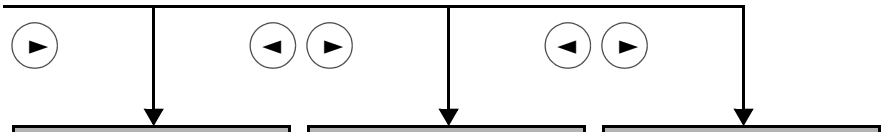
SPEED		
0	Unit UNIT	(P18)
1	Minimum scale MIN. SCALE	(P18)
2	UTM type UTM TYPE	(P18)
3	Moving average AVERAGE	(P22)
4	Quick stop mode QUICK STOP	(P18)

ENCODER		
0	Encoder pulse ENCODER	(P19)
1	Unit UNIT	(P20)
2	Minimum scale MIN. SCALE	(P20)
3	Direction DIRECTION	(P20)
4	Moving average AVERAGE	(P22)
5	Zero clear ZERO CLEAR	(P20)
6	Zero clear from the recording start REC.ST.CLR	(P20)
7	Recording angle mode REC.ANG.MD	(P20)
8	Other pulse * OTHER PUL.	(P19)

Setting items having * mark
are displayed when the encoder pulse
is set to OTHER

HOLD		
0	Hold mode HOLD MODE	(P26)
1	Start mode START MODE	(P26)
2	Start level START LEV.	(P27)
3	Stop level STOP LEVEL	(P27)
4	Zero clear at the start of hold section START CLR	(P27)

The setting items in each category can be changed using the ▲ ▼ keys.



GRAPH		
0	Plot mode PLOT MODE	(P35)
1	Start mode START MODE	(P35)
2	Start level START LEV.	(P35)
3	Stop mode STOP MODE	(P36)
4	Maximum recording time MAX.REC.TM	(P36)
5	Pretrigger PRETRIGGER	(P36)
6	X-axis start point X START	(P36)
7	X-axis scale X SCALE	(P36)
8	Y-axis start point Y START	(P37)
9	Y-axis scale Y SCALE	(P37)
10	Position of Y-axis start point Y ST.POS.	(P37)

SYSTEM		
0	Backlight BACKLIGHT	(P24)
1	Power off POWER OFF	(P25)
2	ID ID	(P23)
3	Date DATE	(P24)
4	Time TIME	(P24)
5	Buzzer BUZZER	(P24)
6	Calibration protection CAL. PROT.	(P24)
7	Setting protection SET. PROT.	(P24)
8	Visibility VISIBILITY	(P25)
9	Initialize INITIALIZE	(P52)
10	Memory check MEM. CHECK	(P51)
11	Version VERSION	(P25)
12	Password PASSWORD	(P52)

USB		
0	Baud rate BAUDRATE	(P39)
1	Data bit DATA BIT	(P39)
2	Stop bit STOP BIT	(P39)
3	Parity bit PARITY BIT	(P39)
4	Delimiter DELIMITER	(P39)
5	Received characters REC. CHAR.	(P39)
6	Send characters SEND CHAR.	(P39)

3-2. List of setting values

■Torque

	Name	Default value	Range	Setting protection	Calibration protection
0	Zero calibration (ZERO CAL.)	0	-5.000 to 5.000 [V]		◎
1	UTM capacity (UTM CAP.)	18: 1000 Nm	0: 0.03, 1: 0.05, 2: 0.1, 3: 0.2, 4: 0.3, 5: 0.5, 6: 1, 7: 2, 8: 3, 9: 5, 10: 10, 11: 20, 12: 30, 13: 50, 14: 100, 15: 200, 16: 300, 17: 500, 18: 1000, 19: 2000, 20: 3000, 21: 5000, 22: 10000 [Nm], 23: OTHER		◎
2	Sign (SIGN)	0: NORMAL	0: NORMAL, 1: REVERSE 2: ABSOLUTE		◎
3	Minimum scale (MIN. SCALE)	0: 1	0: 1, 1: 2, 2: 5, 3: 10, 4: 20, 5: 50, 6: 100		◎
4	Low-pass filter (LPF)	3: 300 Hz	0: 10, 1: 30, 2: 100, 3: 300, 4: 1k, 5: 3k, 6: 10k, 7: 30k [Hz]	◎	
5	Moving average (AVERAGE)	0	0 to 999	◎	
6	Upper limit (UPPER LIM.)	9999	-9999 to 9999	◎	
7	Lower limit (LOWER LIM.)	-9999	-9999 to 9999	◎	
8	Other capacity (OTHER CAP.) *	100	1 to 99999		◎
9	Unit (UNIT) *	1: Nm	0: mNm, 1: Nm, 2: kNm		◎
10	Decimal point (DECIMAL P.) *	0: 0000	0: 0000, 1: 000.0, 2: 00.00, 3: 0.000		◎

Setting items having * mark are displayed when the UTM capacity is set to OTHER.

■Rotation speed

	Name	Default value	Range	Setting protection	Calibration protection
0	Unit (UNIT)	0: rpm	0: rpm, 1: min^{-1}		◎
1	Minimum scale (MIN. SCALE)	0: 1	0: 1, 1: 2, 2: 5, 3: 10, 4: 20, 5: 50, 6: 100		◎
2	UTM type (UTM TYPE)	1: UTMⅡ	0: UTM, 1: UTMⅡ		◎
3	Moving average (AVERAGE)	0	0 to 999	◎	
4	Quick stop mode (QUICK STOP)	1: ON	0: OFF, 1: ON		◎

■Encoder

	Name	Default value	Range	Setting protection	Calibration protection
0	Encoder pulse (ENCODER)	0: NOT USE	0: NOT USE, 1: 720PULSE, 2: 1080PULSE, 3: 1440PULSE, 4: 1800PULSE, 5: 2000PULSE, 6: 2880PULSE, 7: 3600PULSE, 8: 4000PULSE, 9: OTHER		◎
1	Unit (UNIT)	0: deg	0: deg, 1: rad		◎
2	Minimum scale (MIN. SCALE)	3: 1	0: 0.1, 1: 0.2, 2: 0.5, 3: 1, 4: 2, 5: 5, 6: 10, 7: 20, 8: 50, 9: 100		◎
3	Direction (DIRECTION)	0: NORMAL	0: NORMAL, 1: REVERSE		◎
4	Moving average (AVERAGE)	0	0 to 999	◎	
5	Zero clear (ZERO CLEAR)	2500R	1 to 2500 [R]		◎
6	Zero clear from the recording start (REC.ST.CLR)	1: ON	0: OFF, 1: ON	◎	
7	Recording angle mode (REC.ANG.MD)	0: PER SAMP.	0: PER SAMP., 1: PER ANG.	◎	
8	Other pulse (OTHER PUL.) *	2000	1 to 9999		◎

Setting items having * mark are displayed when the encoder pulse is set to OTHER.

■Hold

	Name	Default value	Range	Setting protection	Calibration protection
0	Hold mode (HOLD MODE)	1: SAMPLE	0: OFF, 1: SAMPLE, 2: PEAK, 3: BOTTOM, 4: P-P, 5: AVERAGE, 6: PEAK ANG	◎	
1	Start mode (START MODE)	0: KEY	0: KEY, 1: LEVEL	◎	
2	Start level (START LEV.)	10	-9999 to 9999	◎	
3	Stop level (STOP LEVEL)	0	-9999 to 9999	◎	
4	Zero clear at the start of hold section (START CLR)	0: OFF	0: OFF, 1: ON	◎	

■Graph

	Name	Default value	Range	Setting protection	Calibration protection
0	Plot mode (PLOT MODE)	0: REPEAT	0: REPEAT, 1: SINGLE	◎	
1	Start mode (START MODE)	0: KEY	0: KEY, 1: EDGE ↑ , 2: EDGE ↓	◎	
2	Start level (START LEV.)	10	-9999 to 9999	◎	
3	Stop mode (STOP MODE)	0: CYCLE	0: CYCLE, 1: MAX. REC.	◎	
4	Maximum recording time (MAX.REC.TM)	0: 5S	0: 5, 1: 10, 2: 20, 3: 40, 4: 50, 5: 100 [S]	◎	
5	Pretrigger (PRETRIGGER)	0: OFF	0: OFF, 1: 10, 2: 20, 3: 30, 4: 40, 5: 50 [%]	◎	
6	X-axis start point (X START)	0	-1000000 to 1000000	◎	
7	X-axis scale (X SCALE)	12: 1	Encoder enabled 0: 10, 1: 20, 2: 40, 3: 80, 4: 100, 5: 200, 6: 400, 7: 800, 8: 1000, 9: 2000, 10: 4000, 11: 8000, 12: 10000, 13: 20000, 14: 40000, 15: 80000, 16: 100000, 17: 200000 Encoder disabled 0: 0.001, 1: 0.002, 2: 0.004, 3: 0.008, 4: 0.01, 5: 0.02, 6: 0.04, 7: 0.08, 8: 0.1, 9: 0.2, 10: 0.4, 11: 0.8, 12: 1, 13: 2, 14: 4, 15: 8, 16: 10, 17: 20 [s]	◎	
8	Y-axis start point (Y START)	0	-9999 to 9999	◎	
9	Y-axis scale (Y SCALE)	9: 500	0: 10, 1: 20, 2: 30, 3: 40, 4: 50, 5: 100, 6: 200, 7: 300, 8: 400, 9: 500, 10: 1000, 11: 2000, 12: 4000	◎	
10	Position of Y-axis start point (Y ST.POS.)	1: CENTER	0: BOTTOM, 1: CENTER	◎	

■System

	Name	Default value	Range	Setting protection	Calibration protection
0	Backlight (BACKLIGHT)	60S	0 to 600 [S]	◎	
1	Power off (POWER OFF)	10 MIN	0 to 10 [MIN]	◎	
2	ID (ID)	0	0 to 9999	◎	
3	Date (DATE)		2000/01/01 to 2099/12/31	◎	
4	Time (TIME)		00:00:00 to 23:59:59	◎	
5	Buzzer (BUZZER)	1: ON	0: OFF, 1: ON	◎	
6	Calibration protection (CAL. PROT.)	0: OFF	0: OFF, 1: ON		
7	Setting protection (SET. PROT.)	0: OFF	0: OFF, 1: ON		
8	Visibility (VISIBILITY)	1: L (0.5s)	0: OFF, 1: L (0.5s), 2: M (1.0s), 3: H (2.0s)	◎	
9	Initialize (INITIALIZE)				
10	Memory check (MEM. CHECK)				
11	Version (VERSION)				
12	Password (PASSWORD)				

■USB

	Name	Default value	Range	Setting protection	Calibration protection
0	Baud rate (BAUDRATE)	2: 38400 bps	0: 9600, 1: 19200, 2: 38400, 3: 57600, 4: 115.2k, 5: 230.4k, 6: 691.2k [bps]	◎	
1	Data bit (DATA BIT)	1: 8 bit	0: 7, 1: 8 [bit]	◎	
2	Stop bit (STOP BIT)	0: 1 bit	0: 1, 1: 2 [bit]	◎	
3	Parity bit (PARITY BIT)	1: EVEN	0: NON, 1: EVEN, 2: ODD	◎	
4	Delimiter (DELIMITER)	0: CR	0: CR, 1: CR+LF	◎	
5	Received characters (REC. CHAR.)		ASCII0 to 9, A to Z (Small letters are also displayed as capitalized.), CR, LF, ■ (others)		
6	Send characters (SEND CHAR.)				

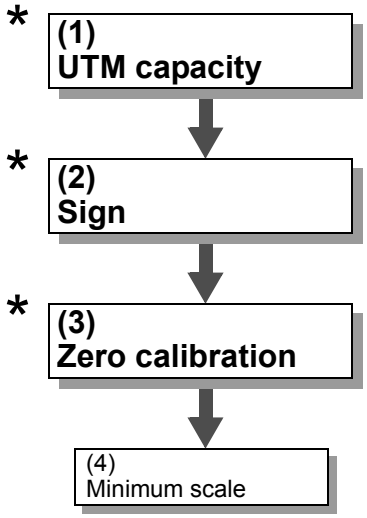
Default value: Factory default value and status
Setting protection/Calibration protection:
Setting value change is prohibited by the protection setting.

4 Torque Settings

4-1. Calibration

"Calibration" is the operation of matching the TM400 with a sensor.
Check the UTMⅡ to be used.

4-2. Calibration procedure for torque



Register the rated capacity value of the sensor.

Set the sign of the sensor.

Set the zero point of the sensor in an unloaded condition (where no force and so on is applied to a sensor).

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

*: Be sure to perform the setting.

■UTM capacity (UTM CAP.)

Select the rated capacity of UTMⅡ connected.

<Setting range> 0.03, 0.05, 0.1, 0.2, 0.3, 0.5, 1, 2, 3, 5, 10, 20, 30, 50,100, 200, 300, 500, 1000, 2000, 3000, 5000, 10000 [Nm], OTHER

* The following setting items only available when OTHER is selected, and arbitrary calibration can be made.

- Other capacity - Unit - Decimal point

■Other capacity (OTHER CAP.)

(These items only available in case the UTM capacity is set to OTHER)

Set the arbitrary torque value against 5V input from UTMⅡ.

<Setting range> 1 to 99999

■Unit (UNIT)

(These items only available in case the UTM capacity is set to OTHER)

Set the unit of torque to display.

<Setting range> mNm, Nm, kNm

■Decimal point (DECIMAL P.)

(These items only available in case the UTM capacity is set to OTHER)

Set the decimal point of torque to display.

<Setting range> 0000, 000.0, 00.00, 0.000

■Sign (SIGN)

Set the sign of torque.

<Setting range> NORMAL, REVERSE, ABSOLUTE

- NORMAL Viewing the UTMII from the drive side, the direction in which the load side is twisted counterclockwise is displayed as the positive direction.
- REVERSE Viewing the UTMII from the drive side, the direction in which the load side is twisted clockwise is displayed as the positive direction.
- ABSOLUTE Shows the absolute value of torque without the direction of the load.

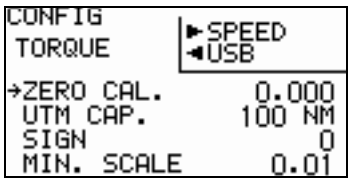
■Zero calibration (ZERO CAL.)

Zero point is registered while torque load is not applied to UTMII . Furthermore, if the initial torque remains in the jig and so on for the purpose of measurement, the zero point may be registered while the initial torque is being applied; however, the initial torque range needs to be subtracted from the signal input range.

<Setting range> -5.000 to 5.000 [V]

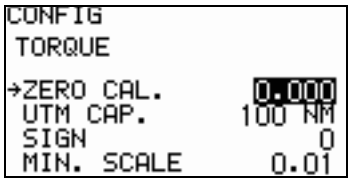
1. Press the (SET) key on the main screen and enter the setting value display screen.

2. Display the "CONFIG TORQUE" screen using the (◄) (►) keys.



3. Select zero calibration using the (▲) (▼) keys.

4. Unload the sensor and press the (SET) key.

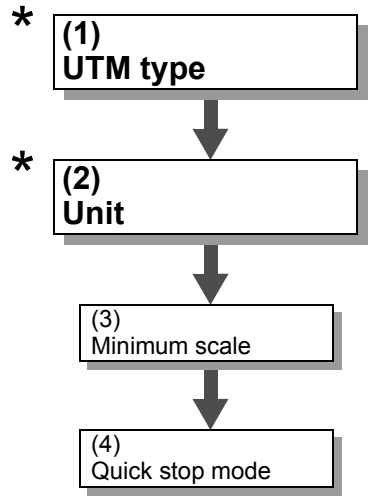


■Minimum scale (MIN. SCALE) (optional if there is no change)

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

<Setting range> 1, 2, 5, 10, 20, 50, 100

4-3. Calibration procedure for rotation speed



Set the type of UTM to be used.

Set the unit of value to display.

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

Choose whether or not to use the function to forcibly reset the rotation speed to 0 in an quick stop.
(optional if there is no change)

*: Be sure to perform the setting.

■UTM type (UTM TYPE)

Set the type of UTM to be used.

<Setting range> UTM, UTMII

■Unit (UNIT)

Set the unit of value to display.

<Setting range> rpm, min^{-1}

■Minimum scale (MIN. SCALE) (optional if there is no change)

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

<Setting range> 1, 2, 5, 10, 20, 50, 100

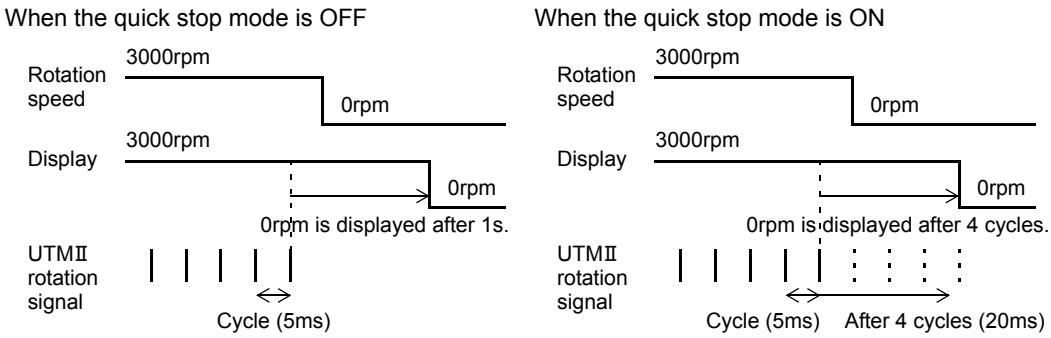
■Quick stop mode (QUICK STOP) (optional if there is no change)

This is a function to shorten the time for the rotation speed display of the TM400 to reach zero after rotation stop.

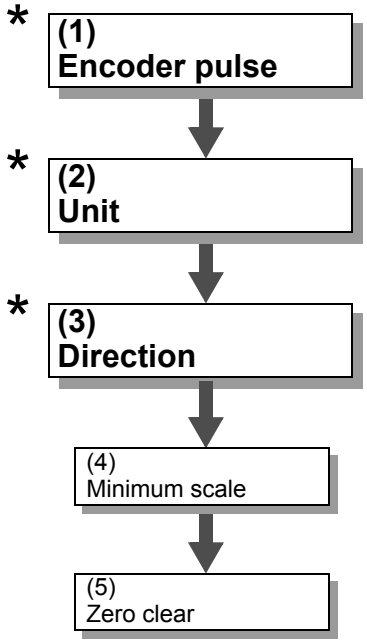
<Setting range> OFF, ON

- OFF The display reaches zero about 1s after rotation stop.
- ON The display is forcibly reset to zero in case of rapid deceleration (The rotation speed is reduced rapidly to 1/4.).

e.g.) Rapid deceleration from 3000rpm



4-4. Calibration procedure for the encoder (only when using the encoder)



Set the number of pulse input from the rotary encoder per a rotation.

Set the unit of value to display.

Set the rotation direction of UTMⅡ.

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

Set the timing to reset the angle display to zero.
(optional if there is no change)

*: Be sure to perform the setting.

■Encoder pulse (ENCODER)

Set the number of pulse input from the rotary encoder per a rotation.

<Setting range> NOT USE, 720PULSE, 1080PULSE, 1440PULSE, 1800PULSE, 2000PULSE, 2880PULSE, 3600PULSE, 4000PULSE, OTHER

* The following setting items only available when OTHER is selected, and arbitrary number of pulse input can be set.

- Other pulse

■Other pulse (OTHER PUL.)

(These items only available in case the Encoder pulse is set to OTHER)

Set the number of pulse input from the rotary encoder per a rotation.

<Setting range> 1 to 9999

■Unit (UNIT)

Set the unit of value to display.

<Setting range> deg, rad

■Direction (DIRECTION)

Set the rotation direction of UTMⅡ.

<Setting range> NORMAL, REVERSE

- NORMAL Select this option when using the UTMⅡ clockwise viewing from the drive side.
- REVERSE Select this option when using the UTMⅡ counterclockwise viewing from the drive side.

* Change the setting if the direction of rotation does not conform with increase/decrease of angle display.

■Minimum scale (MIN. SCALE) (optional if there is no change)

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

<Setting range> 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100

■Zero clear (ZERO CLEAR) (optional if there is no change)

Set the timing to reset the angle display to zero.
The angle display will be reset to zero at a specified number of revolutions.

<Setting range> 1 to 2500 [R]

■Zero clear from the recording start (REC.ST.CLR)

Set whether or not to reset the angle to zero at the start of recording.

<Setting range> OFF, ON

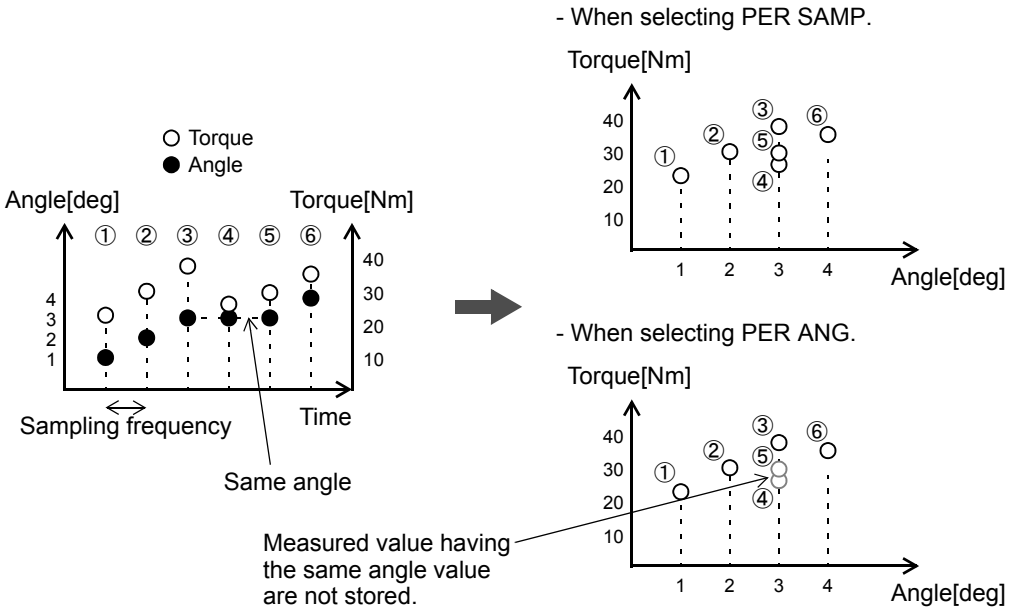
- OFF The angle is not reset to zero at the start of recording and displayed on a graph as is.
- ON The angle is reset to zero at the start of recording and displayed so on a graph.
  If PEAK ANG (peak hold (angle)) is selected in hold mode, the peak angle can be identified. You can easily check the amount of angle movement from the measurement starting point using this function.

■Recording angle mode (REC.ANG.MD)

Torque value acquisition method can be selected.

<Setting range> PER SAMP., PER ANG.

- PER SAMP. Torque value is measured and saved synchronizing with sampling frequency. It is suitable for storing time-series data. Recording time length is fixed according to maximum recording time setting, but 100 second at max.
- PER ANG. Torque value is measured and saved synchronizing with angle signal input. Since the measuring timing is being changed according to angle signal input, measured data would not be time-series. Measured data having the same angle value are not stored therefore the recording time is longer than PER SAMP..



5 Function Setting Procedures

5-1. Low-pass filter (LPF)

This is a low-pass filter for canceling unnecessary noise contents by filtering input signals from UTMⅡ. A cut-off frequency of a low-pass filter can be selected from 10Hz to 30kHz. Frequency contents higher than the set frequencies will be attenuated. The higher the cut-off frequency, the quicker the response to input signals, but noise contents may also be displayed.

<Setting range> 10, 30, 100, 300, 1k, 3k, 10k, 30k [Hz]

5-2. Moving average (AVERAGE)

This filter takes the moving averages of the A/D converted data and reduces fluctuation of indicated values. The number of times to perform the moving average can be set up to 999 times. The higher the number of times, the more stable the indicated values, but the response will be slower. The lower the number of times, the quicker the response, but indicated values will be more likely to fluctuate.

<Setting range> 0 to 999

5-3. Upper limit (UPPER LIM.)/ lower limit (LOWER LIM.)

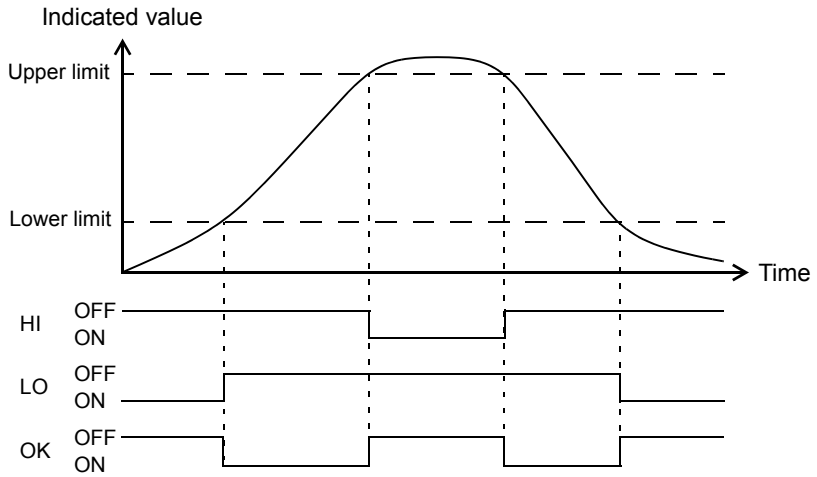
This function sets the upper limit and lower limit, and lights on the HI status display when an indicated value exceeds the upper limit, and LO status display when an indicated value falls below the lower limit.

<Setting range> -9999 to 9999

<ON conditions of HI/LO>

- HI: Indicated value > Upper limit setting value
- LO: Indicated value < Lower limit setting value
- OK: Lower limit setting value ≦ Indicated value ≦ Upper limit setting value

● Operation of upper and lower limits



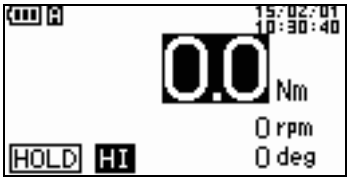
5-4. One-touch zero

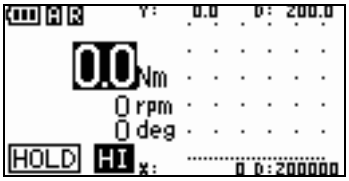
This is a function to set the indicated value to zero with a single touch of key operation.

■Operation procedure of one-touch zero

When not using the rotary encoder

1. Press the (ZERO) key.

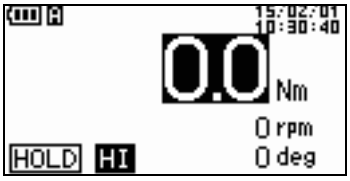


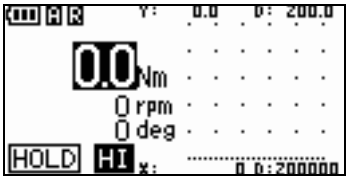


2. The current load is reset to zero if the (SET) key is pressed.
The operation stops if the (ESC) key is pressed.

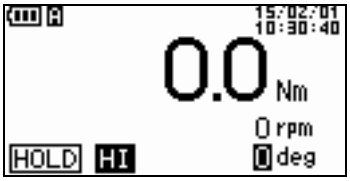
When using the rotary encoder

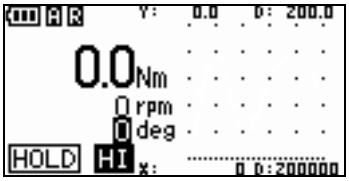
1. The torque display starts flashing if the (ZERO) key is pressed.





2. The angle display starts flashing if the (ZERO) key is pressed once more.





3. The flashing sensor input is set to zero if the (SET) key is pressed while the display to reset is flashing.
The operation stops if the (ESC) key is pressed.

5-5. ID setting (ID)

Sets the device ID of the TM400.
Separate ID can be assigned to each device.

<Setting range> 0 to 9999

5-6. Calibration protection (CAL. PROT.)/ setting protection (SET. PROT.)

This function prohibits changes to settings to prevent setting and calibration values from being changed by operational errors.

<Setting range> OFF, ON

Key point

Refer to P.12 "3-2.List of setting values" for setting items locked by the calibration protection and setting protection.

5-7. Date (DATE)

Sets the date for the main unit.

<Setting range> 2000/01/01 to 2099/12/31

5-8. Time (TIME)

Sets the time for the main unit.

<Setting range> 00:00:00 to 23:59:59

5-9. Buzzer (BUZZER)

Sets the buzzer.

* Buzzer refers to the key clicking sound.

<Setting range> OFF, ON

5-10. Backlight (BACKLIGHT)

The backlight is illuminated for a fixed time after pressing the key. The fixed time is set by this function.

<Setting range> 0 to 600 [S]

Key points

If the time is set as 0 seconds, the backlight will be always illuminated.
The backlight time setting affects the battery hours.
The longer the backlight time, the shorter the battery hours.
If the backlight time is longer than the power off time (refer to P.25 "5-11.Power off (POWER OFF)"), the power off time is prioritized.

5-11. Power off (POWER OFF)

When the TM400 is not operated for a fixed time, it enters into the low power consumption mode.

<Setting range> 0 to 10 [MIN]

Key points

If the setting is set as 0 minutes, it will not enter into the low power consumption mode.
Furthermore, it will not enter into the low power consumption mode while using the external power supply or during recording.
To recover from the low power consumption mode, turn on the power again or press any key on the main unit.

5-12. Visibility (VISIBILITY)

This is a function to display the values for torque and rotation speed in a way that is easy to see by averaging the display values. Only the displayed values are averaged. The data stored inside the TM400 (graphs, hold) are not averaged.

<Setting range> OFF, L (0.5s), M (1.0s), H (2.0s)

5-13. Version (VERSION)

The version of the main unit can be confirmed.

6 Hold Function

6-1. Hold function

The hold function operates during indicated value display or graph display.

Each hold operation is performed using the HOLD key.

■Hold mode (HOLD MODE)

There are six hold modes for the TM400.

When not using the hold function, be sure to turn OFF the hold mode and use the product.

(When turned OFF, the hold function does not operate and the input value is displayed at all times.)

<Setting range> OFF, SAMPLE, PEAK, BOTTOM, P-P, AVERAGE, PEAK ANG

- OFF: Hold function OFF
- Sample hold: Holds an arbitrary point (torque, rotation speed, angle).
- Peak hold: Holds the maximum value (peak value) of torque in the positive direction.
  Does not hold rotation speed or angle.
- Bottom hold: Holds the maximum value (bottom value) of torque in the negative direction.
  Does not hold rotation speed or angle.
- Peak to peak hold: The difference in the bottom and peak values of torque (range) is displayed.
  Does not hold rotation speed or angle.
- Average hold: Holds the torque average in the specified section.
  Does not hold rotation speed or angle.
- Peak hold (angle): Holds the maximum value (peak value) of torque in the positive direction and the maximum value (peak value) of angle in the positive direction. Rotation speed will not be hold.

■Start mode (START MODE)

There are two start mode settings for the TM400.

<Setting range> KEY, LEVEL

- Key: Monitors all data during the time period after the HOLD key has been pressed until the HOLD key is pressed again.
- Level: Monitors data after the indicated value has passed the start level until it passes the stop level.
  After the indicated value has passed the stop level, it waits until the value passes the start level again.

* If the hold mode is set as sample hold setting, the start mode is ignored.

■Start level (START LEV.)

Sets the level to start detection.

<Setting range> -9999 to 9999

■Stop level (STOP LEVEL)

Sets the level to stop detection.

<Setting range> -9999 to 9999

■Zero clear at the start of hold section (START CLR)

Set whether or not to reset the angle to zero at the start of hold section.

* This function works only when the peak hold (angle) is selected.

<Setting range> OFF, ON

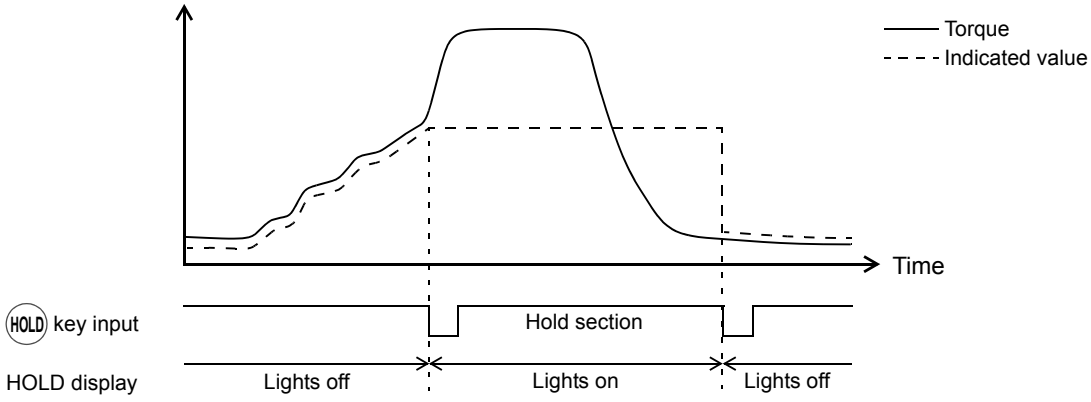
- OFF: The angle is not reset to zero at the start of hold section.
- ON: The angle is reset to zero at the start of hold section.

* Do not use this function in combination with "zero clear from the recording start (REC.ST.CLR)" that is described in encoder setting.

6-2. Sample hold

Holds an arbitrary point.

- Operation of sample hold



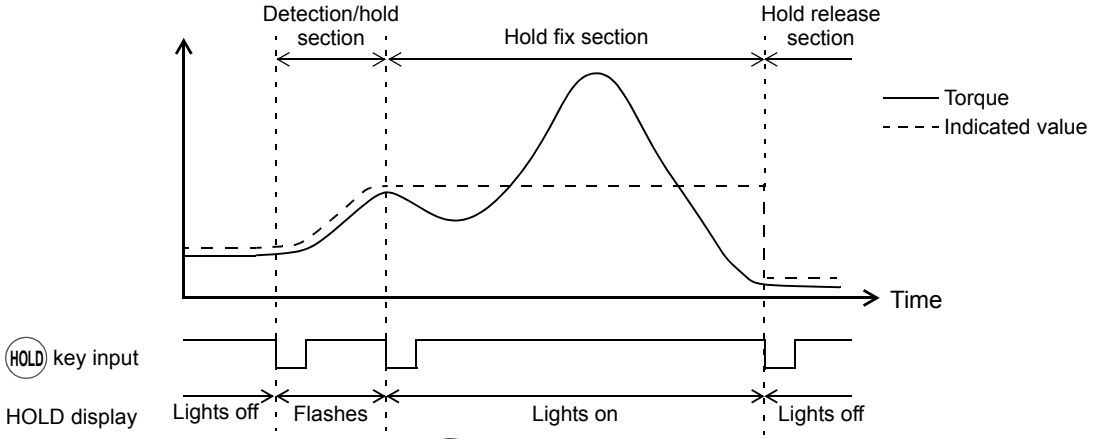
Holds the indicated value at HOLD key down.

Press the HOLD key again to release hold.

6-3. Peak hold

Holds the maximum value (peak value) of torque in the positive direction.

- Operation of peak hold (start mode: key)

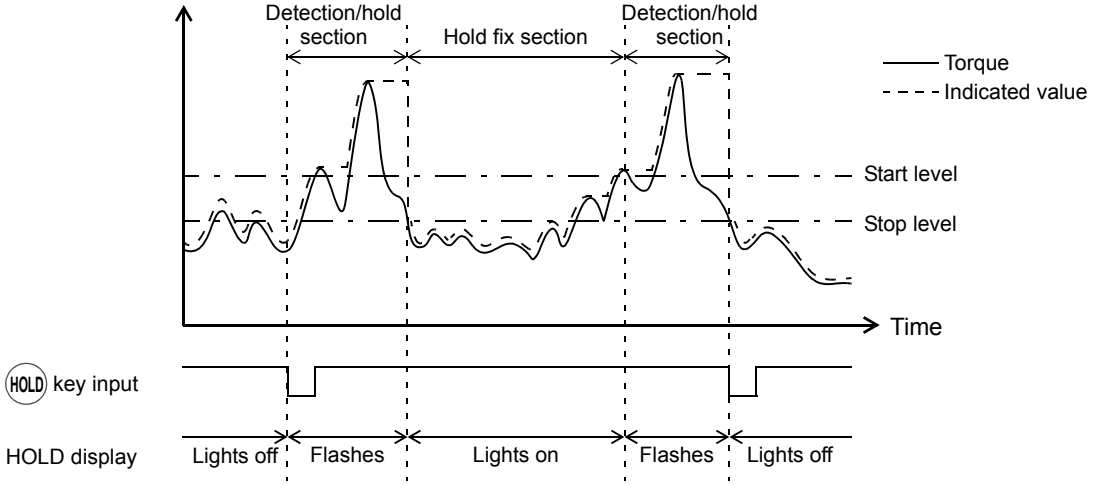


Holds the maximum value after the HOLD key down.

Press the HOLD key again to confirm.

Press the HOLD key again to release hold.

- Operation of peak hold (start mode: level)



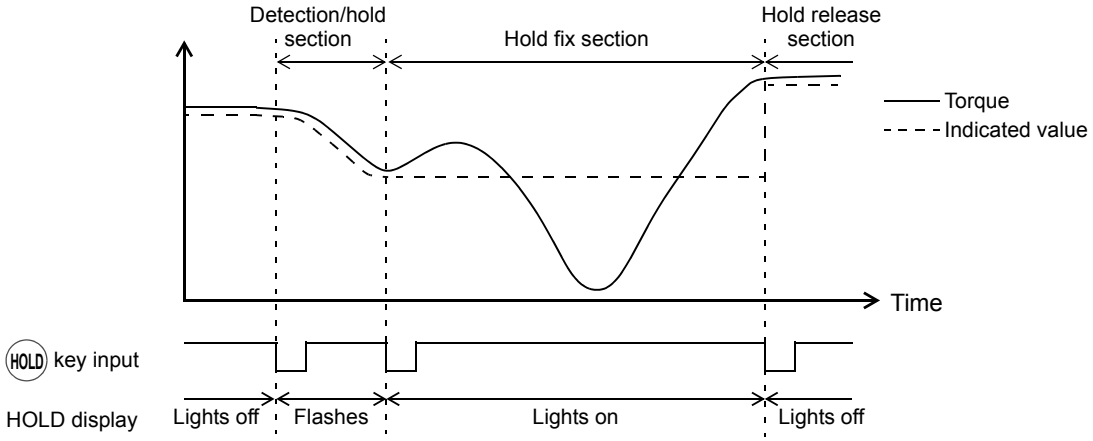
The hold operation starts when the torque exceeds the start level from below the start level after pressing the HOLD key. When the torque falls below the stop level, detection will be stopped and the torque will be fixed. After the torque falls below the stop level, the torque will be compared with the start level again.

Press the HOLD key again to stop hold operation.

6-4. Bottom hold

Holds the maximum value (bottom value) of torque in the negative direction.

- Operation of bottom hold (start mode: key)

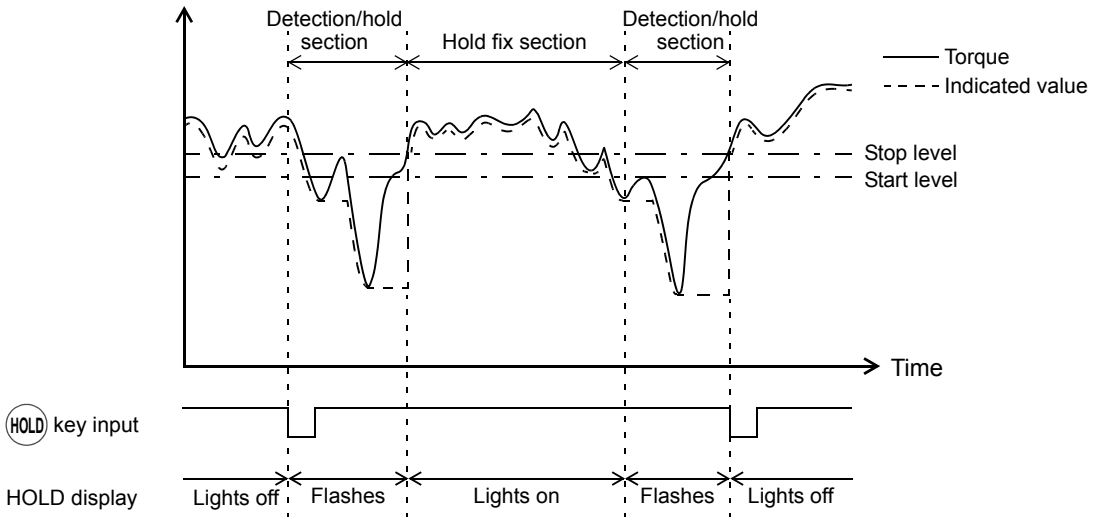


Holds the minimum value after the HOLD key down.

Press the HOLD key again to confirm.

Press the HOLD key again to release hold.

- Operation of bottom hold (start mode: level)



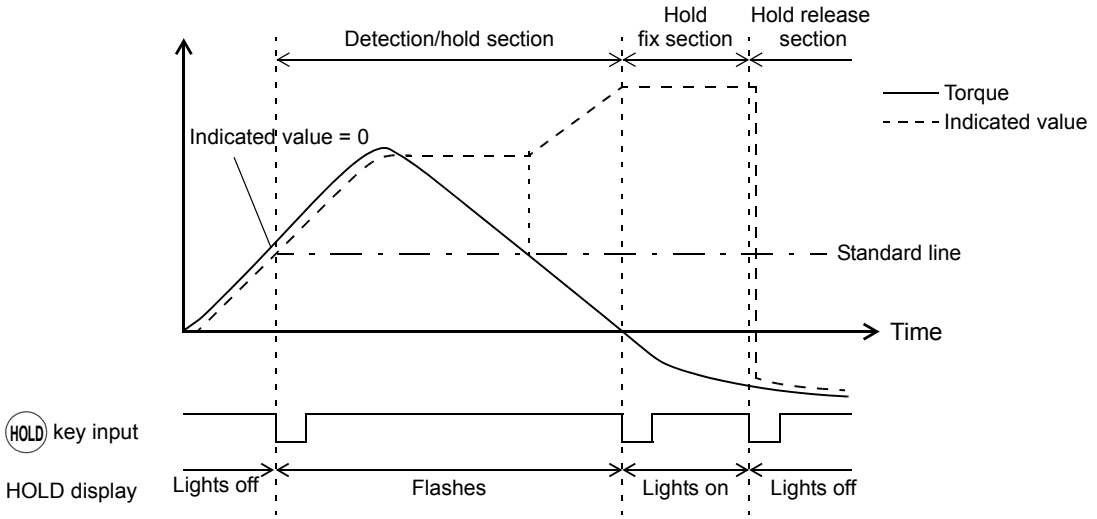
The hold operation starts when the torque falls below the start level from above the start level after pressing the HOLD key. When the torque exceeds the stop level, detection will be stopped and the torque will be fixed. After the torque exceeds the stop level, the torque will be compared with the start level again.

Press the HOLD key again to stop hold operation.

6-5. Peak to peak hold

Holds the difference (range) between the peak and bottom values of torque.

- Operation of peak to peak hold (start mode: key)

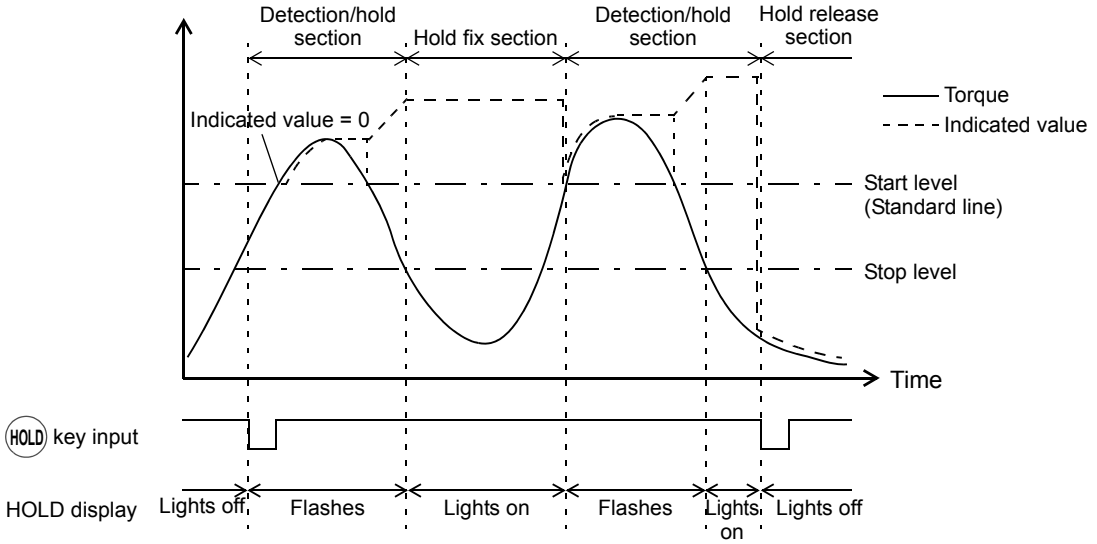


Holds the input at the HOLD key down as the standard value, and the maximum difference of the input values as the indicated value.

Press the HOLD key again to confirm.

Press the HOLD key again to stop hold operation.

- Operation of peak to peak hold (start mode: level)



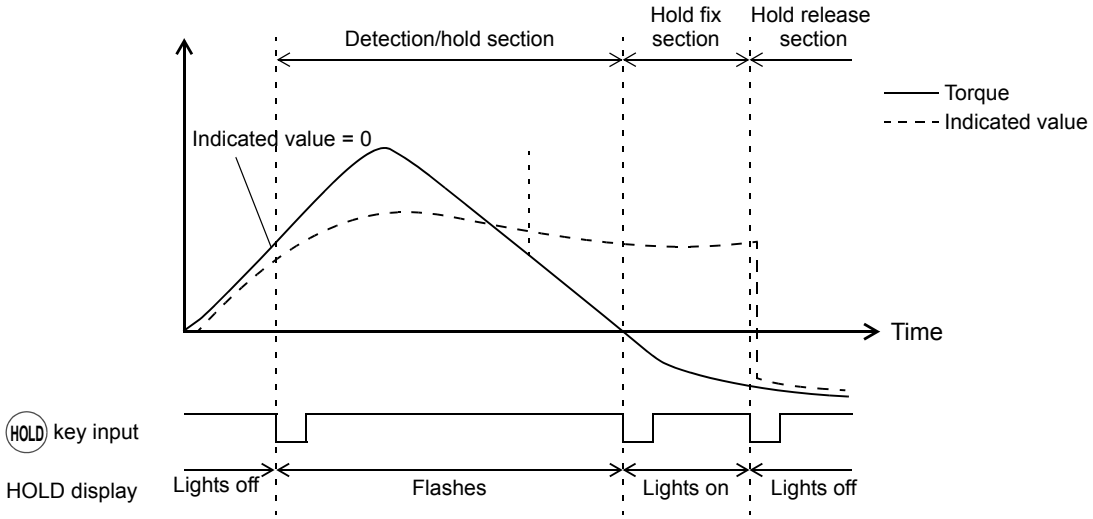
The hold operation starts when the torque passes the start level (from above to below or from below to above) after pressing the HOLD key. Afterwards, the hold operation continues until the torque passes the stop level (in the opposite direction of the start level). After the passing the stop level, the hold data is displayed while monitoring the indicated value to pass the start level.

Press the HOLD key again to stop hold operation.

6-6. Average hold

Holds the average value of torque.

- Operation of average hold (start mode: key)

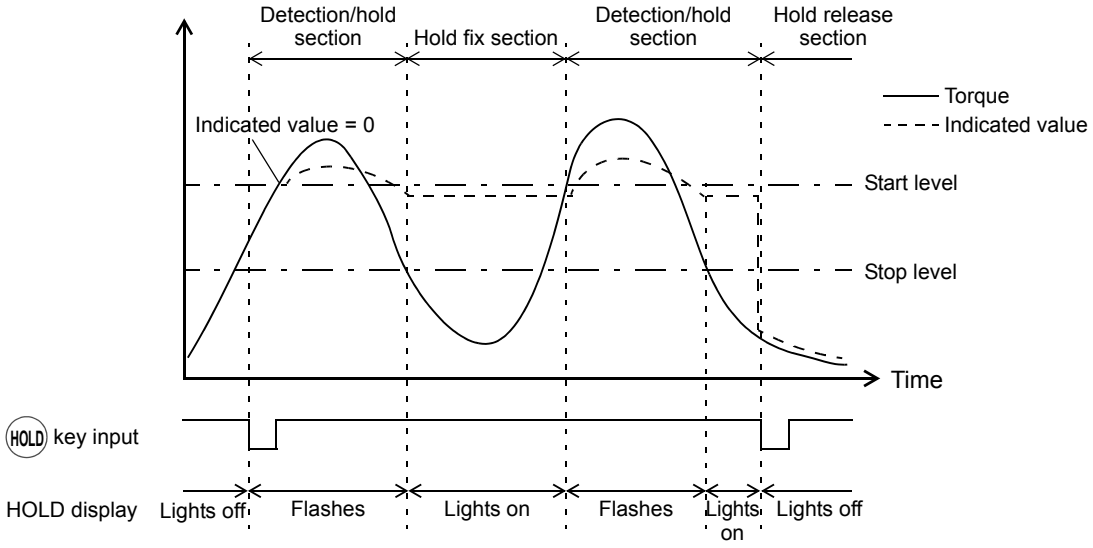


Holds the average value after pressing the HOLD key as the indicated value.

Press the HOLD key again to confirm.

Press the HOLD key again to stop hold operation.

- Operation of average hold (start mode: level)



The hold operation starts when the torque passes the start level (from above to below or from below to above) after pressing the HOLD key. Afterwards, the hold operation continues until the torque passes the stop level (in the opposite direction of the start level). After the passing the stop level, the hold data is displayed while monitoring the indicated value to pass the start level.

Press the HOLD key again to stop hold operation.

Key points

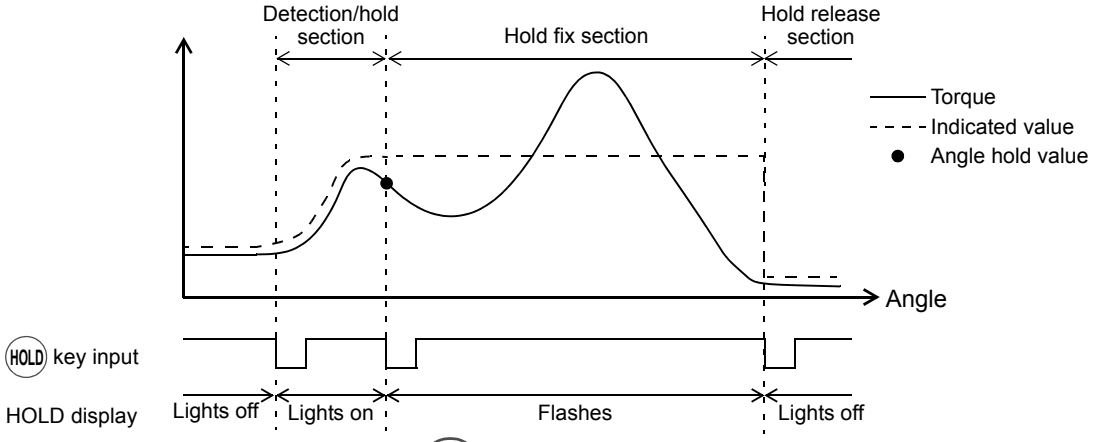
The detection section for average hold is up to 24 hours.
It will automatically stop after 24 hours.

6-7. Peak hold (angle)

Holds the maximum value (peak value) of torque in the positive direction and the maximum value (peak value) of angle in the positive direction.

* Usable only when rotary encoder is being used.

- Operation of angle peak hold (start mode: key)

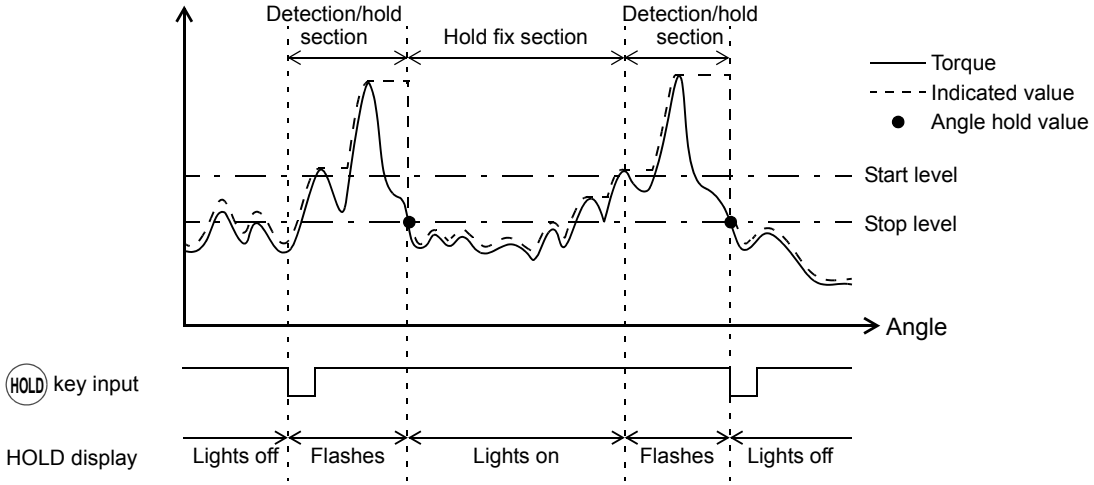


Holds the maximum value after the HOLD key down.

Press the HOLD key again to confirm.

Press the HOLD key again to release hold.

- Operation of peak hold (angle) (start mode: level)



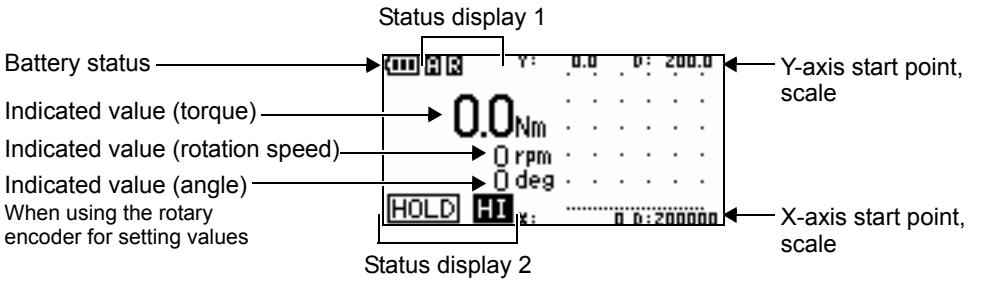
After pressing the HOLD key, hold operation starts when torque and angle exceeds the start level from below repetitively. When the torque falls below the stop level, detection will be stopped and the torque will be fixed. After the torque falls below the stop level, the torque will be compared with the start level again.

Press the HOLD key again to stop hold operation.

7 Graph

The TM400 is equipped with a function to display the input data on a graph.
The settings related to graph display are explained as follows.

7-1. Graph display



* The screen resolution for X and Y-axis is 50 dots.

■Types of displayed graphs

Depending on whether "the encoder is used" or not, the type of graph to be plotted changes.

- Not used

  Plots a torque-time graph.

  Full-scale plotting for X-axis at the maximum.

  * Full scale = X-axis start point + X-axis scale division x 5
  * To plot a graph for five seconds or longer, change the setting value of "maximum recording time".
  * To plot a graph for longer than 10 seconds, the plotting data is taken as follows (thin-out):

5 seconds	No thin-out	20ksps
10 seconds	Take 1 data from 2 samples	10ksps
20 seconds	Take 1 data from 4 samples	5ksps
40 seconds	Take 1 data from 5 samples	4ksps
50 seconds	Take 1 data from 10 samples	2ksps
100 seconds	Take 1 data from 20 samples	1ksps

- Used

  Plots a torque-angle graph.

  Displayed graph is changed according to recording angle mode setting.

  - PER SAMP.: Torque value is measured and saved synchronizing with sampling frequency.
    It is suitable for storing time-series data.
    Recording time length is fixed according to maximum recording time[*1] setting, but 100 second at max.
  - PER ANG.: Torque value is measured and saved synchronizing with angle signal input.
    Since the measuring timing is being changed according to angle signal input, measured data would not be time-series.
    Measured data having the same angle value are not stored therefore the recording time is longer than PER SAMP..

*1: The plotting time can be changed by setting the maximum recording time of setting values as follows (thin-out):

5 seconds	No thin-out	20ksps
10 seconds	Take 1 data from 2 samples	10ksps
20 seconds	Take 1 data from 4 samples	5ksps
40 seconds	Take 1 data from 5 samples	4ksps
50 seconds	Take 1 data from 10 samples	2ksps
100 seconds	Take 1 data from 20 samples	1ksps

If sample hold, peak hold or bottom hold is operated during graph plotting, the graph will be marked.

■Plot mode (PLOT MODE)

Sets the repeat condition for plotting operation.

<Setting range> REPEAT, SINGLE

- REPEAT Once the SAVE key is pressed, plotting is repeated until the SAVE key is pressed again.
- SINGLE Plots once if the SAVE key is pressed once.

■Start mode (START MODE)

The plotting start operation changes according to the start mode.

<Setting range> KEY, EDGE ↑ , EDGE ↓

- KEY Starts taking data and plotting a graph if the SAVE key is pressed.
- EDGE ↑ Starts taking data and plotting a graph when the torque crosses the level from below to above after the SAVE key is pressed.
  * The level is set by the setting value "start level".
- EDGE ↓ Starts taking data and plotting a graph when the torque crosses the level from above to below after the SAVE key is pressed.
  * The level is set by the setting value "start level".

■Start level (START LEV.)

Sets the level to be crossed.

* Enabled only when the start mode is EDGE ↑ or EDGE ↓ .

<Setting range> -9999 to 9999

■Stop mode (STOP MODE)

Sets the stop mode for graph.

<Setting range> CYCLE, MAX. REC.

- CYCLE Use of encoder
  - Not used: Stops plotting when the graph is plotted up to the X-axis full scale or the maximum recording time.
  - Used: Stops plotting when the graph is plotted up to the timing of the angle to be reset to 0 (set by the setting value "zero clear") or the maximum recording time.
- MAX. REC. Stops plotting when the graph is plotted up to the maximum recording time. The graph will be overwritten.

■Maximum recording time (MAX.REC.TM)

The maximum time for recording is set by this function.

<Setting range> 5, 10, 20, 40, 50, 100 [S]

■Pretrigger (PRETRIGGER)

Plots a graph by tracing back the length of time set as a rate against the full scale.

* Enabled only when the encoder is not used and the start mode is EDGE ↑ or EDGE ↓ .

<Setting range> OFF, 10, 20, 30, 40, 50 [%]

■X-axis start point (X START)

Sets the start point for X-axis of a graph.

* Enabled only when the encoder is used.

<Setting range> -1000000 to 1000000

■X-axis scale (X SCALE)

Sets the X-axis scale of a graph.

The X-axis scale can also be changed on a graph display screen (◄ ► keys).

<Setting range> Encoder enabled

10, 20, 40, 80, 100, 200, 400, 800, 1000, 2000, 4000, 8000, 10000, 20000, 40000, 80000, 100000, 200000

(Decimal place is automatically determined according to the minimum scale setting.)

Encoder disabled

0.001, 0.002, 0.004, 0.008, 0.01, 0.02, 0.04, 0.08, 0.1, 0.2, 0.4, 0.8, 1, 2, 4, 8, 10, 20 [s]

* The settable range changes depending on the setting of maximum recording time.

5s.....0.001 to 1	40s ..... 0.001 to 8
10s.....0.001 to 2	50s ..... 0.001 to 10
20s.....0.001 to 4	100s ..... 0.001 to 20

■Y-axis start point (Y START)

Sets the start point for Y-axis of a graph.

<Setting range> -9999 to 9999

■Y-axis scale (Y SCALE)

Sets the Y-axis scale of a graph.

The Y-axis scale can also be changed on a graph display screen (◄ ► keys).

<Setting range> 10, 20, 30, 40, 50, 100, 200, 300, 400, 500, 1000, 2000

■Position of Y-axis start point (Y ST.POS.)

Sets the position of Y-axis start point

<Setting range> BOTTOM, CENTER

- BOTTOM The starting line of Y-axis is set to the bottom of the graph.
- CENTER The starting line of the Y-axis is set to the middle of the graph. It is preferable when torque value straddle both polarities.

8 USB Interface

USB interface is used to read the indicated values of the TM400 and to write the setting values into the TM400. This interface is convenient for processing such as totals and records by connecting the TM400 to a PC. Furthermore, reading and writing setting values and reading graph data are possible using a dedicated PC application.

■Communication specifications

Communication standard	USB Ver.2.0 compliant, full speed (12Mbps)
Class	Communication class
Transmission speed	Select from 9600, 19200, 38400, 57600, 115.2k, 230.4k, or 691.2k bps
Bit configuration	Start bit: 1 bit Data bit: Select from 7 or 8 bit Stop bit: Select from 1 or 2 bit Parity bit: Select from NONE, even number, or odd number Delimiter during transmission: Select from CR or CR+LF
Code	ASCII
Connector	mini-B TYPE

■PC operating environment

OS	Windows 7 Home Premium/Professional/Ultimate 32/64 bit
Display	800x640 pixel or above
USB port	One free port
USB driver	Virtual COM Port (VCP) Drivers (developed by FTDI Limited)

■USB driver installation

In order to connect the USB of the TM400, USB driver must be installed.
For details, refer to the FTDI website, and download and install the driver following the procedure.

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

■USB connection

Connect with a USB cable.
The USB connector of the TM400 is mini-B TYPE.

■Virtual COM port check

Check the virtual COM port number to which the TM400 is connected from the Device Manager of the PC.

■USB interface setting

Set the USB I/F setting of the TM400. The I/F setting is transmission.

Baud rate (BAUDRATE)

<Setting range> 9600, 19200, 38400, 57600, 115.2k, 230.4k, 691.2k [bps]

Data bit (DATA BIT)

<Setting range> 7, 8 [bit]

Stop bit (STOP BIT)

<Setting range> 1, 2 [bit]

Parity bit (PARITY BIT)

<Setting range> NON, EVEN, ODD

Delimiter (DELIMITER)

<Setting range> CR, CR+LF

Received characters (REC. CHAR.)

<Setting range> ASCII 0 to 9, A to Z

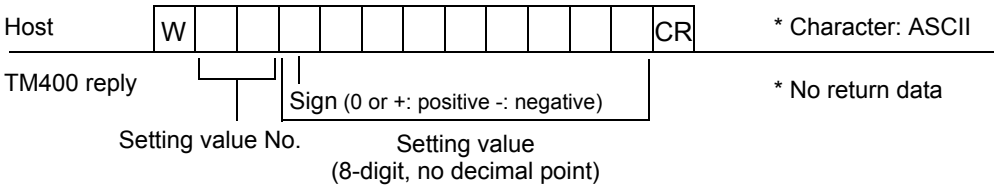
(Small letters are also displayed as capitalized.),CR, LF, ■ (others)

Send characters (SEND CHAR.)

Transmits forcibly the same data as RA command.

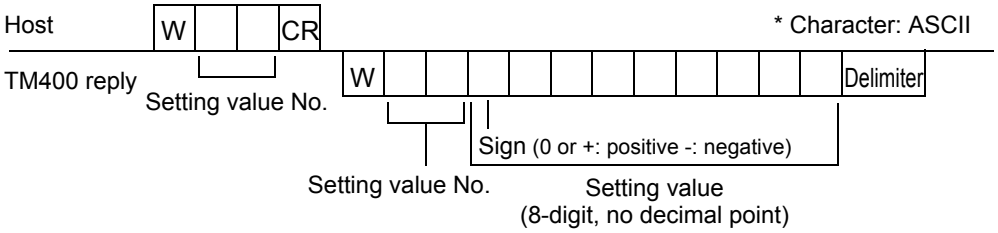
■Communication format for commands

- Writing setting values



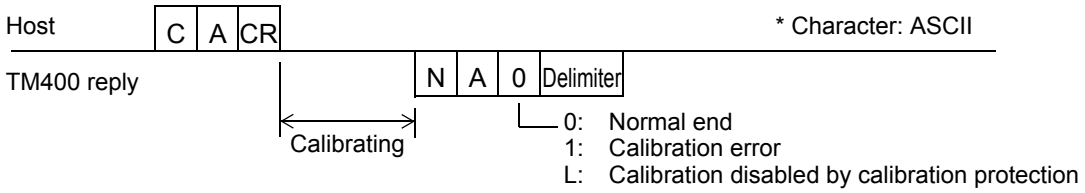
∗ Refer to P.43 "n Setting value communication format" for setting value No.

- Reading setting value

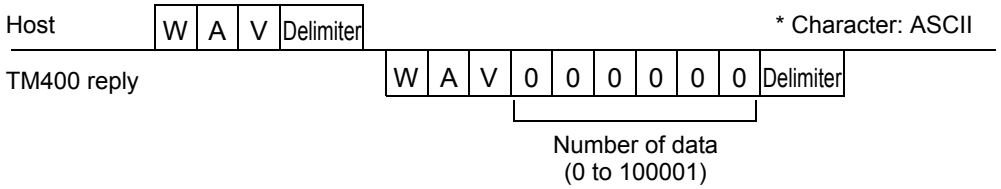


∗ Refer to P.43 "n Setting value communication format" for setting value No.

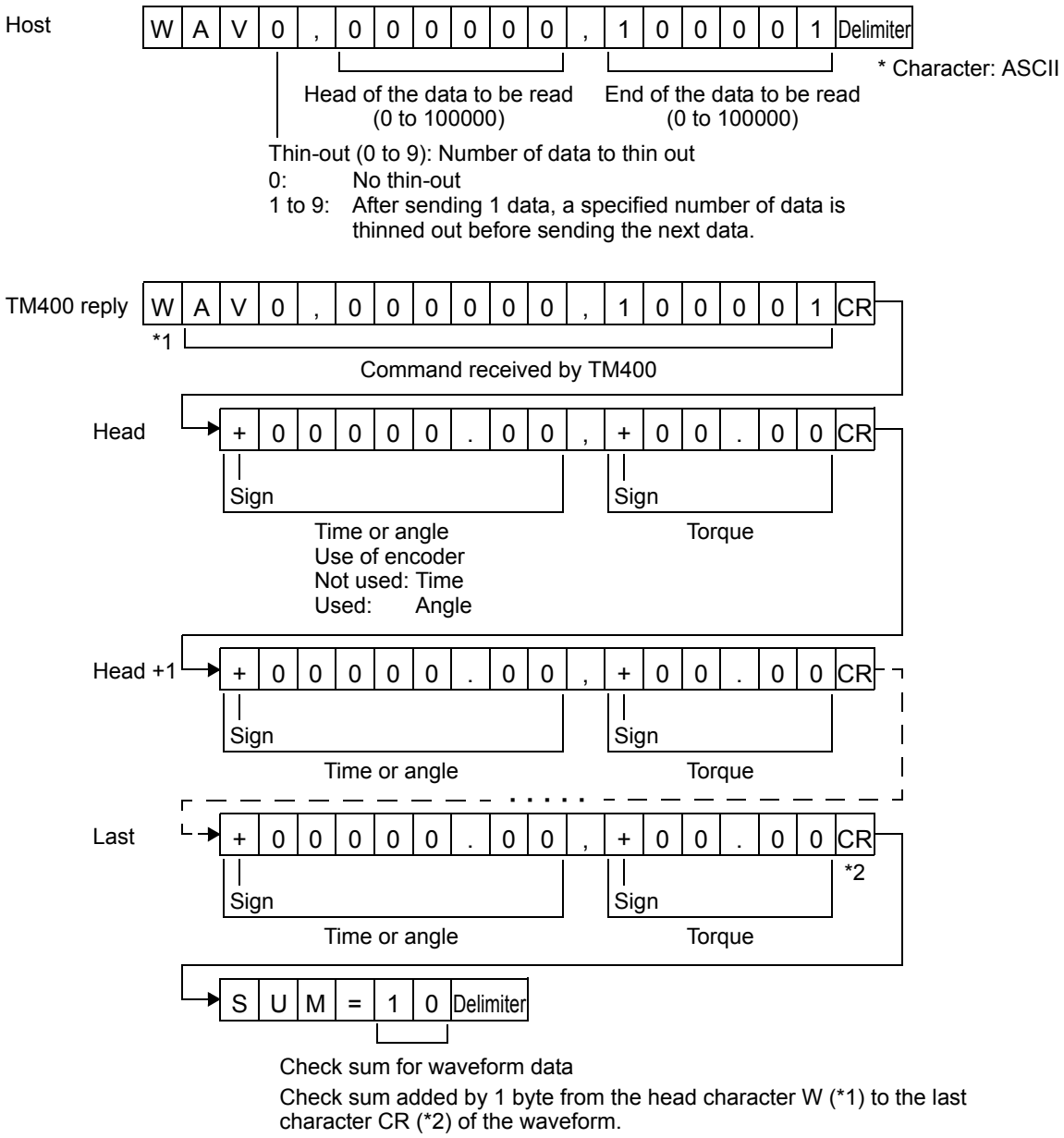
- Zero calibration



- Checking the number of saved waveform data



- Reading saved waveform data

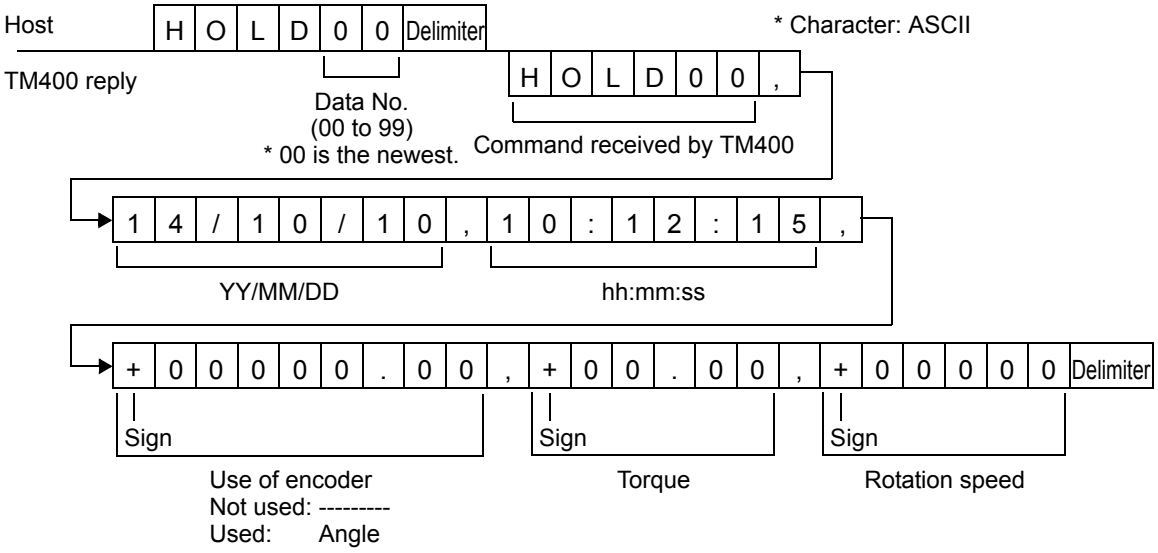


Key points

Depending on the baud rate setting of USB, there will be a limit on amount of data to be read.

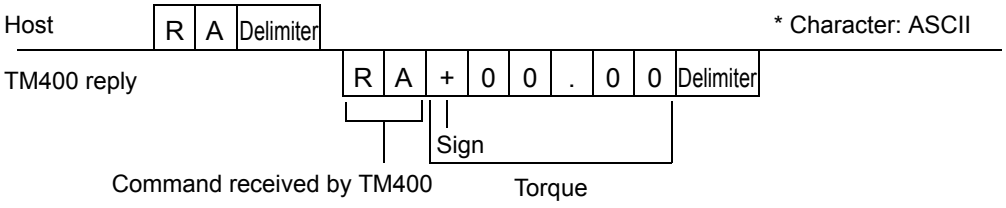
Baud rate (bps)	Number of data
9600	10000
19200	20000
38400	40000
57600	60000
115.2k or more	100000

- Reading hold data

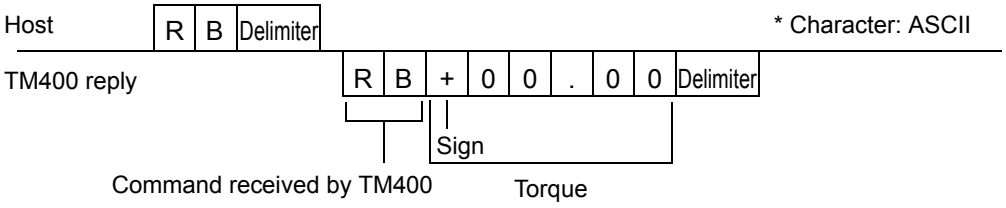


- Reading indicated value

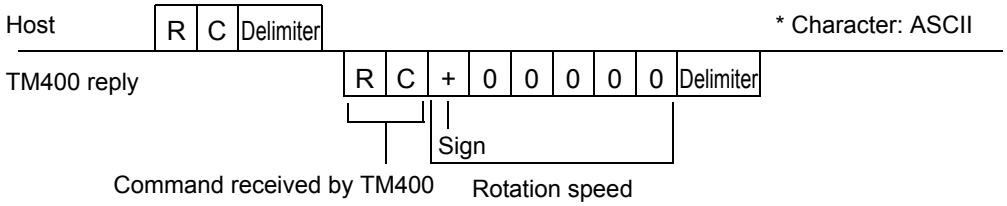
- Reading torque (display value)



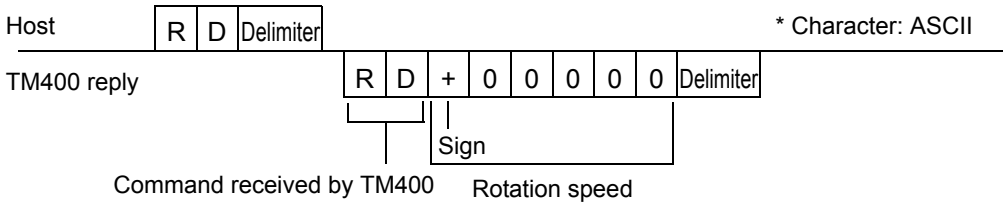
- Reading torque (current value)



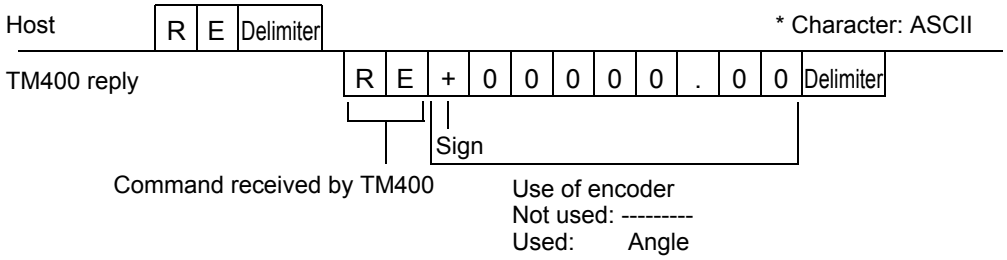
- Reading rotation speed (display value)



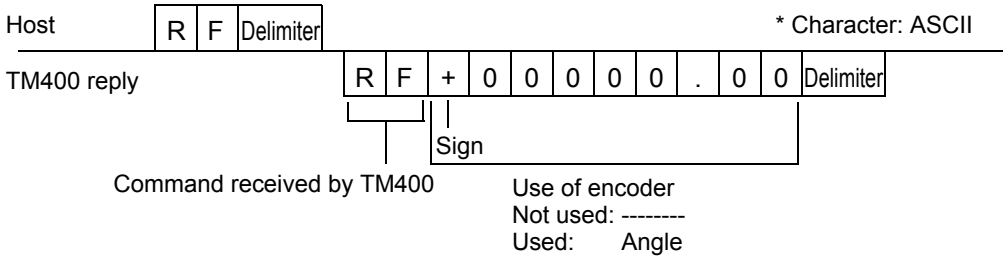
- Reading rotation speed (current value)



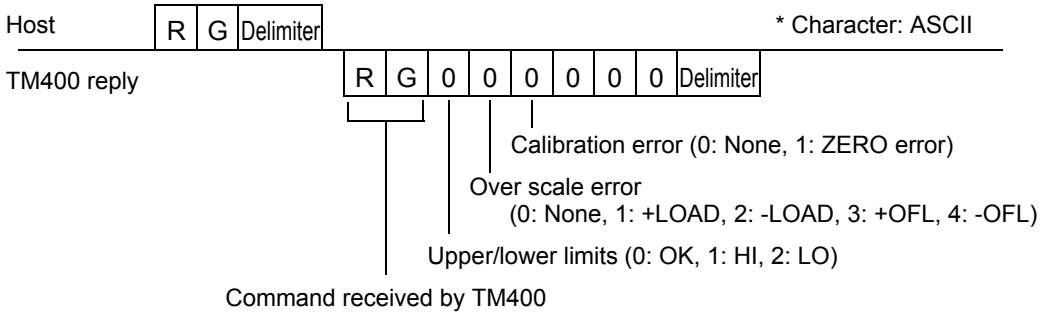
- Reading angle (display value)



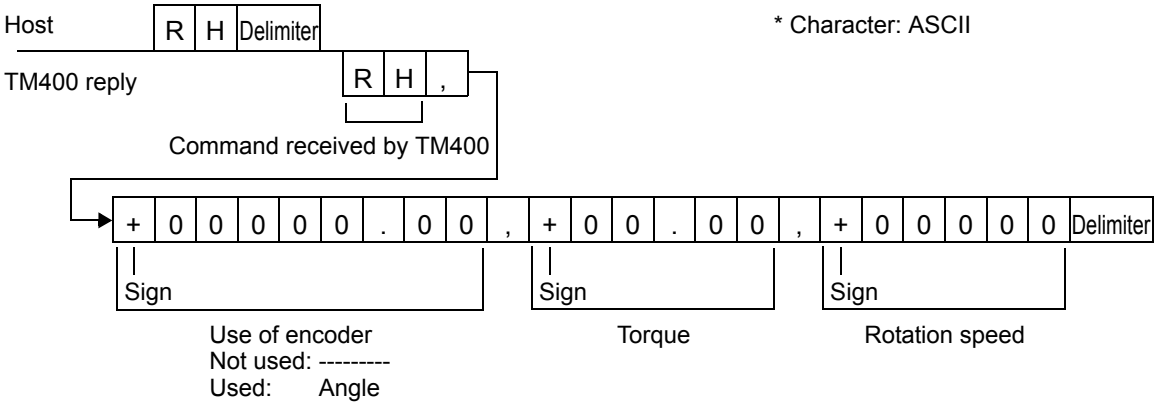
- Reading angle (current value)



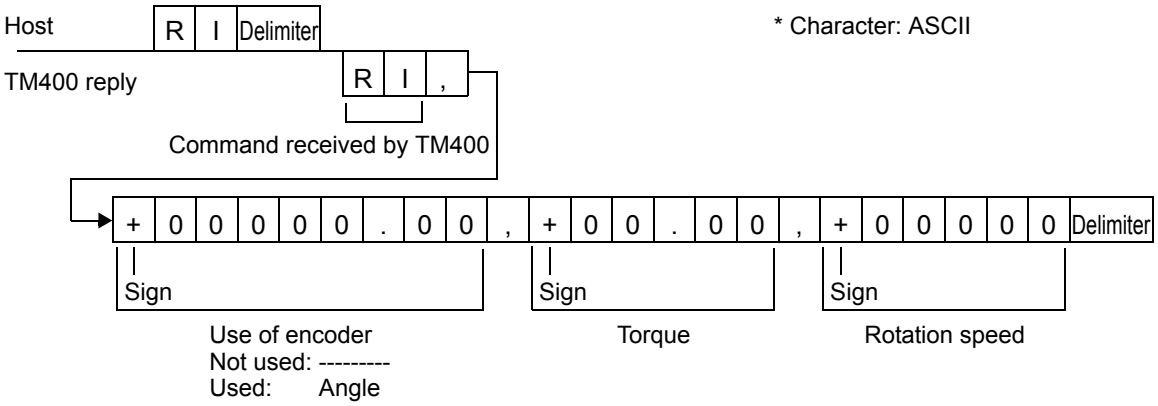
- Reading torque status



- Reading three display values



- Reading three current values



■Setting value communication format

Transmitted data when writing the setting value, return data when reading the setting value.

UTM capacity
W 0 1 0 0 0 0 0 0 0 CR (No writing at Calibration LOCK)

Sign
W 0 2 0 0 0 0 0 0 0 0 CR (No writing at Calibration LOCK)

Minimum scale
W 0 3 0 0 0 0 0 0 0 0 CR (No writing at Calibration LOCK)

Low-pass filter
W 0 4 0 0 0 0 0 0 0 0 CR (No writing at Set value LOCK)

Moving average
W 0 5 0 0 0 0 0 0 CR (No writing at Set value LOCK)

Upper limit
W 0 6 ± 0 0 0 0 CR (No writing at Set value LOCK)

Lower limit
W 0 7 ± 0 0 0 0 CR (No writing at Set value LOCK)

Other capacity *
W 0 8 0 0 0 0 CR (No writing at Calibration LOCK)

Unit *
W 0 9 0 0 0 0 0 0 0 0 CR (No writing at Calibration LOCK)

Decimal point *
W 0 A 0 0 0 0 0 0 0 0 CR (No writing at Calibration LOCK)

Items having * mark are readable/writable when the UTM capacity is set to OTHER

Setting value No. | Sign or 0 | Setting value (Max. 8 digits) | Read: Delimiter

∗ Only input 0 where the setting value is 0.

Unit

W	1	0	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Minimum scale

W	1	1	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

UTM type

W	1	2	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Moving average

W	1	3	0	0	0	0	0	0				CR

(No writing at Set value LOCK)

Quick stop mode

W	1	4	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Encoder pulse

W	2	0	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Unit

W	2	1	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Minimum scale

W	2	2	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Direction

W	2	3	0	0	0	0	0	0	0	0		CR

(No writing at Calibration LOCK)

Moving average

W	2	4	0	0	0	0	0	0				CR

(No writing at Set value LOCK)

Zero clear

W	2	5	0	0	0	0	0					CR

(No writing at Calibration LOCK)

Zero clear from the recording start

W	2	6	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Recording angle mode

W	2	7	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Other pulse *

W	2	8	0	0	0	0	0					CR

(No writing at Calibration LOCK)

Items having * mark are readable/writable when the encoder pulse is set to OTHER

Hold mode

W	3	0	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Start mode

W	3	1	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Start level

W	3	2	±	0	0	0	0					CR

(No writing at Set value LOCK)

Stop level

W	3	3	±	0	0	0	0					CR

(No writing at Set value LOCK)

Plot mode

W	4	0	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Start mode

W	4	1	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Start level

W	4	2	±	0	0	0	0					CR

(No writing at Set value LOCK)

Stop mode

W	4	3	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Maximum recording time

W	4	4	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Pretrigger

W	4	5	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

X-axis start point

W	4	6	±	0								CR

(No writing at Set value LOCK)

X-axis scale

W	4	7	0	0	0	0	0	0	0			CR

(No writing at Set value LOCK)

Y-axis start point

W	4	8	±	0	0	0	0					CR

(No writing at Set value LOCK)

Y-axis scale

W	4	9	0	0	0	0	0	0	0			CR

(No writing at Set value LOCK)

Position of Y-axis start point

W	4	A	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Sign or 0

Read: Delimiter

Setting value No.

Setting value (Max. 8 digits)

∗ Only input 0 where the setting value is 0.

Backlight

W	5	0	0	0	0	0	0	0				CR

(No writing at Set value LOCK)

Power off

W	5	1	0	0	0	0	0	0	0			CR

(No writing at Set value LOCK)

ID

W	5	2	0	0	0	0	0					CR

(No writing at Set value LOCK)

Date

W	5	3	0									CR

(No writing at Set value LOCK)

Time

W	5	4	0	0	0							CR

(No writing at Set value LOCK)

Buzzer

W	5	5	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Calibration protection

W	5	6	0	0	0	0	0	0	0	0		CR

Setting protection

W	5	7	0	0	0	0	0	0	0	0		CR

Visibility

W	5	8	0	0	0	0	0	0	0	0		CR

(No writing at Set value LOCK)

Baudrate

W	6	0	0	0	0	0	0	0	0	0		CR

(Read only)

Data bot

W	6	1	0	0	0	0	0	0	0	0		CR

(Read only)

Stop bit

W	6	2	0	0	0	0	0	0	0	0		CR

(Read only)

Parity bit

W	6	3	0	0	0	0	0	0	0	0		CR

(Read only)

Delimiter

W	6	4	0	0	0	0	0	0	0	0		CR

(Read only)

Sign or 0

Read: Delimiter

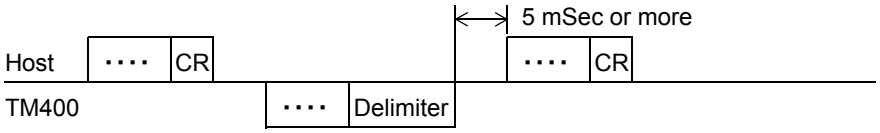
Setting value No.

Setting value (Max. 8 digits)

∗ Only input 0 where the setting value is 0.

Attention

After receiving a response from the TM400, leave an interval of 5 mSec or more before sending the next command from the host.



9 Specifications

9-1. Specifications

■Torque input: Voltage input

Signal input range	-5.0 to 5.0V Input impedance: 1MΩ or over	
Accuracy	Non-linearity: Zero drift: Gain drift:	0.02% FS ± 1 digit or less 0.2mV/°C RTI or less 0.01%/°C or less
Analog filter	Low-pass filter (-6dB/oct.) Select from 10, 30, 100, 300, 1k, 3k, 10k, or 30k Hz	
A/D converter	Speed: Resolution:	20000 times/sec 24 bit (binary) approx. 1/30000 for 5V input

■Rotation speed input: Pulse input (open collector)

Maximum input rotation speed	According to the output frequency of the UTMⅡ series
Minimum input rotation speed	15rpm
Minimum detected pulse range	50μs
Circuit configuration	No-voltage contact input (minus common) Open collector can be connected (Ic = approx. 10mA)

■Encoder input: Pulse input (open collector)

Maximum input frequency	50kHz
Circuit configuration	No-voltage contact input (minus common) Open collector can be connected (Ic = approx. 10mA)

■Display section

Display unit	128x64 dot monochrome LCD (display area 28x57mm)
Display content	Numerical value display (torque, rotation speed, angle) Graph display (torque-time, torque-displacement) Status display (High, Low, OK, Hold)
Status display	Status display 1: A (AC adapter in use)/N (writing NOV RAM)/ B (backup battery error)/P (buffering data for pretrigger)/ R (taking graph) Status display 2: HI/OK/LO/HOLD

■Recording section

Hold data	100 points	
Graph data	20ksps (no thin-out)	5 seconds
	10ksps (Take 1 data from 2 samples)	10 seconds
	5ksps (Take 1 data from 4 samples)	20 seconds
	4ksps (Take 1 data from 5 samples)	40 seconds
	2ksps (Take 1 data from 10 samples)	50 seconds
	1ksps (Take 1 data from 20 samples)	100 seconds

■Hold function

Hold mode:	Sample/Peak/Bottom/Peak to peak/ Average/Peak (angle)
Start mode:	All section/Level

■Clock

Display	Year (last 2 digits of the western calendar year), month, day, hour, minute
Accuracy	One minute per month (room temperature)

■Interface

USB interface

Communication standard	USB Ver.2.0 compliant, full speed (12Mbps) Communication class
Transmission speed	Select from 9600, 19200, 38400, 57600, 115.2k, 230.4k, or 691.2k bps
Connector	mini-B TYPE

■Operation

Power switch	Locker switch	One piece
Setting keys	Membrane keys (SAVE, HOLD, ZERO, ESC, SET, ◄, ►, ▲, ▼)	

■General performance

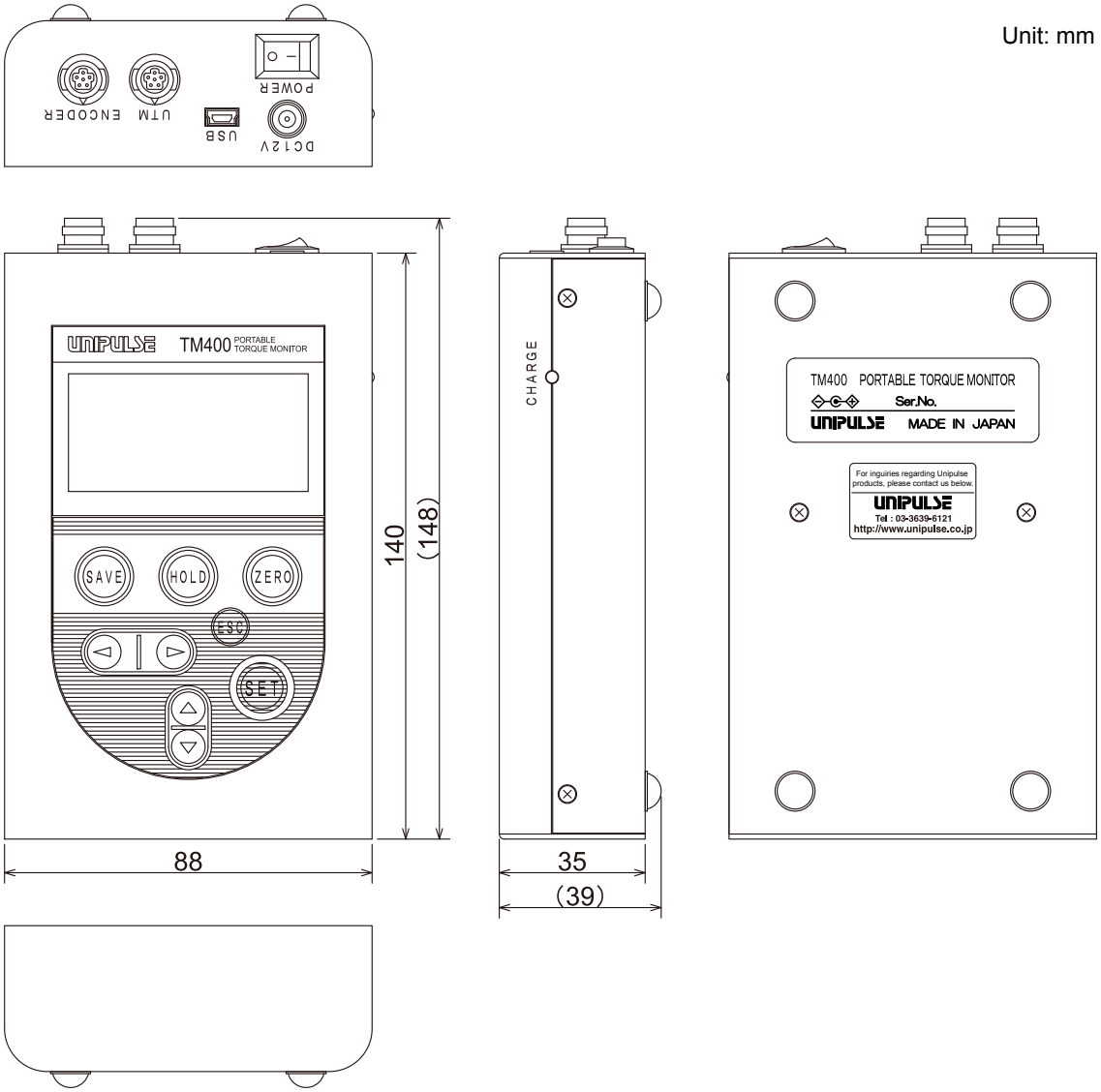
Power supply	Built-in rechargeable battery (lithium ion battery) Duration for continuous use: Five hours AC adapter	
Power consumption	Approx. 7W (with AC adapter) Approx. 34W (while charging)	
Backup power supply	Holds setting values and record data with lithium battery (Warranty period: Five years or more)	
Operating conditions	Temperature:	Operating temperature -10 to +40°C Storage temperature -20 to +60°C
	Humidity:	85%RH or less (no condensation)
Dimensions	88W × 140H × 35D (mm) (not including protruding sections)	
Weight	Approx. 500 g	

■Accessories

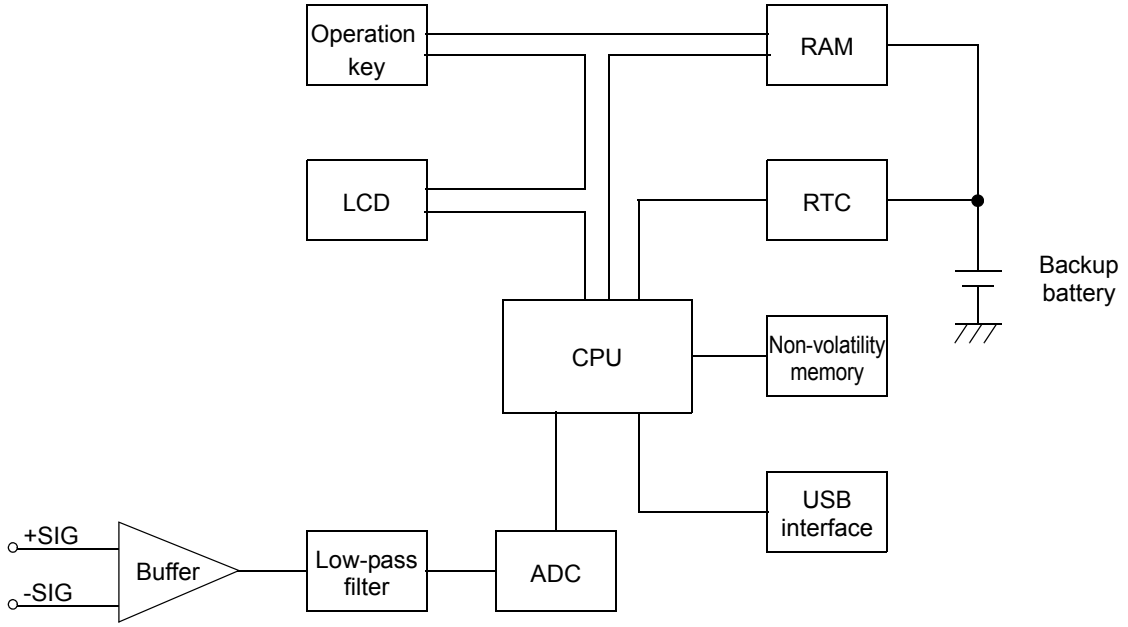
Operation manual 1
Dedicated AC adapter..... 1
Connection cable for UTMⅡ (2m)..... 1
Connection cable for UTMⅡ rotary encoder (2m) 1

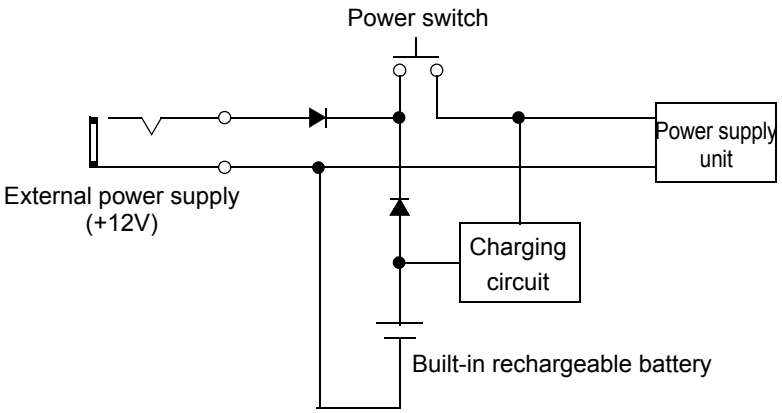
9-2. External dimensions

Unit: mm



9-3. Block diagram





10 Appendices

10-1. List of error displays

■Torque

-LOAD	Signal input range Over by -5V	The input electric signal substantially exceeds the signal input range. This occurs also when an excessive load is applied to the sensor or when the input terminal becomes open circuit due to cable disconnection and so forth.
+LOAD	Signal input range Over by +5V	
OFL1	When below -9999	This occurs when a load greater than the assumed load is applied to the sensor or when calibrating below the measurement range. Check calibration, items to be measured and so on.
OFL2	When over 9999	
ZERO	Zero calibration range over	The signal input range is substantially exceeded when zero calibration is performed. Check to see that there is no excessive load applied to the sensor or disconnection.

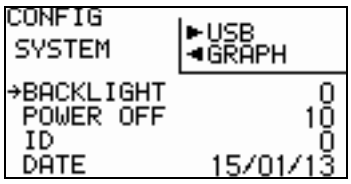
10-2. Memory check/initialize

■Memory check (MEM. CHECK)

Memory check examines the internal memory of the main unit automatically and detects errors.

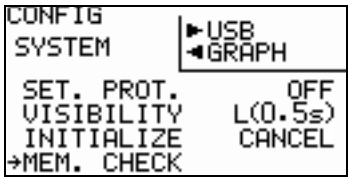
1. Press the (SET) key on the main screen and enter the setting value display screen.

2. Display the "SYSTEM" screen using the (◄) (►) keys.

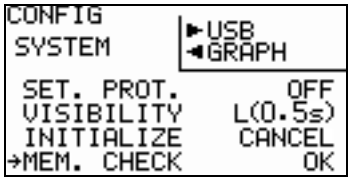


3. Select memory check (MEM. CHECK) using the (▲) (▼) keys.
The arrow (→) moves to the left of selected item.

4. Memory check is performed when the (SET) key is pressed.
It takes a few seconds.



5. The result will be displayed.



■Initialize (INITIALIZE)

This operation rewrites the internal memory contents to the factory default contents.
In this operation, zero calibration, UTM capacity, sign, minimum scale, unit, UTM type, quick stop mode, use of encoder, direction, zero clear, ID, date and time remain unchanged; however, other setting values can be rewritten to the factory default values.

⚠ Precautions
When initialize is performed, recorded data will be also deleted.

10-3.Password (PASSWORD)

This is a setting for maintenance and inspection.
Do not make any changes.

10-4.Troubleshooting

Trouble	Countermeasures
Does not indicate the expected value.	To newly connect a sensor, calibration is required. Use the new sensor after performing calibration.
The power cannot be turned on.	The battery charge may be running out. Connect the dedicated AC adapter included and charge the battery.
The screen fades out automatically.	The TM400 is equipped with a function to enter into the low power consumption mode automatically if it is left without operation (power off). To recover from the low power consumption mode, turn on the power again or press any key. When not using the power off function, set the power off setting to 0 minutes.

10-5. Conformity with EC directives

The TM400 Torque Monitor is a CE-marked EC-Directive-conforming product (by the Council of the European Union).

- Low Voltage Directive EN62311:2008 (test distance: 10cm)
- EMC Directives; EN61326-1
  EN55011
  EN61000-3-2
  EN61000-3-3
  EN61000-4-2
  EN61000-4-3
  EN61000-4-4
  EN61000-4-5
  EN61000-4-6
  EN61000-4-8
  EN61000-4-11

Key point

The AC adapter accompanying as standard complies with CE marking compliance.

⚠ Precautions

Use shielded cables (for encoder, USB and UTM).

Unipulse Corporation

International Sales Department

9-11 Nihonbashi Hisamatsu-cho, Chuo-ku, Tokyo 103-0005
Tel: +81-3-3639-6120 Fax: +81-3-3639-6130

www.unipulse.tokyo/en/

□	Head Office:	9-11 Nihonbashi Hisamatsu-cho, Chuo-ku, Tokyo 103-0005
□	Technical Center:	1-3 Sengendainishi, Koshigaya, Saitama 343-0041
□	Nagoya Sales Office:	TOMITA Bldg. 2-5 Ushijima-cho, Nishi-ku, Nagoya 451-0046
□	Osaka Sales Office:	Sumitomo Seimei Shin Osaka Kita Bldg. 4-1-14 Miyahara, Yodogawa-ku, Osaka 532-0003
□	Hiroshima Sales Office:	Hiroshima Dai-ichi Seimei OS Bldg. 1-2-21 Matoba-cho, Minami-ku, Hiroshima 732-0824