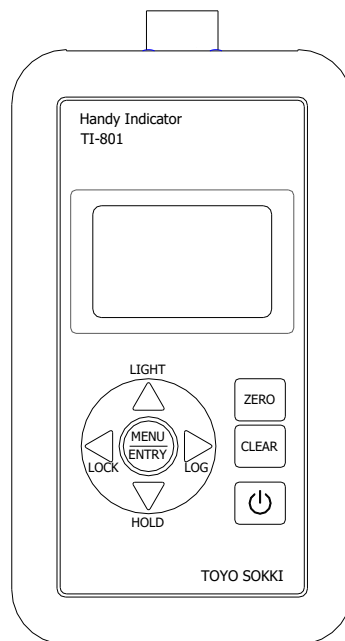




# PORTABLE DIGITAL INDICATOR

MODEL T I – 8 0 1

OPERATION MANUAL



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※This operation manual conforms to program version 1.00 and later.

This document is translated from MA4-00297-R0 (Japanese)

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## § 1. Safety Notice

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Please read this manual carefully to ensure the safety use of this unit.  
Precautions in this chapter help to prevent any injury or damage to the user and other personnel, so please read the following precautions carefully.

Precaution on general

 **WARNING**

- ① **Do not disassemble or modify this unit. Which may cause fire, injury, electric shock, malfunction, etc.**
- ② **Keep liquids away from this unit. Otherwise, it may cause overheating, electric shock, malfunction, etc.**
- ③ **Use a specified power supply. Using an improper power supply may cause overheating, fire, malfunction, etc.**

Precaution on wiring

 **CAUTION**

- ① **Turn power OFF of this unit before wiring.**
- ② **Wire to the terminal correctly and firmly.**

Precaution on installation

 **CAUTION**

**Do not install this unit to the following places.**

- ① **Place where exists direct sunlight.**
- ② **Place where exists condensation.**
- ③ **Place where exists exceeded temperature or humidity of specified value.**
- ④ **Place where exists much dust.**
- ⑤ **Place where exists inflammable gas or inflammable steam.**
- ⑥ **Place where exists an extensive vibration or impact.**
- ⑦ **Place where exists strong electromagnetic fields.**
- ⑧ **Place where exists other expected hazards**

Warranty

This unit is covered by one year warranty from original delivery date against design and manufactural failure under normal and safe use of this unit.

Any repair or exchange has to be paid even during warranty period if the following cases is applied.

- Failure due to wrong usage, disassembly, improper power supply, accident or acts of God.
- Failure due to services or repair by a person other than TOYO staff.

Warranty does not cover an equipment connected to this unit. We are exempted from failure of the connected equipment.

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## § 2. Summary

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This indicator is a portable digital indicator which has a signal input channel from a distortion gauge type transducer. It is handy to maintain and inspect the equipment or facility by using this unit because it is battery powered.

This unit has an analog to digital conversion of two sampling speed. Normal sampling speed makes a measurement certain and stable. High speed sampling suits for observing fast movement of an object.

This unit has various functions such as logging function, hold function, and serial communication function, etc.

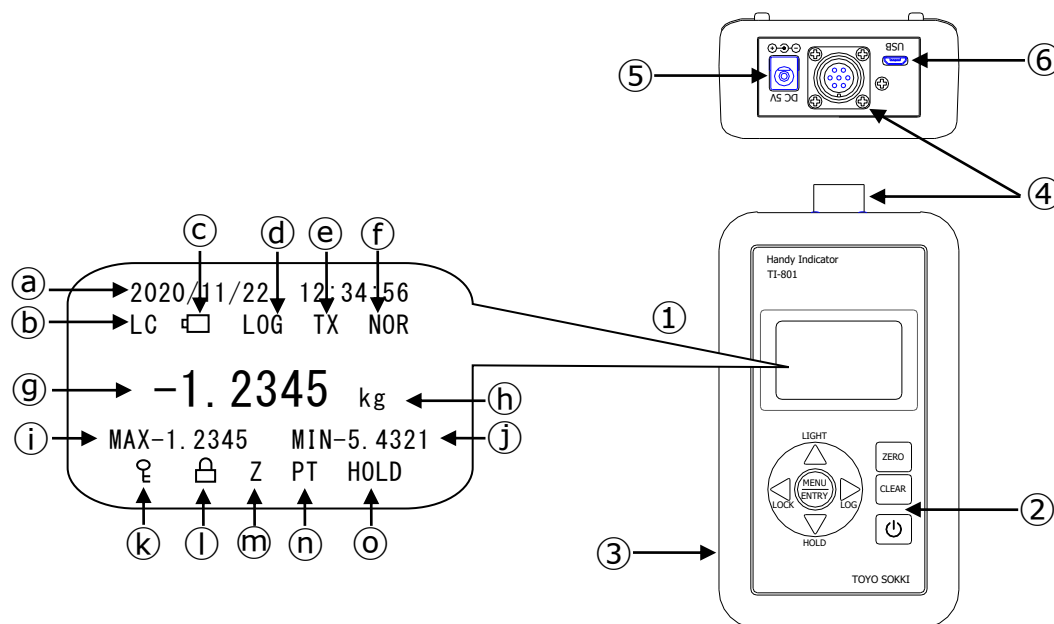
Logging function is helpful for collecting data to conduct experiment and communication function is useful to store and analyze data on computer connected by USB cable.

This unit also has an expanded function to measure a distortion rate using a bridge box which is sold separately.

The power is supplied by three AA alkaline batteries (LR6x3) or AC adaptor which is sold separately.

### § 3. Appearance and Each part name

Appearance of the unit



#### ① LCD with back light

Place	Indicator	Content
①	2020/11/22 12:34:56	Date and Time YYYY/MM/DD hh:mm:ss
②	LC	Load Cell measurement
	SG	Distortion measurement
	HM	Hum Check measurement
③	☐	Battery remain amount
④	LOG	Turn on when logging is prepared. Blink during logging.
⑤	TX	Blink during transmitting data
⑥	NOR	Normal sampling speed. 8 times/second
	FST	Fast sampling speed. 1,000 times/second
⑦	-1.2345	Measured value
⑧	kg	Unit
⑨	MAX	Peak Hold value
⑩	MIN	Bottom Hold value
⑪	☒	Key Locked
⑫	☒	Calibration Locked
⑬	Z	During Tare Subtraction or Net Calculation
⑭	PT	The value of Preset Tare Subtraction has been set
	PN	The value of Net Calculation has been set
⑮	HOLD	During Hold operation

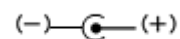
② Key switches

Key	Measuring Mode	Function Mode
⏻	Power ON/OFF	
ZERO	Perform Tare subtraction	–
CLEAR	Cancel Tare subtraction	Cancel the setting or Leave Function Mode
LIGHT/▲	Turn LCD back light ON/OFF	Increase the value of the selected digit Select a candidate upward
HOLD/▼	Start/Stop Hold operation	Decrease the value of the selected digit Select a candidate downward
LOCK/◀	Lock/Unlock keys	Select the digit toward left
LOG/▶	Start/Stop logging	Select the digit toward right
MENU/ENTRY	Enter Function Mode	Memorize the setting

③ Silicon cover

④ Connector to Load Cell or Sensor

⑤ DC+5V input terminal for external AC adaptor (sold separately)



⑥ micro USB type B terminal

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## § 4. Function & Operation

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### 4 – 1) Measuring Mode

There are three measurements as the followings

1. Load Cell (LC) measurement
2. Distortion (SG) measurement
3. Hum Check (HM) measurement

Each measurement is selected at [Meas.config / Sensor].

Many functions described below are common to above three measurements, but some of them are restricted to one or two of measurements.

#### 1) LCD back light

Back light is turned ON/OFF each time when **[LIGHT]** key is pushed.

Time period to turn ON the back light is selected at [General config / LCD light] in Function Mode.

This function is common to three measurements.

#### 2) Auto Power OFF

Turn power OFF automatically after a time period starting from the last key operation.

A time period is selected at [General config / Power OFF] in Function Mode.

This function is common to three measurements.

#### 3) Battery remaining amount

Battery remaining amount is indicated by three phases.

■ more than 50%      ▣ more than 15%      □ less than 15%

It is recommended to use an AC adaptor when logging data because the battery will be consumed quickly.

When the battery remaining amount becomes less than 15%, change to three new batteries at the same time as soon as possible.

This function is common to three measurements.

※Indicator is a rough estimate because battery remaining amount will depend on battery type and surrounding temperature.

#### 4) Over Load

This is a function of alert for over-loading of Load Cell. The measured value blinks to inform that it exceeds the preset rated capacity of Load Cell, which set at [Meas.config / Capacity] in Function Mode. Tare subtraction cannot be done during over-loaded.

This function is restricted to Load Cell measurement.

#### 5) Tare Subtraction

When pushing **[ZERO]** key for 1 second, perform Tare subtraction. 'Z' will be indicated on LCD during Tare subtraction.

When pushing **[CLEAR]** key for 1 second, clear Tare subtraction.

Tare value is memorized even after powered OFF.

Tare subtraction cannot be done when over-loaded.

This function is restricted to Load Cell measurement and Distortion measurement. Tare value is cleared when the measurement is changed.

#### 6) Preset Tare Subtraction

This function is used for an object that have a known container weight (Tare value) beforehand. Select a candidate [Pre-Tare] at [General config / Tare Sel] in Function Mode.

Set the numeric value at [General config / Pre-Tare] in Function Mode. Setting range is -99999 to +99999.

When the value other than 0 is set, 'PT' will be indicated on LCD and Tare value is subtracted from the measured value afterwards.

This function is restricted to Load Cell measurement.

Please choose one either Preset Tare Subtraction or Net Calculation

#### 7) Net Calculation

This function is used for an object that have a known content amount (Net value) beforehand. Select a candidate [Pre-Net] at [General config / Tare Sel] in Function Mode.

Set the numeric value at [General config / Pre-Tare] in Function Mode. Setting range is -99999 to +99999.

When the value other than 0 is set, 'PN' will be indicated on LCD.

When pushing **ZERO** key in Measuring Mode, 'Z' will be indicated on LCD and the measured value is set to the preset Net value. Increase / decrease amount is displayed from that moment. Memorize the value of subtracting Net value from the measured value.

This function is restricted to Load Cell measurement.

Please choose one either Preset Tare Subtraction or Net Calculation

#### 8) Hold

Set Hold function ON at [General config / Hold] in Function Mode beforehand. Push **HOLD** key to start/stop Hold operation.

Display maximum value (Peak Hold) and minimum value (Bottom Hold) during Hold operation.

The measured value is not hold during Hold operation.

'HOLD' is indicated on LCD during Hold operation. 'HOLD' is disappeared when stopping Hold operation, but maximum value and minimum value are still displayed until next Hold operation.

This function is restricted to Load Cell measurement and Distortion measurement.

#### 9) A/D sampling speed

Select sampling speed [Normal] or [Fast] at [Meas.config / A/D Sampling] in Function Mode.

Fast sampling suits for observing fast movement of an object but makes the measured value fluctuate more than normal sampling.

Normal sampling : 8 times / second

Fast sampling : 1,000 times / second

This function is restricted to Load Cell measurement and Distortion measurement.

#### 10) Digital Filter

Select the number of times of moving average at [Meas.config / Digital Filter] in Function Mode.

The selective number of normal sampling is different from fast sampling.

When it is set larger, the measured value becomes more stable.

This function is restricted to Load Cell measurement and Distortion measurement.

#### 11) Key Lock

This function is to prevent wrong operation.

Push **LOCK** key for 1 second to lock / unlock keys. 'L' is indicated on LCD and any key is not accepted other than **LOCK** key and **ON** key during key locked status.

This function is common to three measurements.

#### 12) Cal Lock

This function prevents to change the span calibrated value from wrong operation.

Select [Lock] at [Protect / Cal Lock] in Function Mode. 'L' is indicated on LCD and span calibration cannot be done but zero calibration is accepted.

This function is common to three measurements.



#### 4 – 2) Logging data

When logging data, data are memorized to a non-volatile internal memory. Data are not vanished even after powered OFF.

Non-volatile memory can store only one dose of data from start to stop of logging. Each time to start logging, data can be overwritten to the oldest data.

When logging multiple times, a dose of data should be transferred and saved to an external computer each time at the end of logging.


Storable data in internal memory are

Normal sampling : 4,000 data of date/time and the measured value

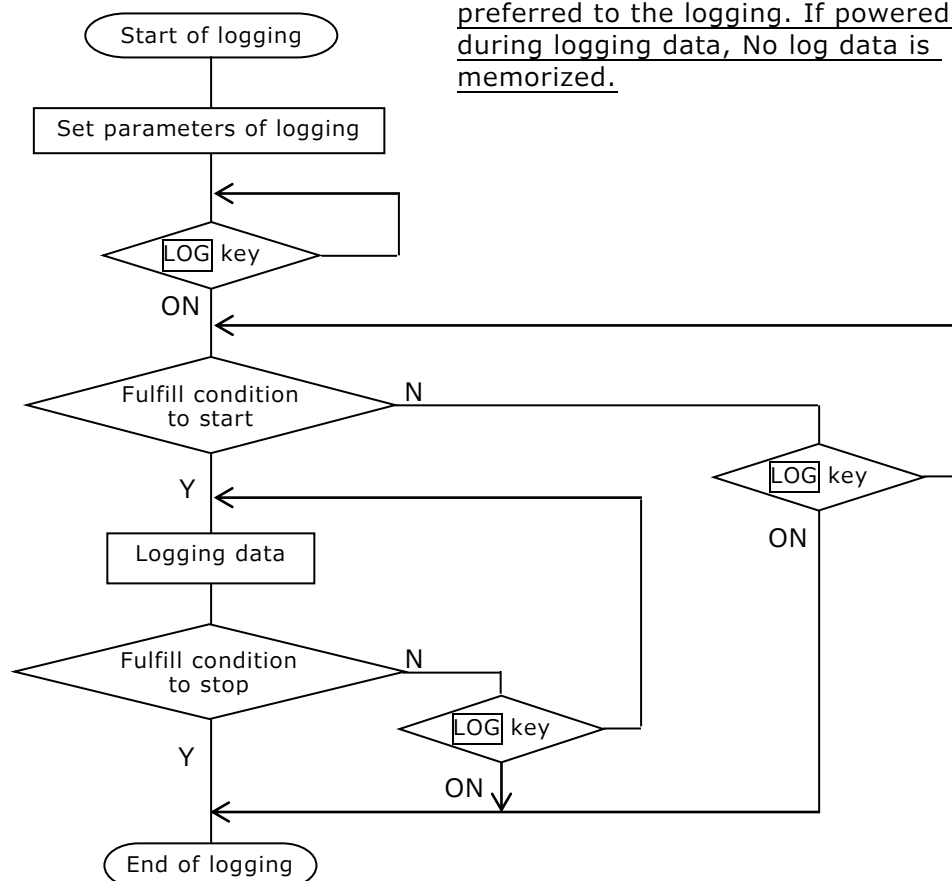
Fast sampling : date/time of start logging, 10,000 data of the measured values, date/time of stop logging

※When logging data, battery will be consumed quickly. It will be out of battery on the way if logging longer hours or the reserved time of logging is set. It is recommended to use an AC adaptor (sold separately) in that case.


※If the reserved start time is set, don't turn power OFF and keep this unit stand by ('Power Saved' is displayed). Because this unit cannot be powered ON automatically on the reserved time.

※If  key is pushed or battery runs out during logging data, No log data is memorized.

※Auto power OFF should be OFF because it is preferred to the logging. If powered OFF during logging data, No log data is memorized.



#### 1) Start / Stop logging

- ① [Manual] : Start when  key is pushed
- ② [Above Trigger] : Start/Stop when the measured value go above the start level
- ③ [Below Trigger] : Start/Stop when the measured value go below the stop level
- ④ [Timer] : Start/Stop at the reserved time
- ⑤ [Times] : Stop when the number of logging data reaches to the preset value

When **LOG** key is pushed during logging data, logging is forced to stop regardless of condition to stop.

When the number of data reaches to the maximum capacity, 4,000 data in normal sampling or 10,000 data in fast sampling, logging is forced to stop except the condition of [Repeat].

## 2) Logging interval

Set the interval of logging data in a unit of second.

Setting range is 0 to 9999 second (2hours 46minutes 39seconds).

If setting value is 0, interval becomes sampling period, as 8 data/second in normal sampling, or 1,000 data/second in fast sampling.

## 3) The number of logging times

Set the number of logging times to stop.

Setting range is 0 to 9999 times or select [Repeat].

If setting value is 0, the number of logging times becomes 4,000 times in normal sampling or 10,000 times in fast sampling.

If setting value is more than 4,000 in normal sampling, logging is stopped at 4,000 times.

If select [Repeat], data exceeded the maximum number will be over-written to the oldest data until stop.

## 4) Start / Stop level

Set the threshold value to start / stop logging. It compares to the measured value when [Above Trigger] or [Below Trigger] is selected at [Logging Set / Log Start Or Log Stop].

① [Start Level] : Start logging when the measured value go above/below the start level

② [Stop Level] : Stop logging when the measured value go above/below the stop level

## 5) Timer reservation to start / stop logging

Start/Stop logging when an internal clock will be at the reserved time.

If time difference between the present time and the reserved time is more than 3 minutes, 'Power Saved' is displayed on LCD. Power applied to Load Cell will be cut and current consumption will be minimized at power saved status.

※When the reserved start time is set, keep this unit to be powered ON. This unit cannot be powered ON automatically on the reserved time.

If the start time of logging lag behind the time of inner clock, start logging immediately.

If the stop time of logging lag behind the time of inner clock, log only one data and stop logging. Please set the correct start / stop time of logging.

## 6) Confirmation of log data

### ① Display log data

Select [ON] at [General config / Log Disp] in Function Mode to display log data.

Push **▲** or **▼** key to scroll the log data.

Push **CLEAR** key to return to Measuring Mode.

### ② Transmit log data to an external equipment

Transmit whole log data by serial communication.

Select [ON] at [Communication / Serial Comm. / LIST] in Function Mode to transmit log data.

Any key other than **U** key is not accepted until whole log data have been transmitted.

Format of transmitting data depends on normal / fast sampling, please refer to section 4-3).

## 4 – 3) Serial communication

This unit can transmit data or receive command to / from an external equipment through serial communication on micro USB terminal.

### ① UART (Universal Asynchronous Receiver/Transmitter) operation

- [OFF] : Stop serial communication
- [Stream] : Keep transmitting the measured value. Effective in normal sampling. No data transmitted in fast sampling.
- [Command] : Receive a command from an external equipment and this unit will transmit an allocated response.
- [List] : Select [ON] to transmit list of log data. Any key other than  key is not accepted until whole logging data have been transmitted.

② Communication Protocol

Data length: 7bit, Parity: Even, Stop bit: 2 bit, Baud rate: 38,400 bps

③ Data Format (ASCII code)

Example of Stream data format

Measured value	Data bit											
	1	2	3	4	5	6	7	8	9	10	11	12
Non decimal point	W	T	,	±	0	1	2	3	4	5	CR	LF
With decimal point	W	T	,	±	1	2	3	4	.	5	CR	LF
When over loaded	O	L	,	±	9	9	9	9	.	9	CR	LF

Example of List of log data format

	Data bit											
	1	2	3	4	5	6	7	8	9	10	11	12
List of log data of normal sampling  (date/time and measured value)	Y	Y	Y	Y	/	M	M	/	D	D	,	h
	13	14	15	16	17	18	19	20	21	22	23	24
	h	:	m	m	:	s	s	,	W	T	,	±
	25	26	27	28	29	30	31	32				
	0	1	2	3	4	5	CR	LF				
List of log data of fast sampling  (start date/time. all measured values, stop date/time)	Y	Y	Y	Y	/	M	M	/	D	D	,	h
	13	14	15	16	17	18	19	20	21			
	h	:	m	m	:	s	s	CR	LF			
	1	2	3	4	5	6	7	8	9	10	11	12
	W	T	,	±	0	1	2	3	4	5	CR	LF
	1	2	3	4	5	6	7	8	9	10	11	12
	Y	Y	Y	Y	/	M	M	/	D	D	,	h
	13	14	15	16	17	18	19	20	21			
	h	:	m	m	:	s	s	CR	LF			

YYYY=Year, MM=Month, DD=Date, hh=Hour, mm=Minute, ss=Second

④ Command from an external equipment

Command	Response	Function
REQ	WT,±#####	Request for the measured value
DAZ	DAZ	Tare subtraction
AZR	AZR	Clear Tare subtraction
PTR	PTR, ±#####	Request for the preset Tare/Net value
PTR,±#####	PTR,±#####	Set the preset Tare/Net value
LOG	refer to ③ above	Request for list of log data

Error code	Content	Remarks
ERR-01	Memory error Writing error	Writing failure to non-volatile memory, etc.
ERR-02	Non implementation	Tare subtraction during over load, etc.
ERR-03	Format abnormality	Undefined command, Parity error, etc.

Attach a terminator, CR(0DH), LF(0AH) to the last of each command and response.  
#####: Decimal point is attached as response of REQ command. Forbid decimal point when setting value as PTR command.

#### 4 – 4) Distortion measurement

This unit has an expanded function to measure a distortion rate using a bridge box which is sold separately.

Select [Strain Gage] at [Meas.config / Sensor] in Function Mode.

Gauge rate is fixed to 2. ( $1\text{mV/V} = 2,000\mu\epsilon$ )

Measurement parameters are set as Unit =  $\mu\epsilon$  ( $10^{-6}\epsilon$ ), Decimal point = 0, Division = 1.

There is a One Gauge linearity correction function. Select [ON] at [Meas.config / 1G Linearity] in Function Mode. Correction formula =  $\epsilon / (1 - \epsilon)$   $\epsilon$ : distortion rate

#### 4 – 5) HUM noise check

This function is able to measure the relative noise level originated from commercial power source (Hum noise 50/60Hz), which affects Load Cell under measurement.

Select [HUM Check] at [Meas.config / Sensor] in Function Mode.

The measured noise value is peak to peak level and a unit is  $\mu\text{V}$ .

Measurement conditions are as follows,

- ① This unit must be battery powered

If powered by AC adaptor or USB cable is connected to other equipment, this unit cannot measure hum noise correctly because of incoming noise from them.

- ② Nothing is placed on Load Cell.

- ③ A/D sampling is fixed to fast sampling.

※The measured hum noise value is rough value not precise level.

#### 4 – 6) Function setting

Various functions are implemented in Function Mode.

Push **ENTRY** key for 1 second to enter Function Mode.

Please refer to section §6. Function Mode.

#### 4 – 7) Test Mode

This is a function to confirm the operation of this unit. The response of indication and external input / output signal in Test Mode is different from Measuring Mode. Please take measures for a connected external equipment to keep it from abnormality.

Enter Test Mode by pushing **ENTRY** key while turning power ON or pushing [ON] 3 times at [Protect / Test] in the Function Mode.

## § 5. Calibration

As for the calibration method, there are two kinds of calibration, as [Equivalent Input Calibration] which input the equivalent output voltage of Load Cell by key operation, and as [Actual Load Calibration] which use a reference weight as an actual load. Calibration can be done by either method but it will be operated by the last calibration. Recommend to calibrate by an actual load as much as possible.

### 5 – 1) Cancel Calibration Lock

There is a calibration lock function to keep the calibrated value secure from wrong operation. '🔒' is indicated on LCD during calibration locked. But zero point calibration can be done. Please cancel a calibration locked status prior to operate calibration. Calibration lock function is set in Function Mode.

	Function Mode	Example of setting	Operation
1	Category Select (※) Protect	Protect	Select [Protect] by using ▲ or ▼ key Push [ENTRY] key to enter Protect category
2	Protect Cal Lock Test	Cal Lock	Select [Cal Lock] by using ▲ or ▼ key Push [ENTRY] key to proceed to Cal Lock menu
3	CAL Lock Unlock Lock	Unlock	Select [Unlock] by using ▲ or ▼ key Push [ENTRY] key to memorize

※abbreviated other categories / sub menus / candidates

### 5 – 2) Preparation prior to calibration

	Function Mode	Example of setting	Operation
1	Category Select (※) Meas.config	Meas.config	Select [Meas.config] by using ▲ or ▼ key Push [ENTRY] key to enter Meas.config category
2	Meas.config (※) Unit	Unit	Select [Unit] by using ▲ or ▼ key Push [ENTRY] key to proceed to Unit menu
3	Unit (※) g kg	kg	Select [kg] by using ▲ or ▼ key Push [ENTRY] key to memorize
4	Meas.config (※) Decimal Point	Decimal Point	Select [Decimal Point] by using ▲ or ▼ key Push [ENTRY] key to proceed to Decimal Point menu
5	Decimal Point (※) 0 0.0	0	Select [0] by using ▲ or ▼ key Push [ENTRY] key to memorize
6	Meas.config (※) Division	Division	Select [Division] by using ▲ or ▼ key Push [ENTRY] key to proceed to Division menu
7	Division (※) 1 2	1	Select [1] by using ▲ or ▼ key Push [ENTRY] key to memorize
8	Meas.config (※) Capacity	Capacity	Select [Capacity] by using ▲ or ▼ key Push [ENTRY] key to proceed to Capacity menu
9	Capacity 99999 kg	99999	Select the digit by using ◀ or ▶ key Increase/Decrease the selected digit by using ▲ or ▼ key to set the rated capacity of Load Cell Push [ENTRY] key to memorize
10	Meas.config (※) Digital Filter	Digital Filter	Select [Digital Filter] by using ▲ or ▼ key Push [ENTRY] key to proceed to Digital Filter menu
11	Digital.Filter (NOR) (※) 1 2	4	Select [4] by using ▲ or ▼ key Push [ENTRY] key to memorize Candidates are different from fast sampling

※abbreviated other categories / sub menus / candidates

5 – 3) Calibration by actual load

	Function Mode	Example of setting	Operation
1	Category Select (※) Calibration	Calibration	Select [Calibration] by using ▲ or ▼ key Push <b>ENTRY</b> key to enter Calibration category
2	Calibration (※) Cal Zero	Cal Zero	Select [Cal Zero] by using ▲ or ▼ key Push <b>ENTRY</b> key to proceed to Cal Zero menu
3	Cal Zero 00000 kg	0 (fixed)	Place no load on Load Cell Push <b>ENTRY</b> key to calibrate zero
4	Calibration (※) Cal Span	Cal Span	Select [Cal Span] by using ▲ or ▼ key Push <b>ENTRY</b> key to proceed to Cal Span menu
5	Cal Span 10000 kg	10000	Place a reference weight on Load Cell Select the digit by using ◀ or ▶ key Increase/Decrease the selected digit by using ▲ or ▼ key to set the weight value Push <b>ENTRY</b> key to calibrate span amount

※abbreviated other categories / sub menus / candidates

5 – 4) Calibration by equivalent input

	Function Mode	Example of setting	Operation
1	Category Select (※) Calibration	Calibration	Select [Calibration] by using ▲ or ▼ key Push <b>ENTRY</b> key to enter Calibration category
2	Calibration (※) E.Zr.Adj	E.Zr.Adj	Select [E.Zr.Adj] by using ▲ or ▼ key Push <b>ENTRY</b> key to proceed to E.Zr.Adj menu
3	E.Zr.Adj 0.0000 mV/V	0.0000	Select the digit by using ◀ or ▶ key Increase/Decrease the selected digit by using ▲ or ▼ key to set zero voltage (mV/V) of Load Cell Push <b>ENTRY</b> key to calibrate equivalent zero
4	Calibration (※) E.Span	E.Span	Select [E.Span] by using ▲ or ▼ key Push <b>ENTRY</b> key to proceed to E.Span menu
5	E.Span 10000 kg	10000	Select the digit by using ◀ or ▶ key Increase/Decrease the selected digit by using ▲ or ▼ key to set the display value of span amount Push <b>ENTRY</b> key to memorize
6	Calibration (※) E.Sp.Adj	E.Sp.Adj	Select [E.Sp.Adj] by using ▲ or ▼ key Push <b>ENTRY</b> key to proceed to E.Sp.Adj menu
7	E.Sp.Adj 1.0000 mV/V	1.0000	Select the digit by using ◀ or ▶ key Increase/Decrease the selected digit by using ▲ or ▼ key to set span voltage (mV/V) of Load Cell Push <b>ENTRY</b> key to calibrate equivalent span

※abbreviated other categories / sub menus / candidates

## § 6. Function Mode

### 6 – 1) How to operate

- ① Enter Function Mode by pushing **MENU/ENTRY** key for 1 second.
- ② Select categories or menus by using **▲** or **▼** key.
- ③ Push **ENTRY** key to determine
- ④ When setting a numerical value, select the digit by using **◀** or **▶** key and increase /decrease the value by **▲** or **▼** key.
- ⑤ Select the value or candidate by using **▲** or **▼** key.
- ⑥ When completed the setting, memorize by pushing **ENTRY** key.
- ⑦ To cancel the setting or leave Function Mode, push **CLEAR** key.
- ⑧ Back to Measuring Mode automatically without key operation for 3 minutes.

### 6 – 2) Function Table

<b>1 General config</b>				
	Function Mode	Content	Setting value /candidates	Operation
1	Pre-Tare	Preset Tare value	-99999 to +99999	Set numerical value (0 at the time of shipment)
2	Tare Sel	Select pre-Tare /pre-Net	Pre-Tare	Preset Tare Subtraction (at the time of shipment)
			Pre-Net	NET Calculation
3	Hold	Hold operation	OFF	Hold OFF (at the time of shipment)
			ON	Hold ON
4	Buzzer	Buzzer	OFF	Buzzer disabled
			ON	Buzzer enabled (at the time of shipment)
5	LCD light	Time period of turning LCD Back light ON	1min.	Lighted ON for 1 minutes
			2min.	Lighted ON for 2 minutes
			5min	Lighted ON for 5 minute (at the time of shipment)
			10min.	Lighted ON for 10 minutes
			Always	Lighted ON always
6	Power OFF	Time period of auto power OFF	10min.	After 10minutes
			30min.	After 30minutes (at the time of shipment)
			60min.	After 60minutes
			Non	No auto power OFF
7	DATE	Date/time of inner clock	YY/MM/DD hh:mm:ss	YY=Year, MM=Month, DD=Date hh=Hour, mm=Minute, ss=Second (Japan standard time is set at the time of shipment)
8	Log Disp	Display log data	OFF	Do not display log data (at the time of shipment)
			ON	Display log data

<b>2 Logging Set</b>				
	Function Mode	Content	Setting value /candidates	Operation
1	Log Start	Select the method to start logging	OFF	Logging disabled (at the time of shipment)
			Manual	Start logging by <b>LOG</b> key
			Above Trigger	Start logging when the measured value go above the start level
			Below Trigger	Start logging when the measured value go below the start level

			Timer	Start logging at the reserved time
2	Log Stop	Select the method to stop logging	Times	Stop logging at the preset number of times (at the time of shipment)
			Above Trigger	Stop logging when the measured value go above the stop level
			Below Trigger	Stop logging when the measured value go below the stop level
			Timer	Stop logging at the reserved time
3	Log Interval	Interval of logging	0 to 9999 sec	Set numerical value Setting 0 operates as follows 8 data/sec. in normal sampling 1,000 data/sec. in fast sampling (0 at the time of shipment)
4	Log Times	The number of times of logging	0 to 9999 times	Set numerical value Setting 0 operates as follows 4,000 times in normal sampling 10,000 times in fast sampling (0 at the time of shipment)
			Repeat	Data will be over-written to the oldest data repeatedly
5	Start Level	Threshold level to start trigger	±99999	Set numerical value (+99999 at the time of shipment)
6	Stop Level	Threshold level to stop trigger	±99999	Set numerical value (+99999 at the time of shipment)
7	Start Time	Reserved time to start logging	YY/MM/DD hh:mm	YY=Year, MM=Month, DD=Date hh=Hour, mm=Minute (21/01/01 00:00 at the time of shipment)
8	Stop Time	Reserved time to stop logging	YY/MM/DD hh:mm	

3 Communication				
	Function Mode	Content	Setting candidates	Operation
1	Serial Comm.	Setting serial communication	OFF	Disabled (at the time of shipment)
			Stream	Transmit data only
			Command	Receive command and Transmit data
			List	When selecting [ON], transmit whole log data

4 Meas.config				
	Function Mode	Content	Setting value /candidates	Operation
1	Sensor	Connected sensor type	Load Cell	Load Cell measurement (at the time of shipment)
			Strain Gage	Distortion measurement
			HUM Check	HUM check measurement
2	1G Linearity	One Gauge linearity correction	OFF	Disabled (at the time of shipment)
			ON	Enabled
3	A/D Sampling	Sampling speed	Normal	Normal speed sampling (at the time of shipment)
			Fast	Fast speed sampling
4	Unit	Unit of the measured value	g	gram
			kg	kilogram (at the time of shipment)
			t	ton



			N	Newton
			kN	kilo Newton
			N·m	Newton·meter
			kN·m	kilo Newton·meter
			Pa	Pascal
			kPa	kilo Pascal
			MPa	Mega Pascal
			gf	gram force
			kgf	kilogram force
			tf	ton force
			mm	millimeter
			%	Percentage
			mV/V	millivolt per volt
			$\mu\epsilon$	micro strain
			(None)	No unit
5	Decimal Point	Decimal point position	0	No decimal point (at the time of shipment)
			0.0	1 digit after decimal point
			0.00	2 digit after decimal point
			0.000	3 digit after decimal point
			0.0000	4 digit after decimal point
6	Division	Minimum division of the measured value	1	Minimum division 1 (at the time of shipment)
			2	Minimum division 2
			5	Minimum division 5
			10	Minimum division 10
			20	Minimum division 20
			50	Minimum division 50
			100	Minimum division 100
7	Capacity	Rated capacity of Load Cell	0 to +99999	Set numerical value (99999 at the time of shipment)
8	Digital Filter	The number of times of moving average in normal sampling	1	
			2	
			4	(at the time of shipment)
			8	
			12	
			16	
			24	
			32	
		Ditto in fast sampling	1	
			5	
			10	
			20	(at the time of shipment)
			50	
			100	
			200	

<b>5 Calibration</b>				
	Function Mode	Content	Setting value	Operation
1	Cal Zero	Calibrate zero	00000 (fixed)	Place no load on Load Cell Push <b>ENTRY</b> key to calibrate zero
2	Cal Span	Calibrate span	$\pm 1$ to $\pm 99999$	Place a reference weight on Load Cell Set a weight value (10000 at the time of shipment)




3	E.Zr.Adj	Calibrate equivalent zero	0 to $\pm 2.8000$	Zero voltage (mV/V) of Load Cell Set numerical value (0.0000 at the time of shipment)
4	E.Span	Display value of span amount	$\pm 1$ to $\pm 99999$	Set numerical value (10000 at the time of shipment)
5	E.Sp.Adj	Calibrate equivalent span	$\pm 0.1$ to $\pm 3.0000$	Span voltage (mV/V) of Load Cell Set numerical value (1.0000 at the time of shipment)

<b>6 Protect</b>				
	Function Mode	Content	Setting candidates	Operation
1	Cal Lock	Calibration lock	Unlock	Span calibration enabled (at the time of shipment)
			Lock	Span calibration disabled
2	Test	Shift to Test Mode	OFF	Do not shift to Test Mode (at the time of shipment)
			ON	Push <b>ENTRY</b> key 3 times to shift to Test Mode











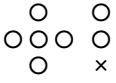






## § 7. Test Mode

※The response of external I/O signal and indication of display is different during Test Mode. Please take measures to connected external equipment to keep it from abnormality. Test Mode confirms conditions of this unit by manual operation.

### 7 – 1) Operation method

- 1) To enter Test Mode, push **ENTRY** key while powering ON or select [ON] 3 times at [Protect / Test] of Function Mode.
- 2) To leave Test Mode, turn power OFF or push  key 3 times while displaying Model Name or Program Version in Test Mode.
- 3) Push  key to proceed to the next item. Push  key to return to the previous item.

### 7 – 2) Test item

	Guide Display	Content	Description
1	TEST	Test Mode	Proceed to Model Name after 2 seconds
2	TI-801	Model Name	Push  key 3 times to leave Test Mode
			Push  key to the next item
			Push  key to the previous item
3	P-X.XX	Program Version	Push  key 3 times to leave Test Mode
			Push  key to the next item
			Push  key to the previous item
4	S/N XXXXX	Serial Number	Push  key to the next item
			Push  key to the previous item
5		Check LCD / Buzzer	Displayed pattern is changed at every second
			Push <b>ZERO</b> key to turn back light ON/OFF
			Push <b>CLEAR</b> key to turn buzzer ON/OFF
			Push  key to the next item
6	Key 	Check Keys	Indicate $\bigcirc \rightarrow X$ when allocated key is pushed except power  key
			Push  key twice to the next item
			Push  key twice to the previous item
7	Serial Comm.	Check Serial Communication	Transmit data by pushing <b>ZERO</b> or <b>CLEAR</b> key
			Receive command 'REQ' and transmit data Data: WT, ±##### <sup>C<sub>L</sub></sup> <sub>R<sub>F</sub></sub> # = Measured value
			Push  key to the next item
8	Sensor input ±X.XXXX mV/V	Check input voltage from Load Cell	Push <b>ZERO</b> key to set the value zero
			Push <b>CLEAR</b> key to restore the value
			Push  key to the next item
			Push  key to the previous item

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## § 8. Troubleshooting

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If this unit does not work properly, please take the following measures. If the trouble still cannot be solved, then please contact our company.

At query, please inform us the model name, product serial number, and conditions of this unit as detailed as possible. The model name of Load Cell or a sensor connected to this unit should be also informed.

### 8 – 1 ) Basic check point

- 1) Please check if using a correct power supply.  
This unit is supplied voltage with three AA alkaline batteries (LR6x3) or dedicated AC adaptor sold separately.
- 2) Please check that wires are connected to the terminal properly and firmly.

### 8 – 2 ) Precautions at the time of calibration.

#### 1) Error occurs at the time of zero calibration.

- In case of exceeding the range of zero calibration.

To perform zero point calibration, Load Cell output with no load should be in the range of  $-2.8$  to  $+2.8$ mV/V. Please contact us if it is out of the range of  $\pm 2.8$ mV/V, when using Load Cell whose rated output is more than 3.3mV/V.

#### 2) Error occurs at the time of span calibration, or display value is not correct as set in span calibration.

- In case of a sensor output being higher.

This unit cannot measure in a system that the sum of initial Tare value and measured value exceed 3.3mV/V. Please contact us when the rating output of the sensor is more than 3.3mV/V.

- In case of input level of span calibration being lower.

This unit cannot calibrate span when span amount of output of Load Cell is too small. Increase minimum scale to make resolution rougher or use an appropriate Load Cell.

#### 3) Fluctuation of indication

- In case of span amount against resolution being not enough.

The input sensitivity of this unit is  $0.2\mu\text{V}/\text{digit}$  and indication resolution is  $1/10,000$  at  $1.0\text{mV}/\text{V}$  input. If the resolution is more than this, fluctuation of indication becomes bigger. In this case, please increase minimum scale until not to be noticeable of fluctuation.

### 8 – 3 ) Countermeasure when abnormal display is indicated

#### 1) In case of [A/D over] blinking

It is considered to be disconnected a part or whole of Load Cell cable. Refer the section 8-5) Checking Sensor (Load Cell).

#### 2) In case of the measured value blinking when not over-loaded. These two causes are considered

- ① Disconnection of sensor cable
- ② Sensor failure

Please check input signal from a sensor in Test Mode.

### 8 – 4 ) Judgement whether this unit has malfunction

#### 1) Please confirm whether the sensor excitation voltage is correct.

Set this unit to operation [Sensor input] in Test Mode before checking the excitation voltage. Because it is impossible to measure the excitation voltage in normal sampling. Please disconnect Load Cell cable from this unit and check the voltage by a tester between #A(+EXC) and #C(-EXC) of connector is stable at  $2\text{V} \pm 0.2\text{V}$ . If it is not stable, this unit should have malfunction.

2) Make electrical short between #D(+SIG) and #B(-SIG) of connector (make input voltage 0mV/V). Check input voltage in Test Mode. Please confirm whether it is stable at around 0.0000 mV/V. If it is not stable, this unit should have malfunction. If it is stable, please check Load Cell side.

3) Serial communication check  
Please perform serial communication check in Test Mode.

#### 8 – 5) Checking Sensor (Load Cell)

Good or bad rough judgement can be done by measuring input/output resistance and insulation resistance because Load Cell is structured by a bridge circuit.  
(Please make sure to power OFF this unit first and disconnect Load Cell before checking resistance)

1) Fault judging method by resistance of Load Cell.

Check bridge resistance of Load Cell by a tester, and confirm whether input/output resistance are correct.

2) Fault judging method by insulation resistance of Load Cell.

Measure insulation resistance between shield line and other with voltage less than 50V. If the insulation resistance has more than 1000MΩ, insulation of Load Cell is no problem.

#### 8 – 6) Error indication

	Indication	Contents
1	The measured value is blinking	Alerting damage of a sensor. The measured value exceeds the preset capacity. Please check the setting value at [Meas.config / capacity] in Function Mode.
2	[A/D over] or [A/D-over]	Input signal from Load Cell or a sensor exceeds the range of input. Please check a sensor or a cable whether there is disconnection, damage or failure.
3	[CAL ERR]	Calibrated signal and value exceeds the range of calibration. Please check them during calibration.
4	[Fail]	Processing other task. Please try again after for a while.
5	[Mem Err]	Cannot memorize properly. Please try again after for a while.
6	[Memory Error]	There is a memory failure. Please contact TOYO

## § 9. Specifications




### 9 – 1) A/D convert part

1) Input signal range			-3.3 to +3.3 mV/V
2) Non linearity	Normal		$\pm 0.02\%FS \pm 1\text{count}$
	Fast		$\pm 0.02\%FS \pm 1\text{count}$
3) Temperature Characteristic	Normal	zero	$\pm 0.0025\%FS/^\circ\text{C}$ typ. at 1.0mV/V input
		sensitivity	$\pm 0.0025\%$ of Reading/ $^\circ\text{C}$ typ.
	Fast	zero	$\pm 0.005\%FS/^\circ\text{C}$ typ. at 1.0mV/V input
		sensitivity	$\pm 0.005\%$ of Reading/ $^\circ\text{C}$ typ.
4) Frequency response	Normal		approx. 0.9Hz(-3dB) at Digital Filter=4
	Fast		approx. 20Hz(-3dB) at Digital Filter=20
5) Sampling speed	Normal		approx. 8 times/sec. (125ms)
	Fast		approx. 1,000 times/sec. (1ms)
6) Power for transducer			DC2V $\pm 5\%$ , 25mA (able to connect 4 sensors of 350 $\Omega$ )

### 9 – 2) Zero point and Sensitivity part

1) Adjustment range	zero	adjustable within the range of $\pm 2.8\text{mV/V}$ input
	sensitivity	adjustable within the range of $\pm 0.1$ to $\pm 3.0\text{mV/V}$ input
2) Minimum input sensitivity		0.2 $\mu\text{V}/\text{digit}$ (display resolution 1/10,000 at 1.0mV/V input)
3) Calibration method		Actual load method or Equivalent input method
4) Accuracy of Equivalent calibration method		$\pm 0.2\%FS$ (at 1.0mV/V input)






### 9 – 3) Display part

1) Display device		LCD 128 x 64 dot with white back light
2) Measured value display		$\pm 99999$ (zero suppressed)
3) Division		1, 2, 5, 10, 20, 50, 100
4) Decimal point		0 (Nil), 0.0, 0.00, 0.000, 0.0000
5) Over load		Blinking when the measured value exceeds a capacity ([A/D over] is displayed when input is out of range of A/D)
6) Unit display		g, kg, t, N, kN, N·m, kN·m, Pa, kPa, MPa, gf, kgf, tf, mm, %, mV/V, $\mu\text{E}$ , (None)
7) Status indication		LC:Load Cell, SG:Distortion, HM;HUM Check,  : Battery remain, LOG:Logging, TX:Transmit serial data NOR/FST:Normal/Fast sampling,  :Key Locked,  :Calibration Locked, Z:Tare subtraction, PT/PN:Preset Tare subtraction/Preset Net calculation, HOLD:Hold operation
8) Display update period	Normal	approx. 8 times/sec. (125ms)
	Fast	approx. 10 times/sec. (100ms)

### 9 – 4) I/O part

#### 1) Operation switch

8 key switches

	:	Power
ZERO	:	Tare subtraction
CLEAR	:	Clear Tare subtraction
LIGHT / 	:	LCD back light
HOLD / 	:	Hold
LOCK / 	:	Key Lock
LOG / 	:	Logging
ENTRY/MENU	:	Enter Function Mode/Memorize

2) UART (Universal Asynchronous Receiver/Transmitter)

- ① Communication speed 384,00bps
- ② Communication protocol Data length:7bit, Stop bit:2bit, Parity:Even  
Data: ASCII Code
- ③ Communication format TOYO dedicated format
- ④ Terminal Micro USB type-B

9 – 5 ) Data Logger part

Store one dose of log data to a non-volatile memory

- Memory capacity: Normal 4,000 data of Date/Time and measured value  
Fast Start Date/Time, 10,000 data of measured value,  
Stop Date/Time

9 – 6 ) Distortion measurement part

- 1) Gauge input signal Using a dedicated bridge box which is sold separately
- 2) Applied voltage to a gauge DC2V±5%
- 3) Gauge resistance 120Ω or more
- 4) Gauge rate 2 fixed (1mV/V =2,000 με)
- 5) Range of measurement ±12,000με (distortion level 10<sup>-6</sup> )
- 6) Accuracy of measurement ±0.2%Reading ±5count
- 7) Temperature zero ±1count/°C  
Characteristic sensitivity ±0.01%Reading/°C

9 – 7 ) HUM Check part

- 1) Range of measurement ±15,000μV
- 2) Display update period approx. 10 times/second (100ms)

9 – 8 ) General

- 1) Countermeasure of power failure Data are memorized to a non-volatile memory
- 2) Supplied power voltage Two ways to be powered
  - ① Three AA alkaline batteries (LR6x3)
  - ② Dedicated AC adaptor TI-801-AC-KIT (sold separately)
- 3) Consumption current approx. 70mA  
(LCD back light OFF, connected to one 350Ω Load Cell)
- 4) Battery life approx. 30 hours (same as above condition)
- 5) Inner clock Powered by secondary manganese lithium battery
- 6) Operating temp. and humidity range -10 to +40°C, 85%R.H. or less (no existent condensation)
- 7) Mass approx. 350g (include silicone cover, exclude batteries)

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## § 1 0. List of Models and Accessories

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1 0 – 1) Model

TI – 801

Product model name

1 0 – 2) Attached accessory

- |                                      |        |
|--------------------------------------|--------|
| 1) Operation manual                  | 1 copy |
| 2) USB terminal cover                | 1 pc   |
| 3) AA alkaline battery (for testing) | 3 pcs  |

1 0 – 3) Accessory sold separately

- |                   |  |
|-------------------|--|
| 1) TI-801-AC-KIT  | Dedicated AC adaptor   |
| 2) TI-801-USB-KIT | Dedicated USB cable for serial communication                                 |
| 3) TB-13m         | Dedicated bridge box of One Gauge 3 lines measurement for both 120Ω and 350Ω |
| 4) TB-2Gm         | Dedicated bridge box of Two Gauge measurement                                |

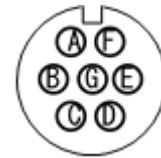
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## § 1 1. Terminal Layout

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1) Load Cell input connector (PRC03-21A10-7F: TAJIMI ELECTRONICS)

No.	Connection Signal	
A	+EXC	Excitation voltage to Load Cell (+)
B	-SIG	Input signal from Load Cell (-)
C	-EXC	Excitation voltage to Load Cell (-)
D	+SIG	Input signal from Load Cell (+)
E	SHLD	Shield line of Load Cell cable
F	NC	No connection
G	NC	No connection



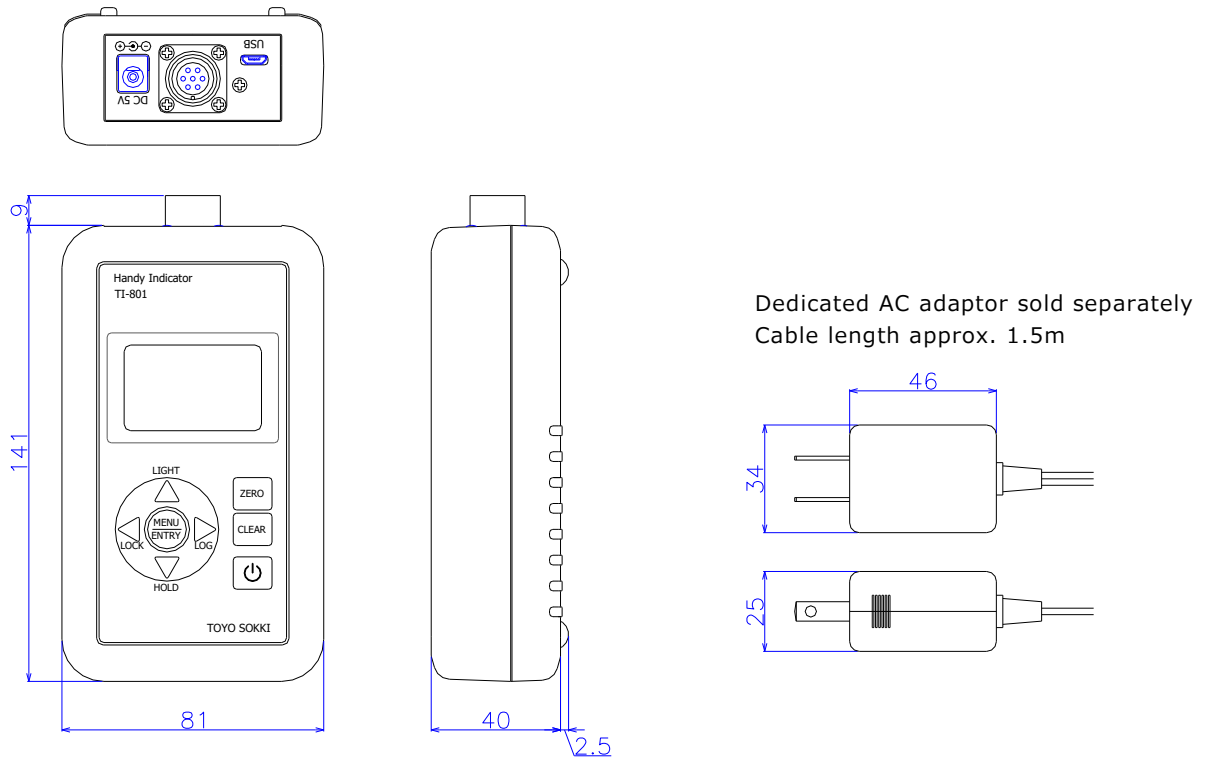
View from top of connector

Applicable plug connector (PRC03-12A10-7M10.5: TAJIMI ELECTRONICS)

Wire apart from a power line or a motor drive line with noise to prevent malfunction. The cable wiring color varies depending on the manufacturer or a model. Refer to the Test Report attached to Load Cell, check the signal name and color, and connect correctly and firmly.



## § 1 2. Dimensional drawing



## § 1 3. Function Block Diagram

