Digital Strain Indicator

TD－35

Operation Manual

Teac Corporation

Ver 2006/ 4/18

P/N D009185-00C

Preface

Thank you for purchasing a TD-35 Digital Strain Indicator.
Read this manual and understand the contents correctly before using the product for the best performance of the TD-35.

Warranty

This is a product that has passed a strict in-house quality inspection. We will repair or exchange it upon any failure or trouble of this product according to the service standard prescribed by TEAC Corporation. This TEAC warrantee shall also fully comply with any local product liability law.

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1. Overview

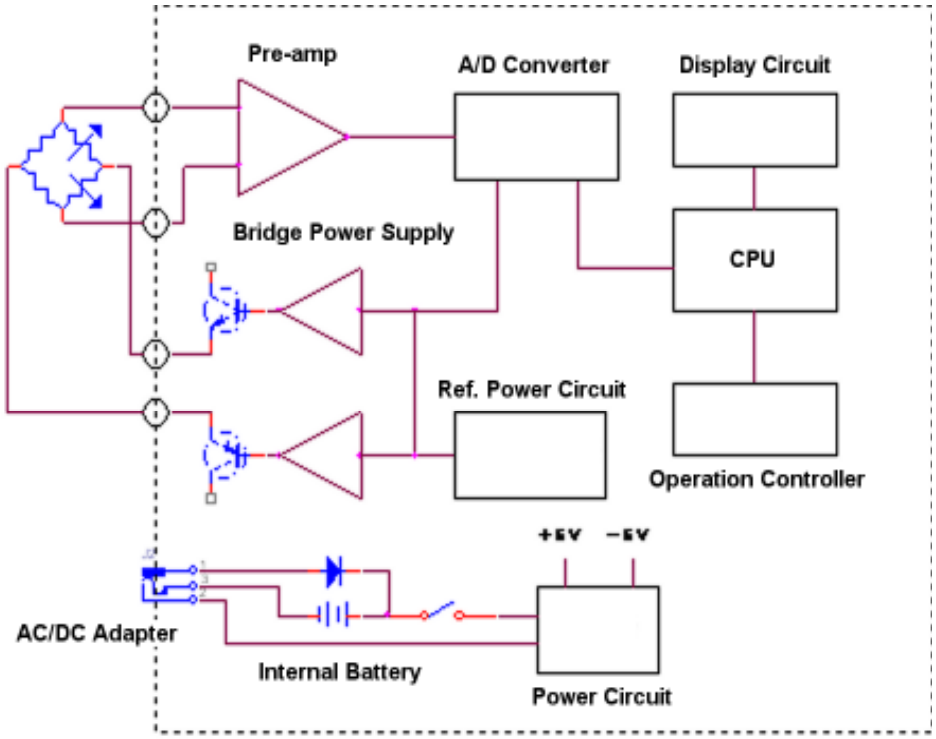
The TD-35 is a digital strain indicator that suits various strain gauge base sensors, used for the indication of pressure, load or torque as well as the load-cell. This offers the display resolution of ±20000×10-6 strain. In addition to the display in strain unit, it is also capable of converting the value into a real unit such as in Newton (N) using the preset sensor-output-value (mV/V) for direct reading convenience. This operates with a built-in battery (AAA type) or external AC power supply (using an AC adaptor).

2. Features

1) Small and compact size.
2) All necessary functions for the static strain indicator are equipped and ready to make a measurement simply by connecting the sensor.
3) Suited for almost all types of strain gauge base sensors such as load and pressure.

3. Configuration

1) Pre-amp
2) A/D converter
3) Display circuit
4) Ref. power circuit
5) CPU
6) Bridge power supply
7) Operation controller
8) Internal battery
9) AC adapter
10) Power circuit


Pre-amp
A/D Converter
Display Circuit
Bridge Power Supply
CPU
Ref. Power Circuit
Operation Controller
+5V
−5V
AC/DC Adapter
Internal Battery
Power Circuit

4. Standard Accessories

1) ZR6(Y) Oxyride dry-cell battery ····· Qty 4
2) Operation Manual ····· Qty 1
3) AC Adapter ····· Qty 1

5. Specifications

Input	: Strain gauge type connector
Input connector	: NDI-7R connector
Bridge power supply	: Approx. DC 2.5V, Max current 30mA
Input range	: $\pm 20000 \times 10^{-6}$ strain ($\pm$10mV/V)
Zero shift	: $\pm 10000 \times 10^{-6}$ strain, digital adjustment
Display	: Strain display mode : 0~$\pm 20000 \times 10^{-6}$ strain User display mode : 0~20000$\times 10^{-6}$ strain value can be converted to an arbitrary user value within 0~99999 (with arbitrary decimal point)
Display module	: LCD, Character height approx. 12mm,
Display frequency	: Approx. 6 times/second
Peak hold	: Maximum value during measurement
Calibration accuracy	: 0.1% F.S or less (FS = 20000$\times 10^{-6}$ strain)
Linearity	: $\pm 1 \times 10^{-6}$ strain +1digit
Stability Zero	: $\pm 0.2 \times 10^{-6}$ strain/℃
Stability Sensitivity	: $\pm 0.1 \times 10^{-6}$ strain/℃
Low battery voltage warning	: LCD shows “B” under approx. 4V

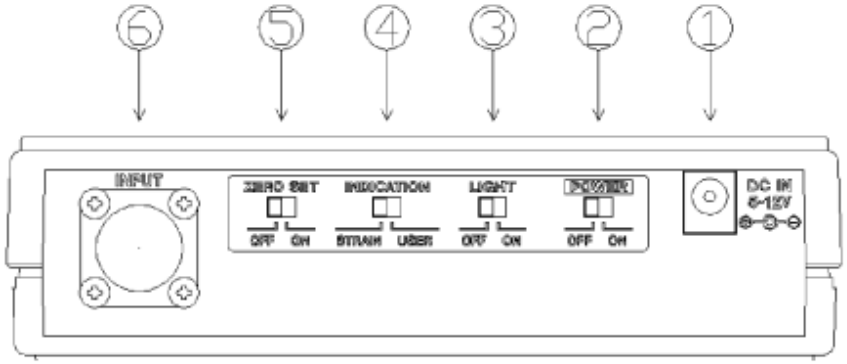
Operating condition

Temperature range	: 0～45℃
Humidity range	: Max. 80% RH (without condensation)
Storage temperature range	: -40～80℃
Power supply (Internal)	: ZR6(Y9) dry battery
(Externnal)	: DC5～8V AC adapter
(Current consumption)	: Approx. 170mA/DC6V (when sensor=120Ω, Back-light=OFF)
Battery life	: Approx. 8 hours (when ZR6(Y) Oxiride dry-cell battery, sensor=120Ω, Back-light=OFF, at room temperature)

Dimension	**: 150mm(W)x100mm(D)x40mm(H)** (excluding **umbo)**
Weight	**: Approx. 500g (including ZR6(Y) dry-cell battery)**

6. Operation

6.1 Functions and controls in rear panel



① DC IN - External Power Input Connector

The power input connector when AC power is used.
Use the supplied accessory AC adapter for the external power.

② POWER - Power Switch

The power switch for the internal battery or the external power.
When the external power is connected, the internal battery is used and not consumed.

③ LIGHT - Back-light Switch for LCD

The ON/OFF switch for the display back-light. Note that twice as much power is consumed when it is turned on in battery operation.

④ INDICATION - Display Unit Switch

The switch to select whether the strain input is displayed in strain unit (STRAIN) or the mV/V input is displayed in user defined unit (USER).
When STRAIN is selected, it displays in strain quantity ($x10^{-6}$ strain), and when USER is selected, it displays in user defined quantity.

⑤ ZERO - Zero Cancel ON/OFF Switch

The ON/OFF switch of the zero cancel operation.
When it is ON, the zero cancellation is performed by pressing and holding ⑬ "SELECT" on the operation panel and press ⑨↓"ZERO-RESET".

When it is OFF, the zero cancel operation is not performed and it displays the strain quantity with reference to the TD-35 internal zero in the selected display mode set in ④. This can be used to check the initial balance value of the strain gauge or strain gauge sensor.

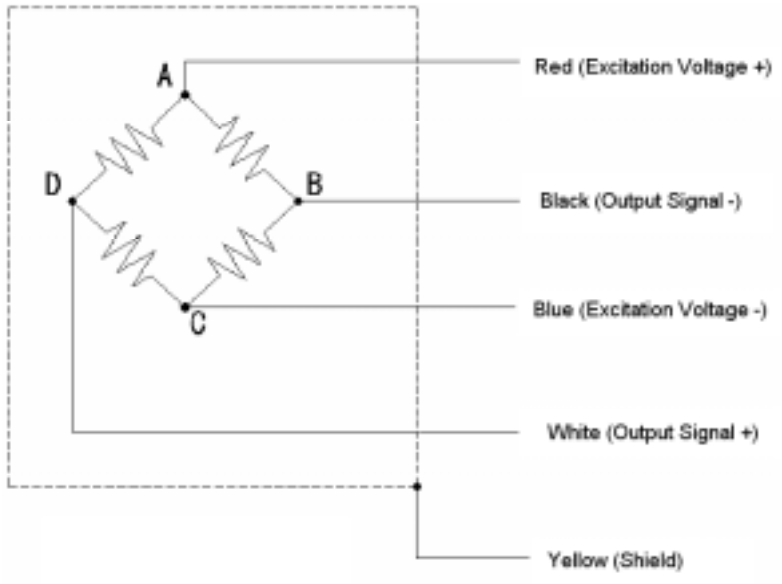
⑥ INPUT - Sensor Input Connector

The NDIS standard input connector for the strain gauge sensor. Applicable plug model is PRC03-12A10-7M10.5 made by Tajimi-Musen.

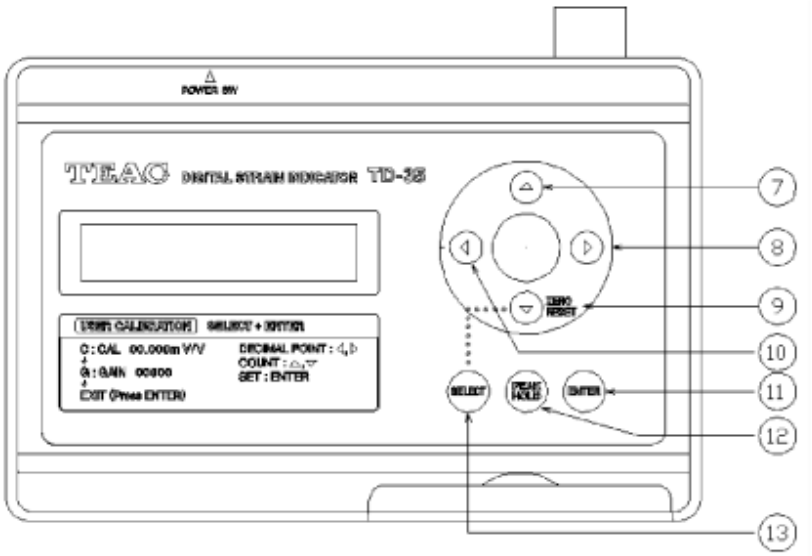
Pin	Signal (Cable Color)
A	Bridge Voltage + (Red)
B	Bridge Output − (Black)
C	Bridge Voltage − (Blue)
D	Bridge Output + (White)
E	Shield (Yellow)
F	No Connection
G	No Connection

(Color in parentheses is of our company's color)

Strain gauge sensor connecting diagram



6.2 Operating Function and Controls



⑦ **↑ Key**

Used to increase the setting value

⑧ **→ Key**

Used to move the digit during setting value

⑨ **↓ Key (ZERO-RESET)**

Used to decrement the setting value or zero cancellation when used together with ⑬ key.

⑩ **← Key**

Used to move the digit while setting value

⑪ **ENTER Key**

Used to set the value in various settings

⑫ **PEAK HOLD Key**

Used to select the peak hold operation

It holds and displays the maximum value of the A/D sampling data. During the peak hold operation, [P] is displayed in the LCD. When [P] is displayed, press this key again and [P] disappears indicating that the peak hold mode is canceled, the display mode returns to normal.

⑬ **SELECT Key**

Used to combine with other keys for various operations

Key Operation	Operation
⑬SELECT Key + ⑨↓Key	Zero cancel
⑬SELECT Key + ⑪ENTER Key	USER unit display
⑬SELECT Key + ⑧ →Key ⑩ ←Key	Set values or decimal point in USER unit display mode

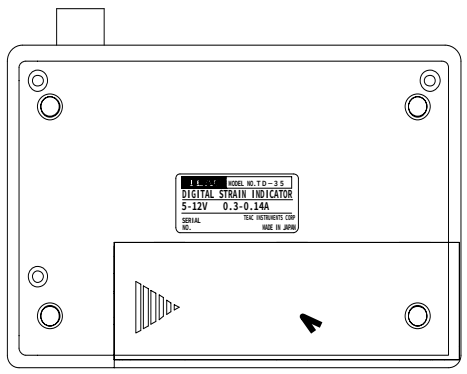
6.3 Internal Battery and Replacement

The AAA type Oxiride dry-cell battery is recommended but any other AAA type battery may be used. However the operating time will vary depending upon the battery used. The operating time of approx. 8 hours described in the specification is under the conditions of a ZR6(Y) Oxiride dry-cell battery used at room temperature. When the voltage drops below 4V, [B] is displayed on the LCD. When it occurs replace the battery or switch to the external power source soon. When replacing the battery or switching to the external power, turn off the POWER switch ② in the rear panel. (Note that it does not automatically switch to the external AC power source in battery operation)

Battery Storage

It is installed in the area where the lid in the rear panel slides.

Rear View



→ **Slides to this direction**

Battery Storage

7. Measuring Method

7.1 Notes in Measurement

■ TD-35 is a strain measuring instrument primarily for the static strain (DC ～about 3Hz).
The A/D sampling frequency of TD-35 is 6Hz. For the strain measurement of a higher frequency component, use the dynamic strain measuring instrument instead.

■ Because the signal from the strain gauge or sensor is minute, pay special attention to noise intrusion.
For the signal cable from the sensor, use the dedicated 4-wire shielded cable.

■ Use it where the signal cable does not touch or run parallel to the power line. Also keep the signal cable away from any strong magnetic field generating devices such as a motor or a power transformer.

■ During operation, avoid direct sunlight, high temperature, high humidity, or places where dew condensation may occur such as rapid temperature or humidity changes.

7.2 Wire Connection

This is a strain indicator for measuring the strain gauge type sensor gauge output such as a load-cell. For the strain measurement of an individual strain gauge, use the BX-100 strain gauge bridge box with the 1-gauge or the 2-gauge method.

7.3 Measurement

7.3.1 Strain Measurement

Connect a sensor to ⑥ INPUT in the rear panel, switch ④ INDICATION to STRAIN, and ⑤ ZERO SET to OFF, then turn on the power. It is now ready in strain display mode.

■ Zero Adjustment

Switch ⑤ ZERO SET in the rear panel to ON, press ⑨ (↓Key) ZERO RESET while holding ⑬ SELECT button in the operation panel, and the display changes to zero and it is now ready for zero adjustment. The range of zero adjustment is $\pm 10000 \times 10^{-6}$ strain.
When it exceeds the range, the LCD displays [OFF OVER] and you will not be able to return to the previous display for the zero adjustment.
When you wish to make a zero adjustment, set it to within $\pm 10000 \times 10^{-6}$

strain by referencing the material in the back of this manual, then make a zero adjustment.

■ Peak Hold Display

Press ⑫ PEAK HOLD button and the display shows [P] then the peak hold operation starts. It continues until ⑫ PEAK HOLD button is pressed again.

7.3.2 User Unit Display Measurement

Connect ⑥ INPUT in the rear panel to a sensor, switch ④ INDICATION to USER, and the display mode becomes a user display mode. The displayed value is computed according to the user defined physical quantity (Kg, etc.) vs. sensor sensitivity (mV/V) setting.

■ Sensor Sensitivity (mV/V and rated capacity) setting procedure

Press ⑪ ENTER while holding ⑬ SELECT in the operation panel, and the display changes to **C 00.000**. Move to a desired digit using ⑧(→) or ⑩(←) key, and select values using ⑦(↑) or ⑨(↓) key. Once a desired value is set, press ⑪ ENTER. Then the rated capacity is displayed as **G 00000**. Move to a desired digit using ⑧(→) or ⑩(←) key, and select values using ⑦(↑) or ⑨(↓) key. (The rated capacity is a value found in the sensor's data sheet)

To change the decimal point position, move the cursor to a desired decimal point position using ⑧(→) or ⑩(←) key, press ⑪ ENTER key, and the character display becomes reversed. Move to a desired position using ⑧(→) or ⑩(←) key, and press ⑪ ENTER. When all of the settings are finished, press ⑪ ENTER one more time.

■ How to set the number of digits below decimal point in the measurement screen

The number of display digits below decimal point can be selected during measurement. Press ⑧(→) or ⑩(←) key while holding ⑬ SELECT, and the character at the cursor becomes inverted. Move to a desired digit using ⑧(→) or ⑩(←) key, then press ⑪ENTER. Note that the maximum value to be displayed is 9999 including the number after the decimal point.

■ Zero adjustment and peak hold display

The operation and function are the same as strain measurement. Switch ⑤ ZERO SET in the rear panel to "ON". The zero adjustment is engaged by pressing ⑨(↓key) ZERO RESET while holding ⑬ SELECT button. The adjustable range is $\pm 10000 \times 10^{-6}$ in strain quantity.

■ Display accuracy

The numerical value that is smaller than 1×10^{-6} strain in "input

strain quantity converted value ” can be displayed by moving the decimal point. However, not all digits in display are guaranteed due to the stability or accuracy, etc.

■ Initial Setting

Turn ② POWER on while holding both ⑬ SELECT button and ⑦ ↑ key simultaneously, and keep holding both keys until the measurement value appears. The unit is then initialized to the user unit of 1.000mV/V and the displayed value of 2000.

7.4 Alarm Display

Alarm during measurement

■ OVER

Description : Displayed value exceeds the limit of 9999

Countermeasure : If in user unit mode, adjust the maximum digits or the coefficient so that the expected maximum measurement value fits in 9999.

■ OFF OVER

Description : Input value exceeds the offset adjustable range.

Countermeasure : Refer to Zero Adjustment in the back of the material and adjust the bridge balance to the level smaller than $\pm 10000 \times 10^{-6}$ strain.

■ AD +OVER/-OVER

Description : The input level from sensor exceeds $\pm 20000 \times 10^{-6}$ strain.

Countermeasure : Open wire or disconnection of sensor or sensor cable is considered. Make a correction.

Power on error message

The following alarm indicates errors from EEPROM rewrite times (10^7 times), data storage life (10 years), setting, internal process. PRM ERR is an error during setting and the others do not occur during normal operation. In case of an error, turn off the power then turn it back on. If the error continues, contact our sales department or distributor.

1. RECOVER : Invalid user unit coefficient. (Unit reboots as result)
   Power has been disturbed during data saving to ROM.
2. PRM ERR : Invalid conversion coefficient
   One or both terms in sensitivity (mV/V) are zero. (Enter a valid value)

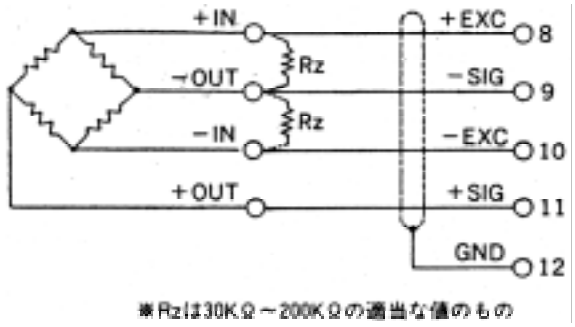
3. AD ERR : Communication with internal A/D failed. (Reboot the unit)
4. CAL ERR : Invalid written data in ROM.
5. ROM WERR : ROM write failure.
6. ROM RERR : ROM read failure.
7. ROM EERR : ROM erase failure.
8. SYS ERR : Internal process error.
9. BAD CALD : Calibration failure due to the abnormal ROM data.

8. Miscellaneous Materials

ZERO adjustment of strain gauge sensor

The sensor generates a slight voltage even if no load is applied.
When there is a tare weight such as a weight measuring device, the voltage equivalent to the tare weight is generated. The zero adjustment range of TD-35 is ±5mV/V (± 10000×10^{-6} strain). In case it does not meet the zero adjustment within this range, as shown in the figure below, the zero point shift resister that corresponds to the sensor output can be externally connected so that the zero point is shifted electrically.

RZ is connected to only one side depending on the direction of the sensor. The direction of zero shift changes depending on the connection either between -SIG(B) and +EXC(A) or -SIG(B) and -EXC(C). The RZ is to be connected between -SIG and +EXC(B-A) when the imbalance needs to be canceled such as in subtracting tare weight of measuring weight devices (tare weight appears as positive in sensor output).



The resister to be used (RZ) directly influences the zero drift characteristic of the sensor, therefore use the resister that has an excellent temperature coefficient. (25ppm/℃ or less recommended) This method can be used for sensitivity calibration when the indicator is replaced.

In general, the initial calibration is done by combining with a sensor and an actual applied load. However, when a re-calibration is not feasible, it can be done with the following substitution method without using an actual load.
After initial calibration, connect an appropriate resister (RZ) to one side of the bridge and record the displayed value, then remove the resister. When the indicator is replaced for a reason of servicing or so forth, connect the same resister used above, adjust ZERO balance, and make a sensitivity adjustment so that the reading value becomes the same as the previously recorded value.

The table in next page shows the resister values and the shift amount when a resister is connected to one side of the bridge circuits having two different resister values, 350Ω and 120Ω. These resister values are calculated amounts and they may be off due to the errors in the input and the output resistance of the sensor. Use these values only as an estimate or guideline.

Added resister value versus input conversion strain of the bridge circuit with 350 Ω and 120Ω resistance.

Shift Qty・Sensor ($\times 10^{-6}$ strain)	Sensor ・350Ω	Sensor ・120Ω
200	875	300
400	437	150
600	291	100
800	219	75
1000	175	60
1200	146	50
1400	125	43
1600	109	37
1800	97	33
2000	87	30
2400	73	25
2800	62	21
3200	55	19
3600	48	17
4000	44	15
		(unit- KΩ)

List of switch settings on measurement items

Strain Meas.

SW No.	Display	Descipt.	Setting
④	INDICATION	Indication Value Unit	STRAIN
⑤	ZERO SET	Offset	OFF

User Unit Meas.

SW No.	Display	Descipt.	Setting
④	INDICATION	Indication Value Unit	USER
⑤	ZERO SET	Offset	OFF

Strain Offset Meas.

SW No.	Display	Descipt.	Setting
④	INDICATION	Indication Value Unit	STRAIN
⑤	ZERO SET	Offset	ON

User Unit Offset Meas.

SW No.	Display	Descipt.	Setting
④	INDICATION	Indication Value Unit	USER
⑤	ZERO SET	Offset	ON

Strain Peakhold Meas.

SW No.	Display	Descipt.	Setting
④	INDICATION	Indication Value Unit	STRAIN
⑤	ZERO SET	Offset	ON or OFF

User Unit Peakhold Meas.

SW No.	Display	Descipt.	Setting
④	INDICATION	Indication Value Unit	USER
⑤	ZERO SET	Offset	ON or OFF

9. External View