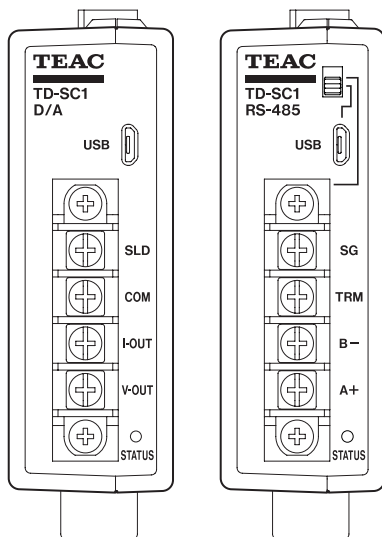


TEAC

Load Cell Signal Conditioner Instructions for Use

TD-SC1



Introduction

Thank you for purchasing the TD-SC1 Load Cell Signal Conditioner.

Please read this document in its entirety before using the product to get the best performance and ensure safe and proper operation.

In this manual, “this unit” or “TD-SC1” is used when referring to both TD-SC1 (D/A) and TD-SC1 (485) models.

TD-SC1 (D/A) shows it has D/A, and TD-SC1 (485) shows it has RS-485.

Features

- Support for TEDS sensors makes calibration easy. Automatic calibration is also possible when a TEDS sensor is connected.
- An equivalent input function is included, making sensitivity adjustment without actual loads easy.
- Supports remote sense functions. Even using long cables measurement is possible without losing precision.
- Static strain measurement is possible. Identifying load cell defects and other problems through plastic deformity is easy.
- Supports high and low limit comparison functions.
- Supports hold functions, including peak hold, bottom hold and holds with zone designations.
- Attaches to common DIN rails.
- Product complies with RoHS.

Included accessories

If anything is missing or damaged, contact us. (For contact information, see the last page.)

Input/output connector plug	
B2CF 3.50/18/180LR SN OR BX	1
Micro USB-B cable	1
Power input terminal bank cover (pre-installed on unit)	1

The following additional accessories are included with the TD-SC1 (D/A).

KEC-NS0604-02 D/A terminal bank	1
D/A terminal bank cover	1

The following additional accessories are included with the TD-SC1 (485).

KEC-NS0604-02 RS-485 terminal bank	1
RS-485 terminal bank cover	1

Disclaimers

Information is given about products in this manual only for the purpose of example and does not indicate any guarantees against infringements of third-party intellectual property rights and other rights related to them. TEAC Corporation will bear no responsibility for infringements on third-party intellectual property rights or their occurrence because of the use of these products.

Company names and product names in this document are the trademarks or registered trademarks of their respective owners.

Safety information

This document describes the safety instructions for the operation of this unit. Before operating the product, read this document carefully to familiarize yourself with the unit.



WARNING

Follow the instructions below to avoid risk of serious personal injury and death.

Never use beyond the rated specifications as there is the danger of property damage, injury, fire or electrical shock.

Never use in flammable gaseous environments including the following locations as there is the danger of explosion.

- Locations containing corrosive or flammable gases
- Locations near water, oil or subject to chemical splash

If this product malfunctions (smells strange or becomes hot), stop using it immediately and unplug the power cord as there is danger of fire or electrical shock.

Never attempt to disassemble the product.

Carefully check connections and wiring before applying power.

Be sure to ground the product (with ground resistance of 100 Ω or less).

To allow the operator to immediately shut off the power to the product, install a switch or circuit breaker that complies with both IEC60947-1 and IEC60947-3 requirements near the product. The switch or breaker installed must also indicate that it functions to shut off the power to the unit.

Do not allow foreign objects such as metal fragments that result from cutting panels, wires or other materials to enter this unit.

If the unit is dropped or subject to strong impacts, it could break. If this occurs, stop using it and contact the seller from which you purchased it.

Overvoltage category: I
Pollution degree: 2

If the unit is used in a manner not specified by the manufacturer, the protection provided by the unit may be impaired.

Safety information



CAUTION

Follow the instructions below to avoid risk of personal injury or property damage.

Disconnect the power cord when performing the following.

- When wiring or connecting cables to the terminal banks for connecting the DC power supply, load cells and external inputs and outputs
- When connecting the ground line

Wait for at least five seconds between turning the unit on and off.

Never touch the connectors while the product is turned on.

When connecting to a power supply, frame ground, signal input/output connector or D/A or RS-485 terminal bank, be sure to wire them correctly after confirming the signal names and pin assignment numbers. Use shielded cables for signal input/output cables (load cell, external input/output).

Before use, fix the cables separately so that they do not hang to prevent the connectors from being pulled out and to protect the connectors from unnecessary pressure.

Conduct wiring in a place so that it will not be together or parallel with electrical wiring.

Avoid use in locations like the following.

- Near a power line
- Where a strong electric or magnetic field is present
- Where static electricity or noise, (for example, from a relay) is generated

Do not install in the following environments.

- Locations subject to temperatures exceeding the specified ranges for temperature and humidity
- Locations subject to radiant heat from heat sources
- Locations with high salt or iron content
- Locations exposed to dirt and dust
- Locations subject to direct vibration or shock
- Locations subject to severe temperature changes
- Outdoor, or locations with an altitude of higher than 2000 m
- Locations where freezing or condensation might occur

Do not operate a damaged unit.

The unit is classified as an open-type (built-in) device and must be installed inside a control panel.

If the top cover or panel faces become dirty, wipe it gently with a soft cloth that has been slightly dampened with a diluted neutral cleaning fluid and wrung out well. DO NOT use a chemically treated dust cloth, paint thinner, or other flammable solvents. Using any of them could damage the coating of the product.

If the product is used in a manner unintended by the manufacturer, the user's safety may be adversely affected.

Always attach the DC power terminal bank cover when an electric current is present.

If subject to electromagnetic waves (from transceivers, mobile phones, amateur wireless transmissions, etc.), use metal pipes for the wiring or make other countermeasures using shielding.

Model for USA

Supplier's Declaration of Conformity

Model number: TD-SC1

Trade name: TEAC

Responsible party: TEAC AMERICA, INC.

Address: 10410 Pioneer Blvd. Unit #1, Santa Fe Springs, California 90670, U.S.A.

Telephone number: 1-323-726-0303

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.



Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Model for Canada

Innovation, Science and Economic Development Canada's Compliance Statement:

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Model for Europe

DECLARATION OF CONFORMITY

This product complies with the European Directives request, and the other Commission Regulations.



DECLARACIÓN DE CONFORMIDAD

Este producto cumple con las exigencias de las directivas europeas y con los reglamentos de la Comisión Europea.

DÉCLARATION DE CONFORMITÉ

Ce produit est conforme aux directives européennes et aux autres réglementations de la Commission européenne.

KONFORMITÄTSERKLÄRUNG

Dieses Produkt entspricht den Anforderungen europäischer Richtlinien sowie anderen Verordnungen der Kommission.

Model for UK

This product complies with the applicable UK regulations.



WARNING

This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

ATENCIÓN

Este es un producto de clase A. En un entorno no profesional, este aparato puede producir interferencias de radio, en cuyo caso el usuario será el responsable de tomar las medidas necesarias para solucionarlo.

AVERTISSEMENT

Il s'agit d'un produit de Classe A. Dans un environnement domestique, cet appareil peut provoquer des interférences radio, dans ce cas l'utilisateur peut être amené à prendre des mesures appropriées.

Warnung

Dies ist eine Einrichtung, welche die Funk-Entstörung nach Klasse A besitzt. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen und dafür aufzukommen.

Safety information

DISCLAIMER

TEAC disclaims all warranty, either expressed or implied, with respect to this product and the accompanying written materials. In no event shall TEAC be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information or other loss) arising out of the use of or inability to use this product.

Disposing of this product

When disposing of this product, including accessories, consumable parts and related items, follow the regulations of the local, regional and national governments.

For European Customers

Disposal of electrical and electronic equipment and batteries and/or accumulators

- a) All electrical/electronic equipment and waste batteries/accumulators should be disposed of separately from the municipal waste stream via collection facilities designated by the government or local authorities.
- b) By disposing of electrical/electronic equipment and waste batteries/accumulators correctly, you will help save valuable resources and prevent any potential negative effects on human health and the environment.
- c) Improper disposal of waste electrical/electronic equipment and batteries/accumulators can have serious effects on the environment and human health because of the presence of hazardous substances in the equipment.

- d) The Waste Electrical and Electronic Equipment (WEEE) symbols, which show wheeled bins that have been crossed out, indicate that electrical/electronic equipment and batteries/accumulators must be collected and disposed of separately from household waste.



If a battery or accumulator contains more than the specified values of lead (Pb), mercury (Hg), and/or cadmium (Cd) as defined in the Battery Directive (2006/66/EC, 2013/56/EU), then the chemical symbols for those elements will be indicated beneath the WEEE symbol.



Pb, Hg, Cd

- e) Return and collection systems are available to end users. For more detailed information about the disposal of old electrical/electronic equipment and waste batteries/accumulators, please contact your city office, waste disposal service or the shop where you purchased the equipment.

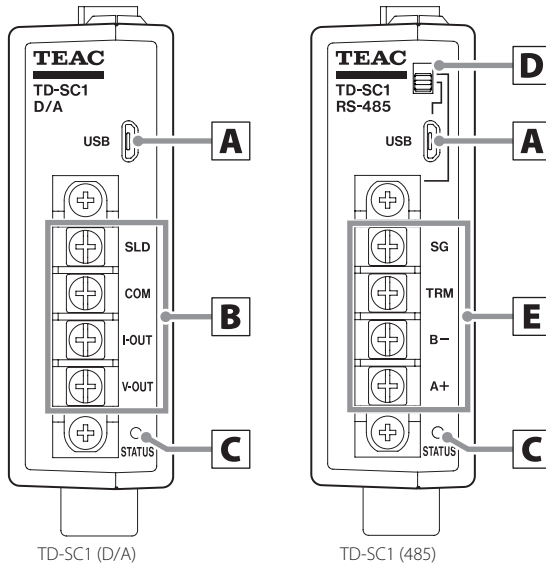
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1. Names and functions of parts

1-1. Front



A USB port

Use this for communication with this unit.

ATTENTION

Do not use a USB hub when connecting the USB port on this unit and a computer. Connect them directly.

B D/A output terminals

C STATUS indicator

Blue	Power on
Magenta	Input level overload, command being executed
Blinking blue/magenta	Starting up (only immediately after the power is turned on)

D USB/RS-485 switch

Use this to select the communication method used with this unit.

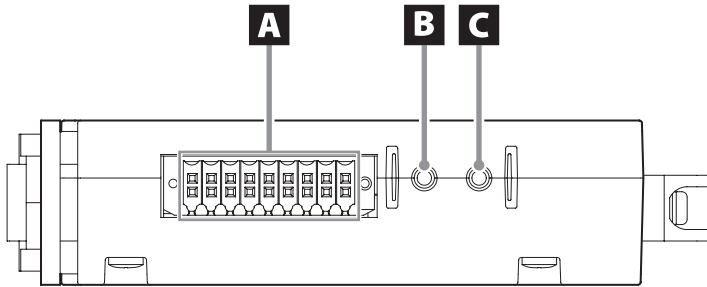
E RS-485 terminals

NOTE

Use communications to make settings for this unit. See the chapter on the communication method being used for details.

1. Names and functions of parts

1-2. Top



A Input/output connector

Insert the included input/output connector plug here. Connect strain gauge transducers, TEDS sensors, control inputs and comparison outputs.

B CAL button

If not TD-SC1 (D/A)

When Calibration Value Lock is OFF, press and hold to conduct actual load calibration.

TD-SC1(D/A) only

D/A test output occurs while pressing this button.

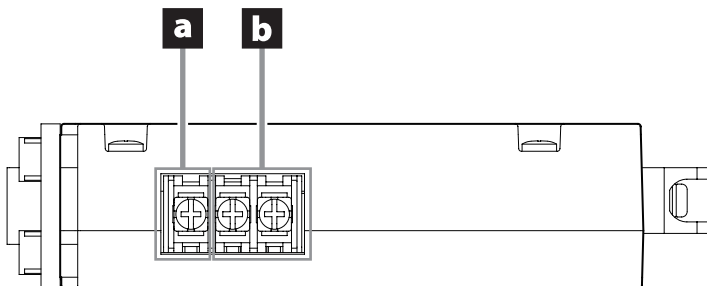
C ZERO button

When Calibration Value Lock is OFF, press and hold to use the zero balancing function.

NOTE

If Main Unit Operation Lock is ON, the operation buttons (CAL and ZERO) on the unit will be disabled (page 31).

1-3. Bottom



a FG (frame grounding) terminal

Frame grounding terminal for DC power supply.

⚠ **Always be sure to connect the frame grounding terminal.**

b DC power supply input terminals

Connect a DC power supply.

The voltage range is DC 24 V \pm 10%.

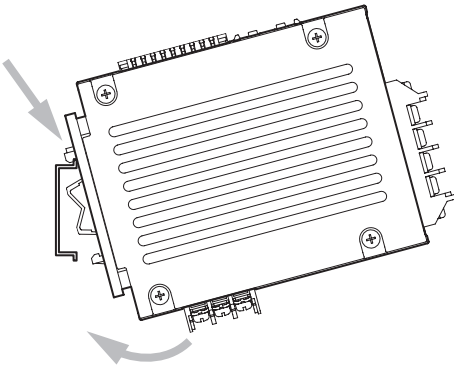
2. Installation

Follow these procedures to install the unit in a control panel.

2-1. Attaching to a DIN rail

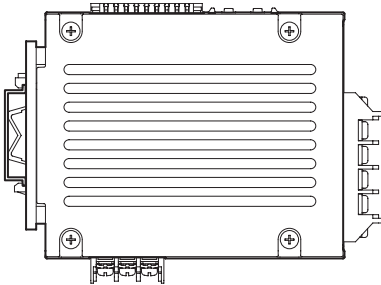
1 Insert the adapter into the DIN rail at an angle to attach it.

- The supported DIN rail width is 35 mm.



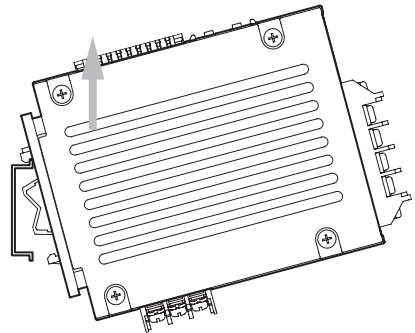
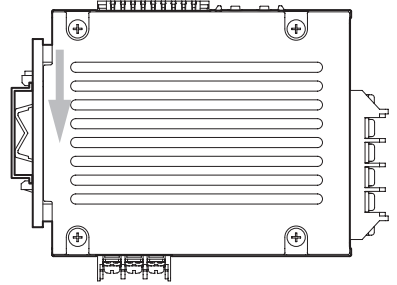
ATTENTION

After attaching the adapter to the DIN rail, confirm that it is not loose.



2-2. Removing from a DIN rail

Press the unit down so that the lower clasp on the adapter disconnects from the DIN rail. Then, pull it forward to remove it.



3. Making connections

3-1. Connecting to the input/output connector

A 2-piece type connector is used.

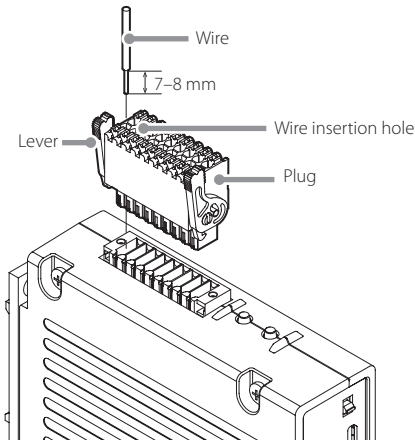
Insert the included input/output connector plug into the input/output connector.

When wiring the input/output connector plug, press the button for each pin while inserting the wire.

ATTENTION

Do not connect any connector plug other than the one included because doing so could make it unsafe.

3-1-1. Input/output connector



- 1** Remove 7 to 8 mm of the covering from the wire being connected, and twist it so that the tip does not come apart.

Suitable wiring is 0.14 to 1.5 mm² (26–16 AWG).

- 2** While pressing the buttons attached to each pin, insert the wires into the holes so that the tips do not come apart.

- 3** Pull the wire gently to confirm that it is securely clamped into the hole.

- 4** After the wires have been connected, press the plug into the indicator until the levers on both its sides lock.

3-2. Connecting a strain gauge transducer

3-2-1. About the remote sense function

Set the Remote Sense setting before connecting the sensor (page 27).

By default, this is set to “Unused (4-wire format)”.

The 6-wire format (remote sense format) is a superior connection method that compensates for reduced voltages due to cable length and voltage changes due to temperature changes, for example.

In systems installed outdoors and other situations where temperature changes are expected, as well as in cases when general precision is desired, for example, we recommend using the 6-wire format for remote sense.

ATTENTION

- When using the 6-wire format (remote sense format), before connecting a sensor, always set “Remote Sense” to “Used (6-wire format)”.
- Use “Unused (4-wire format)” with 4-wire format.
- Incorrect connections or settings could cause damage to sensors.

3-2-2. Notes about bridge voltage (excitation voltage)

As a reference for setting the bridge voltage, consider that the output from the sensor should be increased, and set the maximum voltage in a range that does not exceed the maximum safe excitation voltage on the sensor test report.

A sensor could be damaged if this is set to a value that exceeds its maximum safe excitation voltage.

ATTENTION

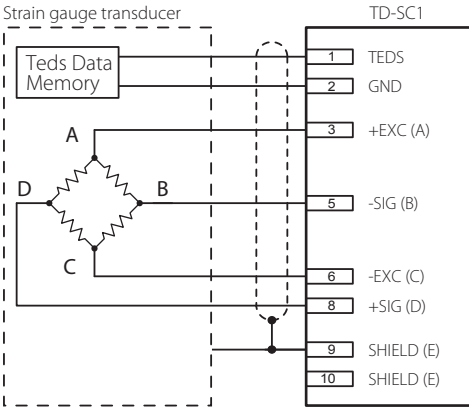
- If the maximum safe excitation voltage is less than 10 V, set the bridge voltage to 5 V before connecting.
- In TEDS calibration, when TEDS data is read, if the bridge voltage setting is greater than the maximum safe excitation voltage recorded in the TEDS memory, the bridge voltage will be changed to a value less than the maximum safe excitation voltage.

NOTE

The default value is 5 V.

3. Making connections

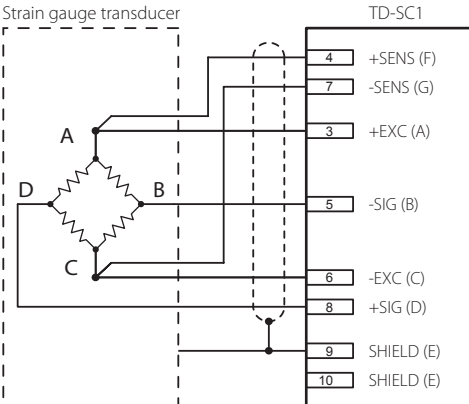
Connecting TEDS sensors and 4-wire sensors



Terminal number	Signal	Wire color
1	TEDS	Orange
2	GND	Green
3	+EXC (A)	Red
4	+SENS (F)	—
5	-SIG (B)	Black
6	-EXC (C)	Blue
7	-SENS(G)	—
8	+SIG (D)	White
9/10	SHIELD (E)	Yellow

- The wire colors are those that we use in the strain gauge transducers that we make.
- TEDS and remote sense (SENS) can be used at the same time.

Connecting using 6-wire format



Usable sensor characteristics

- Output between +SIG and -SIG: ± 5.0 mV/V or less
- Voltage (current) between +EXC and -EXC: 5 or 10 V DC $\pm 10\%$ (30mA maximum current)

ATTENTION

Do not connect sensors that do not meet the rated output (output between +SIG and -SIG) and the maximum safe excitation voltage (voltage between +EXC and -EXC) specifications.

NOTE

If not using the TEDS function, terminals 1 and 2 can be left open.

3. Making connections

3-3. Control input and output terminals

3-3-1. Control input terminals

Terminal number	Signal	Explanation
11	D/Z	<p>Sets the indicator value digitally to 0.</p> <ul style="list-style-type: none"> ● Maintain the ON state for more than 30 ms. <p>This is active when Enable Digital Zero is set to ON.</p>
12	Hold	<p>Holds function using hold start signals when this is ON.</p> <p>This becomes disabled if the Hold Mode is set to "OFF".</p>
13	Clear	<p>This turns on when a hold is cleared in any hold mode except sample hold.</p> <p>Whether Clear signals are enabled or disabled can be set using the Clear signal setting.</p>
17	+(+24V)	DC24V power supply input terminal
18	-(0V)	This is the 0V terminal for DC24V power supply and the control input signal common terminal.

- When using a control input connector, a separate DC24V power supply is necessary for the control input circuit.
- The control input signal is isolated from the unit's circuits by a photocoupler.

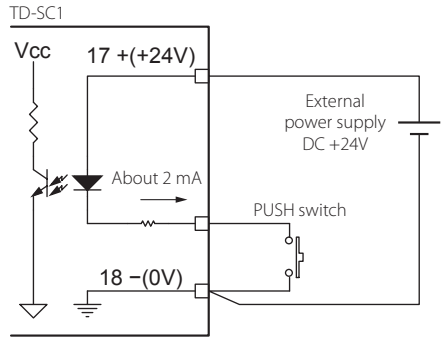
⚠ CAUTION

For terminals 17 and 18, use a power supply that conforms to the limited energy circuit specification in IEC61010-1. Failure to do so could cause fire or other hazards.

3-3-2. Connecting control input terminals

Signals are input with the external input circuit when shorted or opened between any control input terminal and the common terminal.

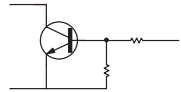
Shorts occur from both contact and non-contact (transistor).



Example when contact signal used



Example when transistor used



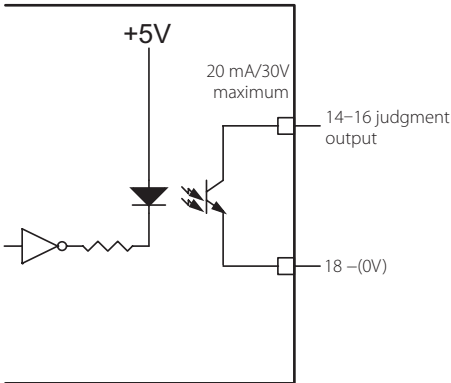
- When external contact is ON, about 2 mA flows. When using a transistor, for example, select one with a resistance of at least 10 Ω and elements that allow a flow of at least 40 mA when on.
- 18 -(0V) is the common terminal for the 11 IN (D/Z), 12 IN (Hold) and 13 IN (Clear) control input terminals.
- Do not apply voltage from an external source to a control input terminal.

3-3-3. Comparison output terminals

Terminal number	Signal	Explanation
14	HI	High limit judgment output
15	LO	Low limit judgment output
16	OK	OK judgment output
18	-(0V)	Comparison output common terminal

- The comparison output is isolated from the unit's circuits by a photocoupler.

Open collector output (NPN, current sync)
20mA/30V maximum collector current



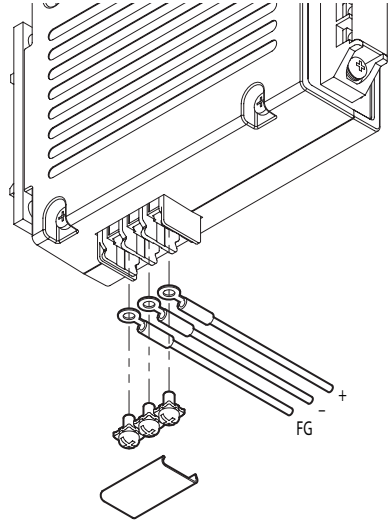
- For the operation of each signal, see "10. Comparison settings" on page 46.

3-4. Connecting the DC power supply input terminals

The DC power supply input voltage should be $24\text{ V} \pm 10\%$.

Use a power supply cord that is 0.517 to 2.081 mm^2 (20 to 14 AWG).

When connecting to the terminal bank, use a solderless terminal (M3, width of 6 mm or less).



ATTENTION

- If using the unit as a CE compliant product, the power cord must be no more than 3m long.
- Allow the unit to warm up for at least five minutes after supplying power to it.
- The recommended tightening torque for terminals is 0.5 N·m (5.1 kgf·cm).

⚠ Always attach the cover to the power supply input terminal bank. Failure to do so could result in fire, electric shock or malfunction.

⚠ Use a power supply that conforms to a limited energy circuit as specified in IEC61010-1. Failure to do so could cause fire or other hazards.

3. Making connections

3-5. Input/output testing functions

3-5-1. Input/output testing

When input/output testing is on, D/A output and control input/output terminal testing can be conducted.

Input/Output Testing ON/OFF

0: OFF
1: ON

NOTE

When input/output testing is on, only use input/output testing commands. Using other commands could stop input/output testing.

3-5-1-1. D/A Test Output*

While the CAL button is being pressed, a voltage or current is output from a D/A output terminal according to the value set for the Test A/D Input Value.

Select the D/A output using the D/A Output Mode.

Test A/D Input Value

0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
Unit: mV/V

*TD-SC1(D/A) only

3-5-1-2. Test Control Input/Output Terminals

Output Terminals

This outputs the status of the set terminal from the output terminals.

Output is assigned to bits.

(output bit 0: OK / 1: LO / 2: HI)

Bit	MSB 2	1	LSB 0
Terminal name	HI	LO	OK

LOW: 1
HIGH: 0

Input Terminals

This returns current input terminal values.

Bit	MSB 2	1	LSB 0
Terminal name	DZ	HOLD	CLEAR

LOW: 1
HIGH: 0

4. Control app

Use communications to make settings for this unit. See the chapter on the communication method being used for details. A control app that makes the unit's settings easy is available. Use this control app to make the unit's settings if you are not making your own control app for the unit.

- You can download and use the app for free.

4-1. App availability

Download the control app from the following address.

<https://loadcell.jp/en/>

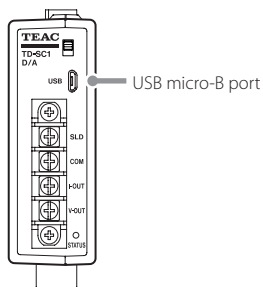
You can also contact us. (For contact information, see the last page.)

For details about installation and operation procedures, see the attached operation manual.

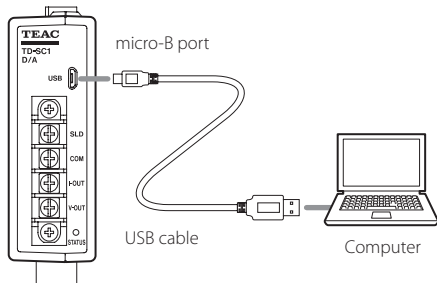
In this chapter we explain the USB functions of the TD-SC1.

5-1. Connections

5-1-1. USB port



Example of connection with a computer



ATTENTION

Do not use a USB hub when connecting the USB port on this unit and a computer. Connect them directly.

5-1-2. When using a TD-SC1 (485)

To use the USB of the TD-SC1 (485) for transmission, slide the USB/RS-485 switch down.

6. RS-485

In this chapter we explain the RS-485 functions of the TD-SC1 (485).

6-1. RS-485 overview

Format: RS-485 two-wire type

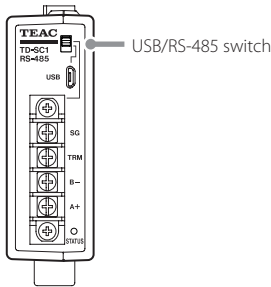
Transmission format: start-stop synchronization, half-duplex transmission

Number of connected units: 32 maximum (including master)

Code: ASCII

6-2. Connections

6-2-1. RS-485 terminals



RS-485 terminals

Signal name	Explanation
A+	Data (not reversed)
B-	Data (reversed)
TRM	Terminator (by shorting B- and TRM, it can be used as a terminator (110 Ω))
SG	Connection line

6-2-2. Inserting and removing RS-485 terminal bank

- You can remove the terminal bank from the main unit by loosening the two black screws at the ends of the terminal bank and pulling it out.
- Always disconnect the power before removing or installing a terminal bank.

6-2-3. Connecting the RS-485 terminals

- We recommend using twisted-pair cables for connections.
- If these units will be used at both ends, short the B- and TRM terminals. (This will enable termination.)
- Always disconnect the power before working with wiring.
- The recommended torque for the RS-485 terminal screws and attachment screws is 0.69 N·m ≈ 7 kgf·cm.
- After wiring, attach the terminal bank cover.

CAUTION

For the RS-485 connector, use the included KEC-NS0604-02. Do not use any other connector because doing so could make it unsafe.

6-2-4. Selecting RS-485 transmission

To use this unit with RS-485 for transmission, slide the USB/RS-485 switch up.

- Always disconnect the power before moving the switch.

6-3. RS-485 transmission settings

RS-485 setting items are added to the TD-SC1 (485).

Setting	Format	Default value	Options
Communication Mode	Selection	TD Format (BCC)	TD Format TD Format (BCC) Continuous Transmission
ID Number	Input	1	1 to 31
Baud Rate	Selection	115200	4800 9600 19200 38400 57600 115200
Bit Length	Selection	8-bit	8-bit 7-bit
Parity Bit	Selection	None	None Odd Even
Stop Bit	Selection	1-bit	1-bit 2-bit
Delimiter	Selection	CR + LF	CR + LF CR

- RS-485 transmission settings can only be read and written when connected by USB. When connected by RS-485, they can only be read. (RS-485 transmission settings cannot be changed when connected by RS-485.)
- After changing RS-485 settings, restart the unit.

Communication Mode

Select the RS-485 transmission protocol.

TD Format This transmission protocol is unique to the TD-SC1.

TD Format (BCC) This transmission protocol adds checksum (BCC) to the TD format.

Continuous Transmission This continuously transmits TD Format polling command (0001) data.

ID Number

This can be set between 1 and 31. Set so it does not overlap with the IDs of other stations.

Baud Rate

Set the transmission speed for RS-485 communication.

Bit Length

Set according to the transmission requirements of connected equipment.

Parity Bit

Set according to the transmission requirements of connected equipment.

Stop Bit

Set according to the transmission requirements of connected equipment.

Delimiter

Set according to the transmission requirements of connected equipment.

6-4. Transmission protocols (TD Format/TD Format (BCC))

TD Format does not use checksums.
 TD Format (BCC) adds checksums after data.

6-4-1. Commands

TD Format

HEX	0x23	0x30	0x31	0x33	0x30	0x30	0x32	0x2D	0x30	0x31	0x38	0x30	0x30	0x0D
ASCII	#	0	1	3	0	0	2	-	0	1	8	0	0	

ID number
Command No.
Data

TD Format (BCC)

HEX	0x23	0x30	0x31	0x33	0x30	0x30	0x32	0x2D	0x30	0x31	0x38	0x30	0x30	0x34	0x43	0x0D
ASCII	#	0	1	3	0	0	2	-	0	1	8	0	0	4	C	CR

ID number
Command No.
Data
Checksum

The first character in the command must always be "#".
 The final characters must be "CR".
 The data length will be 0 to 6 characters according to the command.
 The checksum (BCC) adds each byte of the ID number, command and data and divides the lower 8 bits into upper and lower parts of 4 bits each and saves them in ASCII as the checksum.

In the example above, the total of the ID number, command and data is as follows.

$$0x30+0x31+0x33+0x30+0x30+0x32+0x2D+0x30+0x31+0x38+0x30+0x30 = 0x24C$$

The checksum is the lower 8 bits, which is 0x4C.

6-4-2. Responses

The characters at the beginning of the response show the command execution result. The reply is "ACK" if it was completed properly or "NAK" if it ended in an error.

The characters at the end of the response can be set to either "CR" and "LF" or just "CR" (page 19).

Command execution result when completed properly

TD Format

HEX	0x06	0x30	0x31	0x33	0x30	0x30	0x32	0x0D	0x0A
ASCII	ACK	0	1	3	0	0	2	CR	LF

ID number

Command No.

TD Format (BCC)

HEX	0x06	0x30	0x31	0x33	0x30	0x30	0x32	0x32	0x36	0x0D	0x0A
ASCII	ACK	0	1	3	0	0	2	2	6	CR	LF

ID number

Command No.

Checksum

When there is response data, it is sent after the command number.

The data length will be 0 to 9 characters according to the command.

Checksum calculation is the same as in the "Commands" section above.

In the example above, the total of the ID number, command and data is as follows.

$$0x30+0x31+0x33+0x30+0x30+0x32 \\ = 0x126$$

The checksum is the lower 8 bits, which is 0x26.

Command execution result when ended with error

TD Format

HEX	0x15	0x30	0x31	0x33	0x30	0x30	0x32	0x0D	0x0A
ASCII	NAK	0	1	3	0	0	2	CR	LF

ID number

Command No.

TD Format (BCC)

HEX	0x15	0x30	0x31	0x33	0x30	0x30	0x32	0x32	0x36	0x0D	0x0A
ASCII	NAK	0	1	3	0	0	2	2	6	CR	LF

ID number

Command No.

Checksum

The following are possible causes of errors.

- Improper command number (unsupported command, etc.)
- Overlapping commands issued
- Improper command parameters (setting values)
- Checksum error occurred (when TD Format (BCC) transmission mode is selected)

6-5. Transmission commands

In this section, examples of transmission using TD Format (BCC) are given.

To transmit using TD Format, remove the checksum from the transmission examples.

These examples are of transmissions with a device with ID number 1.

Example responses are only given for command execution results that have completed properly.

For response data values that are not fixed, numbers are given as “x” and symbols are given as “±”.

- “bit 0” is LSB.

6-5-1. Polling (0001)

Command

HEX	0x23	0x30	0x31	0x30	0x30	0x30	0x31	0x32	0x32	0x0D
ASCII	#	0	1	0	0	0	1	2	2	CR

└──────────┘
└──────────┘
└──────────┘
 ID number Command No. Checksum

Response

HEX	0x06	0x30	0x31	0x30	0x30	0x30	0x31							0x2E				0x0D	0x0A
ASCII	ACK	0	1	0	0	0	1	ST1	ST2	±	x	x	x	.	x	x	x	CR	LF

└──────────┘
└──────────┘
└──────────┘
└──────────┘
└──────────┘
 ID number Command No. Data Checksum

Data

The data is comprised of ST1, ST2 and indicator values.

The code returned for ST1 and ST2 uses ASCII 0x80 and later for bit definition, and the lower 7 bits are assigned to status.

Be aware that the valid statuses for ST1 and ST2 vary as follows depending on the bit length setting,

ST1 (8-bit length)

bit	Name	Status
0	Command Status	0: Standing by 1: Executing
1		2: Error occurred 3: Continuous sending mode
2	Nearly Zero Output	0: OFF 1: ON
3	Hold Output	0: OFF 1: ON
4	Zero Tracking	0: OFF 1: ON
5	Setting Value	0: No.1 1: No.2
6	Memory	2: No.3 3: No.4
7	Fixed Value (1)	

ST2 (8-bit length)

bit	Name	Status
0	Stable Output	0: OFF 1: ON
1	OK Output	0: OFF 1: ON
2	High Limit Judgment Output	0: OFF 1: ON
3	Low Limit Judgment Output	0: OFF 1: ON
4	Indicator Value Exceeded* (±FULL, OVER)	0: OFF 1: ON
5	Fixed Value (0)	
6	Fixed Value (0)	
7	Fixed Value (1)	

*FULL: Maximum display value exceeded,
OVER: AD input overloaded

ST1 (7-bit length)

bit	Name	Status
0	Command Status	0: Standing by 1: Executing
1		2: Error occurred 3: Continuous sending mode
2	Nearly Zero Output	0: OFF 1: ON
3	Hold Output	0: OFF 1: ON
4	Zero Tracking	0: OFF 1: ON
5	Fixed Value (1)	
6	Fixed Value (1)	
7	don't care	

ST2 (7-bit length)

bit	Name	Status
0	Stable Output	0: OFF 1: ON
1	OK Output	0: OFF 1: ON
2	High Limit Judgment Output	0: OFF 1: ON
3	Low Limit Judgment Output	0: OFF 1: ON
4	Indicator Value Exceeded* (±FULL, OVER)	0: OFF 1: ON
5	Fixed Value (1)	
6	Fixed Value (1)	
7	don't care	

*FULL: Maximum display value exceeded,
OVER: AD input overloaded

6-5-2. Status Polling (0002)

This only returns polling (0001) status data.

Command

HEX	0x23	0x30	0x31	0x30	0x30	0x30	0x32	0x32	0x33	0x0D
ASCII	#	0	1	0	0	0	2	2	3	CR

└──────────┘
└──────────────────────────┘
└──────────┘
 ID number Command No. Checksum

Response

HEX	0x06	0x30	0x31	0x30	0x30	0x30	0x32					0x0D	0x0A
ASCII	ACK	0	1	0	0	0	2	ST1	ST2	x	x	CR	LF

└──────────┘
└──────────────────────────┘
└──────────┘
└──────────┘
 ID number Command No. Data Checksum

Data

The data is comprised of ST1 and ST2.

The contents of ST1 and ST2 are the same as polling (0001).

6. RS-485

6-5-3. Indicator Value Polling (0003)

This only returns polling (0001) indicator values.

Command

HEX	0x23	0x30	0x31	0x30	0x30	0x30	0x32	0x32	0x34	0x0D
ASCII	#	0	1	0	0	0	3	2	4	CR

ID number
Command No.
Checksum

Response

HEX	0x06	0x30	0x31	0x30	0x30	0x30	0x32					0x2E				0x0D	0x0A	
ASCII	ACK	0	1	0	0	0	3	±	×	×	×	.	×	×	×	×	CR	LF

ID number
Command No.
Data
Checksum

6-5-4. Setting value writing/execution command format

Command numbers 0000 to 5802 in “6-6. Commands” on page 27 are transmitted in this format. Data is fixed to 6 characters. If the data lacks 6 characters, each opening will be filled with a “0”.

- Responses will be returned before execution commands complete operation (Immediate completion).
- Always use a polling command (0001) or polling status (0002) to confirm that the ST1 command status is standby before issuing the next command.
- Parameters set in the command data should be aligned to the right.

Command

Hold Mode Setting (4001) example

HEX	0x23	0x30	0x31	0x34	0x30	0x30	0x31	0x30	0x30	0x30	0x30	0x30				0x0D
ASCII	#	0	1	4	0	0	1	0	0	0	0	0	×	×	×	CR

ID number
Command No.
6 data characters, aligned to the right
Checksum

Response

Hold Mode Setting (4001) example

HEX	0x06	0x30	0x31	0x34	0x30	0x30	0x31	0x45	0x30	0x0D	0x0A
ASCII	ACK	0	1	4	0	0	1	E	0	CR	LF

ID number
Command No.
Checksum

6-5-5. Setting value loading command format

Command numbers 0000 to 5802 in "6-6. Commands" on page 27 are transmitted in this format. Data is fixed to 6 characters. If the data lacks 6 characters, each opening will be filled with a "0".

Command

Hold Mode Setting (4001) example

HEX	0x23	0x30	0x31	0x34	0x30	0x30	0x31	0x45	0x30	0x0D
ASCII	#	0	1	4	0	0	1	E	0	CR

└──────────┘
└──────────┘
└──────────┘
 ID number Command No. Checksum

Response

Hold Mode Setting (4001) example

HEX	0x06	0x30	0x31	0x34	0x30	0x30	0x31	0x30	0x30	0x30	0x30	0x30	0x30	0x30	0x0D	0x0A
ASCII	ACK	0	1	4	0	0	1	0	0	0	0	0	0	0	CR	LF

└──────────┘
└──────────┘
└──────────┘
└──────────┘
 ID number Command No. 6 data characters Checksum

6-5-6. TEDS command format

Command numbers 6001 to 6007 in "6-6. Commands" on page 27 are transmitted in this format. Data is fixed to 8 characters. If the data lacks 8 characters, each opening will be filled with a "0".

Command

Example of TEDS maximum rated capacity (6002)

HEX	0x23	0x30	0x31	0x36	0x30	0x30	0x32	0x32	0x39	0x0D
ASCII	#	0	1	6	0	0	2	2	9	CR

└──────────┘
└──────────┘
└──────────┘
 ID number Command No. Checksum

Response

Example of TEDS maximum rated capacity (6002)

HEX	0x06	0x30	0x31	0x36	0x30	0x30	0x32	0x32	0x30	0x30	0x32	0x30	0x30	0x30	0x30	0x30	0x41	0x44	0x0D	0x0A
ASCII	ACK	0	1	6	0	0	2	2	0	0	2	0	0	0	0	0	A	D	CR	LF

└──────────┘
└──────────┘
└──────────┘
└──────────┘
 ID number Command No. 8 data characters Checksum

Data

The decimal point position (1st character of data) is 2, so the rated capacity is 200.00.

- See the following page for details about the data format.

6. RS-485

6-5-7. Maximum Rated Capacity (6002), Maximum Rated Output (6003), Sensor Impedance (6004) and Maximum Excitation Level (6005) data formats

Byte	+0	+1	+2	+3	+4	+5	+6	+7
HEX								
ASCII	POS	x	x	x	x	x	x	x

Data (no decimal point)

POS(decimal point position)

0: None, 1: 0.0, 2: 0.00, 3: 0.000, 4: 0.0000

6-5-8. Continuous transmission format

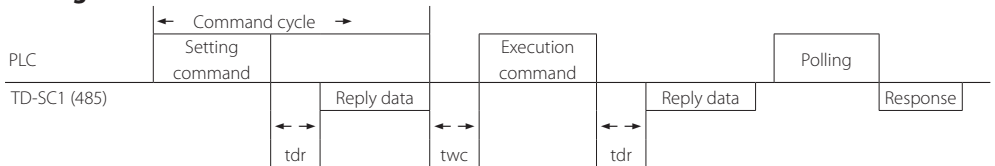
In "Communication Mode" on page 19, select "Continuous Transmission" to continuously send polling (0001) response data. No checksum is added during continuous transmission.

HEX	0x06	0x30	0x31	0x30	0x30	0x30	0x31							0x2E			0x0D	0x0A
ASCII	ACK	0	1	0	0	0	1	ST1	ST2	±	x	x	x	.	x	x	CR	LF

ID number
Command No.
Data

See "6-5-1. Polling (0001)" on page 22 for details about the data format.

Timing



tdr: 5000ms maximum command response

twc: 30ms minimum command interval

ATTENTION

The twc command interval value varies depending on the command type. Leave 30 ms for polling and setting commands. Leave about 100 ms for calibration, setting memory and other commands that include operations.

6-6. Commands

6-6-1. Execution

Setting name	Command No.	R/W	Default value	Command data (setting value)	Operation explanation
Digital Zero	0000	W		10	page 42
Clear Digital Zero	0000	W		11	page 45
Hold On	0000	W		12	page 14
Hold Off	0000	W		13	
Hold Lock	0000	W		14	page 53
Hold Clear	0000	W		15	page 14
Switch to Home Screen	0000	W		17	page 45
Switch Static Strain Disp. Mode	0000	W		20	page 45

6-6-2. Polling

Setting name	Command No.	R/W	Default value	Command data (setting value)	Operation explanation
Polling	0001	R			page 22
Status Polling	0002	R			page 23
Indicator Value Polling	0003	R			page 24

6-6-3. Calibration

Group	Setting name	Command No.	R/W	Default value (actual unit)	Command data (setting value)	Operation explanation
	Bridge Voltage	1001	R/W	2 (5 V)	1: 10 V 2: 5 V	page 37
	Decimal Point Position	1002	R/W	2 (0.00)	0: None/1:0.0/2: 0.00/3: 0.000/4: 0.0000	page 37
	Zero Point Input Calibration	1003	R/W	0 (0 mV/V)	-5000 to 5000 (changed to -5.000 to 5.000 mV/V internally)	page 42
	Zero Balancing	1004	R/W	0	When W, command data will be ignored and zero balancing will be conducted. When R, the current setting value will be returned as $\mu\text{V/V}$.	page 42
	Remote Sense	1005	R/W	0	0: Unused (4-wire format) 1: Used (6-wire format)	page 36
Equivalent Input Calibration	Rated Output Value	1101	R/W	3000 (3.000 mV/V)	50 to 5000 (changed to 0.050 to 5.000 mV/V internally)	page 37
	Rated Capacity Value	1102	R/W	10000 (100.00)	00001 to 99999	page 37
Actual Load Calibration	Rated Capacity Value	1103	R/W	10000 (100.00)	00001 to 99999	page 39
TEDS Calibration	TEDS Calibration	1104	W			page 41

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Group	Setting name	Command No.	R/W	Default value (actual unit)	Command data (setting value)	Operation explanation
Linearization Calibration	Enable/Disable Linearization Calibration	1200	R/W	0: Disabled	0: Disabled 1: Enabled	page 38 page 40
	Select Linearization Point	1201	R/W		1 to 3	
	Enable/Disable Selection Point	1202	R/W	0: Disabled	0: Disabled 1: Enabled	
	Sensor Output Value for Calibration Point	1203	R/W		4-digit sensor output value (no decimal) (0 < setting value < rated output value)	
	Output Load Value for Calibration Point (Equivalent Input)	1204	R/W		±99999	page 38
	Output Load Value for Calibration Point (Actual Load Input)	1205	R/W		±99999	page 40
Display	Minimum Scale Selection	1402	R/W	0: 1	0: 1 1: 2 2: 5 3: 10	page 42
	Display Frequency Selection	1403	R/W	4 times	0: 4 times 1: 6 times 2: 10 times 3: 20 times	page 42
	Maximum Display Value	1404	R/W	11000 (110.00)	00000 to 99999	page 42
	Sensor Input Logic	1405	R/W	0: Standard	0: Standard 1: Reversed	page 42

6-6-4. Condition settings

Group	Setting name	Command No.	R/W	Default value (actual unit)	Command data (setting value)	Operation explanation
Filter	Low-Pass Filter Selection	2001	R/W	4: 100 Hz	0: OFF	page 43
					1: 3 Hz	
					2: 10 Hz	
					3: 30 Hz	
					4: 100 Hz	
					5: 300 Hz	
	6: 1000 Hz					
	Moving Average Data Set Size Selection*	2002	R/W	0: OFF	0: OFF	page 43
					1: 16 times	
					2: 32 times	
					3: 64 times	
					4: 128 times	
5: 256 times						
6: 512 times						
7: 1024 times						
8: 2048 times						
Automatic Digital Filter	2003	R/W	1: ON	0: OFF 1: ON	page 43	
Moving Average Data Set Size*	2004	R/W	0: OFF	0: OFF 1: Disabled 2~2048: Moving average data set size	page 43	
Motion Detect	Time	2101	R/W	15 (1.5 second)	0 to 99 (changed to 0.0 to 9.9 seconds internally)	page 44
	Width	2102	R/W	00005 (000.05)	00000 to 00999	
Zero Tracking	Time	2201	R/W	0 (0.0)	0 to 99 (changed to 0.0 to 9.9 seconds internally)	page 44
	Width	2202	R/W	00000 (000.00)	00000 to 00999	
Digital Zero	Enable Digital Zero	2301	R/W	1: ON	0: OFF 1: ON	page 45
	Digital Zero Limit Value	2302	R/W	99999 (999.99)	00000 to 99999	page 45
Digital Offset		2303	R/W	00000 (000.00)	-19999 to 19999	page 45
Select Data Output		2401	R/W	0: Display Output	0: Hold value is output in coordination with display 1: Input is output as is	page 45

*The last set command for Moving Average Data Set Size Selection (2002) or Moving Average Data Set Size (2004) is enabled. If only one is set, the other will be set to 0: OFF.

6. RS-485

6-6-5. Comparison settings

Group	Setting name	Command No.	R/W	Default value (actual unit)	Command data (setting value)	Operation explanation
Comparison Value Settings	High Limit Value (HI)	3002	R/W	10000 (100.00)	-99999 to 99999	page 46
	Low Limit Value (LO)	3003	R/W	05000 (050.00)	-99999 to 99999	
Comparison Pattern Setting		3005	R/W	2: LO/OK/HI	0: OK/LO/HI	page 46
					1: OK/LO/HI	
					2: LO/OK/HI	
					3: LO/HI/OK	
Comparison Mode Setting		3006	R/W	0: Compare Always	0: Compare Always	page 47
					1: Compare During Stable	
					2: Compare Except Nearly Zero	
					3: Compare During Stable Except Nearly Zero	
					4: Compare During Held	
5: Disable Comparison						
Hysteresis		3101	R/W	00000 (000.00)	00000 to 99999	page 48
Comparison Output Pattern		3103	R/W	0: Standard Output	0: Standard Output 1: Area Output	page 49
Nearly Zero		3104	R/W	00100 (001.00)	00000 to 09999	page 49

6-6-6. Hold function settings

Group	Setting name	Command No.	R/W	Default value	Command data (setting value)	Operation explanation
Hold Mode		4001	R/W	1: SAMPLE	0: OFF	page 50
					1: SAMPLE	
					2: PEAK	
External Hold Mode		4004	R/W	0: Level	3: BOTTOM	page 53
					0: Level	
					1: Pulse	
Clear Signal		4005	R/W	1: Enabled	0: Disabled	page 53
					1: Enabled	
Zone Definition		4006	R/W	0: OFF	0: OFF	page 53
					1: ON	
Auto Zero		4007	R/W	0: OFF	0: OFF	page 53
					1: ON	

6-6-7. System settings

Group	Setting name	Command No.	R/W	Default value	Command data (setting value)	Operation explanation
Setting Value Memory		5002	R/W	0: Memory 1	0: Memory 1	page 54
					1: Memory 2	
					2: Memory 3	
					3: Memory 4	
Save All Setting Values		5003	W		90	page 54
Device Information	Device Name	5010	R		"TD-SC1 " 16-byte (characters first, followed by spaces)	page 54
	Communication Option	5012	R		0: DA 1: EtherNet/IP 2: CC-Link 3: RS-485	
	Version	5020	R		"1.00 " 6-byte (characters first, followed by spaces)	
Lock	Calibration Value Lock	5201	R/W	0: OFF	0: OFF 1: ON	page 54
	Setting Value Lock	5202	R/W	0: OFF	0: OFF 1: ON	
	Main Unit Operation Lock	5203	R	0: OFF	0: OFF 1: ON	
Device Number		5500	R/W	0000	0000 to 9999	page 54
RS-485 Transmission Settings*	Port Selection	5700	R		0: USB 1: RS-485	page 19
	ID Number	5701	R	1	1 to 31	
	Communication Mode	5702	R	1: TD Format (BCC)	0: TD Format 1: TD Format (BCC) 2: Continuous Transmission	
	Baud Rate	5703	R	5: 115200	0: 4800	
					1: 9600	
					2: 19200	
					3: 38400	
					4: 57600	
	5: 115200					
	Bit Length	5704	R	0: 8-bit	0: 8-bit 1: 7-bit	
Parity Bit	5705	R	0: None	0: None 1: Odd 2: Even		
Stop Bit	5706	R	0: 1-bit	0: 1-bit 1: 2-bit		
Delimiter	5707	R	0: CR + LF	0: CR + LF 1: CR		
USB Transmission	Communication Mode	5802	R/W	0: TD Format	R 0: TD Format 1: TD Format (BCC) W 000: TD Format 100: TD Format (BCC)	

*When connected by RS-485, RS-485 transmission settings cannot be changed.

6. RS-485

6-6-8. TEDS

Group	Setting name	Command No.	R/W	Default value	Command data (setting value)	Operation explanation
Show TEDS Data ¹⁾	Serial Number	6001	R		0 to 99999999	page 55
	Maximum Rated Capacity	6002	R		BCD (highest byte is decimal point position)	
	Maximum Rated Output	6003	R		BCD (highest byte is decimal point position) (mV/V)	
	Sensor Impedance	6004	R		BCD (highest byte is decimal point position) (Ω)	
	Maximum Excitation Level	6005	R		BCD (highest byte is decimal point position) (V)	
	Calibration Date ²⁾	6006	R/W		R (BCD) Year/month/day (yyyy/mm/dd) W (BCD) Year/month/day (yy/mm/dd)	
	Model Number	6007	R		BCD	
Rewrite TEDS Data	Rewrite Data	6010	R/W		R: Read TEDS data (without calibration) W: 000015, Write TEDS calibration data	page 55
	Restore Data	6011	W		W: 000015, Restore TEDS data	page 55

1 The calibration date will be BCD and other data will as indicated in "6-5-7. Maximum Rated Capacity (6002), Maximum Rated Output (6003), Sensor Impedance (6004) and Maximum Excitation Level (6005) data formats" on page 26.

2 If the date is September 17, 2021, R(BCD) is 20210917 and W(BCD) is 210917

6-6-9. Input/output testing

Group	Setting name	Command No.	R/W	Default value	Command data (setting value)	Operation explanation
	Input/Output Testing ON/OFF	1700	R/W	0: OFF	0: OFF 1: ON	page 16
Test Control Input/ Output Terminals	Output Terminals	1710	W*		bit 0: OK / 1: LO / 2: HI	
	Input Terminals	1711	R*		bit 0: CLEAR / 1: HOLD / 2: DZ	

*0 is low and 1 is high for each bit.

In this chapter we explain the D/A converter functions of the TD-SC1 (D/A).

The D/A converter settings only affect TD-SC1 (D/A) models.

The D/A converter allows for analog output that corresponds to the unit indicator value.

The analog output range is either 0–±10V voltage output or 4–20mA current output. Set the maximum voltage output between ±1 V and ±10 V in 1V steps using the D/A Maximum Voltage setting.

Analog output from zero (0 V, 4 mA) to full scale (±10 V, 20 mA) can be achieved according to the digital values set using D/A Zero and D/A Full Scale settings.

The zero point and full scale cannot be changed separately for current output and voltage output.

7-1. D/A output terminals

These can output either voltage or current.

They cannot output both at the same time. Use the D/A output mode to set the voltage and current (page 34).

Signal name	Explanation
SLD	GND with external device
V-OUT	D/A voltage output
I-OUT	D/A current output
COM	D/A output common terminal

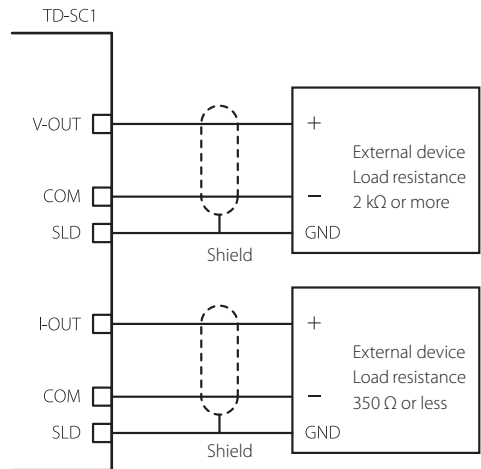
- The D/A output is isolated from this unit's circuits.

For voltage output, connect an external device with a load resistance of 2 kΩ or more to V-OUT and COM.

For current output, connect an external device with a load resistance, including cable wiring resistance, of 350 Ω or less to I-OUT and COM.

NOTE

With static strain display, analog output will be zero.



7-2. D/A Zero

Set the indicator value to output for D/A Zero (0V voltage or 4mA current).

7. D/A converter

7-3. D/A Full Scale

With the "7-2. D/A Zero" value as the reference, set the span for the indicator values output to D/A.

When the "7-2. D/A Zero" and "7-3. D/A Full Scale" setting values are added, the "7-5. D/A Maximum Voltage" setting value voltage (20 mA when in electrical current mode) is output.

The following are examples of when "7-5. D/A Maximum Voltage" is set to 10 V.

Setting example 1

D/A Zero	000.00
D/A Full Scale	100.00

Indicator value	D/A output
100.00	10 V (20 mA)
0.00	0 V (4 mA)
-100.00	-10 V(-- mA)

Setting example 2

D/A Zero	020.00
D/A Full Scale	100.00

Indicator value	D/A output
120.00	10 V (20 mA)
20.00	0 V (4 mA)
-80.00	-10 V(-- mA)

Setting example 3

D/A Zero	020.00
D/A Full Scale	-100.00

Indicator value	D/A output
120.00	-10 V(-- mA)
20.00	0 V (4 mA)
-80.00	10 V (20 mA)

Setting example 4

D/A Zero	-010.00
D/A Full Scale	020.00

Indicator value	D/A output
10.00	10 V (20 mA)
-10.00	0 V (4 mA)
-30.00	-10 V(-- mA)

ATTENTION

If calibration is conducted, when the rated capacity is confirmed, it will be set as the D/A full scale value.

7-4. D/A Output Mode

Select voltage or current.

7-5. D/A Maximum Voltage

Voltage setting (limiter)

- The output has an extended range of about 10% more than the set value. The output voltage range is the same in the negative direction. For example, when set to 5 V, the D/A output voltage range will be about -5.5 V to +5.5 V, and +5 V will be output when the "7-2. D/A Zero" and "7-3. D/A Full Scale" setting values are added.

Connecting the unit with a strain gauge transducer and setting how the indicator values will be shown is called "calibration". The following three calibration methods can be used with the unit.

1. Equivalent input calibration

This calibration method does not depend on actual loads. It only requires the input of the strain gauge transducer rated output (mV/V) and the rated capacity (value you want shown). Use this to calibrate easily when an actual load cannot be applied.

Examples:

- Load
 - 100kN rated capacity, 2.001mV/V rated output
- Pressure
 - 10.00MPa rated capacity, 2.002mV/V rated output
- Torque
 - 15.00N·m rated capacity, 2.502mV/V rated output

In this manner, by recording values from test reports, the gain can be determined automatically and shown.

2. Actual load calibration

This calibration method measures the values of actual loads on the strain gauge transducer.

By applying an actual load that is as close as possible to the maximum measured value, calibration with less error is possible.

3. TEDS calibration

This calibration method uses the strain gauge transducer rated output (mV/V) and rated capacity that are recorded in TEDS memory.

Note, however, that equipment with TEDS memory includes both 1kbit and 4kbit devices, but the unit only supports 4kbit.

Sensor check before calibrating

After connecting a sensor and providing power, calibration is not possible if the indicator value is unstable or the status indicator lights magenta. If this occurs, check the indicator value after issuing a Switch Static Strain Disp. Mode execution command, setting it to Static Strain Display Mode. In this mode, the sensor output itself is shown as a strain amount unit (μST), so input between 0 and ± 5.0 mV/V will be shown as a value from 0 to ± 10000 .

Overview of zero balancing and digital zero functions

1. Zero balancing value definition

This is the value for which zero balancing is conducted during the sensor calibration procedures in this chapter.

2. Digital zero (D/Z) value definition

The digital zero (D/Z) function that shows zero separately from the zero balancing value can be used only when Enable Digital Zero is set to ON.

Depending on the setting, the zero value might not be retained when the power is restarted.

Name	When power restarted
Digital zero (D/Z) value	The set zero value is reset, and the zero balancing value is shown.
Zero balancing value	The set zero value is retained.

A strain gauge transducer should have written test results with contents such as the following.

Rated Capacity	Load, barometric pressure, etc. (with units of kN, Mpa, etc.)
Rated Output	Voltage (unit: mV/V)
Linearity	%R.O.
Hysteresis	%R.O.
Safe excitation voltage (maximum)	V (bridge voltage)
Input Terminal Resistance	Ω
Output Terminal Resistance	Ω
Zero Balance	%R.O.

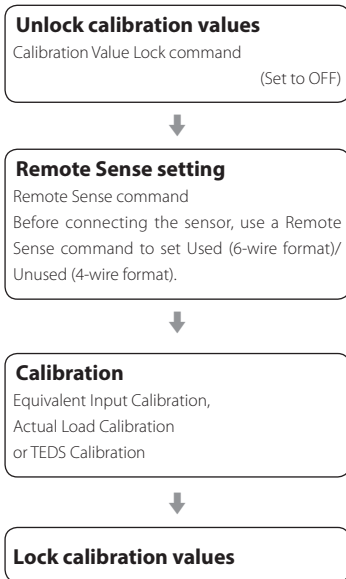
- The data necessary for equivalent input calibration are rated capacity and rated output.
- Some of this data is written to the internal memory of the TEDS sensor.

8. Calibration

8-1. Procedures shared by all calibration methods

The three calibration methods are equivalent input calibration, actual load calibration and TEDS calibration. All the calibration methods have the same procedures before and after calibration.

An overview of the calibration procedures is shown below.



Following an explanation of the procedures to be conducted before and after calibration are explanations of the procedures for equivalent input calibration, actual load calibration and TEDS calibration.

ATTENTION

When calibration is conducted, the D/A Converter setting will be initialized automatically according to the calibration value (TD-SC1 (D/A) only).

8-1-1. Locking and unlocking calibration values

Usually, the unit is used with Calibration Value Lock set to ON. This must be set to OFF before calibration. After calibration, set it to ON again.

ATTENTION

In order to prevent accidental changes to the calibration value, set Calibration Value lock to ON after calibration.

NOTE

See "14-1. Lock item list" on page 56 for information about settings that cannot be changed when Calibration Value Lock is ON.

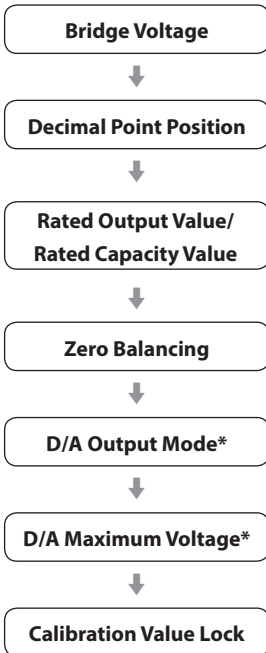
8-1-2. Remote Sense

Before connecting a sensor, confirm the sensor specifications. Furthermore, when using a 6-wire format (remote sense format), use a Remote Sense command to select "Used (6-wire format)". When using a TEDS sensor or a 4-wire format, set it to "Unused (4-wire format)".

8-2. Equivalent input calibration

This method determines the calibration value by recording rated output and rated capacity values from a test report. Use this to calibrate easily when an actual load cannot be applied.

An overview of the equivalent input calibration procedures is shown below.



- See “7. D/A converter” on page 33 for information about D/A settings.

*TD-SC1 (D/A) only

8-2-1. Bridge Voltage

Options: 5 V, 10 V

Set the bridge voltage to supply to the strain gauge transducer.

- As a reference for setting the bridge voltage, consider that the output from the sensor should be increased, and set the maximum voltage in a range that does not exceed the maximum safe excitation voltage on the sensor test report.

ATTENTION

A sensor could be damaged if this is set to a value that exceeds its maximum safe excitation voltage.

NOTE

The default value is 5 V.

8-2-2. Decimal Point Position

Set the decimal point position for the rated capacity value.

8-2-3. Rated Output Value

Input range: 0.050 to 5.000 mV/V

Set the rated output of the strain gauge transducer being used.

8-2-4. Rated Capacity Value

Set the rated capacity of the strain gauge transducer being used.

NOTE

The decimal point position set here will be used as the indicator value decimal point position.

ATTENTION

When using a D/A option, the rated capacity is set as the D/A full scale value.

8-2-5. Zero Balancing

With no load on the sensor, send a Zero Balancing command.

During zero balancing, ST1 will be “Executing”.

- If ST1 becomes “Error occurred”, conduct countermeasures and redo calibration.

8. Calibration

8-2-6. D/A Output Mode

Options: voltage, current

8-2-7. D/A Maximum Voltage

Range: ± 1 to ± 10 (1V increments)

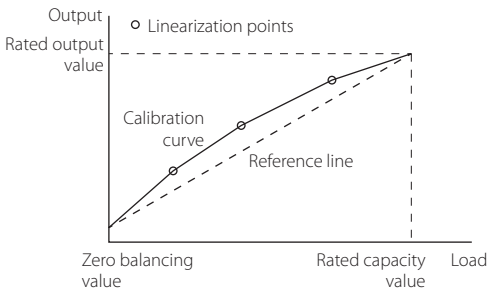
NOTE

For information about D/A settings, see “7. D/A converter” on page 33.

8-2-8. Calibration Value Lock

To prevent unintended changes to the calibration value, Calibration Value Lock should usually be set to ON.

8-2-9. Linearization Calibration



If linearization calibration is not conducted, a line connecting the two points between the zero balancing value and the rated capacity value will be used to calculate load. Conducting linearization calibration improves the linearity of load measurements by increasing the number of calibration points. Set the linearization calibration after equivalent input calibration.

1 Use the Enable/Disable Linearization Calibration command to enable linearization calibration.

2 Use the Select Linearization Point command to set the number of the linearization point (calibration point).

3 Use the Enable/Disable Selection Point command to enable the selection point.

4 Set the calibration values.

Use the Sensor Output Value for Calibration Point and Output Load Value for Calibration Point (equivalent input) commands to set the calibration values.

The calibration point output load value cannot be set to a value that would be 5% or more relative to the straight-line (reference line) that connects the no-load and rated load outputs.

ATTENTION

The following conditions must always be met.

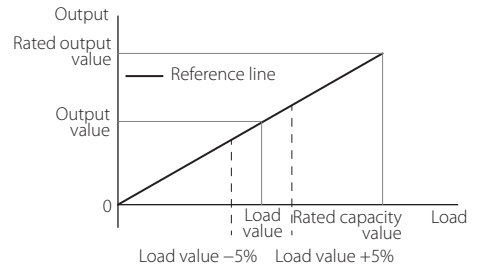
- $0 < \text{output value} < \text{rated output value}$
- $\text{Previous output value} < \text{current output value}$

5 Repeat steps 2–3 to set the necessary linearization points.

Linearization points can be set in a maximum of three locations.

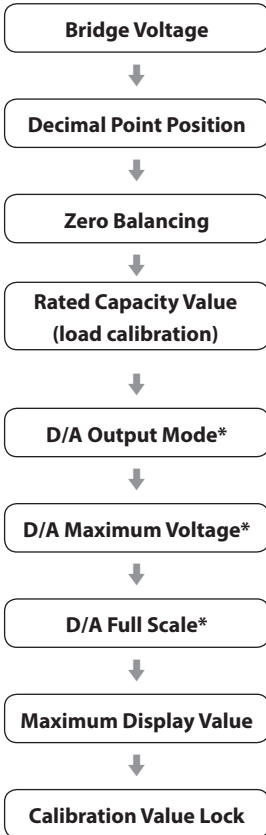
NOTE

- To disable linearization points after setting linearization calibration values, use the Enable/Disable Selection Point command to disable the selected points. Since set calibration values are saved, enabling selected points will enable linearization points without setting values.
- The possible range of linearization is shown by the dashed lines in the illustration below.



8-3. Actual load calibration

Calibrate by applying an actual load to the sensor.



- See “7. D/A converter” on page 33 for information about D/A settings.

*TD-SC1 (D/A) only

8-3-1. Bridge Voltage

Options: 5 V, 10 V

Set the bridge voltage to supply to the strain gauge transducer.

- As a reference for setting the bridge voltage, consider that the output from the sensor should be increased, and set the maximum voltage in a range that does not exceed the maximum safe excitation voltage on the sensor test report.

ATTENTION

A sensor could be damaged if this is set to a value that exceeds its maximum safe excitation voltage.

NOTE

The default value is 5 V.

8-3-2. Decimal Point Position

Set the decimal point position for the rated capacity value.

8-3-3. Zero Balancing

With no load on the sensor, send a Zero Balancing command.

During zero balancing, ST1 will be “Executing”.

- If ST1 becomes “Error occurred”, conduct countermeasures and redo calibration.

8-3-4. Rated Capacity Value (load calibration)

1 Apply an actual load to the sensor.

2 Set the rated capacity value.

3 Check ST1.

The process completed properly if it is “Standing by”.

- If it is “Error occurred”, conduct countermeasures and redo calibration.

ATTENTION

For the TD-SC1 (D/A), the rated capacity is set to the D/A full scale value.

NOTE

The decimal point position set here will be used as the indicator value decimal point position.

8. Calibration

8-3-5. D/A Output Mode

Options: voltage, current

8-3-6. D/A Maximum Voltage

Range: ± 1 to ± 10 (1V increments)

8-3-7. D/A Full Scale

With the "7-2. D/A Zero" value as the reference, set the span for the indicator values output to D/A. When the "7-2. D/A Zero" setting value is added, the "7-5. D/A Maximum Voltage" setting value voltage (20 mA when in electrical current mode) is output.

NOTE

For information about D/A settings, see "7. D/A converter" on page 33.

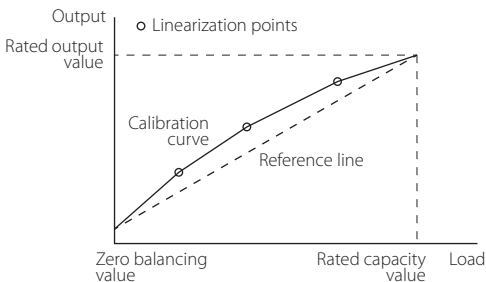
8-3-8. Maximum Display Value

Set the highest displayed value (page 42).

8-3-9. Calibration Value Lock

To prevent unintended changes to the calibration value, Calibration Value Lock should usually be set to ON.

8-3-10. Linearization Calibration



If linearization calibration is not conducted, a line connecting the two points between the zero balancing value and the rated capacity value will be used to calculate load.

Conducting linearization calibration improves the linearity of load measurements by increasing the number of calibration points.

Set the linearization calibration after actual load calibration.

1 Use the **Enable/Disable Linearization Calibration** command to enable linearization calibration.

2 Use the **Select Linearization Point** command to set the number of the linearization point (calibration point).

3 Use the **Enable/Disable Selection Point** command to enable the selection point.

4 After applying a load to the sensor, use the **Output Load Value for Calibration Point (actual load input)** command to set the load that was applied to the sensor.

After the command is transmitted, the output value will be measured.

The output value cannot be set to a value that would be 5% or more relative to the straight-line (reference line) that connects the no-load and rated load outputs.

ATTENTION

The following conditions must always be met.

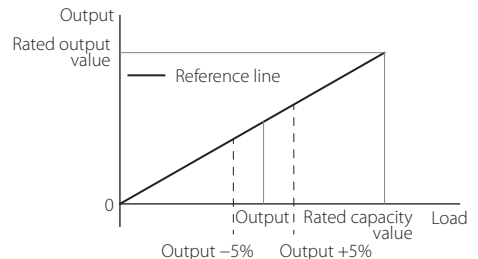
- $0 < \text{output value} < \text{rated capacity}$
- Previous output value $<$ current output value

5 Repeat steps 2-3 to set the necessary linearization points.

Linearization points can be set in a maximum of three locations.

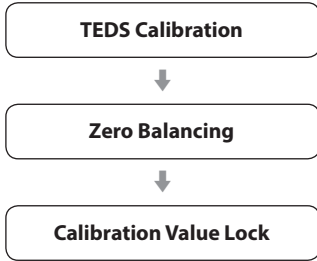
NOTE

- To disable linearization points after setting linearization calibration values, use the **Enable/Disable Selection Point** command to disable the selected points. Since set calibration values are saved, enabling selected points will enable linearization points without measuring again.
- The possible range of linearization is shown by the dashed lines in the illustration below.



8-4. TEDS calibration

A TEDS sensor has calibration information, including rated output and rated capacity, stored in its memory. TEDS calibration reads this calibration information to automatically record calibration values.



8-4-1. TEDS Calibration

Send a TEDS Calibration command.

Rated capacity digit shown during TEDS calibration

TEDS sensor rated capacity value	Unit shown	Indicator value
1	N, kN	01.000
2	N, kN	02.000
3	N, kN	03.000
4	N, kN	04.000
5	N, kN	05.000
10	N, kN	010.00
20	N, kN	020.00
30	N, kN	030.00
40	N, kN	040.00
50	N, kN	050.00
100	N, kN	0100.0
200	N, kN	0200.0
300	N, kN	0300.0
400	N, kN	0400.0
500	N, kN	0500.0

NOTE

- TEDS data is automatically loaded when the power is turned on.
- The decimal point position for the rated capacity will be used as the decimal point position for the indicator value.
- D/A settings will become as follows*:
D/A Output Mode: Voltage
D/A Maximum Voltage: 10 V
- The Maximum Display Value is set to 110% of the rated capacity.

*TD-SC1 (D/A) only

ATTENTION

The bridge voltage will be set to a value that is less than the maximum safe excitation voltage stored in the TEDS memory.

8-4-2. Zero Balancing

With no load on the sensor, send a Zero Balancing command. During zero balancing, ST1 will be "Executing".

- If ST1 becomes "Error occurred", conduct countermeasures and redo calibration.

8-4-3. Calibration Value Lock

To prevent unintended changes to the calibration value, Calibration Value Lock should usually be set to ON.

ATTENTION

If Calibration Value Lock is ON, automatic calibration will not occur when the unit is turned on.

8. Calibration

8-5. Remote Sense

Before connecting the sensor, set which type will be connected in advance.

Options: Used (6-wire format)
Unused (4-wire format)

ATTENTION

Incorrect connections or settings could cause damage to sensors.

8-6. Minimum Scale Selection

Set the minimum digital change of the indicator value.

Options: 1, 2, 5, 10

8-7. Display Frequency Selection

Select the number of times that the indicator value is shown per second.

Options: 4, 6, 10, 20

8-8. Maximum Display Value

Set the highest displayed value.

The default value is set to 110% of the rated capacity.

If this value is exceeded, the STATUS indicator will light magenta.

ATTENTION

The input value will be checked with a value converted to match the input signal.

If the value converted to match the input exceeds 5.0 mmV/V, the setting value will be adjusted to be equivalent to 5.0 mmV/V.

The default value will be checked in the same manner and adjusted if necessary.

8-9. Sensor Input Logic

The sensor input logic can be reversed artificially.

Normally, "Standard" should be used.

NOTE

- "Reversed" does not electrically reverse the input.
- After changing this setting, always redo zero.

8-10. Zero Balancing

You can conduct zero balancing even without resetting the calibration value.

1 Set Calibration Value Lock to OFF.

See "8-1-1. Locking and unlocking calibration values" on page 36.

2 With no load on the sensor, press and hold the ZERO button or send a Zero Balancing command.

During zero balancing, the STATUS indicator will become magenta.

3 Set Calibration Value Lock to ON.

ATTENTION

Zero balancing cannot be conducted during static strain display.

8-11. Zero Point Input Calibration

Set the zero point output value.

- Any desired output value can be set as the zero point.

8-12. Digital Zero

The current indicator value becomes zero.

- The digital zero can be adjusted in the range between absolute values of the Digital Zero Limit Value.
- Digital zero is cleared by turning off the power supply or using Clear Digital Zero.

ATTENTION

The digital zero function cannot be executed during static strain display.

9-1. Filter

9-1-1. Low-Pass Filter Selection

Set the low pass filter cutoff frequency (Hz).

Options: 3, 10, 30, 100, 300, 1000, None

NOTE

When set to "None", the AD converter anti-aliasing function is enabled for sampling frequencies to the top of the range.

9-1-2. Moving Average Data Set Size Selection

Set the moving average data set size for the measured data.

Options: OFF, 16, 32, 64, 128, 256, 512, 1024, 2048

9-1-3. Automatic Digital Filter

When the input signal is stable, the unit can temporarily set the filter's moving average data set size to 1024, reducing indicator value unsteadiness.

This function is used for the display of indicator values and affects judgments and DA output.

This does not function during hold execution, so it has no effect on measured values.

This function can be disabled by setting it to OFF.

Options: ON, OFF

9-1-4. Moving Average Data Set Size

This sets the moving average data set size for the measured data to the desired size.

Range: 0, 2–2048

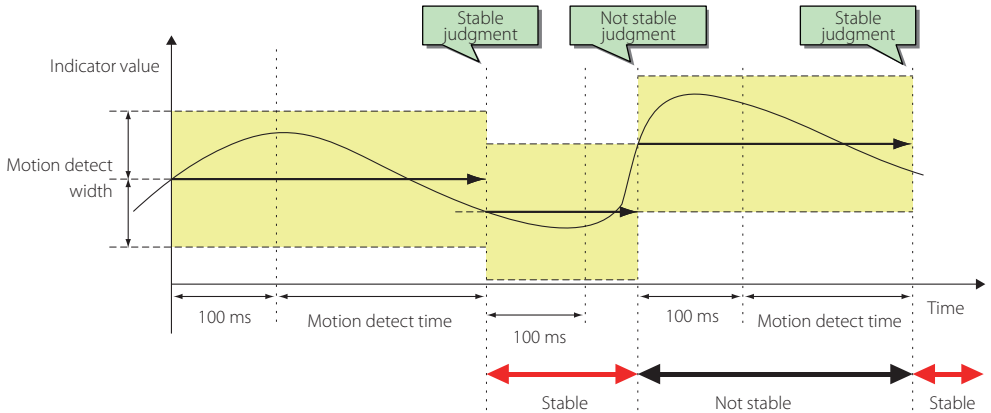
9. Condition settings

9-2. Motion Detect

Set the parameters used to detect stability.

The indicator value is judged to be stable if a difference less than the set width occurs between the current indicator value and the indicator value 100 ms before, and this continues for the set time.

The motion detect function is closely related to the comparison mode. See "10-3. Comparison Mode Setting" for details.



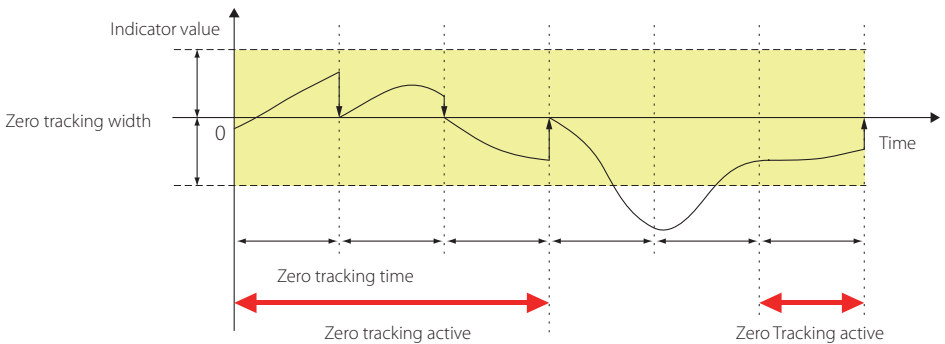
9-3. Zero tracking

This function automatically tracks drift and other gradual changes to the zero point.

With Zero tracking, when the zero point moves no more than the set width, the indicator value is automatically adjusted to zero each set time interval.

This only functions when Calibration Value Lock is ON and Enable Digital Zero is ON.

Zero tracking will not function if its time is set to 0.0 seconds and its width is set to 0.0.



9-4. Digital offset

The set value is subtracted from the measured value (digital zero).

9-5. Digital Zero

9-5-1. Enable Digital Zero

When Enable Digital Zero is set to OFF, the digital zero function will not be executed even if the D/Z signal is ON for the control input terminal.

9-5-2. Digital Zero Limit Value

This sets the digital zero adjustment range. (The setting value unit is the same as for the indicator value.)

ATTENTION

If the current sensor input value exceeds the digital zero limit setting value, the result of Digital Zero Limit Value command execution will end with an error and the indicator value will not become zero.

9-5-3. Clear Digital Zero

The display adjustment that has been made with Digital Zero is reverted so that the unadjusted value is shown again.

When zero balancing has been conducted, the value is shown as zero.

9-6. Switch Static Strain Disp. Mode (static strain display mode)

When a Switch Static Strain Disp. Mode execution command is issued, the input signal is shown using the strain amount unit (μST) (page 27).

Use when checking sensor output and when investigating unsteadiness in indicator values, including unsteadiness caused by sensors and cables, as well as for other problems.

NOTE

- To exit static strain display mode, issue a Switch to Home Screen execution command.
- Static strain is shown using 1-gauge method with a gauge factor of 2.0.

9-7. Select Data Output

Select the data output from the D/A converter of the TD-SC1 (D/A).

Select Data Output has the following two options.

The hold value is output in coordination with the display.

The input is output as is.

10. Comparison settings

10-1. Comparison value settings

Use this function to set the high limit and low limit values, compare them with indicator values, and turn judgment output ON for each one.

HI: high limit value

LO: low limit value

ATTENTION

Input values that meet this condition: low limit value < high limit value.

10-2. Comparison Pattern Setting

You can change the judgment output high limit and low limit assignments of HI and LO.

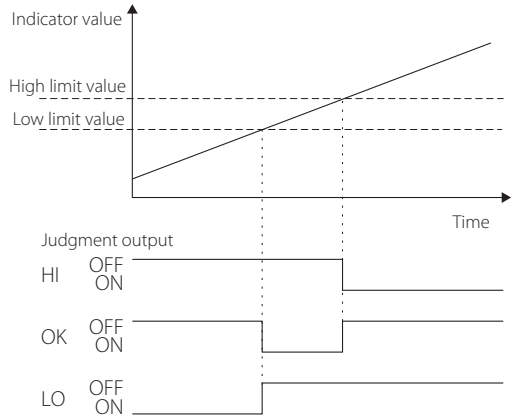
Options:

OK/LO/HI

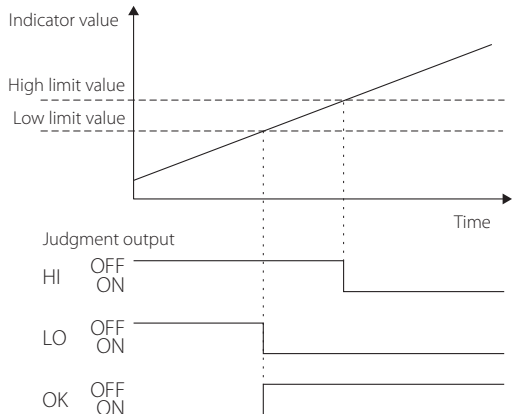
LO/OK/HI

LO/HI/OK

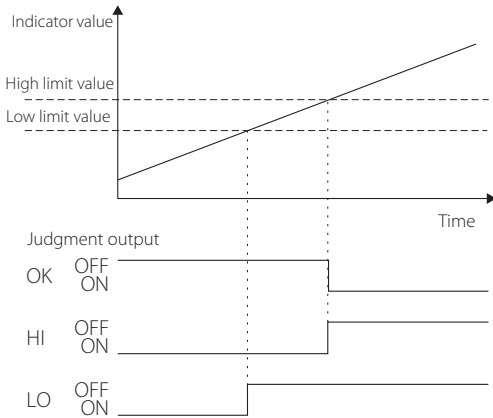
When set to LO/OK/HI, one is assigned to high limit and one is assigned to low limit (when Standard Comparison Output Pattern setting)



When set to OK/LO/HI, all are assigned to high limit (when Standard Comparison Output Pattern setting)



When set to LO/HI/OK, all are assigned to low limit (when Standard Comparison Output Pattern setting)



10-3. Comparison Mode Setting

Set the conditions for judging high limit and low limit.

NOTE

Compare During Stable, Compare Except Nearly Zero and Compare During Stable Except Nearly Zero comparison modes are closely related to motion detect and nearly zero functions. See "9-2. Motion Detect" and "10-6. Nearly Zero" for details.

10. Comparison settings

10-4. Hysteresis

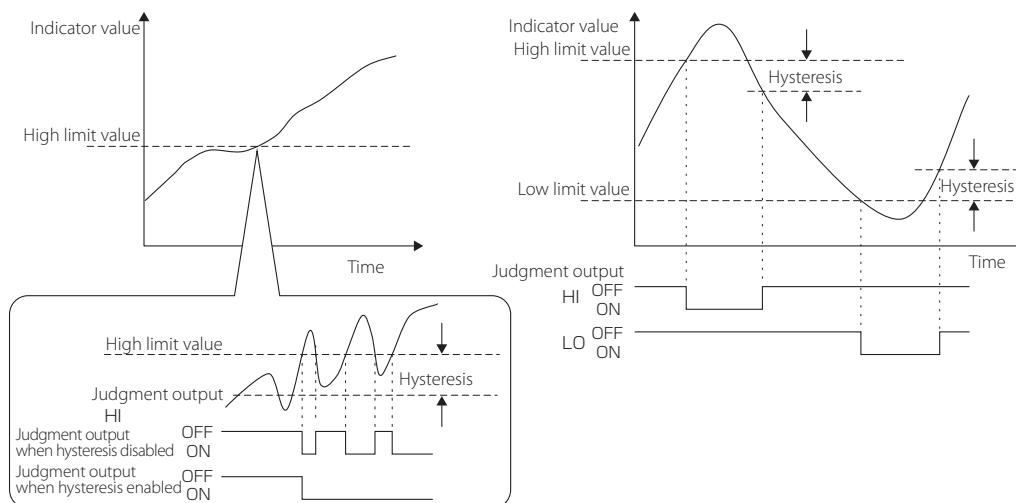
This function applies a width to switching from ON to OFF for high limit and low limit judgment.

If the indicator value fluctuates near a comparison value, causing judgment output to chatter between ON and OFF, adjustment of the hysteresis value can prevent this chattering.

The operation of hysteresis changes as follows according to the Comparison Pattern Setting.

For limit boundary values that are greater than the OK position, it operates in the negative direction. For limit boundary values that are less than the OK position, it operates in the positive direction.

When the Comparison Pattern Setting is LO/OK/HI, hysteresis activates for the high limit value when an indicator value decreases and for the low limit and low limit value when an indicator value increases.



Judgment output conditions (when Comparison Output Pattern is set to Standard Output)

Judgment output	Status	Condition
HI	OFF → ON	High limit value < indicator value
	ON → OFF	Indicator value ≤ (high limit value – hysteresis setting value)
LO	OFF → ON	Indicator value < low limit value
	ON → OFF	(Low limit value + hysteresis setting value) ≤ indicator value

ATTENTION

Set the hysteresis setting value so that it meets the following condition.

Low limit value < (high limit value – hysteresis setting value)

NOTE

- The same hysteresis width setting is used with high limit and low limit values.
- If set to "0", hysteresis will be disabled.

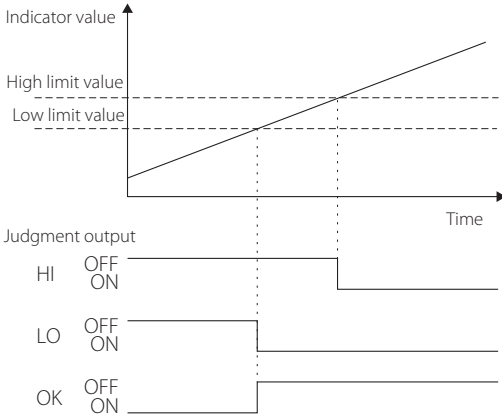
10-5. Comparison Output Pattern

The two types of judgment output operation are Standard Output and Area Output.

In these examples, the judgment output behavior is for when the Comparison Pattern Setting is "1" (OK/LO/HI).

10-5-1. Standard Output

Judgment output operation is as follows.
(when hysteresis is "0")
HI: high limit value < indicator value
LO: low limit value < indicator value
OK: indicator value < low limit value

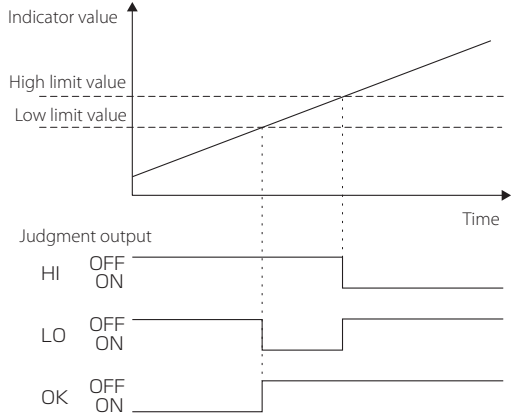


NOTE

Judgment output operation changes according to the hysteresis setting. See "10-4. Hysteresis" on page 48.

10-5-2. Area Output

Judgment output operation is as follows.
(when hysteresis is "0")
HI: high limit value < indicator value
LO: Low limit value < indicator value < high limit value
OK: indicator value < low limit value



NOTE

Judgment output operation changes according to the hysteresis setting. See "10-4. Hysteresis" on page 48.

10-6. Nearly Zero

Set the range in which indicator values are evaluated as being nearly zero.

NOTE

Nearly Zero judgment results are closely related to high limit and low limit judgment output.
See "10-3. Comparison Mode Setting" on page 47 for details.

11. Hold function settings

11-1. Hold Mode

The Hold Mode has the following four types.

OFF

No hold

Sample

Sample hold

Peak

Peak hold

Bottom

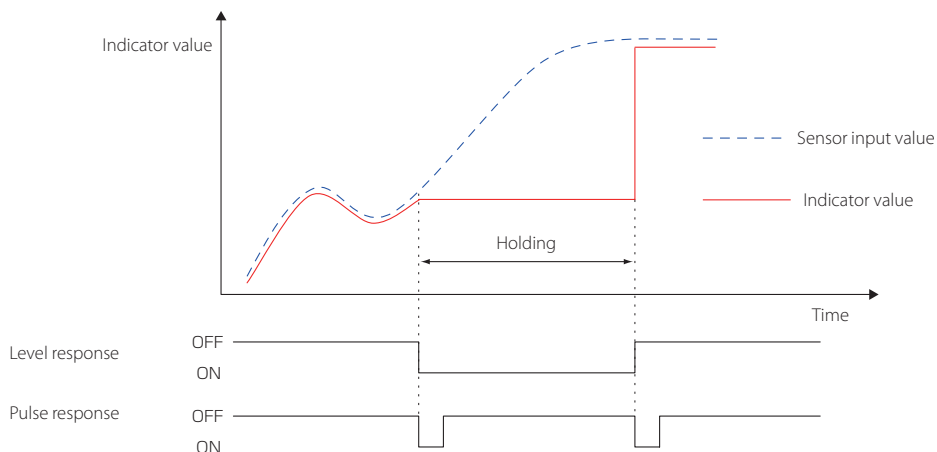
Bottom hold

11-1-1. Hold value reading

The data returned by Polling (0001) or Indicator Value Polling (0003) when holding is the hold value.

11-1-2. Sample hold

The Hold On command or a Hold signal from the control input terminal can be used to hold the indicator value. Send a Hold On command to hold an indicator value, and send a Hold Off command to stop holding it.



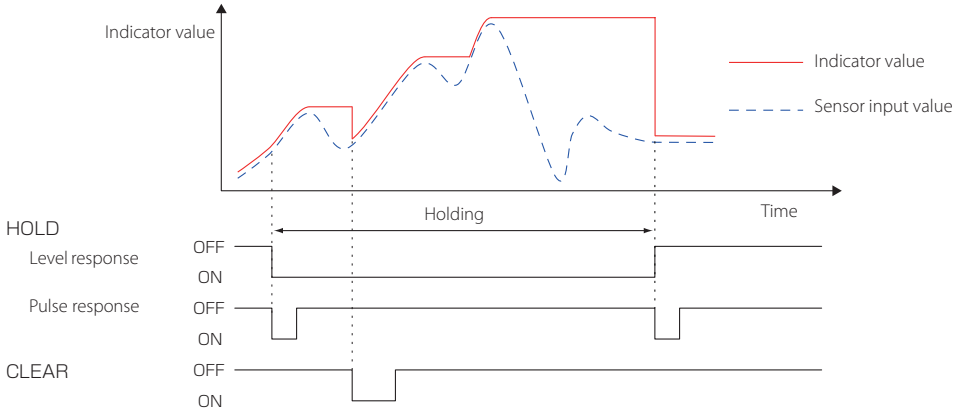
- Level or Pulse can be selected as the control input terminal Hold signal format using the External Hold Mode Setting.
- Zone Definition cannot be used with the sample hold mode.
- When using the sample hold mode, you cannot use a control input terminal Clear signal.

11-1-3. Peak hold

11-1-3-1. No Zone Definition

While a Hold On command is active or while a control input terminal Hold signal is ON, the maximum value (peak value) in the indicator value positive direction is held. Sending a Hold Off command or making the Hold signal OFF will end the peak hold.

When holding, sending a Hold Clear command or making the control input terminal Clear signal ON will also reset the peak value.



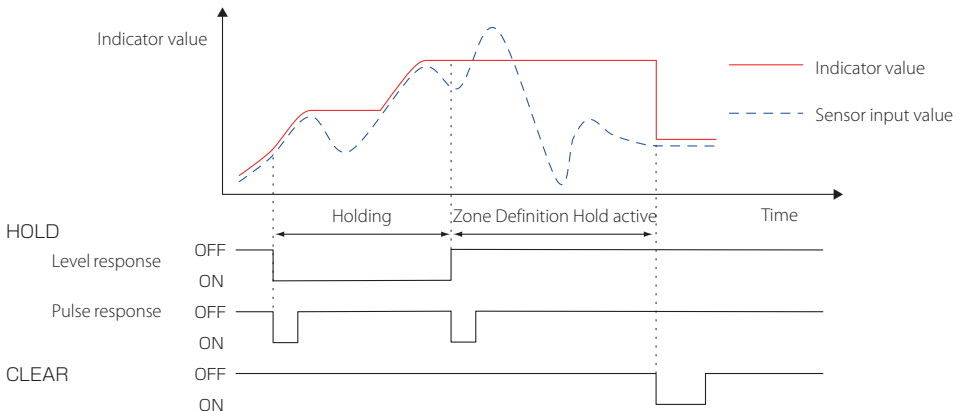
ATTENTION

When using Clear and Hold signals (when level response), maintain the ON state for at least 10 ms.

11-1-3-2. Zone Definition used

The indicator value when the hold operation completes continues to be held.

A hold will be reset by sending a Hold Clear command or by the control input terminal Clear signal becoming ON.



When holding, sending a Hold Clear command or making the control input terminal Clear signal ON will reset the peak value.

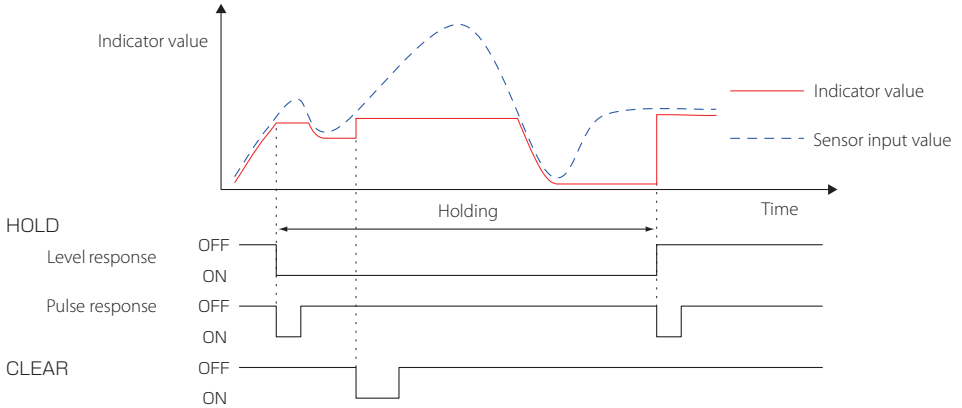
11. Hold function settings

11-1-4. Bottom hold

11-1-4-1. No Zone Definition

While a Hold On command has been sent or a control input terminal Hold signal is ON, the lowest indicator value (bottom value) is held. Sending a Hold Off command or making the control input terminal Hold signal OFF will end the bottom hold.

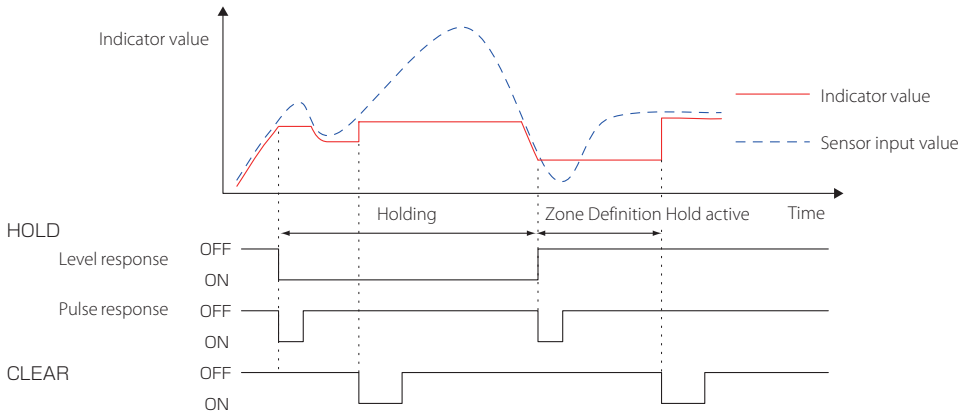
When holding, sending a Hold Clear command or making the control input terminal Clear signal ON will also reset the bottom value.



11-1-4-2. Zone Definition used

The indicator value when the hold operation completes continues to be held.

A hold will be reset by sending a Hold Clear command or by making the control input terminal Clear signal become ON.



When holding, sending a Hold Clear command or making the control input terminal Clear signal ON will also reset the bottom value.

11-2. External Hold Mode

Select the control input terminal Hold signal format.
The External Hold Mode has the following two types.

- Level
- Pulse

11-3. Clear signal

The Clear signal command sets whether control input terminal Clear signals are enabled or disabled.

11-4. Zone Definition

When Zone Definition is set to ON, the indicator value when the hold ends will continue to be held.

Send a Hold Clear command or use a Clear signal to stop holding it.

Options: ON, OFF

11-5. Hold Lock

While holding, sending a Hold Lock command will hold the indicator value.

Send a Hold Clear command or use a Clear signal to stop holding it.

11-6. Auto Zero

Set whether or not to automatically execute a Digital Zero when a hold starts (ON/OFF).

ON: automatically execute the digital zero function when a hold starts

OFF: do not automatically execute the digital zero function when a hold starts

12. System settings

12-1. Setting value memory

Select the setting value memory.

You can save up to 4 memories with setting values and switch among them.

- The selected memory setting is changed directly.
- You cannot copy between setting memories.

When shipped from the factory, memories 1 to 4 are set at default values.

See the setting value list for the setting values that can be saved in memories 1 to 4.

NOTE

The calibration value does not change.

ATTENTION

Interrupting the power while writing setting values will not only cause the values to not be recorded, it might also corrupt the memory. Do not interrupt the power supply while executing a Setting Value Memory command.

12-2. Save All Setting Values

The current settings can all be saved together in a setting value memory.

12-3. Device Information

The following information can be read from a communicating device.

Device Name
Communication Option
Version

12-4. Lock

12-4-1. Calibration Value Lock

See "14-1. Lock item list" on page 56 for information about settings that cannot be changed when Calibration Value Lock is ON.

12-4-2. Setting Value Lock

See "14-1. Lock item list" on page 56 for information about settings that cannot be changed when Setting Value Lock is ON.

12-4-3. Main Unit Operation Lock

If Main Unit Operation Lock is ON, the operation buttons (CAL and ZERO) on the unit will be disabled.

12-5. Device Number

You can give this unit a unique number.

12-6. Reset

You can restore settings to their default values (initialize them).

When the power is on, press and hold the ZERO and CAL buttons at the same time to reset the setting values even if Calibration Value Lock and Setting Value Lock are ON.

If Calibration Value Lock and Setting Value Lock are OFF, pressing and holding the ZERO and CAL buttons at the same time will reset the setting values even during startup.

NOTE

Of the setting values that can be saved in Memory 1–4, only the current selected setting value memory is reset.

ATTENTION

Always stop power to the unit once after executing a "Reset".

By connecting a sensor that supports IEEE1451.4 Transducer Electronic Data Sheet (TEDS) to the unit, the rated output stored in the sensor can be loaded and this can be applied to calibration of the indicator with this function.

In addition, the value calibrated by the unit itself can be loaded to the TEDS sensor and its original value can be restored.

These functions are supported by TEDS sensors that comply with the standard shown in the table below.

Note, however that equipment with TEDS memory includes both 1kbit and 4kbit devices, but the unit only supports 4kbit.

TEDS standard			
IEEE 1451.4 (V0.9)	IEEE1451.4 (V1.0)		
	Template ID		
	Bridge Sensors (33)	Strain Gauge (35)	Other
-	✓✓	✓	-

- ✓✓ TEDS calibration, TEDS data writing and TEDS data restoration supported
- ✓ TEDS calibration supported
- Not supported

13-1. Rewrite TEDS Data

The current calibration values (rated output and rated capacity) and calibration date will be written to the TEDS memory.

The indicator unit will not be written.

13-2. Restore TEDS Data

This restores the factory default calibration values of a product using the data from "Rewrite TEDS Data" above.

13-3. Show TEDS Data

Values can be read by executing the following commands from the TEDS data display group.

- Serial number (6001)
- Maximum rated capacity (6002)
- Maximum rated output (6003)
- Sensor Impedance (6004)
- Maximum excitation level (6005)
- Calibration date (6006)
- Model number (6007)

14. Settings

14-1. Lock item list

14-1-1. Calibration

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
	Bridge Voltage	✓		
	Decimal Point Position	✓		
	Zero Point Input Calibration	✓		
	Zero Balancing	✓		
	Remote Sense	✓		
Equivalent Input Calibration	Rated Output Value	✓		
	Rated Capacity Value	✓		
Actual Load Calibration	Rated Capacity Value	✓		
TEDS Calibration	TEDS Calibration	✓		
Linearization Calibration	Enable/Disable Linearization Calibration	✓		
	Select Linearization Point	✓		
	Enable/Disable Selection Point	✓		
	Sensor Output Value for Calibration Point	✓		
	Output Load Value for Calibration Point (Equivalent Input)	✓		
	Output Load Value for Calibration Point (Actual Load Input)	✓		
D/A Converter	D/A Output Mode		✓	
	D/A Maximum Voltage		✓	
	D/A Zero		✓	
	D/A Full Scale		✓	
Display	Minimum Scale Selection	✓		
	Display Frequency Selection	✓		
	Maximum Display Value	✓		
	Sensor Input Logic	✓		

14-1-2. Condition settings

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
Filter	Low-Pass Filter Selection		✓	✓
	Moving Average Data Set Size Selection		✓	✓
	Automatic Digital Filter		✓	✓
	Moving Average Data Set Size		✓	✓
Motion Detect	Time		✓	✓
	Width		✓	✓
Zero Tracking	Time		✓	✓
	Width		✓	✓
Digital Zero	Enable Digital Zero		✓	
	Digital Zero Limit Value		✓	
Digital Offset			✓	
Select Data Output			✓	✓

14-1-3. Comparison settings

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
Comparison Value Settings	High Limit Value (HI)		✓	✓
	Low Limit Value (LO)		✓	✓
Comparison Pattern Setting			✓	✓
Comparison Mode Setting			✓	✓
Hysteresis			✓	✓
Comparison Output Pattern			✓	✓
Nearly Zero			✓	✓

14-1-4. Hold function settings

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
Hold Mode			✓	✓
External Hold Mode			✓	✓
Clear signal			✓	✓
Zone Definition			✓	✓
Auto Zero			✓	✓

14-1-5. System settings

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
Setting Value Memory			✓	
Save All Setting Values			✓	
Device Information	Device Name			
	Communication Option			
	Version			
Lock	Calibration Value Lock			
	Setting Value Lock			
	Main Unit Operation Lock			
Device Number			✓	
RS-485 Transmission Settings	Port Selection			
	ID Number		✓	
	Communication Mode		✓	
	Baud Rate		✓	
	Bit Length		✓	
	Parity Bit		✓	
	Stop Bit		✓	
Delimiter		✓		
USB Transmission	Communication Mode		✓	

14-1-6. TEDS settings

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
Show TEDS Data	Serial Number			
	Maximum Rated Capacity			
	Maximum Rated Output			
	Sensor Impedance			
	Maximum Excitation Level			
	Calibration Date			
	Model Number			
Rewrite TEDS Data	Rewrite Data			
	Restore Data			

14. Settings

14-1-7. Input/output testing

Group	Setting name	Calibration Value Lock	Setting Value Lock	Setting Value Memory
	Input/Output Testing ON/OFF			
D/A Test Output	Test A/D Input Value		✓	
Test Control Input/Output Terminals	Output Terminals			
	Input Terminals			

15. Warranty explanation

- The warranty period for this device is one year from the date of purchase.
- Be aware that repairs will require payment in the following cases even during the warranty period.
 - (1) Malfunction or damage due to misuse
 - (2) Malfunction or damage caused by modifications or repairs conducted by any party other than our company or a service person designated by our company
 - (3) Malfunction or damage caused by dropping, transportation or similar handling after product delivery
 - (4) Malfunction or damage caused by fire, earthquake, water, lightning or other natural disaster
 - (5) Malfunction or damage caused by external factors, including power supplies and equipment environmental conditions, that deviate from the operation requirements of this product
 - (6) Malfunction or damage if the product was not purchased from our company or an agent designated by our company
- We offer paid service after the conclusion of the warranty period. For details, please contact the retailer where you purchased the unit or a contact on the back cover of this manual.
- Be aware that our company will bear no responsibility for any secondary damages resulting from the operation of this device or related to data.
- Information is given about products in this manual only for the purpose of example and does not indicate any guarantees against infringements of third-party intellectual property rights and other rights related to them. TEAC Corporation will bear no responsibility for infringements on third-party intellectual property rights or their occurrence because of the use of these products.

16. Specifications

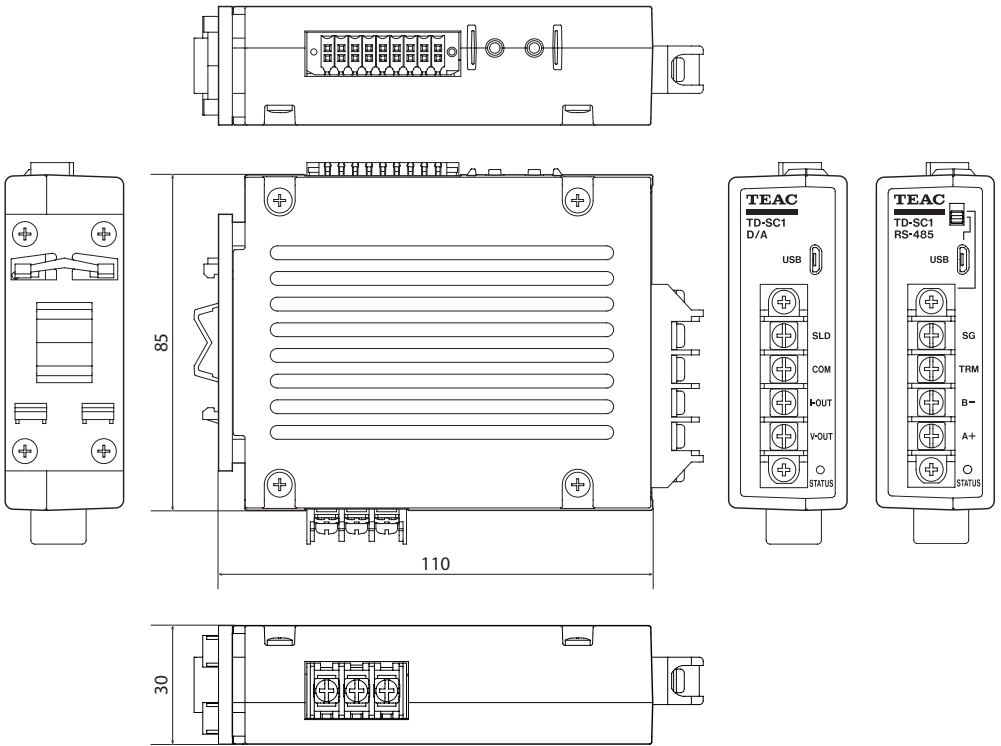
Bridge voltage		DC 10 V, 5V±10% (30mA current maximum, can be used with remote sense)
Signal input range		±5.0 mV/V
Equivalent input/ TEDS	Calibration range	0.05 mV/V – 5.0 mV/V
	Calibration precision	Within 0.1% F.S. (when using 1m standard TEAC Ø8, 6-core shielded cable with 350Ω impedance, 10V BV and 5mV/V setting)
Precision	Linearity	Within 0.01% F.S. +1 digit (when input is 5 mV/V)
	Zero drift	Within 0.5 μV/°C (input conversion value)
	Gain drift	Within ±0.005% F.S./°C
A/D conversion		24-bit, 20000 times/second
Digital filter		Select 3, 10, 30, 100, 300, 1000 Hz(–6 dB/oct) or none
D/A output**		4000 times per second, isolated output, ±1–±10V (set in 1V steps) and about 1/59000 resolution (when set to ±10V), or 4–20mA and about 1/43000 resolution
TEDS function		IEEE1451.4 class 2 mix mode interface
Indicator value	Display range	–99999 to 99999
	Decimal point	Display position selectable
	Times displayed	Select 4, 6, 10 or 20 times/second
Setting items	Calibration settings	Zero Balancing, TEDS Calibration, Actual Load Calibration, Equivalent Input Calibration
	Function settings	High Limit, Low Limit, Comparison Mode, Hysteresis, Nearly Zero, Moving Average, Low Pass Filter, Motion Detect, Zero Tracking, Static Strain, Digital Zero, Digital Offset, Zone Definition, Hold Mode, Lock, Minimum Grid, Display Times, Bridge Voltage, Digital Zero Limit Value, Clear Digital Zero, Comparison Output Pattern, Select Data Output**, D/A Converter**, Remote Sense
Hold functions		Sample hold, peak hold, bottom hold, zone definition hold (peak, bottom)
External input and output signals	Input	Hold, Clear, Digital Zero (isolated from main unit circuits using a photocoupler)
	Output	HI, OK, LO open collector output (isolated from main unit circuits using a photocoupler)
	RS-485*	A+, B– (isolated from main unit circuits using a photocoupler), TRM, SG
Power supply		Ratings: 24V DC ±10%, 7 W
Operating temperature range		0°C to 40°C
Storage temperature range		–20°C to 60°C
Operating humidity range		85% RH or less (without condensation)
Applicable standards		CE marking, FCC (Class A), UL61010-1, UKCA marking
External dimensions (W × H × D)		Approximately 30 mm × 85 mm × 110 mm (without protrusions)
Weight		About 210 g

*TD-SC1 (485) only

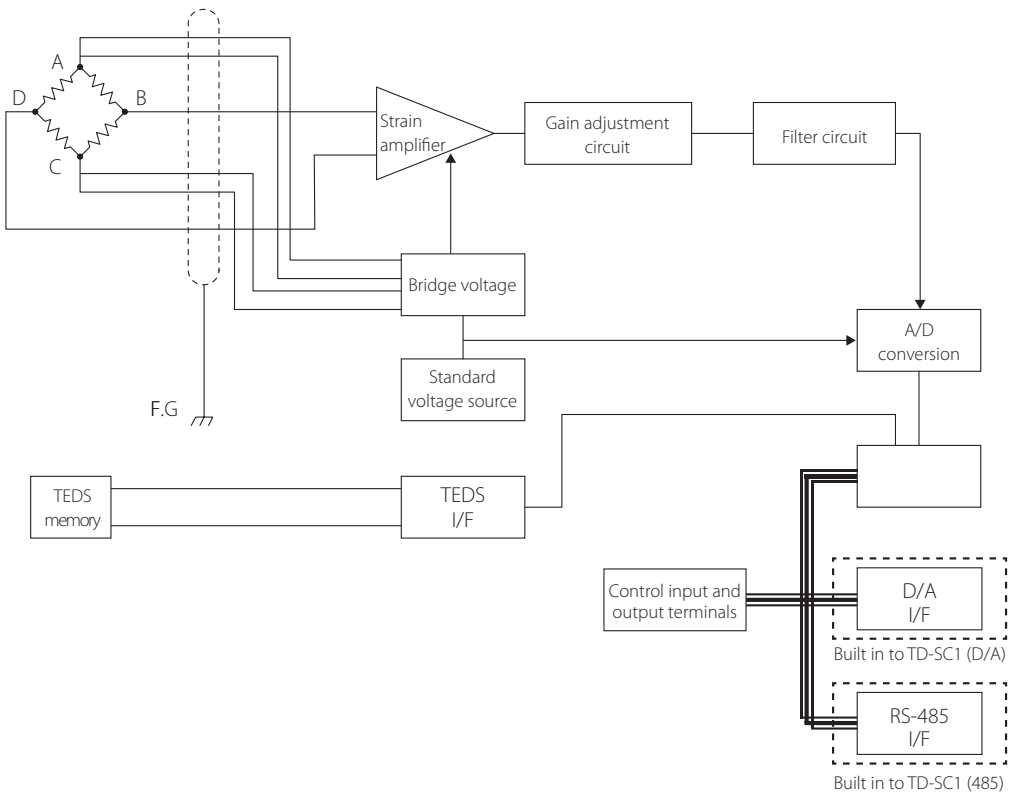
**TD-SC1 (D/A) only

- Specifications and appearance are subject to change without notice.
- Weight and dimensions are approximate.
- Illustrations in this owner's manual might differ slightly from production models.

17. External drawings



18. Block diagram



TEAC

TEAC CORPORATION	1-47 Ochiai, Tama-shi, Tokyo 206-8530, Japan	Phone: +81-42-356-9154
TEAC AMERICA, INC.	10410 Pioneer Blvd. Unit #1, Santa Fe Springs, California 90670, U.S.A.	Phone: +1-323-726-0303
TEAC EUROPE GmbH. (EU Importer)	Bahnstrasse 12, 65205 Wiesbaden-Erbenheim, Germany	Phone: +49-(0)611-7158-349
TEAC UK Limited (UK Importer)	Luminous House, 300 South Row, Milton Keynes, Buckinghamshire, MK9 2FR, UK	Phone: +44-1923-797205
TEAC SALES & TRADING (ShenZhen) CO., LTD.	Room 817, Xinian Center A, Tairan Nine Road West, Shennan Road, Futian District, Shenzhen, Guangdong Province 518040, China	Phone: +86-755-88311561-2
