

TS-3200A

DIGITAL TORQUE METER

INSTRUCTION MANUAL

Warranty

1. This product is covered by a warranty for a period of one year from the date of purchase.
 2. This warranty covers free-of-charge repair for defects judged to be the responsibility of the manufacturer, i.e., defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
 3. For free-of-charge repair, contact either your sales representative or our sales office nearby.
 4. The following failures will be handled on a fee basis even during the warranty period.
 - (a) Failures occurring through misuse, mis-operation, or modification
 - (b) Failures occurring through mishandling (dropping) or transportation
 - (c) Failures occurring through natural calamities (fires, earthquakes, flooding, and lightning), environmental disruption, or abnormal voltage.
- * For repairs after the warranty period expired, contact your sales representative or our sales office nearby.

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2. The contents of this document are subject to change without notice.
3. This document has been produced based on a series of strict verifications and inspections. Should a failure occur nonetheless, please inform our sales representative or sales office.
4. Ono Sokki shall have no liability for any effect resulting from any operation, whether or not the effect is attributable to a defect in the documentation.

INTRODUCTION

Thank you very much for your selection of the TS-3200A Digital Torque Meter.

To ensure that you get the most out of your new Digital Torque Meter, we recommend that you read and follow the instructions in this document carefully.

The TS-3200A Digital Torque Meter was severely checked for normal operation before shipment. When you unpack the unit, make sure that it has not been damaged during transportation, and then check operation according to this document.

If it is damaged or does not operate normally as described in this document, contact your dealer or ONO SOKKI sales office nearby.

FOR YOUR SAFETY

Please read this manual including this section to ensure safe and proper use of your TS-3200A Digital Torque Meter.

ONO SOKKI, Ltd. bears no responsibility for any warranty regarding damages, failures, or injury resulting from failure to follow directions in this manual during operation.

Meaning of Symbols

- In this document and this section, precautions are classified into two categories:

WARNING and CAUTION

This depends on the degree of danger or damage possible if the precaution is ignored and the product is used incorrectly.

 WARNING	This symbol is used to indicate precautions where there is a risk of death or serious personal injury to the operator if the product is handled incorrectly.
 CAUTION	This symbol is used to indicate precautions where there is a risk of some personal injury to the operator or only material damage to the product if the product is handled incorrectly.

BEFORE USING



WARNING

- Use the instrument with the specified voltage. The standard voltage is 100 to 240VAC (no selection required). Use of power other than that specified may cause damage to the instrument. Before turning the power ON, make sure that the power meets the specified voltage.
- Only use fuses with the rating (current, voltage, and blowout characteristics) specified for the instrument.
Rating: 250VAC 2A time-lag fuse
Use of fuses other than that specified may cause failure. Also, be sure to turn the power OFF and unplug the power cord for at least one minute before replacing fuses.
- Do not operate this instrument in locations where there is gas or steam. Using this instrument where there is steam or combustible or explosive gas may cause an explosion.
- Do not operate this instrument in locations where corrosive gas is present. Corrosion may cause inferior connection resulting in failure.
- Do not use the instrument in locations subject to excessive vibration, humidity, or dust. Because this instrument is a precision instrument, using it in locations subject to excessive vibration, humidity, or dust may cause failure.
- Avoid using the instrument in locations with high temperature because there is a risk of fire. Using this instrument in locations having a temperature exceeding the specified operating temperature range may cause the instrument to catch on fire.
- Do not block the heat radiation system because there is a risk of fire if heat builds up inside the instrument. Place the instrument away from the wall in locations with the best ventilation possible.
- Never dismantle or disassemble the instrument. Do not remove the casing or take apart this instrument. Use of this instrument without its casing or while taken apart may cause damage to equipment or electric shock. When internal adjustment, inspection, or repairs are required, contact your dealer or ONO SOKKI sales office nearby.
- Do not splash or spill water on the instrument because there is a risk of fire or electric shock because of short-circuit or heat development. If you get water inside the instrument, unplug the power cord immediately and call your dealer or ONO SOKKI sales office nearby as soon as possible.
- Use the instrument within the specified temperature range (0 to +40°C). Using or storing the instrument in locations with rapid temperature change may cause condensation inside it which can cause failure.

PRECAUTIONS ON ELECTRIC SHOCK



- Never cut the internal or external ground wire of a product or disconnect the wire connected to the protective ground terminal of the instrument because doing so may cause electric shock or damage to the instrument.
- Before connecting the instrument to the device under measurement or external control circuit, make sure that protective earth is securely made and that the power is OFF. Connecting to external equipment without protective earth or while the power is still ON may cause electric shock.
- Before touching parts of the instrument where voltage/current is output or circuits connected to parts where voltage/current is output, make sure that the power is OFF. Touching such parts without turning the power OFF may cause electric shock. Be sure to sufficiently insulate circuits from output voltage/current.
- Be sure that the power always meets specified voltage, current, and frequency requirements. Use of power other than that specified may cause electric shock, fire, or damage to the instrument.
- If you hear thunder, do not touch any metal parts of the instrument or the plug because there is a risk of electric shock from conducted lighting. Do not use this instrument outdoors if you hear thunder.

ABOUT THE POWER CORD



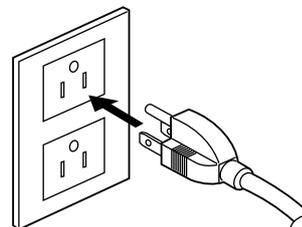
- Be sure to use the power cable and power plug supplied with the instrument or the ones specified by ONO SOKKI. Use the standard AC power cable supplied with the instrument with 125VAC or less. When operating the instrument with voltage exceeding 125VAC, be sure to use the specified power cable (with a withstand voltage of 250VAC or higher) which is prepared as an option.
- Turn the power OFF before plugging or unplugging the power cable failure to do so may cause surge voltage, etc., resulting in failure.
- If the instrument will not be in use for a prolonged period of time, unplug the power cord from the outlet. There is a risk of deteriorated insulation which may cause electric shock, short circuit, or fire.
- Do not use three-pronged power cords with extension cords which do not have a ground wire because doing so defeats protective grounding.

ABOUT PROTECTIVE GROUNDING



- Be sure to ground the instrument for safety and noise elimination. The grounding method is shown below.

- Grounding with a three-pronged power plug. Plug the supplied three-pronged AC power cord into a three-pronged outlet.



IF A PROBLEM OCCURS



- If any metal, water, or foreign object should fall inside, unplug the instrument immediately. Using the instrument after metal, water, or foreign object has fallen inside may cause fire or electric shock. Unplug the instrument immediately, then contact your dealer or ONO SOKKI sales office nearby as soon as possible.
- If you perceive smoke, noise, or abnormal odor coming from the instrument or if you accidentally drop or damage it, unplug the instrument immediately. Using the instrument under such conditions may cause fire or electric shock. Contact your dealer or ONO SOKKI sales office nearby as soon as possible.

ABOUT INSTALLATION AND CONNECTIONS



- Do not install the instrument in unstable locations. If the instrument should fall it may cause injury or damage to equipment.
- Do not place large or heavy objects on top of the instrument. If an object on top of the instrument should fall it may cause injury or damage to equipment.
- Do not install the instrument in locations where there is oily smoke or steam or where there is high humidity or lots of dust. Electricity could conduct through oil, water vapor, or dust resulting in fire or electric shock.
- Do not install the instrument in locations subject to extremely high temperature or direct sunlight because doing so may cause fire.
- Turn the power OFF before connecting a signal cable. There is a risk of electric shock or fire.

ABOUT THE POWER CORD



- Be sure to hold onto the plug portion when plugging in or unplugging the power cord. Pulling on the cord may damage or break the cord possibly resulting in fire or electric shock.
- Do not plug in or unplug the power cord while your hands are wet. There is a risk of electric shock.
- Keep the power cord away from heaters or appliances which generate high temperature as the cord casing may melt resulting in fire or electric shock.
- To prevent electric shock due to deteriorated insulation or fire due to leakage, if the instrument will not be in use for a prolonged period of time, unplug the power cord from the outlet or turn OFF the breaker on the distribution panel.

MEASUREMENT



- Do not connect or disconnect input cables during measurement because there is a risk of failure of external devices.
- Do not turn the power OFF during measurement because there is a risk of failure of external devices.
- For correct measurement, be sure to set specific values for the Torque Meter according to Chapter 3, "Basic Operations."
- When using measurement values for control feedback signals, etc., apply interlocking using the READY signal from the REMOTE connector.
- Be careful to the voltage output for rotary encoding. Do not short-circuit connector REVO 2 on the rear panel, which is a +12V voltage output (pin C) for supplying the power to a rotary encoder. If it is short-circuited, the fuse blows resulting in failure.
- Do not short-circuit the analog voltage output (the + and - pins of connector ANALOG OUT) because there is a risk of failure.

CONTENTS

Chapter 1 Overview

1.1	Overview	1-2
1.2	Block Diagram	1-3
1.3	System Configuration	1-6
1.4	Checking Accessories	1-7
1.5	Precautions on Wiring of Torque Meter	1-8

Chapter 2 Before Use

2.1	Name and Function of Each Section	2-2
2.1.1	Front Panel	2-2
2.1.2	Rear Panel	2-4
2.2	Detector Connections	2-8

Chapter 3 Basic Operations

3.1	Sequence of Basic Operations	3-2
3.1.1	Basic Key Operations	3-3
3.2	Setting Parameters of Torque Detector	3-4
3.3	Selecting Rotational Direction (CW/CCW)	3-10
3.3.1	CW/CCW	3-11
3.3.2	Selecting CW/CCW Using a Panel Switch	3-12
3.3.3	Selecting CW/CCW Using REMOTE Function	3-14
3.4	Zero Adjustment	3-15
3.4.1	Automatic Zero Value Setting	3-16
3.5	Setting Frequency Characteristic N-0 Compensation Values of Detector	3-18
3.5.1	Manual Setting of N-0 Compensation Values	3-19
3.5.2	Automatic Setting of N-0 Compensation Values	3-22
3.6	Setting Parameters of Rotary Encoder	3-24
3.6.1	When Rpm Is Not Detected Directly from Rotating Shaft (Input of RATIO)	3-28
3.7	Setting Output (POWER) Operational Conditions	3-30
3.8	Setting Measurement Display	3-32
3.9	Setting Analog Output	3-35

Chapter 4 Other Operations

4.1	Using REMOTE Function	4-2
4.1.1	Input (Dry Contact Input)	4-2
4.1.2	Output (Dry Contact Output)	4-3
4.1.3	Pin Arrangement	4-4
4.2	Selecting Detector Parameter Settings	4-5
4.3	LOCK Function	4-6
4.4	MAX, MIN, P-P, and RIPPLE of Display Data	4-7

4.4.1	Displaying MAX, MIN, P-P, and RIPPLE.....	4-9
4.5	Taking Absolute Values of Measured Data	4-10
4.6	Synchronous Operation	4-13
4.7	Checking Settings	4-14
4.8	Calibrating Analog Output	4-15
4.9	Self-Check	4-16
4.9.1	Description of Items	4-17
4.10	Initializing Settings	4-19
4.11	Turning LCD Off	4-20
4.11.1	Turning Off	4-20
4.11.2	Adjusting Contrast	4-21
4.12	Torque Unit Conversion	4-22
4.12.1	Converting Unit System from kgf to N	4-23
4.13	Temperature Compensation for FACTOR of Torque Detector	4-24
4.14	Default Settings	4-26

Chapter 5 Options

5.1	Analog Output High-Speed Response (1ms) TS-0321	5-2
5.2	Comparator TS-0322	5-5
5.2.1	Description of Functions	5-6
5.2.2	Description of MODE	5-8
5.2.3	Setting Procedure	5-10
5.2.4	Recommended Interfaces	5-12
5.3	BCD Output TS-0323	5-13
5.3.1	Description of Each Signal	5-13
5.3.2	Recommended Interface	5-17
5.3.3	Timing Chart	5-18
5.4	RS-232C Interface	5-20
5.4.1	Overview	5-20
5.4.2	Specifications	5-20
5.4.3	Connection with PC	5-21
5.4.4	Check Procedure at Hyper Terminal	5-23
5.5	GP-IB Interface	5-25
5.5.1	Overview	5-25
5.5.2	Precautions Before Use	5-26
5.5.3	GP-IB Specifications	5-27
5.5.4	GP-IB Interface Functions	5-29
5.5.5	GP-IB Address Settings	5-31
5.6	Communication Commands (RS-232C/GP-IB/LAN)	5-32
5.6.1	Parameter Settings	5-32
5.6.2	Display Mode	5-33
5.6.3	Measurement Commands	5-34
5.6.4	BCD Output (Effective When TS-0323 Is Installed)	5-35
5.6.5	Torque Settings	5-36
5.6.6	Rpm Settings	5-38
5.6.7	Output (POWER) Settings	5-39

5.6.8	Analog Output Settings	5-40
5.6.9	Comparator (CMP Comparison) (Effective When TS-0322 Is Installed)	5-41
5.6.10	Measurement Commands	5-42
5.6.11	Check Commands	5-44
5.6.12	Backup Commands	5-45
5.6.13	Bus Commands (Applied Only to GP-IB)	5-45
5.7	Adding One Analog Output Channel TS-0328	5-46

Chapter 6 Menus

6.1	[MENU] Key	6-2
6.2	[CAL] Key	6-6
6.3	[TRQ ZERO] Key	6-6

Chapter 7 Troubleshooting

7.1	Troubleshooting	7-2
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Chapter 8 Specifications

8.1	Torque Signal Measurement Unit	8-2
8.2	Rotational Signal Measurement Unit	8-4
8.3	POWER (Output) Measurement Unit	8-6
8.4	Display Panel	8-7
8.5	Interface Unit	8-8
8.6	General Specifications	8-11
8.7	Accessories	8-11
8.8	Outside Dimensions	8-12

Chapter 1 Overview

1.1 Overview

1.2 Block Diagram

1.3 System Configuration

1.4 Checking Accessories

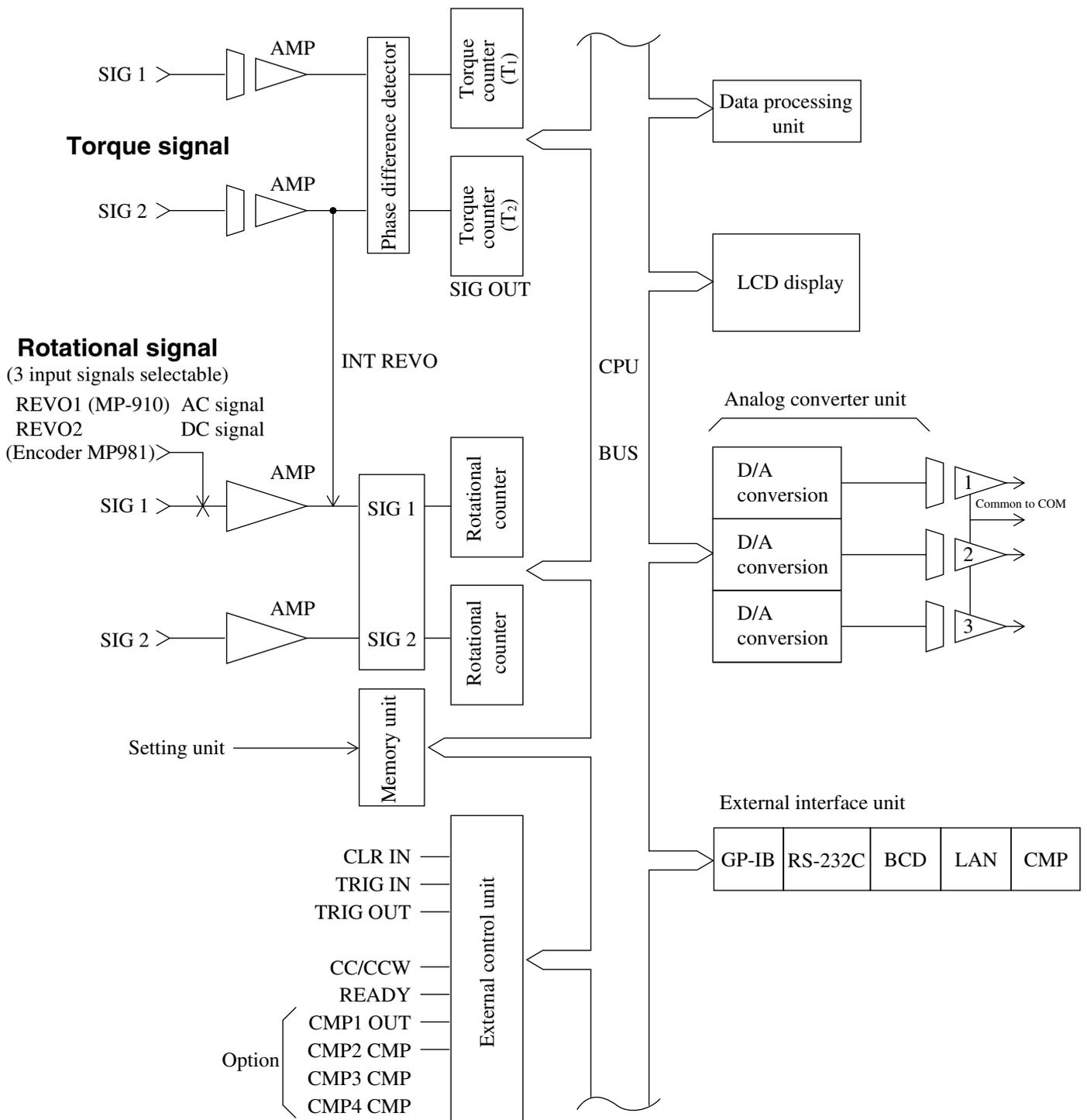
1.5 Precautions on Wiring of Torque Meter

1.1 Overview

The TS-3200A is a torque meter which digitally converts the phase difference between two signals of a phase-conversion type torque detector to torque values. It performs all processing from detection to display in digital form, enabling torque measurement with excellent precision, durability, and reproducibility.

Since the TS-3200A measures the torque and rpm at the same time and is provided with an analog output as standard, remote function, etc., it can be used to control external load devices.

1.2 Block Diagram



[Isolation symbol] shows isolation.

- **Phase difference detector**

Detects the phase difference between two torque signals to oscillates a pulse train corresponding to phase variation.

- **Torque counters**

Since the TS-3200A has a short sampling time, it is provided with two torque counters: one counts the pulse train which is proportional to the phase difference and the other counts the pulse train with a fixed phase difference (360 degrees) to obtain T1 and T2, respectively.

- **Rotational counters**

Like the torque counter unit, the TS-3200A is provided with two rotational counters: one counts the number of input signal pulses, N, and the other counts the total value of the integrated period, T. Although the sampling time synchronizes with the torque counter units, the count times of the two counters are not the same because of different input signals.

- **Memory unit**

This unit consists of nonvolatile memory which memorizes various parameters (including N-0 compensation) specified by key entry.

- **Data processing unit**

This unit consists mainly of a microprocessor to perform high-speed operation, time constant operation, sequence control, and interface control.

It processes high-speed operation for each sampling time (4ms/optionally 1ms) based on the expression below. The unit counts the pulse train which is proportional to the phase difference and the pulse train with a fixed phase difference (360 degrees) to obtain T1 and T2, respectively.

$$\text{Torque} = \frac{CF}{2} \times \frac{T_1}{T_2} - Z - N_0 \quad (\text{The decimal point unit is ignored.})$$

$$\text{Rotational speed} = \text{Input frequency (Hz)} \times \frac{Kn}{P} \times \frac{1}{\text{RATIO}}$$

Kn = 60 when the unit is r/min.

Kn = 1 when the unit is r/s.

Kn = P when the unit is Hz.

$$\text{Output (W)} = 2\pi \times \text{torque (N-m)} \times \text{Rotational speed (r/s)}$$

$$\text{Output (W)} = \frac{2\pi}{60} \times \text{torque (N-m)} \times \text{Rotational speed (r/min)}$$

$$PS = 0.7355 \text{ kW}$$

Related parameters

- C: Range: Most significant digit of the capacity of the detector
- F: Factor: Instrumental error compensation value by the detector (Should be changed for each unit.)
- Z: Zero point compensation value in the no-load condition
- N0: Frequency characteristic compensation value of the detector
- P: Number of pulses
- RATIO: Gear ratio

- **Analog converter unit**

The result of high-speed operation is output by the D/A converter in analog form. The conversion factor of digital value and analog value is determined by CAPACITY. The full-scale voltage output is 10V.

- **LCD display**

Displays torque (TORQUE), rotation (REVO), or output (POWER) which is selected, as well as each parameter setting.

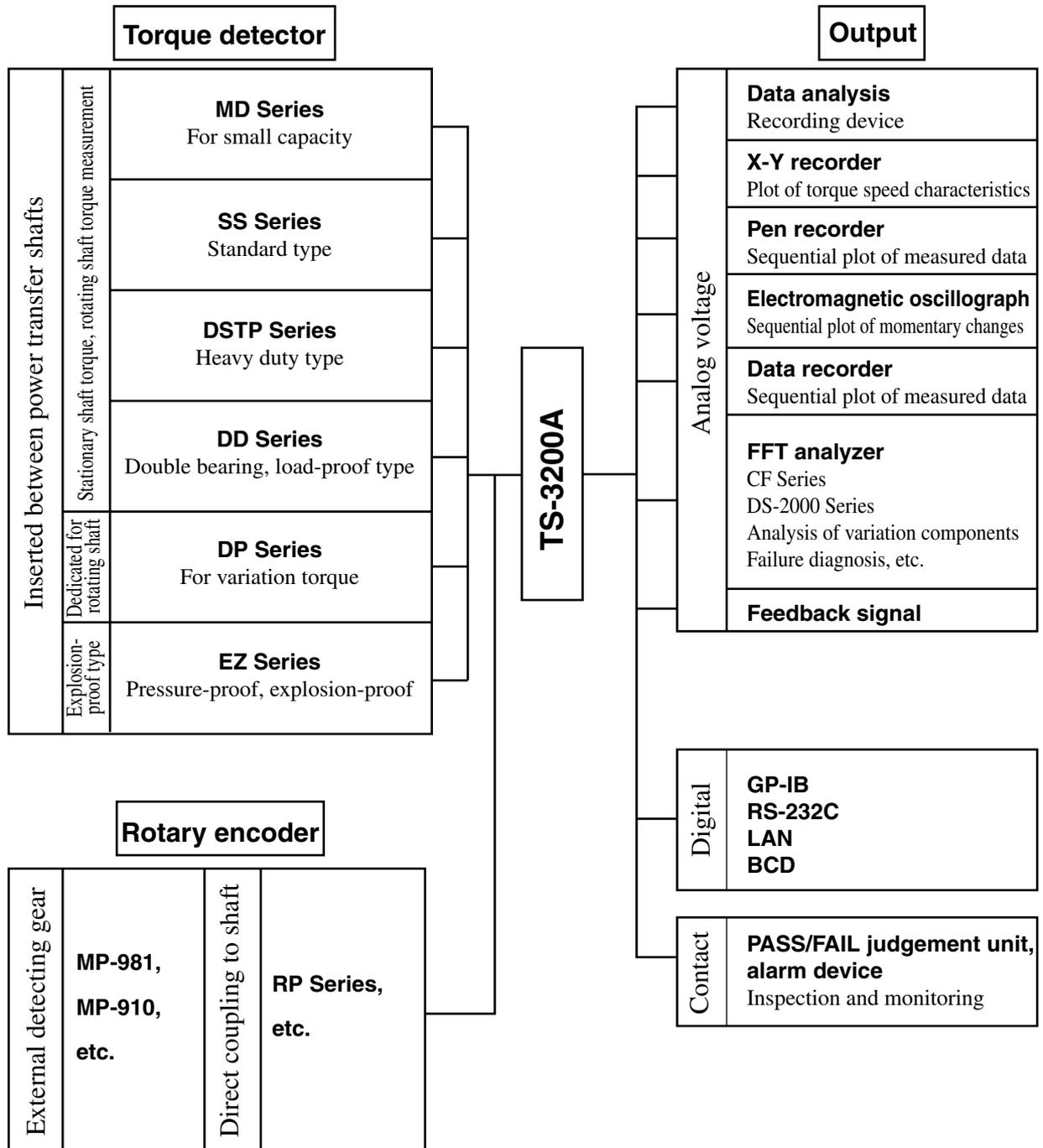
- **External interface unit (option)**

- GP-IB unit: General-purpose interface specified by IEEE488
 This bi-directional bus system allows setting of various parameters as well as data output.
- RS232c: Serial communication interface specified by EIA
- LAN: Ethernet interface applicable to 100BASE-TX/10BASE-T
- BCD output: 2-channel positive logic parallel data output
- CMP output: 4-channel comparator contact output

- **External control unit**

This unit is a sequence control input/output interface based on external signals.
The terminal is a contact output with a photo mos relay.

1.3 System Configuration



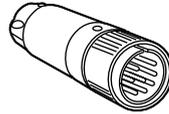
1.4 Checking Accessories

When unpacking the unit, make sure that you have all the following accessories.

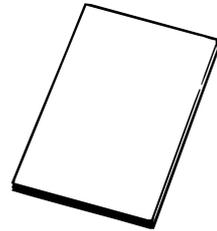
Name	Model	Quantity	Remark
AC power cable	AX-203	1	1.9 m
REMOTE connector	R03-PB8M	1	
Instruction manual		1	



AC power cable



REMOTE connector



Instruction manual

1.5 Precautions on Wiring of Torque Meter

In recent years, increasing number of test devices using or measuring inverters have been used. An inverter emits noise because of the operating principle and may affect other devices near it. Torque meters are not an exception. The degree of effect depends on the amount of noise generation, installation condition of signal lines, device installation condition, distance between the inverter and device, and other factors. Trouble caused by noise from the inverter can be reduced by observing the following precautions on wiring installation. For other causes than noise from the inverter, it is recommended that the following precautions be observed at the time of installation.

- (1) Take measures for radiation noise on the side of the inverter unit and the motor.
- (2) Separate the input and output lines of the main circuit of the inverter from the power and signal lines of the torque meter (cables for torque counters and rotational counters).
The rough standard distance of separation is 300mm or more. If separation is difficult or ineffective, apply metal conduit tubes to the power and signal lines of the torque meter and then connect one side of the metal part to a good ground.
- (3) Use the supplied cables for the power and signal lines of the torque meter.
- (4) Connect the rack for the torque detector to a good ground.
- (5) Connect the torque meter to a power circuit which is isolated from the power circuit of the inverter.
If isolation results in no improvements, install a noise cut transformer for EMI measures, etc.

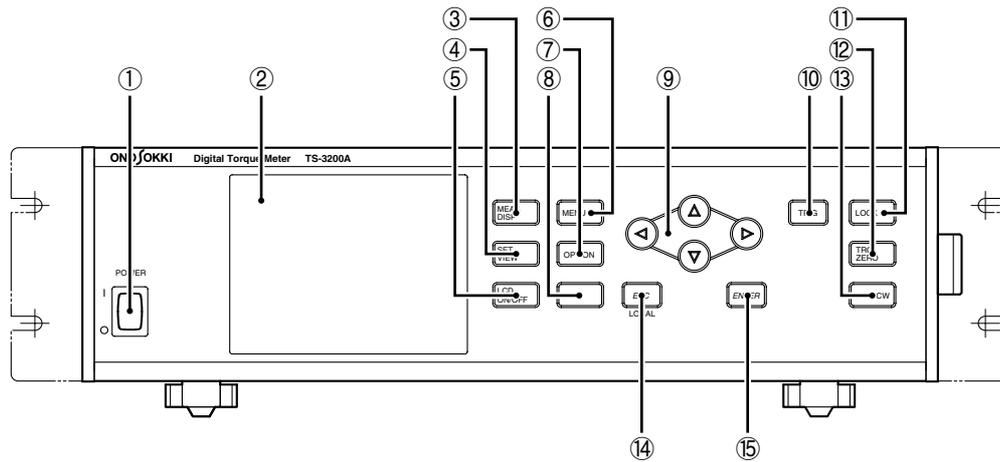
Chapter 2 Before Use

2.1 Name and Function of Each Section

2.2 Detector Connections

2.1 Name and Function of Each Section

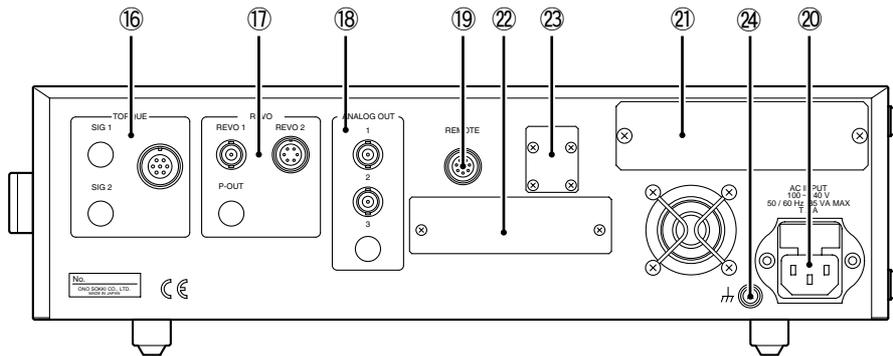
2.1.1 Front Panel



- ① **Power switch**
Turns the power of the TS-3200A ON or OFF.
When the power is ON, the LED lights up in green.
- ② **LCD display**
Displays measured data and parameter settings.
- ③ **MEAS DISP key**
Selects the measurement screen.
- ④ **SET VIEW key**
Displays various settings.
- ⑤ **LCD ON/OFF key**
Turns the LCD display ON or OFF.
The operating life of the LCD panel/backlight can be extended by turning the LCD display OFF when not in use.

- ⑥ MENU key
Selects the parameter setting screen.
- ⑦ OPTION key
Displays mounted options collectively.
- ⑧ CAL key
Selects the calibration screen of the analog output.
- ⑨ Cursor key
◀ key, ▶ key
Move the cursor to a target item within the setting display.
▲ key, ▼ key
Increments/decrements numeric values when entering condition settings.
- ⑩ TRIG key
External trigger key.
This key is effective when the MODE of the measured data display, comparator function, and peak hold function is set to EXT.
- ⑪ LOCK key
Locks the TRQ ZERO key and CW/CCW key.
- ⑫ TRQ ZERO key
Selects the torque zero compensation value screen in the no-load condition.
- ⑬ CW/CCW key
Since the torque zero point compensation value differs according to the rotational direction (CW/CCW), change the rotational direction with this switch. To change the direction, press and hold this key for 2 seconds.
- ⑭ ESC/LOCAL Key
ESC: Returns to the previous screen. The last screen of ESC is the measurement screen.
LOCAL: This key is used as the local key when option GP-IB is installed.
- ⑮ ENTER key
Press this key to change the menu item or establish the setting.

2.1.2 Rear Panel



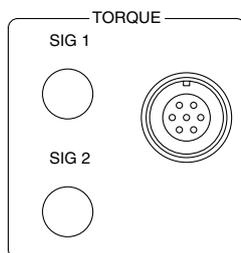
* In pin arrangement, COM is an abbreviation of common and NC is an abbreviation of "Not connected."

① TORQUE SIG

Torque detector signal input/output connector

Connector: TRC116-23A10-7F (Tajimi Electronics)

Applicable connector: TRC116-12A10-7M10.5 (Tajimi Electronics)



Pin arrangement

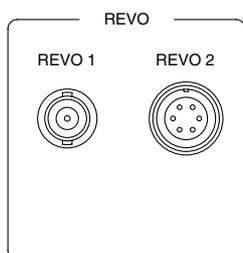
A	SIG 1
B	SIG 2
C	SIG 1 COM
D	SIG 2 COM
E	NC
F	SIG COM
G	NC

SIG1/SIG2 cannot be used. (Blind panel)

⑰ REVO

Connectors for rotary encoder signal input. The signal can be input to either of the following two connectors.

- REVO1 Applicable connector: C02 type (BNC)
- REVO2 Connector: R03-R6F
Applicable connector: R03-PB6M (Tajimi Electronics)



Pin arrangement (REVO 1)

1	SIG (+)
2	COM (-)

The core wire of the connector is 1.

Pin arrangement (P-OUT)

1	SIG (+)
2	COM (-)

The core wire of the connector is 1.

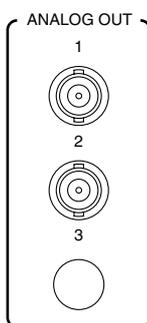
Pin arrangement (REVO 2)

A	SIG 1	1-phase signal input
B	SIG 2	2-phase signal input
C	12V	Power supply for sensors
D	FG	Frame ground
E	SIG COM	Signal common
F	12V COM	Power supply common for sensors

⑱ ANALOG OUT

Connectors for analog output.

Connector: C02 type (BNC) 2CH



Pin arrangement (ANALOG OUT 1)

1	SIG (+)
2	COM (-)

The core wire of the connector is 1.

Pin arrangement (ANALOG OUT 2)

1	SIG (+)
2	COM (-)

The core wire of the connector is 1.

Pin arrangement (ANALOG OUT 3 : OPTION)

1	SIG (+)
2	COM (-)

The core wire of the connector is 1.

⑲ REMOTE

Connector for external control signal input/output.

Connector: R03-R8F

Applicable connector: R03-PB8M (Tajimi Electronics)

REMOTE



Pin arrangement

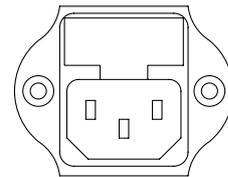
A	CLR IN	Input
B	TRIG IN	
C	CCW/CCW selection	
D	Input common	
E	READY OUT	Output
F	COM for the above	
G	TRIG OUT	
H	COM for the above	

⑳ AC LINE

AC power plug

Functions as fuse holder for the AC line.

AC INPUT
100-240 V
50 / 60 Hz 70 VA MAX
FUSE T2A



㉑ Communication option slot

● GP-IB

Connector: Conforms to IEEE 488-1978.

● RS232C

Connector: Dsub 9-pin (male)

Applicable connector: Dsub 9-pin (female)

Pin arrangement

1	NC
2	RXD
3	TXD
4	DTR
5	COM
6	DSR
7	RTS
8	CTS
9	NC

● LAN

Connector: RJ-45 type (conforming to Category 5)

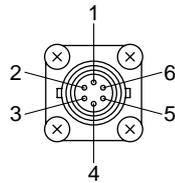
② BCD output (option)

Connector: 57-40500 (DDK)
 Applicable connector: 57-30500(DDK) Amphenol full-pitch, 50 pins
 For the connector table, refer to 5.3, "BCD Output TS-0323."

③ Comparator output (option)

Connector: RM12BRB-6P (Hirose Electric)
 Applicable connector: RM12BPG-6S (Hirose Electric)

Pin arrangement



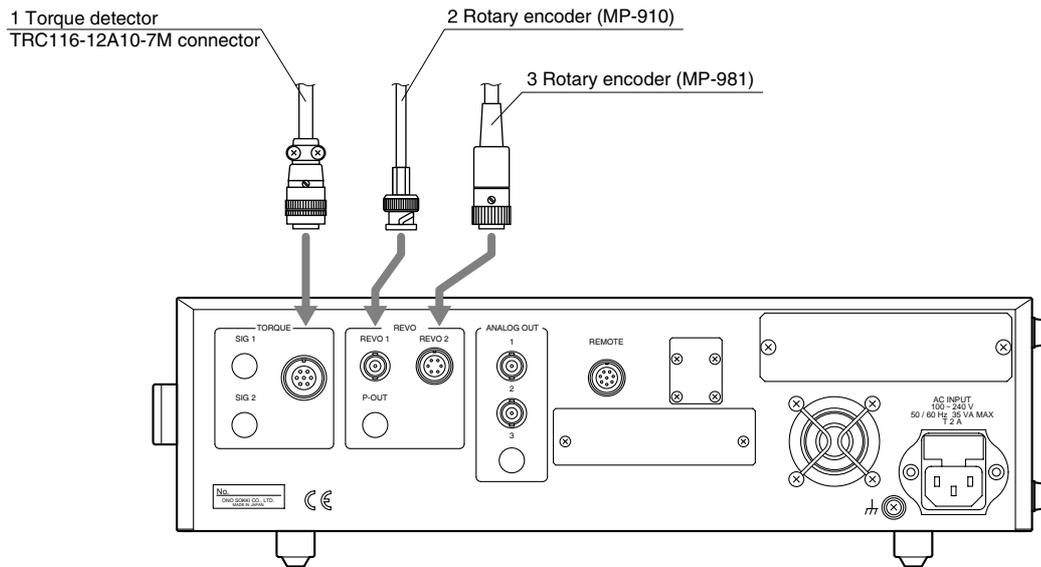
1	CMP OUT1
2	CMP OUT2
3	CMP OUT1, 2 COM
4	CMP OUT3
5	CMP OUT24
6	CMP OUT3, 4 COM

④ Ground terminal

Connect to a good ground as required.

2.2 Detector Connections

The TS-3200A and detectors are connected with the specified torque cable and the rotational cables.



Torque cable:

Connect ①.

Rotational cable:

Connect ② or ③. (Cannot be connected at the same time.)

Chapter 3 Basic Operations

3.1 Sequence of Basic Operations

3.2 Setting Parameters of Torque Detector

3.3 Selecting Rotational Direction (CW/CCW)

3.4 Zero Adjustment

3.5 Setting Frequency Characteristic N-0

 Compensation Values of Detector

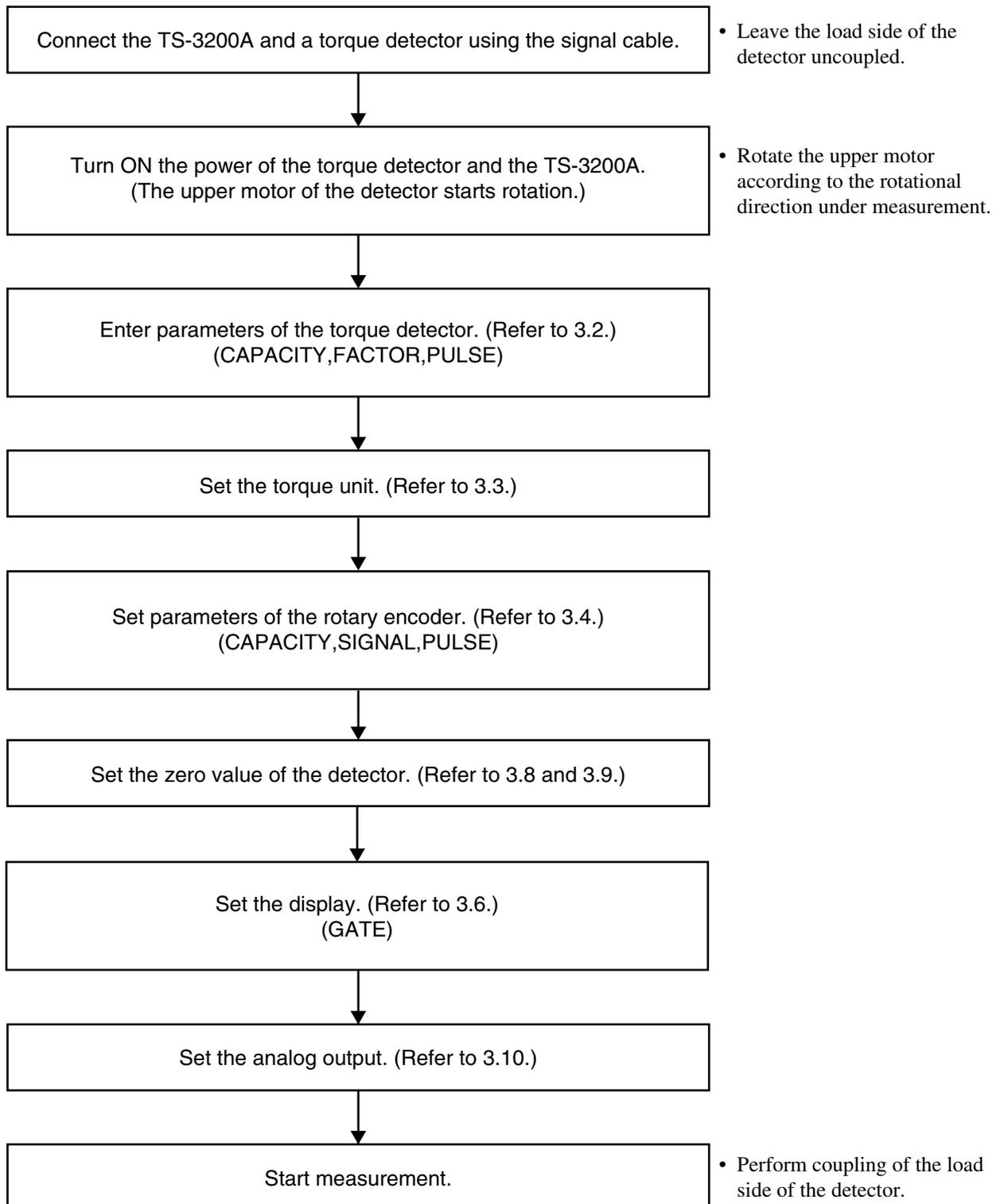
3.6 Setting Parameters of Rotary Encoder

3.7 Setting Output (POWER) Operational
 Conditions

3.8 Setting Measurement Display

3.9 Setting Analog Output

3.1 Sequence of Basic Operations



3.1.1 Basic Key Operations

In the following explanation, direct switches on the front panel are enclosed in [] and soft menus of the LCD display in ().

◀	Moves the cursor to the left.
▲	Moves the cursor upwards.
▼	Moves the cursor downward.
▶	Moves the cursor to the right.
ENTER	Establishes the setting and then proceeds with the next item.
ESC	Returns to one-step higher level. GP-IB remote mode: Local key
MENU	DETECTOR setting. USER setting
LOCK	TorqueZero, Locks the CW/CCW key.
CW/CCW	Selects the torque zero CW/CCW. DETECTOR setting. (Effective at the time of Rotation Int.) Press and hold this key to change the mode.
TRQ ZERO	Sets the torque zero value.
TRIG	Trigger key. Effective at the time of display Gate Ext, deviation, ripple factor, peak hold.
LCD ON/OFF	Turns the LCD and back light ON or OFF.
MEAS DISP	Measurement screen
SET VIEW	Displays a list of parameter settings.
OPTION	Displays installed options only for check.
CAL	Analog output zero and span setting/check functions.

- (1) When you press the [MENU] key, the parameter setting menu appears.
- (2) Press the ▲, ▼, ◀, and ▶ keys to display the target item.
The items which can be selected are highlighted and blinking (referred to as cursor hereafter).
The cursor can be moved to the target position using the ◀ and ▶ cursor control keys.
The selected item and numeric value can be switched between using the ▲ and ▼ cursor control keys.
- (3) Press the [ENTER] key to establish the setting.
- (4) Repeat steps (2) and (3) depending on the item.
- (5) Press the [ESC] key to return to the previous stage.
- (6) When you have set all items, press the [MEASDISP] key to select the measurement mode.

3.2 Setting Parameters of Torque Detector

Enter parameters (specific values) of the torque detector. Enter the numeric values of FACTOR, CAPACITY, and PULSE inscribed on the name plate of the torque detector. The unit specified by UNIT of item CAPACITY becomes the unit for the measurement display.

However, numeric values containing a decimal point cannot be entered as items CAPACITY and FACTOR. Change values to integers before entering.

■ Example of Name Plate

TORQUE DETECTOR					
MODEL SS-	050	FACTOR	8086	120	P / R
CAPACITY	5N·m	RANGE	5	26	°C
MAX. SPEED	6000	r/min	No.	05012345	
PAT. No. 481850 481989 490762					
ONO SOKKI CO., LTD.					
MADE IN JAPAN					
Caution: When viewing from drive side of torque detector, set rotation switch up for CW rotation, down for CCW rotation					

■ Initial Settings

The initial settings at the time of shipment are shown below. Change these values according to the torque detector.

CAPACITY	+5
UNIT	Nm
FACTOR	8000
P/R	60 [P/R]
DIGIT (number of digits)	4

• CAPACITY

The capacity refers to the rated capacity of the detector. Enter the numeric value inscribed on the name plate of the torque detector. The value entered here becomes the full scale at the time of analog output setting.

Input range: ±1 to 9999 (The polarity can be changed.)

3. Basic Operations

- **UNIT (unit)**

The unit specified here becomes the unit for the measurement display. (For selection of the unit, refer to 4.12, "Torque Unit Conversion.")

- 1: mNm
- 2: Nm
- 3: kNm

- **DIGIT (the number of digits of the measurement display)**

The number of display digits of the measurement display (including decimal places) is 4 or 5. When the number of digit of item RANGE in the name plate of the torque detector is 1, select 4; when it is 2, select 5. However, the increase in the number of digits does not result in improved accuracy of torque measurement.

When the **CAPACITY** setting is 5Nm

RANGE	DIGIT (Number of input digits)	Setting Measurement Display
5	4	5.000
50	5	5.0000

- **Item FACTOR**

Input range 1 to 65535

- **P/RR (the number of built-in gear teeth)**

This indicates the number of teeth of the gear inside the torque detector. It is not the number of teeth of the rotary encoder attached to the shaft of the torque detector. In this case, enter the numeric value inscribed in the name plate of the torque detector. Depending on the model of torque detector, the rpm can be detected from the the number of teeth of the built-in gear.

Operating Procedure

Example: In case of torque detector SS-050

CAPACITY	5Nm
FACTOR	8086
PULSE	120P/R
DIGIT	4 digits

Note: For numeric values containing the decimal point, take the unit (mNm/Nm/kNm) into consideration to convert the value into an integer before entering.

- (1) Press the [MENU] key.

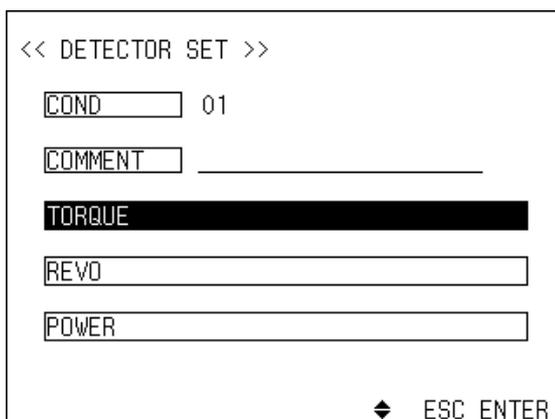
The following screen appears.



```
<< Menu >>
DETECTOR SET
USER SET
ESC ENTER
```

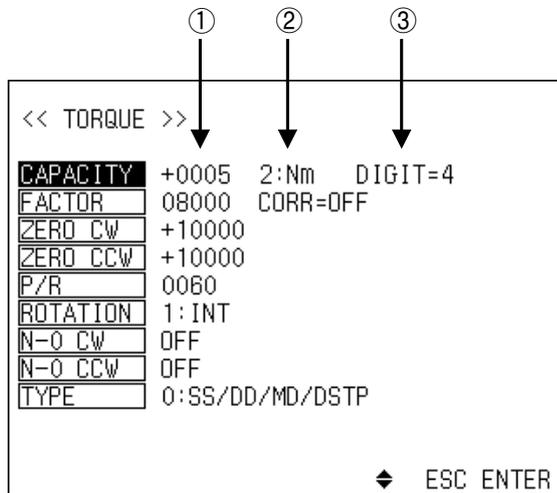
- (2) Select (DETECTOR SET) and then press the [ENTER] key.

The following screen appears.



```
<< DETECTOR SET >>
COND 01
COMMENT
TORQUE
REVO
POWER
ESC ENTER
```

- (3) Select (TORQUE) using the **▲** and **▼** keys and then press the [ENTER] key.
The following screen appears.



■ Setting Capacity

- (4) Select (CAPACITY) using the **▲** and **▼** keys and then press the [ENTER] key.
- (5) ① Enter the capacity.
Enter +0005 using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.
Press the [ENTER] key to move the cursor to ②.

② Enter the unit.

Select 2:Nm using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.
Press the [ENTER] key to move the cursor to ③.

③ Select the number of display digits.

Select 4 using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.

When you press the [ENTER] key, the values specified as ①, ②, and ③ are established and the cursor moves to (CAPACITY).

If you do not press the [ENTER] key in step ③, settings ① to ③ are not updated.

Be sure to make setting through ① to ③ and then move the cursor to (CAPACITY) by pressing the [ENTER] key.

■ Setting Factor

- (6) Select (FACTOR) using the ▲, ▼, ◀, and ▶ keys and then press the [ENTER] key.
Press the [ENTER] key to move the cursor to a numeric unit.

- (7) Enter 8086 as FACTOR using the ▲, ▼, ◀, and ▶ keys and then press the [ENTER] key.
When you press the [ENTER] key, the setting is established and then the cursor moves to (FACTOR).

After setting a numeric value of FACTOR, the FACTOR temperature compensation value can be set.
For the setting procedure, refer to 4.13, "Temperature Compensation for FACTOR of Torque Detector."

■ Zero Adjustment

Cannot be specified in this screen.
Refer to 3.4, "Zero Adjustment."

■ Setting the Number of Pulses

This pulse setting is reflected when 0:IntRevo is selected for
3.6, "Setting Parameters of Rotary Encoder" regardless of torque measurement.
When using the rotary encoder of the MP-910, MP-981, etc., you do not need to change this setting.
Leave the default value unchanged.

- (8) Select (P/R) using the ▼ key and then press the [ENTER] key.
Press the [ENTER] key to move the cursor to the numeric value.

- (9) Enter 0120 as the number of pulses using the ▲, ▼, ◀, and ▶ keys and then press the [ENTER] key.
When you press the [ENTER] key, the numeric value is established and then the cursor moves to (P/R).

■ Selecting Rotational Direction Selection Mode

- (10) Select (ROTATION) using the ▼ key and then press the [ENTER] key.
0: EXT Select the rotational direction using the EXT REMOTE function.
1: INT Select the rotational direction using the INT [CW/CCW] key.
For details, refer to 3.3, "Selecting Rotational Direction (CW/CCW)."

■ **Setting Torque Detector Type**

(11) Select (TYPE) using the key and then press the [ENTER] key.

0: SS/DD/DSTP/MD Torque measurement can be performed from the stationary condition (rpm 0).

1: DP Torque measurement cannot be performed in the stationary condition.

This parameter is reflected in the torque measurement ready state.

When 0:SS/DD/DSTP/MD is selected, measurement becomes ready when the motor of the torque detector is rotating and detection pulse generated.

When 1:DP is selected, presence or absence of the detection pulse of the torque detector is not reflected in the torque measurement ready state.

For N-0 CW/N-0CCW, refer to 3.5, "Setting Frequency Characteristic N-0 Compensation Values of Detector."

(12) Select 0:SS/DD/DSTP/MD or 1:DP using the and keys and then press the [ENTER] key.

This completes parameter setting for the torque detector.

3.3 Selecting Rotational Direction (CW/CCW)

It is necessary to select CW/CCW of the TS-3200A and torque detector according to the rotational direction under measurement.

The TS-3200A is provided with the following two different methods:

1. Using a panel switch of the TS-3200A to select CW/CCW
2. Using the REMOTE Function of the TS-3200A to select CW/CCW

3.3.1 CW/CCW

ONO SOKKI uses CW/CCW to represent the rotational direction of the shaft of the torque detector.

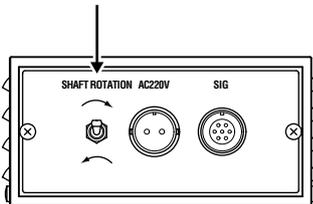
CW

When the shaft rotates clockwise when viewed from the torque detector drive side

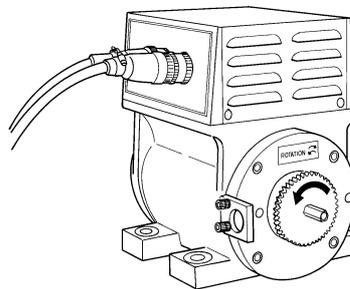
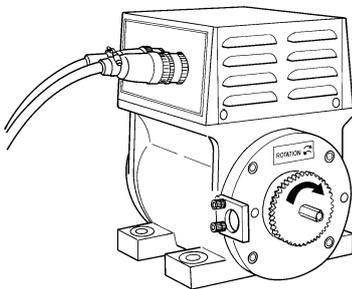
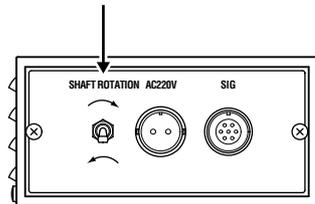
CCW

When the shaft rotates counterclockwise when viewed from the torque detector drive side

Set this switch to the upward position.



Set this switch to the downward position.



The MD type and SS type are supplied with a single-phase motor. Set the switch to the same direction as the shaft rotational direction shown in the name plate.

The switch can be set to the upward, middle, and downward positions.

At the middle position, the motor stops.

3.3.2 Selecting CW/CCW Using a Panel Switch

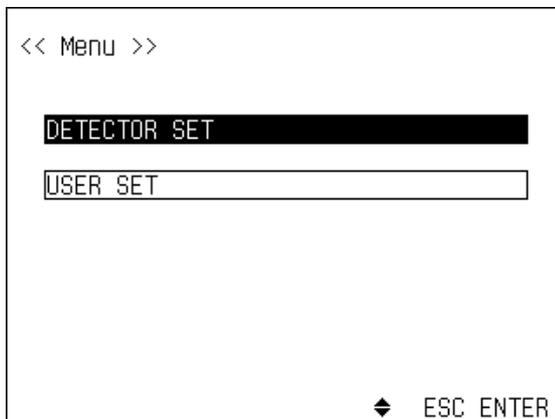
CW/CCW can be changed using a panel switch of the TS-3200A.

Change the switch of the torque detector according to the rotational direction.

Operating Procedure

- (1) Press the [MENU] key.

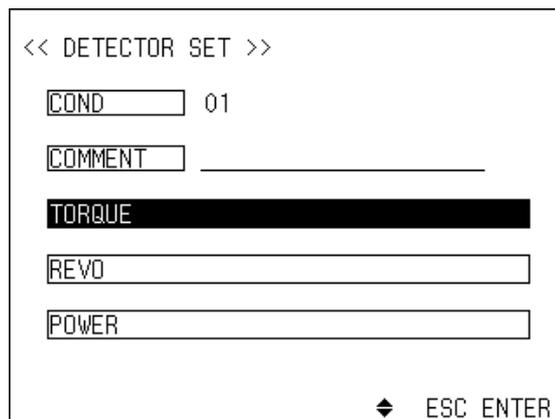
The following screen appears.



```
<< Menu >>
DETECTOR SET
USER SET
◆ ESC ENTER
```

- (2) Select (DETECTOR SET) and then press the [ENTER] key.

The following screen appears.

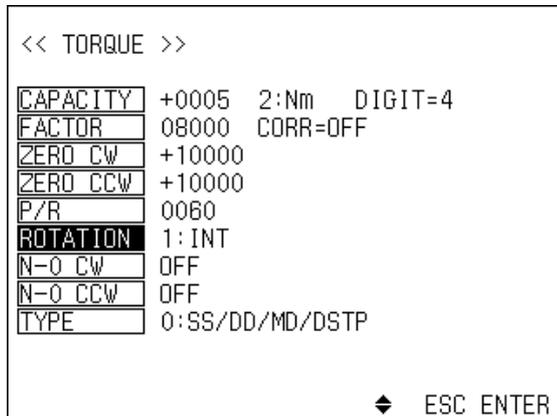


```
<< DETECTOR SET >>
COND 01
COMMENT
TORQUE
REVO
POWER
◆ ESC ENTER
```

3. Basic Operations

- (3) Select (TORQUE) using the **▲** and **▼** keys and then press the [ENTER] key.

The following screen appears.



- (4) Select (ROTATION) using the **▲** and **▼** keys and then press the [ENTER] key.

- (5) Select 1:INT using the **▲** and **▼** keys and then press the [ENTER] key.

- (6) Press and hold the [CW/CCW] key for 2 seconds or longer.

When the measurement screen and torque zero setting screen are displayed, the status display at the top right of the LCD changes to CW or CCW.



CW Highlighted

CW Not highlighted

ROTATION1: INT

ROTATION0: EXT

Note: When status display LOCK at the bottom of the LCD is highlighted in the torque zero screen of the measurement screen, the [CW/CCW] key is locked.
Each time you press the [LOCK] key, it switches between LOCK and UNLOCK.

3.3.3 Selecting CW/CCW Using REMOTE Function

When the REMOTE function is used, CW/CCW can be selected using an external sequence. Change the switch of the torque detector according to the rotational direction.

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (DETECTOR SET) and then press the [ENTER] key.
- (3) Select (TORQUE) using the ▲ and ▼ keys and then press the [ENTER] key. The following screen appears.

<< TORQUE >>	
CAPACITY	+0005 2:Nm DIGIT=4
FACTOR	08000 CORR=OFF
ZERO CW	+10000
ZERO CCW	+10000
P/R	0060
ROTATION	0:EXT
N-O CW	OFF
N-O CCW	OFF
TYPE	0:SS/DD/MD/DSTP
◆ ESC ENTER	

- (4) Select (ROTATION) using the ▲ and ▼ keys and then press the [ENTER] key.
- (5) Select 0:EXT using the ▲ and ▼ keys and then press the [ENTER] key.
- (6) Connect signal between pins C and D of the REMOTE connector.
CW: Opens between C and D.
CCW: Short-circuit between C and D.

Refer to 4.1, "Using REMOTE Function" for details on the REMOTE function.

3.4 Zero Adjustment

Stop shaft rotation of the torque detector and rotate only the upper motor in the no-load condition. Zero adjustment refers to correction of the torque indication of the TS-3200A in this case. Zero adjustment is not achieved only by connecting the torque signal cable.

The no-load condition is a condition in which the load side, drive side, or both sides of the shaft of the torque detector are not connected.

Perform zero adjustment separately for each of the CW and CCW directions. Only the rotational direction currently selected can be specified. When performing measurement only in either direction, perform zero adjustment only for that direction. To set the other direction, change the direction referencing 3.3, "Selecting Rotational Direction (CW/CCW)."

Note: Even if you use the CLR IN function in 4.1, "Using REMOTE Function" to perform zero adjustment during CLR, this operation is not effective.

- **Initial settings**

	Zero value
CW	10000
CCW	10000

- **Zero adjustment for AUTO (automatic)**

Perform zero adjustment automatically by capturing the average value for one second so that the torque value currently displayed becomes zero.

- **Zero adjustment for MANU (manual)**

Zero adjustment can be performed manually. For example, a condition where torque is applied to some extent is set as the zero value, then the amount of increase or decrease is displayed in reference to this value. The zero value can be shifted in any desired manner.

Enter the numeric value without the decimal point (a sequence of numbers excluding the decimal point) as shown below.

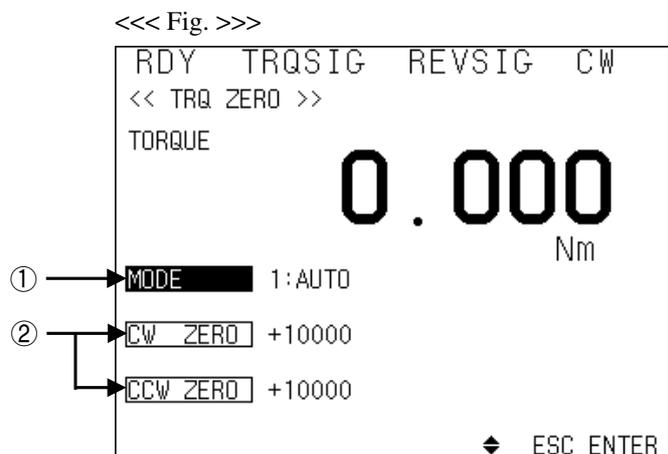
Display	Input value
10.04	1004

3.4.1 Automatic Zero Value Setting

When 5 seconds or more have elapsed after turning on the power of the detector, perform the following operation.

Operating Procedure

- (1) Connect the TS-3200A and the torque detector using the signal cable.
- (2) When the shaft of the torque detector is in the no-load condition, then turn on the power. Make sure the rotational direction (CW or CCW) under measurement, then change over the upper motor of the torque detector and the TS-3200A according to the rotational direction. When using a detector which does not use the upper motor, such as the DP type, rotate the drive shaft (no-load condition) and then make this setting when it is rotating at 100r/min or or higher speed.
- (3) Press the [TRQ ZERO] key.
The following screen appears.



- (4) Press the [ENTER] key.

Note: Automatic zero adjustment is effective only when the above screen ① is in the **RDY** state (measurement ready state).

■ AUTO (automatic) Setting

(4) Select MODE.

The default value is 1: AUTO. Press the [ENTER] key.

When you press the [ENTER] key, the torque zero compensation value is determined automatically.

■ MANU (manual operation) Setting

(5) ① Select MODE.

Select 2:MANU using the **▲** and **▼** keys and then press the [ENTER] key.

Press the [ENTER] key to move the cursor to ②.

The default value is 1: AUTO. Therefore, if you select 2:MANU, exit the torque zero setting screen, then enter the same screen again, 1: AUTO is selected.

② CW ZERO/CCW ZERO

Numeric values have already been set to CW ZERO and CCW ZERO.

The torque value currently displayed in the measurement display (with the decimal point removed) is added.

Example:

Current setting: 4000

LCD display value: -10.04

Torque zero value = $4000 + (-1004) = 2996$

Press the [ENTER] key.

■ Clear Function

(5) Select MODE.

Select 3: CLR using the **▲** and **▼** keys and then press the [ENTER] key.

When you press the [ENTER] key, the zero value for the rotational direction currently selected becomes the default value.

3.5 Setting Frequency Characteristic N-0 Compensation Values of Detector

Despite shaft rotation in the no-load condition, a number may be displayed in the torque display depending on the frequency characteristic of the detector and display, and the friction torque of the detector. N-0 compensation corrects this kind of error to enable accurate measurement.

Compensation value for each rpm is specified for up to 10 points. Corrected torque values are displayed and output at the time of measurement of rpms less than the specified highest rpm.

Although it is necessary to perform N-0 compensation to cancel air friction of the equipment under test and the friction torque of the bearing, etc., this compensation is performed only when there is reproducibility. When deviation is sufficiently small, there is no necessity for compensation.

When entering N-0 compensation values, compensation may be performed from the no-load characteristic table in the Inspection Result supplied with the torque detector. However, when measuring the load torque using a small torque detector (MD type), it is necessary to take check data instead of using the values in the Inspection Result. For details, refer to the instruction manual of the small torque detector.

- **ON/OFF function**

It is possible to select whether or not to perform N-0 compensation.

When ON, N-0 compensation is performed with the specified values.

When OFF, N-0 compensation is not performed even if N-0 compensation values are specified.

- **Manual setting (MANU)**

MANU: Compensation values are entered separately for up to 10 points. This setting is used when automatic setting cannot be performed or when fine compensation is required partially.

- **Automatic setting (AUTO)**

AUTO: N-0 compensation is performed by taking compensation values automatically for up to 10 points.

However, it is necessary to rotate the shaft actually up to the rpm specified by REVO CAPACITY.

- **Clearing N-0 compensation value (CLR)**

All the specified N-0 compensation values are cleared.

3.5.1 Manual Setting of N-0 Compensation Values

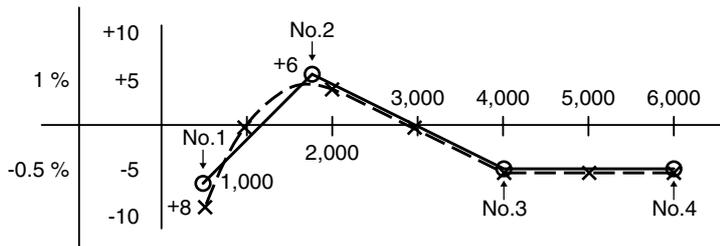
Example: Setting N-0 compensation value for the CW direction

Prepare the following table, rotate the detection shaft using a motor, etc., then record the torque display value for each rpm.

Note: Like zero compensation, enter display values, with the decimal point removed, in the count column. This also applies to rpm display values.

Rpm (r/min)	0	500	1000	2000	3000	4000	5000	6000
Count		-10	0	5	0	-5	-5	-5

Then, plot values using the horizontal axis for the rpm and the vertical axis for the torque display value to determine compensation points.



Point	No. 1	No. 2	No. 3	No. 4
Rpm	500	1800	4000	6000
Compensation value	-8	+6	-5	-5

The detector can be thought to have the frequency characteristic shown by the broken line shown below. When approximation is made linearly using 4 compensation points, Nos.1 to 4 are selected. In the above example, when more data are taken around 2000r/min where the curve largely changes, compensation values can be set more finely resulting in more accurate measurement.

Operating Procedure

- (1) Press the [MENU] key.

The following screen appears.

```
<< Menu >>
DETECTOR SET
USER SET
◆ ESC ENTER
```

- (2) Select (DETECTOR SET) and then press the [ENTER] key.

The following screen appears.

```
<< DETECTOR SET >>
COND 01
COMMENT
TORQUE
REVO
POWER
◆ ESC ENTER
```

- (3) Select (TORQUE) using the **▲** and **▼** keys and then press the [ENTER] key.

The following screen appears.

```
<< TORQUE >>
CAPACITY +0005 2:Nm DIGIT=4
FACTOR 08000 CORR=OFF
ZERO CW +10000
ZERO CCW +10000
P/R 0060
ROTATION 0:EXT
N-O CW OFF
N-O CCW OFF
TYPE 0:SS/DD/MD/DSTP
◆ ESC ENTER
```

- (4) Select (N-0 CW) or (N-0 CCW) using the **▲** and **▼** keys and then press the [ENTER] key.
The following screen appears.

```

RDY TRQSIG REVSIG CW
<< N-0 >> CW
① → ON/OFF 0:OFF TORQUE: 0.000
    REVO : 0
② → MODE 0:AUTO

P REVO TORQUE P REVO TORQUE
1 00000 +0000 6 00000 +0000
2 00000 +0000 7 00000 +0000
3 00000 +0000 8 00000 +0000
4 00000 +0000 9 00000 +0000
5 00000 +0000 10 00000 +0000

◆ ESC ENTER
  
```

- (5)① Select (ON/OFF). (N-0 compensation)

Select 1:ON or 2:OFF using the **▲** and **▼** keys and then press the [ENTER] key.

Press the [ENTER] key to move the cursor to ②.

1:ON Use N-0 compensation.

0:OFF Does not use N-0 compensation.

To acquire N-0 compensation values manually, select 2:OFF, enter a compensation value, then select 1:ON.

- ② Enter MODE.

Select 0:AUTO or 1:MANU using the **▲** and **▼** keys and then press the [ENTER] key.

0:AUTO Sets N-0 compensation values automatically.

1:MANU Sets N-0 compensation values manually.

- (6) Enter the REVO (rpm) and TORQUE (torque) values for P1 to P10 using the **▲** and **▼** keys and then press the [ENTER] key.

Enter REVO and TORQUE display values with the decimal point removed.

It is not necessary to enter values for all of P1 to 10. To omit entry, set REVO and TORQUE to 0.

Example:

REVO	1000.0 r/min	→	10000
	100.0r/min	→	01000
TORQUE	0.010Nm	→	0010 (in case of DIGIT4)
	0.0011Nm	→	00011 (in case of DIGIT5)

- Note:
- Be careful not to set the same rotational speed to compensation points.
 - When N-0 compensation values are manually obtained and set, set POINT to 0:0 with reference to 3.6, "Setting Parameters of Rotary Encoder" to set the decimal point position of the rotational speed to the initial value. After setting N-0 compensation values, use an arbitrary POINT setting.

3.5.2 Automatic Setting of N-0 Compensation Values

N-0 compensation values are set while increasing the rotating speed of the torque detector from zero to the rpm specified as CAPACITY. In order to minimize the influence of the inertia of the object under measurement, a sufficiently long time (about 30 seconds) shall be taken as the time from zero to the maximum rpm (specified as CAPACITY). Whether or not compensation values are used can be specified by the ON/OFF setting.

Operating Procedure

- (1) Steps (1) to (4) below are the same as those in 3.5.1, "Manual Setting of N-0 Compensation Values."

Refer to 3.5.1, "Manual Setting of N-0 Compensation Values."

- (5)① Select the ON/OFF setting of N-0 compensation.

RDY TRQSIG REVSIG CW					
<< N-0 >> CW					
ON/OFF		0:OFF	TORQUE:	0.000	
MODE		0:AUTO	REVO :	0	
P	REVO	TORQUE	P	REVO	TORQUE
1	00000	+0000	6	00000	+0000
2	00000	+0000	7	00000	+0000
3	00000	+0000	8	00000	+0000
4	00000	+0000	9	00000	+0000
5	00000	+0000	10	00000	+0000
◆ ESC ENTER					

Select 1:ON or 2:OFF using the ▲ and ▼ keys.

1:ON Use N-0 compensation.

0:OFF Does not use N-0 compensation.

To set N-0 compensation values automatically, select 2:OFF, obtain data, then select 1:ON.

- ② Select MODE.

Select 0:AUTO using the ▲ and ▼ keys and then press the [ENTER] key.

When you press the [ENTER] key, automatic sampling of N-0 compensation values starts. Increase the rpm of the torque detector slowly from zero to CAPACITY (rated rpm) of REVO (rpm).

When the rpm reaches CAPACITY of REVO, data is established by pressing the [EXIT] key.

3. Basic Operations

If the time for rpm to increase from 0 to CAPACITY is short disturbing normal sampling of compensation data or if the rpm has not reached CAPACITY, the following error message appears.

DATA NOT ENOUGH

If the maximum rpm is not reached, reduce CAPACITY and then perform N-0 compensation.

- To set the opposite direction, perform the operation in 3.3, "Selecting Rotational Direction (CW/CCW)", select (4) N-0 CCW, then perform the same operation.

By selecting 1:ON as the ON/OFF setting, N-0 compensation values become effective.

3.6 Setting Parameters of Rotary Encoder

Enter measurement conditions for the rotary encoder.

Operating Procedure

■ Default Settings

The default settings at the time of shipment are shown below. They depend on measurement conditions for the rotary encoder.

CAPACITY	10000
UNIT	r/min
LOW	1 r/min
SIGNAL	Revo 2 (Single)
P/R	60[P/R]

- (1) Press the [MENU] key.
- (2) Select DETECTOR SET is selected and then press the [ENTER] key.
- (3) Select (REVO) and then press the [ENTER] key.

The following screen appears.

```
<< REVO >>
CAPACITY 10000 0:r/min LOW=00001
P/R      00060
SIGNAL   2:Revo2(Single)
RATIO    +0001/0001
POINT    0:0
OFFSET   00000  [AUTO] [CLR]

◆ ESC ENTER
```

• CAPACITY

The value specified here becomes the full-scale value of the analog output. The position of the decimal point of the display changes according to the input value of CAPACITY.

• Input range

10 to 99999

Input value of CAPACITY	Decimal point position of measurement display	Minimum input value of LOW
10000 to 99999	00000	1
1000 to 9999	0000.0	1.0
100 to 999	000.00	0.01
10 to 99	00.000	0.001

• UNIT (unit)

The unit specified here becomes the unit for the measurement display.

r/min, r/s, Hz

• LOW

When a certain rpm or lower rpm values do not need to be measured and displayed, the value is set as LOW.

When an rpm below the setting continues, both the display and analog output become almost zero.

When SIGNAL is 0:Int Revo, the minimum input value of LOW shall be 1.

Set LOW after CAPACITY, P/R, and RATIO have been set.

• P/R

Enter the number of pulses oscillated by the rotary encoder for each rotation of the shaft of the rotary encoder.

When using a gear, enter the number of teeth; when an encoder is used, enter the number of oscillations.

• SIGNAL

Select the rotary encoder to be used.

0:Int Revo: When using SIG2 of the torque detector as a rotation signal

Note: When the motor supplied with the torque detector is rotating, the display values becomes greater by the rpm.

1: Revo1: When the MP-910 is used (input from the REVO1 connector on the rear panel)

2:Revo2 (Single): When the MP-981 is used (input from the REVO2 connector on the rear panel)

3:Revo2: (Double): When a 2-phase type encoder is used (input from the REVO2 connector on the rear panel)

When 0:Int Revo is selected, P/R performed by the (DETECTOR) and (TORQUE) settings becomes effective.

• RATIO

Refer to 3.6.1, "When Rpm Is Not Detected Directly from Rotating Shaft (Input of RATIO)."

- **POINT**

Although the decimal point position of the REVO (rpm) display is specified by CAPACITY, it can be changed. However, only such setting that decreases the number of significant decimal places can be made.

- **OFFSET**

It is possible to offset the measurement value of REVO (rpm).

Measured value = Actual rpm - OFFSET value

With manual setting, press the [ENTER] key, enter a numeric values using the ▲, ▼, ◀, and ▶ keys, then press the [ENTER] key.

With automatic setting, move the cursor to (AUTO) using the ▶ key and then press the [ENTER] key.

The rpm currently measured becomes the OFFSET value.

Move the cursor to (CLR) using the ▶ key and then press the [ENTER] key. The specified OFFSET value is set to 0.

■ Number of Pulses for Rotary Encoding

The number of pulses specified for rotary encoding depends on the type of the torque detector and the rotary encoding method.

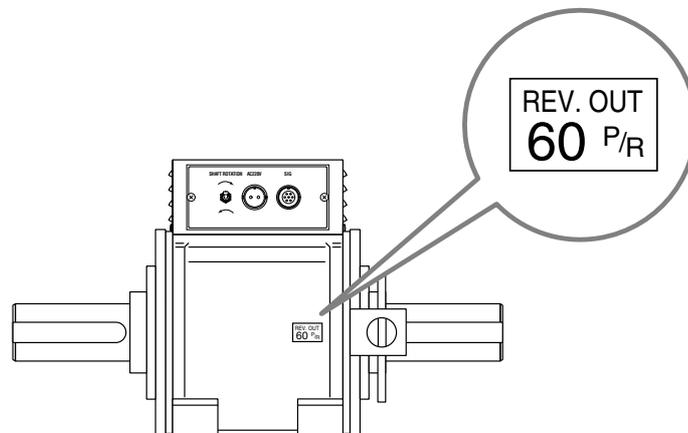
Check the type of the torque detector used and then select the applicable number of pulses from the following description.

- For the SS type, DSTP type, and MD type torque detectors, specify the number of pulses in the following table.

(When a rotary encoder is standard specification)

Model	Number of pulses for rotary encoding
All models of SS Series	60
DSTP - 002 to 02	60
DSTP - 05 to 2	60
DSTP - 5 to 20	60
DSTP - 50	120
DSTP - 100	120
DSTP - 200	120
DSTP - 500 to 1000	120
DSTP - 2000 to 5000	120
All models of MD Series	120

- For the DD type, EZ type, and other special torque detectors, specify the number of pulses described in the name plate located near the rotary encoder.

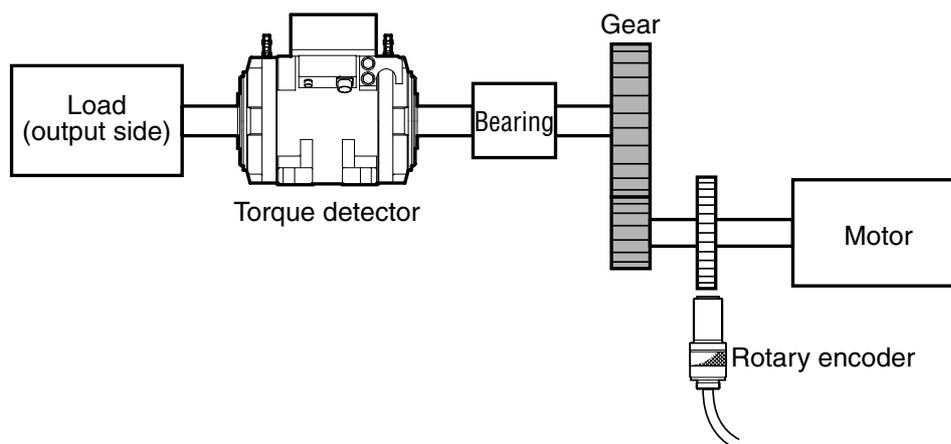


- When measuring the rpm with 0:Int Revo using the DP type torque detector, specify the number of pulses in the following table.

Model	Number of pulses for rotary encoding	Model	Number of pulses for rotary encoding
DP-002	120	DP-101	120
DP-005	120	DP-201	120
DP-010	120	DP-501	120
DP-020	120	DP-102	180
DP-050	120	DP-202	180
DP-100	120	DP-502	180
DP-200	120	DP-103	180
DP-500	120	DP-203	300

3.6.1 When Rpm Is Not Detected Directly from Rotating Shaft (Input of RATIO)

When putting a gear, etc. between the shaft to which the rotary encoder is attached and the output shaft, as shown below, to decrease or increase the output speed (rotary encoding is not possible on the output shaft side), the gear ratio is set as RATIO.



```
<< REVO >>
CAPACITY 10000 0:r/min LOW=00001
P/R 00060
SIGNAL 2:Revo2(Single)
RATIO +0001/0001
POINT 0:0
OFFSET 00000 [AUTO] [CLR]

◆ ESC ENTER
```

- When the speed is decreased with a gear ratio of 1/10, set +0010/0001.
- When the speed is increased with a gear ratio of 20, set +0001/0020.

• Initial setting

+0001/0001

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (DETECTOR SET) and then press the [ENTER] key.
- (3) Select (REVO) and then press the [ENTER] key.

The following screen appears.

<< REVO >>	
CAPACITY	10000 0:r/min LOW=00001
P/R	00060
SIGNAL	2:Revo2(Single)
RATIO	+0001/0001
POINT	0:0
OFFSET	00000 <input type="checkbox"/> AUTO <input type="checkbox"/> CLR
◆ ESC ENTER	

- (4) Select (RATIO) using the and keys and then press the [ENTER] key.

Press the [ENTER] key to move the cursor to the numerator of +0001/0001.

When you specify a numeric value and then press the [ENTER] key, the cursor moves to the denominator.

When you specify a numeric value and then press the [ENTER] key, the cursor moves to RATIO.

Perform the above operation even with either of the numerator or denominator setting. If you set only the numerator and return to RATIO by pressing the [ESC] key, the setting is invalidated.

3.7 Setting Output (POWER) Operational Conditions

Enter operational conditions for POWER (output) from the torque and rpm measurement ranges (CAPACITY).

Output (W) = 2π x Torque (N-m) x Rotational speed (r/s)

Output (W) = $\frac{2\pi}{60}$ x Torque (N-m) x Rotational speed (r/min)

PS = 0.7355kW

CAPACITY specified here becomes the analog full-scale value.

Do not set conditions which are too different because doing so may disallow display and analog output to be applied.

- **Initial setting**

200W

- **Setting range**

±00001 to 99999

- **UNIT (unit)**

0:mW

1:W

2:kW

3:PS

Operating Procedure

- (1) Press the [MENU] key.
The following screen appears.

```

<< Menu >>

DETECTOR SET
USER SET

                                ◆ ESC ENTER
  
```

- (2) Select (DETECTOR SET) and then press the [ENTER] key.
The following screen appears.

```

<< DETECTOR SET >>

COND 01
COMMENT _____
TORQUE _____
REVO _____
POWER _____

                                ◆ ESC ENTER
  
```

- (3) Select (POWER) using the ▲ and ▼ keys and then press the [ENTER] key.
The following screen appears.

```

<< POWER >>

CAPACITY +00200 1:W

                                ESC ENTER
  
```

3.8 Setting Measurement Display

The measurement display enables four different display formats.
Select and set any desired measurement items.

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
The following screen appears.

```
<< USER SET >>

DISPLAY
ANALOG OUT
OPTION
TEST MODE

◆ ESC ENTER
```

- (3) Select (DISPLAY) using the **▲** and **▼** keys and then press the [ENTER] key.
The following screen appears.

```
<< DISPLAY SET >>
DISP 0:Normal
GATE INT 1.0s   AVE TIME 0.250s

ITEM  MODE  GATE  ABS
MAIN1 0:TORQUE 0:NOR 0:INT 0:OFF
MAIN2 1:REVO  0:NOR 0:INT 0:OFF
MAIN3 2:POWER  0:NOR 0:INT 0:OFF
SUB1  0:TORQUE 1:MAX  0:INT 0:OFF
SUB2  0:TORQUE 2:MIN  0:INT 0:OFF
SUB3  0:TORQUE 3:P-P  0:INT 0:OFF
SUB4  3:OFF   0:NOR  0:INT 0:OFF

◆ ESC ENTER
```

Note: For ITEM of SUB4, only TORQUE can be selected.
For MODE, NOR, MAX, MIN, P-P, or RIP can be selected.

• DISP: Display format setting

Images for display formats are shown below.

Select 0 to 3 using the \blacktriangle , \blacktriangledown , \blacktriangleleft , and \blacktriangleright keys and then press the [ENTER] key.

0: Normal

1: Triple

2: Main&Sub

3: All

0: Normal

RDY	TRQSIG	REVSIG	CW
COND:01 COMMENT:			
TORQUE NOR	0.000		Nm
REVO NOR	0		r/min
CMP1	2	3	4 TRIGIN LOCK

1: Triple

RDY	TRQSIG	REVSIG	CW
COND:01 COMMENT:			
TORQUE NOR	0.000		Nm
REVO NOR	0		r/min
POWER NOR	0.00		W
CMP1	2	3	4 TRIGIN LOCK

2: Main&Sub

RDY	TRQSIG	REVSIG	CW
COND:01 COMMENT:			
TORQUE NOR	0.000		Nm
REVO NOR	0		r/min
T-MAX	0.000 Nm	T-MIN	0.000 Nm
T-PP	0.000 Nm	T-RIP	----- %
CMP1	2	3	4 TRIGIN LOCK

3: All

RDY	TRQSIG	REVSIG	CW
COND:01 COMMENT:			
TORQUE NOR	0.000		Nm
REVO NOR	0		r/min
POWER NOR	0.00		W
TORQUE MAX	0.000		Nm
TORQUE MIN	0.000		Nm
TORQUE PP	0.000		Nm
TORQUE RIP	-----		%
CMP1	2	3	4 TRIGIN LOCK

• GATE INT: Display refresh time

The display value becomes an average value in the specified refresh time.

Setting range: 0.1s to 10.0s

With a setting less than 0.1s

- Fix the refresh time of LCD display to 1s.
- Reflect in the gate time measured data RGD command (only GP-IB) and BCDOUT of GP-IB.

- **ITEM**

Select the display item from the following:

- 0: Torque
- 1: Revo
- 2: Power

- **AVE TIME: Data average time setting for measurement of MAX, MIN, P-P, RIPPLE**

Setting range 0.004s to 10.000s

Refer to 4.4, "MAX, MIN, P-P, and RIPPLE of Display Data" for details.

- **GATE**

Select the display refresh mode from the following:

INT: Refreshes the display at intervals specified as INT:GATE INT.

EXT: Refreshes the display using the TRIG switch on the front panel or the TETRIG IN signal of the REMO function.

- **MODE**

Select the display mode from the following:

For 1:MAX to 4:RIPPLE, refer to 4.4, "MAX, MIN, P-P, and RIPPLE of Display Data."

- 0: NOR Average value between gates
- 1: MAX Maximum value between gates
- 2: MIN Minimum value between gates
- 3: P-P P-P value between gates
- 4: RIPPLE Torque ripple value between gates (Can be selected only with SUB4.)

- **ABS**

Select the presence or absence of the absolute value display from the following:

- 0: OFF Normal value display
- 1: ON Absolute value display

3.9 Setting Analog Output

Any two out of torque, rotation, and POWER (output) can be output to ANALOG OUT 1 and 2 on the rear panel. These output terminals are isolated from the torque input section and the chassis of the TS-3200A.

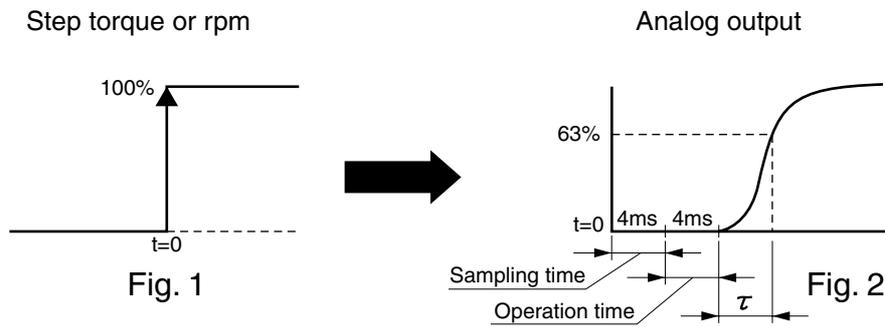
The time constant (τ) can be set in the range from 16ms to 64s. A smaller time constant value makes the output close to the instantaneous value, while a greater time constant value makes the output close to the average value. With a too small time constant value, however, the torque ripple component of the detector may appear in the output signal.

When using the MD Series and SS Series torque detector, set 63ms or more.

• Specifications

Output items:	Select from torque, rotation, and output (POWER).
Number of outputs:	2
Output connector:	ANALOG OUT 1 ANALOG OUT 2 ANALOG OUT 3 (Option: TS-0328)
Output signal:	Voltage 0 to $\pm 10\text{V}/\text{F.S}$
Proper load resistance:	10k Ω or higher
Full scale:	The full-scale value of the output voltage can be changed in 0.01v steps. For the full scale, the value specified by item CAPACITY of the [DETECTOR SET] setting is used as the rated value.
Sample time:	4ms (1/256Hz) Measurement is performed with a sampling time of 4ms (1/256Hz). The output data is updated at 4ms intervals (1/256Hz) regardless of the time constant (τ) setting.

- **Time constant**



When a step torque signal is applied to the torque detector as shown above, the analog output changes as shown in Fig. 2. In this case, the time period until the the analog output reaches 63% of the output voltage is referred to as time constant (τ). With a time constant setting of $\tau=16\text{ms}$, for example, the time period until the analog output reaches 63% of the output voltage is 16ms when a step torque signal is applied to the torque detector as shown above.

The time constant is obtained through digital filter processing using the following exponential averaging:

$$\text{Exponential averaging: } A_n = A_{n-1} + (M_n - A_{n-1}) / K$$

The nth analog output, A_n , is obtained by subtracting the exponential average of up to (n-1)th analog output, A_{n-1} , from the nth measurement value, M_n , dividing by the averaging coefficient, K, then adding A_{n-1} .

M_n is the data obtained at each 4ms sampling interval and K time constant setting τ . When $\tau=16\text{ms}$, K equals 4.

In terms of general filter characteristics, there is the relationship between cutoff frequency f_c and time constant τ .

$$\tau = 1 / 2\pi f_c$$

For example, when $\tau=16\text{ms}$, f_c nearly equals 10Hz.

Average processing by exponential averaging has the 1st order low-pass characteristic of the filter.

- **Allowable ranges**

0:OFF* 1:16ms 2:31ms 3:63ms 4:125ms 5:250ms 6:500ms 7:1s 8:2s 9:4s A:8s B:16s C:32s D:64s

* Only when the TS-0321 high-speed response option is installed, 0:OFF is displayed.

When 0:OFF is selected, a response with 4ms sampling time results.

Note: The operation methods for digital display and analog output are as follows:

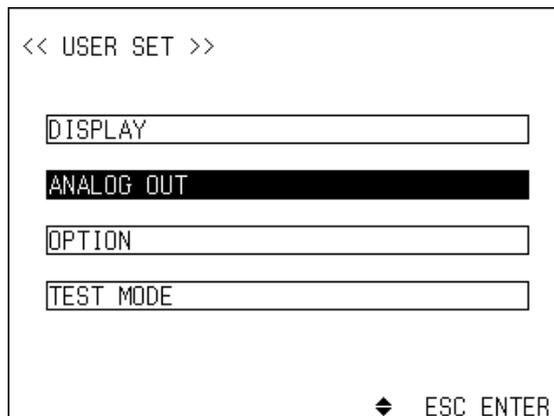
- * Digital display value: Simple arithmetic average of high-speed sampled torque and rpm (at each gate time)
- * Analog output value: Exponential average of high-speed sampled torque and rpm (with a time constant setting)

Operating Procedure

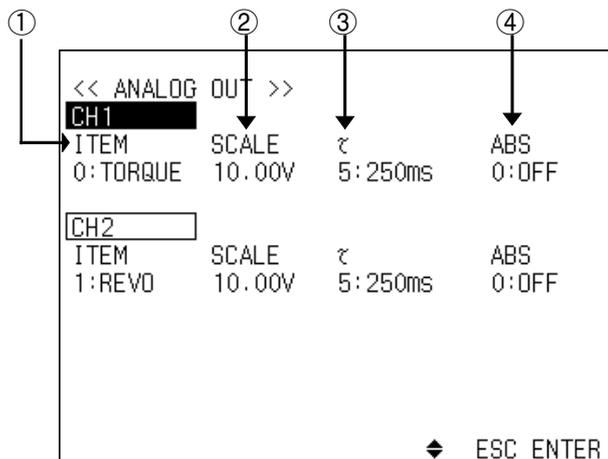
- (1) Press the [MENU] key.
The following screen appears.



- (2) Select (USER SET) and then press the [ENTER] key.
The following screen appears.



- (3) Select (ANALOG OUT) and then press the [ENTER] key.
The following screen appears.



① ITEM

Select the item to be output.

0: TORQUE

1: REVO

2: POWER

② SCALE

Set the full-scale value in 0.01V steps.

0.01 to 10.00V

③ τ

Set a time constant.

④ ABS

Set this setting to ON for output with absolute value.

Note: If you do not press the [ENTER] key in step ④, the measured data in steps ① to ④ are not updated.

Chapter 4 Other Operations

- 4.1 Using REMOTE Function
- 4.2 Selecting Detector Parameter Settings
- 4.3 LOCK Function
- 4.4 MAX, MIN, P-P, and RIPPLE of Display Data
- 4.5 Taking Absolute Values of Measured Data
- 4.6 Synchronous Operation
- 4.7 Checking Settings
- 4.8 Calibrating Analog Output
- 4.9 Self-Check
- 4.10 Initializing Settings
- 4.11 Turning LCD Off
- 4.12 Torque Unit Conversion
- 4.13 Temperature Compensation for FACTOR of Torque Detector
- 4.14 Default Settings

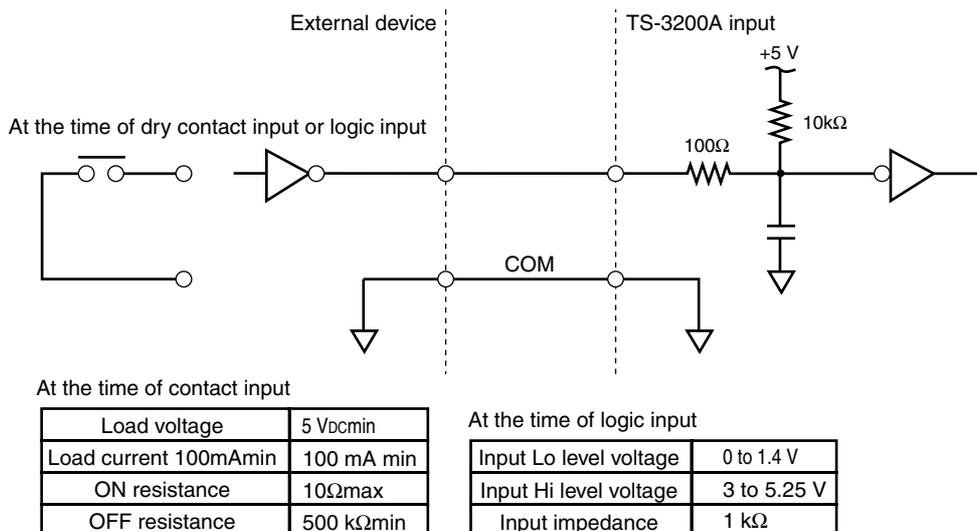
4.1 Using REMOTE Function

Note: The total length of the cable connected to the REMOTE connector shall be 5m or less. If malfunction is caused by noise, perform shield processing as required.

4.1.1 Input (Dry Contact Input)

• Functions

CW/CCW selection:	For selection of CW/CCW from outside
Contact input:	CW when open CCW when closed
Logic:	CW for Hi CCW for Lo
CLR IN:	Forcibly sets both analog and digital outputs to 0 while the contact input is closed (logic input Lo).
TRIG IN:	Selects the display or BCD data in synchronization with the signal. Data is changed when the input to TRIG IN changes from contact open to close (from the Hi to Lo logic).
Input interval:	100ms to 32s



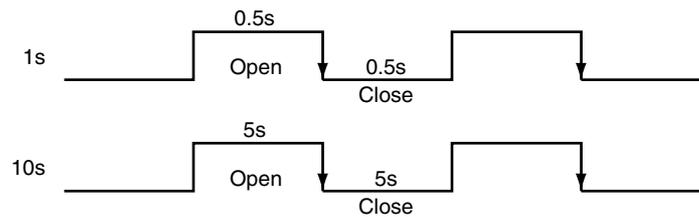
4.1.2 Output (Dry Contact Output)

• Function

TRIG OUT:

Output in synchronization with the GATE time

The time specified as GATE INT in 3.8, "Setting Measurement Display."



Display and BCD are switched between at the timing indicated by ↓.

READY output

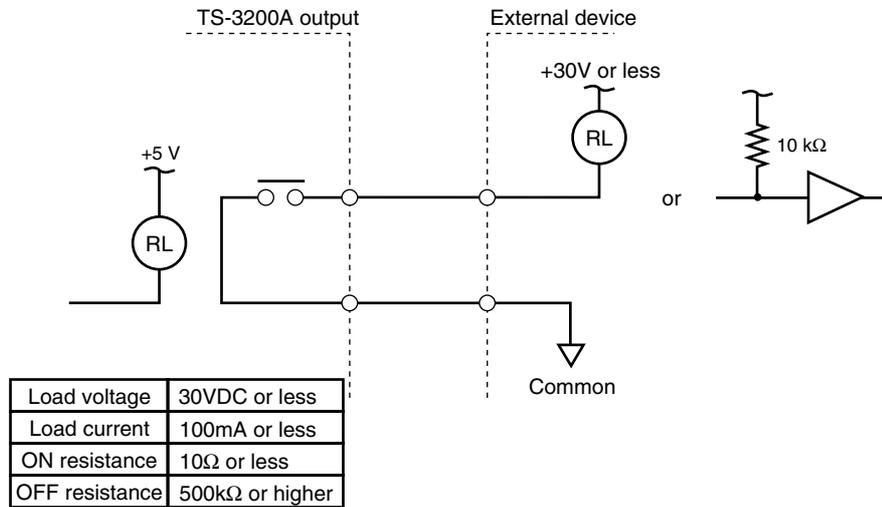
The contact closes in the measurement mode. When using the output of the TS-3200A as a feedback signal for control, etc., use the READY output for safety to apply interlocking.

When the following conditions are met, the measurement mode is entered.

• Conditions

- ① Not the CAL Mode.
- ② The TRQ SIG display is highlighted when non-DP type is used for TYPE of DETECTOR setting.
- ③ CLR IN of REMOTE is open.
- ④ Not the TEST Mode.

■ Recommended Interface



4.1.3 Pin Arrangement

Connector: R03-R8F
 Applicable connector: R03-PB8M (Tajimi Electronics)

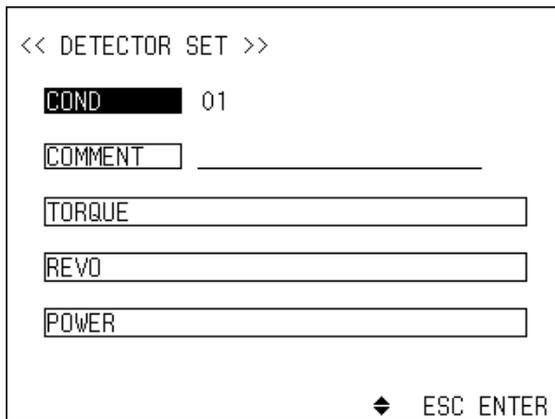
Pin arrangement

A	CLR IN	Input
B	TRIG IN	
C	CCW/CCW selection	
D	Input common	
E	READY OUT	Output
F	COM for the above	
G	TRIG OUT	
H	COM for the above	

4.2 Selecting Detector Parameter Settings

With the TS-3200A, it is possible to set up to 10 different parameter settings of the detector, etc. as condition files.

Since comment entry is possible for each condition file, this function is effective when using multiple detectors by selecting each one.



```
<< DETECTOR SET >>
COND 01
COMMENT _____
TORQUE _____
REVO _____
POWER _____
◆ ESC ENTER
```

COND: 01 to COND10

10 parameter settings can be registered to COND01 through COND10.

10 parameter settings are saved automatically.

COMMENT: Alphanumeric characters including symbols displayed in the menu can be entered.

Note: Use the [SPC] key when you want to change an existing character to a space.

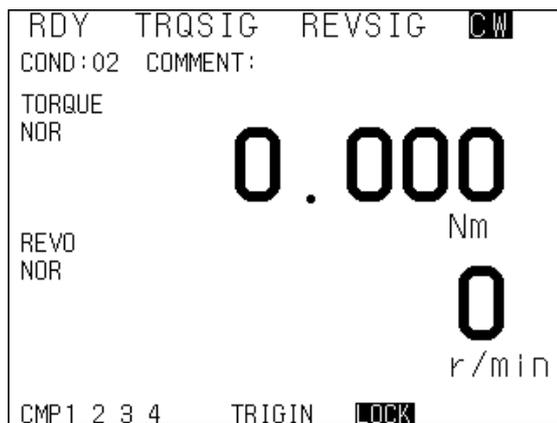
Although (DETECTOR SET) is saved basically, only comparator setting (USER SET) is saved at the same time.

4.3 LOCK Function

Of the direct key switches on the front panel, this function locks (disables) only the [CW/CCW] and [TRQ ZERO] switches which may cause failure if switched during measurement.

Each time you press the [LOCK] switch, the switches are locked or unlocked.

When locked, character LOCK is highlighted.



Highlighted when locked

4.4 MAX, MIN, P-P, and RIPPLE of Display Data

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (DISPLAY) using the \blacktriangle and \blacktriangledown keys and then press the [ENTER] key.
The following screen appears.

```

<< DISPLAY SET >>
DISP 0:Normal
GATE INT 1.0s  AVE TIME 0.250s
ITEM  MODE  GATE  ABS
MAIN1 0:TORQUE 0:NOR 0:INT 0:OFF
MAIN2 1:REVO  0:NOR 0:INT 0:OFF
MAIN3 2:POWER  0:NOR 0:INT 0:OFF
SUB1  0:TORQUE 1:MAX 0:INT 0:OFF
SUB2  0:TORQUE 2:MIN 0:INT 0:OFF
SUB3  0:TORQUE 3:P-P 0:INT 0:OFF
SUB4  0:TORQUE 4:RIP 0:INT 0:OFF
          ◆  ESC ENTER

```

• MODE

- 0:NOR Displays normal data.
- 1:MAX Displays the maximum value.
- 2:MIN Displays the minimum value.
- 3:P-P Swing between the maximum and minimum values
- 4:RIPPLE Can be set only with SUB4. Displays the torque ripple factor in %.

- **GATE INT**

Setting range: 0.1 to 10s

This setting indicates the gate time when GATE selection is 0:INT, which is the data update timing in case of LCD display and BCD OUT (GATE INT).

The data is the average value with the gate time of 4ms sample data.

If this setting is less than 1s, however, only BCD OUT follows the setting and the LCD display is updated at 1-second intervals. The update timing of the display data for MODE1-3 depends on the GATE selection.

In case of GATE 0:INT

The 4-ms interval sample data averaged by AVE TIME is used to display the MAX, MIN, and P-P data within the time specified by GATE INT.

In case of GATE 1:EXT

The 4-ms interval sample data averaged by AVE TIME is used to display the MAX, MIN, and P-P data between the external trigger (TRIG IN) and the next one.

- **External trigger**

Generated by pressing the [TRIG] switch on the front panel or short-circuiting REMOTE function TRIG IN pin and common.

- **AVE TIME**

Setting range: 0.004 to 10s

Data average time MODE is applied to the MAX, MIN, P-P, and RIPPLE data.

TS-3200A are sampling data at 4ms intervals. The MAX, MIN, P-P, and RIPPLE data are extracted from the 4-ms interval sample data averaged by the specified time.

Note: The average time cannot be set in 0.001s steps because of the relationship with internal sample (4ms).

After setting the time, when you press the [ENTER] key, the time is changed to a setting which can be processed.

4.4.1 Displaying MAX, MIN, P-P, and RIPPLE

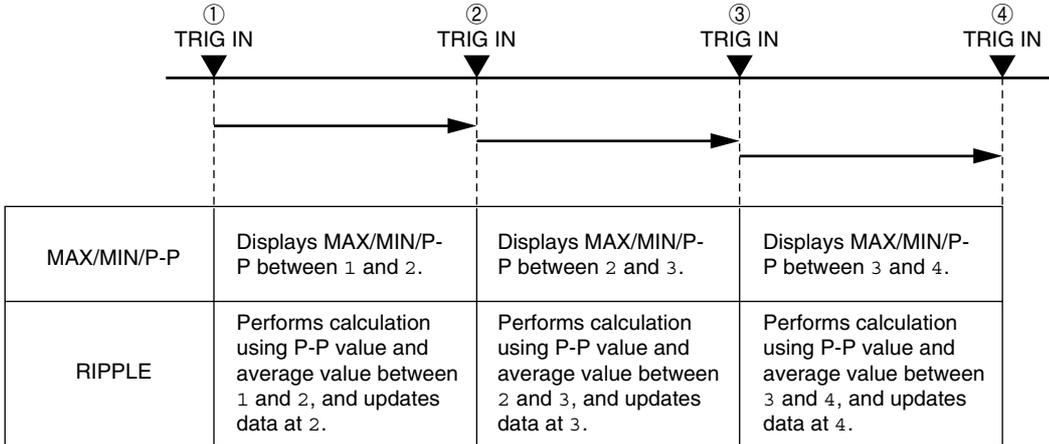
■ **MAX, MIN, P-P**

The previous data is reset at TRIG IN and the MAX, MIN, and P-P values up to the next TRIG IN are displayed.

■ **RIPPLE**

Percent display is made from the P-P value and average value between TRIG IN and the next TRIG IN based on the operational expression.

■ **Timing Chart**



■ **RIPPLE (Ripple Factor)**

In measurement of torque ripple of a motor, etc., the torque ripple factor can also be measured.

Operational expression

$$\text{Ripple factor (\%)} = \frac{\text{Torque P-P value between GATES}}{\text{Torque average value between GATES}} \times 100$$

RIPPLE measurement is possible when GATE of the DISPLAY setting is any.

In case of GATE IN, data is updated at intervals of the GATE time.

In case of GATE EXT, calculation is performed for data between TRIG IN and next TRIG IN, then the data is updated.

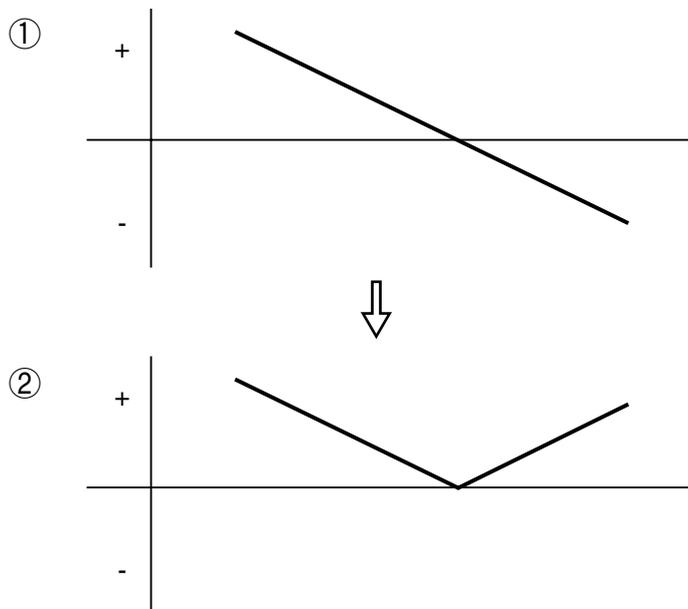
Note: When the average value between GATES is 0 or when it exceeds 100%, display changes "-----" unconditionally.

4.5 Taking Absolute Values of Measured Data

Absolute values can be taken independently for LCD display, analog output, and comparator data.

Torque measurement values have the polarity: positive (+) torque and negative (-) torque. This function is effective to know the absolute value regardless of the polarity of torque and to apply interlocking with excessive torque regardless of the polarity.

When the absolute value of data ① is taken, ② results.



Operating Procedure

■ In Case of DISPLAY

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (DISPLAY) using the ▲ and ▼ keys and then press the [ENTER] key.
The following screen appears.

```

<< DISPLAY SET >>
DISP 0:Normal
GATE INT 1.0s   AVE TIME 0.250s
ITEM  MODE  GATE  ABS
MAIN1 0:TORQUE 0:NOR 0:INT 1:ON
MAIN2 1:REVO  0:NOR 0:INT 0:OFF
MAIN3 2:POWER 0:NOR 0:INT 0:OFF
SUB1  0:TORQUE 1:MAX 0:INT 0:OFF
SUB2  0:TORQUE 2:MIN 0:INT 0:OFF
SUB3  0:TORQUE 3:P-P 0:INT 0:OFF
SUB4  0:TORQUE 4:RIP 0:INT 0:OFF
                                  ◀▶ ESC ENTER

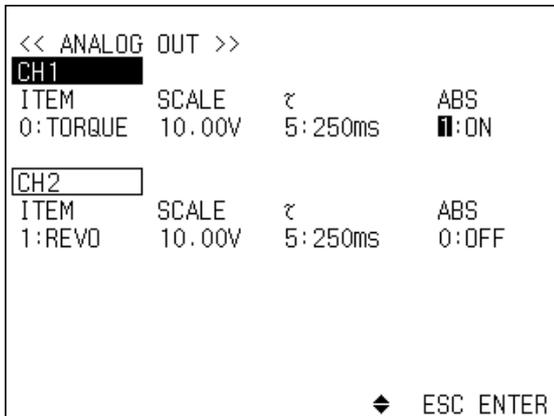
```

- (4) Select items (MAIN1) to (SUB4) for absolute value setting using the ▲ and ▼ keys to set an absolute value and then press the [ENTER] key to move the cursor.
- (5) Select 1:ON of ABS using the ▲ and ▼ keys and then press the [ENTER] key.

■ In Case of Analog Output

Steps (1) and (2) are the same as those in "In Case of DISPLAY display."

- (3) Select (ANALOG OUT) using the **▲** and **▼** keys and then press the [ENTER] key.
The following screen appears.



- (4) Select CH1 and CH2 using the **▲** and **▼** keys and then press the [ENTER] key to move the cursor.
- (5) Select 1:ON of ABS using the **▲** and **▼** keys and then press the [ENTER] key.

■ In Case of Comparator

When installing an option, refer to 5.2, "Comparator TS-0322."

For any option, use the following setting.

ABS

- | | |
|--------|----------------|
| 0: OFF | Normal setting |
| 1: ON | Absolute value |

4.6 Synchronous Operation

Synchronous operation of multiple TS-3200A is possible by synchronizing the gate time (LCD display, etc.) of them.

The slave TS-3200A synchronizes with the TRIG OUT timing output by the master TS-3200A.

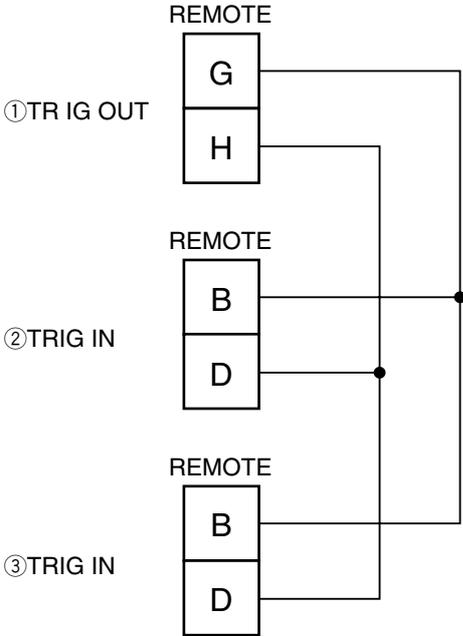
The gate time of the slave TS-3200A equals the time period between TRIG IN and next TRIG IN.

Connections are shown below.

GATE selection for display (DISPLAY) is performed in the DISPLAY setting screen.

Connections

- ① TS-3200A-1 master
 - ② TS-3200A-2 slave 1
 - ③ TS-3200A-3 slave 2
-
- ① TRIG OUT
DISPLAY GATE Selection 0:INT
 - ② TRIG IN
DISPLAY GATE Selection 1:EXT
 - ③ TRIG IN
DISPLAY GATE Selection 1:EXT



4.7 Checking Settings

It is possible to check detector parameter settings DETECTOR SET and USER SET collectively.

Press the [SETVIEW] key on the front panel.

Overall settings can be checked by scrolling the screen using the ▲ and ▼ keys.

```
<< SET VIEW >>
COND=01 COMMENT=
<TORQUE>          <REVO>
CAPACITY=+0005Nm  CAPACITY=10000r/min
DIGIT   =4        LOWER=00001
FACTOR  =08000    PULSE=060
ZERO CW  =+10000  SIGNAL=Revo2(Single)
ZERO CCW=+10000  RATIO=+0001/0001
P/R     =0060     POINT=0
ROTATION=INT      OFFSET=00000
N=0 CW  =OFF
N=0 CCW =OFF      <POWER>
TYPE=SS/DD/MD/DSTP CAPACITY=+00200W
                               ◆ ESC ENTER
```

4.8 Calibrating Analog Output

The TS-3200A has been calibrated before shipment.

If you calibrate the TS-3200A, be sure to use a voltmeter with an accuracy of $\pm 0.02\%$ or higher.

Note: During CAL operation, the measurement ready state turns OFF.

There are two different methods for the [CAL] function.

■ EXT CALIBRATION (External Output Calibration)

When an analog output is recorded on an external recorder, if it is necessary to adjust ZERO and SPAN positions, the external recorder (pen recorder, X-Y recorder, or the like) can be calibrated by outputting an arbitrary voltage from the TS-3200A.

■ INT CALIBRATION (Internal Output Calibration)

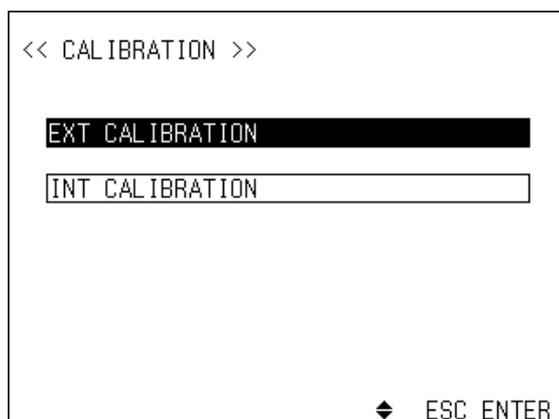
By measuring the analog output with an internal voltmeter and inputting relevant numerical values to the TS-3200A, internal compensation can be performed to enable adjustment of ZERO and SPAN.

Operating Procedure

■ When EXT CALIBRATION Is Displayed

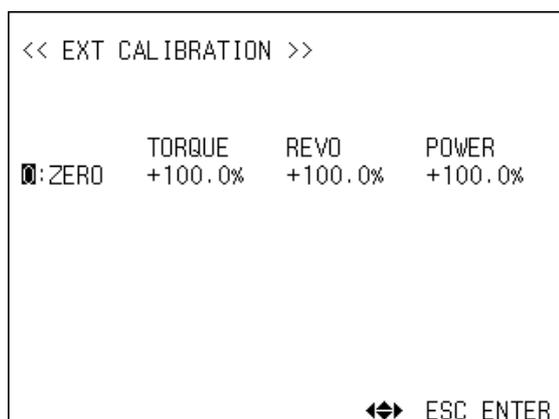
- (1) Press the [CAL] key.

The following screen appears.



- (2) Using the **▲** and **▼** keys, select (EXT CALIBRATION) and then press the [ENTER] key.

The following screen appears.



When you select 0: ZERO and then press the [ENTER] key, 0V voltage is output.

When you select 1: SPAN and then press the [ENTER] key, 10V voltage is output. Depending on the % setting, the voltage can be output as a percentage with respect to 10V. However, if the SCALE setting is not 10V, the setting in 3.9, "Setting Analog Output" is assumed.

Example

Setting	SCALE setup	Analog output
+100 %	10.00	10 V
+100 %	5.00	5 V
+50 %	10.00	5 V
-100 %	10.00	-10 V

■ When INT CALIBRATION Is Displayed

- (1) Same as "■ When EXT CALIBRATION Is Displayed."
- (2) Using the **▲** and **▼** keys, select (INT CALIBRATION) and then press the [ENTER] key.
The following is displayed.

```

<< CALIBRATION >>
ANALOG OUT D/A adjust
CH1  0:ZERO  +00.000V  +00.000V
CH2  0:ZERO  +00.000V  +00.000V
                                           ◆ ESC ENTER

```

Note: For the optional analog output channel (TS-0328), refer to 5.7, "Adding One Analog Output Channel" in Chapter 5.

• Calibrating CH1

Connect a voltmeter to ANALOG OUT1 on the rear panel.

- ① Select (CH1) using the **▲** and **▼** keys and then press the [ENTER] key.
- ② Select 0:ZERO using the **▲** and **▼** keys and then press the [ENTER] key.
- ③ Enter the display value of the connected voltmeter using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.

When the voltmeter is in the - display mode, make setting like -0.005V.

- ④ Select (1:SPAN) using the **◀** and **▶** keys and then press the [ENTER] key.
- ⑤ Enter the display value of the connected voltmeter using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.

• Calibrating CH2

Connect a voltmeter to ANALOG OUT2 on the rear panel.

- ① Select (CH2) using the **▲** and **▼** keys and then press the [ENTER] key.
- Perform the same operations as steps ② to ⑤ for CH1.

To adjust and check the scale of the recorder connected to the TS-3200A, select only 0:ZERO/1:SPAN.

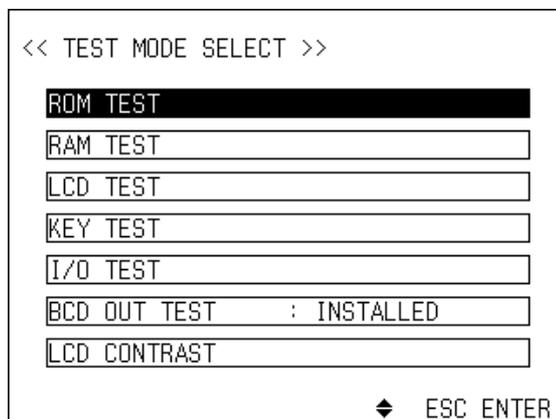
4.9 Self-Check

The following describes the procedure to check the basic functions of the TS-3200A.

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (TEST MODE) and then press the [ENTER] key.

The following screen appears.



- (4) Select an item using the ▲ and ▼ keys and then press the [ENTER] key.

4.9.1 Description of Items

- **ROM TEST**

Displays the current version of the CPU execution program.

```
<< ROM TEST >>

  TS-3200A DIGITAL TORQUE METER

  Version 2.00

  Copyright(C) 2003
  ONO SOKKI Co.,Ltd

                                     ESC
```

- **RAM TEST**

Checks whether the built-in work RAM is normal.

When there is no problem, "OK" is displayed.

- **LCD TEST**

Inverts dots of the LCD display to check whether there is any missing dot.

- **KEY TEST**

Checks whether key switches are operating normally.

Displays the item of the pressed switch.

```
<< KEY TEST >>

  KEY TEST START

  ENTER
```

- **I/O TEST**

Checks the contact input function and contact output function.

```
<< I/O TEST >>

<INPUT>
ROTATION CLR      TRIG      HOLD
0:OFF   0:OFF   0:OFF   0:OFF

<OUTPUT>
RDY      TRIG  BCDDAV  CMP1   CMP2
0:OFF   0:OFF  0:OFF  0:OFF  0:OFF
CMP3    CMP4
0:OFF   0:OFF

◀▶ ESC ENTER
```

Contact input: Performed by short-circuiting the item-related pin of each connector.

Contact output: Connect a continuity tester and a device to the item-related pin of each connector.
Select each item to turn the output ON or OFF forcibly.

- **BCD TEST**

Effective when the BCD OUT option is mounted.

The BCD output is incremented from 00000 to 99999.

4.10 Initializing Settings

If the TS-3200A hangs up because of defective settings, it is necessary to initialize the backup memory with the following procedure.

① Initializing the entire backup memory

Turn the power ON while holding down the [TRIG] and [ESC] keys.

② Initializing settings other than the analog calibration data

Turn the power ON while holding down the [ENTER] and [LOCK] keys.

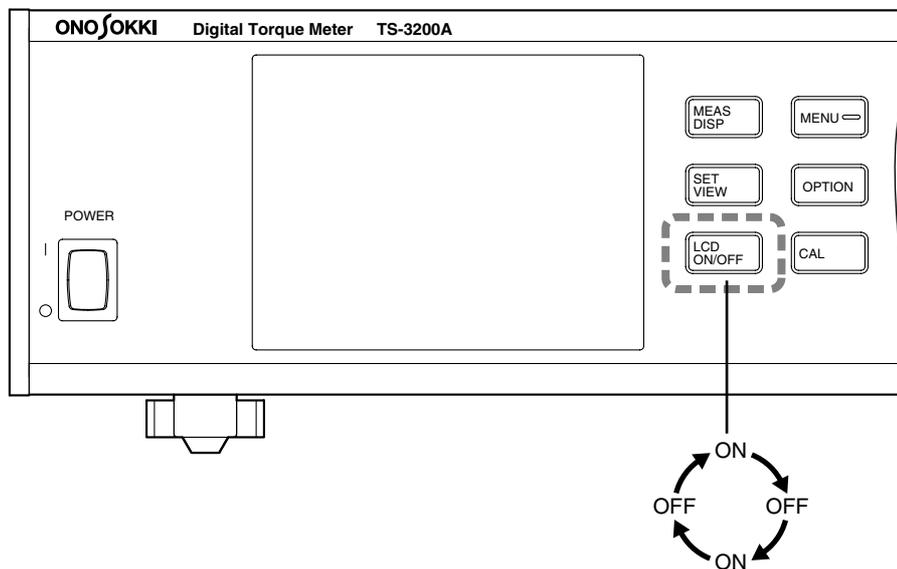
③ Initializing only the selected condition No.

Turn the power ON while holding down the [TRIG] and [ENTER] keys.

4.11 Turning LCD Off

4.11.1 Turning Off

Since the back light of the LCD display has a life, it is recommended that you turn off the LCD display when you do not need to see it.



Each time you press the LCDON/OFF switch, the LCD display turns ON or OFF.

If you turn the power OFF with the LCD display turned OFF and then turn the power back ON, the initial screen appears and then disappears.

The life of the LCD back light is 10000 hours min. (25°C ±3°C).

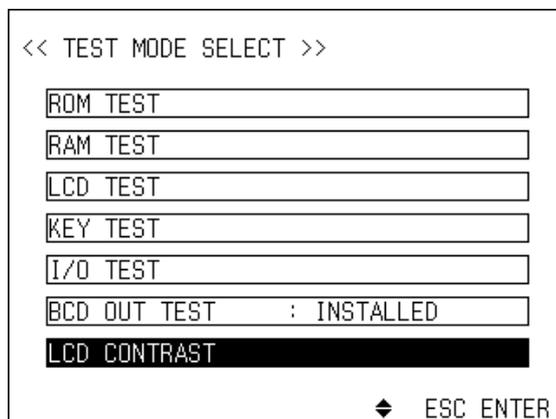
The definition of the life of the back light is "the time until the brightness becomes 1/2 of the initial value."

4.11.2 Adjusting Contrast

Adjustment of the LCD contrast is possible.

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (TEST MODE) using the \blacktriangle and \blacktriangledown keys and then press the [ENTER] key.
The following screen appears.



- (4) Select (LCD CONTRAST) using the \blacktriangle and \blacktriangledown keys and then press the [ENTER] key.
Adjust the contrast adjustment screen using the \blacktriangle and \blacktriangledown keys.
 \blacktriangle key: The screen becomes light.
 \blacktriangledown key: The screen becomes dark.
 The contrast setting is memorized even if turn power is turned OFF.
 The default setting can be selected using the \blacktriangle or \blacktriangledown key.



4.12 Torque Unit Conversion

The unit of torque display is determined by [DETECTOR].

If you want to measure torque using a different unit from the one inscribed on the detector, change FACTOR and CAPACITY according to the conversion expression.

- Notes:
- Enter an integer. (Decimal numbers cannot be entered.)
 - For the N system, enter converted values of FACTOR and CAPACITY with a number with 4 digits or less.

Unit system

N (Newton) system mNm, Nm, kNm

1Nm = 1000mNm 1kNm = 1000Nm

■ Name Plate of Torque Detector

The torque detector is provided with a name plate as shown below.

TORQUE DETECTOR						
MODEL	SS-	050	FACTOR	8086	120	P / R
CAPACITY		5N·m	RANGE	5	26	°C
MAX. SPEED		6000	r/min	No.	05012345	
PAT. No. 481850 481989 490762						
ONO SOKKI CO., LTD.						
MADE IN JAPAN						
Caution: When viewing from drive side of torque detector, set rotation switch up for CW rotation, down for CCW rotation						

CAPACITY: Capacity
FACTOR: Factor
RANGE: Range
MAX SPEED: Maximum rpm
P/R: Number of teeth

4.12.1 Converting Unit System from kgf to N

When using a torque detector with the kgf unit system purchased before, it is necessary to convert the value of FACTOR and CAPACITY. However, unit system conversion from kgf to N is possible only for detectors with a CAPACITY inscription of 10 gfc_m or more.

Conversion Procedure

■ Converting Numeric Value and Unit of CAPACITY (1 kgf_m = 9.807Nm)

- ① Convert the numeric value inscribed as CAPACITY into kgf_m.
 $10\text{gfc}_m = 0.0001\text{kgf}_m$
 $1\text{kgfc}_m = 0.01\text{kgf}_m$
- ② Multiply the value obtained in ① by 10. (Make setting assuming that 0.1kgf_m equals 1Nm.)
- ③ When the value obtained in ② is:
 - Less than 1
→ Multiply the value by 1000, set the result as CAPACITY, then set the unit to mNm.
 - Equal to or greater than 1 and less than 1000
→ Set the value as CAPACITY and the unit to Nm.
 - Equal to or greater than 1000
→ Divide the value by 1000, set the result as CAPACITY, then set the unit to kNm.

■ Converting FACTOR Value

- ① Calculate new FACTOR by multiplying FACTOR inscribed on the detector by 0.9807.
 $\text{New FACTOR} = \text{Old FACTOR} \times 0.9807$
- ② Set the result as FACTOR.

4.13 Temperature Compensation for FACTOR of Torque Detector

With phase difference torque detectors from ONO SOKKI, the material of the torsion bar at the detecting section has temperature characteristics.

Since temperature characteristics affect FACTOR, temperature compensation after measurement is not required if you have performed measurement using the corrected FACTOR. Since the temperature of the torsion bar at the time of detector calibration in ONO SOKKI is inscribed on the name plate, FACTOR is corrected automatically by entering the inscribed temperature value and the temperature value of the torsion bar in the operating environment.

Measure the temperature of the torsion bar by bringing a thermometer such as a thermocouple into contact with the end of the torque shaft.

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (DETECTOR SET) and then press the [ENTER] key.
- (3) Select (TORQUE) using the  and  keys and then press the [ENTER] key.

The following screen appears.

```
<< TORQUE >>
CAPACITY +0005 2:Nm DIGIT=4
FACTOR 08000 CORR=OFF
ZERO CW +10000
ZERO CCW +10000
P/R 0080
ROTATION 1:INT
N-O CW OFF
N-O CCW OFF
TYPE 0:SS/DD/MD/DSTP
◆ ESC ENTER
```

4. Other Operations

- (4) Select (FACTOR) using the **▲** and **▼** keys and then press the [ENTER] key.
The following screen appears.

```

<< TORQUE >>
CAPACITY +0005 2:Nm DIGIT=4
FACTOR 08000 CORR=OFF
ZERO CW +10000
ZERO CCW +10000
P/R 0060
ROTATION 1:INT
N-O CW OFF
N-O CCW OFF
TYPE 0:SS/DD/MD/DSTP
                                ◆ ESC ENTER
  
```

- (5) Move the cursor to CORR=OFF using the **▶** key and then press the [ENTER] key.
The following screen appears.

```

<< TORQUE FACTOR TEMP CORR. >>
ON/OFF 0:OFF
K 0:0.03
T1 25 ℃
T2 25 ℃
                                ◆ ESC ENTER
  
```

- **ON/OFF**

0:OFF Temperature compensation not provided
1:ON Temperature compensation provided

- **K**

0:0.03 (standard detector with material SNCM439)
1:0.005 (custom-ordered detector with material NiSpanC)

- **T1**

Temperature inscribed in the name plate of the detector

- **T2**

Temperature of the end of the detector shaft in the environment under measurement

FACTOR after temperature compensation =
$$\frac{\text{FACTOR before compensation}}{1 + \frac{K(T_2 - T_1)}{100}}$$

4.14 Default Settings

■ DETECTOR SET

TORQUE	Item	Default value
	CAPACITY	5
	UNIT	N m
	DIGIT	4
	FACTOR	8000
	CORR	OFF
	P/R	60
	ROTATION	Int
	ZERO CW	10000
	ZERO CCW	10000
	N-0 CW	OFF R1 to 10=0 T1 to 10=0
	N-0 CCW	OFF R1 to 10=0 T1 to 10=0
	TYPE	SS / DD / MD / DSTP

REVO	Item	Default value
	CAPACITY	10000
	P/R	60
	SIGNAL	Revo2 (Single)
	LOW	1
	POINT	0
	RATIP	+1 / 1
	OFF SET	0

POWER	Item	Default value
	CAPACITY	+200
	UNIT	W

■ USER SET

Display	DISP		NORMAL		
	GATE INT		1 s		
	AVE TIME		0.250s		
		ITEM	MODE	GATE	ABS
MAIN1	Torque	NOR	INT	OFF	
MAIN2	Revo	NOR	INT	OFF	
MAIN3	Power	NOR	INT	OFF	
SUB1	Torque	MAX	INT	OFF	
SUB2	Torque	MIN	INT	OFF	
SUB3	Torque	P-P	INT	OFF	
SUB4	Torque	RIPPLE	INT	OFF	

Analog Out	CH	ITEM	Scale	Time constant (τ)	ABS
	CH1	Torque	10.0V	250ms	OFF
	CH2	Revo	10.0V	250ms	OFF
	CH3	Power	10.0V	250ms	OFF

* CH3: Option

When an option is mounted

BCD OUT	CH	ITEM	GATE
	CH1	Torque	INT
	CH2	Revo	INT

Comparator	CH	ITEM	SET	MODE	AVE TIME	ABS	H/L
	CH1	Torque	\pm XXXXXX	AVE	0.250s	OFF	OFF
	CH2	Torque	\pm XXXXXX	AVE	0.250s	OFF	OFF
	CH3	Torque	\pm XXXXXX	AVE	0.250s	OFF	OFF
	CH4	Torque	\pm XXXXXX	AVE	0.250s	OFF	OFF

Sample Time	4 ms
RS-232C baud rate	9600bps
GP-IB address	2

Chapter 5 Options

- 5.1 Analog Output High-Speed Response
(1ms) TS-0321
- 5.2 Comparator TS-0322
- 5.3 BDC Output TS-0323
- 5.4 RS-232C Interface
- 5.5 GP-IB Interface
- 5.6 Communication Commands
(RS-232C/GP-IB/LAN)
- 5.7 Adding One Analog Output Channel
TS-0328

5.1 Analog Output High-Speed Response (1ms) TS-0321A

The TS-3200A has a standard time constant of 16ms to 64s for the analog output.

When the TS-0321A option is built in the TS-3200A, 4ms or 1ms can be selected as the sampling time.

When 1ms sampling time is selected, the analog output is updated at 1ms sampling intervals allowing high-speed response.

When the TS-0321A is built in and 4ms sampling time is selected, OFF (exponential averaging not performed) is added to the time constant setting for the analog output.

However, there are the following restrictions for 1ms sampling time.

Restrictions

- The comparator function (CMP 1 OUT, CMP 2 OUT, CMP 3 OUT and CMP 4 OUT terminals) does not operate.
- The time constant for the analog output cannot be set.
Only the ON/OFF setting of the low-pass filter ($f_c/80\text{Hz}40\text{ dB/dec}$) can be made.

Operating Procedure

- (1) Press the [MENU] key.
The following screen appears.

```
<< Menu >>  
  
DETECTOR SET  
USER SET  
  
◆ ESC ENTER
```

- (2) Select (USER SET) and then press the [ENTER] key.
The following screen appears.

```
<< USER SET >>  
  
DISPLAY  
ANALOG OUT  
OPTION  
TEST MODE  
  
◆ ESC ENTER
```

- (3) Select (OPTION) and then press the [ENTER] key.
The following screen appears.

```
<< OPTION >>  
  
HIGH RESPONSE TS-0321A: INSTALLED  
COMPARATOR TS-0322A: INSTALLED  
BCD OUT TS-0323: NOT INSTALLED  
LAN TS-0324: NOT INSTALLED  
RS-232C TS-0325: INSTALLED  
GP-IB TS-0326: NOT INSTALLED  
ANALOG TS-0328: INSTALLED  
  
◆ ESC ENTER
```

- (4) Select (HIGH RESPONSE TS-0321:INSTALLED) and then press the [ENTER] key.
The following screen appears.

```

<< HIGH RESPONSE >>
SAMPLE TIME 0:4ms

ESC ENTER

```

- (5) Select 0:4ms or 1:1ms using the \blacktriangle and \blacktriangledown keys and then press the [ENTER] key.
When the TS-0321 option is mounted and 0:4ms is selected, 0:OFF is added as a time constant setting for selection.

```

<< ANALOG OUT >>
CH1
ITEM    SCALE    τ      ABS
0:TORQUE 10.00V    0:OFF  0:OFF

CH2
ITEM    SCALE    τ      ABS
1:REVD 10.00V    0:OFF  0:OFF

◆ ESC ENTER

```

When 1:1ms is selected, time constant setting is disabled and only the ON/OFF setting of the low-pass filter (fc/80Hz 40 dB/dec) can be made.

```

<< ANALOG OUT >>
CH1
ITEM    SCALE    fc     ABS
0:TORQUE 10.00V    0:OFF  0:OFF

CH2
ITEM    SCALE    fc     ABS
1:REVD 10.00V    0:OFF  0:OFF

◆ ESC ENTER

```

5.2 Comparator TS-0322A

This option incorporates the comparison setting function allowing 2-channel comparison setting. It can be used to control torque, rpm, and output (POWER). It compares the measured value with a setting and makes contact output.

■ Default Settings

	CMP 1	CMP 2	CMP 3	CMP 4
ITEM	0 : Torque		0 : Torque	
MODE	AVE		AVE	
AVE TIME	00.250s		00.250s	
ABS	OFF		OFF	
SET1	+00.000		+00.000	
H/L1	OFF		OFF	
SET2		+00.000		+00.000
H/L2		OFF		OFF

5.2.1 Description of Functions

<< COMPARATOR >>			
CH1.CH2			
ITEM	MODE	AVE TIME	ABS
0: TORQUE	0: AVE	0.250s	0: OFF
H/L1	SET1	H/L2	SET2
0: HI	+00.000	0: HI	+00.000
CH3.CH4			
ITEM	MODE	AVE TIME	ABS
0: TORQUE	0: AVE	0.250s	0: OFF
H/L1	SET1	H/L2	SET2
0: HI	+00.000	0: HI	+00.000
			◆ ESC ENTER

- **CH1/CH2/CH3/CH4**

The comparator function can be performed for 4 channels.

- **ITEM**

Select a comparison item.

- 0: TORQUE Torque
- 1: REVO Rpm
- 2: POWER Output

- **SET1, SET2**

Enter a comparison setting.

- **MODE**

Select the comparison mode.

- 0: AVE Compares the sectional average value for each AVE TIME (average time) setting with the setting.
- 1: PEAK Performs peak hold based on the sectional average value for each AVE TIME (average time) setting and, using it as measured value, then compares it with the setting.
- 2: EXT Compares the sectional average value from the external trigger signal (referred to as TRIG IN hereafter) to next TRIG IN with the setting.
TRIG IN is generated by short-circuiting the TRIG IN pin of the TRIG switch on the front panel or the REMOTE function (or by setting the logic to L).

- **AVE TIME**

The average time setting is 0.004 to 10.000s.

The average time cannot be set in 0.001s steps because of the relationship with internal sampling.

Although any time can be specified, this setting is converted to a neighbor value which can be processed internally when you press the [ENTER] key.

- **ABS**

Measured values are compared as absolute values.

For absolute values, refer to 4.5, "Taking Absolute Values of Measured Data."

- **H/L**

Specify the output logic.

- 0: HI Short-circuits COMP OUT when comparison setting \geq measured data.
- 1: LO Short-circuits COMP OUT when comparison setting \leq measured data.
- 2: ON Always ON
- 3: OFF Always OFF

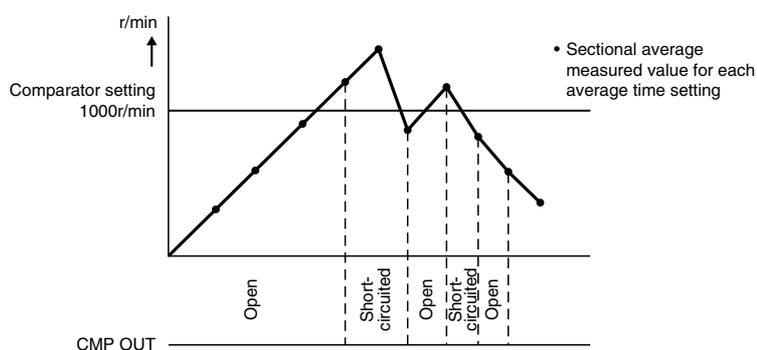
5.2.2 Description of MODE

■ AVE (0.004 to 10.000s)

The sectional average measured value for each average time setting is compared with the comparator setting.

When the average measured value exceeds the comparison measured data, the contact output is made.

Example: REVO 1000 r/min

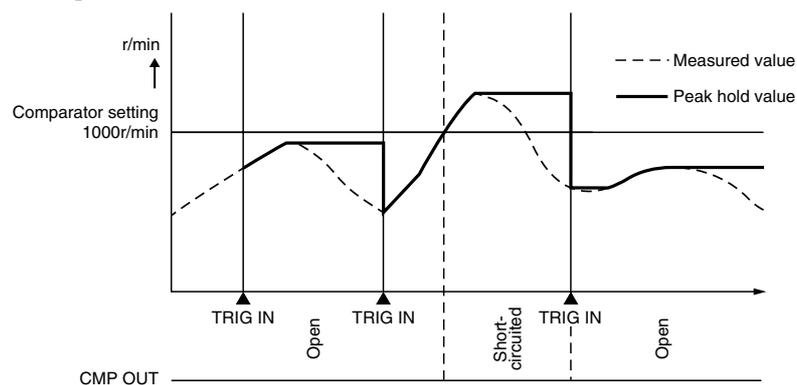


The above short-circuit and open conditions apply to output logic H. For output logic L, the open and short-circuit conditions are reversed.

■ PEAK (0.004 to 10.000s)

Peak hold is performed by the measured data for each specified average time, then the value is compared with the comparator setting. *

Example: REVO 1000 r/min



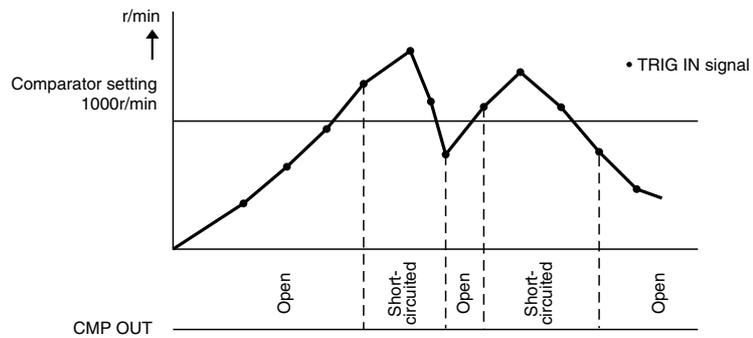
* When the peak hold value exceeds the setting, the COMP OUT terminal of REMOTE is short-circuited. If the measured data is less than the setting when TRIG signal is input next time, the COMP OUT terminal is opened.

The above short-circuit and open conditions apply to output logic H. For output logic L, the open and short-circuit conditions are reversed.

■ EXT

The average measured value from the TRIG IN signal to the next TRIG IN signal is compared with the comparator setting.

When the average measured value exceeds the comparator setting, contact output is made.



The above short-circuit and open conditions apply to output logic H. For output logic L, the open and short-circuit conditions are reversed.

5.2.3 Setting Procedure

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) and (OPTION) are selected and then press the [ENTER] key.

The following screen appears.

```
<< OPTION >>
HIGH RESPONSE TS-0321A:INSTALLED
COMPARATOR TS-0322A:INSTALLED
BCD OUT TS-0323:NOT INSTALLED
LAN TS-0324:NOT INSTALLED
RS-232C TS-0325:INSTALLED
GP-IB TS-0326:NOT INSTALLED
ANALOG TS-0328:INSTALLED
◆ ESC ENTER
```

- (4) Select (COMPARATOR TS-0322:INSTALLED) using the ▲ and ▼ keys and then press the [ENTER] key.

The following screen appears.

```
<< COMPARATOR >>
CH1.CH2
ITEM MODE AVE TIME ABS
0:TORQUE 0:AVE 0.250s 0:OFF
H/L1 SET1 H/L2 SET2
0:HI +00.000 0:HI +00.000
CH3.CH4
ITEM MODE AVE TIME ABS
0:TORQUE 0:AVE 0.250s 0:OFF
H/L1 SET1 H/L2 SET2
0:HI +00.000 0:HI +00.000
◆ ESC ENTER
```

- (5) Select (ITEM), (SET), (MODE), (AVE TIME), and (H/L) using the **▲** and **▼** keys and then press the [ENTER] key.
- ① Select (CH1 and CH2) or (CH3 and CH4) using the **▲** and **▼** keys and then press the [ENTER] key.
 - ② Select a comparison item of (ITEM) using the **▲** and **▼** keys and then press the [ENTER] key.
The cursor moves to (SET).
 - ③ Enter the comparison setting of (SET) using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.
The cursor moves to (MODE).
 - ④ Select the comparison mode of (MODE) using the **▲** and **▼** keys and then press the [ENTER] key.
The cursor moves to (AVE TIME).
 - ⑤ Select the travel time setting of (AVE TIME) using the **▲**, **▼**, **◀**, and **▶** keys and then press the [ENTER] key.
The cursor moves to (H/L).
 - ⑥ Select the output logic (H/L) using the **▲** and **▼** keys and then press the [ENTER] key.
The cursor returns to the channel (CH1, CH2), (CH3, CH4) selected by ①.

If you do not press the [ENTER] key in step ⑥, the settings in steps ② to ⑥ are not updated.

Be sure make setting in steps ② to ⑥ continuously and then press the [ENTER] key to return the cursor to CH1/CH2/CH3/CH4.

Since the comparison operation timing depends on MODE, refer to 5.2.2, "Description of MODE."

5.2.4 Recommended Interfaces

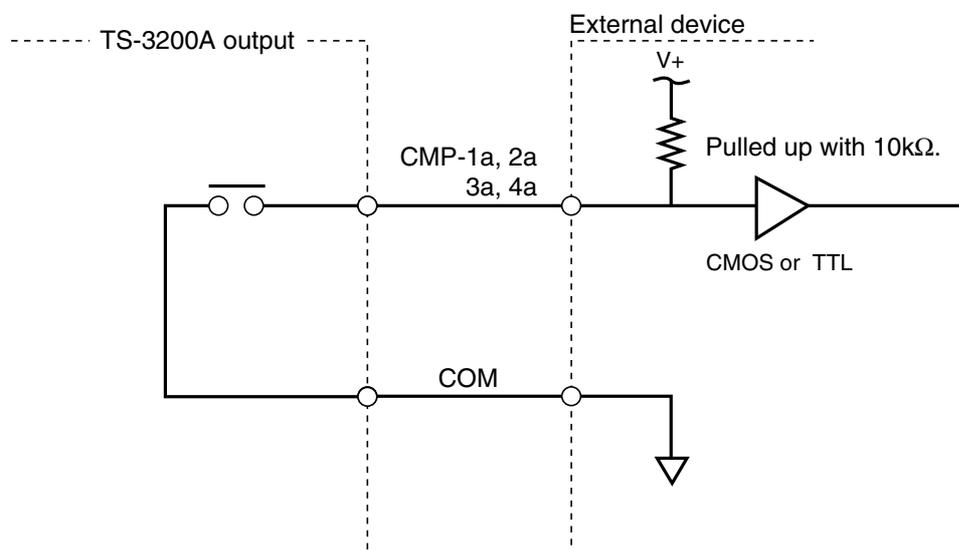
For the interface of the REMOTE function TRIG IN used in the PEAK and EXT modes, refer to 4.1, "Using REMOTE Function."

■ CMP UUT (Contact Output) Interface

Pin No.	Function	
1	CMP-1a	CH1
2	CMP-2a	CH2
3	CMP-1c, CMP-2c	CH1, CH2
4	CMP-3a	CH3
5	CMP-4a	CH4
6	CMP-3c, CMP-4c	CH3, CH4

Output format	Dry contact
Withstand voltage	30VDC or less
Load power supply	100mA or less
ON resistance	10 Ω or less
OFF resistance	500k Ω or higher

The following interface circuit is recommended.



5.3 BCD Output TS-0323

The BCD output and DAV command output of the TS-3200A are all open-collector outputs. The following explains signals as logic recognized by the external device assuming that the BCD output and DAV command are connected to the external device through the recommended interface.

Note: Total length of cable connected to BCD OUT shall not exceed 5m.

5.3.1 Description of Each Signal

① Data output

CH1: The decimal point is not output.

CH2: The decimal point is not output.

Positive logic 5-digit parallel output

Open-collector output

② Polarity output

CH1 42 pins (- output) / 43 pins (+ output)

CH2 44 pins (- output) / 45 pins (+ output)

Open-collector output

When measured data is positive (+), pins 42 and 44 (- output): Lo (ON)/ pins 43 and 45 (+ output): Hi (OFF)

When measured data is negative (-), pins 42 and 44 (- output): Hi (OFF)/ pins 43 and 45 (+ output): Lo (ON)

③ DAV command output

Open-collector output

Outputs the DAV command signal with negative logic pulse while the BCD output data is being updated. (Refer to the timing chart.)

④ Hold input

When the contact close (Lo level) signal is input, the BCD output data is held. The hold state is retained while this signal holds the contact close condition (Lo level).

Also in the hold state, the count circuit performs the count operation according to the input signal from the torque sensor. Therefore, when the hold state is canceled, the BCD output data changes to the measured data at that timing.

Pin No.	Signal name	I/O	Pin No.	Signal name	I/O
1	Ch1 data 1 x 10 ⁰	O	26	Ch2 data 2 x 10 ¹	O
2	Ch1 data 2 x 10 ⁰	O	27	Ch2 data 4 x 10 ¹	O
3	Ch1 data 4 x 10 ⁰	O	28	Ch2 data 8 x 10 ¹	O
4	Ch1 data 8 x 10 ⁰	O	29	Ch2 data 1 x 10 ²	O
5	Ch1 data 1 x 10 ¹	O	30	Ch2 data 2 x 10 ²	O
6	Ch1 data 2 x 10 ¹	O	31	Ch2 data 4 x 10 ²	O
7	Ch1 data 4 x 10 ¹	O	32	Ch2 data 8 x 10 ²	O
8	Ch1 data 8 x 10 ¹	O	33	Ch2 data 1 x 10 ³	O
9	Ch1 data 1 x 10 ²	O	34	Ch2 data 2 x 10 ³	O
10	Ch1 data 2 x 10 ²	O	35	Ch2 data 4 x 10 ³	O
11	Ch1 data 4 x 10 ²	O	36	Ch2 data 8 x 10 ³	O
12	Ch1 data 8 x 10 ²	O	37	Ch2 data 1 x 10 ⁴	O
13	Ch1 data 1 x 10 ³	O	38	Ch2 data 2 x 10 ⁴	O
14	Ch1 data 2 x 10 ³	O	39	Ch2 data 4 x 10 ⁴	O
15	Ch1 data 4 x 10 ³	O	40	Ch2 data 8 x 10 ⁴	O
16	Ch1 data 8 x 10 ³	O	41	N.C.	
17	Ch1 data 1 x 10 ⁴	O	42	Ch1 polarity (-)	O
18	Ch1 data 2 x 10 ⁴	O	43	Ch1 polarity (+)	O
19	Ch1 data 4 x 10 ⁴	O	44	Ch2 polarity (-)	O
20	Ch1 data 8 x 10 ⁴	O	45	Ch2 polarity (+)	
21	Ch2 data 1 x 10 ⁰	O	46	N.C.	
22	Ch2 data 2 x 10 ⁰	O	47	HOLD IN	I
23	Ch2 data 4 x 10 ⁰	O	48	N.C.	
24	Ch2 data 8 x 10 ⁰	O	49	BCD DAV (updating data)	O
25	Ch2 data 1 x 10 ¹	O	50	COM	

N.C., unused pins, are used inside the TS-3200A. Do not use them for relaying or other purposes.

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (OPTION) and then press the [ENTER] key.

The following screen appears.

```

<< OPTION >>
HIGH RESPONSE TS-0321A:INSTALLED
COMPARATOR TS-0322A:INSTALLED
BCD OUT TS-0323:INSTALLED
LAN TS-0324:NOT INSTALLED
RS-232C TS-0325:INSTALLED
GP-IB TS-0326:NOT INSTALLED
ANALOG TS-0328:INSTALLED
      ◆ ESC ENTER
  
```

- (4) Select (BCD OUT TS-0323:INSTALLED) and then press the [ENTER] key.

The following screen appears.

```

<< BCD OUT >>
CH1
ITEM      MODE
3:OFF     0:GATE INT

CH2
ITEM      MODE
3:OFF     0:GATE INT
      ◆ ESC ENTER
  
```

• ITEM

Select a comparison item.

- | | |
|-----------|------------|
| 0: TORQUE | Torque |
| 1: REVO | Rpm |
| 2: POWER | Output |
| 3: OFF | Always OFF |

- **MODE**

Select the comparison mode.

- 0: GATE INT Updates the output for each time specified by GATE INT of DISPLAY.
Data is the sectional average in the time setting.
- 1: GATE EXT Updates the output using the TRIG key on the front panel or the TRIG
IN signal of the REMOTE function. Data is the sectional average between TRIG and
next TRIG.
- 2 :SAMPLE Like the analog output, data is updated (at 4ms intervals) according to the time
constant (exponential average).

- **τ**

Time constant setting

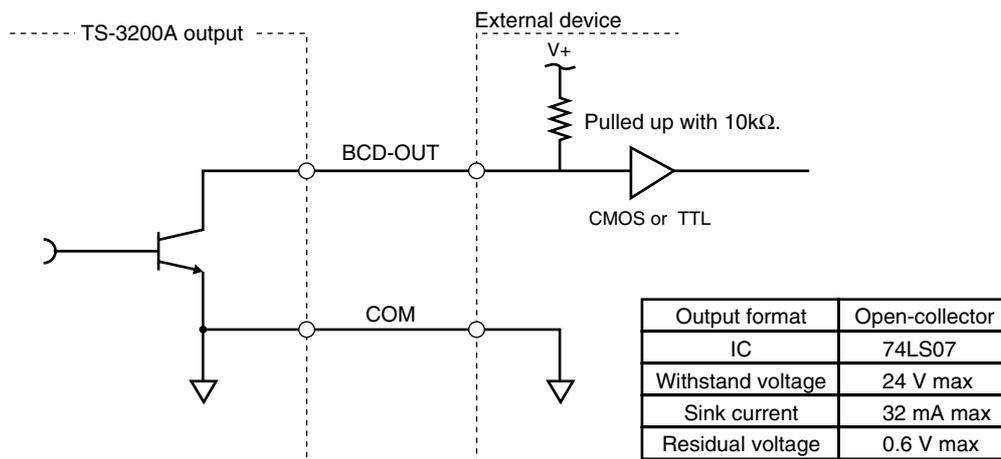
This item can be set only when 2:SAMPLE is selected as (MODE).

The definition and setting of the time constant are the same as those of the analog output. Refer to "Time Constant" in 3.9, "Setting Analog Output."

5.3.2 Recommended Interface

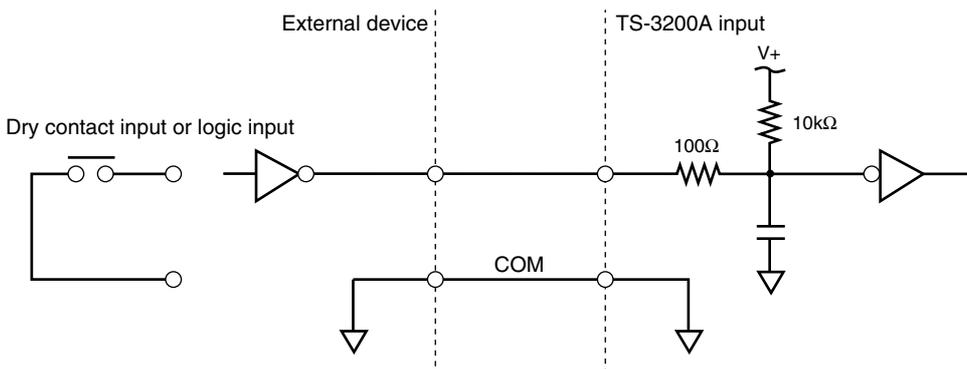
The following interface circuit is recommended.

- ① BCD output / polarity output / DAV (updating data)



- ② Hold input

Input a signal without chattering.



At the time of contact input

Load voltage	5 V _{oc} min
Load current	100 mA min
ON resistance	10Ωmax
OFF resistance	500 kΩmin

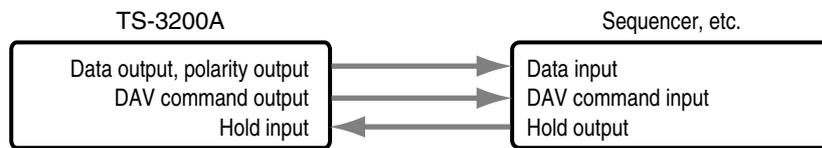
At the time of logic input

Input Lo level voltage	0 to 1.4 V
Input Hi level voltage	3 to 5.25 V
Input impedance	1 kΩ

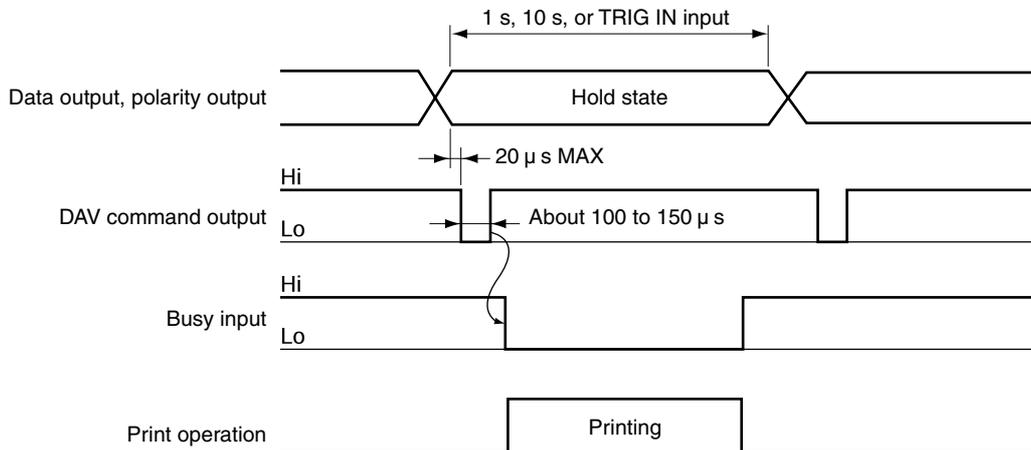
5.3.3 Timing Chart

Since the data/polarity output is counted for each GATE setting, data may not be updated even if the hold signal is canceled and then held again within the specified GATE time.

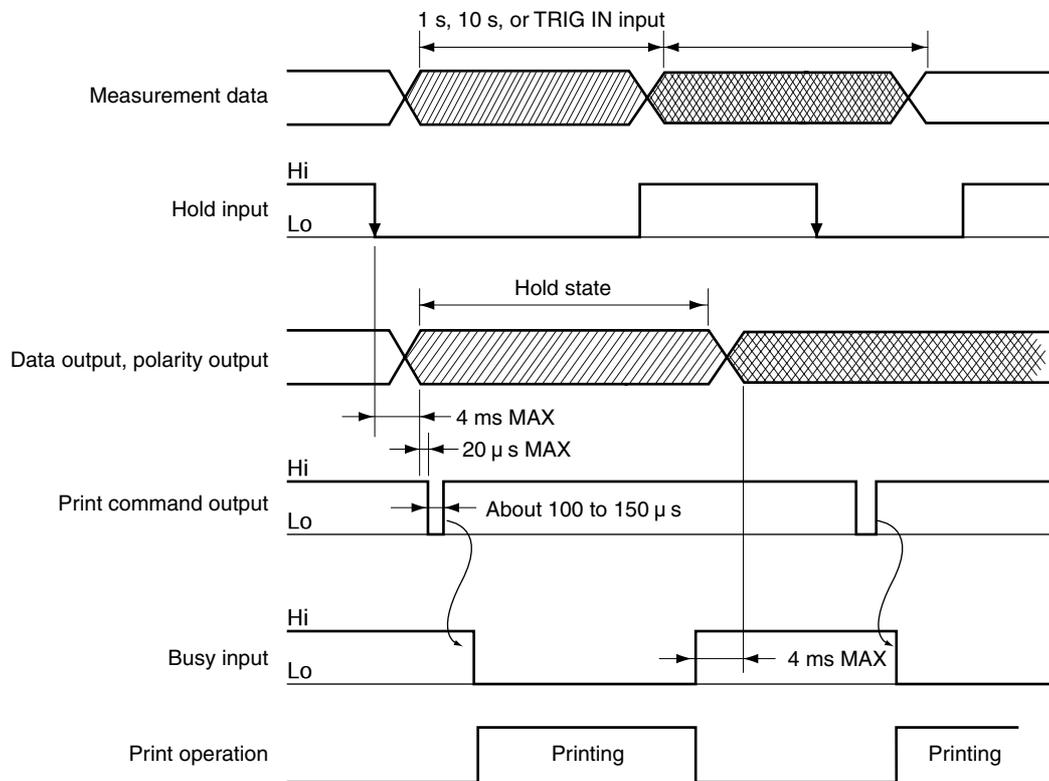
Since the pulse width of the DAV command output is as short as about 5 μ s, it cannot be read by the general-purpose I/O port of the sequencer. When reading the BCD data and polarity, be sure to perform hold input using the sequencer.



- When hold input is not used (Repeating the following pattern continuously)
 Since the BCD data is updated when the DAV command is LO, read the data at the rising edge.



● When hold input is used



5.4 RS-232C Interface TS-0325

5.4.1 Overview

The RS-232C is a serial communication interface standardized by Electronic Industries Association (EIA). The RS-232C interface of the TS-3200A enables data read-out, N-0 compensation value write, and other operations using appropriate programs for minicomputers and personal computers.

5.4.2 Specifications

Standard:	Conforms to EIA and JISX5101.
Communication system:	Start-stop transmission full-duplex mode
Transmission rate (baud rate):	1200/2400/4800/9600/19200 bps
Character length:	8 bits
Parity check:	None
Stop bit length:	1 bit
X parameter control:	Hardware control (using RTS/CTS)
Terminator:	CR+LF

Pin arrangement

1	NC
2	RXD
3	TXD
4	DTR
5	COM
6	DSR
7	RTS
8	CTS
9	NC

5.4.3 Connection with PC

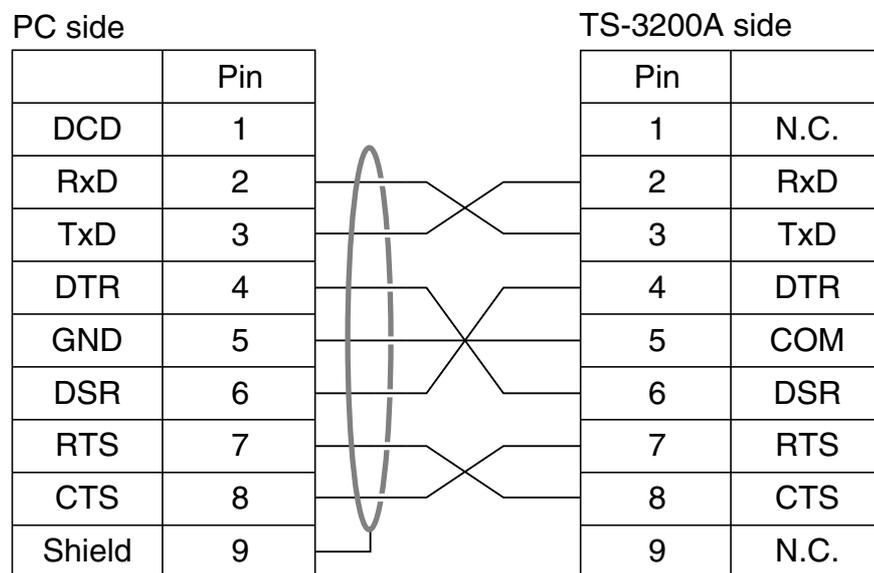
Cable connection

Connection with PC is made with a cross cable.

Use a cable which can be connected normally referencing the pin arrangement of the TS-3200A.

Cable connection

Basic connection



Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (OPTION) and then press the [ENTER] key.

The following screen appears.

<< OPTION >>	
HIGH RESPONSE TS-0321A:INSTALLED	
COMPARATOR TS-0322A:INSTALLED	
BCD OUT TS-0323:INSTALLED	
LAN TS-0324:NOT INSTALLED	
RS-232C TS-0325:INSTALLED	
GP-IB TS-0326:NOT INSTALLED	
ANALOG TS-0328:INSTALLED	
◆ ESC ENTER	

- (4) Select (RS-232CTS-0325:INSTALLED) using the ▲ and ▼ keys and then press the [ENTER] key.

The following screen appears.

<< RS-232C >>	
BAUD	4:19200 bps
ESC ENTER	

- (5) Select a baud rate (1200/2400/4800/9600/19200bps) using the ▲ and ▼ keys.

5.4.4 Check Procedure at Hyper Terminal

Hyper Terminal, an accessory of Windows, make it easier to check communication.

1. Prepare an RS-232C cable and connect the personal computer and the TS-3200A using it.
2. Start WindowsXX.
3. Select Start, Programs, Accessories, then Hyper Terminal.
4. When the Hyper Terminal window opens, activate HYPERTRM.EXE.
5. If message "You need to install a modem before you can make a connection. Would you like to do this now?" appears, press [No].
6. The connection setting window appears.
Enter TS3200 as Name:, select an icon, then press OK.
7. The telephone number window appears.
Select Direct to Com1 or Direct to Com2 as Connection(N): and then press OK.
Select the Com port number to which the RS-232C cable is connected.
8. When the property of the selected COM_ opens, make port setting.
Bits per seconds: 9600 (conforming to the setting on the TS-3200A side)
Data bits: 8
Parity: None
Stop bits: 1
Flow control: Hardware
Enter and select the above items and then press OK.
9. Select File and then Properties to open the Property window. Select the [Settings] tab and then make the following setting.
Using function key, arrow key, and Ctrl key
Select the Terminal keys.
Emulation: VT100

10. Press [ASCII Setup] to open the ASCII setting window and then make the following setting.
[ASCII Sending]
Check the following items:
Send line ends with line feeds
Echo typed characters locally
[ASCII Receiving]
Check the following items:
Append line feeds to incoming line ends
Wrap lines that exceed terminal width
Then, press OK.
To close the window currently open, press OK again.
11. Select File(F) and then Save As(A).
Since the file name field has been loaded with TS3200, press OK.
12. Enter commands with half-size capital upper-case letters to enable communication.

5.5 GP-IB Interface TS-0326

5.5.1 Overview

The General Purpose Interface Bus (GP-IB), also referred to as IEEE bus, is a general-purpose interface bus system approved by the Institute of Electrical and Electronics Engineers (IEEE). It allows connection between digital devices using dedicated connectors (standardized by IEEE488) and cables.

When this GP-IB interface bus is applied, the interfaces of all devices are based exactly on the same standard, allowing parallel connection of up to 15 devices (in the form of so-called daisy chain). The 3-wire handshake system is employed for data transmission, ensuring accurate data transmission even between transmitting and receiving devices with different transmission rates.

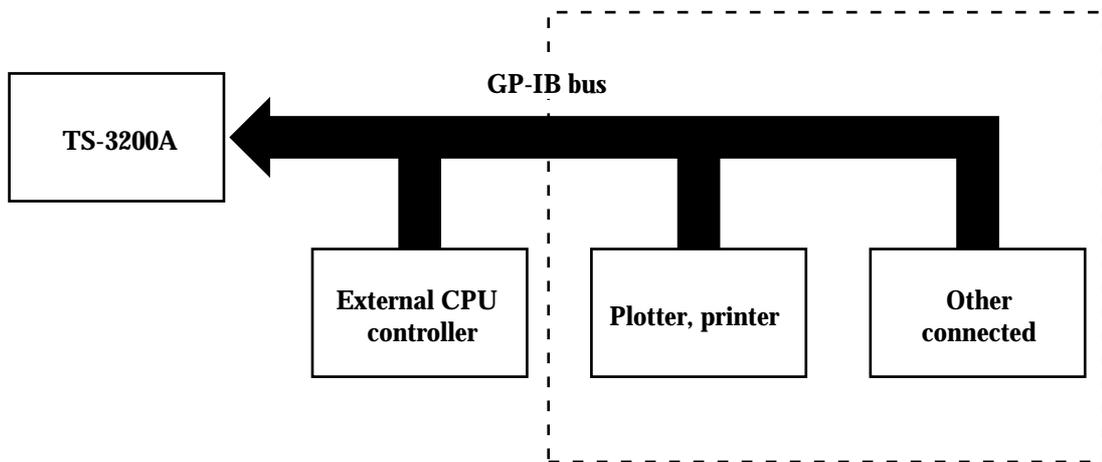
The GP-IB interface built in the TS-3200A makes it possible to specify the panel and receive data through programming operation on a minicomputer or a personal computer.

The TS-3200A is used as a slave device and therefore controlled by commands from the host computer.

5.5.2 Precautions Before Use

When the TS-3200A is used with a computer (controller) connected to it, if the power of any devices (plotters, printers, and other measuring devices) connected to the controller is turned off, noise margin may be deteriorated.

When using the TS-3200A, therefore, make sure that the power of all the devices connected to the controller is turned ON and that unnecessary devices are disconnected from the controller.



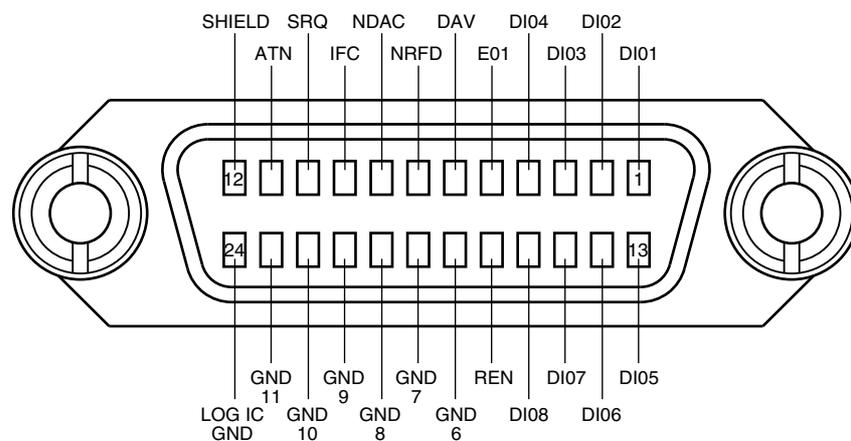
Various devices connected

- Turn on the power of all the connected devices even if any are not to be used
 - Disconnect unnecessary devices.
-
- **Connect the GP-IB cables securely.**
Check whether the cables are connected securely before use.
 - **Check the address of the TS-3200A.**
When a computer is used to control the TS-3200A, check address settings.
 - **Check the terminator of the controller.**
The transmitting/receiving terminator of the TS-3200A is CR+LF.
Use the same terminator also for the controller.
 - **Check whether the command type agrees with the program sequence.**
For example, if you send a command for data read and then another one to the TS-3200A, the TS-3200A waits until it is specified as a talker resulting in program lock.
Make setting so that command type agrees with the program sequence.

5.5.3 GP-IB Specifications

- | | |
|---------------------------------------|--|
| ① Full length of cables | 20m or less (total length of all cables) |
| ② Length of one cable | 5m or less (only connection between devices) |
| ③ Maximum number of devices connected | 15 or less (including one controller) |
| ④ Signal lines | |

For the GP-IB interface, dedicated 24-pin connectors are used. Of the 24 signal lines, eight lines data lines (D101-D108), eight lines are control lines, and remaining eight lines are ground lines. The control lines are classified into three handshake lines (DAV, NRFD, and NDAC) and five control lines (ATN, REN, IFC, SRQ, and EOI). This data transmission system based on three handshake lines ensures accurate data transmission between transmitting side (talkers) and receiving side (listeners) with different transmission capabilities.



e. Operation of each signal line

- DIO1-8 (data lines)

Used for general data (including 8-bit parallel and address bus commands), etc.

- DAV (Data Valid)

Indicates that the data on DIO is valid.

- NRFD (Not Ready For Data)

Indicates that the listener can receive the data on DIO.

- NDAC (Not Data Accepted)

Indicates that the listener has received the data on DIO.

- ATN (Attention)

This signal line indicates whether the data on DIO is general data or a bus command.

- REN (Remote Enable)

This signal line is used to distinguish the remote or local mode for each device.

- IFC (Interface Clear)

This signal line is used to clear the interface for each device.

- SRQ (Service Request)

This signal line requests the controller for serial polling.

- EOI (End or Identify)

This signal line indicates the end continuous data.

5.5.4 GP-IB Interface Functions

This GP-IB interface is provided with the following functions:

Code	Function
SH 1	Transmitting handshake function provided
AH 1	Receiving handshake function provided
T 6	Basic talker function provided Serial polling function provided Talker cancel by MLA (My Listen Address)
L 4	Basic listener function provided Listener-only mode not provided Listener cancel by MTA (My Talk Address)
SR 1	Service request function provided
RL 1	Remote local function provided
PP 0	Parallel polling function not provided
DC 1	Device clear function provided
DT 1	Device trigger function provided
C 0	Controller function not provided

TS-3200A Interface Functions

(1) Taker functions

- Multiple talkers cannot exist on the GP-IB (IEEE488) bus at the same time.
- When the ATN signal from the controller is the High level, sends out data to the listener.
- Performs source handshake automatically.
- Specified as a talker when MTA (My Talk Address) is received from the controller.
- Talker is canceled when MLA (My Listen Address) is received from the controller.
- Talker is canceled when UNT (Untalk) is received from a controller.

If bus command transmission from the controller to the TS-3200A is not possible depending on the preceding or following command flow, the GP-IB bus may hang up (bus lock). Therefore, the interface functions are not always effective.

Example:

1. Send a command for data read from the TS-3200A. (Waiting for talker)
Attempt to write data without specifying the TS-3200A as a talker.
2. Send a command for data write to the TS-3200A. (Waiting for listener)
Attempt to read data by specifying the TS-3200A as a talker.

In both Examples 1 and 2, the command flow and listener/talker specification are mismatched, resulting in hang-up.

(2) Listener functions

- Multiple listeners can exist on the GP-IB (IEEE488) bus at the same time.
- When the ATN signal from the controller is the High level, reads data from the bus.
- Performs acceptor handshake automatically.
- Specified as a listener when MLA (My Listen Address) is received from the controller.
- Listener is canceled when MTA (My Talk Address) is received from the controller.
- Listener is canceled when UNL (Unlisten) is received from the controller.

Like talkers, bus command reception may be disabled (hang-up) also in case of listeners.

To cancel this condition, it is necessary to send IFC (uni-line message) or DCL (multi-line message) to the TS-3200A. Normally, it is not necessary to press the system reset of the TS-3200A.

Usually, listener specification is executed first for the PRINT statement (OUTPUT statement) and talker specification first for the INPUT statement of the personal computer, resulting in no problem.

(3) Bus commands

Effective bus commands (multi-line messages) for this interface are shown below. Other commands are ignored (without affecting operation).

Command	Symbol	Data line	Function
DEVICE CLEAR	DCL	X0010100	Clears a device.
GO TO LOCAL	GTL	X0000001	Cancels remote.
LOCAL LOCKOUT	LLO	X0010001	Inhibits local switches.
MY LISTEN ADDRESS	MLA	X01LLLLL ₁	Listener specification
MY TALK ADDRESS	MTA	X10TTTTT ₂	Talker specification
OTHER TALK ADDRESS	OTA	X10TTTTT ₂	Other talker specification
SELECTED DEVICE CLEAR	SDC	X0000100	Clears device specified as listener.
SERIAL POLL DISABLE	SPD	X0011001	Invalidates serial polling.
SERIAL POLL ENABLE	SPE	X0011000	Validates serial polling.
UN LISTEN	UNL	X0111111	Cancels a listener.
UN TALK	UNT	X1011111	Cancels a talker.
GROUP EXECUTE TRIGGER	GET	X0001000	Applies trigger.

1: LLLLL Listener dress

2: TTTTT Talker address

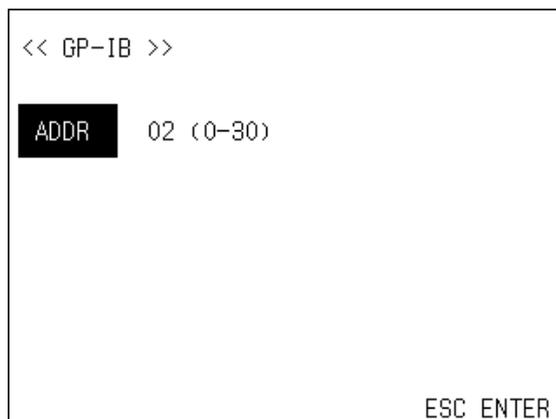
Note: The DC function (device clear function) of the TS-3200A only initializes this interface at the same time as IFC.

5.5.5 GP-IB Address Settings

Operating Procedure

- (1) Press the [MENU] key.
- (2) Select (USER SET) and then press the [ENTER] key.
- (3) Select (OPTION) and then press the [ENTER] key.
- (4) Select (GP-IBTS-0326:INSTALLED) using the ▲ and ▼ keys and then press the [ENTER] key.

The following screen appears.



- (4) Select address (0-30) using the ▲ and ▼ keys and then press the [ENTER] key.

5.6 Communication Commands (RS-232C/GP-IB/LAN)

Basically RS-232C, GP-IB, and LAN commands are common.

Commands with a trailing () function as a default value read command when () is omitted. In the actual setting, () is not necessary.

5.6.1 Parameter Settings

With the TS-3200A, 10 different parameter settings can be registered with file formats CONDITION1-10. First, the CONDITION number (1-10) setting is selected. Then, various parameters are set for the selected CONDITION.

CND(d)	CONDITION number selection d = 1 to 10
CMT(d)	Comment entry d = Up to 20 alphanumeric characters

5.6.2 Display Mode

LDM(d) LCD display mode selection (DISP)

d = 0:NORMAL
 1:TRIPLE
 2:MAIN&SUB
 3:ALL

LDSn(d, m, g, a) LCD display selection

	Display position	Item
n=	1:MAIN1	d= 0:TORQUE
	2:MAIN2	1:REVO
	3:MAIN3	2:POWER
	4:SUB1	3:OFF (Display OFF)
	5:SUB2	
	6:SUB3	
	7:SUB4	

	Display mode	Gate selection	Absolute value display
m=	0:NORMAL	g= 0:INT	a= 0:OFF
	1:MAX	1:EXT	1:ON
	2:MIN		
	3:PP		
	4:RIPPLE factor (Only SUB4 can be selected.)		

LDG(t) Gate time setting

t = 0.1 to 10s

LDA(t) Data average time setting at the time of display deviation data (MAX, MIN, PP, RIPPLE factor)

t = 0.004 to 10s

5.6.3 Measurement Commands

RLDn LCD display data read (ASCII) (Reads LCD display value.)

This command outputs data in the following formats:

When OFF, 0 is returned. Returns measured value only when LCD display is made.

n= 1: MAIN1

2:MAIN2

3:MAIN3

4:SUB1

5:SUB2

6:SUB3

7:SUB4

+XXXXX	UUUUU	CR+LF
①	②	③

① DISPLAY1 data: 7 characters (including symbols and decimal point)

② DISPLAY1 unit data: 5 characters

③ Delimiter: Carriage return (0DH) + Line feed (0AH)

In case of deviation data read (ASCII) and MAX, MIN, P-P data read, the data determined when this command was issued is returned.

Data is determined in 4ms after TRIG IN reception.

5.6.4 BCD Output (Effective When TS-0323 Is Installed)

BCDc(,d)	<p>BCD output item setting</p> <p>c= Channel 1 or 2</p> <p>d= 0:TORQUE 1:REVO 2:POWER 3:OFF</p>
BCGc(,d)	<p>BCD output data update mode setting</p> <p>c = Channel 1 or 2</p> <p>d = 0:GATE INT (internal gate) 1:GATE EXT(TRIG IN) 2:SAMPLE (usually 4ms / 1ms for high-speed option)</p>
BCTc(,d)	<p>BCD output data time constant setting</p> <p>Effective in the Sample update mode</p> <p>c = Channel 1 or 2</p> <p>d = 0:OFF, 1:16ms, 2:31ms, 3:63ms, 4:125ms, 5:250ms, 6:500ms, 7:1s, 8:2s, 9:4s, A:8s, B:16s,C:32s,D:64s</p> <p>0:OFF can be selected only when 4ms SAMPLE is selected with the high-speed option mounted.</p>

5.6.5 Torque Settings

DTR(d)	Torque detector rotation d = 0:EXT 1:INTCW 2:INTCCW
DTZn(d)	Torque detector zero n = 0:CW 1:CCW d = 0 to 99999 - Auto Zero when 1.
DTF(d)	Torque detector factor d = 1 to 65535
DTC(d)	Torque detector capacity d = \pm 1-9999
TTU(d)	Torque detector unit, Effective in the [Foreign mode]. d= 0:mNm 1:Nm 2:kNm 3:[gcm] 4:[kgcm] 5:[kgm] 6:[tm] 7:[ozin] 8:[ftlb] 9:[deg]
DTU(d)	Torque detector unit, Effective in the [Foreign mode]. Successive command for the TS-3600B/TS-3100B d= 0:---- [gcm] 1:---- [kgcm] 2:---- [kgm] 3:--- [tm] 4:mNm 5:Nm 6:kNm 7:---- [ozin] 8:---- [ftlb] 9:--- [deg] 10:--- [rad] Ignores this command.

DTD(d)	<p>Number of digits of torque detector (DIGIT)</p> <p>d = 4:4 digits 5:5 digits Increase in the number of digits does not result in improved torque measurement accuracy.</p>
DTP(d)	<p>Number of teeth of torque detector</p> <p>d = 1 to 9999</p>
DTNn(,r,t)	<p>Torque detector N-0</p> <p>n = 0: CW 1: CCW</p> <p>r = 0 to 99999 Rotation data</p> <p>t = 0 to ±99999 Torque data</p> <p>The number of points for the N-0 setting is 10 per each rotational direction (CW/CCW). With GP-IB, to read setup data using this command, send DTN0 or DTN1 and then read data continuously 10 times. In other cases, GP-IB is locked.</p>
DNSn(,f)	<p>Torque detector N-0 switch</p> <p>n = 0: CW 1: CCW</p> <p>f = 0: OFF 1: ON 2: CLR</p>
DNAd	<p>N-0 auto</p> <p>d = 0: stop (calculate) 1: start (sampling)</p>
DTT(d)	<p>Torque detector type</p> <p>d = 0: SS/DD/DSTP/MDTYPE(DYNAMIC STATIC DETECTOR) 1: DP TYPE(DYNAMIC DETECTOR)</p> <p>If the torque detector is the hollow body rotation type (a motor is installed at the top, such as MD, SS, DSTP, MD), select 0: DYNAMIC STATIC DETECTOR; otherwise, select 1: DYNAMIC DETECTOR.</p>

5.6.6 Rpm Settings

DRC(d)	Rotary encoder capacity d = 1 to 99999
DRL(d)	Rotary encoder The minimum detection rpm setting which depends on the capacity. d = 0.001 -
DRPn(d)	Number of teeth of rotary encoder Since the number of teeth of the TS-3200A is 1, n is not necessary for the TS-3200A. With the TS-3600B/TS-3110B, set n = 0-2. When the TS-3200A receives this command, it sets only the number of teeth, d. Be sure to supply a comma (.). d = 1 to 99999 Example: When the number of teeth of detector is 120 DRP,120 If , is missing, GP-IB is locked.
TRU(d)	Rotary encoder unit d = 0:r/min 1:r/s 2:Hz
DRU(d)	Rotary encoder unit Successive command for the TS-3600B/TS-3100B d = 0:r/min 1:r/s 2: --- [rdps] Invalid even if received. 3:Hz
DRR(d)	Rotary encoder ratio d = $\pm 1-9999/1-9999$
DRS(d)	Rotary encoder signal source d = 0:INT REVO (TRQ SIG2) 1:REVO1 2:REVO2(SINGLE) 3:REVO2(DOUBLE) When 4 or 5 is received, it is ignored.
ROS(d)	Rpm offset value setting d = 0 to 9999: Manual = -1: Auto (automatic setting)

5.6.7 Output (POWER) Settings

DFC(d)	Output capacity d = $\pm 1-99999$
DFU(d)	Output unit d = 0:mW 1:W 2:kW 3:PS 4: -- Invalid even if received by TS-3200A.

5.6.8 Analog Output Settings

DASc(,d)	<p>D/A output source</p> <p>c = 1 to 2: 3 or greater is ignored.</p> <p>d = 0:TORQUE</p> <p>1:REVO</p> <p>2:POWER</p>
DADc(,d)	<p>D/A output data</p> <p>c = 1 to 2: 3 or greater is ignored.</p> <p>d = 0.1 to 10.00 [V] Output full scale setting</p>
DABc(,d)	<p>D/A output method</p> <p>If the TS-3200A receives only VOLTAGE, it ignores this command.</p> <p>c = 1 to the number of channels mounted</p> <p>d = 0:VOLTAGE(0-10V)</p> <p>1 or greater is ignored.</p>
DATc(,d)	<p>D/A output time constant</p> <p>c = 1 to 2: 3 or greater is ignored.</p> <p>d = 0:OFF, 1:16ms, 2:31ms, 3:63ms, 4:125ms, 5:250ms, 6:500ms, 7:1s, 8:2s, 9:4s, A:8s, B:16s,C:32s,D:64s</p> <p>0:OFF can be selected only when the TS-0321 is mounted and 4ms SAMPLE is selected.</p>
ABS _n (d)	<p>Absolute mode</p> <p>n = 4:ANALOG OUT CH1</p> <p>5:ANALOG OUT CH2</p> <p>d = 0:NOR (usual), 1:ABS (absolute value)</p>

5.6.9 Comparator (CMP Comparison) (Effective When TS-0322 Is Installed)

CPSc(,d)	<p>Comparator source</p> <p>c = 1 or 2 (1:1 and 2 Channel, 2:3 and 4 Channel)</p> <p>d = 0:TORQUE</p> <p>1:REVO</p> <p>2:POWER</p> <p>3:ON</p> <p>4:OFF</p>
CPDc(,d)	<p>Comparator data</p> <p>c = Channel 1, 2, 3 or 4</p> <p>d = 0 to ±99999</p>
CPTc(,d)	<p>Comparator average time</p> <p>c = 1 or 2 (1:1 and 2 Channel, 2:3 and 4 Channel)</p> <p>d = 0.004 to 10.000</p>
CPLc(,d)	<p>Comparator output logic</p> <p>c = Channel 1, 2, 3 or 4</p> <p>d = 0:H</p> <p>1:L</p>
ABSn(d)	<p>Absolute mode</p> <p>n = 2:COMPARATOR1</p> <p>3:COMPARATOR2</p> <p>d = 0:NOR (usual)</p> <p>1:ABS (absolute value)</p>

5.6.10 Measurement Commands

MES **Measurement mode**
 Ends clear, ends CAL, ends TEST, and forcibly ends N-0 AUTO.
 Equivalent to the "MEASDISP" panel key.

CLCn **Clear control**
 n = 0 CLROFF
 n = 1 CLRON Forcibly zeros the display, analog output, BCD output, etc.

RDD **Display data read (ASCII) Read display data**
 Successive commands for the TS-3600B/TS-3100B
 Since the TS-3200A allows 7-row display, when this command is received, data for the items set in main display 1 to 2 are returned.
 With this command, data is output in the following format:

+XX.XXX	UUUU	(Space)	+XXX.XX	UUUU	CR+LF
①	②	③	④	⑤	⑥

- ① Upper row display data: Right-justified, signed 7 characters
- ② Unit data: 4 characters at the time of GPIB (/min for r/min), 5 characters at the time of RS
- ③ Space: 2 characters
- ④ Lower row display data: Right-justified, signed 7 characters
- ⑤ Unit data: 4 characters at the time of GPIB (/min for r/min), 5 characters at the time of RS
- ⑥ Delimiter: Carriage return (ODH) + Line feed (OAH)

RGD **Gate data read (ASCII) Read average value for each gate setting**
 Successive commands for the TS-3600B/TS-3100B
 With this command, data is output in the following format. Only GPIB is possible.

However, if the gate time setting is 0.3s or less, normal communication may be disturbed.

+XX.XXX	UUUU	(Space)	+XXX.XX	UUUU	(Space)	+XXX.XX	UUUU	CR+LF
①	②	③	④	⑤	⑥	⑦	⑧	⑨

- ① Torque average value data: 7 characters (including signs and decimal point)
- ② Torque unit data: 4 characters
- ③ Space: 2 characters
- ④ Rotational average data: 7 characters (including signs and decimal point)
- ⑤ Rotation unit data: 4 characters (/min for r/min)
- ⑥ Space: 2 characters
- ⑦ Output average data: 7 characters (including signs and decimal point)
- ⑧ Output unit data: 4 characters
- ⑨ Delimiter: Carriage return (ODH) + Line feed (OAH)

RTD Read external I/O interface status

7	6	5	4	3	2	1	0
0	CMP OUT2	CMP OUT1	READY	ROTATION	TRG OUT	TRG IN	CLR IN

SMS(m) Service request mask setting (applied only to GPIB)

By setting the bit of the corresponding interruption factor to 1 (unmask) or 0 (mask), it is possible to generate interruption for any desired interruption factors. When the power is turned ON, interruptions are masked (all set to 0).

128	64	32	16	8	4	2	1
7	6	5	4	3	2	1	0
-	Request bit	I/O Change	-	TEST END	-	TRG IN	TRG OUT

I/O Change means a change of REMOTE I/O.

5.6.11 Check Commands

TSTn Performs self test. (The settings differ from the TS-3600B).

n = 0: Displays the ROM TEST version.

1:RAM TEST

2:LCD TEST

3:KEY TEST

4:I/O TEST

5:BCD TEST

Outputs a service request at the end.

ICSn1n2n3[,d] Analog output calibration

If the option in [] is omitted, only the status is changed but calibration is not performed.

n1 = OFF (measurement mode)

1 to 2 Calibration channel 3-6 are ignored.

n2 = 0 Voltage (fixed) If (current) is received, the following are ignored:

n3 = 0 ZERO

1 SPAN

d = Reading of digital voltmeter XX.XXX[V]

ICDn1n2n3 Read the analog output calibration level

n1 = 1 to 2 Calibration channel 3-6 are ignored.

n2 = 0 Voltage (fixed) If (current) is received, the following are ignored:

n3 = 0 ZERO

1 SPAN

Data is returned as an integer with the decimal point ignored.

5.6.12 Backup Commands

RAC	Read the entire backup memory Reads only the currently selected CONDITION number.
SAC	Writes data to the entire backup memory Writes data only to the currently selected CONDITION number.
ACCn	Backup memory initialization control n = 0: Initializes all items. n = 1: Initializes all items excluding the analog calibration data specified by CAL. (GP-IB settings are not initialized.)

5.6.13 Bus Commands (Applied Only to GP-IB)

GTL (Go To Local)

Cancels the remote mode and accepts key operations from the panel key.
Effective also in the local lockout.

SDC (Selected Device Clear)

Performs the same function as IFC. The GP-IB interface is initialized to the condition when the power is turned ON. Since this command is an addressed command, only the TS-3200A can be cleared out of multiple devices connected to the GP-IB line.

GET (Group Execute Trigger)

This command is applied when the GATE setting is EXT.
The TRIG IN signal of the EXT GATE function, for which TRIG IN setting is required.

5.7 Adding One Analog Output Channel TS-0328

5.7.1 Overview

One analog output channel of the TS-3200A is added. Calibration and other setup can be performed with the same procedures as for CH1 and CH2.

5.7.2 Setup Procedures

CH3 is added to the analog output setup as follows:

For setup items, refer to 3.9, "Setting Analog Output" (3-35).

<< ANALOG OUT >>				
CH1				
ITEM	SCALE	τ		ABS
0:TORQUE	10.00V	5:250ms		0:OFF
CH2				
ITEM	SCALE	τ		ABS
1:REVO	10.00V	5:250ms		0:OFF
CH3				
ITEM	SCALE	τ		ABS
2:POWER	10.00V	5:250ms		0:OFF
				◆ ESC ENTER

5.7.3 Calibrating the Added Channel

INT CALIBRATION setup

CH3 is added to the INT CALIBRATION setup screen as follows:

For setup items, refer to 4.8, "Calibrating Analog Output" (4-15).

<< INT CALIBRATION >>			
ANALOG OUT D/A adjust			
CH1	0:ZERO	+00.000V	+00.000V
CH2	0:ZERO	+00.000V	+00.000V
CH3	0:ZERO	+00.000V	+00.000V
◆ ESC ENTER			

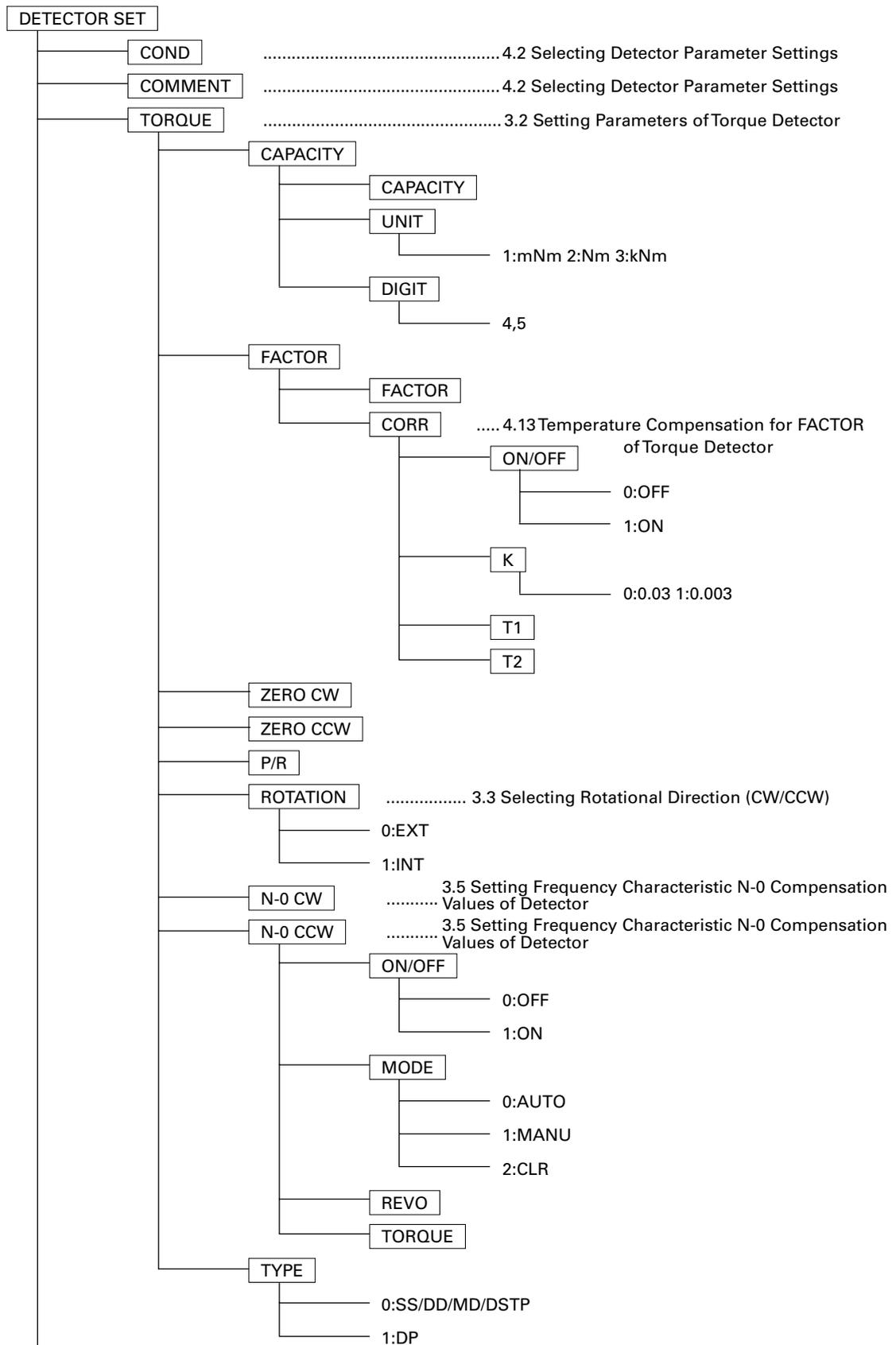
Chapter 6 Menus

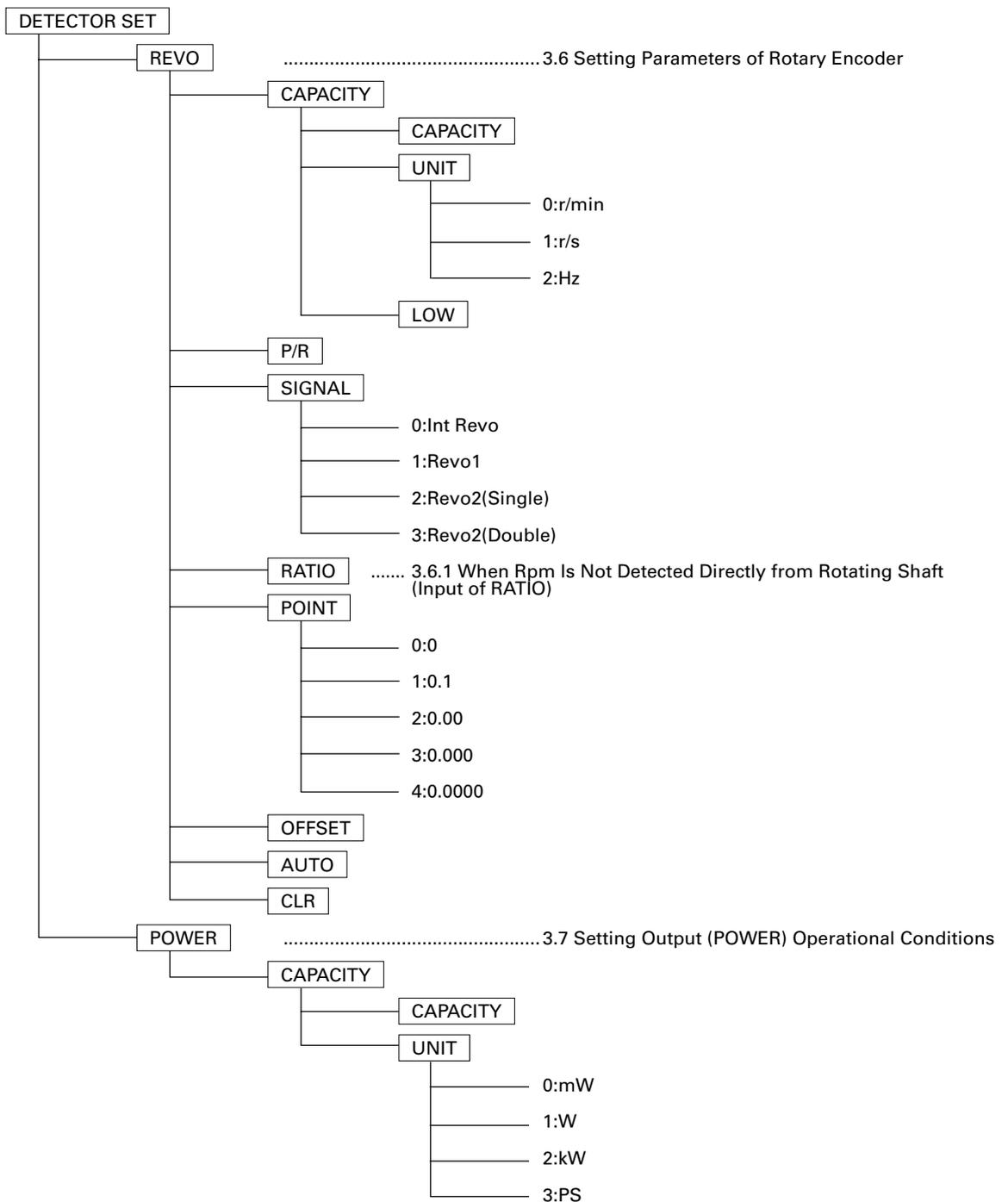
6.1 [MENU] Key

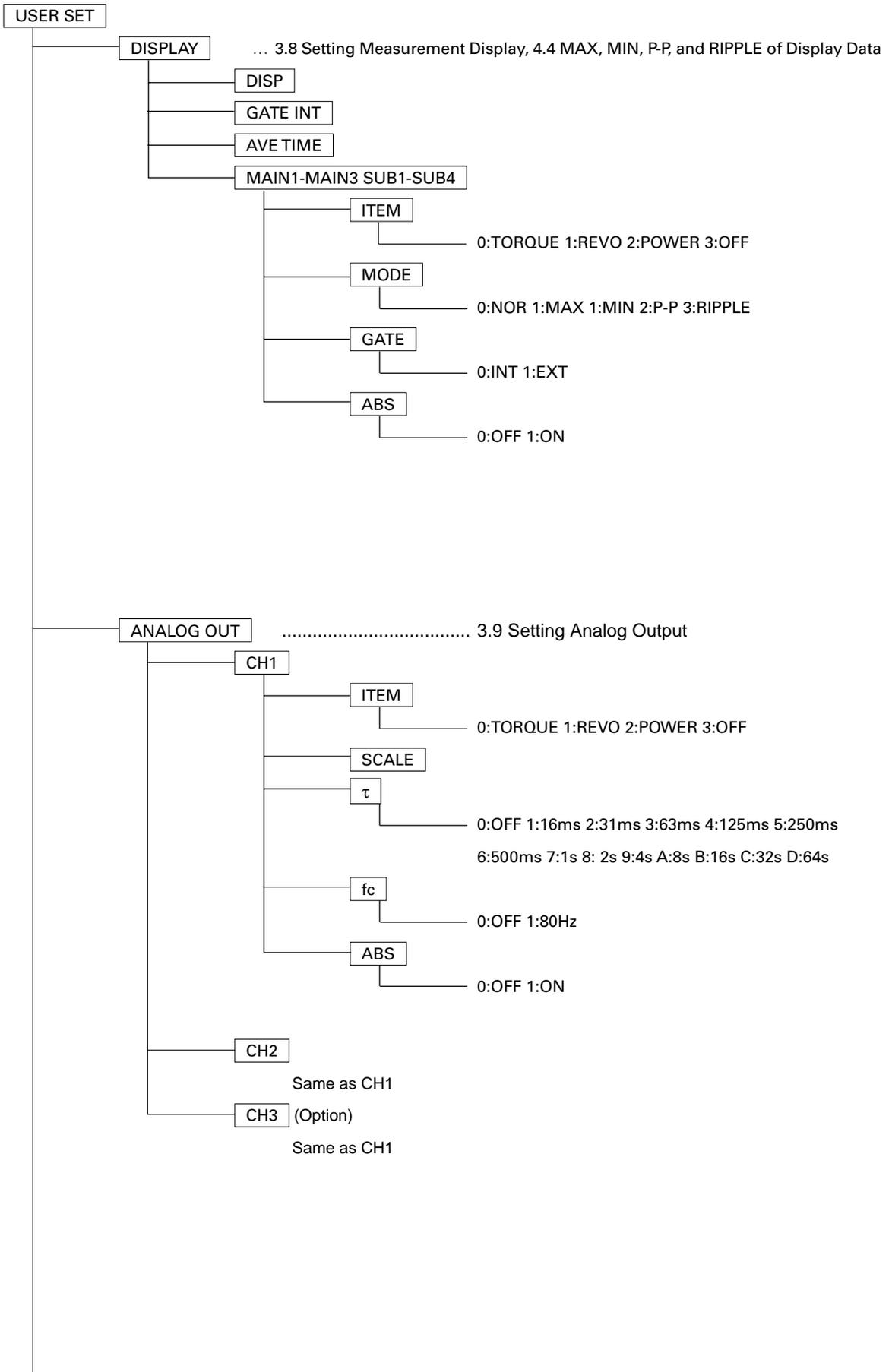
6.2 [CAL] Key

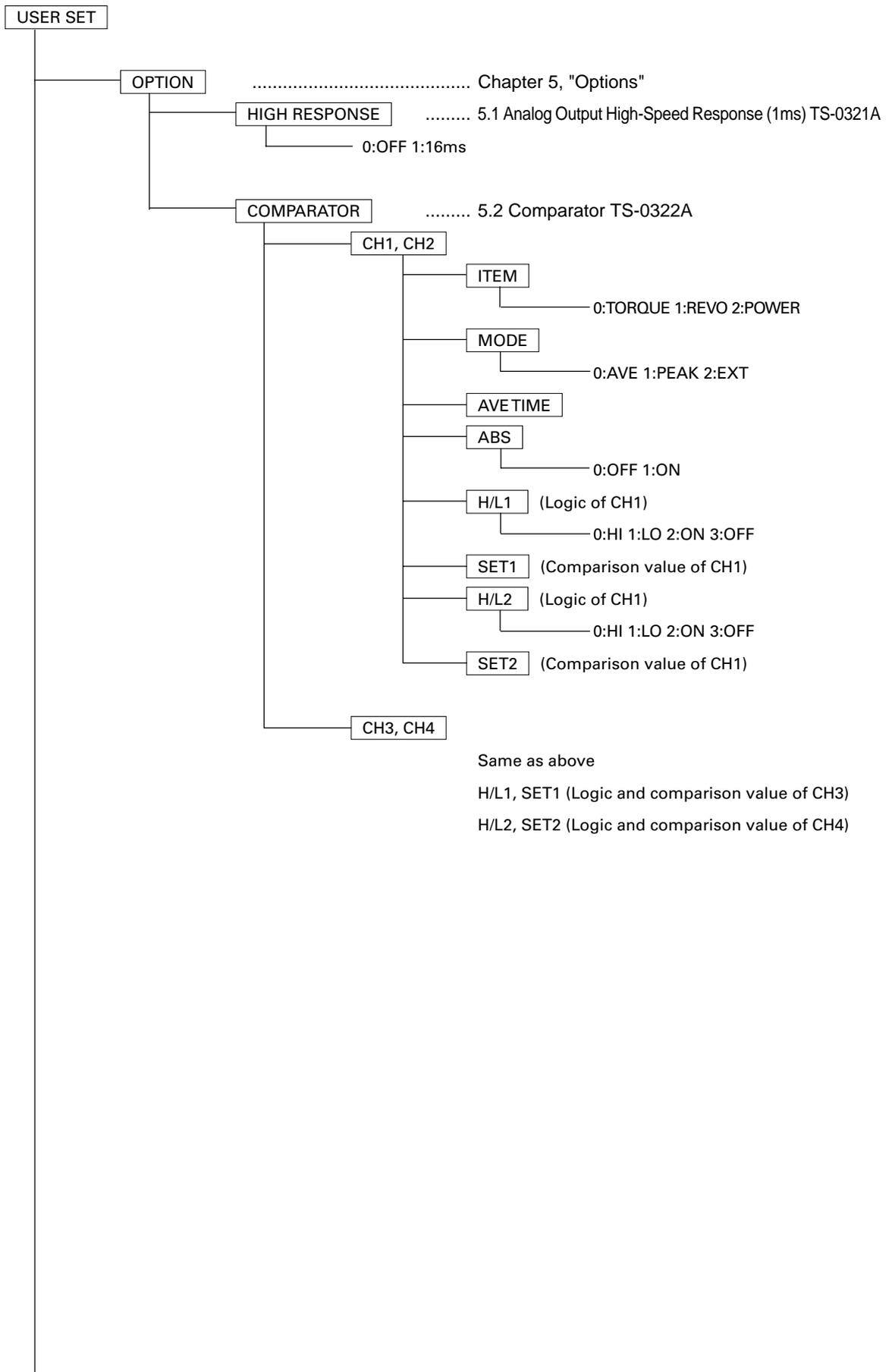
6.3 [TRQ ZERO] Key

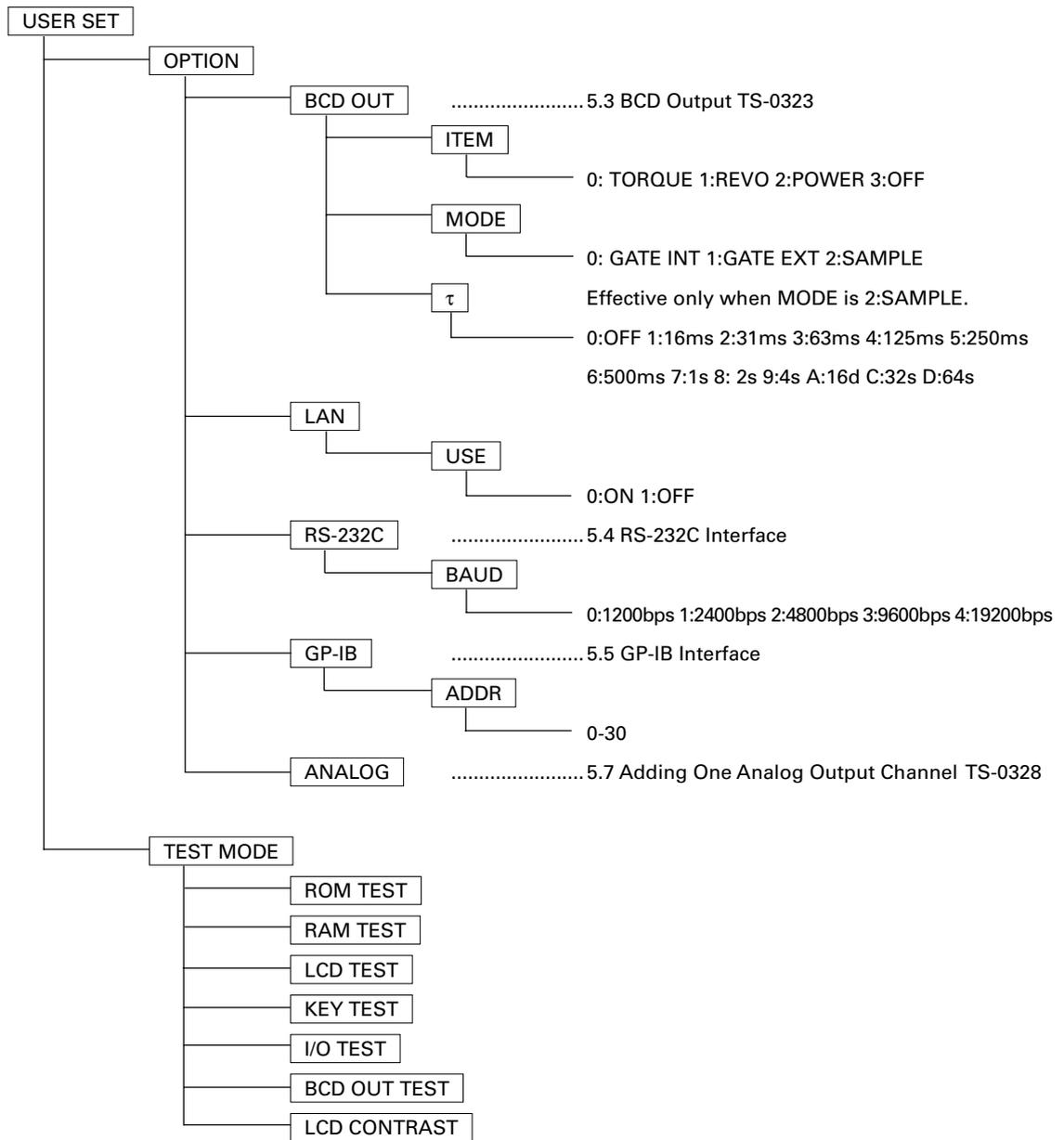
6.1 [MENU] Key



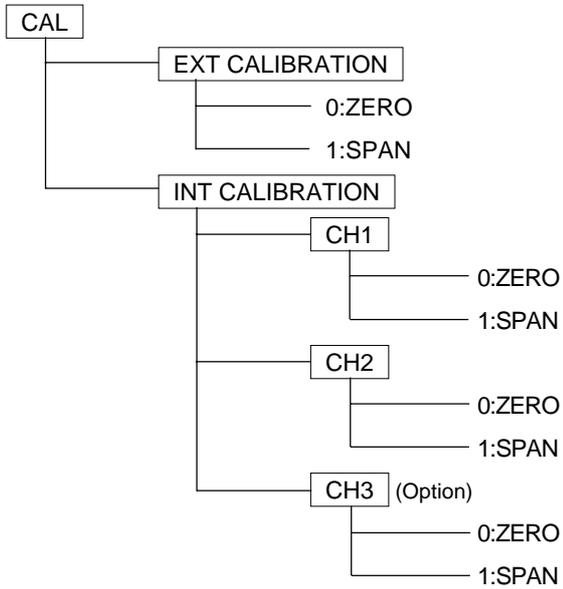




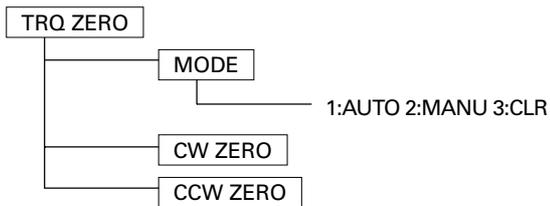




6.2 [CAL] Key



6.3 [TRQ ZERO] Key



Chapter 7 Troubleshooting

7.1 Troubleshooting

If you think of a failure, check the following points first.

If the TS-3200A does not operate normally after check, contact your dealer or ONO SOKKI sales office nearby.

Symptom	Cause	Check point	Solution	Remarks
The power supply is not turned ON.	The power cable is disconnected.	Check connection.	Plug power cords securely into outlet and inlet.	
	The fuse has blown.	Check the fuse in the fuse holder.	Replace fuse. Contact sales office or dealer.	
The system is not activated after turning on the power.	Damaged backup memory	POWER LED is lit and initial screen of LCD is normal.	Perform backup memory clear operation.	4.10 "Initializing Settings"
	Failed circuit component	POWER LED is lit.	Contact sales office or dealer.	
Cannot make DISPLAY display.		Check whether DISPLAY setting is OFF.		3.8 "Setting Measurement Display"
The measurement unit display does not change.	Incorrect display condition setting	Check whether DISPLAY setting screen is MAX, MIN, and P-P.		4.4 "MAX, MIN, P-P, and RIPPLE of Display Data"
The LCD display remains OFF.	Turned OFF by the LCD ON/OFF function.	Press the LCD ON/OFF switch.		4.11 "Turning LCD Off"
	The back light is not lit or life has expired.	The life of back light is 10000 hours min.		
The torque display remains 0.	No signal comes from the torque detector.	Is the motor supplied with the torque detector rotating ?	Rotate the motor supplied with the torque detector. In case of SS, the switch changes in three positions. Set the switch to the rotational direction to be measured, other than neutral.	3.3 "Selecting Rotational Direction (CW/CCW)"
		Is [TRQ SIG] highlighted in the measurement screen ?		
Mismatched torque display	Incorrect DETECTOR setting	42- Does DETECTOR setting agree with detector name plate ?	Make DETECTOR setting correctly.	3.2 "Setting Parameters of Torque Detector"
The torque display is not 0 without load.	Torque zero operation has not been performed.		Perform TRQ ZERO operation.	3.4 "Zero Adjustment"
	Excessive torque was applied resulting in twisted detector.	Is the torque zero value is almost the same as the value of Test Results of the detector ?	Contact sales office or dealer (to repair the detector).	
	There exists a static load.	Is 0 indicated by shaking the shaft ?	Use the detector solely.	

7. Troubleshooting

Symptom	Cause	Check point	Solution	Remarks
No rpm	Incorrect DETECTOR setting	Is SIGNAL selection in DETECTOR settings correct ?	Select SIGNAL according to the connected detector.	3.6 "Setting Parameters of Rotary Encoder"
Mismatched rpm display	Incorrect DETECTOR setting	Are DETECTOR settings such as P/R correct ?	Make DETECTOR setting correctly.	
Measurement display - - - - -	Measured value overflow	Check CAPACITY in DETECTOR settings.	Set CAPACITY which suits the detector.	
No analog output	Incorrect ANALOG OUT setting	Is the setting turned OFF ?	Make setting again.	3.9 "Setting Analog Output"
	Inappropriate load connected	Check whether the load resistance is 10kohms or higher.	Set the load resistance or device input impedance to 10kohms or more.	
RS232C communication not possible.	Baud rate setting does not suit the host side.	Check the baud rate setting	Set the baud rate according to the host side.	5.4.3 "Connection with PC"
GP-IB communication not possible.	Mismatched address setting	Check the address setting	Set the address to the host side setting.	5.5 "GP-IB Interface"
GP-IB communication is locked.	The command function does not agree with the program sequence.	Check the program.	Correct the program.	
Abnormal BCD output	Wrong wiring of connection cable	Is wiring correct ?	Correct wiring.	5.3 "BCD Output TS-0323"
	Incorrect sampling timing	Check the timing chart.	Change the sequence.	
Abnormal comparator function	Incorrect setting	Is the item turned OFF ?	Change the setting.	5.2 "Comparator TS-0322"
		Is the setting appropriate ?	Change the setting.	
	Incorrect wiring	Is wiring correct ?	Correct wiring.	
LAN communication not possible.	Incorrect setting	Check settings such as the IP address.	Make setting again.	
	Trouble of LAN system	Check the LED display below cable connection.	Correct the LAN system side.	
	Program bug	Is any protocol other than socket-through used ?	Correct the program.	

Chapter 8 Specifications

The following specifications apply to a single unit of the TS-3200A.

Since the overall accuracy is determined in combination with the detector, also check the accuracy of the detector used.

8.1 Torque Signal Measurement Unit

Input Section

Amplifier	Isolated unbalanced DC amplification
Input signal	Phase difference conversion type detector output signal
Input impedance	About 2k Ω (with an input signal amplitude of 2Vpp or less)
Input frequency range	200Hz to 50kHz
Input signal amplitude range	0.2Vpp to 15Vpp
Connector	TRC116-23A10-7F (Tajimi Electronics)

Setup Section

Capacity	± 1 -9999
Factor	1 to 65535
Unit	mNm, Nm, kNm
Number of teeth of detector	P/R 1 to 9999
Torque zero compensation value	CW/CCW Memorized in memory for each direction.
Response	Time constant setting 16ms/31ms/63ms/125ms/250ms/500ms/1s/2s/4s/8s/16s/32s/64s OFF is added only when the TS-0321 option is mounted.
Number of display digits	(Polarity + 4 digits (default)) / (Polarity + 5 digits) selectable

Measurement Section

Measurement clock	4.195MHz
Sampling clock	Sampling time for one data 1/256Hz (about 4ms)

Display Section

Number of display digits	(Polarity + 4 digits) / (Polarity + 5 digits) selectable
Unit	mNm/Nm/kNm
Display gate time setting	1s to 10s (shared with the rotating section) or external gate
Accuracy	When combined with the detector (with 1s gate time) N-0 compensation used: $\pm 0.2\%$ / full-scale ± 1 count (4-digits) N-0 compensation not used: $\pm 0.5\%$ / full-scale ± 1 count (4-digits)

Output Section

Analog output format	Voltage output $0 \pm 10V/F.S$
Scale	Attenuation setting of the full scale is possible from 0.1V to 10V in 0.1V steps.
Response	16ms to 64s depending on the time constant setting OFF is provided only when the TS-0321 option is mounted.
Accuracy	When combined with the detector (with 1s average value) N-0 compensation used: $\pm 0.2\%$ / full-scale N-0 compensation not used: $\pm 0.5\%$ / full-scale
Temperature drift (TS)	$\pm 0.01\%$ / full scale / °C
Appropriate load resistance	10k Ω or higher

8.2 Rotational Signal Measurement Unit

Input Section

■ Sine Wave of REVO1 MP910, etc.

Amplifier	AC amplification
Input impedance	10k Ω or higher
Input frequency range	10Hz to 100kHz
Input signal amplitude range	0.2Vrms to 45Vrms
Connector	BNC

■ Square Wave of REVO2 MP981, etc.

Amplifier	Unbalanced DC amplification
Input impedance	10k Ω or higher
Input frequency range	1Hz to 200kHz (guaranteed accuracy is 10Hz or more)
Input signal amplitude range	HIGH level: +4 to +30V LOW level: 0.6V or less Pulse width: 2 μ s or more
Phase judgement	When REVO2 (Double) is selected as 90-degree phase difference signal input When SIG2 leads SIG1 by 90 degrees: CW When SIG2 lags behind SIG1 by 90 degrees: CCW
Power supply	12VDC 100mA
Connector	R03-R6F (Tajimi Electronics)

■ INTSIGN Torque Detector SIG2

Conforms to the "Input Section" in 8.1, "Torque Signal Measurement Unit."

Setup Section

Signal selection	REVO1 (MP910), REVO2 (MP981), INTSIG (torque detector SIG2)
Capacity	1 to 99999 (limited by the number of teeth of the detector and ratio setting)
Unit	r/min, r/s, Hz
Minimum measurement rpm setting	Rpm corresponding to 1Hz input frequency \leq Setting $<$ Capacity
Number of teeth of detector	1 to 99999 P/R
Ratio setting	± 1 to 9999/1 to 9999
Rpm offset setting	Effective only for r/min ± 1 to 9999 Measured value = Actual measurement value - Rpm offset
Response	Time constant setting 16ms/31ms/63ms/125ms/250ms/500ms/1s/2s/4s/8s/16s/32s/64s OFF is added only when the TS-0321 option is mounted.

Measurement Unit

Measurement clock	4.195MHz
Sampling clock	Sampling time for one data 1/256Hz (about 4ms)

Display Section

Number of display digits	5 digits
Unit	r/min, r/s, Hz
Display gate time setting	1s to 10s (shared with the torque unit) or external gate
Accuracy	$\pm 0.05\%$ / full-scale ± 1 count (with 1s gate time)

Output Section

Analog output format	Voltage output 0 to ± 10 V/full scale (2-phase signal input: CCW for minus output)
Scale	Attenuation setting of the full scale is possible from 0.1V to 10V in 0.1V steps.
Response	16ms to 64s depending on the time constant setting OFF is provided only when the TS-0321 option is mounted.
Accuracy (1s average value)	$\pm 0.1\%$ / full scale
Temperature drift	$\pm 0.01\%$ / full scale / $^{\circ}\text{C}$
Appropriate load resistance	10k Ω or higher

8.3 POWER (Output) Measurement Unit

Input Section

Calculated from the measured torque and rpm (basic expression)

$$\text{Output (W)} = 2\pi / 60 \times \text{Torque (Nm)} \times \text{Rpm (r/min)}$$

$$\text{PS} = 0.7355\text{kW}$$

Setup Section

Capacity	1 to 99999
Unit	mW, W, kW, PS
Response	Time constant setting 16ms/31ms/63ms/125ms/250ms/500ms/1s/2s/4s/8s/16s/32s/64s OFF is added only when the TS-0321 option is mounted.

Display Section

Number of display digits	Polarity + 5 digits
Unit	mW,W,kW,PS
Display update gate time setting	1s to 10s (shared with torque and rotating section)
Accuracy	Torque display accuracy + Rpm display accuracy

Output Section

Analog output format	Voltage output 0 to $\pm 10\text{V/F.S}$
Scale	Attenuation setting of the full scale is possible from 0.1V to 10V in 0.1V steps.
Response	16ms to 64s depending on the time constant setting OFF is provided only when the TS-0321 option is mounted.
Accuracy (1s average value)	Torque output section accuracy + Rpm output section accuracy
Appropriate load resistance	10k Ω or higher

8.4 Display Panel

Display Section

■ LCD Specifications

Full dot-matrix type LCD panel

Dot color:	White
Background color:	Black 320x240 dots

Back light for the above panel

CFL

LCD back light

ON/OFF function provided

LCD contrast

Adjustment function provided

■ Display Contents

Main display

1 to 3 step display can be selected.
Selects from torque, rpm, and POWER (output).

Sub display

Peak value (MAX, MIN, P-P), ripple factor

Condition display

Ready for measurement (READY), CLR input, torque signal input,
rotation signal input, CW/CCW, comparator output ON/OFF

Operation Section

Membrane switch

16 keys
, , , , ENTER, ESC, MENU, CW/CCW, TRQ ZERO, TRIG,
 MEAS DISP, LCD ON/OFF, LOCK, SET VIEW, OPTION, CAL

8.5 Interface Unit

REMOTE

■ Items

Clear input	Contact input	Sets the measurement value forcibly to 0 when the contact is closed.
Rotational direction selection input	Contact input	Selects the CW/CCW torque zero point. Closes the contact when CCW is selected.
Trigger input	Contact input	Updates display and BCD at contact close when the external gate is selected. ORed with the front panel switch when the trigger function is used.
Trigger output	Contact output	Turns ON/OFF in synchronization with the display gate time. Example: In case of 1s gate, turns ON for 0.5s and OFF for 0.5s. Synchronous operation of multiple TS-3200A is possible using the trigger input and trigger output.
Ready output	Contact output	When the TS-3200A is in the torque measurement mode, the contact closes.

■ Signal Formats

Input section	In case of non-voltage contact input
	Open voltage: 5.25V or less
	Short-circuit current: 1mA or less
Output section	In case of voltage input
	H level: +4 to +5.25V or less
	L level: 0 to +1V
Connector	Photo-MOS relay
	Load voltage: 30VDC or less
	Load current: 100mA or less
	ON resistance: 10ohms or less
	OFF resistance: 500kohms or higher
	R03-R8M

Analog Output

Channel	2 channels
Items	Two items out of torque, rpm, and POWER (output) can be selected. For details, refer to the following: 8.1 Torque Signal Measurement Unit: Output Section 8.2 Rotational Signal Measurement Unit: Output Section 8.3 POWER (Output) Measurement Unit: Output Section
Connector	C02 (BNC)

BCD Output (Option)

Channel	2 channels
Items	Selected from torque, rpm, and output.
Output update	At intervals of gate setup time (0.1 to 10s external) or sampling time
Output format	Positive logic open-collector output
Withstand voltage	24VDC
Sink current	32mA or less
Residual voltage	0.6V or less
Connector	57-40500 Amphenol full pitch, 50 pins

Comparator Output (Option)

Items	Upper or lower limit setting is possible for torque, rpm, and POWER (output).
Channel	4 channels
Output format	Photo-MOS relay
Load voltage	30VDC
Load current	100mA or less
ON resistance	10 Ω or less
OFF resistance	500k Ω or higher

Communication Interfaces (Exclusive Use of the Following Three Options)

■ RS-232C

Standard	Conforms to EIA and JISX5101.
Communication mode	Start-stop transmission, full-duplex mode
Transmission rate (bps)	1200/2400/4800/9600/19200
Character length	8 bits
Parity check	None
Stop bit	1
Terminator	CR+LF
Connector	D-Sub 9-pin male

■ GP-IB

Electrical / mechanical specifications	IEEE488-1978
Function specifications	SH1/AH1/T6/L4/SR1/RL1/PP0/DC1/DT1/C0
Support bus commands	DCL/GTL/LLO/MLA/MTA/OTA/SDC/SPD/SPE/UNL/UNT/GET
Address	Talker/listener address setting (0-30) is possible.
Terminator	CR+LF

■ LAN

Bit rate	100Mbps/10Mbps automatic selection
Transmission medium	100BASE-TX/10BASE-T
Connector	RJ-45 type (applicable to Category 5)
Network protocol	TCP/IP
TCP/IP application	Only socket-through protocol is supported.

8.6 General Specifications

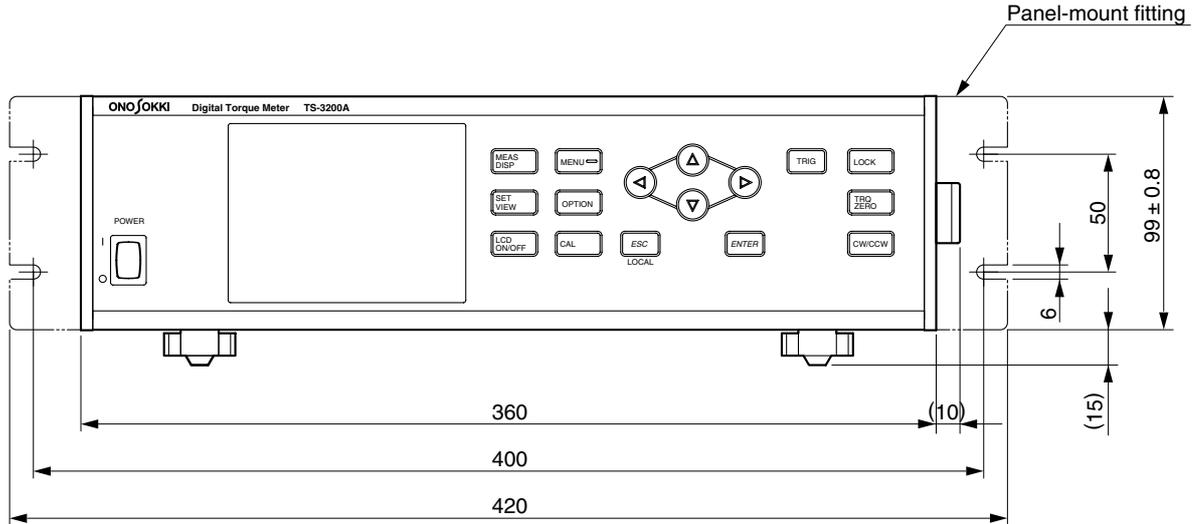
Power voltage	100-240VAC	±10%	50/60Hz
Power consumption	70VA (100VAC) or less		
Insulation resistance	10MΩ or higher (test voltage 500VDC)		
Withstand voltage	1500VAC, 1 minute		
Operating temperature range	0 to 40°C		
Storage temperature range	-10 to 55°C		
Outside dimensions	360(W) x 99(H) x 301(D) (projections not included)		
Weight	5kg		

8.7 Accessories

Instruction manual	x1
AC power cord	x1
Connector for REMOTE	x1

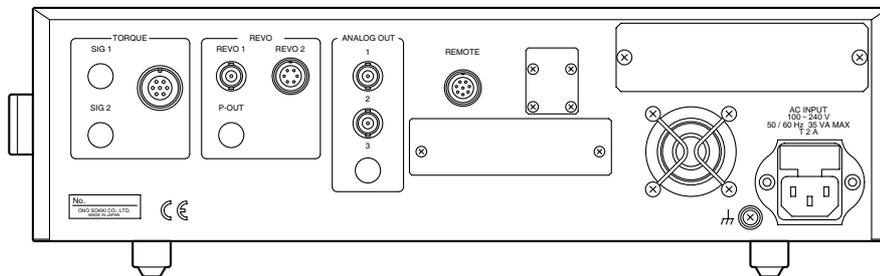
8.8 Outside Dimensions

■ UA0002 Specifications



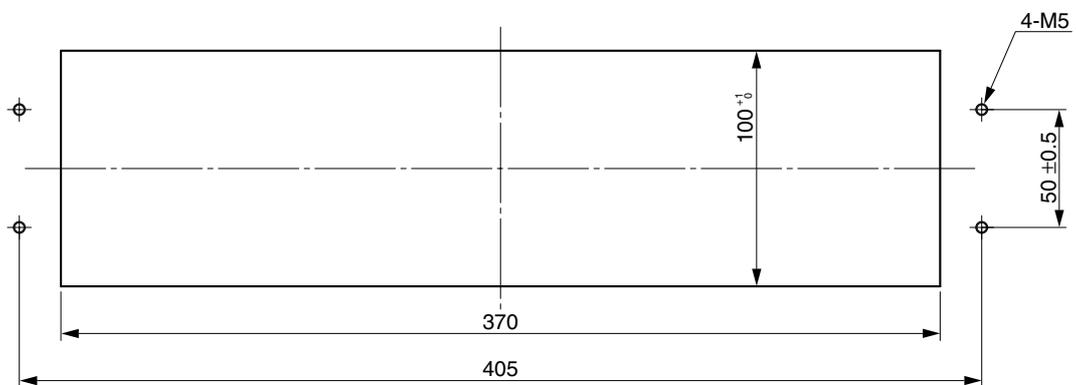
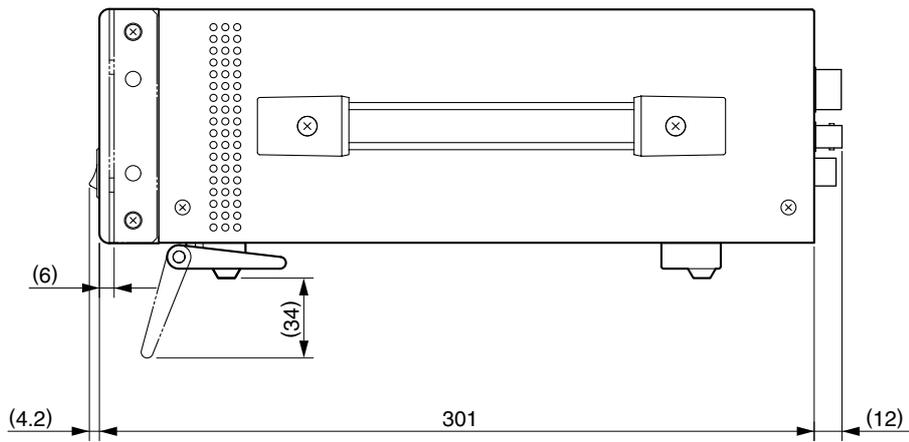
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class A digital apparatus complies with Canadian ICES 005.
 Cet appareil numérique de la classe A est conforme à la norme NMB-505 du Canada.



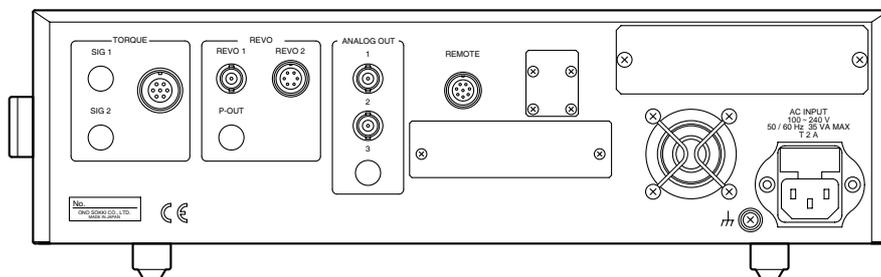
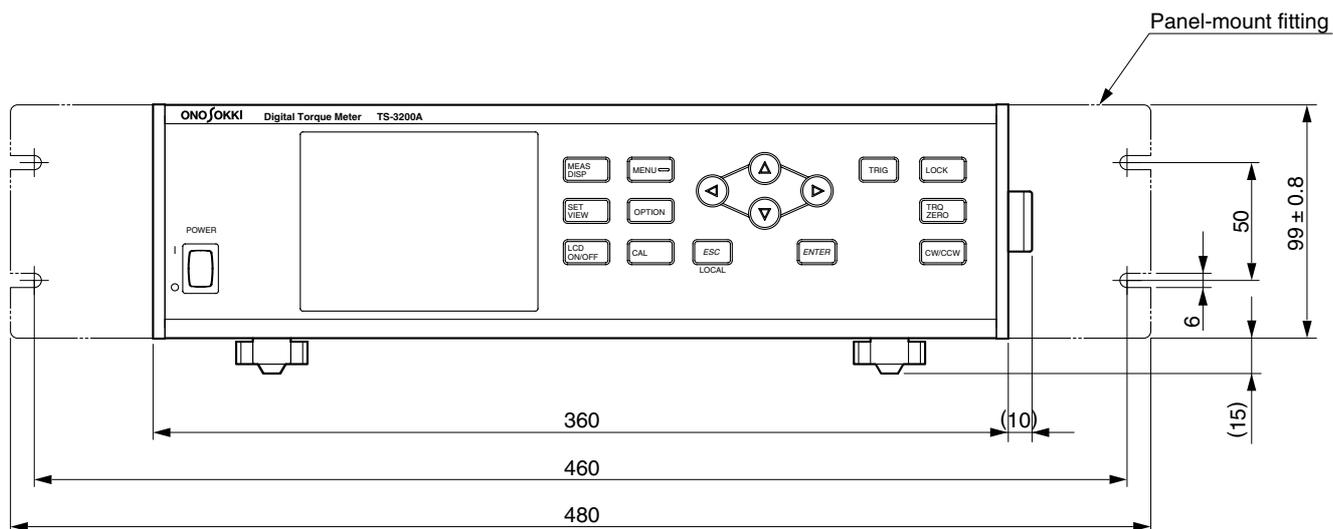
REAR VIEW

8. Specifications



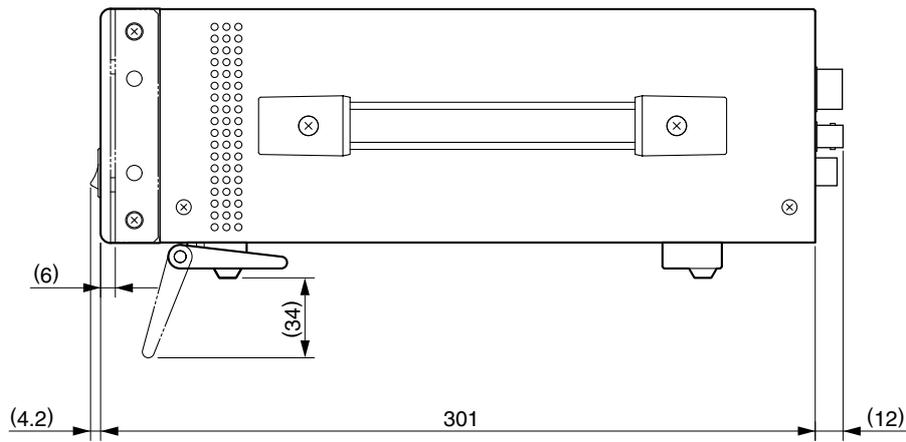
Panel cutout dimensions

■ UA0001 Specifications



REAR VIEW

8. Specifications



ONOSOKKI

*Outer appearance and specifications are subject to change without prior notice.

HOME PAGE: <http://www.onosokki.co.jp/English/english.htm>

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