HIOKI

INSTRUCTION MANUAL

9603-01

EXTERNAL SIGNAL INPUT UNIT

HIOKI E. E. CORPORATION

Contents

Introduction

Thank you for purchasing this HIOKI "9603-01 EXTERNAL SIGNAL INPUT UNIT."
To get the maximum performance from the product, please read this manual first, and keep this at hand.

NOTE For operating environment, maintenance, and disposal at end of life, the same conditions apply as to the main 3194 MOTOR/HARMONIC HiTESTER.

Before use

Before using the product, inspect it and check the operation to make sure that the product was not damaged due to poor storage or transport conditions. If damage is found, contact your dealer or HIOKI representative.

Safety Notes

DANGER

This product is designed to conform to IEC 61010 Safety Standards, and has been thoroughly tested for safety prior to shipment. However, mishandling during use could result in injury or death, as well as damage to the product. Be certain that you understand the instructions and precautions in the manual before use. We disclaim any responsibility for accidents or injuries not resulting directly from product defects.

This Instruction Manual provides information and warnings essential for operating this equipment in a safe manner and for maintaining it in safe operating condition. Before using this equipment, be sure to carefully read the following safety notes.
Read the Instruction Manual supplied with the 3194 product very carefully, and follow the indications given under "DANGER," "WARNING," "CAUTION," and "NOTE."

Safety Symbols

- This symbol is affixed to locations on the equipment where the operator should consult corresponding topics in this manual (which are also marked with the ⚠ symbol) before using relevant functions of the equipment.
- In the manual, this mark indicates explanations which it is particularly important that the user read before using the equipment.

The following symbols are used in this Instruction Manual to indicate the relative importance of cautions and warnings.

DANGER	Indicates that incorrect operation presents extreme danger of accident resulting in death or serious injury to the user.
WARNING	Indicates that incorrect operation presents significant danger of accident resulting in death or serious injury to the user.
⚠ CAUTION	Indicates that incorrect operation presents possibility of injury to the user or damage to the equipment.
NOTE	Denotes items of advice related to performance of the equipment or to its correct operation.

Notes on Use

In order to ensure safe operation and to obtain maximum performance from the product, observe the cautions listed below.

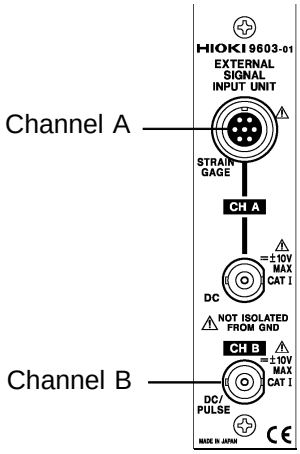
DANGER

The measurement input terminal and chassis of the 3194 are not isolated from each other. Do not exceed the maximum rated working voltage. Doing so can damage the product or cause a serious accident.

NOTE

- The 9603-01 is a factory-fitted option. It therefore requires the 3194 product for calibration or repair.
- For accurate measurement, allow one hour for warming up before use.
- The 9603-01 can be used together with a strain gauge type torque meter, but depending on torque meter specifications, the combination may not work.
- It may not be possible to obtain accurate measurements close to a transformer or conductor carrying a large high-frequency current, or close to any device such as a radio transmitter generating a strong magnetic field.
- To prevent damage to the product, cover the input connector with the supplied cap when no signal is input.

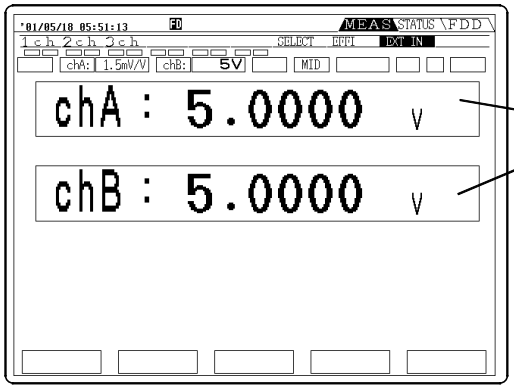
Chapter 1
Overview



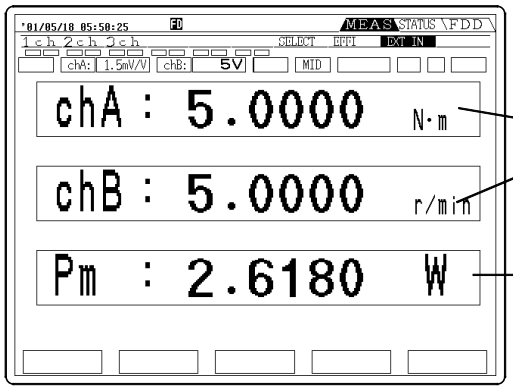
The 9603-01 EXTERNAL SIGNAL INPUT UNIT can read signals from a strain gauge type torque sensor directly to the 3194 product. Further, tachometer signals (analog or pulse) input via the 9603-01 can be used by the 3194 to calculate and display motor power and efficiency.

Chapter 2
Display Screen

There are two display screens: showing two measurement channels and showing the motor power.



Two measurement channels



Two measurement channels

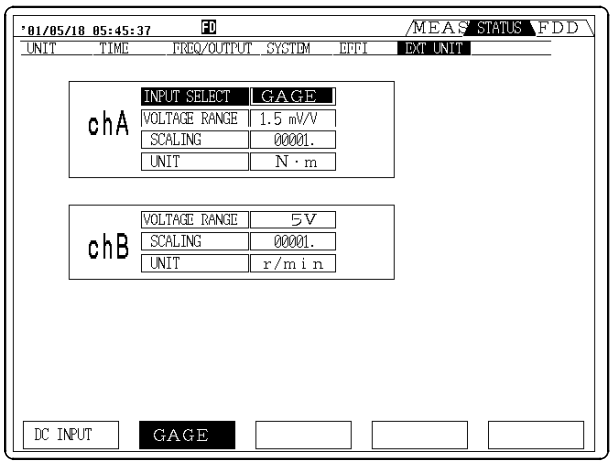
Motor power

Chapter 3
Setting Method

3.1 Changing the chA Input Connector

chA input is used to select either the strain gauge input (7 pin connector) or DC voltage input (BNC pins).
Press the **STATUS** key to switch to the external input screen.

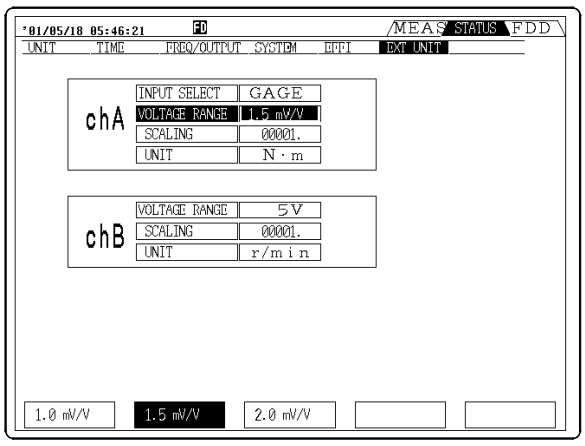
NOTE Input is switched using the internal circuits but do not connect to connectors that are not being used.



3.2 Changing the Range

3.2.1 Strain Gauge Input

Channel A (Strain Gauge) can be used for the torque meter output, and has three ranges: 1 mV/V, 1.5 mV/V, and 2 mV/V. The full scale screen display values for these ranges are 1.0000, 1.5000, and 2.0000 respectively (when the scaling value is 1). The scaling value is calculated as follows:
Scaling value = (rated torque value for the combined torque meter) / (full scale value for the range) After selecting the range, set the units to finish setting channel A.

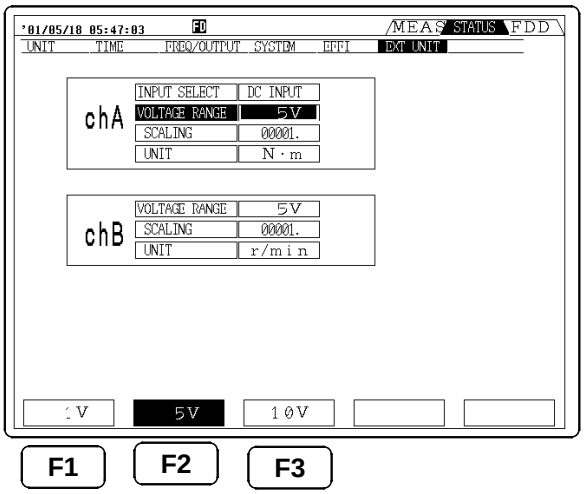


When a rated torque of 100 N.m and a rated output of 1.5 mV/V torque sensor are combined:

1. Set the channel A "VOLTAGE RANGE" to 1.5 mV/V.
2. Set the channel A "SCALING" to 66.667.
3. Set the channel A "UNIT" to N.m.

3.2.2 DC Voltage Input

Both channels A and B have three ranges, of ±1 V, ±5 V, and ±10 V.



Changing on the MEAS screen

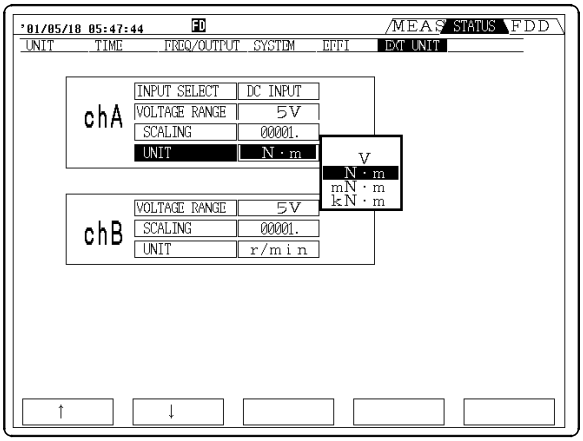
The range for channel A corresponds to the voltage range switching key, and the range for channel B corresponds to the current range switching key.

Changing on the STATUS screen

1. Display the "EXT UNIT" page on the STATUS screen.
2. With the **CURSOR** keys, move the cursor to the "VOLTAGE RANGE" to be changed.
3. Select the voltage range with function keys F1 (1 V), F2 (5 V), or F3 (10 V).

3.3 Setting the Products

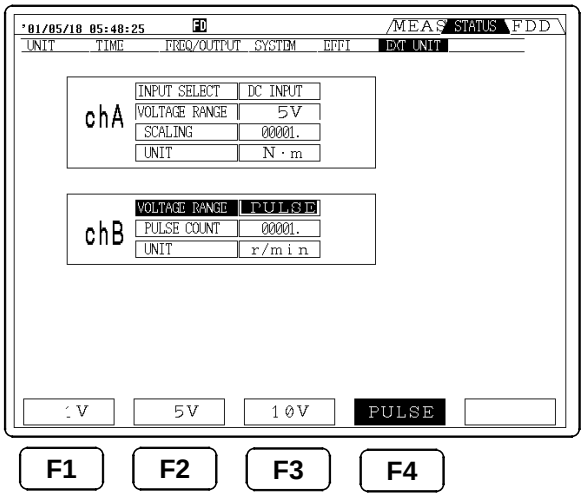
Input DC voltage values can be displayed together with a unit designation.



1. Display the "EXT UNIT" page on the STATUS screen.
2. Using the **CURSOR** keys, move the cursor to"UNIT."
3. Press F1 (↑) or F2 (↓) to set the units.
   Unit for channel A
   (space)⇔ V ⇔ N·m ⇔ mN·m ⇔ kN·m ⇔ kgf·m ⇔ kgf·cm
   Unit for channel B
   (space)⇔ V ⇔ rpm ⇔ N·m ⇔ mN·m ⇔ kN·m ⇔ kgf·m ⇔ kgf·cm
   When the voltage range for channel B is set to PULSE
   Hz ⇔ rpm

3.4 Setting the Pulse

By selecting a pulse input to channel B, the 3194 frequency measurement function can be used to measure a frequency. By setting the unit designation to "rpm" this can be used to directly display the rotation speed of a motor or other device.



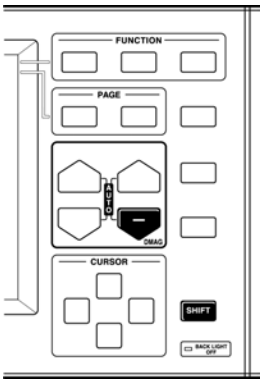
1. Display the "EXT UNIT" page on the STATUS screen.
2. Using the **CURSOR** keys, move the cursor to"VOLTAGE RANGE" for channel B, and press F4 (PULSE)
   If the unit designation is set to "rpm", it is necessary to set the number of pulses input per rotation. In this case, set the Scaling item to the number of pulses for each rotation of the motor.

$$\text{Display value (rpm)} = \frac{\text{Measurement frequency} \times 60}{\text{Number of pulses for each rotation of the motor}}$$

NOTE

- Setting a pulse input signal to channel B unconditionally assigns the frequency measurement function of the 3194 to fc. This ends any previous source set for fc.
- The frequency range of fc is set to auto-ranging. To fix the frequency range, set the range on "FREQ/OUTPUT" page on STATUS screen.

3.5 Zero adjustment



A numerical value may be displayed even if no torque is generated by the torque sensor or connection cable. If this happens, perform zero adjustment.

1. Make sure that no torque is applied to the torque sensor.
2. Press the **SHIFT** key.
3. Press the ▼ key for the current range.

NOTE

- If the value does not become "0" even if you perform zero adjustment, try moving the position of the cable.
- The zero point may differ depending on the rotation frequency, even if no torque is applied to the torque sensor. Perform zero adjustment after you have set the required rotation speed.
- After zero adjustment, do not move the cable. This could disturb the zero point.

3.6 Calculating Motor Power (*P*m)

When the units for channel A are set to torque (N·m, mN·m, kN·m, kgf·m, kgf·cm) and the units for channel B are set to rotation rate (rpm), then the following expression is automatically evaluated and displayed.

Unit for channel A	Motor power calculation
N·m	$\text{Display value for channel A} \times \frac{2 \times \pi \times \text{display value for channel B}}{60}$ (W)
mN·m	$\text{Display value for channel A} \times \frac{2 \times \pi \times \text{display value for channel B}}{60 \times 1000}$ (W)
kN·m	$\text{Display value for channel A} \times \frac{2 \times \pi \times \text{display value for channel B} \times 1000}{60}$ (W)
kgf·m	$\text{Display value for channel A} \times \frac{2 \times \pi \times \text{display value for channel B} \times 9.80665}{60}$ (W)
kgf·cm	$\text{Display value for channel A} \times \frac{2 \times \pi \times \text{display value for channel B} \times 9.80665}{60 \times 100}$ (W)

NOTE The calculation expression depends on the torque units, and care should therefore be taken when setting the units.

Chapter 4
GP-IB/RS-232C Interface

4.1 Overview

WARNING

In order to avoid the possibility of an electric shock, unplug the power meter's power cord and disconnect the other wiring before connecting the GP-IB or RS-232 cable to the interface connector.

⚠ CAUTION

- Turn the power off when connecting the personal computer to the power meter. Connecting or disconnecting cables while the power is on could damage the equipment.
- After connecting the GP-IB or RS-232C cable, always be sure to secure the connection with the screws on the connector.

The 3194 MOTOR/HARMONIC HiTESTER is fitted as standard with a GP-IB/RS-232C interface. Using this interface, all of the functions of the product can be controlled from a personal computer by remote control, for the acquisition of harmonic measurement data.
This section lists the extra commands added for measurement.

This section explains only commands added for the 9603-01.
For details on operation of the GP-IB or RS-232C interface, first refer to Chapter 12, "GP-IB/RS-232C Interface" in the instruction manual of the 3194.

NOTE It is not possible to use simultaneously both GP-IB and RS-232C interfaces.

4.2 Command Reference

4.2.1 Command Reference Explanation

This section explains the commands unique to the 9603-01 EXTERNAL SIGNAL INPUT UNIT.

:Command

■ Indicates functions of message reference

Syntax : Indicates the command syntax.

< > : (Data portion)
Indicates the data format for a command that includes data.
<NR1>= integer data

Response syntax : Indicated only for commands for which a response message is returned.

Example : Shows a simple example illustrating the usage of the command. All transmissions are indicated in "short form."

Function : Describes the function of the command.

Note : Describes points that require special attention when using the command.

Error : Indicates the what kinds of errors might occur.

NOTE
"( )", "< >" marks should not be input.

4.2.2 Specific Commands

:DATAout:ITEM:EXTernalin

■ Sets the output item for the measurement value by using the 9603-01.

Syntax :DATAout:ITEM:EXTernalin <NR1>
<NR1> = 0 - 7

Example ":DATAOUT:ITEM:EXTERNALIN 7"
As the default output items to the floppy disk drive or printer for external signal input unit measurement, specify EXTA, EXTB, PM.

Function Sets the output item for the measurement value with the 9603-01 to FDD or printer.
The item is set as shown below by setting bits, to specify a single numerical value.

Error Execution error / If the setting data is out of the range.

	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
data	—	—	—	—	—	PM	EXTB	EXTA

:DATAout:ITEM:EXTernalin?

■ Queries the output item for the measurement value by using the 9603-01.

Syntax :DATAout:ITEM:EXTernalin?

Response syntax :DATAOUT:ITEM:EXTERNALIN <0-7>

Example
Transmission ":DATAOUT:ITEM:EXTERNALIN?"
Response ":DATAOUT:ITEM:EXTERNALIN 7"

Function Queries the output item for the measurement value with the 9603-01 to FDD or printer.

:DEMAg

■ Degaussing

Syntax :DEMAg <A>,,,
<A> = I1,I2,I3,I4,I5,I6, EXT

Example ":EXTernalinA:RANGe 1.5"
Performing zero adjustment for the 9603-01.

Function Degausses and zero adjusts the current side of the circuit for each input unit. When EXT is specified, the torque sensor input on channel A of the 9603-01 is corrected to zero. You can specify up to seven items.

NOTE
- Valid when an AC/DC sensor is combined with an AC/DC direct input unit or a 9602 AC/DC CLAMP INPUT UNIT.
- Before performing zero adjustment for the 9603-01, make sure that no torque is applied to the torque sensor.

:DISPlay:EXTernalin

■ Makes a setting of the external input display.

Syntax :DISPlay:EXTernalin

Example "DISPLAY:EXTERNALIN"
Makes a setting of the external input display.

Function Makes a setting of the external input display.

:EXTernalin[CH]:RANGe

■ Setting the voltage range for the 9603-01.

Syntax :EXTernalin[CH]:RANGe <NR1>
CH: channel A/B
<NR1> =
1, 1.5, 2 (chA, Strain gauge)
(1.0 mV/V, 1.5 mV/V, 2.0 mV/V)
1, 5, 10 (chA/B, DC)
(1 V, 5 V, 10 V)

Example ":EXTernalinA:RANGe 1.5"
Aligns channel A with a torque sensor output range of 1.5 mV/V.

Function Sets the voltage range for specified channels on the 9603-01. You can select a torque sensor type for channel A.

:EXTernalin[CH]:RANGe?

■ Querying the 9603-01 voltage range.

Syntax :EXTernalin[CH]:RANGe?
CH: channel A/B

Response syntax ":EXTERNALIN[CH]:RANGE <data>"

Example
Transmission ":EXTernalinA:RANGe?"
Response ":EXTERNALINA:RANGE 1.5"

Function Requests the current 9603-01 voltage range.
For channel A (Strain gauge), respond that it is 1. 1.5, or 2.
For channel A/B (DC), respond that it is 1, 5, or 10.

:EXTernalin[CH]:SCALe

■ Sets the scaling value of the 9603-01.

Syntax :EXTernalin [CH]:SCALe <NR1>
CH: channel A/B
<NR1> = 0.0001 - 99999

Example ":EXTERNALINA:SCALE 10"
Sets the scaling value for channel A of the 9603-01 to 10.

Function Sets the scaling value for the specified channel of the 9603-01.

:EXTernalin[CH]:SCALe?

■ Queries the scaling value of the 9603-01.

Syntax :EXTernalin [CH]:SCALe?
CH: channel A/B

Response syntax :EXTERNALIN[CH]:SCALE <NR1>

Example
Transmission ":EXTERNALINA:SCALE?"
Response ":EXTERNALINA:SCALE 10"

Function Queries the scaling value for the specified channel of the 9603-01.

:EXTernalin[CH]:UNIT

■ Sets the units for channel of the 9603-01

Syntax :EXTernalin[CH]:UNIT <units>
CH: channel A/B
units = V, Nm, mNm, kNm, kgfm, kgfcm, rpm

Example ":EXTERNALINA:UNIT Nm"
Sets the units for channel A of the 9603-01 to Nm.

Function Sets the units for the specified channel of the 9603-01.
The units are accepted in capital and small letters.

:EXTernalin[CH]:UNIT?

■ Queries the units for channel of the 9603-01.

Syntax :EXTernalin[CH]:UNIT?
CH: channel A/B

Function Queries the units for the specified channel of the 9603-01.
The unit is output in capital letter.

Response syntax :EXTERNALIN[CH]:UNIT <units>

Example
Transmission ":EXTERNALINA:UNIT?"
Response ":EXTERNALINA:UNIT NM"

:EXTernalinA:GAGE

■ Strain gauge input select command

Syntax :EXTernalinA:GAGE <ON/OFF>

Function Determines whether the channel A input of the 9603-01 is a strain gauge input or a DC voltage input.
Specifying ON select strain gauge input, and specifying OFF selects DC voltage input.

Example ":EXTernalinA:GAGE ON"
Sets channel A to strain gauge input.

:EXTernalinA:GAGE?

■ Strain gauge input select query

Syntax :EXTernalinA:GAGE?

Function Inquires whether channel A of the 9603-01 is currently a strain gauge input or a DC voltage input. The reply "ON" indicates strain gauge input, and the reply "OFF" indicates DC voltage input.

Response syntax ":EXTernalinA:GAGE <ON/OFF>"

Example
Transmission ":EXTernalinA:GAGE?"
Response ":EXTernalinA:GAGE OFF"

:EXTernalinB:PULSe

■ Sets the input type for channel B of the 9603-01.

Syntax :EXTernalinB:PULSe <ON/OFF>

Function Sets the input type for the channel B of the 9603-01 to analog input or pulse input.

Example ":EXTERNALINB:PULSE ON"
Sets the input type for channel B to pulse input.

NOTE When the input type is set to pulse input, the source for frequency measurement channel fc is automatically set to channel B of the 9603-01.
When it is set to OFF, the voltage range for channel B is 10 V.

:EXTernalinB:PULSe?

■ Queries the input type for channel B of the 9603-01.

Syntax :EXTernalinB:PULSe?

Function Queries the input type for channel B of the 9603-01.

Response syntax :EXTERNALIN:PULSE <ON/OFF>

Example
Transmission ":EXTERNALINB:PULSE?"
Response ":EXTERNALINB:PULSE ON"

:EXTernalin[CH]?

■ Queries the settings of the 9603-01.

Syntax :EXTernalin[CH]?
CH: channel A/B

Function Queries the current settings of the 9603-01.

Response syntax :EXTERNALIN[CH]:RANGE <1/5/10>;SCALE <0.0001-10000>;UNIT <units>;PULSE <ON/OFF>;GAGE <ON/OFF>

Example
Transmission ":EXTERNALINA?"
Response ":EXTERNALINA:RANGE 5;SCALE 10;UNIT NM;PULSE OFF;GAGE OFF"

:MEASure:ITEM:EXTernalin

■ Sets the output item for the measurement value by using the 9603-01.

Syntax :MEASure:ITEM:EXTernalin <NR1>
<NR1> = 0 - 7

Function Sets the default items (only data for the external signal input unit) to be transferred in the response message to the ":MEASure?" query in the default mode.
The item is set as shown below by setting bits, to specify a single numerical value.

Example ":MEASURE:ITEM:EXTERNALIN 7"
As the default output items for measurement by external signal input unit, specify EXTA, EXTB, PM.

Error Execution error / If the setting data is out of the range.

	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
data	—	—	—	—	—	PM	EXTB	EXTA

:MEASure:ITEM:EXTernalin?

■ Queries the output item for the measurement value by using the 9603-01.

Syntax :MEASure:ITEM:EXTernalin?

Function Queries the output item of the external input measurement specified by the ":MEASure:ITEM:EXTernalin <NR1>"

Response syntax ":MEASURE:ITEM:EXTERNALIN <NR1>"

Example
Transmission ":MEASURE:ITEM:EXTERNALIN?"
Response ":MEASURE:ITEM:EXTERNALIN 7"

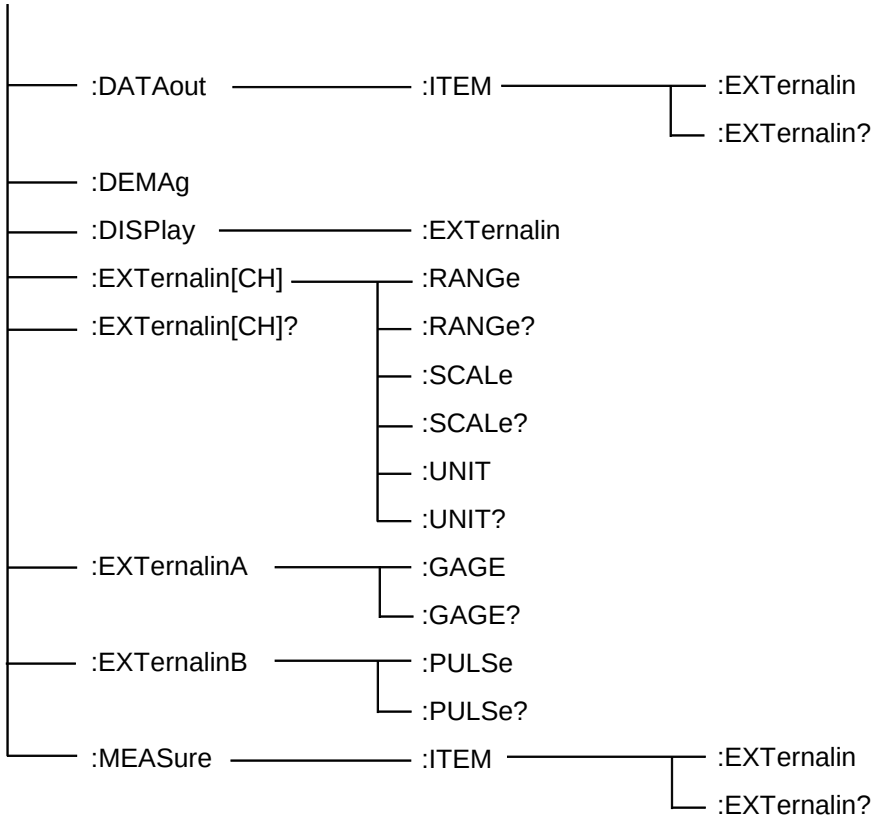
Standard Commands

Command	Data format (number of data items)	Explanation
:DATAout:ITEM:EXTernalin	NR1 numerical data (1)	Sets the output item for the measurement value by using the 9603-01.
:DATAout:ITEM:EXTernalin?		Queries the output item for the measurement value by using the 9603-01.
:DEMAg	Character data (7)	Degaussing
:DISPlay:EXTernalin		Makes a setting of the external input display.
:EXTernalin[CH]:RANGe	NR1/NR2 numerical data (1)	Setting the voltage range for the 9603-01.
:EXTernalin[CH]:RANGe?		Querying the 9603-01 voltage range.
:EXTernalin[CH]:SCALe	NR2 numerical data (1)	Sets the scaling value of the 9603-01.
:EXTernalin[CH]:SCALe?		Queries the scaling value of the 9603-01.
:EXTernalin[CH]:UNIT	Character data (1)	Sets the units for channel of the 9603-01
:EXTernalin[CH]:UNIT?		Queries the units for channel of the 9603-01.
:EXTernalinA:GAGE	ON/OFF (1)	Strain gauge input select command
:EXTernalinA:GAGE?		Setting the voltage range for the 9603-01.
:EXTernalinB:PULSe	ON/OFF (1)	Sets the input type for channel B of the 9603-01.
:EXTernalinB:PULSe?		Queries the input type for channel B of the 9603-01.
:EXTernalin[CH]?		Queries the settings of the 9603-01.
:MEASure:ITEM:EXTernalin	NR1 numerical data (1)	Sets the output item for the measurement value by using the 9603-01.
:MEASure:ITEM:EXTernalin?		Queries the output item for the measurement value by using the 9603-01.

Valid Command According to Condition

Command \ Condition	Integration reset			Integration start			Integration stop		
	HOLD OFF	HOLD ON	PEAK ON	HOLD OFF	HOLD ON	PEAK ON	HOLD OFF	HOLD ON	PEAK ON
:DATAout:ITEM:EXTernalin	○	×	×	×	×	×	×	×	×
:DATAout:ITEM:EXTernalin?	○	○	○	○	○	○	○	○	○
:DEMAg	○	×	×	×	×	×	×	×	×
:DISPlay:EXTernalin	○	○	○	○	○	○	○	○	○
:EXTernalin[CH]:RANGe	○	×	×	×	×	×	×	×	×
:EXTernalin[CH]:RANGe?	○	○	○	○	○	○	○	○	○
:EXTernalin[CH]:SCALe	○	×	×	×	×	×	×	×	×
:EXTernalin[CH]:SCALe?	○	○	○	○	○	○	○	○	○
:EXTernalin[CH]:UNIT	○	×	×	×	×	×	×	×	×
:EXTernalin[CH]:UNIT?	○	○	○	○	○	○	○	○	○
:EXTernalinA:GAGE	○	×	×	×	×	×	×	×	×
:EXTernalinA:GAGE?	○	○	○	○	○	○	○	○	○
:EXTernalinB:PULSe	○	×	×	×	×	×	×	×	×
:EXTernalinB:PULSe?	○	○	○	○	○	○	○	○	○
:EXTernalin[CH]?	○	○	○	○	○	○	○	○	○
:MEASure:ITEM:EXTernalin	○	×	×	×	×	×	×	×	×
:MEASure:ITEM:EXTernalin?	○	○	○	○	○	○	○	○	○

Specific Command Tree



Chapter 5
Specifications

Operating method	Using with the main 3194 (factory-fitted option) However, it is necessary to change to the 3194 version.
Operating method	Applying as to the specifications of the main 3194 product
Temperature coefficient	±0.03%f.s./℃
Analog output	±5 Vf.s. Output accuracy = (Measurement accuracy) ± 0.2%f.s.
Response	FAST (0.1 s) /MID（0.8 s）/SLOW（5.0 s） (The analog output response time is the time such that for an input change from 0% to 90% and 100% to 10% of the nominal range value, the value is within +/- 1% of the final stabilized value.)
Standards Applying Safety:	EN61010-1:1993+A2:1995 (using with the main 3194) Pollution Degree 2, overvoltage category I (anticipated transient overvoltage 330 V)

Configuration

There are two input connectors on chA. Each one corresponds to "strain gauge input" and to "DC voltage input." On the 3194, it is necessary to set which input connector to use. There is one input connector on chB. It corresponds to "DC input" and "pulse input."
On the 3194, it is necessary to set the type of input.

Strain Gauge Input (chA Special Connector)

Measurement accuracy	±0.1%rdg.±0.065%f.s. (23℃±5℃, 80%RH or less) (Adjust including energizing voltage accuracy and the cable configuration.)
Suitable transducer	Strain gauge type transducer (Bridge resistance: 350 Ω～1.5 kΩ) Connectors in use (TAJIMI ELECTRONICS CO.,LTD, PRC03-23A10-7F)
Bridge voltage	3 Vrms, 3 kHz±10%, Sine wave
Zero ajustment	±10%f.s. or less
Measurement range	1 mV/V/1.5 mV/V/2 mV/V
Display (SC=1)	1.0000/1.5000/2.0000
Effective input range	5% to 110% (Display range: 0.1%～130%)
Maximum allowed voltage	200% of range

DC Input (BNC connector of chA/chB)

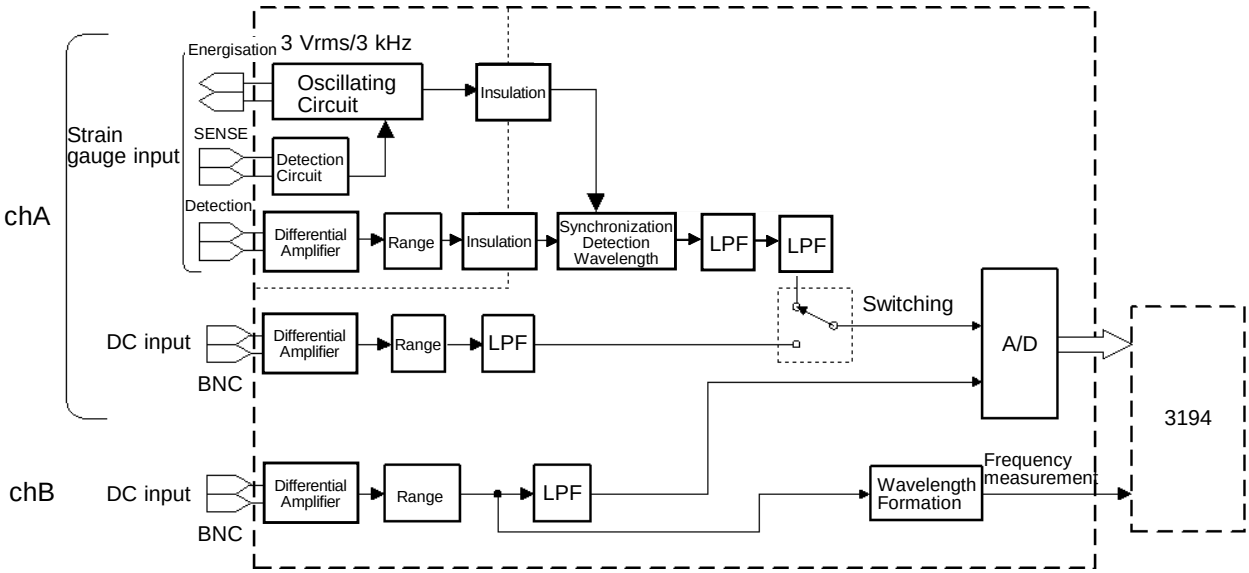
Measurement accuracy	±0.1%rdg.±0.1%f.s. (23℃±5℃, 80%RH or less)
Input resistance	200 kΩ±5% (Differential input)
Measurement range	±1.0000/±5.0000/±10.000 V
Effective input range	1% to 110% (Display range: 0.1%～130%)
Maximum allowed voltage	±20 V

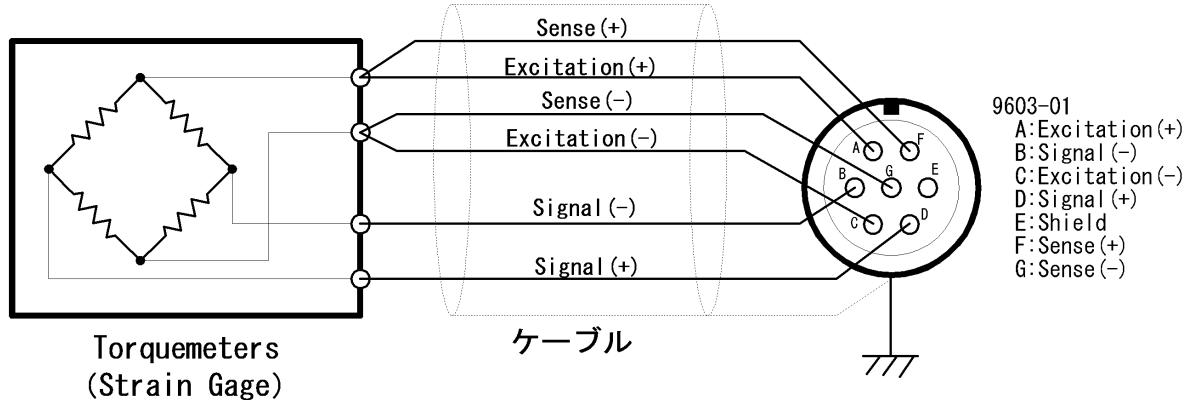
Pulse Input (BNC connector of chB)

Frequency measurement: 1 Hz to 100 kHz. Measurement accuracy depends upon the frequency measurement accuracy of the 3194.
Maximum allowed voltage: ±20 V

Chapter 6 Internal Block Diagram

The voltage input through the connector is converted, in differential and range circuits, to a voltage proportional to the input voltage, and transferred to the 3194 proper by an A/D converter.
When measuring a rotation rate by counting pulses, channel B can be switched so that pulses are counted by the frequency measurement function in the 3194 proper.





HIOKI 9603-01 EXTERNAL SIGNAL INPUT UNIT

Instruction Manual

Publication date: July 2001 Edition 1

Edited and published by HIOKI E.E. CORPORATION
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Printed in Japan 9603B981-00

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9603B981-00 01-07H

Printed on recycled paper