HIOS®

Brushless Screwdriver with Built-in Torque Sensor

PG Series
PG-3000 / PG-5000 / PG-7000

Control Unit
PG-01

User's Manual

Table of Contents

Important Safety Instructions

Please read this manual and the power supply unit manual carefully before use to ensure proper operation. In addition, do not use the product in the way not described in this manual. Please note that we are not responsible for any problems caused by using the product in a manner that does not conform to the contents of this manual, using it improperly, or repairing / modifying by a third party except by us or someone specified by us.

Installation

● Do not install the device at the places described below. Otherwise, it may cause a fire or a failure. A place of high humidity or with a lot of dust

　・A place where it becomes high temperatures

　・A place of fire

　・A place of direct sunshine

　・A place containing corrosive gas in the air

　・Unstable place

● Do not use the device where the ambient temperatures are out of the range of 5 to 40 °C.

Power Supply

● Be sure to install an earth leakage breaker and a safety breaker on the commercial power source before using it.

● Connect the earth wire to the earth wire terminal of the outlet. You may have an electric shock without the earth wire connection in case of an electric leakage.

● Avoid the octopus foot wiring and use of an extension cord. Otherwise, it may cause a fire or an electric shock.

● Do not connect anything other than specified to the connection part of this device. Otherwise, it may cause an electric shock or a failure.

Handling

● Do not wear clothes with flippers on the cuffs, gloves, neckties etc. Otherwise, they may get caught in the rotating screwdriver and cause an injury or a failure.

● Wear suitable clothing and protective eye-wear for work. Cover long hair with a hat etc. so that you can work safely.

● Turn off power when you leave the workplace, or when you attach / remove a bit / an optional item.

● If static electricity is charged, you need to neutralize it before use.

● Avoid an unstable place or an unreasonable posture for work. Otherwise, it may cause an injury.

● Long-time work or some types of work may cause strain on your hands, neck, arms or waist, causing an injury. Avoid long-time work and take a break regularly.

● We recommend use of a balancer to prevent the device from falling and to protect cords / wires.

● Hold the plug when you attach / remove the power cord, screwdriver and so on.

● Protect cords / wires by not giving damages to them; not remodeling them; not pulling them; not bending them forcibly; etc. Also, do not place heavy items on the power cord. Otherwise, it may cause a fire or an electric shock.

● If you detect an uneven rotation, strange noises, overheating or activation of a breaker, etc., stop using the device immediately and have it repaired. However, note that the device may be overheated depending on the frequency of the workpiece or screw types. As a countermeasure, prepare spare screwdrivers of the same model to extend the tact time and use them alternately, or review the selection of screwdriver models.

● Do not overload the device so much that it cannot clutch. Otherwise, it may cause a failure of the motor.

● Do not touch the screwdriver while it is rotating. Otherwise, it may cause an injury or a failure.

● Keep your hands and face away from the rotating section while in use. Otherwise, it may cause an injury.

● Remove the bit from the screwdriver when you

are not working.

- If you cannot attach / remove the bit in the way described in this document, please make contact with our service section.
- Fix the workpiece with jig / clump while in working.
- Do not use the switch lever as a hanger. Otherwise, it may cause an accident or an injury.
- Do not give a strong impact or excessive force. Otherwise, it may cause a failure.
- Do not operate the screwdriver with wet or oiled hands.
- Do not operate the FOR / REV switch before the screwdriver completely stops. Otherwise, it may cause a failure.
- Do not disassemble / remodel this device. Otherwise, it may cause a failure.
- High torque has a large recoil on the hand or arm. Hold the driver firmly to avoid being swung around.

Maintenance and Inspections

- Turn off power and remove the power plug from the outlet when the device is not in use for a long time.

- Remove the accessories from the screwdriver and store them in the package box when it is not in use them for a long time.
- Inspect the device regularly to confirm there are no damages. If you use it with damages, it may cause a fire or an electric shock.
- When you clean the device, turn off the power and remove the power plug from the outlet. Otherwise, it may cause a fire or an electric shock.
- Use dry cloth to wipe of dust or stains. The dust may absorb moisture to allow current to flow, causing a fire.
- Store the device in a place where the appropriate temperatures and humidity are controlled.
- Do not store the device in an unstable place or a place with vibrations. Otherwise, it may cause a failure.
- Keep the device out of reach of anyone but people involved in the workpiece.
- We recommend genuine HIOS parts for replacement.

Checking Supplied Accessories

If an item is missing or damaged, contact the store where you purchased the product.

- Screwdriver
- Bit
- Screwdriver Cord (2m)
- Sensor Cord (1.7m)
- PG-01
- AC Adapter
- RS-232C Cable
- USB to RS-232 Conversion Cable*
- Manual
- User Software CD-ROM

* Please download and install the device driver for the USB to RS-232 conversion cable from the ATEN website.

Setting Up the Device

■ Connect the Cords

Connect all the attached cords.

After all cords are successfully connected, put the power plug into an outlet.

> ⚠ **CAUTION**
>
> ● Make sure the combination of the screwdriver and the power supply is appropriate.
> ● Make sure the power is off.

❶ **Connect the plug and screwdriver cord to the power supply.**

❷ **Connect the screwdriver and sensor cords to the screwdriver and connect the sensor cord to PG-01.**

❸ **Connect the AC adapter to PG-01.**

■ Install the Bit

> ⚠ **CAUTION**
>
> ● Do not install or remove the bit with the power on. It may cause an accident.

❶ **Insert the bit while pushing the joint shaft collar into the body.**

❷ **Release the collar and check if the bit is locked.**

   ● Pull the bit gently to confirm it does not come out.

Remove the Bit

❶ **Pull out the bit while pushing the collar against the body.**

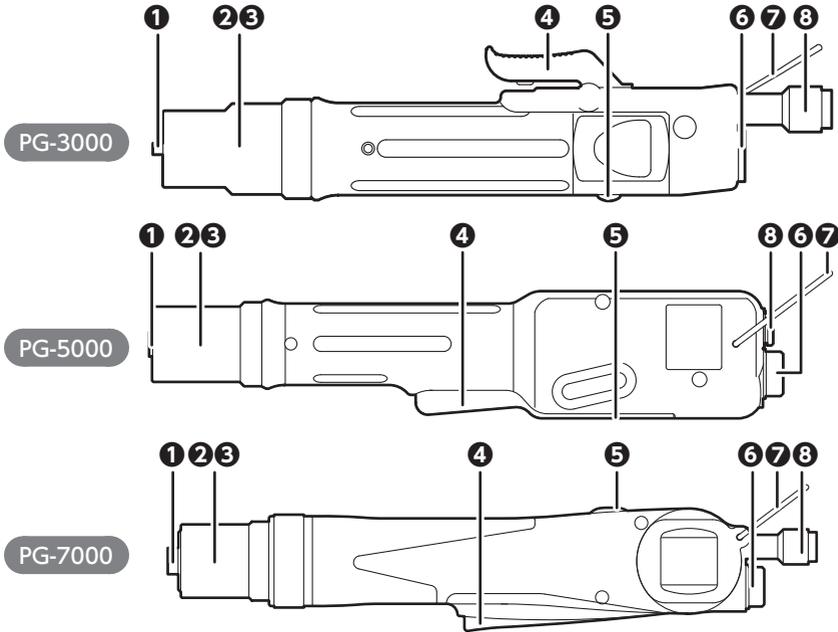## ■ Turn On the Power

❶ **Turn on T-70BL and PG-01.**

> ⚠ **CAUTION**
>
> PG-01 automatically performs zero-adjustment when the power is turned on. Do not apply a load to the tip of the screwdriver or do not start the screwdriver during the adjustment.

Parts and Their Functions

▇ PG-3000/PG-5000/PG-7000

❶ Joint shaft collar
Operate the collar to install or remove the bit.

❷ Nut protection cover
This protects the torque adjustment nut. Turn it counterclockwise for removal.

❸ Torque adjustment nut
Use this for adjustment of the output torque.

❹ Switch lever
Start the screwdriver with the lever.

❺ Forward / reverse switch
You can switch the screwdriver's rotational direction.
↻: Clockwise
OFF: no rotation(PG-5000/PG-7000)
↺: Counterclockwise

❻ Screwdriver cord connector
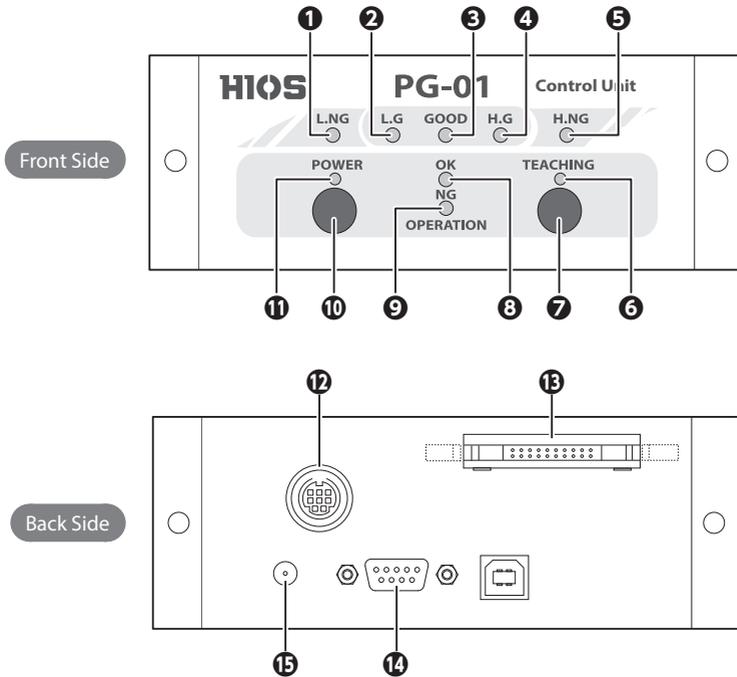To connect the screwdriver cord.

❼ Hanger
To hang the screwdriver on the balancer or like.

❽ Sensor cord connector
To connect the sensor cord.

■ PG-01

The measurement result of tightening a screw will be informed by the indicator and sound.

❶ L.NG Indicator
This indicator is lit when the measured value is no good (smaller than the minimum pass value).

❷ L.G Indicator
This indicator is lit when the measured value is good (larger than the minimum pass value and below the minimum learning value).

❸ GOOD Indicator
This indicator is lit when the measured value is good (larger than the minimum learning value and smaller than the maximum learning value).

❹ H.G Indicator
This indicator is lit when the measured value is good (larger than the maximum learning value and below the maximum pass value).

❺ H.NG Indicator
This indicator is lit when the measured value is no good (larger than the maximum pass value).

❻ Teaching Indicator
This indicator is lit when in the teaching mode (for setting of learning values).

❼ Teaching Button
This is for setting to the teaching mode. Pressing and holding this button (2 seconds or longer) in the teaching mode will cancel the mode. For details of teaching, refer to "Set Learning Values (Teaching)" (P.10).

❽ OPERATION OK Indicator
This indicator is lit while the screwdriver is rotating positively.

❾ OPERATION NG Indicator
This indicator is lit when the operation ends without torque up. This blinks when the operation ends due to an abnormal measurement time.

❿ Power Button
This switch turns power on and off. Press and hold the button for 2 seconds to turn off the power.
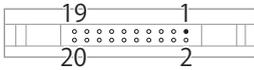
⓫ Power Indicator
This indicator is lit when power is supplied.

⓬ Sensor Cord Connector
This is used to connect the sensor cord.

⓭ I/O Connector
The I/O flat cable is connected here for the evaluation result to be output. The output format is an open collector. Use this when you cannot connect with RS-232C.

PIN No.	Output signal	Description
12	COM GND	—
13	L.NG (NG)	Output when the measurement value is NG (below the minimum pass value)
14	L.G (OK)	Output when the measurement value is OK (equal to or larger than the minimum pass value and smaller than the minimum learning value)
15	GOOD (OK)	Output when the measurement value is OK (equal to or larger than the minimum learning value and smaller than the maximum learning value)
16	H.G (OK)	Output when the measurement value is good (equal to or larger than the minimum learning value and smaller than the maximum learning value)
17	H.NG (NG)	Output when the measurement value is no good (larger than the maximum pass value).

⓮ RS-232C Connector
An RS-232C cable is connected here.

PIN No.	Signal name	I/O
2	RXD	OUT
3	TXD	IN
5	GND	

⓯ AC Adaptor Connector
An AC adaptor is connected here. Power will be automatically supplied when an AC adaptor is connected.

Start and Stop

■ Start the Screwdriver

❶ **Pull the switch lever to start the bit turning. Release it to stop turning.**

■ Stop the Screwdriver

❶ **When the set torque is reached, the clutch in the screwdriver works to stop turning.**

Adjust Torque

> ⚠ **CAUTION**
>
> The "reference table of output torque" and the torque adjustment scale are approximate and do not guarantee actual setting values.
> For accurate torque check, please use an HIOS torque meter and Fidaptor.

❶ **If the torque is determined beforehand, turn the torque adjustment nut and nut fixing ring referring to the "reference table of output torque".**
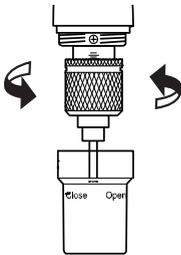
● Turn the torque adjustment nut clockwise to increase the torque and turn it counterclockwise to decrease the torque.
● Adjust it so that the end face of the nut fixing ring is right above the scale.
● After the nut fixing ring is positioned, fit the torque adjustment nut accordingly.

❷ **Try to fasten a screw and check how it is fastened after the screwdriver stops and adjust the most appropriate torque.**

■ Reference Table of Output Torque
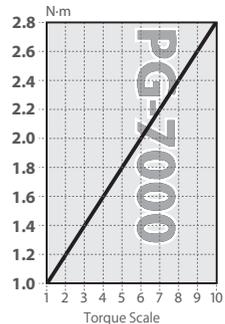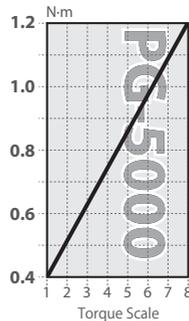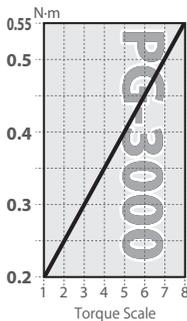
Set Learning Values (Teaching)

Measure the "tightening torque" and "working time" by using screws and materials actually used to set the reference values for work. The two values recorded are the minimum and maximum, respectively. Also, after teaching, it is possible to change the error tolerance of the learning values and the learned values in the attached application or Excel file.

> ⚠ **CAUTION**
>
> Teaching should be done under the same conditions as actual operation.
>
> An error may occur in the measured value if the screw to be used, the materials to be fastened, the attaching method of the screw, etc., are different from actual operation.

❶ **Press and hold the teaching button.**

- ● A buzzer sounds in about 2 seconds and the teaching mode is enabled.
- ● The teaching indicator is lit.
- ● L.NG indicator and H.NG indicator blinks.

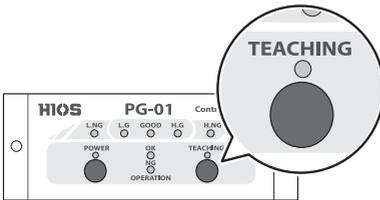❷ **Using the screws and materials to be actually used, perform tightening more than 3 times.**
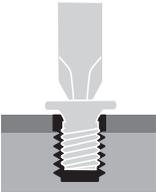
- ● Every time after tightening is completed, a buzzer sounds once, and the measured value is recorded.
- ● The measured values of the third to tenth trials are recorded and the values after the eleventh trial will overwrite the old values.

❸ **Press and hold the teaching button.**

- ● A buzzer sounds in about 2 seconds and the teaching mode ends.
- ● The teaching indicator, L.NG indicator and H.NG indicator turn off.

■ About Learning Values

- ● The learned values do not disappear even when the power is turned off.
- ● To reset the learned values, perform teaching again. The previous learned values will be deleted when the teaching mode is enabled.
- ● After purchasing, please perform teaching with PG-01 for the first time. Otherwise, it is not possible to set learning values with the attached application.

Evaluation of Screw Tightening

- It measures actual screw tightening work in real time, compares the measurement with the learning value, and informs the user of the evaluation result with a indicator and sound.
- The reverse rotation of the screwdriver is not evaluated.
- The allowable error range at the time of purchase is set to 10% for both upper and lower limits. If you want to change it, please use the attached application.

■ OK/NG Judgment of Tightening Torque Value

If no error is detected in the screw tightening work, one of L.G, GOOD or H.G indicator is lit and the buzzer sounds.

Allowable error range
Lower limit value

Allowable error range
Upper limit value

Threshold value

Learning value

Threshold value

L.NG   L.G   GOOD   H.G   H.NG

NG   OK   NG
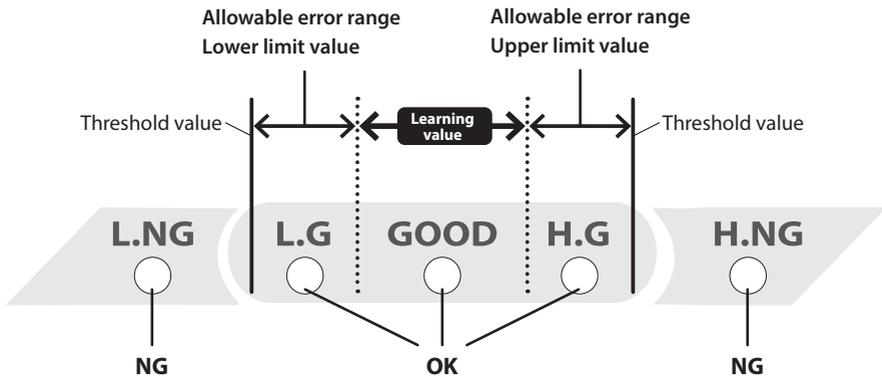
If the torque is within the learning values, the GOOD indicator will be lit, and if it falls within the allowable error range, either L.G or H.G indicator will be lit. Conversely, when the torque is less than the lower limit value, the L.NG indicator will be lit, and when the torque exceeds the upper limit value, the H.NG indicator will be lit, which means fail.

■ Evaluation of Operation Time

- The operation time from start of rotation to stop of the screwdriver is evaluated against the learning values.
- The blinking and lighting of the OPERATION NG indicator will turn off when the START signal is entered again.
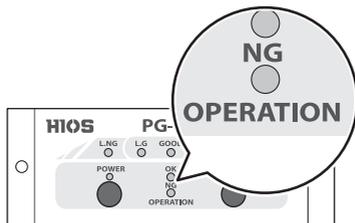
Main reasons why OPERATION NG indicator is lit
- No torque up signal is sent because of reasons like screwdriver idling.

Main reasons why OPERATION NG indicator blinks
- A torque up signal was not sent during the learning measurement period.
  If it is not necessary to strictly measure the operation time, by using the application, change the setting value so that the learning interval will become larger.
- Continuous ON/OFF operations at the end of tightening (pushing the button twice or three times in a row)

⚠ CAUTION

There is a nonintervention time of 100mS for torque measurement and evaluation after the START is input.

Nonintervention time of 100mS
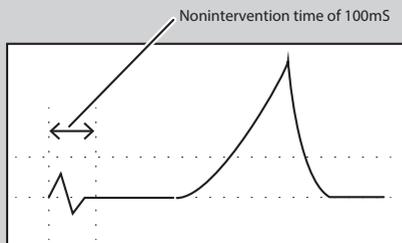
If the screwdriver output is given to a screw even after tightening, the value will be larger than the measuring value and not the expected tightening value.
To perform proper screw tightening, please do not perform continuous operations.

■ Flowchart of Judgment

```
                        ┌──────────────────┐
                        │    Power ON       │
                        └──────────────────┘
                                 │
                                 │    Set the judgment value (TEACHING)      L.NG, and H.NG blinks
                            ◇─────────────────────────►                      if no teaching value is set.
                         Select an operation                │
                            ◇                               ▼                 The set value can be
                                 │                  ┌──────────────────────┐  changed later from the
                        Normal operations           │ Set the evaluated value │  tabulation software on the
                                 │                  │ TEACHING LED is lit (red)│ connected PC.
                                 │                  │ L.NG & H.NG LED blinks (red)│
                                 │                  └──────────────────────┘
```
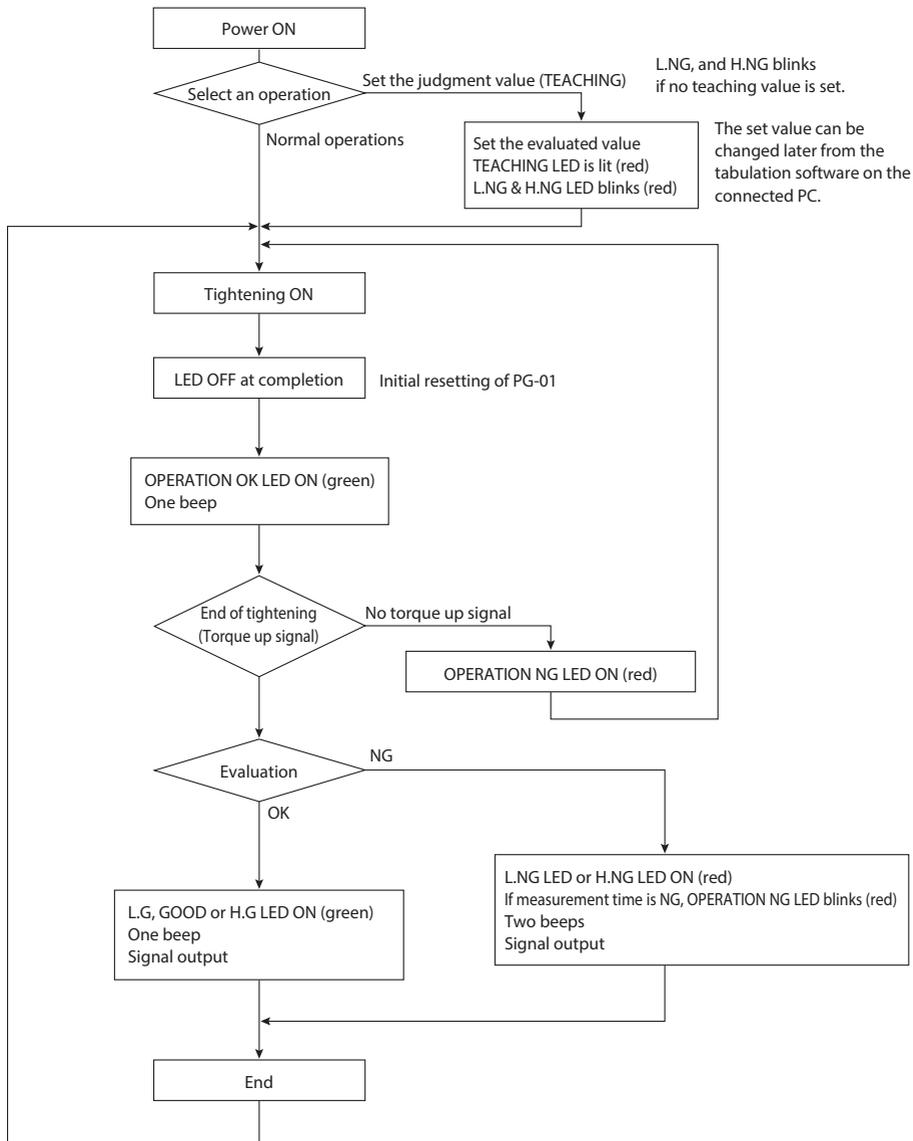
Power ON

Select an operation — Normal operations / Set the judgment value (TEACHING)

L.NG, and H.NG blinks if no teaching value is set.

Set the evaluated value
TEACHING LED is lit (red)
L.NG & H.NG LED blinks (red)

The set value can be changed later from the tabulation software on the connected PC.

Tightening ON

LED OFF at completion — Initial resetting of PG-01

OPERATION OK LED ON (green)
One beep

End of tightening (Torque up signal) — No torque up signal → **OPERATION NG LED ON (red)**

Evaluation — NG / OK

OK →
L.G, GOOD or H.G LED ON (green)
One beep
Signal output

NG →
L.NG LED or H.NG LED ON (red)
If measurement time is NG, OPERATION NG LED blinks (red)
Two beeps
Signal output

End

Connect the ScrewDriver to PC

❶ **Connect the RS-232C cable to PG-01.**

❷ **Connect the USB to RS-232C conversion cable to the RS-232C cable.**

❸ **Connect the USB to RS-232C conversion cable to PC.**

❹ **Download the device driver from the ATEN website and install it on PC.**

Check the website for how to install and supported OSs.

https://www.aten.com/global/en/products/usb-peripherals/usb-converters/uc232a/

❺ **Turn on PG-01.**

■ Check the Port

Open the device manager to check which port PG-01 is connected to.

In Case of Windows 10

❶ **Right-click the Start button and select Device Manager.**

❷ **Click the port (COM and LPT) in the list and check COM number displayed in <ATEN USB to Serial Bridge (COMXX)>.**

■ Data Output Format by Either RS-232C or USB Connection

The data for judgment is output for each measurement in the three formats in the sequence below.

• **Measurement Data**

D10   XXXX   XXXXX\<LF\>
      ❶   ❷

❶ Torque conversion value – 4 digits

❷ Measurement time – 5 digits (unit: mS)

• **Recorded Learning Value**

D00   XXXX   XXXX   XXXX   XXXXX   XXXXX\<LF\>
      ❸   ❹   ❺   ❻   ❼

❸ Display learning number

❹ Display learning minimum value

❺ Display minimum learning measurement time

❻ Display learning maximum value

❼ Display maximum learning measurement time

• **Judgment reference values**

D20   XX   XXXX   XXXX   XXXXX   XXXXX\<LF\>
      ❽   ❾   ❿   ⓫   ⓬

❽ Judgment error rate

❾ Judgment minimum value

❿ Judgment measurement time minimum value

⓫ Judgment maximum value

⓬ Judgment measurement time maximum value

Error-related Output

E90	End which cannot be detected by 0 areas, and judged	[Zero area detection/Impossible judgment ending]
E91	Abnormal termination at measurement time	[The abnormally end at the measurement time]
E92	Study shortage and end which cannot be judged	[The ending about which it is impossible to judge by the learning lack]
E93	Judgment=LOW NG	[Judgment = Low NG]
E94	Judgment=HIGH NG	[Judgment = High NG]

Measurement Judgment Output

E00	Judgment=GOOD	[Judgment = Good]
E01	Judgment=LOW OK	[Judgment = Low OK]
E02	Judgment=HIGH OK	[Judgment = High OK]

■ PC Input

Hyper terminal (Example: Windows XP)

After the PC is turned on and the version information is displayed, auto-zero correction is performed. The following messages for debugging are displayed that are not directly related to measurement.

```
Ver3.04 2022/05/25
[Zero Adj A/D=7C2 G=1EA F=200]
[Zero Adj A/D=806 G=1EB F=200]
[Zero Adj A/D=808 G=1EC F=200]
[Zero Adj A/D=803 G=1ED F=200]
[Zero Adjustment end A/D=7FF Gain=1ED]
```

Example of a Measurement OK Message

In general, messages are either operation check messages or measurement data.

[Job Num = 4] S00 [Lever SW ON] [Job Num = 6] S02 [Torque UP ON]	Operation check message for debugging
D10026900668 D000005026903150033701891 D2002026303210033001928	Measurement data
M21[Judgment=LOW OK] E01 [Judgment end]	Operation check message for debugging

Abnormal Conditions

This displays the condition when judgment results are abnormal.

[Job Num = 4] S00 [Lever SW ON] [Job Num = 6] S02 [Torque UP ON]	Operation check message for debugging
D10028600590 D000006009600010000101894 D2002140513090131201931	Measurement data
[Abnormal termination at measurement time] E91	Operation check message for debugging

■ Data Taking-in Sheet (HIOS-PG-0611-V2-2_5)

By using the data taking-in sheet in the attached CD-ROM, you can check the OK/NG of screw tightening on the PC or record the measurement data.

> ⚠ **CAUTION**
>
> ● Enable macros.
>
>
>
> ● Start settings after turning on PG-01 and connecting it to the PC.
> ● When using USB, the PC may turn off PG-01 automatically in some cases. In that case, please disconnect and reconnect the screwdriver.
> ● There is no reaction to the reverse rotation of the screwdriver.
> ● If you want to take in two types of data, create two files (for example, test1.xls and test2.xls) in advance. Then, start up two applications, and then open each file.
> If you open files by double-clicking them in Windows Explorer, two files are opened in the same application and the application cannot be used.

Operating Environment

The data taking-in sheet was confirmed to be effective in the following environments:
・Microsoft Windows XP
・Microsoft Excel 2003

If it is not functioning, select application type "screwdriver data collection".
Please be aware that maintenance and support services are unavailable since this is sample software.

Configuration of the Screen

❶ **Connection confirmation window**

The login information is displayed.

❷ Disconnect button

This ends data import.

❸ Connect button

This makes the data import standby. If the previous data is necessary, please save the current data first and then connect the screwdriver. (The previous data will be cleared upon connection.)

❹ COM port

Check the port number and enter it. Then, press [Enter] on the keyboard. Usually, select COM as the port.

Cell colors
• Gray: the screwdriver is not connected.
• Yellow: the screwdriver is connected.

❺ LAN settings

Optional

❻ Judge On/Off

Errors E90/E91/E92 can be turned ON/OFF.

ON: the measured values are entered in the datasheet.

OFF: the measured values are entered in the irregular sheet.

❼ Measurement settings processing table

The table shows commands and settings processing that are displayed in the log.

❽ Judgment

This indicates OK/NG of screw tightening with colors.

❾ Output data

Torque equivalent value: this indicates values taken during actual operation.

Measurement time: this indicates the time from screw tightening to torque-up.

Number of the learning: indicates the number of teaching operations performed.

Minimum of the learning: indicates the minimum teaching value (modifiable).

Maximum of the learning: indicates the maximum teaching value (modifiable).

Measurement time of minimum: indicates the teaching minimum time (modifiable).

Measurement time of maximum: indicates the teaching maximum time (modifiable).

After inputting a number, press [Enter] on the keyboard.

 • These learning-related values will be sent to PG-01 by clicking the [Write learn-value] button after entering a number.

 • If the [Learned value change] button is not pressed, the memory in PG-01 won't be updated and the previous value will be recovered after the next torque-up operation.

❿ Judgment comparison data

Torque value: indicates the value output on the graph sheet.

Judgment minimum value: indicates the amount minus the % setting for the learning minimum value.

Judgment maximum value: indicates the amount plus the % setting for the learning maximum value.

Meas. Time of judge minimum: indicates the amount of the time minus the % setting for the learning minimum measurement time.

Meas. Time of judge maximum: indicates the amount of the time plus the % setting for the learning maximum measurement time.

⓫ Judgment error rate (%)

This sets the acceptable evaluation threshold before a screw tightening operation.

Selecting the judgment error rate while the screwdriver is connected transmits the selected rate to PG-01. Even after disconnecting the PC, the selected rate will be retained.

The selectable rates: 0%, 2%, 5%, 10% or 20% (02=2%)

⑫ Work On

Normally this turns on automatically when an operation is performed.

Other Sheet

測定値	測定最小値	測定平均値	測定最大値	差	公 差
60	89	92	95	6	±3.4%

データーシート

グラフシート

イレギュラシート

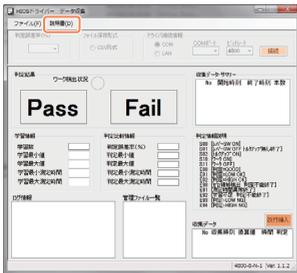## ■ Collection of Screwdriver Data (Application)

The operation data is collected in the same way as the data taking-in sheet. The data is saved in the CSV format.

For details, click [Instructions] on the screen of screwdriver data collection.

Troubleshooting

If you have any problem while using this machine, please check the items in this section before making inquiries.
Then, if the problem persists, please contact your dealer or us.

The L.NG or H.NG indicator blinks when the power is turned on.

There is a possibility that the learning values are not set correctly. Repeat teaching 3 times or more to set the learning values.

The L.NG or H.NG indicator flashes even when the teaching mode is ended and measurement cannot be performed.

There is a possibility that data for evaluation comparison is insufficient. If the learning count is less than 3, the indicator will keep flashing even if the teaching mode ends. Repeat teaching 3 times or more again to set the learning values.
In the following cases it is difficult to make an evaluation, and it may not be counted as learning.
 ・Torque value is 10 or less ("E90" [Zero area detection/Impossible judgment ending])
 ・Idling of the screwdriver occurs or the measurement time is 100 mS or shorter. ("S01" [Lever switch Off(no torque up)])

Setting cannot be changed from the tabulation software.

Click the [Write learn-value] button after input of a number. The settings in PG-1 will be updated by clicking the [Write learn-value] button.

The torque is abnormally low or high.

Turn off the power to check if the cords are connected correctly and then turn on the power again.
If the problem persists, replace the sensor cord.

When a Problem Cannot Be Solved

When contacting us, have the following information ready:
 ・Product name
 ・Description of the problem (detailed description of the operation performed and its result, etc.)
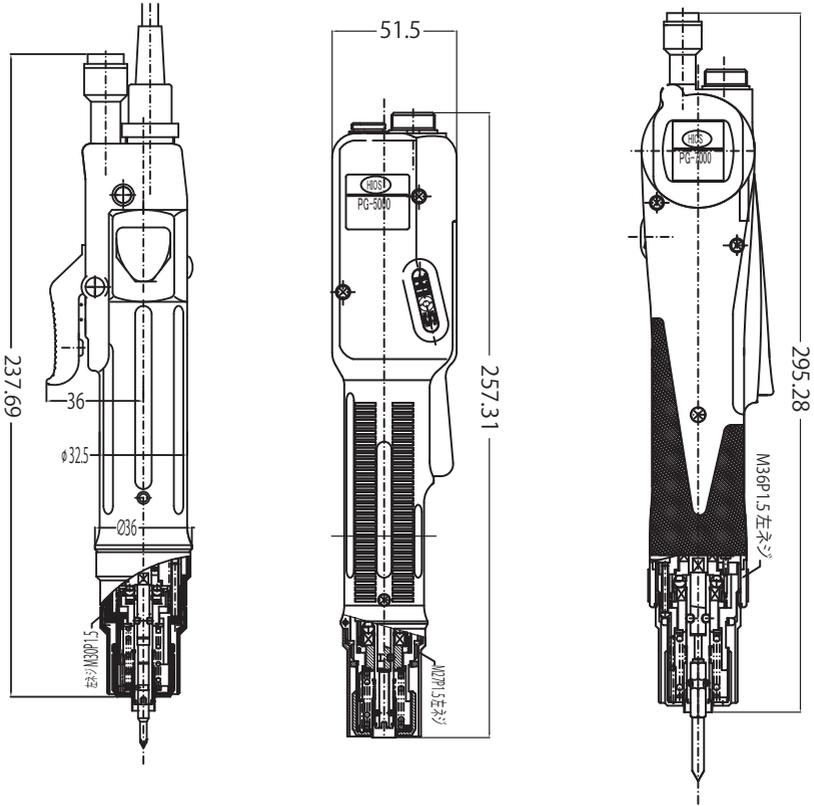 ・Serial number (on the label of the product)

After-sales Service

The PG Series is equipped with an axial force sensor. We recommend overhauling and inspecting the axial force sensor about once a year depending on usage conditions.
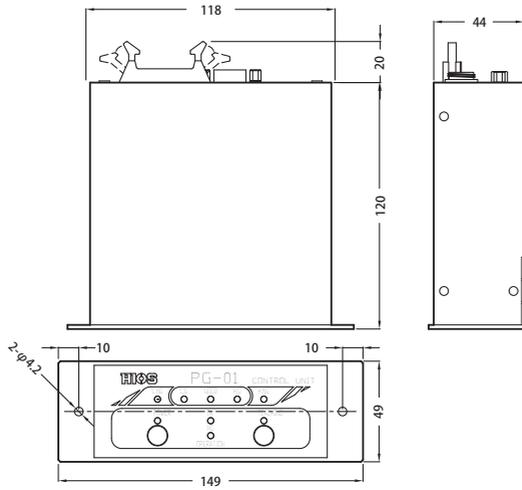
Specifications

The product specifications are subject to change without prior notice due to improvements of the product.

Model		PG-3000	PG-5000	PG-7000
Start Type		Lever		
Output Torque Range (N·m)		0.2–0.55	0.4–1.2	1.0–2.8
Unloaded Rotation Speed (rpm) ±10% [HI/LOW]		980/680	900/590	960/630
Screw Size (mm)	Machine Screw	1.7–2.3	2.3–3.0	2.6–5.0
	Tapping Screw	2.0–2.3	2.0–2.3	2.6–4.0
Weight (g)		345	509	807
Power supply		T-70BL		
Bit Drive	Standard	H4		H5 and 5HEX (compatible)
	Option	—		1/4HEX

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左ネジ M30P1.5

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HIOS
PG-5000

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M27P1.5左ネジ

HIOS
PG-5000

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M36P1.5左ネジ

■ Specifications of PG-01

AC Adaptor	Input: AC100-240V (50-60Hz) Output: DC12V	
Weight	513g	
RS-232C communication	Speed: 4800bps Start bit: 1Bit Stop bit: 1Bit Data length: 8Bit Data format: ASCII Parity: none Standard: RS-232C Terminal: D-SUB 9 pins	
I/O input output	Common to plus and minus Output: sink type	Example of Connections

HIOS®