HIOKI

PW8001 Ld, Lq Analyzer

Instruction Manual

- ✓ This instruction manual only covers the PW8001 Ld,Lq Analyzer.
- ✓ Before using the PW8001, please be sure to read the PW8001 instruction manual.
- ✓ For information on communication settings for the PW8001, please refer to the "9 Connecting to a PC" section of the PW8001 instruction manual.
- ✓ While we have taken great care to ensure the accuracy of the information in this instruction manual, if you find any unclear points or errors, please contact our call center or your nearest sales office.

Aug.2024 Edition 1

Contents

1 Introduction

This software is a dedicated application for the HIOKI PW8001 Power Analyzer.
It communicates with a power analyzer connected via LAN to display motor measurement data and save it in CSV format.

Hereinafter in this document,
the power meter connected to this software may be referred to as the PW8001, power meter, or power Analyzer, and the "PW8001 Ld, Lq Analyzer" may be referred to as this software.

Note
The Ld, Lq measurement using this software cannot be performed on the PW8001 that is not equipped with the motor analysis option.

1.1 Precautions regarding reproduction, copyright, and other considerations for use

Copyright

All rights, including copyright, related to the executable files and documentation of this program are owned by HIOKI E.E. Corporation.

Terms of Use

Without the permission of the copyright holder, you may not engage in the sale of this software for commercial purposes, such as bundling it with other software or books. Additionally, reverse engineering and modification of the software without the permission of the copyright holder are prohibited.

Liability for Use

- This software is freeware. You are free to use it at your own risk.
- Our company assumes no responsibility for any damage arising from the use of this software.
- Our company assumes no responsibility for any bugs or issues that may occur with this software.
- We cannot accept any questions or requests regarding this software.
- This software is subject to change without notice.

Note
National Instruments, NI, ni.com, and LabVIEW are trademarks of National Instruments Corporation (U.S. National Instruments Corporation).
Windows is a registered trademark or trademark of Microsoft Corporation in the United States.

1.2 Required System Configuration

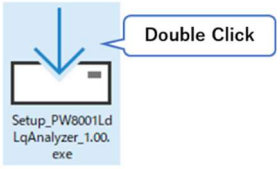
To use the PW8001 Ld,Lq Analyzer, your computer must meet the following system requirements.

Supported OS	Windows 10(64bit) , Windows 11
Software Requirements	LabVIEW Runtime 2019 or later and NI VISA Driver must be installed.
CPU	1.0 GHz or higher
Memory	2.0 GB or higher
HDD	128 MB or more of free space
Display	1920×1080 pixels or higher
Interface	Ethernet（TCP/IP）

2 Installation / Uninstallation

2.1 Installation

To install this software, LabVIEW Runtime 2019 or later and the NI VISA Driver must be installed.
Please match the bit version with that of the application you are using.



Double-click [Setup_PW8001LdLqAnalyzer_1.00.exe] to launch the installer. Follow the installer instructions to proceed with the installation. (File extensions may not be displayed depending on your computer settings.)

Note

・Please install with administrator rights (Administrator).

・Installation may not be possible if other applications are running.

Before installing, please close all applications if possible. In particular,
if antivirus software is running, it may prohibit installation regardless of the presence of viruses.
In such cases, please configure the antivirus software to lift the installation prohibition.

・Please download the LabVIEW Runtime and NI VISA Driver from the National Instruments website.

2.2 Uninstallation

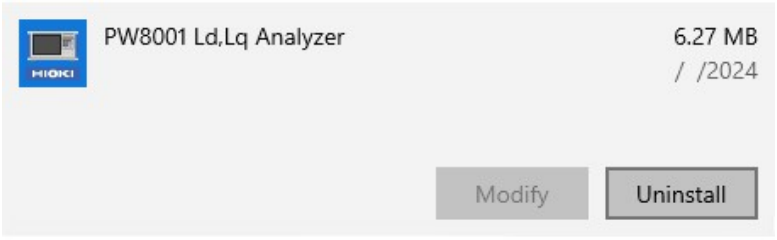
Follow the OS app uninstallation method to perform the installation.

For Windows 10:

①  Right-click the [Start] icon.

② Select [Apps & features].

③ Select [PW8001 Ld,Lq Analyzer] and click it to display the Uninstall button.



④ Click [Uninstall] and follow the installer instructions.

3 How to Use

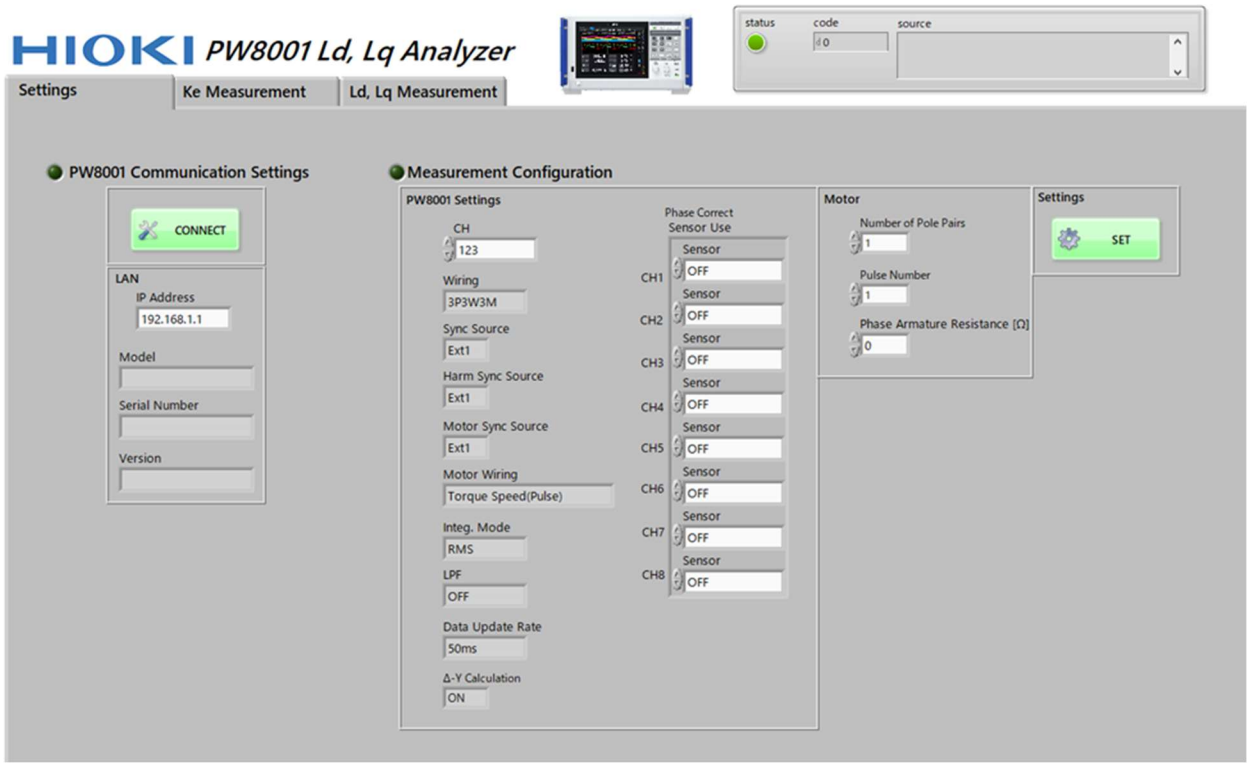
3.1 Overview of Functions

This software performs the measurement of motor parameters using the following steps.

Connecting to the PW8001 & Measurement Settings	Communication settings between the PW8001 and the computer are configured. Settings are made for measuring motor parameters.
Measurement of Induced Voltage Constant	Perform phase zero adjustment and measurement of the induced voltage constant, or user input of the induced voltage phase angle and induced voltage constant.
Ld, Lq Measurement	Measurement and display of motor parameters, graph plotting, and saving in CSV format are performed.

3.2 Startup

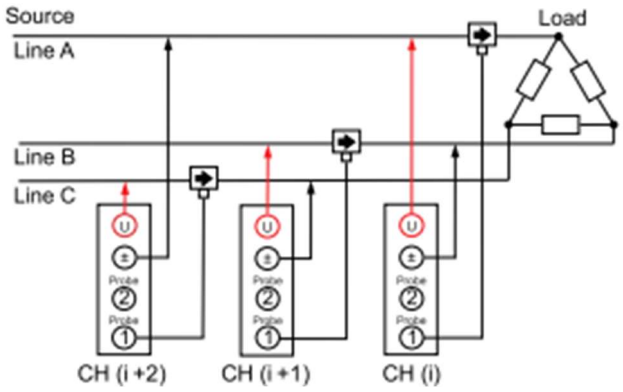
When the application is launched, the settings screen will be displayed.



Settings Screen

3.3 Connecting to the Measurement Line

For the U, V, and W phases of a three-phase motor, wiring is performed with a three-phase three-wire (3P3W3M) connection.

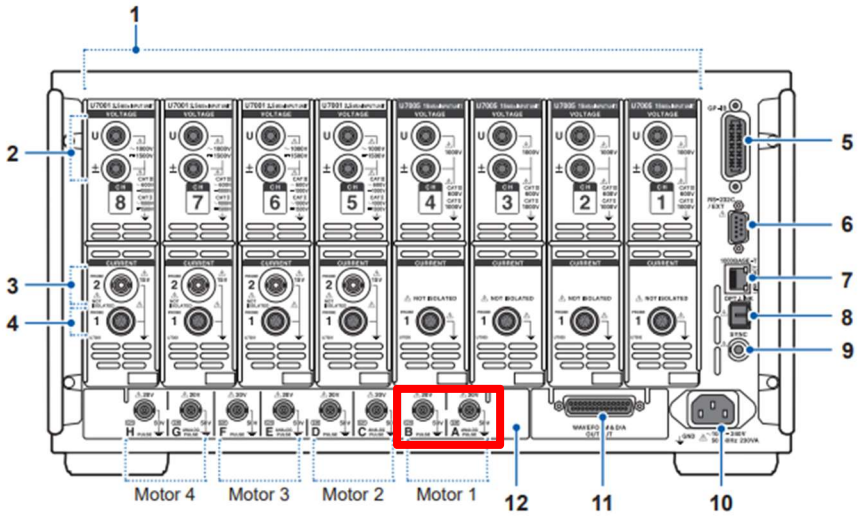


結線図

Connect the pulse signal from the motor to the Motor 1 terminal.

Connect the Z-phase pulse signal from the pulse encoder to CH B.
When measuring torque additionally, connect the torque signal output from the torque sensor to CH A.

**** The PW8001 Ld, Lq Analyzer does not use the A-phase and B-phase pulses from the pulse encoder, but instead uses the Z-phase pulse signal as a reference. Please note that this is different from the usual motor analysis connections.***



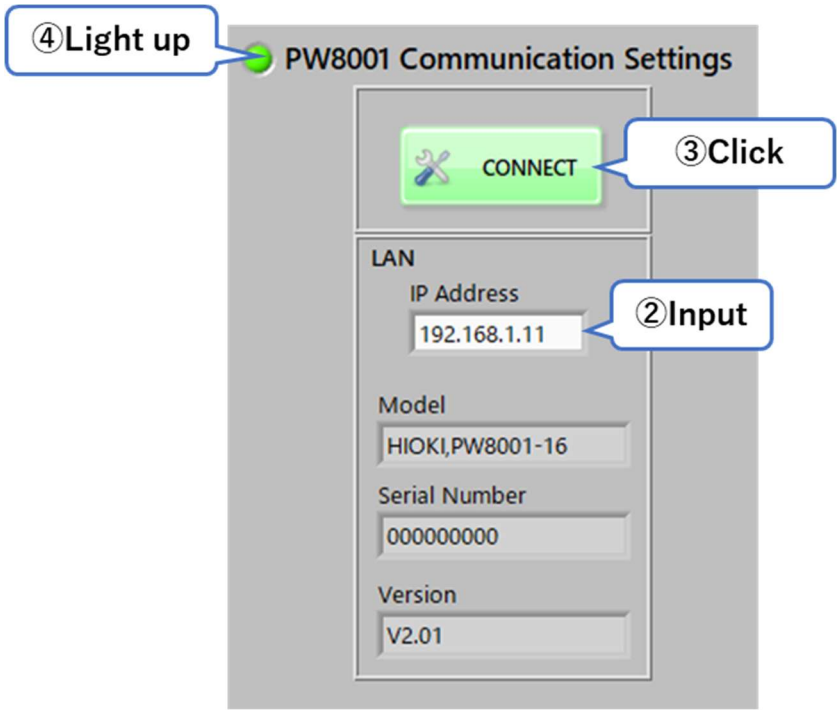
Pulse Signal Input

3.4 Connection Settings with the PW8001

First, configure the communication settings between the PW8001 and the computer.

① Connect the PW8001 and the computer using a LAN cable.
② Enter the IP address of the PW8001 you want to connect to in the [**IP Address**] field.
③ Press the CONNECT button to communicate with the specified connection destination.
④ If communication is successful, the information of the connected PW8001 will be displayed in the [**Model**]、[**Serial Number**]、and [**Version**] fields, and a green light will illuminate.

For information on how to check the IP address of the PW8001, please refer to the instruction manual of the PW8001.



Connection Settings

Note

If the connection fails, please refer to the PW8001 instruction manual and check the cable connection and address settings. Also, please verify that NI-VISA is installed on your PC.

3.5 Measurement Settings

Configure the settings for motor parameter measurement.

① In the [**CH**] column, select the channel on which to perform the measurement.
If there is no unit mounted on the selected channel, it will be invalid.

② In the [**Sensor Use**] column, select the current sensor to be used for the three channels selected in ① and perform phase correction settings.
If you are using a current sensor with automatic phase correction function, select "AUTO."
If you are using a current sensor without an automatic phase correction function, please select the model name from the dropdown list.
Please use the same current sensor for the three channels selected in the [**CH**] column.
Sending a setting other than OFF to a channel that does not have a current sensor connected will result in an error.

③ Enter the number of pole pairs of the motor in the [**Number of Pole Pairs**] column.
The number of motor poles on the main unit may not match the set value.

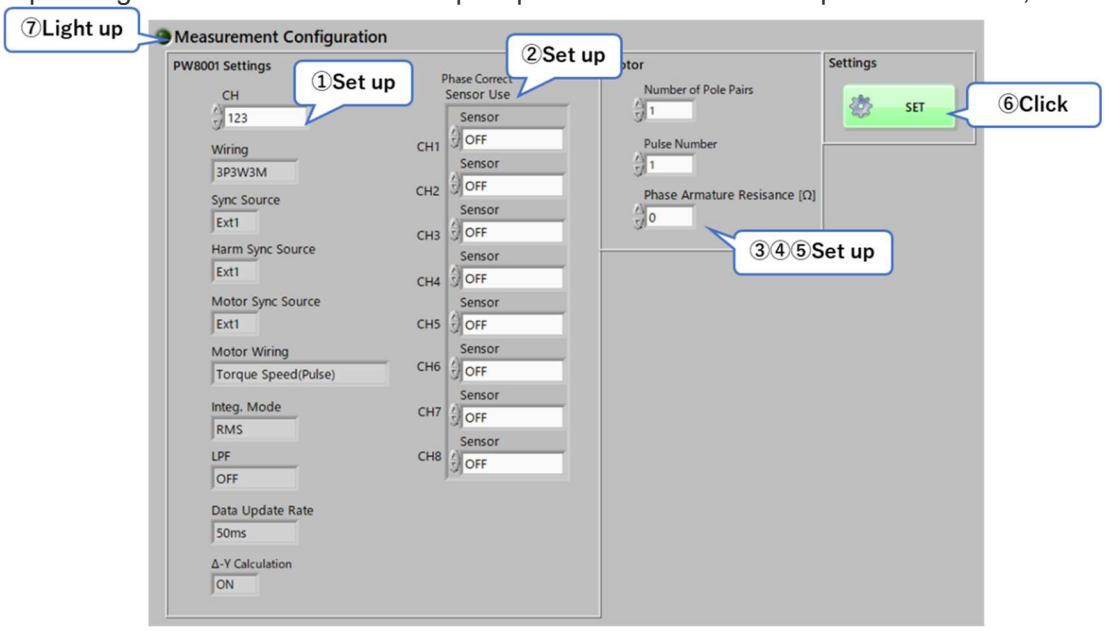
④ Enter the number of pulses in the [**Pulse Number**] column.
If using an incremental rotary encoder, enter 1.

⑤ In the [**Phase Armature Resistance**] field, enter the phase armature resistance value measured using a resistance meter or similar device.

⑥ Press the SET button to send the settings. Zero adjustment will be performed, which may take some time.

⑦ Once the settings are complete, a green light will illuminate.

The input range for the number of motor pole pairs and the number of pulses is 1 to 60,000.



Measurement Settings

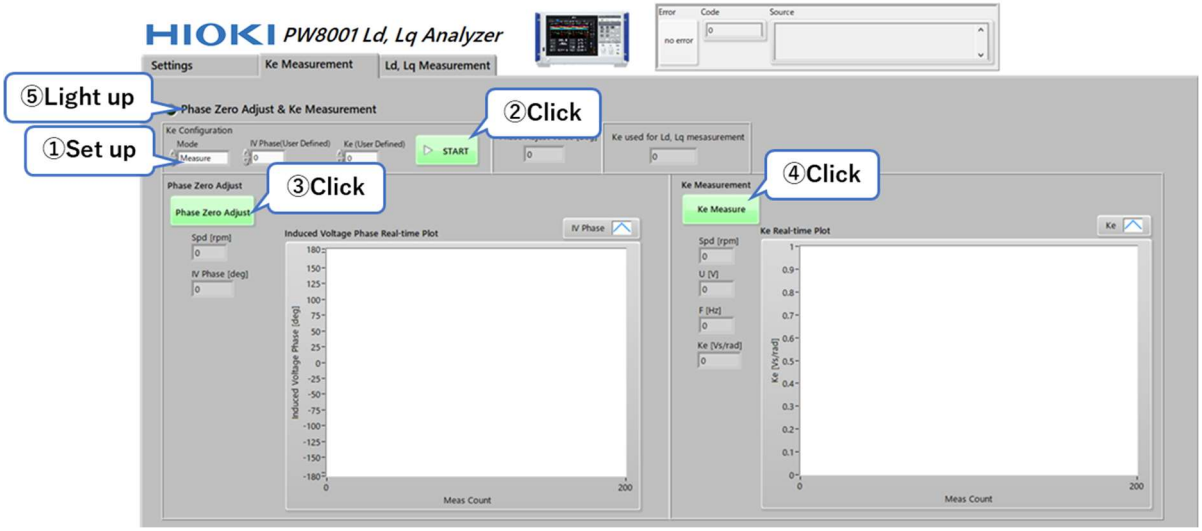
3.6 Measurement of Induced Voltage Constant & User Input

Select the [**Ke Measurement**] tab to perform phase zero adjustment and measurement of the induced voltage constant, as well as user input.

In the Induced Voltage Constant Measurement Mode

Measure the induced voltage phase angle and perform phase zero adjustment, as well as measure the induced voltage constant.

① Rotate the motor from the load side.
② Select Measure in the [**Mode**] field and press the START button.
③ The real-time plot of the induced voltage phase will start, and once the graph stabilizes, press the Phase Zero Adjust button to execute the phase zero adjustment.
④ Once the graph stabilizes, press the Ke Measure button to record the Ke value used for Ld and Lq measurement.
⑤ Once the phase zero adjustment and the measurement of the induced voltage constant are complete, a green light will illuminate.



Induced Voltage Constant Measurement Mode

In the Induced Voltage Constant User Input Mode

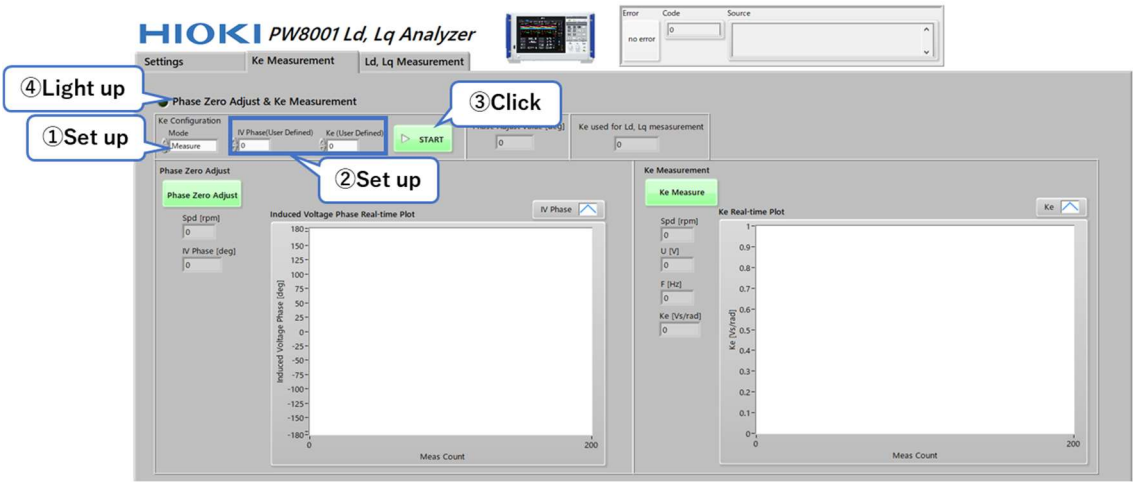
If the induced voltage phase angle and induced voltage constant have already been measured, directly enter the values before performing the phase zero adjustment.

① Select User Defined in the [**Mode**] field.

② Enter the induced voltage phase angle in the [**IV Phase(User Defined)**] field, and the induced voltage constant in the [**Ke(User Defined)**] field.

③ Press the START button. The phase zero adjustment command will be sent to the PW8001 based on the entered induced voltage phase angle.

④ Once the phase zero adjustment is complete, a green light will illuminate.

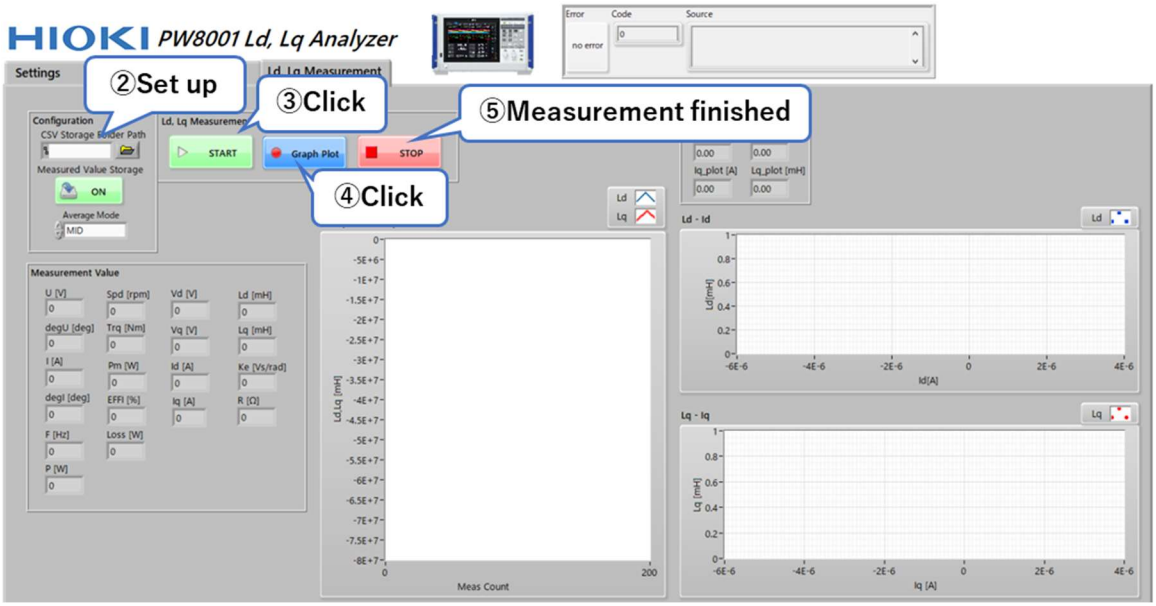


Induced Voltage Constant User Input Mode

3.7 Ld, Lq Measurement

Select the Ld, Lq Measurement tab to perform real-time display of motor measurement data, Ld-Id, Lq-Iq graph plotting, and CSV saving.

(1) Drive the motor using the inverter.
(2) Set the CSV save destination path, turn CSV saving ON/OFF, and select the measurement value averaging mode. If CSV saving is ON, measurement data will be saved to the specified path. If no path is specified, measurement data will not be saved.
(3) Press the START button to begin real-time display of motor measurement data.
(4) Press the Graph Plot button to plot the measurement values at the time of button press on the Ld-Id, Lq-Iq graph.
(5) Press the STOP button to end the measurement.

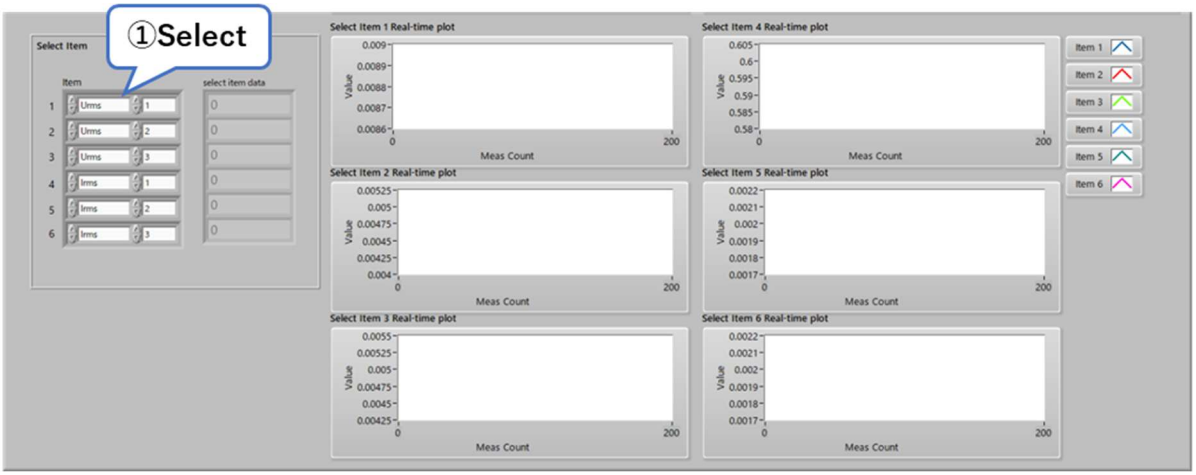


Ld, Lq Measurement Screen

Arbitrary Item Measurement

In addition to Ld, Lq measurement, you can graph plot and save in CSV format the measurement values of up to six arbitrarily selected items.

① Select the data you want to plot on the graph in the [**Item**] column.
② Press the START button to start the real-time display of measurement data.
③ Press the STOP button to end the measurement.



Arbitrary Item Measurement Screen

3.8 CSV File for Saving Measurement Data

If CSV saving is ON, the measurement data will be output to a file.
The timestamp and the date and time in the file name refer to the time on the PC itself.

Measurement Data File

All measurement data from the start to the end of the measurement will be saved.
The data at the time the Graph Plot button is pressed and plotted on the graph is represented by a **1** in the Plot column of the measurement data file.

The file name is saved as follows:

Ld,Lq_meas_Year-Month-Day Hour-Minute-Second.csv

4 Specifications (Detailed Processing)

4.1 PW8001 Setting Items

Wiring	3P3W3M
Sync. Source, Harmonic Sync. Source, Motor Sync. Source	Ext1
Motor Measurement Items	Torque, Speed (Pulse)
Simple Setting Mode (PWM)	Frequency: Upper limit 1kHz, Lower limit 1Hz Integration Mode: RMS U/I Rectification Method: MEAN/RMS LPF: OFF
Voltage/Current Range	AUTO
Motor Pole Number	2
Number of Pulses	Based on user input
Δ-Y Conversion	ON
Current Sensor Phase Correction	AUTO If a model name is specified, use the representative value.
Data Update Rate	50ms
Averaging Mode	Induced Voltage Constant Measurement: Exp MID Ld, Lq Measurement: Based on user selection at the start of measurement
Zero Adjustment	Executed upon Sending Settings

4.2 Measurement of Induced Voltage Constant

Obtain and display harmonic measurement data of the induced voltage phase angle at the Nth order, where N is the number of pole pairs set by the user.

Divide the induced voltage phase angle at the time of pressing the Phase Zero Adjust button by the order N, transmit it to the PW8001 as the first-order induced voltage phase angle, and execute phase zero adjustment.

After the phase zero adjustment, obtain measurement data from the PW8001, identify and display the induced voltage constant.

Record the value of the induced voltage constant at the time of pressing the Ke Measure button and use it for the Ld, Lq measurement.

Acquired measurement data:

RMS value of the N (number of pole pairs) harmonic voltage (Urms), Voltage frequency (FU)

Ke Identification Formula

$$Ke = Urms/2\pi FU$$

The measurement values are obtained using the PW8001's exponential averaging mode MID.
The input range for the induced voltage phase angle in user input mode is −180 to 180 degrees.

4.3 Ld, Lq Measurement

Obtain measurement data from the PW8001, identify and display Ld and Lq.

Measurement Data to be Acquired

Harmonic measurement data:

RMS value of the N (number of pole pairs) harmonic voltage (Urms), voltage phase angle (degU), current RMS value (Irms), and current phase angle (degI)
at the Nth order (where N is the number of pole pairs).

Fundamental measurement data:

Voltage frequency (FU)

Ld,Lq Identification Formula

$$V_d = -U_{rms} \sin degU$$

$$V_q = U_{rms} \cos degU$$

$$I_d = -I_{rms} \sin degI$$

$$I_q = I_{rms} \cos degI$$

$$L_d = \frac{V_q - 2\pi \cdot FU \cdot K_e - RI_q}{2\pi \cdot FU \cdot I_d}$$

$$L_q = \frac{RI_d - V_d}{2\pi \cdot FU \cdot I_q}$$

4.4 CSV File

Saved Parameters

Parameter	Header
Timestamp	Time
Voltage RMS	U
Voltage phase angle	degU
Current RMS	I
Current phase angle	degI
Frequency	F
Active power	P
Rotation speed	Spd
Torque	Trq
Motor power	Pm
Motor efficiency	EFFI
Motor loss	Loss
d -axis voltage	Vd
q -axis voltage	Vq
d axis current	Id
q axis current	Iq
d -axis inductance	Ld
q -axis inductance	Lq
Induced voltage constant	Ke
Phase armature resistance	R
Graph plot	Plot

Automatic range changes of the current sensor or command transmissions to the PW8001 may result in invalid data (such as large values like 7.78E+103) being outputted.

In case measurement values do not appear or are unstable

・Please check the frequency settings for motor measurement.

If the upper frequency limit is set too high, motor measurement items such as rotation speed may not be displayed.

・Noise may be present on the Z-phase pulse input to CH B.

Check the wiring of the cables.

Ground the encoder that outputs the pulse.

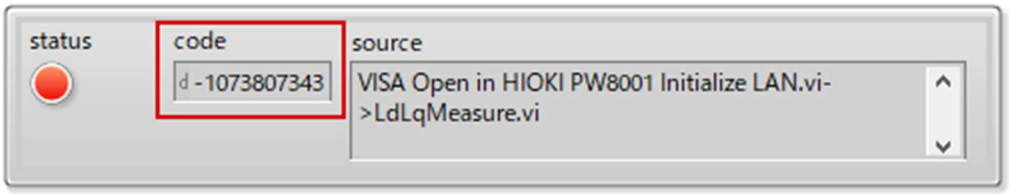
Set the Pulse Noise Filter (PNF).

5 In Case of Error

If an error occurs, please restart the application, correct the cause of the error, and execute it again.

Error Code:-1073807343

・LAN Connection Not Possible



Please check if the IP address is correct, if the LAN is properly connected, and if NI-VISA is installed.

・Unable to Obtain Measurement Values

Please check the LAN connection.

Error Code:1300

・Unable to Configure the PW8001

Please confirm that the units for the three selected channels are mounted in the settings.

Check that the same current sensor is connected across all three channels.

Verify the phase correction settings of the current sensor.

An error will occur if a setting other than OFF is selected for a channel without a connected current sensor, or if the AUTO setting is selected for a current sensor that does not have an automatic recognition feature.

Please reset the integration state of the power meter.

・Unable to Perform Phase Zero Adjustment

Please ensure that the phase angle measurement value (IV Phase) at the time of pressing the Phase Zero Adjust button is within the range of -180 to 180 degrees.

・Motor Analysis Option Not Equipped

Please use a PW8001 equipped with the motor analysis option.

Error Code:1

・Unable to Save CSV File

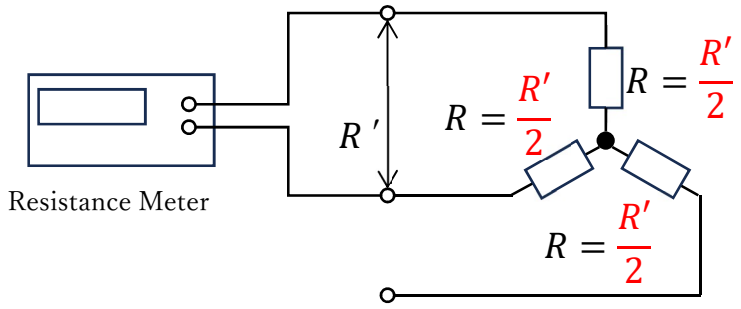
Please check whether the CSV save path is set and whether the path is valid.

6 Appendix

6.1 Measurement of Phase Armature Resistance R

The phase armature resistance R is the winding resistance value per stator phase. Measure the DC resistance between the two terminals of the stator of a star-connected motor and calculate the resistance value R per stator phase.

Calculation of Phase Armature Resistance R

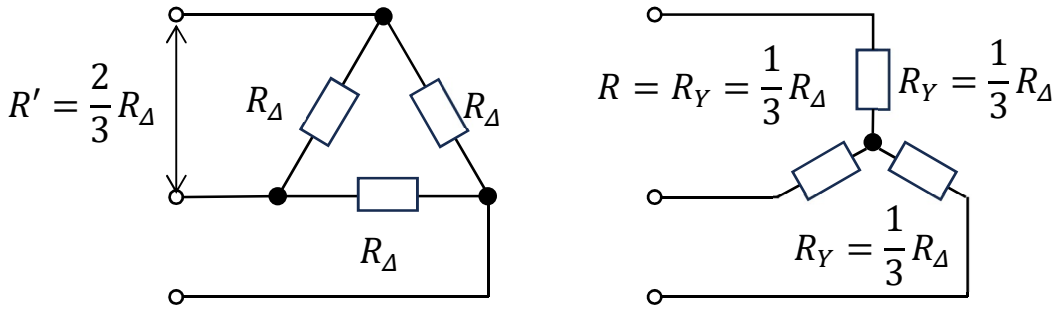


Connect the resistance meter to the motor as shown in the diagram and measure the DC resistance R' [Ω]. Calculate the phase armature resistance R using the following formula.

$$R = \frac{R'}{2} \quad [\Omega]$$

In the case of a delta connection

In the case of a delta connection, the resistance value per stator phase (converted from Δ to Y) is half of the measured resistance value.



Δ-Y connection

$$R = \frac{R'}{2} \quad [\Omega]$$

HIOKI

http://www.hioki.com

HEADQUARTERS
81 Koizumi
Ueda, Nagano 386-1192 Japan

HIOKI EUROPE GmbH
Rudolf-Diesel-Strasse 5
65760 Eschborn, Germany
TEL +49-6173-3234063 FAX +49-6173-3234064
hioki@hioki.eu

Edited and published by HIOKI E.E. CORPORATION
Printed in Japan