



MULTIFUNCTION
DIGITAL LOCK-IN AMPLIFIER

LI5640

INSTRUCTION MANUAL

Introduction

Thank you very much for your purchase of Model LI 5640 Multifunction Digital Lock-in Amplifier. Read "Safety Instructions" on the next page first to ensure safe and proper use of the Model LI5640 Multifunction Digital Lock-in Amplifier.

Warning indications used in this manual

This instruction manual uses the following signal words such as WARNING and CAUTION. Be sure to observe the instruction that follows such signal words for the safety of instrument users and for prevention of instrument damage.



WARNING

This indication gives information to avoid hazard in handling when the user is exposed to life or personal hazard such as electric shock.



CAUTION

This indication gives information to avoid instrument damage in handling.

Safety Instructions

For safe use of the instrument, be sure to observe the following signal words and instructions.

Please note that the NF Corporation will not be responsible for damage that occurred when the user neglected these signal words and instructions and will not indemnify the user for such damage.

This instrument belongs to Insulation Standard Class I Equipment (fitted with protective conductor terminals) as per JIS, IEC and other standards.

- **Be sure to observe the descriptions contained in the instruction manual.**

The instruction manual contains instructions for safe use and operation of this instrument. Be sure to read the manual first before using the instrument.

All warnings contained in the instruction manual aim at preventing hazard that leads to significant accident. They must be strictly observed.

- **Be sure to ground the instrument.**

The instrument causes electric shock if it is not grounded.

Be sure to positively ground the instrument so that the resistance to ground is 100 ohms or less for prevention of electric shock accident.

Connect the three-poled power plug to a three-poled power receptacle that has a protective grounding contact, and the instrument will be automatically grounded.

If a three-pole/two-pole converting adapter is used, be sure to connect the grounding line (green) of the converting adapter to the grounding terminal located close to the receptacle.

- **Confirm the power supply voltage.**

This instrument operates at the power supply voltage given in Section 7.12 "Specifications". Check if the receptacle voltage is adequate to the rated power supply voltage of this instrument before connecting the power supply.

- **Observe the fuse rating.**

Use of inadequate fuse may cause fire and other hazards. Use the fuse with rating specified in Section 7.12 "Specifications".

Before replacing the fuse, be sure to unplug the power supply cord from the receptacle.

- **If any unusual sign is noticed:**

Should the user notice smoke, odor, or noise from the instrument, immediately unplug the power cord and stop the operation.

If any abnormality arises such as the above, keep the instrument inoperable until it is completely repaired and immediately contact the NF representatives.

- **Do not use the instrument in an atmosphere of combustible gases.**

Otherwise, explosion and other hazards may be caused.

- **Do not detach the cover.**

This instrument has high-voltage part inside. Never remove the cover.

Internal inspection must be performed only by trained service technicians familiar with hazard prevention.

- **Do not modify the instrument.**

Never execute any part replacement or modification that is not specified by the NF Corporation.

Doing this may cause unexpected hazard and NF Corporation may not take requested repair.

- **Signal words and Safety Signs**

Signs used on the instrument and in the instruction manual are generally defined as follows:

 **Refer to Sign in the Instruction Manual**

This sign informs the user of a potential hazard, and the signs are given on spots that require user's reference to the instruction manual.

 **WARNING: Warning symbol**


This indication gives information to avoid hazard when the user is exposed to life or personal hazard such as electric shock in handling.


 **CAUTION: Caution symbol**

This indication gives information to avoid instrument damage in handling.

| Indicates that the power switch is turned ON.

○ Indicates that the power switch is turned OFF.

 Indicates that the outer conductor of the connector is connected to the chassis.

 Indicates that the outer conductor of the connector is connected to the signal ground.

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1. General

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1.1 System overview

LI 5640 Multifunction Digital Lock-in Amplifier is a two-phase lock-in amplifier in which high stability is achieved through digital signal processing. The instrument has a basic capability for frequencies ranging from 1mHz to 100kHz and the voltage sensitivity ranging from 2nV to 1V in full scale. In addition, it has a diversity of functions such as measurement of current, higher harmonics and noise density as well as a function to lock to signal without reference signal.

1.2 Features

- **Various functions**

It has diversity of functions such as measurement of current, higher harmonics and noise as well as a function to lock onto signal without reference signal.

- **High stability by digital signal processing**

The instrument operates digitally in major sections such as phase sensitive detector. Therefore, the instrument is mostly free from effects of zero-drift, orthogonality errors and harmonics contained in the input, which are frequent problems in analog systems. It can offer high dynamic reserve (maximum 100dB) without using any analog filter that requires troublesome synchronizing operation and sometimes causes measurement error.

- **Digital signal processing supplies as smooth output as analog signal processing.**

The amplitude resolution of output is 16 bits, and the highest data updating rate of X, Y, R and θ outputs is 256k samples/s. Stepwise changes are not so conspicuous as in analog output. The built-in data memory allows 16k samples/s recording.

- **Quick response**

The shortest time constant is 10 μ s, which allows the user to observe response of approximately 100 μ s.

- **Frequencies as low as 1mHz can be measured**

The instrument can analyze dilatory signals such as thermal response.

Low frequency can be locked onto the reference signal within about two periods.

Provides ripple-less high-speed response by means of a section-averaging filter with integer period.

- **Quick operation response**

It locks onto the reference signal faster than analog systems in the entire frequency range.

In addition, measurement quickly converges to an eventual value because the system responds by estimating the measurement in new setting when any of time constants, sensitivity and other setting is changed.

- **Simple operation panel**

Since buttons are laid out by classified functions and automatic setting functions provide optimal adjustment according to measured signals, the system can be used easily.

- **Analog meters**

Two analog meters help the user grasp the measurements intuitively.

- **External control**

Incorporated GPIB and RS-232 interfaces permit combination with a computer to create an automatic measurement system.

2. Preparation before Use

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2.1 Checking the appearance and accessories

Before use the instrument, read the "Safety Instructions" given in the beginning of the manual first.

Take out components from the package, then check each item.

If you find any abnormal flaw on the instrument visually, or if any part is missing, contact the NF representatives.

If you notice any unusual appearance of the package (scratches, dents etc.), immediately contact the NF representatives too.

- Appearance check

Check the panel face, controls, connectors and others for scratches and dents.

- Accessory check

Accessories of LI5640 are listed in Table 2-1 "Accessories". Check for missing, flaws and other defects.

Table 2-1 Accessories

Instruction manual (LI5640 Instruction Manual)	1
Power cord (7A/125V, 2 m, with three-pole plugs)	1
3-pole/2-pole converting adopter	1
Fuse (time lag, 1A/250V, 5.2 ϕ \times 20mm)	1
Protection cap (for current input connector)	1

The supplied power cord, 3-pole/2-pole converting adapter and fuse can be used at power supply voltage of 100V or 120VAC in Japan. To use the unit at 230VAC, or outside Japan, consult the NF representatives.

To unpack the instrument for transfer or other purposes, place the instrument in a box having appropriate strength and allowance, and fill packing materials that can resist the weight to ensure sufficient protection of the instrument.