7130

Digital Power Meter

7140

Power Analyzer

User Manual

V1.07

MICROTEST

Microtest

Youtube

FaceBook

www.microtest.com.tw

Thank you for choosing MICROTEST products.
MICROTEST is committed to providing our customers with comprehensive instrument information and services. You can always access the latest instrument updates on the MICROTEST website:
https://www.microtest.com.tw/

Important Information:

- Please read the user manual carefully before using the power meter and analyzer.
- For more detailed information, refer to the 7130/ 7140 user manual.
- While every effort has been made to ensure the accuracy of the content in this manual, if you find any unclear or incorrect information, please contact the MICROTEST Sales and Marketing Department. We will be more than happy to assist you.
- The content of this manual is subject to change without prior notice.
- This manual is protected by copyright. Reproduction, reprinting, or modification of its content is prohibited without permission.

Safety Instructions

- **Professional Use:**
  This product is designed for use by personnel with professional knowledge and expertise.
- **Safety Classification:**
  This instrument is classified as an IEC Safety Category 01 device.
- **General Safety Precautions:**
  At all stages of operation, ensure adherence to the following general safety instructions. Failure to operate the instrument in the manner explicitly described in this manual may compromise its protective features. Any consequences arising from non-compliance with these instructions will be the sole responsibility of the customer.
- **Important Information Storage:**
  This manual is an integral part of the product and contains essential information. Please store this manual properly in a secure location near the instrument for easy access when needed. Ensure the manual remains intact and readily available before operating the instrument.

Symbols Used in This Instrument

	Power On
	Power Off
	Power On State
	Power Off State
	This symbol appears on the instrument to indicate that incorrect operation or usage may result in user injury or damage to the instrument. Users are advised to consult the user manual for specific instructions.
WARNING	Indicates actions or conditions that could result in serious or fatal injury to the user. It also provides precautions that can be taken to avoid these hazards.
CAUTION	Indicates actions or conditions that could cause minor injury to the user or damage to the instrument or user data. It also provides precautions that can be taken to prevent these issues.
	Electric Shock Hazard
	Earth Ground Point for AC Mains
	**Do Not Dispose of Electronic Equipment as Unclassified Municipal Waste** Use specialized collection facilities or contact the supplier from whom this instrument was purchased
	Indicates Compliance with EU Directives
NOTE	Provides Useful Information and Tips

Safety Guidelines

1. **Intended Use Only**
   This instrument is designed as a power measurement device capable of measuring items such as voltage, current, and power. Do not use this instrument for any purposes other than power measurement. To prevent electric shock or fire, always use the dedicated power cord. The main power plug must be connected to an outlet with a protective ground. Do not use extension cords without a protective ground, and avoid sharing this power cord with other instruments. Ensure that the power supply voltage matches the instrument's rated voltage and does not exceed the maximum voltage range of the power cord.
2. **Flammable Environments**
   Do not operate the instrument in environments containing flammable gases or vapors, as this poses a significant danger.
3. **Input Limits**
   Ensure that voltage input does not exceed AC 800V and current input does not exceed 30A.
4. **Instrument Care**
   Do not place heavy objects on the instrument, and avoid exposing it to static discharge.
5. **Accessories**
   Use only the dedicated 7140 and 7130 accessories. Do not use accessories with exposed or damaged parts.
6. **Measurement Category**
   This instrument is classified as Category II. Do not use it for measurements in Category III or IV environments.
7. **Maintenance and Repairs**
   If the instrument malfunctions, return it to the manufacturer for professional repair services.
8. **Emergency Response**
   In case of an emergency, you can immediately disconnect the power cord.

Applicable Standards

- **RoHS Directive**: (2015/863/EU)
- **Safety**:
  - EN 61010-1:2010+A1:2019
  - EN IEC 61010-2-030:2021
- **UKCA**:
  - BS EN 61010-1:2010+A1:2019
  - BS EN 61010-2-030:2021+A11:2021
- **EMC**:
  - EN 61326-1:2021*
  - EN 61326-2-1:2021*
- **UKCA**:
  - BS EN IEC 61326-1:2021*
  - BS EN IEC 61326-2-1:2021*
- **EMC**:
  - EN IEC 61000-3-2:2019+A1:2021*
  - EN 61000-3-3:2013+A1:2017+A2:2021*
- **UKCA**:
  - BS EN IEC 61000-3-2:2019+A1:2021*
  - BS EN 61000-3-3:2013+A2:2021*
- **EMC**:
  - EN 55011:2016+A2:2021
- **UKCA**:
  - BS EN 55011:2016+A2:2021

Measurement Category and Requirements

The 7140 and 7130 belong to **Measurement Category II** with a voltage rating of 800V.

※ **Measurement Category II** is applicable for measurements performed directly on circuits connected to low-voltage installations.

Ambient Conditions

1. **Location**:
   Indoors, without direct sunlight, dust-free, minimal conductive pollution, and at an altitude below 2000 m, Pollution Degree 2.
2. **Operating Ambient Temperature and Humidity Range**:
   13°C to 40°C, with humidity below 80% RH (non-condensing).
3. **Storage Ambient Temperature and Humidity Range**:
   -10°C to 50°C, with humidity below 80% RH (non-condensing).

To Achieve the Most Accurate Measurement Results

Please strictly adhere to the following guidelines when using the instrument under specific environmental conditions:

1. **Optimal Temperature**:
   The optimal operating temperature should be maintained within the range of **23±5°C**. This temperature range ensures the instrument achieves an accuracy of **0.05% of reading + 0.05% of range**.
2. **Temperature Coefficient Correction**:
   If you must operate the instrument in environments with temperatures between **13°C and 40°C**, and the temperature deviates from the optimal range, a temperature coefficient correction must be applied to ensure consistent measurement results under varying temperature conditions.
   - **Temperature Coefficient**: When the temperature is **5–18°C** or **28–40°C**, add ±0.03%/°C to the reading.
3. **Anti-Static Measures in Low-Humidity Environments**:
   If the instrument is installed in an environment with humidity below **30%**, use anti-static mats or similar measures to prevent electrostatic disturbances.

Cleaning the Instrument

- **Disconnect the power cord** before cleaning.
- It is recommended to use a soft cloth, microfiber cloth, or soft brush for cleaning. Perform damp wiping using a mixture of mild detergent and water. Do not spray any liquid directly onto the instrument.
- Avoid using organic solvents, such as acetone, methanol, or acetic acid, or any chemicals with strong chemical components.

Content

Chapter 1 Product Overview 9

1.1 Features 9
1.2 Applications 10
1.3 Advantages and Value 11
1.4 General Specifications 12
1.5 Basic Measurement Specifications 13
1.6 About Calibration 24
1.7 Maintenance & Repair 24
1.8 Transportation Guidelines 24

Chapter 2 Product Introduction 25

2.1 Package Contents & Accessories 26
2.2 Front Panel 27
2.3 Rear panel 28
2.4 Functional Block Diagram 30
2.5 Handle and Foot pads 31
2.6 Power-On Procedure 31
2.7 Quick Start: How to Connect and Measure 33
2.8 F71201 Test Box Internal Wiring Diagram 35

Chapter 3 Operation Guide 36

3.1 Zero Calibration 37
3.2 Icon Descriptions 38
3.3 METER Mode Overview 39
3.4 Integrator Mode Overview 51
3.5 Monitor Mode Overview 56
3.5.1 Wave Mode 56
3.5.2 Trend Mode (Available Only on 7140) 62
3.6 Harmonic Mode Overview 68
3.7 Comparator Mode Overview 74
3.8 File Mode 77
3.9 Setup Menu Overview 80
3.10 System Page Overview 87
3.11 Signal I/O Overview 95
3.12 RS-232 Interface Overview 97
3.13 USB Connector 99

3.14 LAN Port Specifications 100

Revision History 101

Chapter 1 Product Overview

This section provides a detailed introduction to the main features and application areas of the 7140 and 7130, highlighting their advantages and value. Comprehensive technical specifications, including dimensions, weight, and power requirements, will be provided. Additionally, important information regarding calibration and maintenance requirements will be outlined to ensure your full understanding of the product. Finally, the accessories and package contents included with the 7140 and 7130 will be listed, giving you a clear understanding of the product's components.

1.1 Features

The below features vary between the 7140 and 7130 models

Model	7140	7130
Test Bandwidth	DC, 0.2Hz ~ 100KHz	DC, 0.2Hz ~ 100KHz
Basic Measurement Accuracy	±0.05%	±0.05%
Sample Rate	500kS/s	500kS/s
Numeric Display	●	●
Harmonic Analysis	100th order	50th order
Voltage and Current Waveform	●	●
Power Trend Graph	●	-
Harmonic Histogram	●	-

1. **High Watt Resolution**:
   Achieves a watt resolution of 1mW with an accuracy of 0.05% of reading + 0.05% of range.
2. **Designed for Single-Phase Power Applications**:
   Supports up to AC 800V and 30A, ideal for residential power applications.
3. **Low Standby Power Measurement**:
   Equipped with an independent integrator display for monitoring energy storage and consumption in power systems.
4. **External Current Transformer (CT) Support**:
   Supports external DC/AC current transformers with BNC signal input,

covering a range of 0.5V to 10V.

5. **High-Spec BNC Isolation Design**:
   Features a rare fully-isolated BNC interface to eliminate the risk of electric shock.
6. **Built-in Comparators**:
   Includes 8 independent comparators for real-time upper and lower limit data analysis.
7. **Multiple Communication Interfaces**:
   Offers USB, LAN, and RS232-C interfaces for versatile communication options.
8. **Comprehensive Analysis Units (7140 only)**:
   The 7140 features independent Meter, Integrator, Monitor, and Harmonic computation units, enabling simultaneous analysis such as harmonic measurement and integration.
9. **Full Harmonic Analysis (7140 only)**:
   Supports harmonic analysis up to the 100th order within a frequency range of 20Hz to 480Hz.
10. **Harmonic Measurement Modes (7140 only)**:
    Provides List Mode and Histogram Mode, making it convenient for measuring harmonics in various electrical devices.
11. **Oscilloscope Functionality (7140 only)**: Displays voltage and current waveforms in real time with exceptional clarity.

1.2 Applications

Power analyzers are primarily used in the following areas:

1. **Chipset Standby Power**:
   Used to measure power consumption in standby and operational modes of chipsets operating at **1.5V to 3.3V**.
2. **Residential and Commercial Buildings**:
   Used to monitor and measure energy consumption in homes, shops, offices, and other locations, aiding in energy usage management and cost control.
3. **Industrial Applications**:
   Used to monitor and control energy consumption in single-phase motors, single-phase equipment, and production lines.
4. **Solar and Wind Energy Systems**:
   In distributed energy systems, single-phase power meters are used to measure and monitor the power generation of solar and wind energy

systems and their integration with the grid.

5. **Commercial Equipment**:
   Used for monitoring energy consumption of various commercial devices such as vending machines, refrigeration units, and office equipment.
6. **Lighting and LED Systems**:
   Used to measure energy usage in lighting systems, LED fixtures, and other illumination equipment, helping improve energy efficiency.
7. **Household Appliances**:
   Used to monitor energy consumption of home appliances such as refrigerators, washing machines, and air conditioners, enabling users to manage energy costs effectively.

1.3 Advantages and Value

The MICROTEST 7140 and 7130 feature a Meter Mode with 27 measurement items, including RMS voltage and current, DC voltage and current, P (active power), Vmn (minimum voltage), and more. Each power analyzer computation unit is equipped with an independent 64-bit integrator, allowing users to perform harmonic calculations and watt-hour integration simultaneously. This overcomes the limitations of older power meters that could not measure power and perform harmonic analysis simultaneously.

The flexible LCD test interface of the 7140 and 7130 allows users to customize the display layout to meet various requirements. Additionally, the 7140 includes a Trend Function, which enables long-term monitoring of power systems, allowing you to track and record energy usage effectively.

To enhance usability, the 7140 and 7130 are equipped with 8 real-time comparators, which can be used for judgment functions. These features make the 7140 a powerful and versatile power analyzer capable of handling a wide range of AC/DC power testing and monitoring needs.

The 7140 also offers a Wave Function under the Monitor screen, which can be used as a voltage and current oscilloscope, providing real-time observation of voltage-current phase angles. The Trend Function under the Monitor screen supports long-term monitoring of power systems, enabling comprehensive power electronics analysis and measurement.

1.4 General Specifications

Basic Measurement Mode Specifications	
Measurement Basis	Measurements are conducted using voltage or current (non-inverter), achieving a stable fundamental frequency with variations within 1%
Frequency Range	Frequency Range
Data Length	Dual 4096x16 RAM for voltage & current
ADC Data Format	16 bits
Sampling Rate	Maximum/Base Sampling Rate: 500kS/s
Computation Precision	IEEE-754 32-bit floating point
Frequency Filters	500Hz cut-off, 100MHz digital chip filter
Signal Filters	Butterworth digital filters: 500Hz, 5kHz, 100kHz (-3dB)
Frequency Acquisition Method	Voltage/Current: 100MHz base frequency dynamic digital frequency counter chip
Phase Lead Detection:	Current-based detection with analog/digital hybrid sensing (error within 5°)

Zero Level Specifications (CF3)					
Voltage			**Current**		
	AC(Noise)	DC(Offset)		AC(Noise)	DC(Offset)
15V	<0.045V	±0.01V	0.005A	<0.00005A	±0.00003A
30V	<0.045V	±0.02V	0.01A	<0.00005A	±0.00003A
60V	<0.045V	±0.03V	0.02A	<0.00005A	±0.00003A
150V	<0.1V	±0.1V	0.05A	<0.00005A	±0.00003A
300V	<0.3V	±0.3V	0.1A	<0.00008A	±0.00004A
600V	<0.6V	±0.6V	0.2A	<0.0008A	±0.0003A
800V	<0.6V	±0.6V	0.5A	<0.005A	±0.0005A
			1A	<0.005A	±0.0005A
			2A	<0.008A	±0.0005A
			5A	<0.008A	±0.0005A
			10A	<0.008A	±0.003A
			20A	<0.008A	±0.003A

Additional Specification Conditions

- Measurements are conducted after a 30-minute warm-up at a stable ambient temperature of 23°C ± 5°C.
- Voltage offset is measured with V+ and V- shorted using a 5cm short wire.
- Current offset is measured with I+ and I- open-circuited.

- AC voltage/current measurements are conducted with the Line-Filter enabled.
- Zero Calibration is required when the ambient temperature approaches 18°C or 28°C

CAT II Rating Specifications (50 Hz / 60 Hz)					
	Voltage (Red)	**Voltage (Black)**	**Current (Red)**	**Current (Black)**	**Chassis Ground**
Voltage (Red)	---	800V RMS	800V RMS	800V RMS	800V RMS
Voltage (Black)	800V RMS	---	800V RMS	800V RMS	800V RMS
Current (Red)	800V RMS	800V RMS	---	800V RMS	800V RMS
Current (Black)	800V RMS	800V RMS	800V RMS	---	800V RMS
Chassis Ground	800V RMS	800V RMS	800V RMS	800V RMS	---

1.5 Basic Measurement Specifications

Accuracy is a key concept in evaluating the precision of a measurement value, and it is typically defined as follows:

- **Full Scale (f.s.):**
  Refers to the maximum numerical range of the current range used during the measurement process.

- **Reading (rdg.):**
  The actual value observed during measurement, as displayed by the measuring instrument.

- **Digital Resolution (dgt.):**
  Represents the smallest display unit of a digital measuring instrument, typically the smallest discernible value, often denoted as "1".

Voltage (V)	
Ranges (Auto or Manual)	15V, 30V, 60V, 150V, 300V, 600V
Operating Principle	True RMS or mean value rectification
Frequency Range	DC and 0.2Hz to 100KHz

AC Accuracy (23°C±5°C)	
0.2 Hz≦f<45 Hz	± (0.1% of reading + 0.1% of range)
45 Hz≦f≦66 Hz	± (0.05% of reading + 0.05 % of range) [Basic Accuracy]
66 Hz<f≦1 kHz	± (0.1% of reading + 0.1 % of range)
1 kHz<f≦10 kHz	± (0.03*f % of reading + 0.2 % of range) f in kHz
10 kHz<f≦100 kHz	± (0.4 % of reading + 0.4 % of range) ±[{0.04*(f–10)} % of reading]
AC Permissible Error Conditions	
Signal Filter Error	For frequencies between 45Hz and 66Hz: Add **0.2% of reading**. For frequencies below 45Hz: Add **0.5% of reading**
CF 6 Error	Add ± 0.05% of range
Temperature Influence	Add ±0.03% of reading/°C in the range 13°C to 18°C or 28°C to 40°C
Post-Calibration Error (Beyond 12 Months)	Add ± (0.05% of reading)
DC Accuracy (23°C±5°C)	
15V	{±0.05% reading ± 0.05% of range}
30V	{±0.05% reading ± 0.05% of range}
60V	{±0.05% reading ± 0.05% of range}
150V	{±0.05% reading ± 0.05% of range}
300V	{±0.05% reading ± 0.05% of range}
600V	{±0.05% reading ± 0.05% of range}
Maximum Input	800V RMS/1132Vpk
Input impedance	1.66M ohm on all ranges

Current (A)			
Ranges (Auto or Manual) (12 ranges)	0.005A (5.0000mA)	0.01A (10.000mA)	0.02A (20.000mA)
	0.05A (50.000mA)	0.1A (100.00mA)	0.2A (200.00mA)
	0.5A (500.00mA)	1A (1.0000A)	2A (2.0000A)
	5A (5.0000A)	10A (10.000A)	20A (20.000A)
External Current sensor BNC input (5 ranges)	0.5V、1V、2V、5V、10V		
Operating Principle	True RMS or mean value rectification		
Frequency Range	DC and 0.2Hz to 100KHz		

AC Accuracy (23°C±5°C)	
0.2Hz≦f<45 Hz	± (0.1% of reading + 0.1% of range)
45 Hz≦f≦66 Hz	± (0.05% of reading + 0.05 % of range) [Basic Accuracy]
66 Hz<f≦1 kHz	± (0.1% of reading + 0.1 % of range)
1 kHz<f≦10 kHz	± ((0.03 * f) % of reading + 0.2% of range)
10 kHz<f≦100 kHz	± (0.4 % of reading + 0.4% of range) ±[{0.04*(f–10)} % of reading]
AC Permissible Error Conditions	
Signal Filter Error	For frequencies between 45Hz and 66Hz: Add ±0.2% of reading. For frequencies below 45Hz: Add ±0.5% of reading.
CF 6 Error	Add ±0.08% of range.
Temperature Influence (AC)	Add ±0.03% of reading/°C for temperatures in the range **5°C to 18°C** or **28°C to 40°C**.
BNC Input Error	Add ± (0.05% of reading + 0.05% of range).
Current Range Error	**1A/ 2A/ 5A:** Add ± (0.1% of Range) **10A/ 20A:** Add ± (0.05 % of reading + 0.25 % of range)
DC Accuracy (23°C±5°C)	
0.005A	± {0.05% of reading + 0.05% of range}
0.01A	± {0.05% of reading + 0.05% of range}
0.02A	± {0.05% of reading + 0.05% of range}
0.05A	± {0.05% of reading + 0.05% of range}
0.1A	± {0.05% of reading + 0.05% of range}
0.2A	± {0.05% of reading + 0.05% of range}
0.5A	± {0.05% of reading + 0.05% of range}
1.0A	± {0.05% of reading + 0.15% of range}
2.0A	± {0.05% of reading + 0.15% of range}
5.0A	± {0.05% of reading + 0.15% of range}
10A	± {0.1% of reading + 0.3% of range}
20A	± {0.1% of reading + 0.3% of range}
Input Impedance	**For 0.5A ~ 20A Ranges**: 0.005 ohm **For 0.005A ~ 0.2A Ranges**: 0.5 ohm **Additional Wire Impedance**: +0.01 ohm (applies to all ranges)
DC Permissible Error Conditions	
Post-Calibration Error: (Beyond 12 Months)	Add ± (0.05% of reading)
Note During measurement, ensure the device is placed in a well-ventilated area. Avoid using it in enclosed or poorly ventilated environments to achieve the most accurate readings.	

Power (P)	
DC Accuracy (23°C±5°C)	
DC accuracy	±0.05% reading ± 0.05% of range
AC Accuracy (23°C±5°C)	

Frequency Range	Accuracy
0.2 Hz≦f<45 Hz	± (0.2% of reading + 0.2% of range)
45 Hz≦f≦66 Hz	± (0.05% of reading + 0.05% of range)
66 Hz<f≦1 kHz	± (0.1% of reading + 0.1 % of range)
1 kHz<f≦10 kHz	± (0.1% of reading + 0.2 % of range) ± [{0.06*(f)} % of reading]
10 kHz<f≦100 kHz	± (0.4 % of reading + 0.4 % of range) ±[{0.07*(f–10)} % of reading]
Permissible Error Conditions(23°C±5°C)	
Signal Filter Error (AC):	For frequencies 45 Hz to 66 Hz: Add 0.3% of reading. For frequencies outside 45 Hz to 66 Hz: Add 1% of reading.
CF 6 Error (DC):	Add range tolerance * 2
BNC Input Error:	Add ± (0.05% of reading + 0.05% of range).
Current Range Error	**1A/ 2A/ 5A:** Add ± (0.1% of Range) **10A/ 20A:** Add ± (0.05 % of reading + 0.25 % of range)
Phase Error Impact on Power Accuracy	
Power Factor (PF) = 0	**For 45 Hz ≤ f ≤ 66 Hz:** Add ±1.0% of S. **For f < 45 Hz or f > 66 Hz:** Add ± {(0.1 + 0.15 * f) % of S} for frequencies up to 100 kHz as reference data. ● **Note: The unit for frequency (f) is kHz.**
When 0 < PF ≤ 1:	**For 45 Hz ≤ f ≤ 66 Hz:** Add ± power reading * {tan(θ) * 0.5} %. **For f < 45 Hz or f > 66 Hz:** Add ± power reading * {tan(θ) * (0.5 * f + 0.2)} %. ● **θ: phase angle of voltage and current**
Post-Calibration Error: (Beyond 12 Months)	Add ± (0.08% of reading).

AC & DC Power Ranges (Auto or Manual): 0.001W to 24kW
This is based on 100% of the voltage range.
The power (P) resolution depends on the current level.

Crest Factor 3

Voltage Range	Current range	CF3 Range	Resolution
15V	0.005~20A	0.075~300W	0.001mW/0.01W
30V	0.005~20A	0.15~600W	0.001mW/0.01W
60V	0.005~20A	0.30~1200W	0.01mW/0.1W
150V	0.005~20A	0.75~3000W	0.01mW/0.1W
300V	0.005~20A	1.5~6000W	0.01mW/0.1W
600V	0.005~20A	3~12000W	0.1mW/1W

Crest Factor 6

Voltage Range	Current range	CF6 Range	Resolution
7.5V	0.0025~10A	0.01875~75W	0.001mW/0.01W
15V	0.0025~10A	0.0375~150W	0.001mW/0.01W
30V	0.0025~10A	0.075~300W	0.001mW/0.01W
75V	0.0025~10A	0.1875~750W	0.01mW/0.1W
150V	0.0025~10A	0.375~1500W	0.01mW/0.1W

Power range with CF3 setting(W) Typical value

Range	0.005A	0.01A	0.02A	0.05A	0.1A	0.2A	0.5A	2A	5A	10A	20A

15V	0.075	0.15	0.3	0.75	1.5	3	7.5	30	75	150	300
30V	0.15	0.3	0.6	1.5	3	6	15	60	150	300	600
60V	0.3	0.6	1.2	3	6	12	30	120	300	600	1.2K
150V	0.75	1.5	3	7.5	15	30	75	300	750	1.5K	3K
300V	1.5	3	6	15	30	60	150	600	1.5k	3K	6K
600V	3	6	12	30	60	120	300	1.2k	3k	6K	12k
Power range with CF6 setting(W) Typical value											
Range	**0.0025A**	**0.005A**	**0.01A**	**0.025A**	**0.05A**	**0.1A**	**0.25A**	**0.5A**	**1A**	**2.5A**	**5A**
7.5V	0.01875	0.0375	0.075	0.1875	0.375	0.75	1.875	3.75	7.5	18.75	37.5
15V	0.0375	0.075	0.15	0.375	0.75	1.5	3.75	7.5	15	37.5	75
30V	0.075	0.15	0.3	0.75	1.5	3	7.5	15	30	75	150
75V	0.1875	0.375	0.75	1.875	3.75	7.5	18.75	37.5	75	187.5	375
150V	0.375	0.75	1.5	3.75	7.5	15	37.5	75	150	375	750
300V	0.75	1.5	3	7.5	15	30	75	150	300	750	1500

Total Harmonic Distortion (THD)	
Fundamental Frequency Range (Auto-Tuned)	20Hz ~ 480Hz
Measuring Input:	Voltage or Current

Frequency (Hz)	
Operating Principle:	Digital Frequency Detector
Accuracy (at 23°C ± 5°C):	±0.05% of reading
Measuring Input:	Voltage or Current

Peak Voltage (V+PK, V-PK, Vpp)	
Ranges (Auto or Manual) (6 Ranges)	15V(30V), 30V(60V), 60V(120V), 150V(300V), 300V(600V), 600V(1132V)
Frequency Range	0.2Hz to 100kHz
Accuracy (at 23°C ± 5°C)	±3% of reading ±3% of range ± (0.01 * F kHz) %

Peak Current (I+PK, I-PK, Ipp)	
Ranges (Auto or Manual) (12 Ranges)	0.005A(0.015A), 0.01A(0.030A), 0.02A(0.06A), 0.05A(0.15A), 0.1A(0.3A), 0.2A(0.6A), 0.5A(1.5A), 1A(3A), 2A(6A), 5A(15A), 10A(30A), 20A(66A)
Frequency Range	0.2Hz to 100kHz
Accuracy	±3% of reading ±3% of range ± (0.2 * F kHz) %

(at 23°C ± 5°C)	

Crest Factor (CF)	
Computation	Peak / RMS
Current Input	CF3: 1.0 ~ 3.0 CF6: 1.0 ~ 6.0
Voltage Input	CF2: 1.0 ~ 2.0

Inrush Current	
Ranges (Auto or Manual) (12 Ranges)	Up to DC 66A pk (20A Range)
Accuracy (at 23°C ± 5°C)	±5% of the selected range

Power Factor (PF)	
Ranges	0.00000 to ±1.00000
Computation	PF=P/S, (P: Active Power, S: Apparent Power)
Accuracy (at 23°C ± 5°C)	PF Error = P error * S error

Phase Angle (DEG)	
Ranges	0.00 to ±180.00
Computation	DEG=ACOS(PF), with lead/lag detection.

Apparent Power (S)	
Ranges	S Range
Computation	S=Vrms * Arms
Accuracy (at 23°C ± 5°C)	When power factor (PF) = 0 **For 45 Hz<f<66 Hz:** Add ±0.2% of VA. **For frequencies up to 100 kHz as reference data:** Add ±(0.2+0.2*f)% of VA{(0.2 + 0.2*f)%, of VA, where f is in kHz.
Reactive Power (Q)	
Ranges	Q Range
Computation	$Q = \sqrt{S^2 - P^2}$
Accuracy (at 23°C ± 5°C)	Q Accuracy = S Accuracy * PF Accuracy

Frequency Accuracy and Sensitivity	
Frequency Range	0.2Hz ~ 100kHz

Accuracy	**0.05% of reading** (Standard sine wave signal must reach 30% of the range).
Sensitivity	**Condition:** Voltage signal must reach 30% of the selected voltage range. Current signal must reach 30% of the selected current range.

Remarks:

- Accuracy is guaranteed only for sine wave signals.
- For the same DUT (Device Under Test), measured frequencies may vary depending on the selected current range. This is particularly relevant for **inverter, high-frequency, or fluctuating loads**.

Minimum Measurable Signal Frequency Range at Different Update Rates		
Update Time (Seconds)	Minimum Frequency	Maximum Frequency
0.05	40 Hz	100 kHz
0.1	20 Hz	
0.2	10 Hz	
0.25	8 Hz	
0.5	5 Hz	
1	2 Hz	
2	1.5 Hz	
5	0.5 Hz	
10	0.2 Hz	

Explanation:
When either the voltage or current signal frequency falls below the minimum measurable frequency corresponding to each update time, the accuracy of all measured values is not guaranteed.

DC Range Specifications in CF3					
Voltage Range	**Minimum Voltage**	**Maximum Voltage**	**Current Range**	**Minimum Current**	**Maximum Current**
15V	0.15V	30V	0.005A	10uA	15mA
30V	0.3V	60V	0.01A	10uA	30mA
60V	0.6V	120V	0.02A	10uA	60mA
150V	1.5V	300V	0.05A	10uA	150mA
300V	3.0V	600V	0.1A	100uA	0.3A
600V	6.0V	800V	0.2A	100uA	0.6A
			0.5A	1mA	1.5A
			1A	1mA	3A
			2A	1mA	6A
			5A	10mA	15A

			10A	10mA	30A
			20A	10mA	30A
DC Range Specifications in CF6					
Voltage Range	**Minimum Voltage**	**Maximum Voltage**	**Current Range**	**Minimum Current**	**Maximum Current**
7.5V	0.3V	30V	0.0025A	10uA	15mA
15V	0.6V	60V	0.005A	10uA	30mA
30V	1.2V	120V	0.01A	10uA	60mA
75V	3.0V	300V	0.025A	10uA	150mA
150V	6.0V	600V	0.05A	100uA	0.3A
300V	6.0V	800V	0.1A	100uA	0.6A
			0.25A	1mA	1.5A
			0.5A	1mA	3A
			1A	1mA	6A
			2.5A	10mA	15A
			5A	10mA	30A
			10A	10mA	30A

- This table provides reference values for the stable measurement range across different voltage and current ranges.
- The signal source used is Fluke 5522A, with the connection cable between the calibrator and the power meter not exceeding 0.5 meters.
- The power analyzer and signal source operate under standard 115V, 60Hz mains voltage conditions, with total harmonic distortion (THD) below 3%.
- Measurements were conducted in an environment with a temperature of 23°C and a relative humidity of 70%.

Additional Specifications:

- When operating below 10% of the selected range, it is recommended to enable the 500Hz Line Filter for improved measurement stability. If the signal frequency is higher, adjust the filter bandwidth accordingly to meet different application requirements.

AC Range Specifications in CF3					
Voltage Range	**Minimum Voltage**	**Maximum Voltage**	**Current Range**	**Minimum Current**	**Maximum Current**
15V	0.15V	21V	0.005A	50uA	11mA
30V	0.3V	42V	0.01A	100uA	22mA
60V	0.6V	84V	0.02A	200uA	44mA
150V	1.5V	212V	0.05A	500uA	0.11A
300V	3.0V	424V	0.1A	1mA	0.22A
600V	6.0V	800V	0.2A	2mA	0.44A

	0.5A	5mA	1.1A
	1A	10mA	2.2A
	2A	10mA	4.4A
	5A	10mA	11A
	10A	10mA	22A
	20A	10mA	30A

AC Range Specifications in CF6					
Voltage Range	**Minimum Voltage**	**Maximum Voltage**	**Current Range**	**Minimum Current**	**Maximum Current**
7.5V	0.3V	21V	0.0025A	50uA	11mA
15V	0.6V	42V	0.005A	100uA	22mA
30V	1.2V	84V	0.01A	200uA	44mA
75V	3.0V	212V	0.025A	500uA	0.11A
150V	6.0V	424V	0.05A	1mA	0.22A
300V	6.0V	800V	0.1A	2mA	0.44A
			0.25A	5mA	1.1A
			0.5A	10mA	2.2A
			1A	10mA	4.4A
			2.5A	10mA	11A
			5A	10mA	22A
			10A	10mA	30A

Additional Specifications:

a. The verification of the AC current ranges listed above is based on the Fluke 5522A calibrator. When the output current reaches 70% of the rated current limit of the 2.99999A range, the low-frequency compensation (LCOMP) function is applied to correct for high-frequency noise present in the output. Additionally, the wiring of the current loop should be kept as short as possible and should not exceed 30 cm.

b. All AC voltage and current ranges are verified using a standard AC sine wave signal.

c. When operating below 10% of the measurement range, if the signal frequency is 50Hz/60Hz, it is recommended to enable the 500Hz Line Filter. If the user's signal frequency is higher, the filter bandwidth should be adjusted accordingly to meet different application requirements.

<table>
<tr><th colspan="4">IEC 61000-4-7 Harmonic Analysis Function Specification</th></tr>
<tr><td>Analysis Basis</td><td colspan="3">Harmonic analysis is performed by obtaining a stable fundamental frequency from voltage or current signals (non-variable frequency sources) with a fluctuation of within 1%.</td></tr>
<tr><td>Frequency Range</td><td colspan="3">20 Hz to 480 Hz</td></tr>
<tr><td>DFT Data Length</td><td>4096</td><td colspan="2" rowspan="2">DFT stands for Discrete Fourier Transform, a mathematical technique used to analyze the frequency components of a signal.</td></tr>
<tr><td>DFT Date Format</td><td>32bit</td></tr>
<tr><td>Measurement Items</td><td colspan="3">● Total Harmonic Distortion (THD) for Orders 1-100
● Voltage & Current Harmonic Components for Orders 1-100:
Voltage Harmonics: V[n]
Current Harmonics: A[n]
● Voltage & Current Harmonic Distortion Percentage for Orders 1-100:
Voltage Distortion: V[n%]
Current Distortion: A[n%]
● Power Harmonics for Orders 1-100:
Harmonic Power: W[n]
Power Distortion Percentage: W[n%]
● Phase Angle between Voltage & Current for Orders 1-100:
Harmonic Phase Angle: DEG[n]
● Voltage RMS (Vrms)
● Current RMS (Irms)
● Active Power (P)
● Power Factor (PF)</td></tr>
<tr><td rowspan="2">Sampling Specifications & Harmonic Analysis Order</td><td>Fundamental Frequency</td><td>Sampling Rate</td><td>Harmonic Analysis Order</td></tr>
<tr><td>20 ≤ F < 480</td><td>Fundamental Frequency * 1024</td><td>2nd to 100th harmonic</td></tr>
</table>

Explanation:

Many power analyzers on the market set a high fundamental frequency range for harmonic measurement, often extending up to 1200 Hz.

However, such designs often overlook harmonic analysis capabilities when the fundamental frequency is below 500 Hz. Some devices may even fail to perform reliable THD analysis beyond the 25th harmonic in these lower fundamental frequency ranges.

To address this limitation, the 7140 significantly enhances performance through:

1. Increasing the sampling rate to 1024 times the fundamental frequency.
2. Implementing a traditional Discrete Fourier Transform (DFT) algorithm.
3. Utilizing dedicated hardware acceleration with high-performance chipsets.

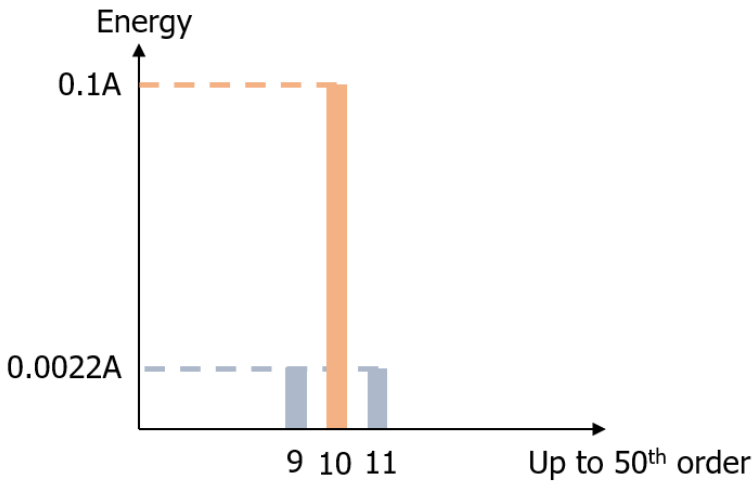
This advanced combination ensures accurate harmonic analysis from the 2nd to the 100th harmonic for fundamental frequencies up to 480 Hz, allowing for a more comprehensive assessment of high-frequency current loading characteristics in electrical devices.

<table>
<tr><td colspan="4">The 7140 is one of the few products on the market capable of achieving this level of performance.</td></tr>
<tr><td>Accuracy</td><td colspan="3">

General Accuracy Adjustment:
Add ±0.2% of range to the normal measurement accuracy.
Adjacent Harmonic Component Influence:
For an nth-order harmonic component input, an additional error term is introduced to its adjacent harmonics:
(nth order reading) * (10/n + 1) %
This additional error affects both the (n-1)th order and (n+1)th order harmonic readings.

Example Calculation:

Input Signal:
Voltage: 10V @ 60Hz
Current: 0.1A @ 600Hz (10th harmonic)
Sinusoidal waveform
10th Order Harmonic Current Measurement: 0.1A
Adjacent Harmonic Current Impact Calculation:
9th order maximum allowable value:
0.1A * (10/10+1)) % = 0.0018A~0.0022A
11th order maximum allowable value:
0.1A * (10/10+1)) % = 0.0018A~0.0022A



</td></tr>
<tr><td rowspan="5">Harmonic Analysis
Compatible with Line Filter Specifications</td><td>Fundamental Frequency</td><td>-3dB Frequency</td><td>Cutoff Harmonic Order (~0.707 Attenuation)</td></tr>
<tr><td>50Hz</td><td>~500HZ</td><td>~10TH</td></tr>
<tr><td>60Hz</td><td>~500HZ</td><td>~8TH</td></tr>
<tr><td>100Hz</td><td>~500HZ</td><td>~5TH</td></tr>
<tr><td>250Hz</td><td>~500HZ</td><td>~2TH</td></tr>
<tr><td>A/D Conversion Rate</td><td colspan="3">20,480 SPS (20 Hz) ~ 491,512 SPS (480 Hz)</td></tr>
<tr><td>A/D Resolution</td><td colspan="3">16 Bits</td></tr>
<tr><td>DFT Conversion Resolution</td><td colspan="3">32 Bits</td></tr>
</table>

Panel Update Rate	0.1 s ~ 60 mins
Common Mode Voltage Specification	
Test Method	Short-circuit the **V+** and **V-** input terminals, leave **I+** and **I-** terminals open, and apply an AC voltage between the **CASE enclosure** and **V+** for testing.
Voltage Specification	$< \left(\frac{0.003\% * F * V}{1000}\right)$, where **F** is in kHz and V is applied voltage.
Current Specification	$< \left(\frac{0.0001\% * F * V}{100000}\right)$, where **F** is in kHz and V is applied voltage.

Voltage & Current Channel Crosstalk Specification	
Current Test Method	Apply voltage to **V+** and **V-** input terminals while leaving **I+** and **I-** terminals open.
Voltage Influence on Current Specification	$< \left(\frac{0.0005\% * F * V}{100}\right)$, where **F** is in kHz and V is applied voltage.
Voltage Test Method	Apply current to **I+** and **I-** input terminals while shorting **V+** and **V-** with a 5 cm wire.
Current Influence on Voltage Specification	$< (0.0005\% * F * \text{Applied Current})$, where **F** is in kHz.

Operating & Storage Environment	
Storage Temperature	-10°C to 50°C
Operating Temperature	23°C ±5°C
Operating Humidity	≤ 80% RH

1.6 About Calibration

To ensure the measuring instrument obtains accurate measurement results within the specified accuracy range, it is recommended to perform calibration once per year.

1.7 Maintenance & Repair

If the instrument requires repair, please contact **MICROTEST** for service. Do not attempt to disassemble or replace any components yourself, as this may cause hazards.

1.8 Transportation Guidelines

To ensure the safety of the instrument during transportation, please follow these precautions:

- Before shipping, **remove all accessories and optional components** from the instrument to prevent damage.
- Use the **original packaging materials** provided at the time of delivery and ensure **double packaging** for extra protection. Please note that we cannot be held responsible for any damage incurred during transportation.
- If the instrument requires servicing, please provide a **clear description of the issue** when sending it for repair. This will help us offer better support.

Properly maintaining your instrument ensures its safety during transportation and servicing.

Chapter 2 Product Introduction

This chapter provides a comprehensive introduction to the **7140 and 7130 instruments**, covering both the **front panel and rear panel**. It offers a detailed description of their **appearance and operational functions**, ensuring a clear guide for users to facilitate easier instrument operation. Special emphasis is placed on the **intuitiveness and user-friendliness** of the interface.

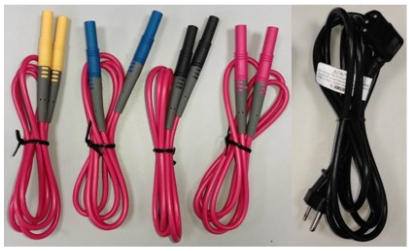
Throughout this chapter, you will gain an in-depth understanding of the **7140 and 7130**, along with **practical operational demonstrations** to help you get started quickly. Each **button, interface, and display screen function** will be explained thoroughly, accompanied by real-world application examples to enhance your comprehension and mastery of the instruments.

Whether you are a **beginner** or an **experienced user**, this section will provide **valuable insights** to help you use the **7140 and 7130 with confidence and efficiency**, ensuring **precise and reliable measurement results**. Our goal is to enhance your user experience, allowing you to fully utilize the **exceptional performance** of these instruments.

2.1 Package Contents & Accessories

Standard package

7140 or 7130 Main unit
TL-PM0001 Test Lead - Red
TL-PM0002 Test Lead - Black
TL-PM0003 Test Lead - Blue
TL-PM0004 Test Lead - Yellow
Power cord



Optional

AX-PM0001 – Red Probe
AX-PM0002 – Black Probe
AX-PM0003 – Blue Clip
AX-PM0004 – Yellow Clip
F71201 include power cord

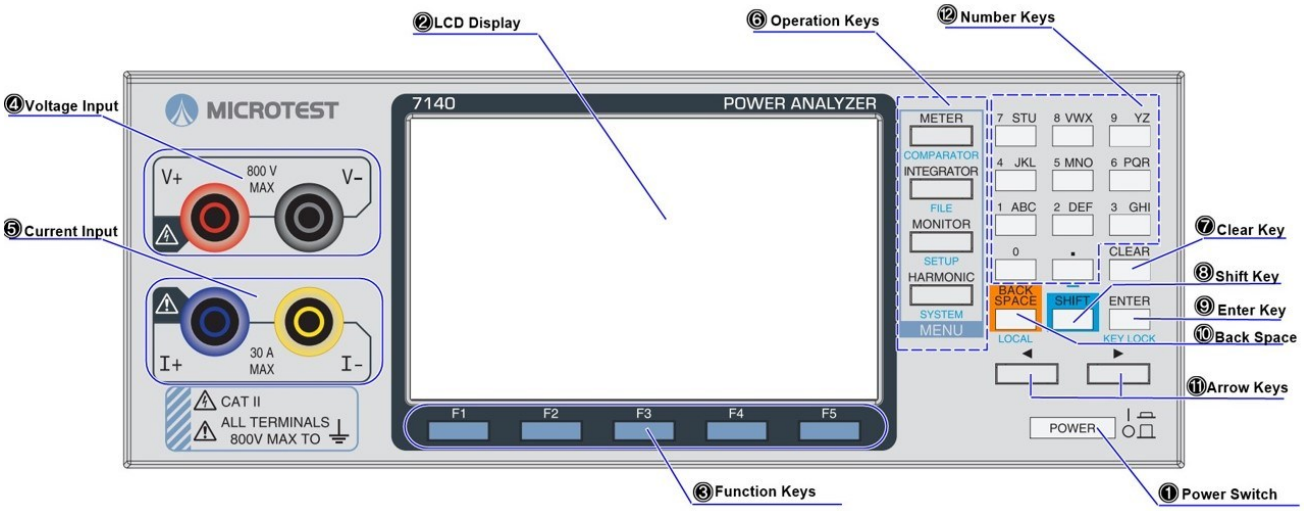


Figure Standard package & Optional Accessories

Standard Accessories	
Name	**Unit**
Power Cord	1
TL-PM0001 Test Lead - Red (100 cm)	1
TL-PM0002 Test Lead - Black (100 cm)	1
TL-PM0003 Test Lead - Blue (100 cm)	1
TL-PM0004 Test Lead - Yellow (100 cm)	1
Optional Accessories (Sold Separately)	
Name	**Unit**
F71201 AC Power Fixture Box (Includes Power Cord)	1
Clamp Current Transformer (100A / 1V)	1
Hall Sensor (500A / 4V)	1
TL-000014 D-Sub Control Cable - 25M to 25M (180 cm)	1
TL-000008 High-Speed USB Cable (180 cm)	1
TL-000006 Network Cable (150 cm)	1
AX-PM0001 Conversion Test Probe - Red	1
AX-PM0002 Conversion Test Probe - Black	1
AX-PM0003 Conversion Alligator Clip - Yellow	1

AX-PM0004 Conversion Alligator Clip - Blue	1

2.2 Front Panel



No.	Name	Function Description
1	Power switch	Turns the power ON or OFF.
2	LCD Display	Displays various setting values, measurement values, and other information.
3	Function Keys	Executes the function corresponding to the label above the key. (For example, in Meter mode, F3 corresponds to the Hold function.)
4	Voltage Input Terminals	For connecting voltage measurement cables
5	Current Input Terminals	For connecting current measurement cables.
6	Operation Keys	Press to enter any mode screen.
	METER / COMPARATOR	Displays the instrument or comparator settings screen.
	INTEGRATOR / FILE	Displays the integration or file settings screen.
	MONITOR / SETUP	Displays the waveform monitoring or setup screen.
	HARMONIC / SYSTEM	Displays the harmonic or system settings screen.
7	Clear	Deletes entered numerical values.

8	Shift	When using the blue-labeled functions on the keys, press the **Shift** key first, then press the target key. (For example, Shift key + METER key = COMPARATOR)
9	Enter / KEY LOCK	Enter: Confirms input values and selections. Key Lock: Enables or disables the key lock function.
10	BACK SPACE / LOCAL	Back space: Returns to the previous step or window. Local: Exits remote control mode and returns to local operation.
11	Arrow Keys	Move the cursor.
12	Number keys	Enter numeric or alphanumeric characters.

2.3 Rear panel

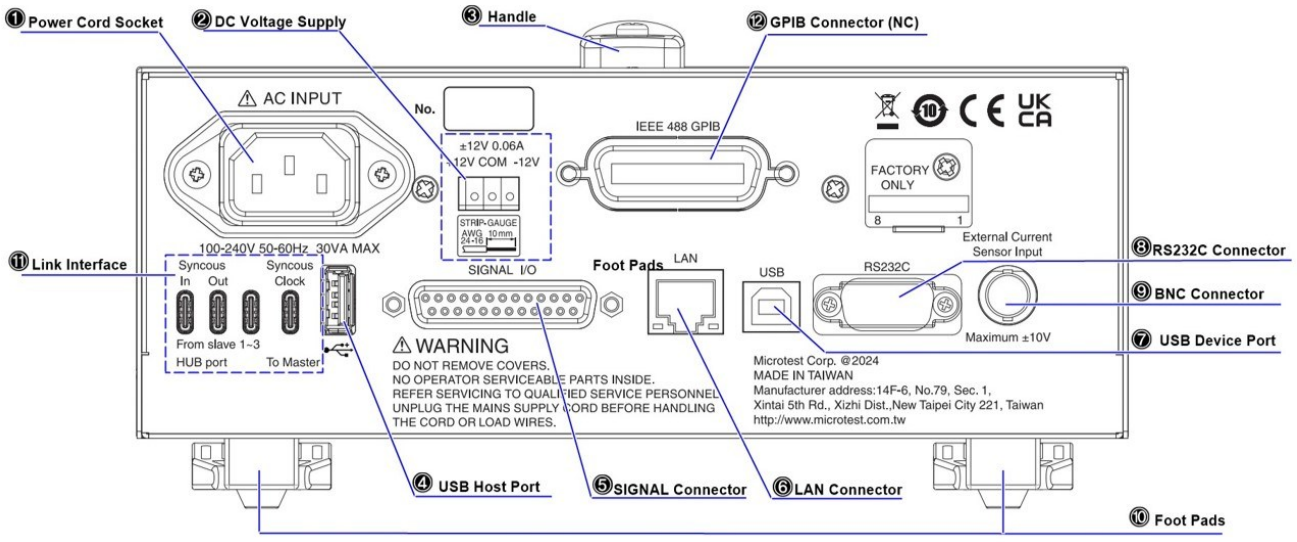


Figure Rear panel

No.	Name	Function Description
1	Power Cord Socket	Connects the power cord (AC 100~240V, 50/60Hz).
2	DC Voltage Supply	Used to connect the Hall sensor.
3	Handle	Used for carrying the instrument.

4	USB Host Port	Connects a USB flash drive (FAT32) for data storage.
5	SIGNAL I/O Connector	Inserts a digital I/O cable for external control or remote operation via the rear panel I/O connector, and generates D/A output.
6	LAN Connector	Used for Ethernet connection via a LAN cable.
7	USB Device Port	Connects a USB type B cable.
8	RS232C Connector	Connects an RS232 cable.
9	BNC Connector	Used to connect a clamp-type current transformer.
10	Foot pads	The front foot pads can be extended to function as a stand.
11	Link Interface	Not available yet.
12	GPIB Connector	Not available yet.

2.4 Functional Block Diagram

This block diagram outlines how the instrument accurately measures voltage and current, processes the signals using high-speed digital components, and provides user-friendly interaction and connectivity. The integration of DSP, FPGA, and MCU ensures high precision and efficiency in data acquisition and display. Key measurement sections include current and voltage sensing, digital isolation, and real-time signal processing.

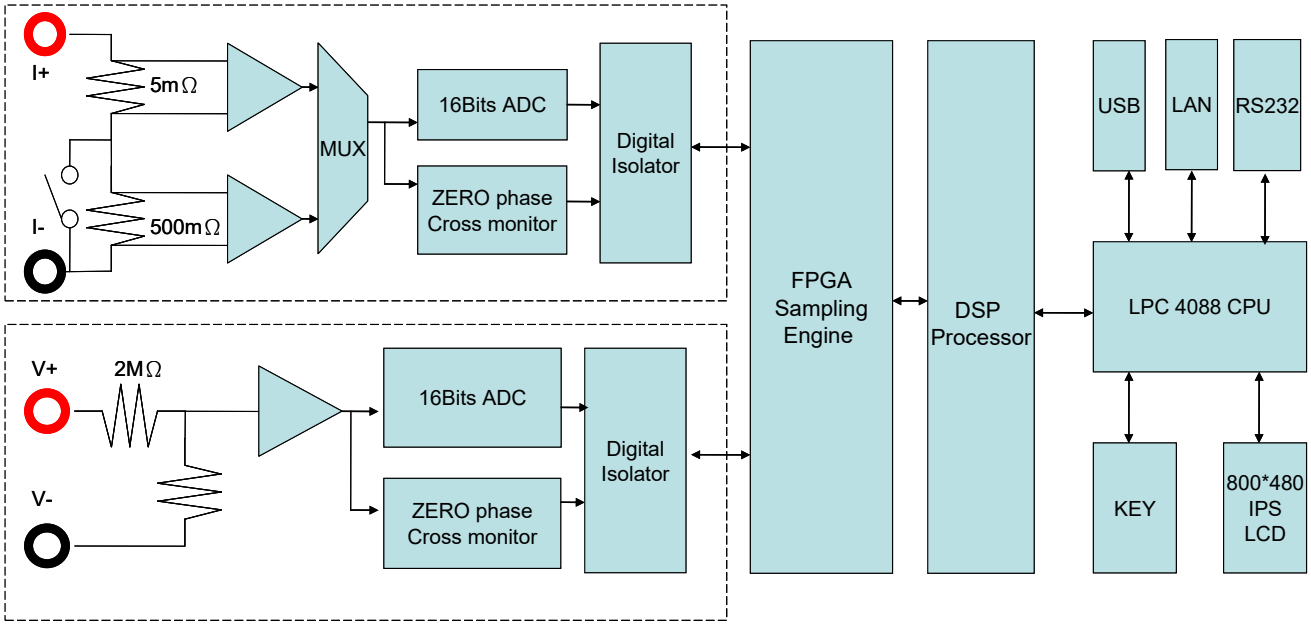
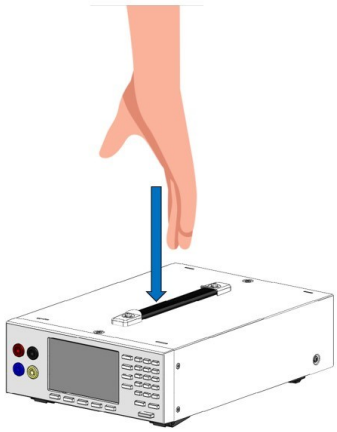


Figure Block Diagram

2.5 Handle and Foot pads

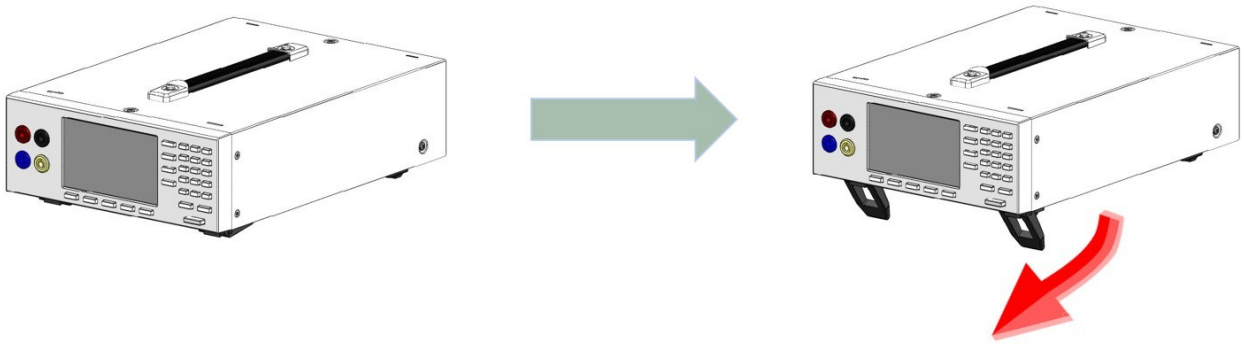
Carrying Handle

The instrument is equipped with a **carrying handle** for easy transportation. To use the handle, press down and lift it as shown in the image.



Foot pads

The foot pads can be flipped down to raise the instrument, providing a better viewing angle for data display. This allows for more comfortable operation and easier monitoring of measurements.



2.6 Power-On Procedure

Follow the steps below to correctly start the **7140 and 7130 instruments**:

1. **Ensure Proper Power Connection**
   - Verify that the **AC power supply voltage is within the 100~240V range**.
   - Securely plug the **power cord** into the power socket of the **7140 and 7130**.
2. **Turn On the Instrument**
   - Press the **POWER** button on the front panel of the **7140**

and 7130.

3. **Verify the Startup Display**
    - Once powered on, the LCD will display the following information:
      "POWER ANALYZER / METER, 7140 & 7130 Firmware Version 1.00"

These steps confirm that the **7140 and 7130** have been successfully powered on and are ready for operation.



Figure 7130 Power-On Screen

4. **Allow Warm-Up Time**
    - Let the **7140 and 7130** warm up for at least **30 minutes** before use.
5. **Perform V± Short-Circuit Zero Calibration**
    - Before performing measurements, it is recommended to conduct **V± short-circuit zero calibration** to ensure measurement accuracy and compliance with the instrument's precision specifications.

2.7 Quick Start: How to Connect and Measure

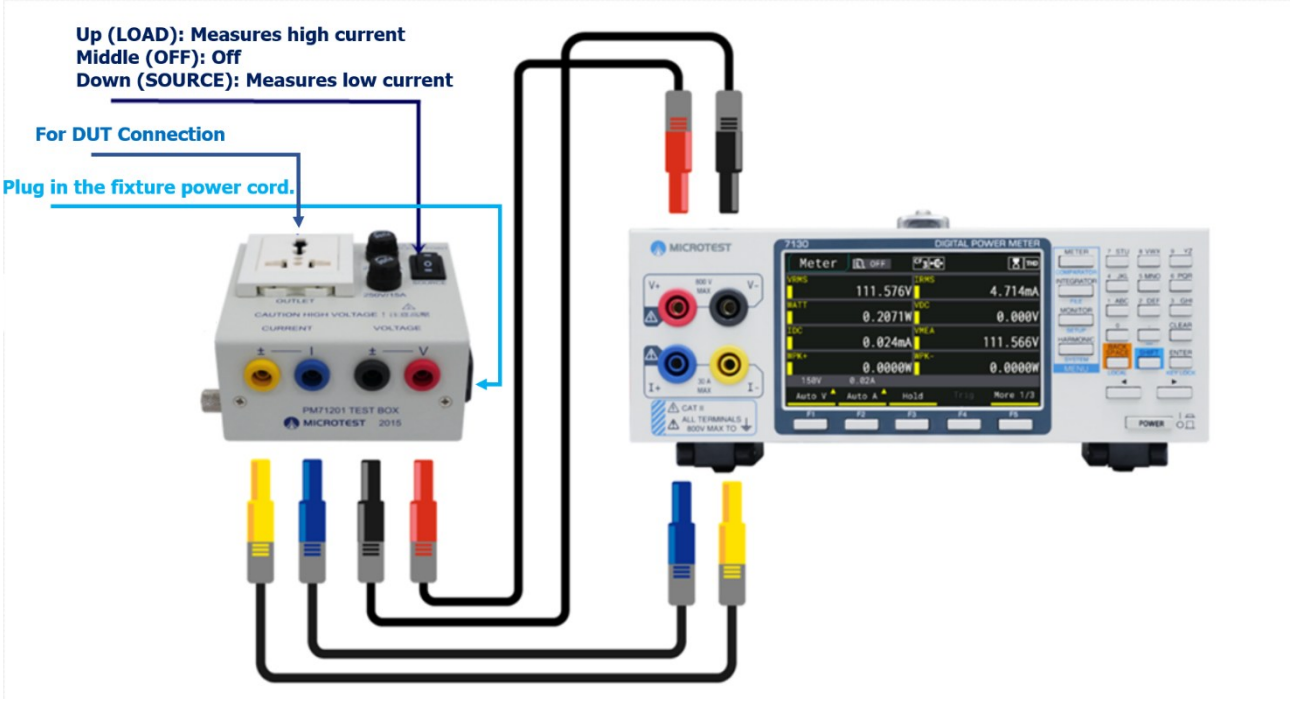


Figure How to Connect and Measure

To ensure proper wiring and correct operation, follow the steps below:

1. **Connect the Test Leads**
    - Match the four test leads to the corresponding terminal colors on the **7140/7130 front panel** and insert them securely into the respective terminals.
    - Similarly, ensure that the test leads are connected to the corresponding color-coded terminals on the **F71201 TEST BOX** for proper signal transmission.
2. **Prepare and Connect the Power Cords**
    - Prepare two **AC power cords**, ensuring that the power supply voltage is within the **AC 100~240V range**.
    - Connect one power cord to the **F71201 TEST BOX power socket** and the other to the **7140 or 7130 power input**, ensuring stable power supply to both devices.
3. **Check Power Compatibility**
    - Note that power outlet designs may vary by country. In some

cases, an adapter may be required to ensure compatibility between the **F71201 TEST BOX** and the local power outlet.
- Select the appropriate power adapter based on the plug type in your region.

4. **Connect the Device Under Test (DUT)**
   - For example, if testing a **6632 Impedance Analyzer**, connect its power cord to an appropriate power source.
   - Then, insert the power cord's plug into the **three-prong power outlet on the top of the F71201 TEST BOX**. Once connected, the instrument is ready for power consumption measurement.
5. **Power Down and Disconnect**
   - After completing the measurement, **turn off the power supply to the test circuit**.
   - Disconnect the **F71201 TEST BOX power cord first**, followed by the test leads.
   - Finally, power off the **7140 or 7130** to complete the disconnection process safely.

2.8 F71201 Test Box Internal Wiring Diagram (Optional Fixture)

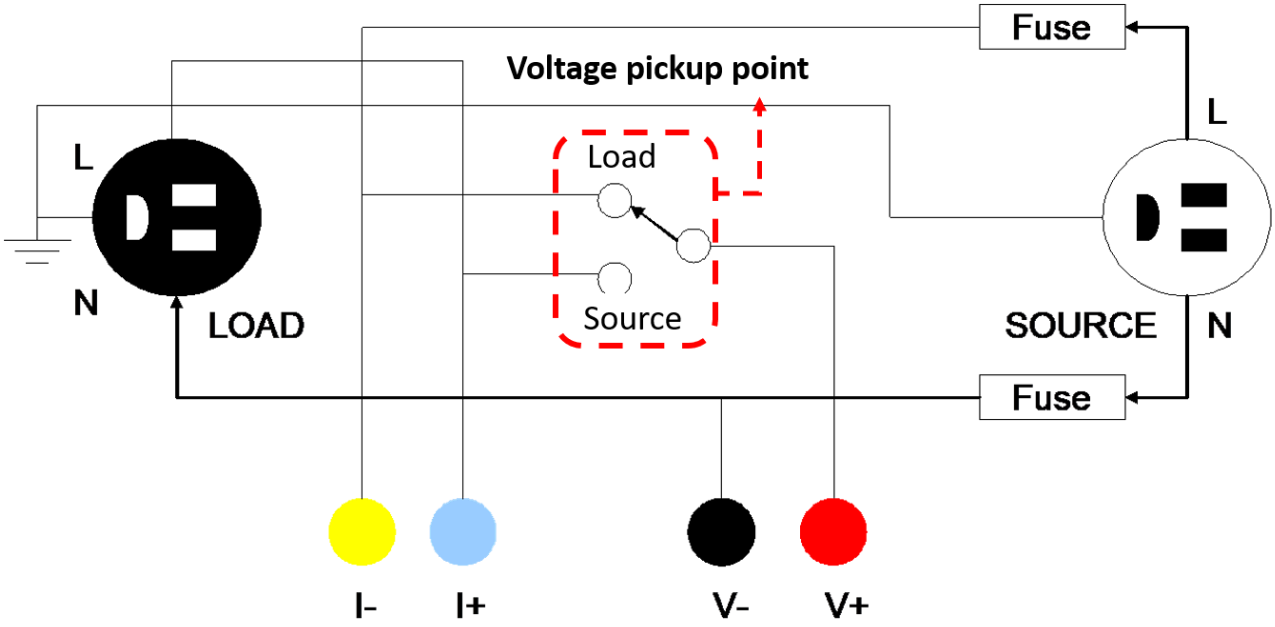


Figure F71201 Test Box Internal Wiring Diagram

The following diagram illustrates the internal wiring of the **F71201 TEST BOX**:

- **Switch Position Load**:
  - The voltage measurement point is connected directly to the Device Under Test (DUT).
  - This setup prevents power measurement errors caused by voltage drop in the wiring loop, which can occur during high-current testing.
  - By measuring voltage at the DUT terminals, this configuration ensures more accurate power readings under high-current conditions.
- **Switch Position Source:**
  - This mode eliminates the power consumption of the 1.66MΩ internal input impedance of the 7140/7130 voltage measurement circuit.
  - It ensures that the measured power is as close to 0W as possible, making it particularly useful for standby power measurements.

- Users should determine whether to set the switch to Position Load or Source based on the current level of the DUT.

This configuration allows for **greater flexibility in power measurement**, enabling users to select the appropriate switch setting for different testing conditions.

NOTE: The current limit for this fixture **must not exceed 15A**.



Before connecting to the mains power, double-check the wiring of the voltage and current input terminals to ensure proper connections and prevent the risk of circuit breaker tripping.

Chapter 3 Operation Guide

This chapter provides a detailed overview of the **7140 and 7130 front panel operations**, including **display functions and key button controls**.
The instrument features the following primary function keys:

- **METER** – Measurement mode
- **INTEGRATOR** – Integration mode
- **MONITOR** – Waveform monitoring
- **HARMONIC** – Harmonic analysis
- **COMPARATOR** – Comparator function
- **FILE** – File management
- **SETUP** – System configuration settings
- **SYSTEM** – Instrument settings and system control

Each function will be explained in detail, covering its **purpose, navigation, and operational procedures** to ensure proper use of the **7140 and 7130**.

This section will help users efficiently operate the instrument and maximize measurement accuracy.

3.1 Zero Calibration

Follow the steps below to perform a **Zero Calibration** on the **7140 and 7130**:

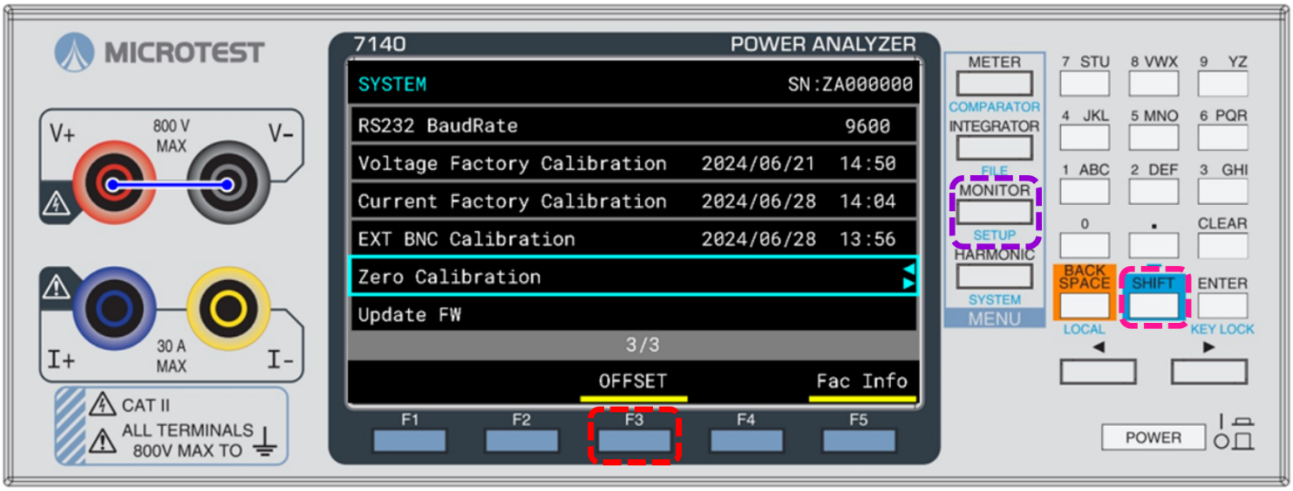
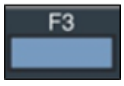


Figure Zero calibration

1. **Short the Voltage Terminals**
   - Connect **V+ and V-** terminals using a test lead to create a **short circuit**.
   - On the **7140 / 7130**, press 

+ 

to enter the **SYSTEM** menu.
2. **Navigate to Zero Calibration Option**
   - Use the  and  **arrow keys** to go to **Page 3/3** in the SYSTEM menu.
   - Move the cursor to the **Zero Calibration** option.
3. **Execute Zero Calibration**
   - Press the 

F3 key (OFFSET) to start the **Zero Calibration process**.

3.2 Icon Descriptions

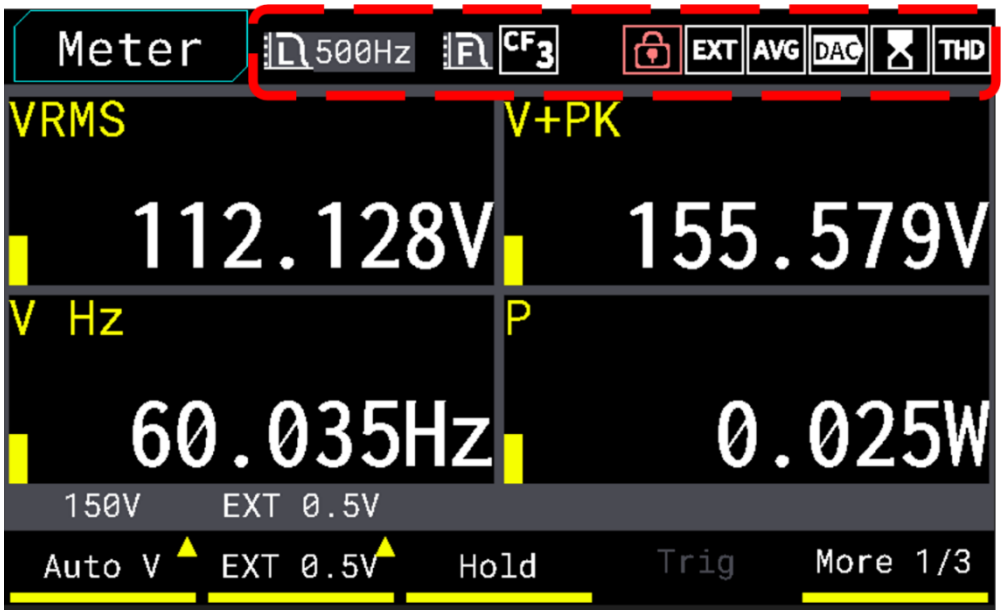
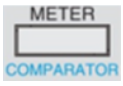


Figure Icon Descriptions

Icon	Description
	**Harmonic function enabled (HARMONIC ON)**. Indicates that the harmonic analysis function is active.
	**Integrator Mode (INTEGRATOR) – Waiting**. The integrator function is selected but has not started.
	**Integration Running (RUN)**. The integration process is currently in progress.
	**Integration Stopped (STOP)**. The integration has either stopped or completed.
	**Digital-to-Analog Conversion (DAC Operation) enabled**. The DAC function is currently active.
	**Averaging Function Enabled (AVG ON)**. The instrument is averaging measurement values.
	**External Range Selection: EXT 0.5V / 1V / 2V / 5V / 10V**. Enables external CT (Current Transformer) scaling.
	**Key Lock Activated (KEY LOCK)** – Press **SHIFT + ENTER/ KEY LOCK** to enable. When active, pressing any key will trigger a **beep sound**.
	**USB Flash Drive Detected** – The instrument has recognized a connected USB drive (**FAT32 format supported**).

	**Trend data saving to USB (FAT32) is active, but no USB drive is inserted**.
	**Frequency Filter Enabled (Frequency Filter ON)**. The instrument is applying a frequency filter to the measurement data.
	**Line Filter Disabled**. No line filter is applied.
	**Line Filter Enabled (500Hz)**. The instrument is filtering input signals at 500Hz.
	**Line Filter Enabled (5kHz)**. The instrument is filtering input signals at 5kHz.
	**Line Filter Enabled (100kHz)**. When Harmonic Mode is active, the 100kHz line filter cannot be selected.
	**Crest Factor = 3 Mode Enabled**. The instrument is measuring using a crest factor of 3.
	**Crest Factor = 6 Mode Enabled**. The instrument is measuring using a crest factor of 6.
	**Instrument in Remote Mode** (:COMMUNICATE:REMOTE ON). The device is controlled remotely. Press **SHIFT + BACK SPACE/ LOCAL** to return to local mode.

3.3 METER Mode Overview

1. After a **30-minute warm-up**, perform **V± short-circuit zero calibration**, then press the 

key to enter **METER Mode**.

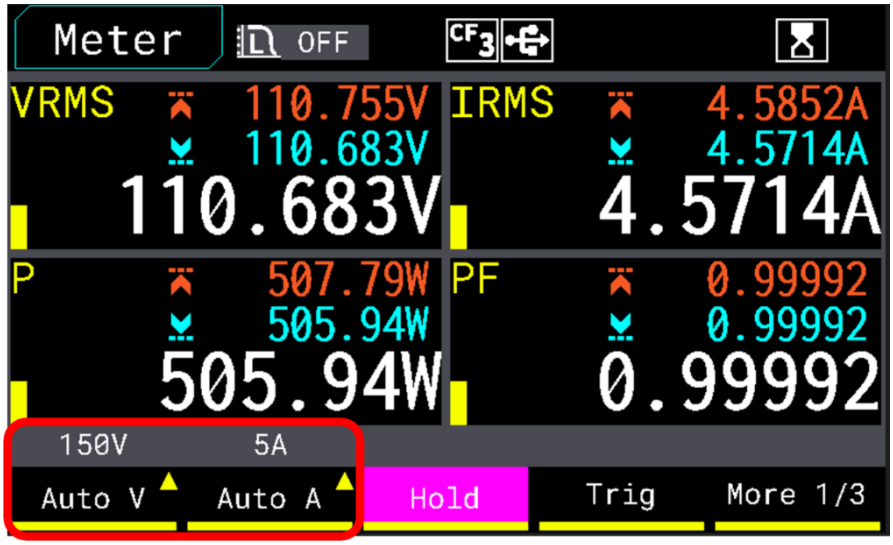
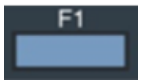


Figure Meter mode

When the voltage and current range is set to **Auto**, the processor will automatically determine the most suitable range based on the measured data.

2. Setting the Voltage Range

Press the 

key 

to select a voltage range.

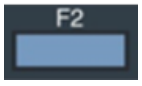
Alternatively, use the  **or**  **arrow keys** to navigate and press 

to confirm the selection.

CF	Voltage
3	AUTO V, 15, 30, 60, 150, 300, 600(V)。
6	AUTO V, 7.5, 15, 30, 75, 150, 300(V)。

Table CF3/CF6 Range Table

3. Setting the Current Range

Press the 

key 

to select a current range.

Alternatively, use the  or  **arrow keys** to navigate and press 

to confirm the selection.

※ The **EXT 0.5V, 1V, 2V, 5V, and 10V** options are only used when a **clamp-type current transformer (CT)** is connected.

CF	Current Range (A)
3	AUTO A, 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20 (A)
6	AUTO A, 0.0025, 0.005, 0.01, 0.025, 0.05, 0.1, 0.25, 0.5, 1, 2.5, 5, 10 (A)

Table CF3/CF6 Current Range Table (Without EXT)

4. Clamp-Type Current Transformer (CT) Setup

1. **Connect the clamp-type current transformer** to the **BNC Connector** on the **rear panel** of the **7140 / 7130**.

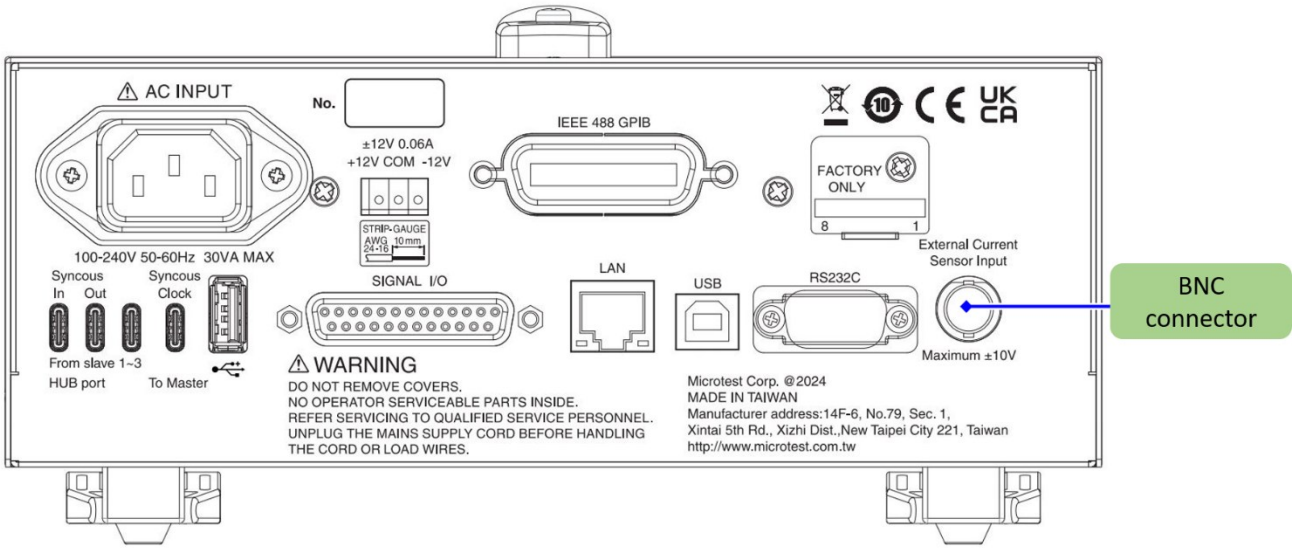


Figure Rear panel BNC connector

2. Press SHIFT + MONITOR SETUP to enter the **SETUP menu**.
3. Use the ◄ or ► **arrow keys** to navigate to the **EXT BNC Filter** option.
4. Press F3 Set CTV to manually configure the **current-to-voltage ratio**.
5. If the measured current is **less than 1% of the CT's rated value**, press F2 ON/OFF to enable **EXT BNC Filter**.
6. Return to the **METER** page and set the **current range** according to the

clamp-type current transformer specifications.

- **Select EXT 0.5V ~ 10V** based on the **clamp-type current transformer output voltage.**

EXT CT	Current Range
	EXT 0.5V, 1V, 2V, 5V, 10V

Table EXT Clamp CT Range (Separate Section)

Example:

When using a **clamp-type current transformer (CT) with a specification of 100A / 1V**, if the measured current is **less than 1% of the CT's rated value (i.e., less than 1A)**, the **EXT BNC Filter should be turned ON** to reduce noise and stabilize the measurement.

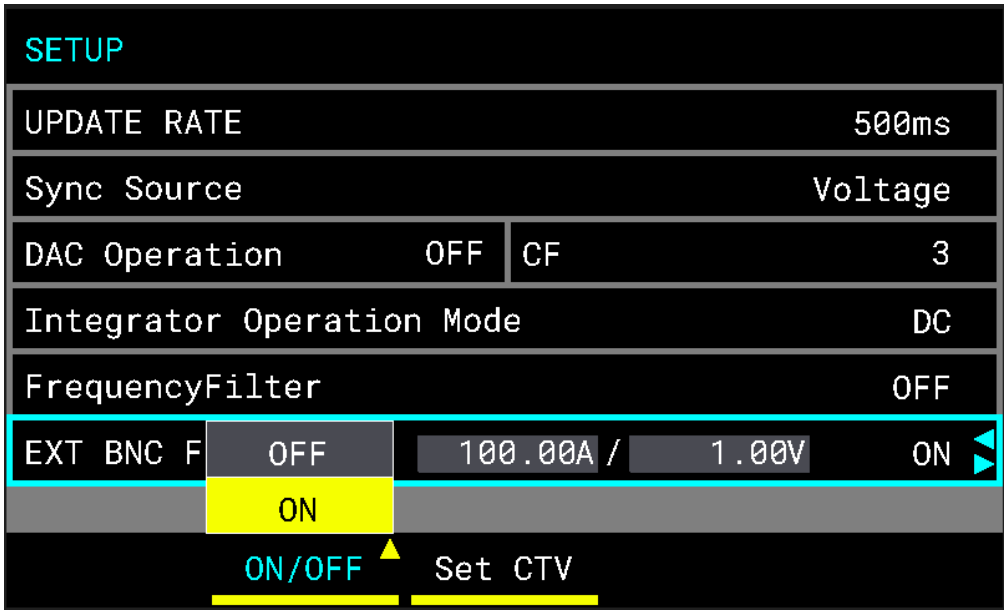


Figure EXT BNC Filter

To correctly position the **clamp-type CT**, press the **release lever** to open the clamp, then securely **clamp it around the conductor** carrying the current to be measured, ensuring that the conductor is properly centered within the clamp's sensing area, as shown in the figure below:

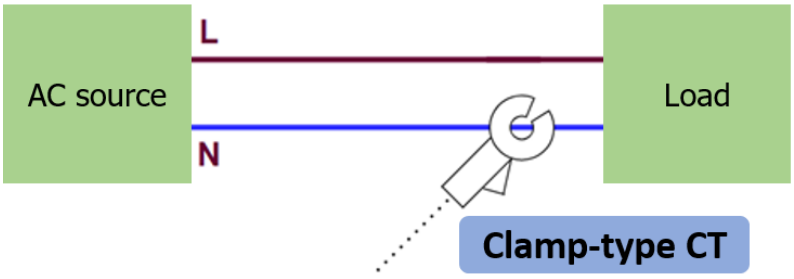
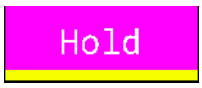


Figure Clamp-type CT connection

5. Hold Function

Press 

freezes the displayed measurement values, preventing updates until Hold is released.

When Hold is activated, the icon changes to 

to indicate the hold state.

6. Trig Function (Single Trigger Mode)

When **Hold** is activated, the 

button lights up, indicating that the instrument is in single trigger mode. Each time the Trig button is pressed, the instrument updates the measurement values once.

7. More Function (Page Navigation)

Used to switch between function pages. Press 

to navigate through 1/3, 2/3, and 3/3 pages.

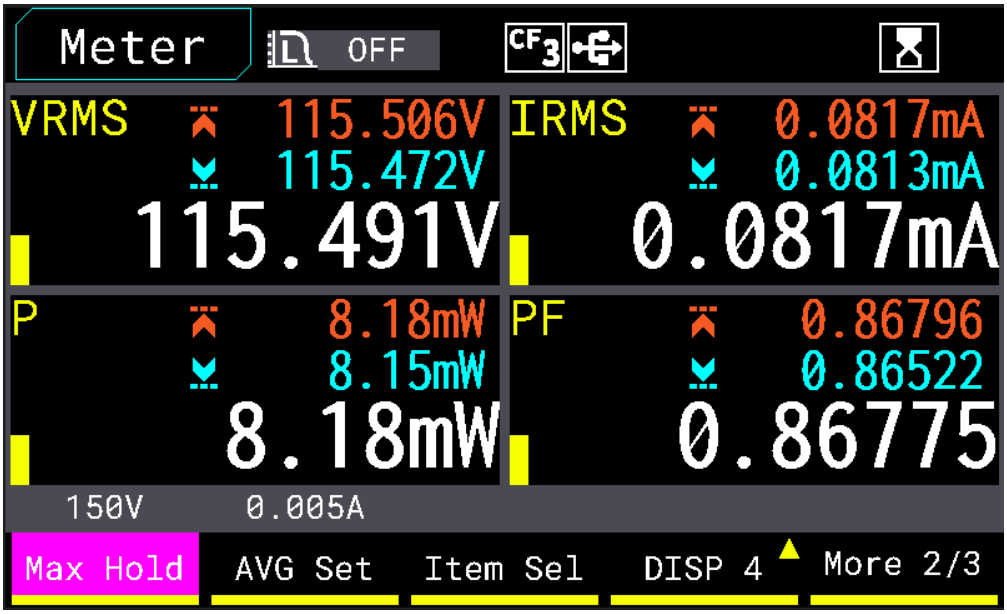


Figure Function page 2/3

8. Max Hold Function

When 

is pressed to activate the **Max Hold Function**, the **icon changes to "**

".

During measurement, the **maximum value** is displayed with icon "", and the **minimum value** is displayed with icon "" above the corresponding measurement item.

Icon	Description
	Maximum value displayed in red
	Minimum value displayed in blue

※ **NOTE: The Max Hold function is not supported on the following pages:**

- DISP 16
- INTEGRATOR
- MONITOR
- HARMONIC

9. Set AVG (Averaging Function)

The **AVG function** is used to stabilize measurement values by applying **moving average calculations**.

How to Set AVG

1. Press 

to enter the **AVG settings page**.

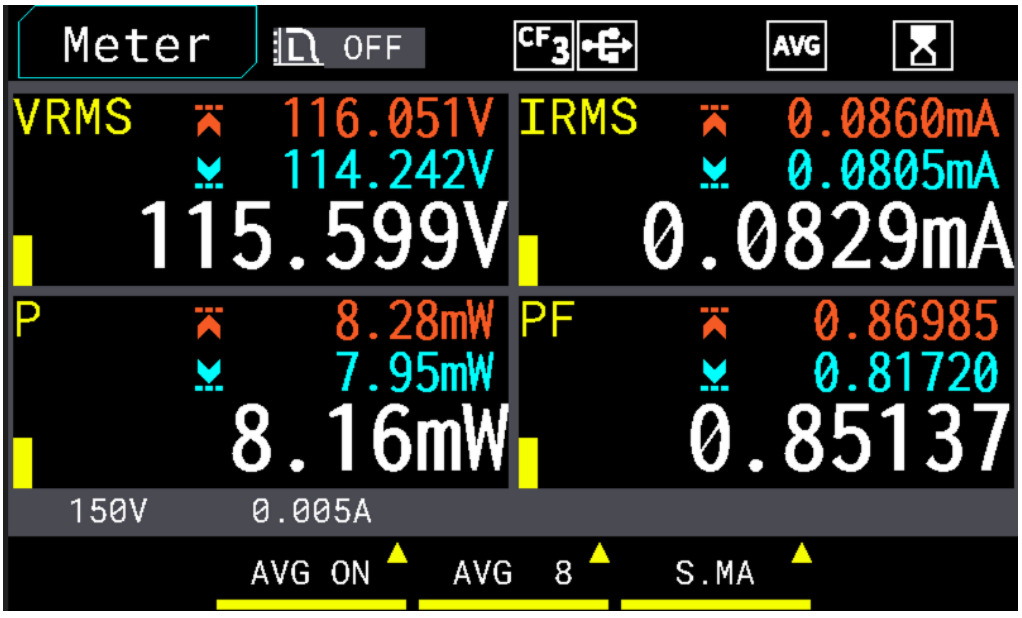


Figure AVG setting page

2. Press 

to enable or disable the **averaging**

function.

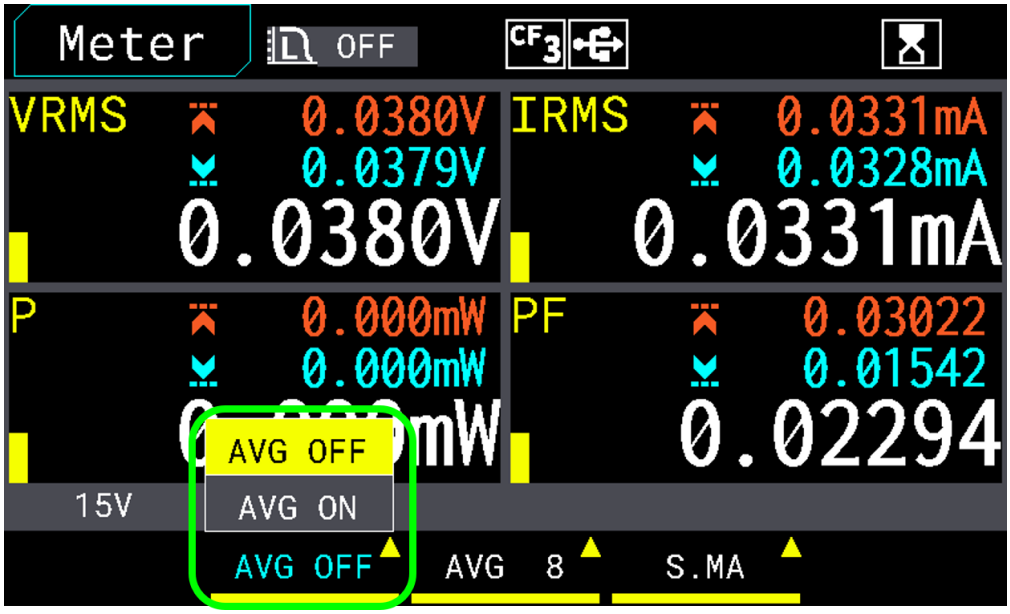


Figure AVG on/off

3. Press 

to set the **number of averaging cycles**:
   - **8, 16, 32, or 64**.

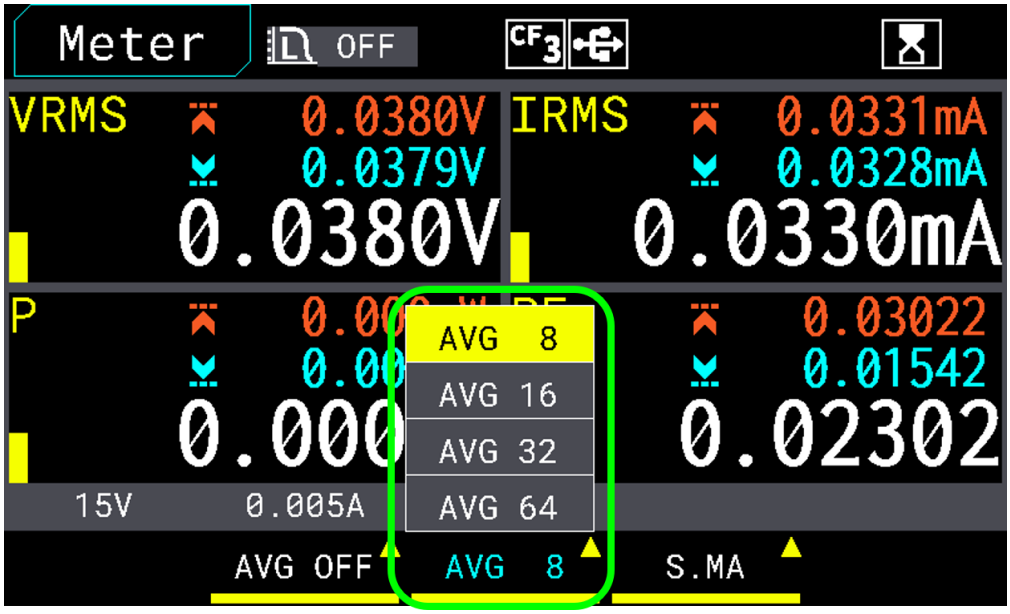


Figure AVG cycles

4. Press 

to select the **averaging calculation method**:
   - **S.MA (Simple Moving Average) Recommended for:**

Long-term trend analysis to reduce short-term fluctuations.

- **E.MA (Exponential Moving Average)**
  Recommended for:
  Short-term trend capturing in rapidly changing test environments.

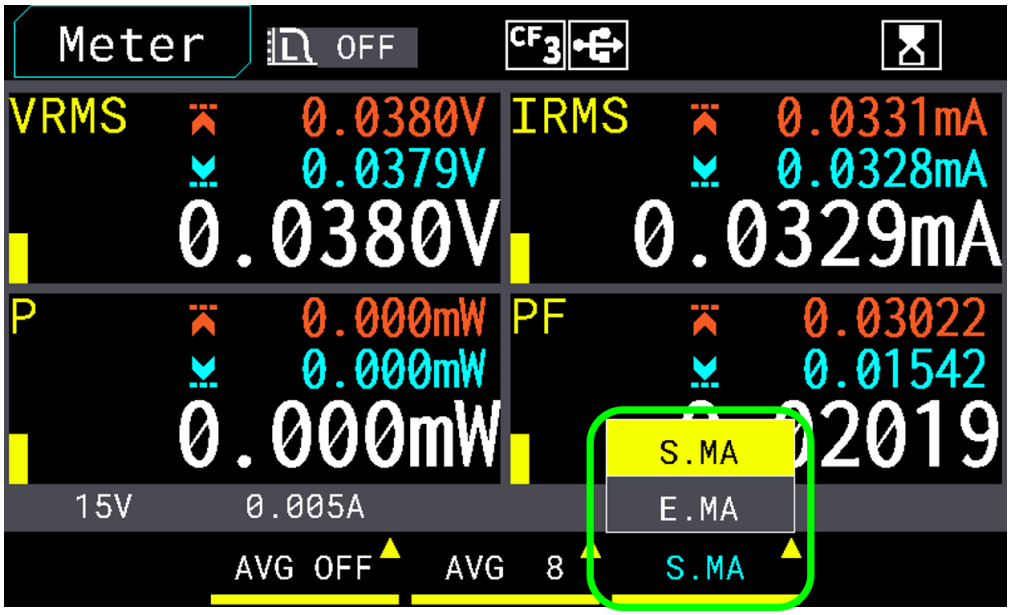


Figure AVG type

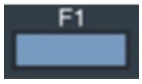
5. Once the settings are complete, press 

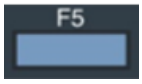
to return to the previous page

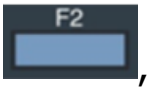
10. Meter mode Item selection

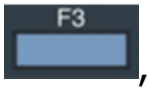
Press 

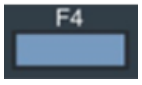
to modify the items displayed on the **DISP screen** and select the required measurement items.

- Use the  and  arrow keys to move the cursor.
- Press 

and 

to switch item page.
- Use 

, 

, and 

to choose the appropriate items.

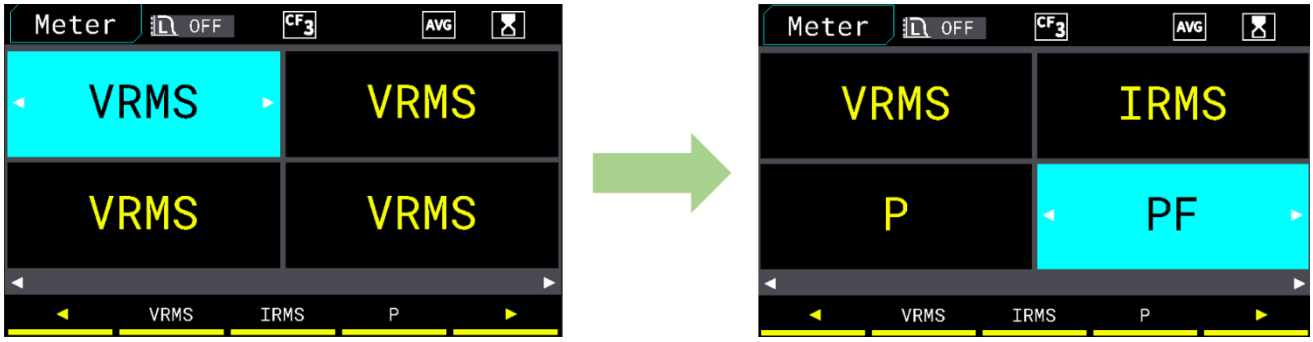


Figure Item selection

Item	Description
VRMS	Voltage Root Mean Square (RMS) Value
IRMS	Current Root Mean Square (RMS) Value
P	Active Power (Real Power)
PF	Power Factor
V+PK	Voltage Positive Peak Value
V-PK	Voltage Negative Peak Value
I+PK	Current Positive Peak Value
I-PK	Current Negative Peak Value
VDC	Voltage Average Value
IDC	Current Average Value
S	Apparent Power
Vmn	Rectified Average Value of Voltage
V Hz	Voltage Frequency
I Hz	Current Frequency
DEG	Voltage-Current Phase Angle
CFV	Voltage Crest Factor
CFI	Current Crest Factor
VTHD	Voltage Total Harmonic Distortion (THD) Percentage
ITHD	Current Total Harmonic Distortion (THD) Percentage
PTHD	Watt Total Harmonic Distortion (THD) Percentage
VPP	Voltage Peak-to-Peak Value
IPP	Current Peak-to-Peak Value
Q	Reactive Power
MCR	Maximum Current Ratio
P+PK	Maximum Power Value
P-PK	Minimum Power Value

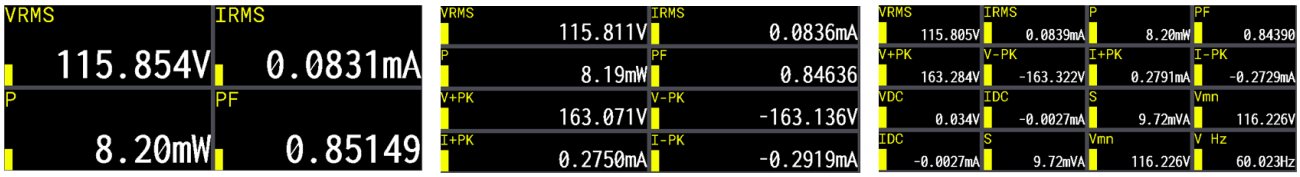
DPF	Displacement Power Factor – Power factor of the fundamental (first harmonic) component
NOTE: When **HARMONIC mode is ON**, only then can **VTHD, ITHD, PTHD, and DPF** be measured.	

Table Items description

11. DISP

Press F4 DISP 4 to set the number of items displayed to **4, 8, or 16**.

This function allows you to view more measurement items simultaneously and enables you to change test parameters using Item Sel.



DISP 4 DISP 8 DISP 16

Figure Display number

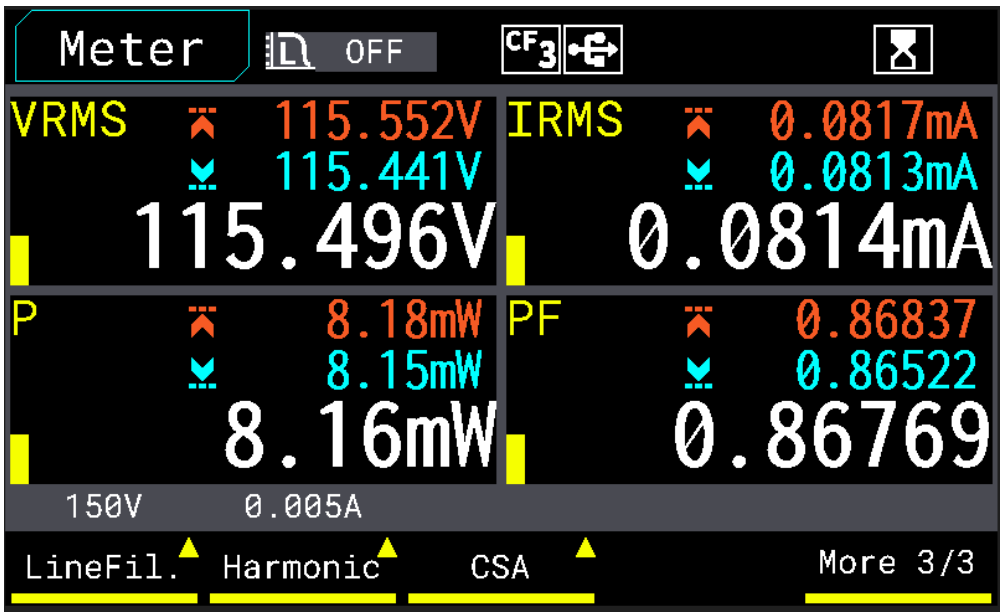


Figure More (3/3)

12. Line Filter

Press 

to access the **Line Filter** function, which is used to process electrical signals. The available frequency bandwidth settings are 500Hz, 5kHz, and 100kHz, allowing for the filtering or elimination of noise, interference, or unwanted signals within a specific frequency range.

1. When the Line Filter frequency is set, the corresponding icon will be displayed according to the selected frequency.
   Example: Set the **Line Filter** to **500Hz** as shown in the figure below.

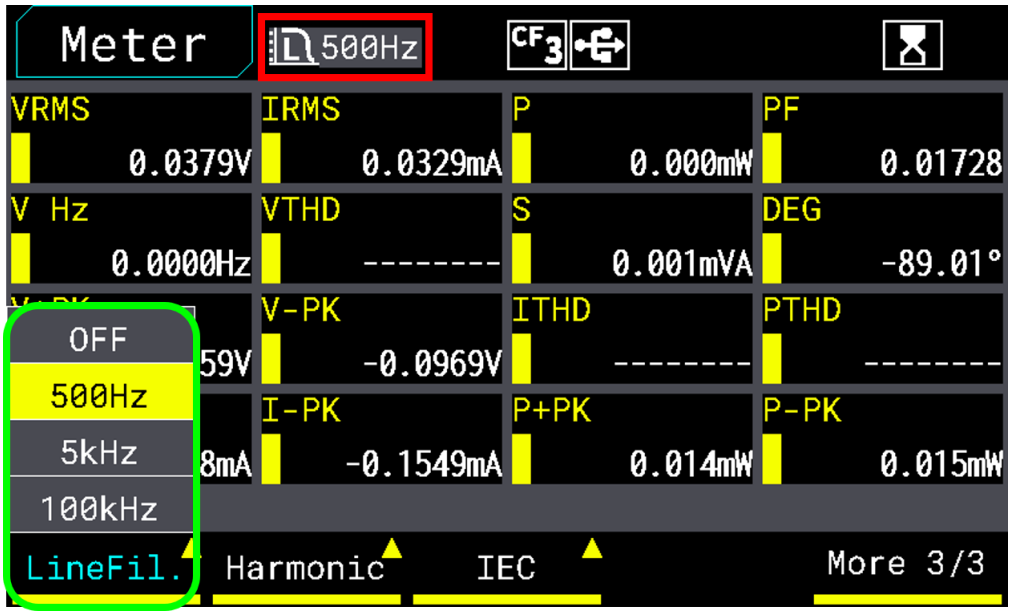


Figure Line Filter

13. Harmonic

Press 

to enable or disable the Harmonic function.

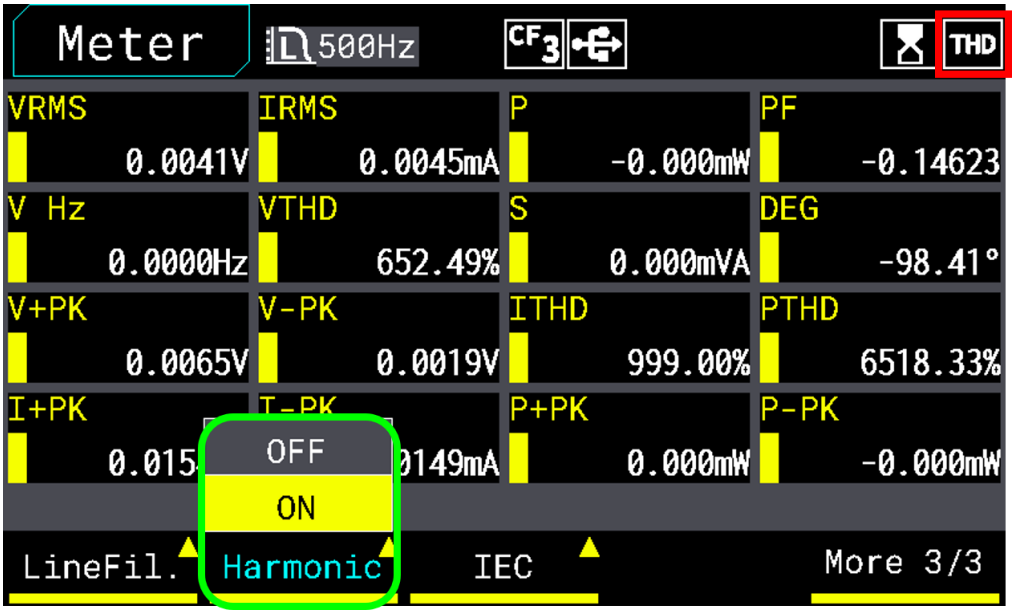


Figure Harmonic

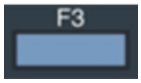
NOTE:

When **HARMONIC mode is ON**, the **line filter bandwidth -3dB points** are limited to **500Hz and 5kHz**.

The **Line Filter function** in the **7140 and 7130** is implemented using an **FPGA-based digital filter hardware**, designed with a **BI-QUAD 2nd-order filter structure**. Both voltage and current measurements have independent **32-bit digital filters**, ensuring that the **-3dB accuracy deviation remains within 0.2%** at all bandwidth settings.

In **Harmonic mode**, due to sampling rate limitations, the maximum **Line Filter bandwidth** can only be set to **5kHz**.

14. Harmonic Calculation Method Selection

Press 

to set the **harmonic calculation method** (CAS or ICE).

The **IEC and CSA Total Harmonic Distortion (THD) percentage definitions** differ as follows:

- **IEC**: Compares the **2nd to 50th-order harmonics** with the **fundamental (1st-order harmonic)**.
- **CSA**: Compares the **2nd to 50th-order harmonics** with the **total harmonics from the 1st to 50th order**.

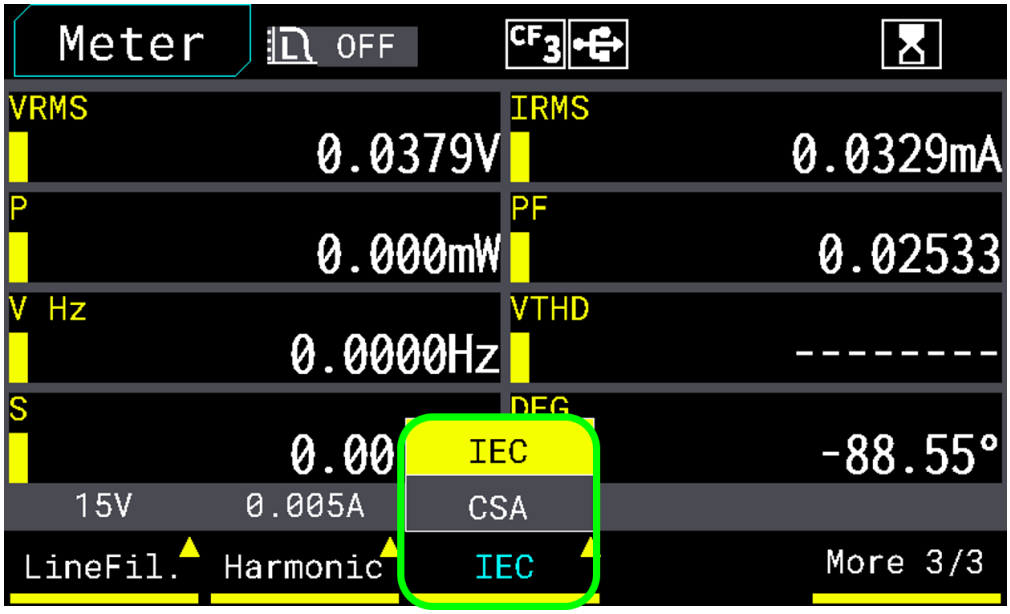


Figure Harmonic Calculation Method

3.4 Integrator Mode Overview

The **7140 and 7130 integration mode** support both **DC and RMS measurement modes**, specifically designed for **standby power measurement of electronic products**. Users can specify measurement durations as needed. Although the **7140 and 7130 are not ErP-certified**, their **continuous sampling hardware design** and **integration results** allow for accurate power analysis of various electrical products.

The **integration function** in the **7140 and 7130** operates **independently of the Harmonic calculation mode**, meaning integration can be performed regardless of whether harmonic analysis is enabled. Once integration is activated by the user, the instrument continuously accumulates measured values, such as **watt-hours (Wh)** and **ampere-hours (Ah)**, through an **FPGA-based continuous sampling process**. These accumulated values are calculated in the background while the **panel update rate** determines how frequently they are displayed.

Users simply need to review the measurement results on the **integration page** once the process is complete.

1. Press 

to enter Integration Mode.
(For switching between **RMS** and **DC** modes, refer to **Section** **Integrator Operation Mode**.)

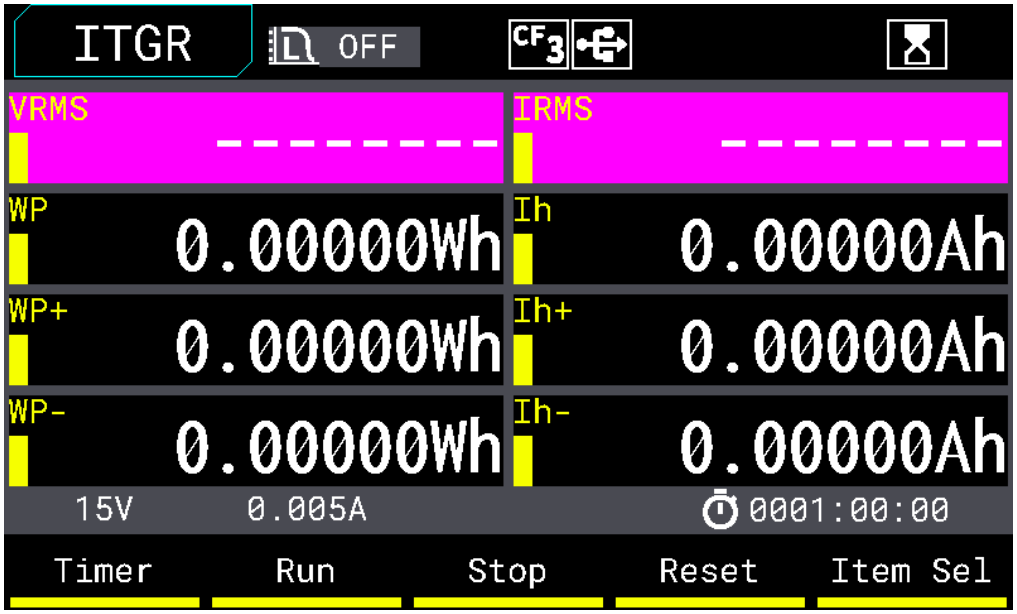
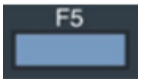


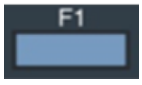
Figure Integrator Mode

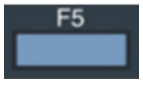
2. **Integrator Item Selection**

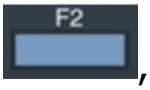
Press 

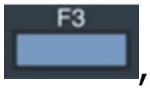


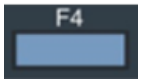
to enter the item selection mode.

- Use the  and  arrow keys to move the cursor.
- Press 

and 

to switch pages.
- Use 

, 

, and 

to choose the appropriate items.

Only ITEM 1 and ITEM 2 can be modified, with items displayed in black background with yellow text.
All other items (ITEM 3 / 4 / 5 / 6 / 7 / 8) are fixed items, displayed in blue background with white text.

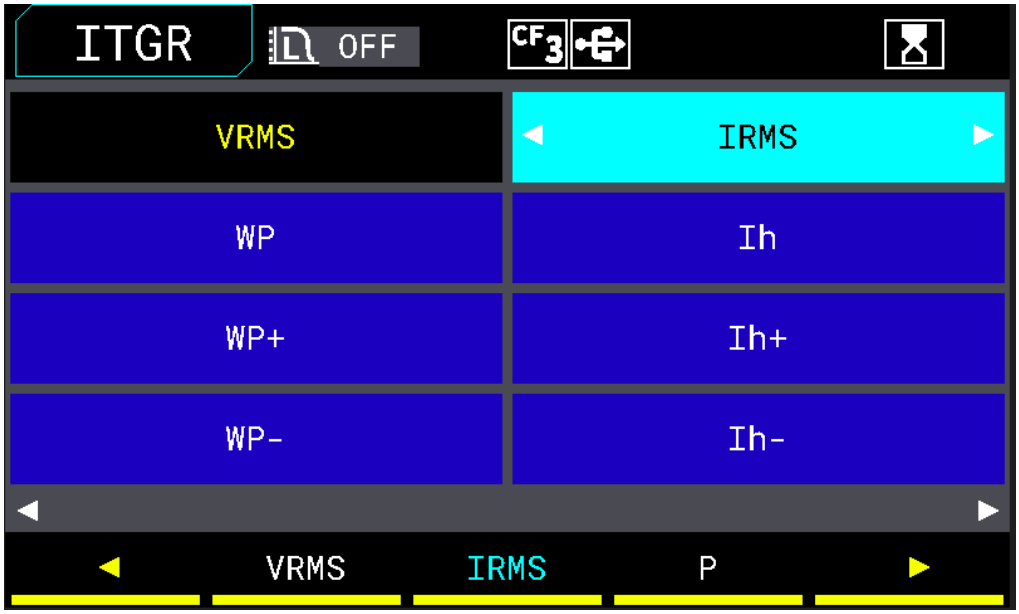


Figure Integrator Item selection

INTEGRATOR Items	Description
WP	Total accumulated active power
WP+	Accumulated positive active power
WP-	Accumulated negative active power
Ih	Total accumulated current
Ih+	Accumulated positive current
Ih-	Accumulated negative current
AVI(/h)	Total accumulated active power divided by the accumulation time
AVP(/h)	Total accumulated current divided by the accumulation time

Table INTEGRATOR Items Description

NOTE:

When **HARMONIC mode is enabled**, only then can the following parameters be measured:

- **VTHD** (Voltage Total Harmonic Distortion)
- **ITHD** (Current Total Harmonic Distortion)
- **PTHD** (Power Total Harmonic Distortion)
- **DPF** (Displacement Power Factor)

For other Items description, please refer to the section "**Meter mode Item selection**"

3. **Integration Time Setting**
4. Press 

to set the total elapsed time

(hhhh:mm:ss). The maximum setting is 9999:59:59.

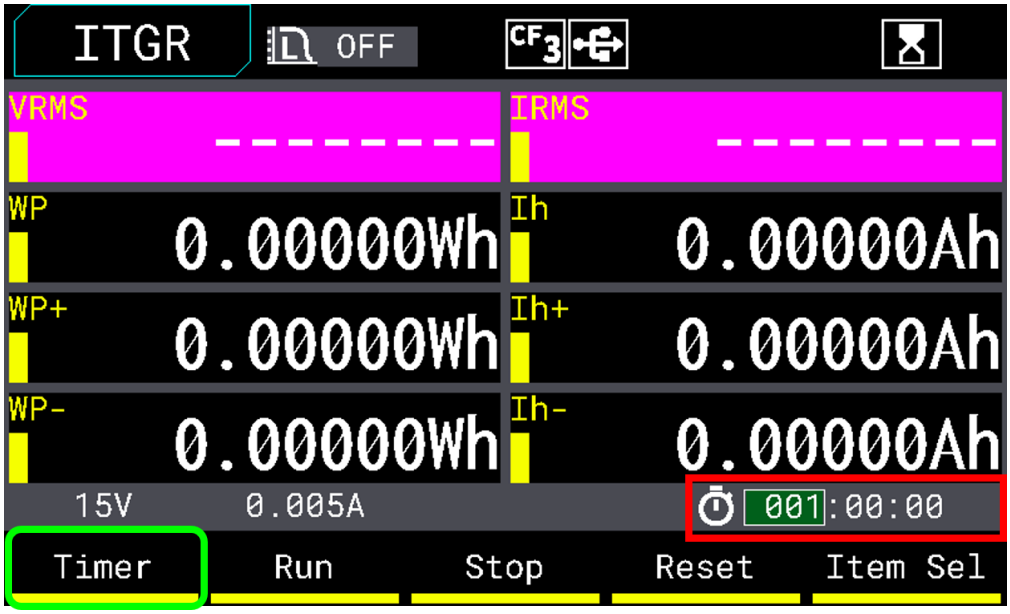


Figure Integration Time Setting

5. Starting Integration

Press 

to start integration.

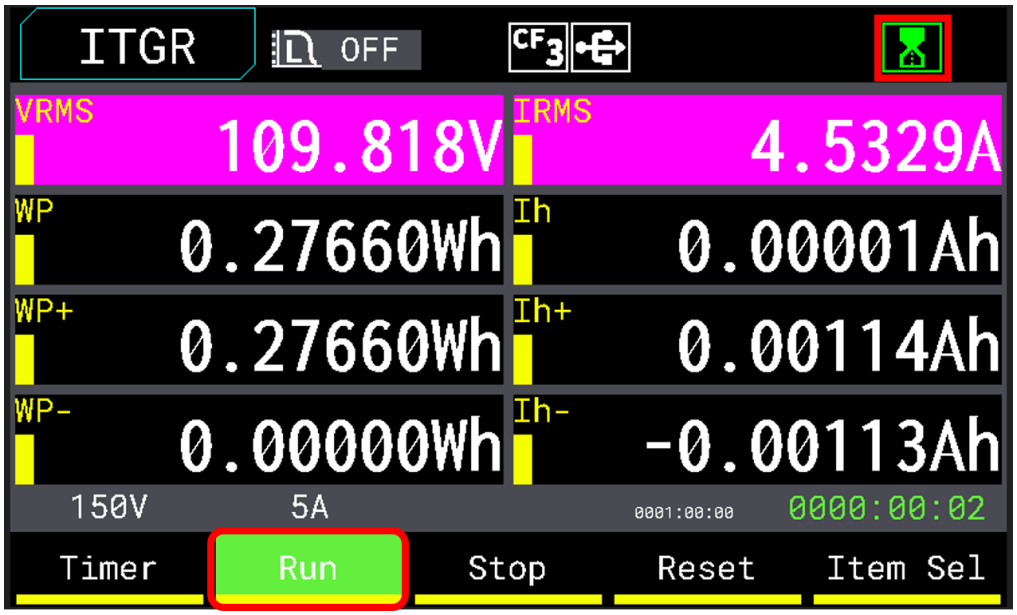


Figure Starting Integrator

6. Stopping Integration

Press 

to stop integration.

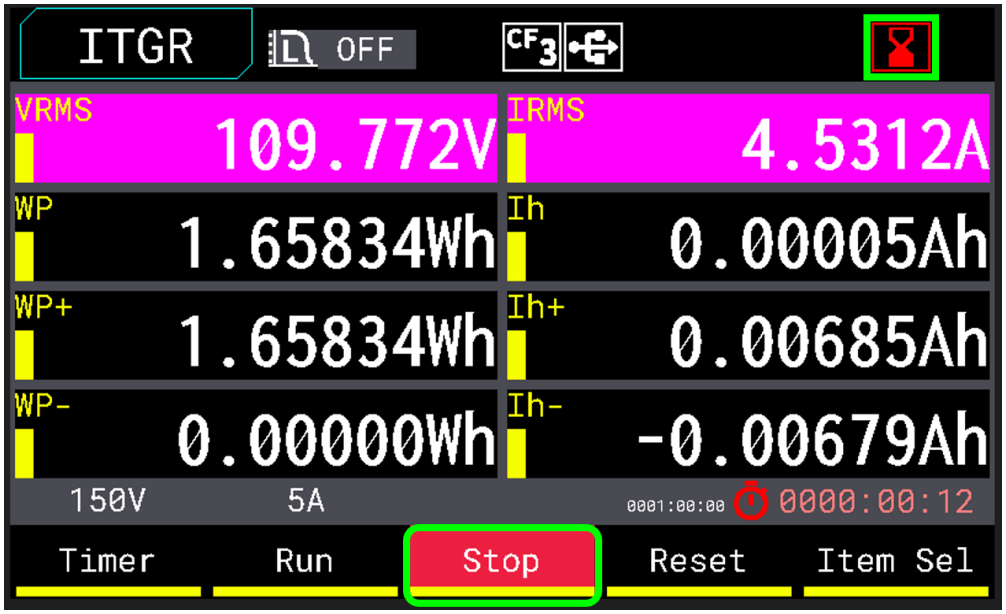


Figure Stopping Integrator

7. Resetting the Timer

Press 

to display a confirmation message: "Do you want to reset the timer?"

Press 

to reset the timer to the previously set time.



Figure Resetting the Timer

3.5 Monitor Mode Overview

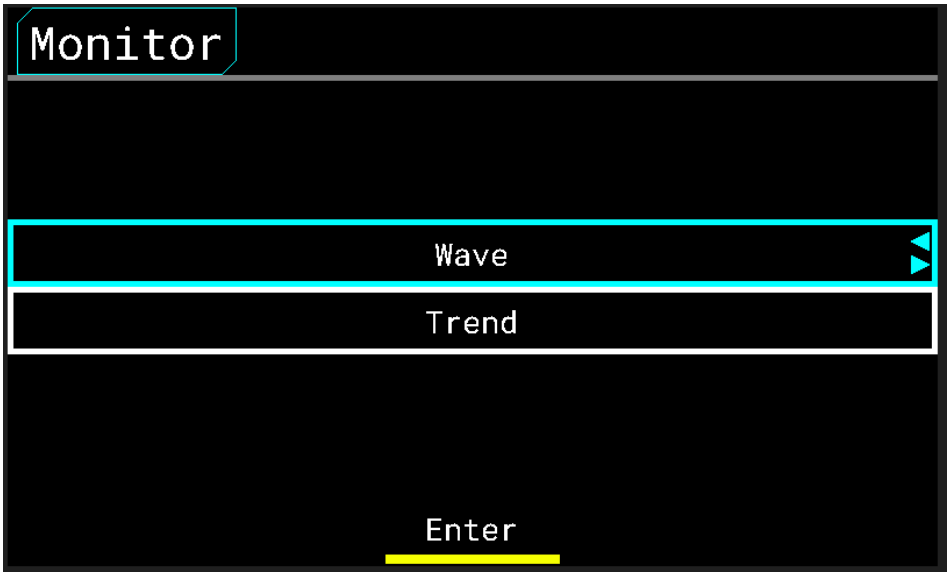
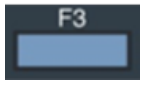


Figure Monitor mode

Press 

to enter Monitor mode.

1. The **Wave** option is available on both the **7140 and 7130**, while the **Trend** function is **only supported on the 7140**.
2. Use the  and  arrow keys to move the cursor, then press 

or 



to enter the selected mode.

3.5.1 Wave Mode

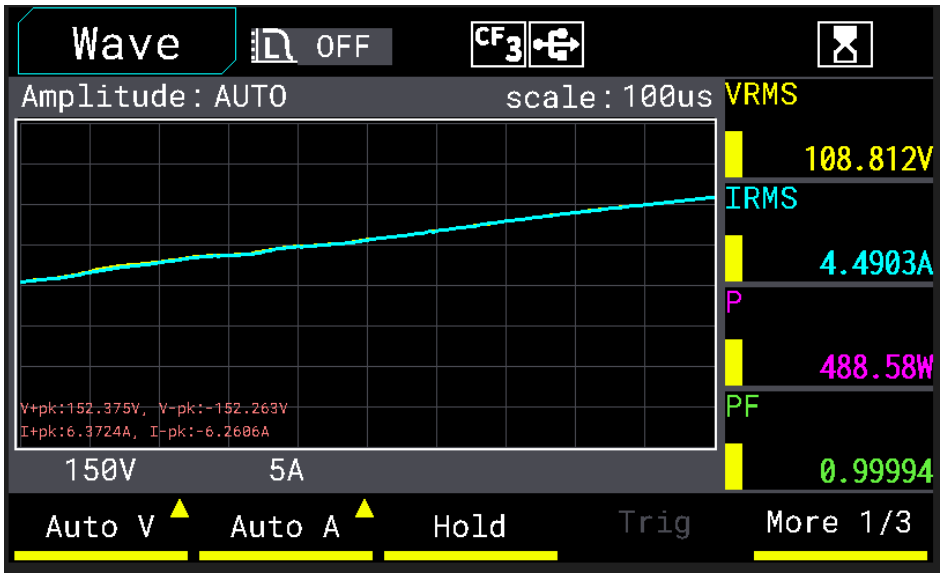


Figure Wave Mode (1/3 Page) Functions

In **Wave Mode (1/3 Page)**, the following function keys are available:

- **F1-**

: Voltage Range Setting – Adjusts the voltage range.
- **F2-**

: Current Range Setting – Adjusts the current range.
- **F3-**

: Hold Function – Freezes the displayed measurement values.
- **F4-**

: Trig Function – Triggers a single measurement when in hold mode.
- **F5-**

: More – Switches between pages 1/3, 2/3, and 3/3.

Note:
Voltage Range Setting, Current Range Setting, Hold Function, and Trig Function follow the same configuration as in **Meter Mode**. For details on their usage, please refer to:
3.3 Meter Mode Overview
- **2. Voltage Range Setting**
- **3. Current Range Setting**
- **5. Hold Function**
- **6. Trig Function**
- **7. More Button**

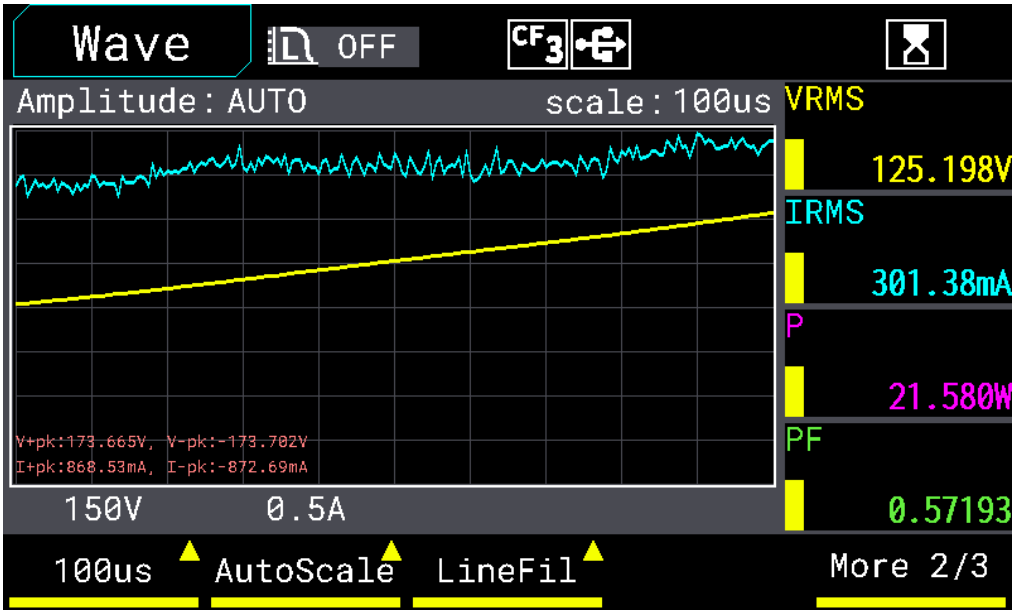
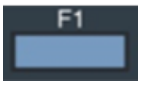


Figure Wave Mode (2/3 Page) Functions

1. Scale setting

Press 



to adjust the scale setting.

The available options are: 100us, 200us, 500us, 1ms, 2ms, 5ms, and 10ms.

Use the  or  to navigate through the options, then press 

to confirm the selection.

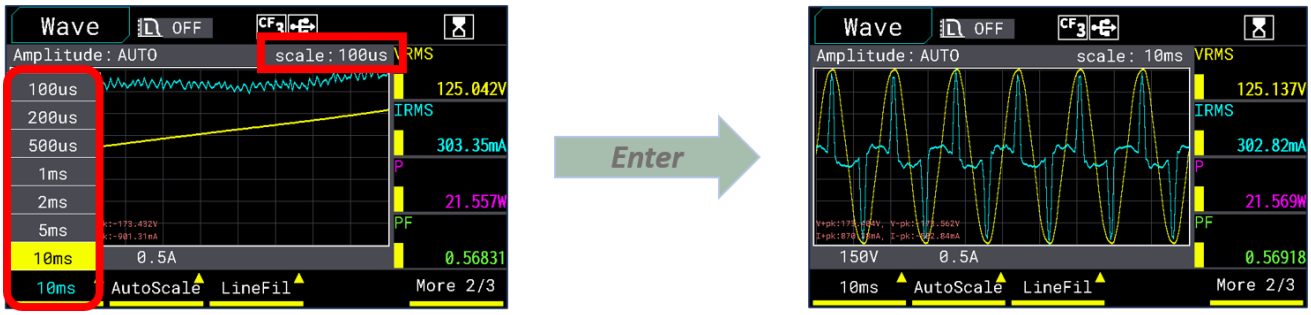
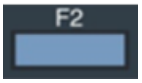


Figure Scale setting

2. Auto-Scale Function

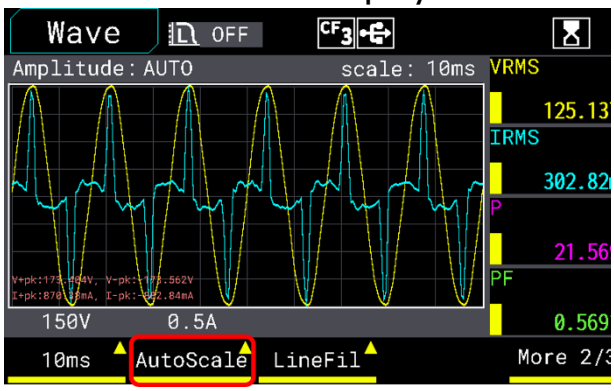
Press 



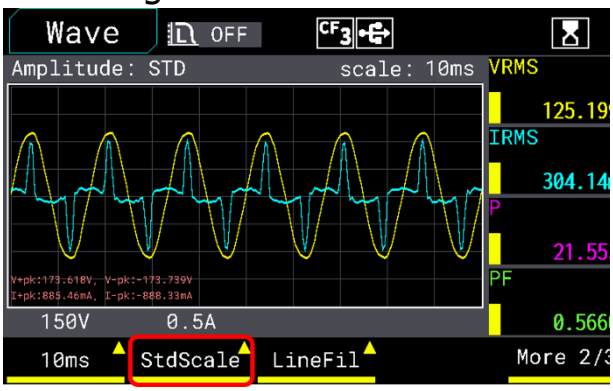
to set the **Amplitude Display Mode** to one of the following options:

- **Auto Scale** – Automatically adjusts the display range based on the measured signal.

- **Std Scale** – Displays the waveform using a fixed standard scale.



Auto Scale



Std Scale

Use the ◄ or ► to navigate and press ENTER KEY LOCK to confirm the selection.

3. Line Filter Setting

Press F3 LineFil. to adjust the **Line Filter** setting.
The available frequency options are: **500 Hz, 5 kHz, 100 kHz.**

Use the ◄ or ► to navigate through the options, then press ENTER KEY LOCK to confirm the selection.

The **Line Filter** helps **reduce noise, eliminate interference, and suppress unwanted signals** within the selected frequency range.

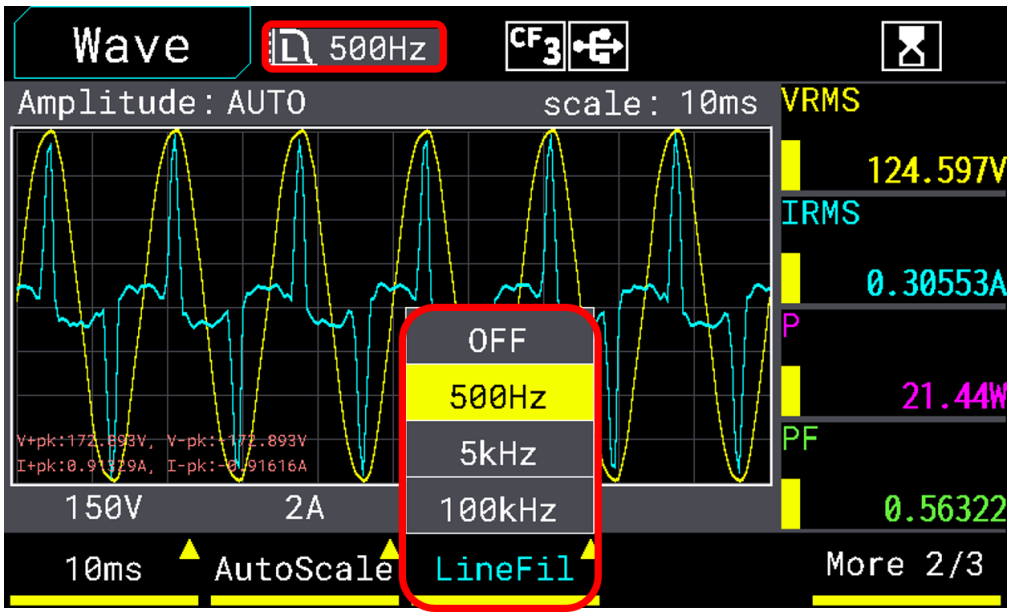


Figure Wave mode Line Filter

4. Item Selection

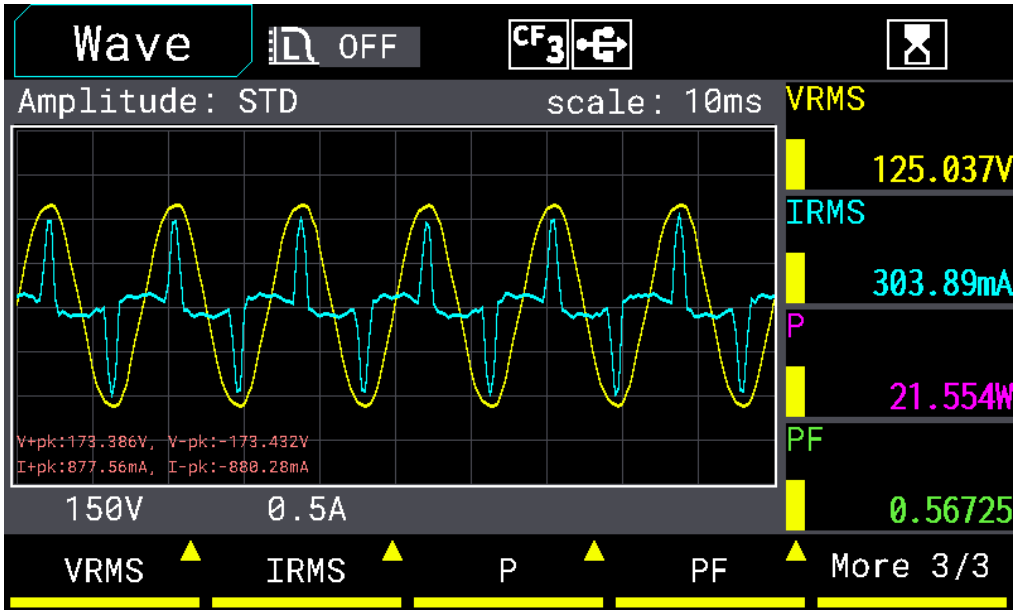


Figure Wave Mode (3/3 Page) Item Selection

Each parameter can be adjusted using the following function keys:

- **F1, F2, F3, and F4** – Switch between available parameter options.

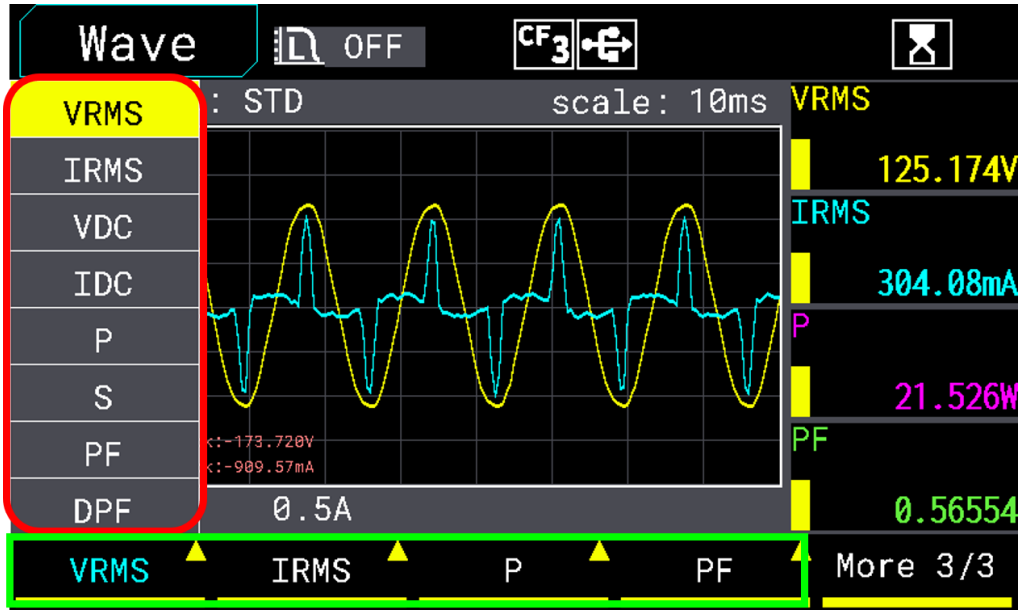


Figure Wave Mode Item Selection

Trend Items	Description
VRMS	Root Mean Square (RMS) Voltage
IRMS	Root Mean Square (RMS) Current
VDC	Average Voltage
IDC	Average Current
P	Active Power
S	Apparent Power
PF	Power Factor
DPF	Displacement Power Factor (Fundamental Power Factor)
Note: **DPF** measurement is only available when the Harmonic function is enabled.	

Table Trend Item

3.5.2 Trend Mode (Available Only on 7140)

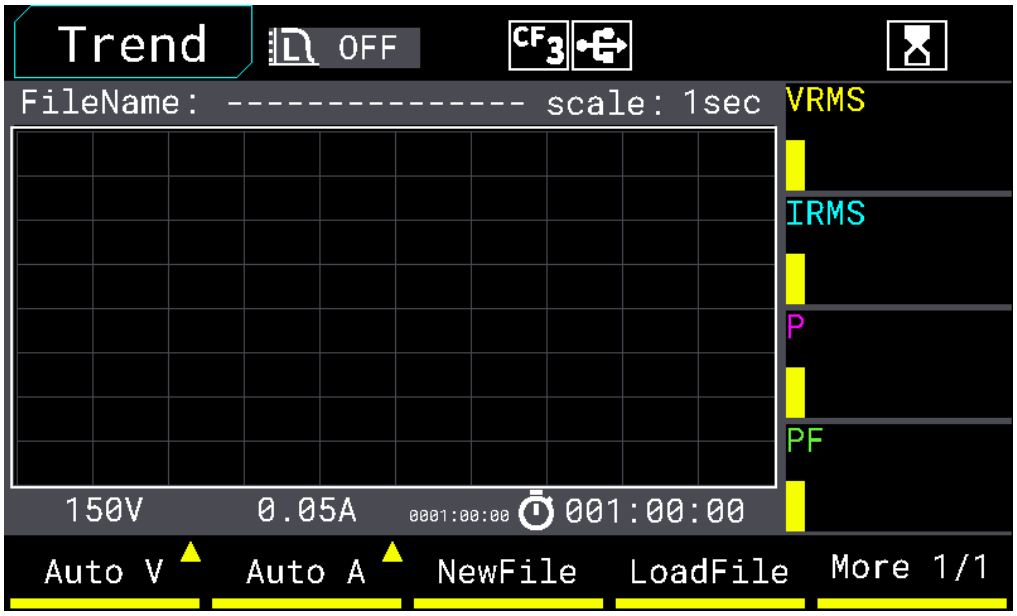


Figure Trend Mode

Note:

Before using Trend Mode, a setting file must be created or loaded.

1. Creating New File

1. Press 

to create a new configuration file.
2. Use the alphanumeric keys to enter the file name.

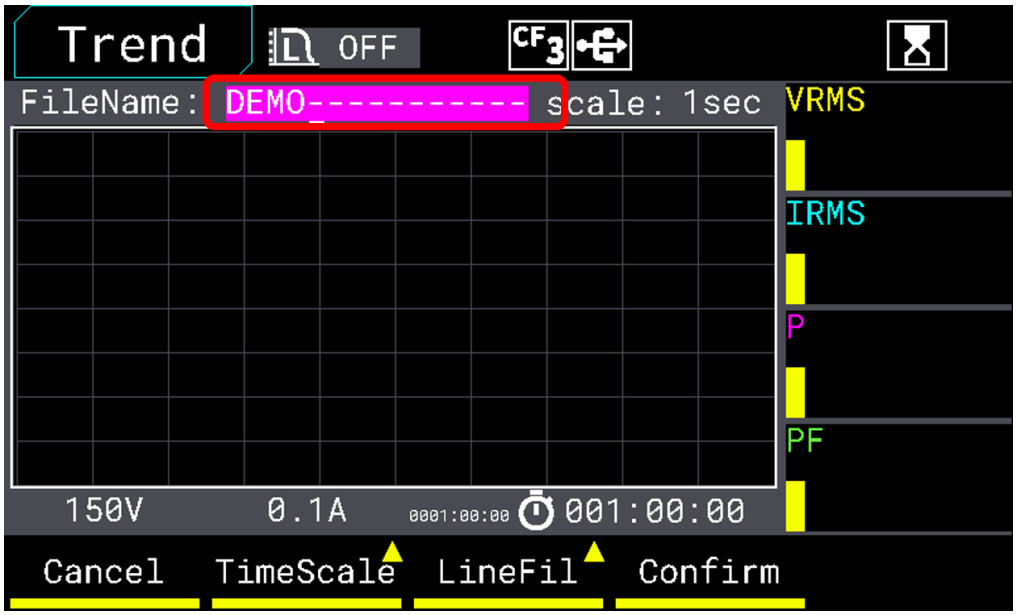


Figure Trend Create file name

3. Press 

to set the time scale.

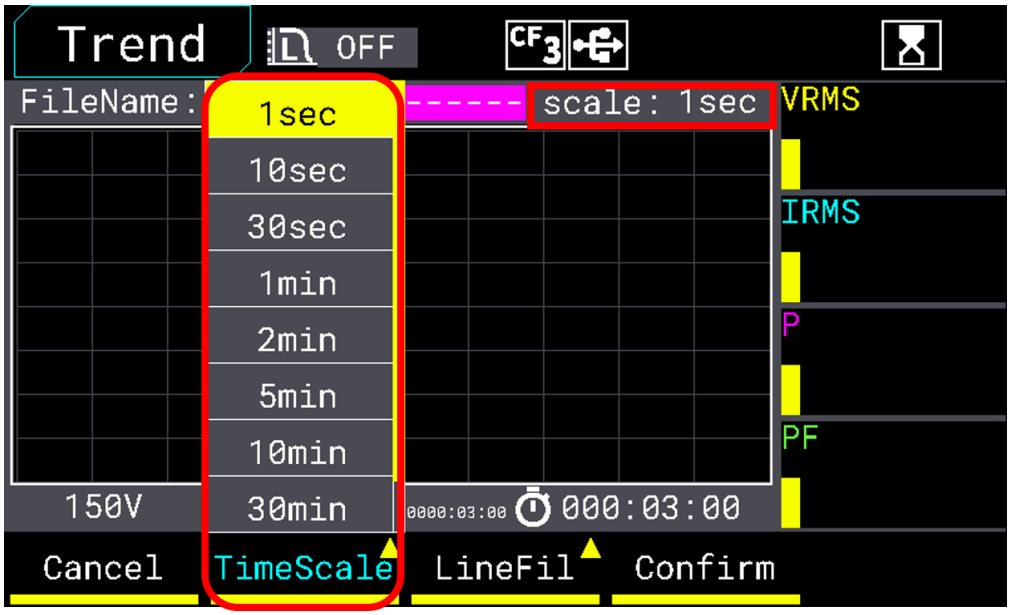


Figure Trend Time Scale

Time Scale	Default Value (hh:mm:ss)	Maximum Time (hh:mm)	Minimum Time (hh:mm)
1sec	00:03:00	01:00	00:01
10sec	00:30:00	10:00	00:01
30sec	01:30:00	30:00:00	00:02
1min	03:20:00	60:00:00	00:05
2min	06:40:00	120:00:00	00:10
5min	16:40:00	300:00:00	00:25
10min	33:20:00	600:00:00	00:50
30min	100:00:00	999:00:00	03:00
60min	200:00:00	999:00:00	05:00

Table Trend Time Scale

4. Press 

to configure the line filter.

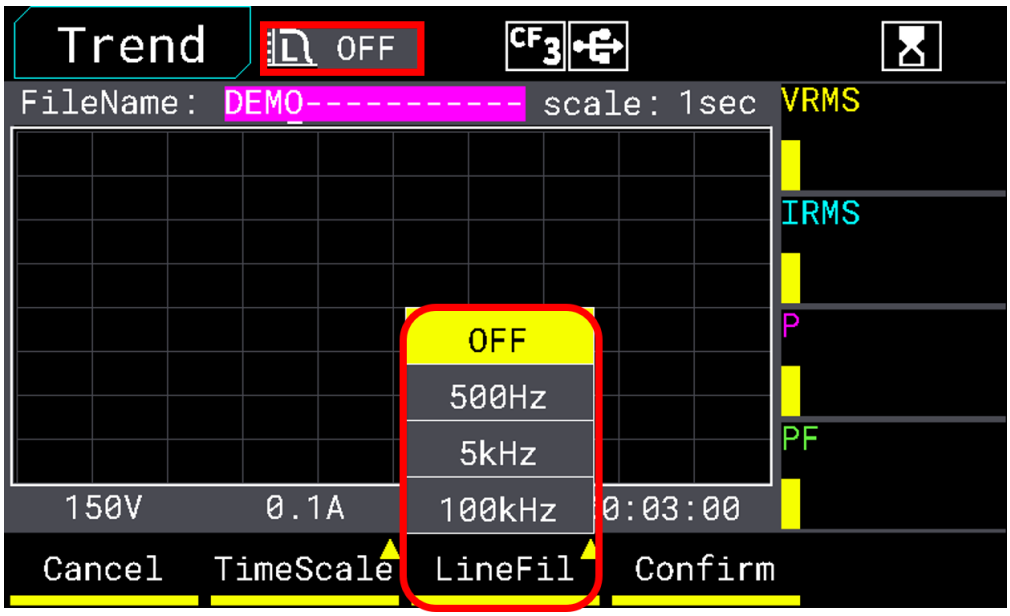
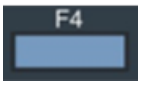
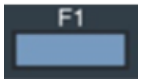


Figure Trend Line Filter

5. Once all settings are configured, press 



to complete the file creation
6. Press 



to **return to the previous screen.**

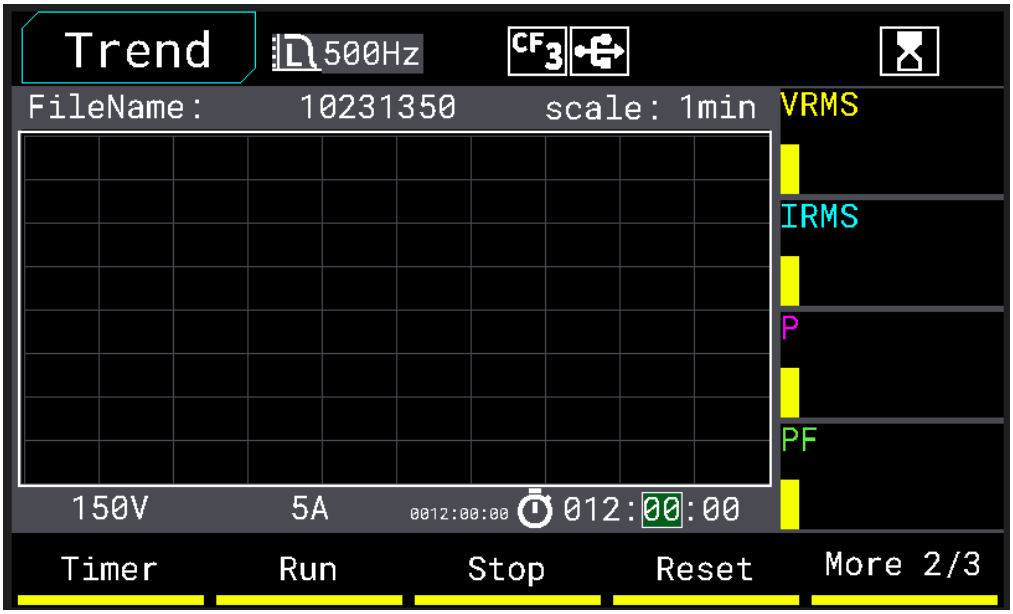
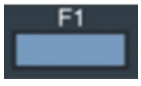
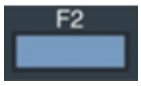


Figure Trend Ready to start

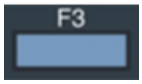
7. Press 



to set the timer.
8. Set the timer value, For example **12:00:00**.
   Note: The available timer range varies depending on the selected time scale. For details, refer to **Table Trend-time scale**.

9. Press 



to start the timer.
10. If you want to change the displayed parameters, go to **More 3/3** to replace them.
11. Return to **More 2/3**, then press 



to stop the timer.

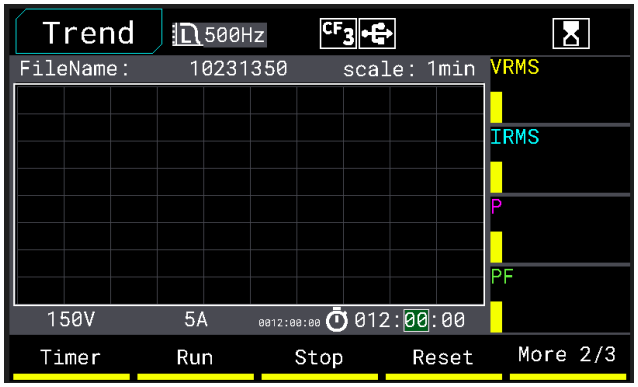


Figure Set Timer

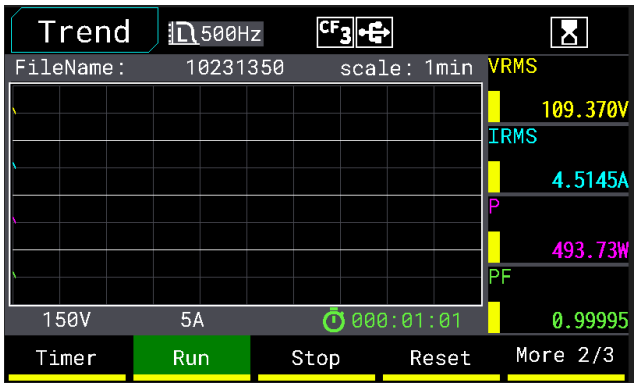


Figure Start Trend Record

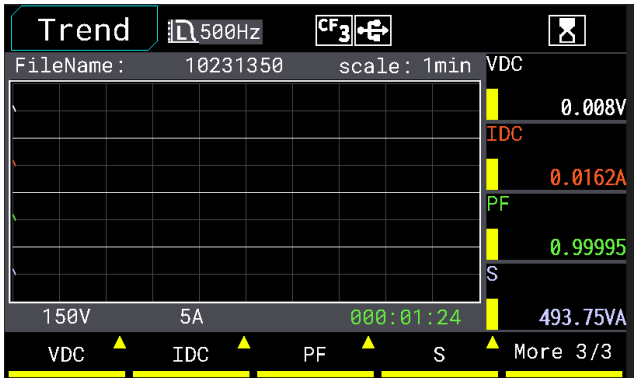


Figure Set Items

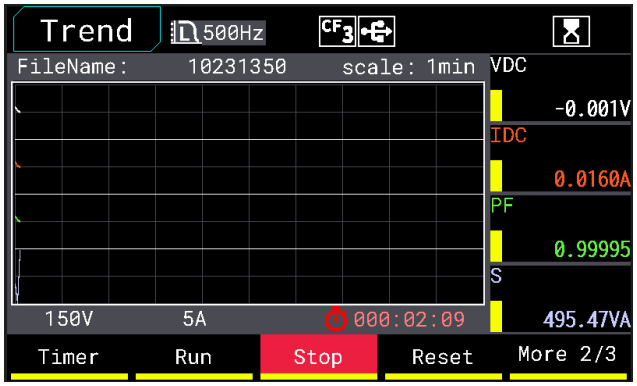
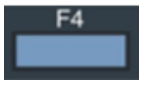


Figure Stop Trend Record

12. Press 



to display the confirmation message: **"Do you want to reset the timer?"**

Press 

to reset the timer to the previously set time.

Note:
DPF measurement is only available when the Harmonic function is enabled.

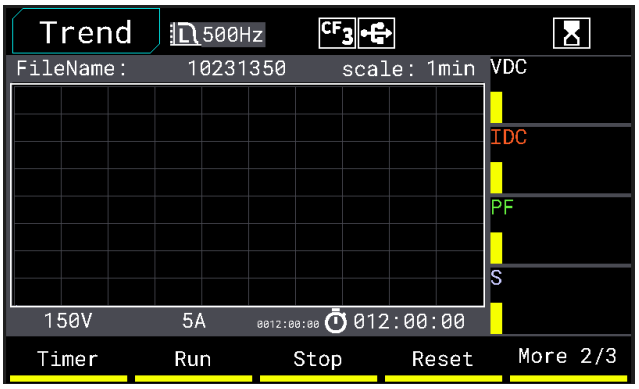


Figure Reset

Note:

During Trend logging, data is continuously saved to the connected USB drive. If the USB is removed during the logging process, data transmission will pause automatically. Once a new USB drive is inserted, logging will resume from the next available record number. For example, if the previous USB recorded up to entry No. 60, the next USB will continue from No. 61 onward.

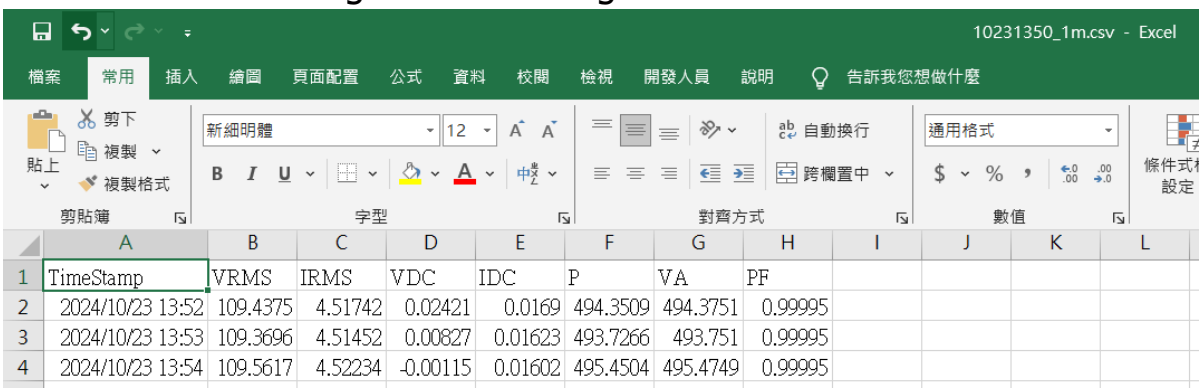
After the test is completed, the full dataset can also be manually saved by pressing **Shift + .** on the instrument panel.

The image below shows the file storage path on the USB drive:

USB:\MICROTEST\MRTG_Value



Figure USB Storage for Trend Data



	A	B	C	D	E	F	G	H	I	J	K	L
1	TimeStamp	VRMS	IRMS	VDC	IDC	P	VA	PF				
2	2024/10/23 13:52	109.4375	4.51742	0.02421	0.0169	494.3509	494.3751	0.99995				
3	2024/10/23 13:53	109.3696	4.51452	0.00827	0.01623	493.7266	493.751	0.99995				
4	2024/10/23 13:54	109.5617	4.52234	-0.00115	0.01602	495.4504	495.4749	0.99995				

Figure Saved File (Recording Duration: 1 Minute)

13. Insert the **USB drive** containing the **saved Trend data** into the **USB port on the rear panel of the 7140**, press F4 LoadFile to select the file, and press F3 Load to load it.

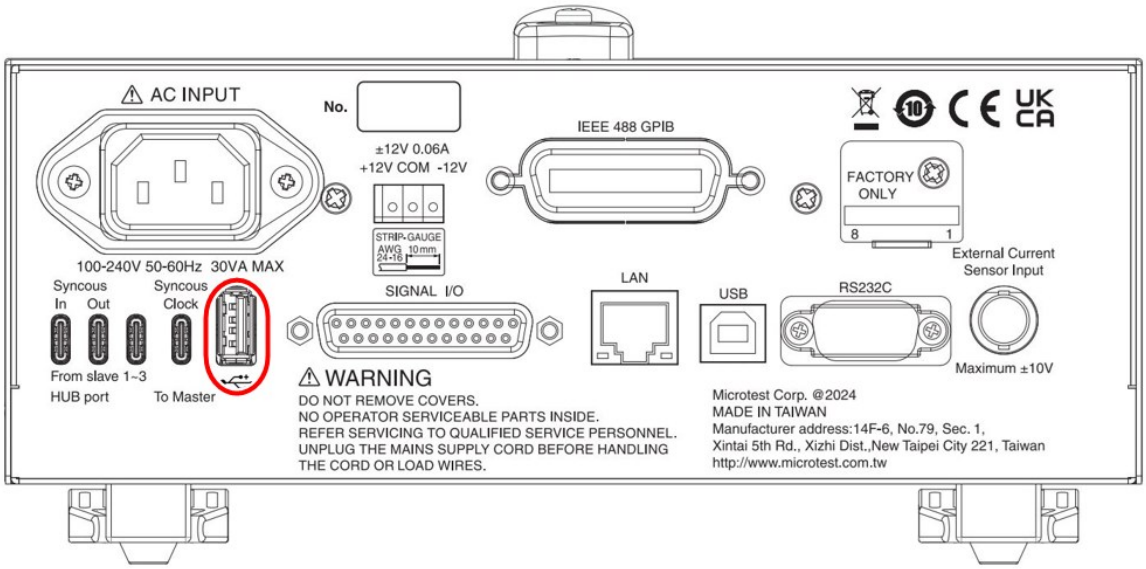


Figure USB Drive Connector

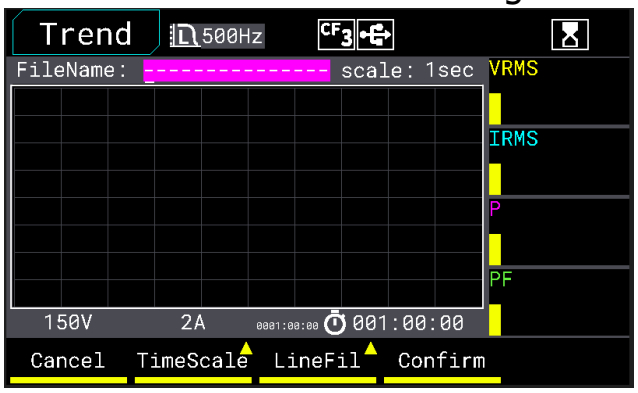


Figure Load File

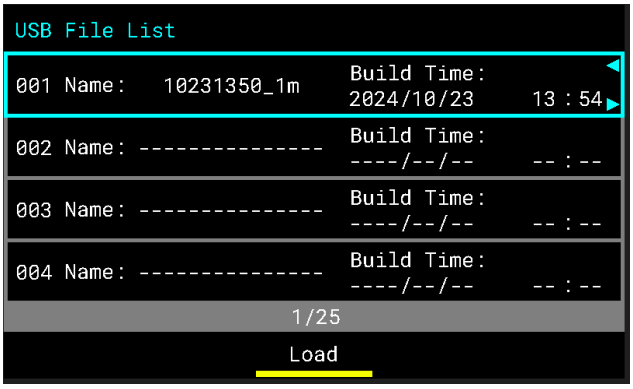


Figure Select USB File

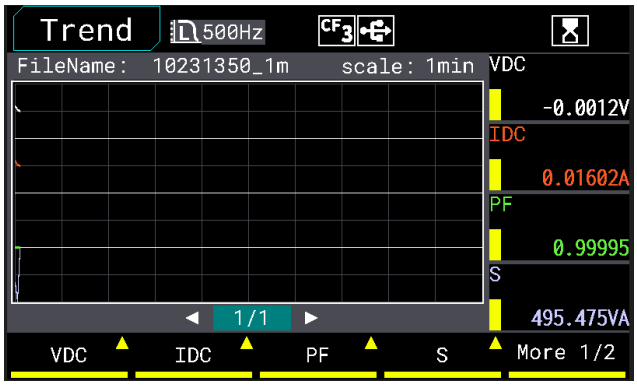


Figure Load Success

3.6 Harmonic Mode Overview

This mode supports **List View** or **Histogram View** (**Histogram is available only on 7140**). The **Histogram option will locate in More 3/4**.

The display items within the red frame are determined by the first four parameters in Meter Mode.
Refer to the section "**Meter mode Item selection**" to change parameters.

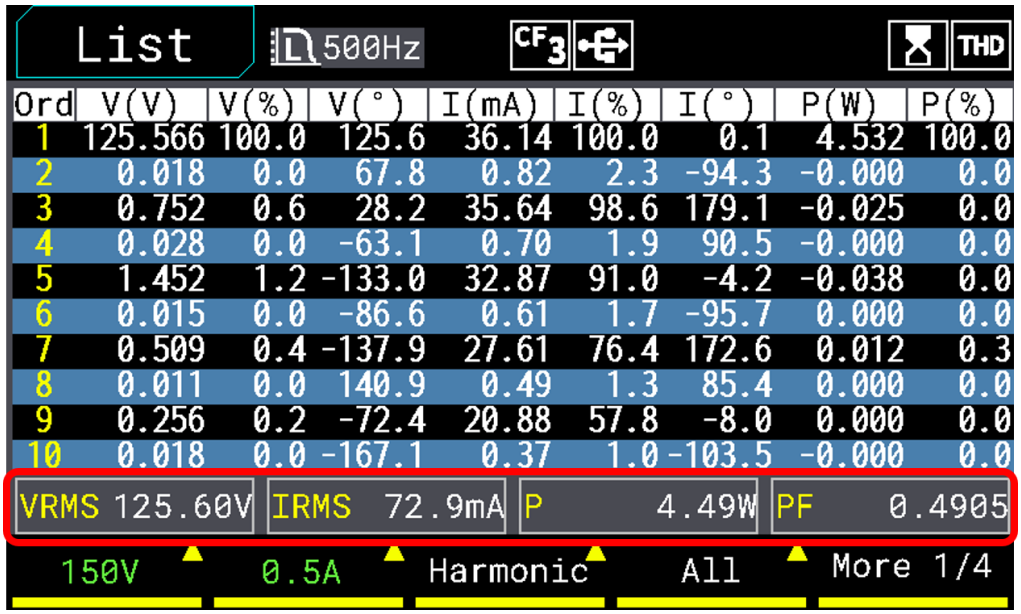
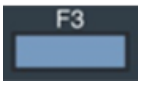


Figure Harmonic Mode

1. Press 

to enter the **Harmonic Mode** page.
2. **Harmonic function**

   Press 



to turn ON or OFF the Harmonic function;

will be displayed in the upper right corner.

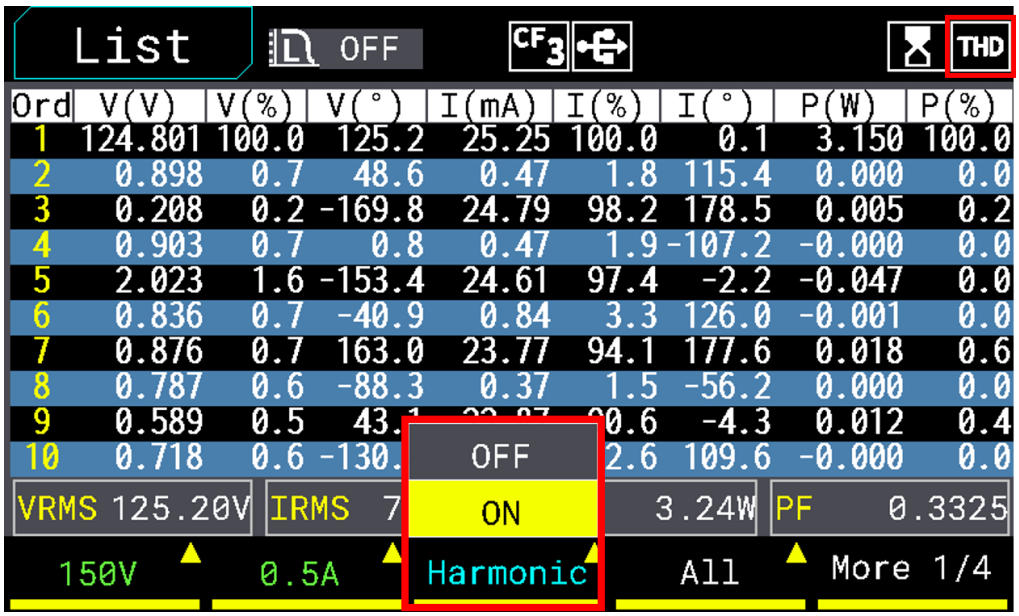


Figure Turn ON/ OFF Hamonic mode

3. Display mode of harmonic list

Press 

to toggle the display between odd-order and even-order harmonics.

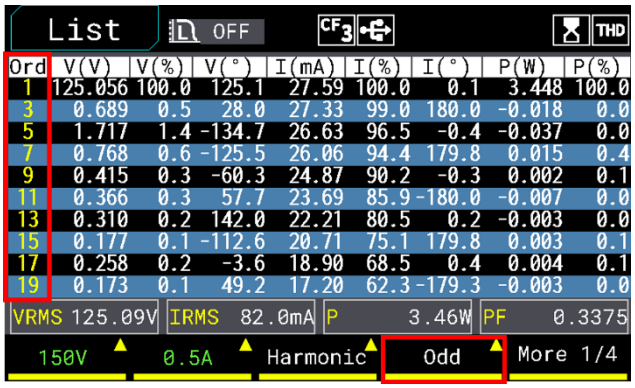


Figure Odd-Order Harmonic View

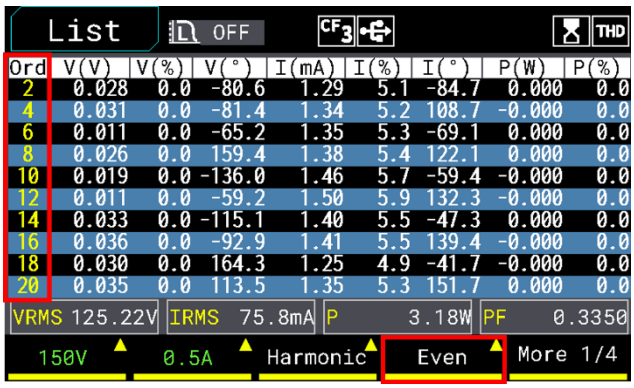


Figure Even-Order Harmonic View

Display	Description
All	Voltage value for 2nd to 100th harmonic orders.
Odd	Current value for 2nd to 100th harmonic orders.
Even	Power value for 2nd to 100th harmonic orders.

4. In **More 2/4**, you can configure **Line Filter** and **ODR 100** (**only available on 7140**) and use **Hold** or **Single Trigger** functions.

5. Line Filter Function

Press 

to toggle the **Line Filter** between **Off**,

500 Hz, and **5 kHz**.

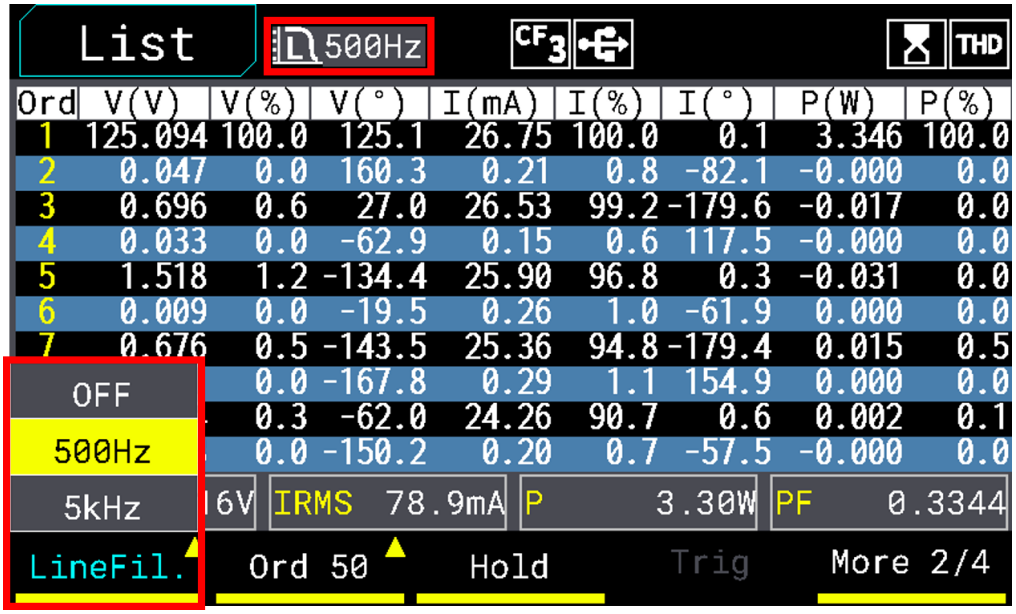
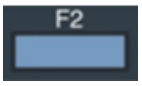


Figure Line Filter Setting

6. Harmonic Order Selection

press 



to toggle the display harmonic order to 50 order or 100 order. (**100** order for **7140 only**).

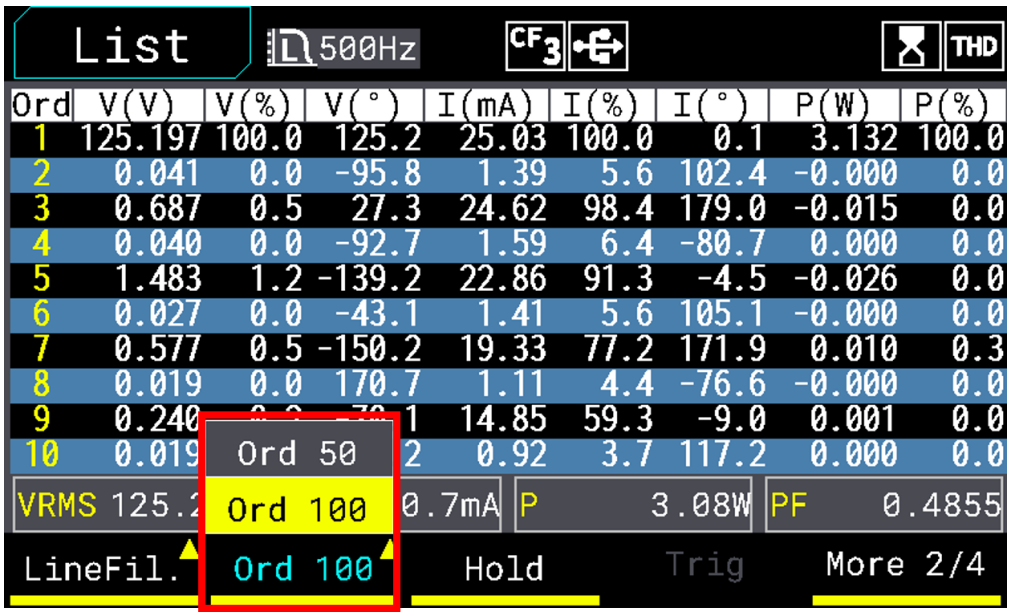


Figure Order selection

7. The **histogram view** is located under **More 3/4.**

Note1:

The histogram view is available only on the 7140.

Note2:

When using Harmonic Mode, the harmonic function must be turned

ON. The icon  should be displayed at the top right corner of the screen.

Figure Histogram View

8. Harmonic Order Selection

press  to toggle the display harmonic order to 50 order or 100 order.

Figure Order selection

9. Hold Function

Press 

freezes the displayed measurement values, preventing updates until Hold is released.

When Hold is activated, the icon changes to 

to indicate the hold state.

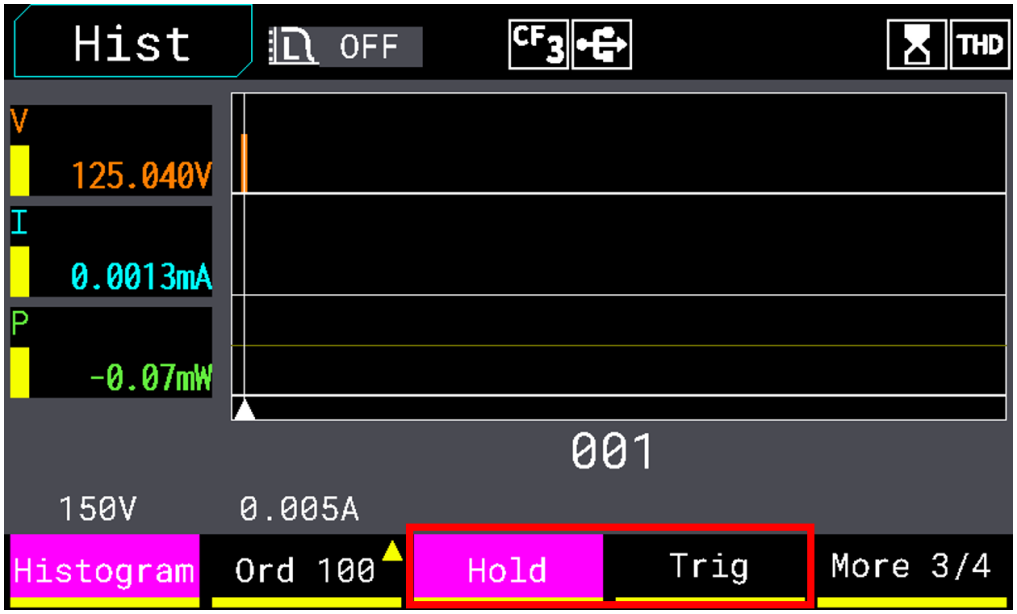


Figure Hold and Trig

10. Trig Function (Single Trigger Mode)

When **Hold** is activated, the 

button lights up, indicating that the instrument is in single trigger mode. Each time the Trig button is pressed, the instrument updates the measurement values once.

11. Item selection

In More 4/4, press F1~F3 to toggle the test items.

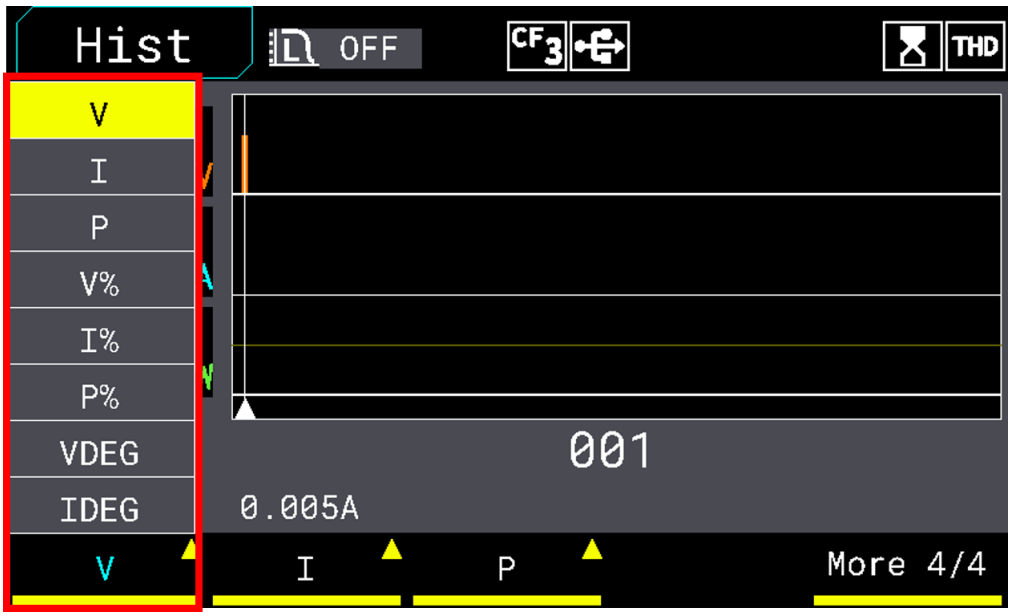


Figure Item selection

Harmonic Items	Description
V	Voltage value for 2nd to 100th harmonic orders.
I	Current value for 2nd to 100th harmonic orders.
P	Power value for 2nd to 100th harmonic orders.
V%	Voltage distortion percentage for 2nd to 100th harmonic orders.
I%	Current distortion percentage for 2nd to 100th harmonic orders.
P%	Power distortion percentage for 2nd to 100th harmonic orders.
VDEG	Phase difference between the fundamental voltage and 2nd to 100th harmonic voltages.
IDEG	Phase difference between the fundamental voltage and 2nd to 100th harmonic currents.

3.7 Comparator Mode Overview

1. Press 

+ 

to enter the **Comparator Mode** page.

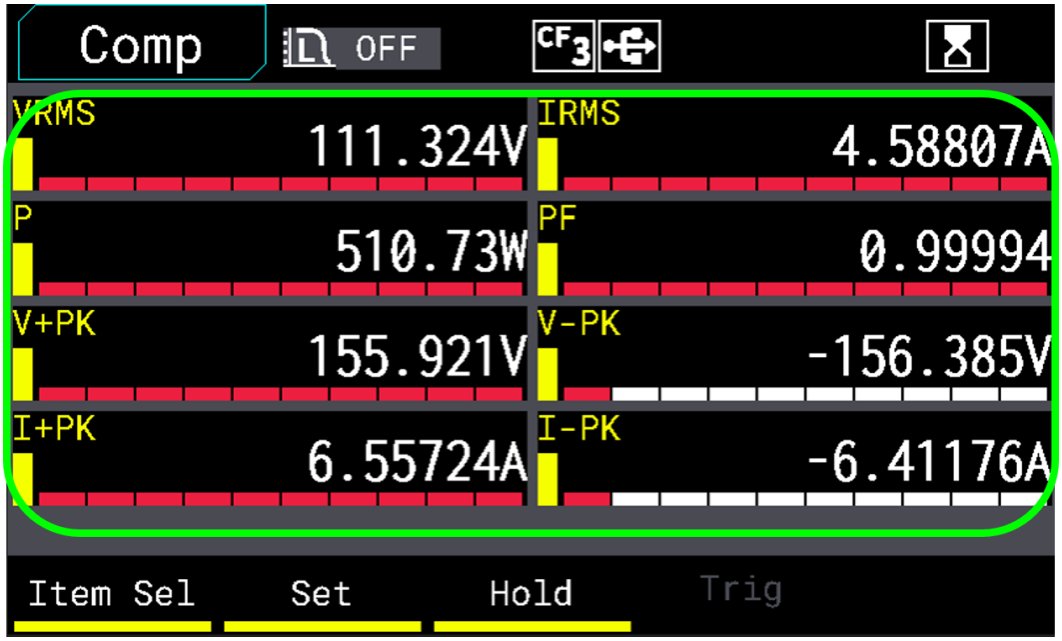
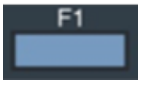


Figure Comparator Mode

NOTE:

- The comparator has a fixed set of **8** test items.
- **VTHD, ITHD, PTHD, and DPF** measurements are only available when the Harmonic function is enabled.

2. Press 

to select the item to be compared.

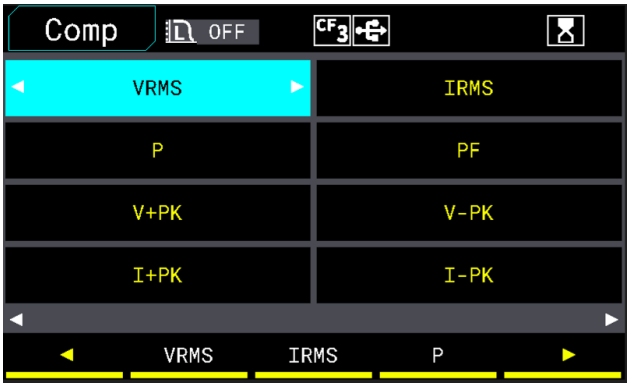


Figure Default items

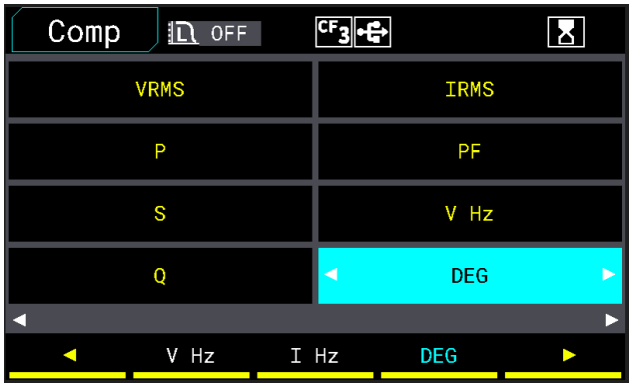
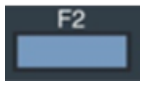


Figure After switching the items

3. Press 



to enter the first **Set** page and use the  or  to navigate through the available item settings.

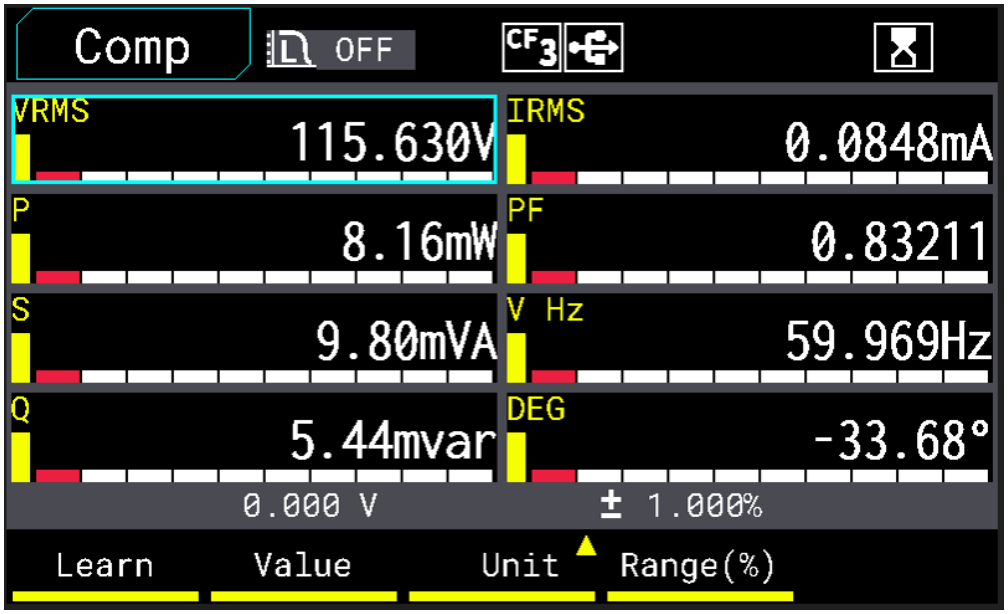
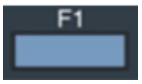
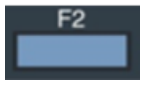


Figure Set page

4. To set **VRMS** as the first parameter, press 



to use the current measured value as the reference value.
5. Press 



to manually enter a standard reference value.

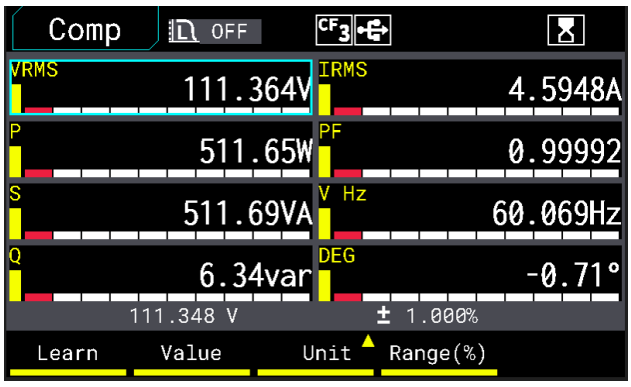


Figure After pressing F1 Learn

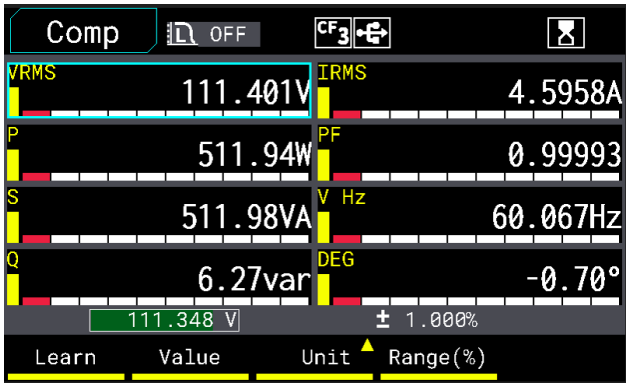
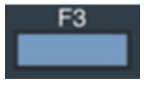
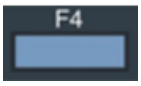


Figure F2 Value setting

6. Press 



to adjust the displayed unit.

7. Press 



to define the tolerance for the reference or standard value. The tolerance range is **0.001% to 99.999%**.

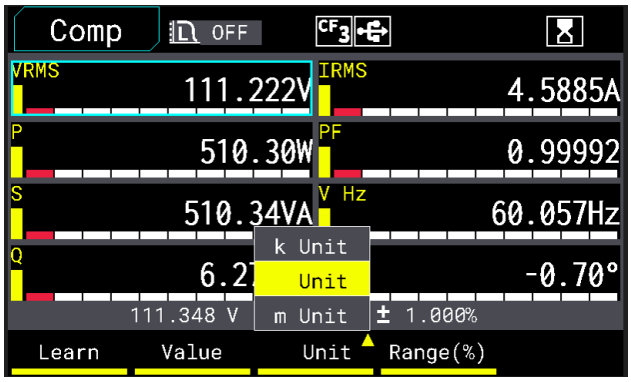


Figure Unit selection

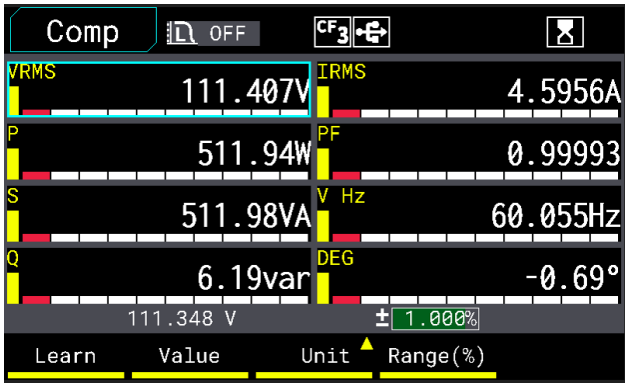


Figure Range(%) setting

8. Once the **settings** are configured, press 

to return to the **Comparator mode** screen.
9. A **bar indicator** at the bottom of the display shows **Pass (Green) or Fail (Red)** status.

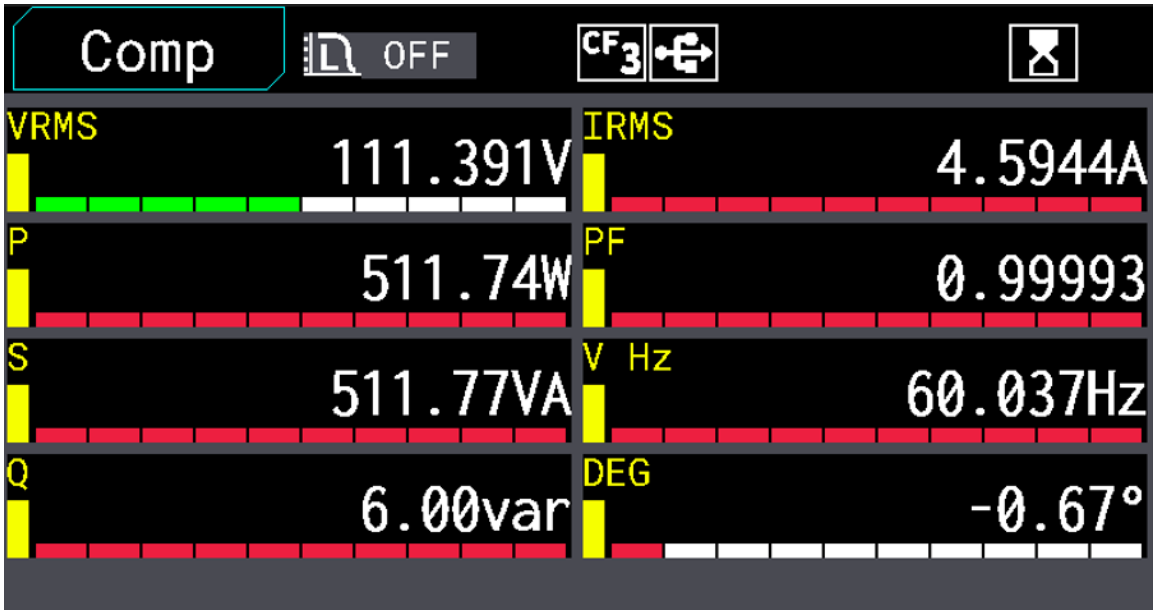


Figure Bar indicator

3.8 File Mode

1. Press SHIFT + INTEGRATOR FILE to enter the **File List** page.

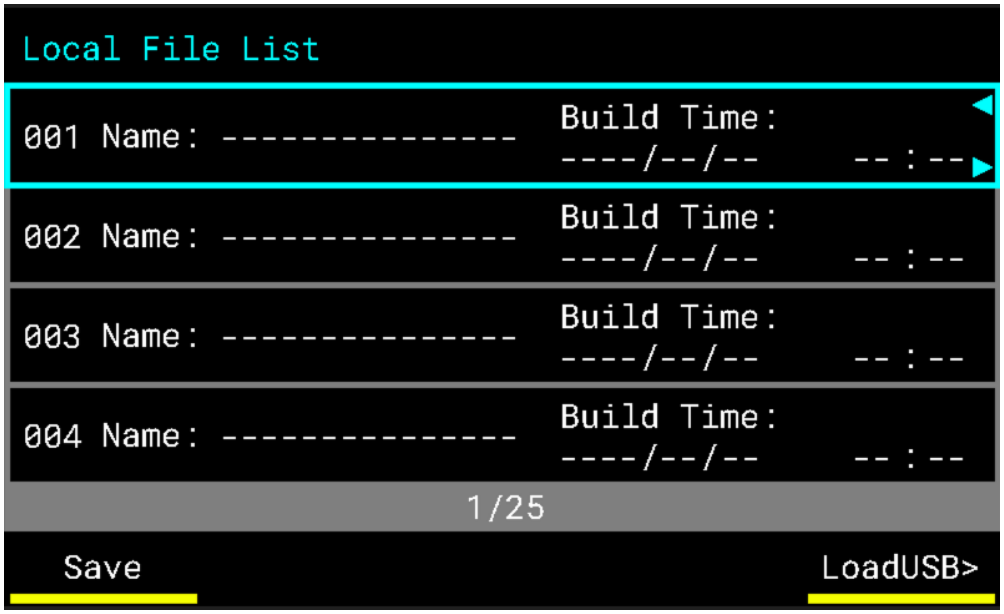


Figure File list

2. Use the ◀ or ▶ to select a storage location (001~100), then press F1 Save to enter the file naming mode.

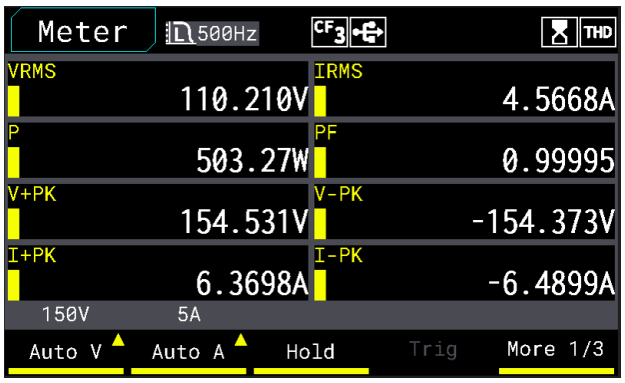


Figure Current setting file

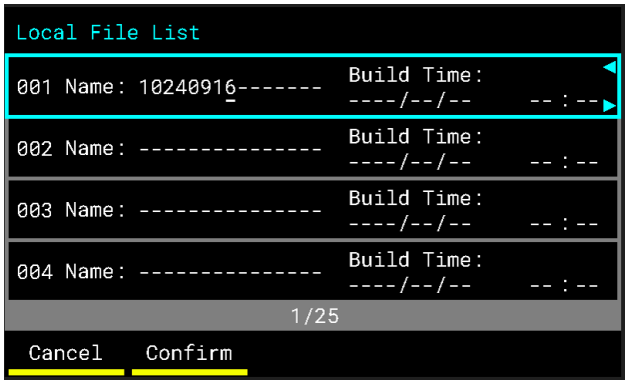


Figure File Naming

3. Enter the new file name and press F2 Confirm to confirm.
4. Press F1 Del to delete the file name within the blue selection box.

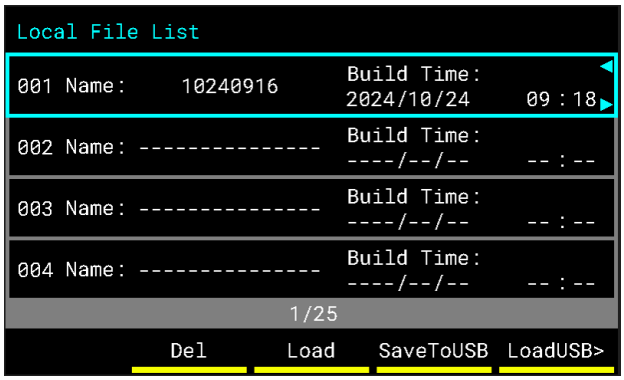


Figure After Press Confirm

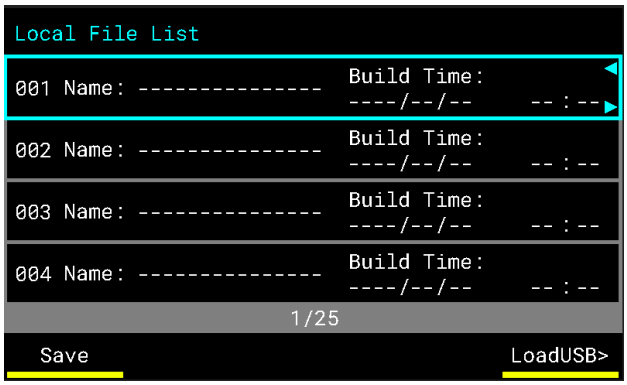


Figure After Delete File

5. Press 

, and a confirmation window **"Load File?"** will appear. Press **Enter** to load the selected file. Once the file is successfully loaded, a message **"Load Completed"** will be displayed.

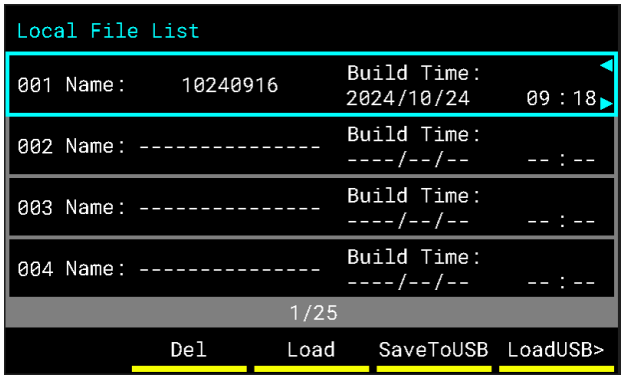


Figure After Load file

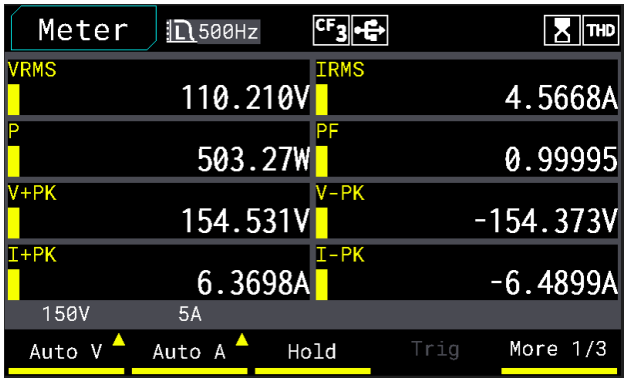


Figure After Delete File

6. Insert a **USB drive** into the **rear USB port** of the **7130/7140**, then press 

to save the selected file into the USB drive.
7. The image below shows the file storage path on the USB drive: **USB:\MICROTEST\Setting**.

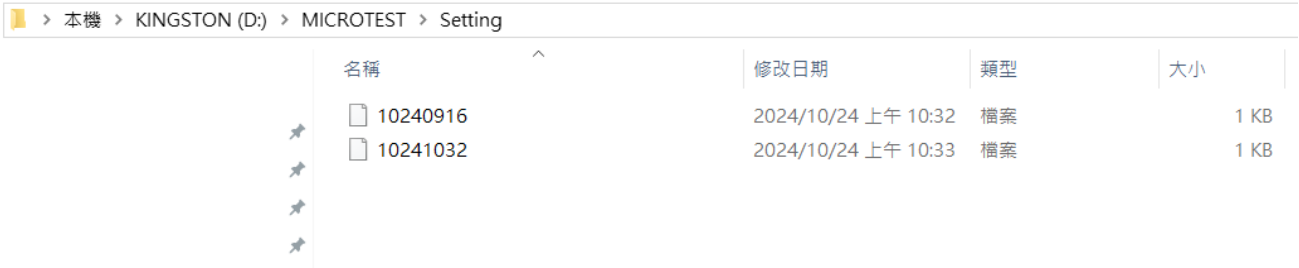
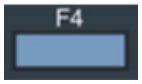
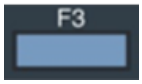


Figure Path on USB Drive

8. Insert the **USB drive** into the **rear USB port** of the **7130/7140**, then press 

to access the **USB file list**. Use the  or  to select the file to be loaded, then press 

to load the selected file.

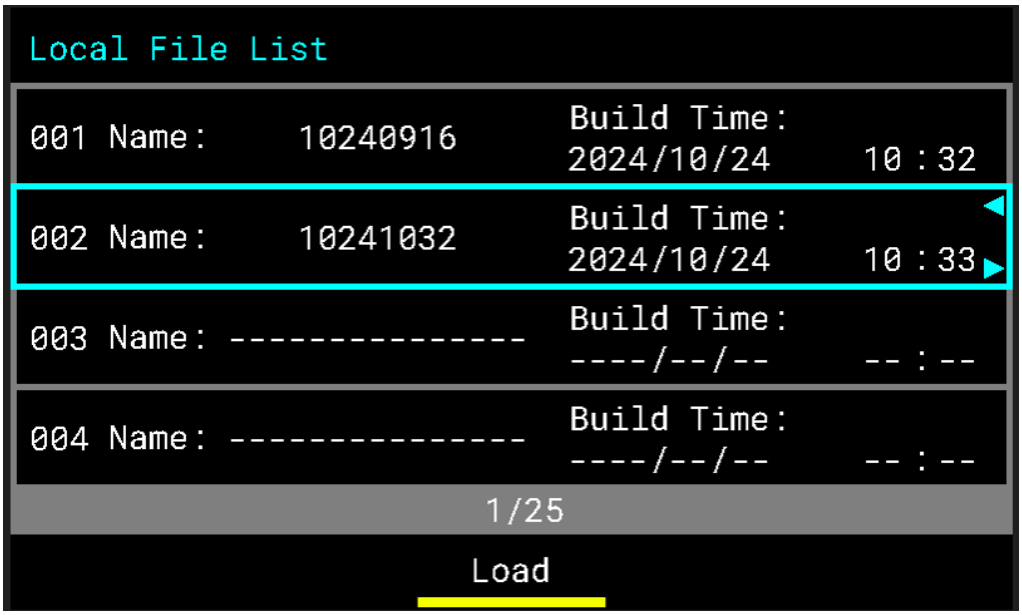


Figure Load Setting File

3.9 Setup Menu Overview

1. Press SHIFT + MONITOR SETUP to access the **Setup Menu.**

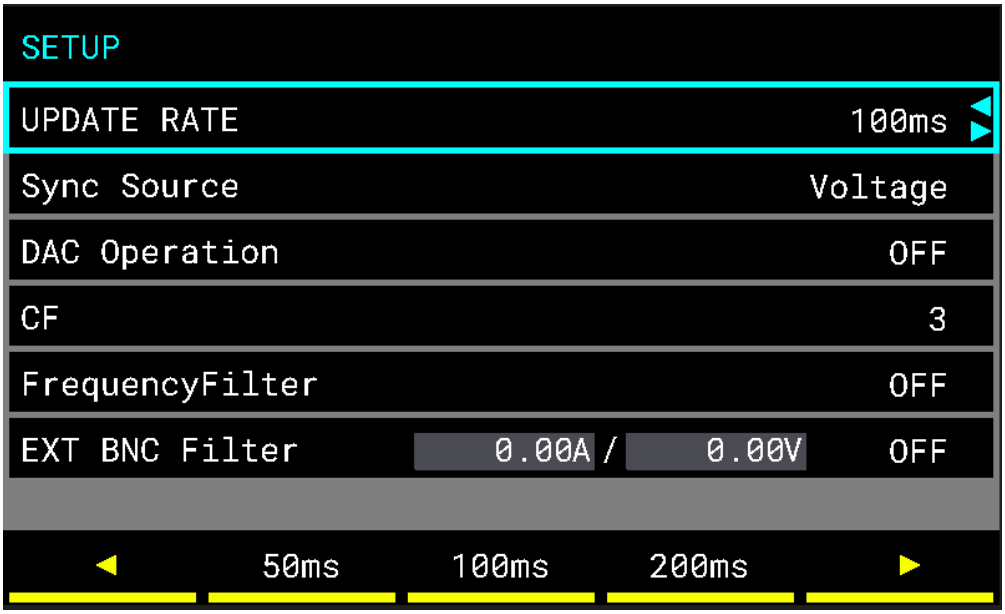


Figure Setup Menu

2. **UPDATE RATE**
   Defines how frequently data is refreshed.
   Available settings:
   50/100/200/250/500msec,
   1/2/5/10/15/30 sec
   1/5/10/15/30/60 min.
   Use the ◄ **or** ► to navigate to the **UPDATE RATE** option and select the desired refresh rate using **F1~F5.**

3. **SYNC SOURCE (Synchronization Source)**
   The synchronization source can be set to one of the following options: **Voltage**, **Current**, or **NO USE (Disabled)**.

   Choosing **Voltage** or **Current** as the synchronization source depends on your specific needs and the type of signal being measured. Ensure a thorough understanding of your application to make the correct selection, optimizing monitoring and measurement performance.

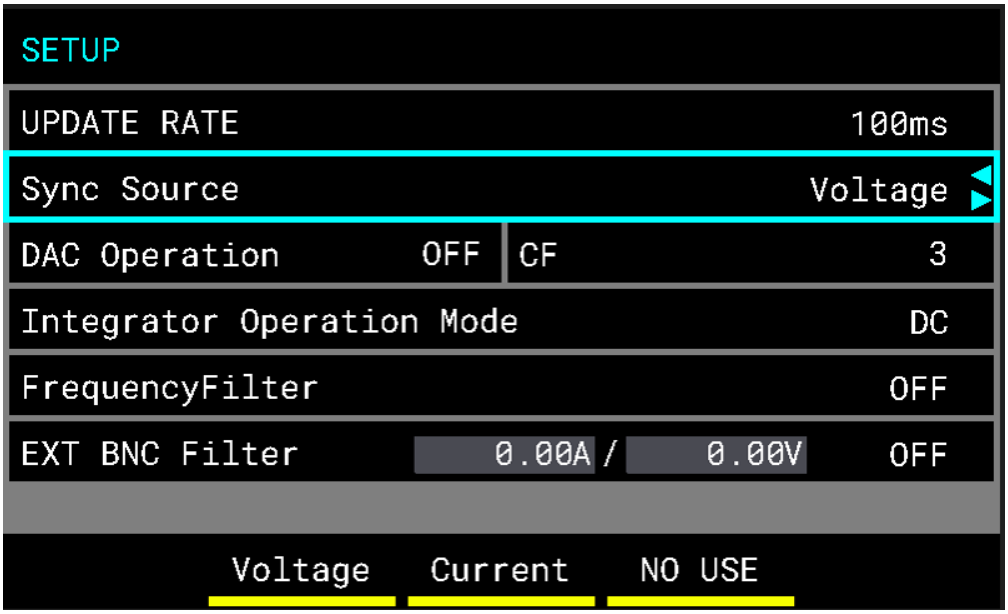


Figure Set Sync Source

Voltage:

- The system prioritizes voltage (**frequency jitter <2%**) as the synchronization source, followed by current.
- If both signals are unstable, the system defaults to **500 KSPS fixed sampling**.
- When the synchronization source is set to voltage, the system will **prioritize detecting a voltage signal for synchronization and measurement**.
- If no voltage signal is detected but a current signal is available, the system **automatically switches to current as the synchronization source**.
- This means that when voltage synchronization is preferred but temporarily unavailable, the system can continue measuring using the current signal.

Current:

- The system prioritizes current (**frequency jitter <2%**) as the synchronization source, followed by voltage.
- If both signals are unstable, the system defaults to **500 KSPS fixed sampling**.
- When the synchronization source is set to current, the system will **prioritize detecting a current signal for synchronization and measurement**.
- If no current signal is detected but a voltage signal is available, the system **automatically switches to voltage as the**

synchronization source.

- This means that when current synchronization is preferred but temporarily unavailable, the system can continue measuring using the voltage signal.
- This function ensures that even under different operating conditions, the system can still perform effective measurements without requiring manual switching of the synchronization source. This improves ease of use, reliability, and measurement accuracy.

No use:

- In many industrial and production line applications requiring **instantaneous power and current measurements**, it is recommended to set the synchronization source to **"No Use"** when used on the production line.
- With this setting, the device will operate at a **fixed 500 ksps sampling rate** and a **fixed sampling duration**, ensuring **the fastest measurement speed and more consistent data**.
- For example, when testing newly manufactured **AC-DC adapters** on a production line, setting the SYNC source to **"No Use"** is an optimal choice.

4. **DAC Operation (Digital-to-Analog Conversion)**

This function **samples ADC data in real time and regenerates it as an analog signal**, allowing external oscilloscopes to observe voltage and current waveforms. The DAC output signal range is **±10V**, and the conversion rate is synchronized with the sampling rate. However, it introduces a **one-sample delay (ADC Sampling Latency)**.

The primary purpose of this function is to assist users in analyzing **basic 50~60Hz electrical products** and **periodic signals**. When the signal frequency increases and the ratio of sampling rate to signal frequency falls below **10 times**, the DAC output may produce a coarser voltage and current signal. However, the output still retains **reference value** for analysis.

Note:

If the **Line Filter** is enabled and the signal exceeds the measurement range, the DAC output may experience oscillations due to digital filtering effects. Please ensure that the signal is within the valid

measurement range (**not in Over Range**) for the DAC to **accurately reproduce the original waveform**.

This function converts real-time **ADC sampled data** into an **analog signal**, allowing an external **oscilloscope** to observe **voltage and current waveforms**

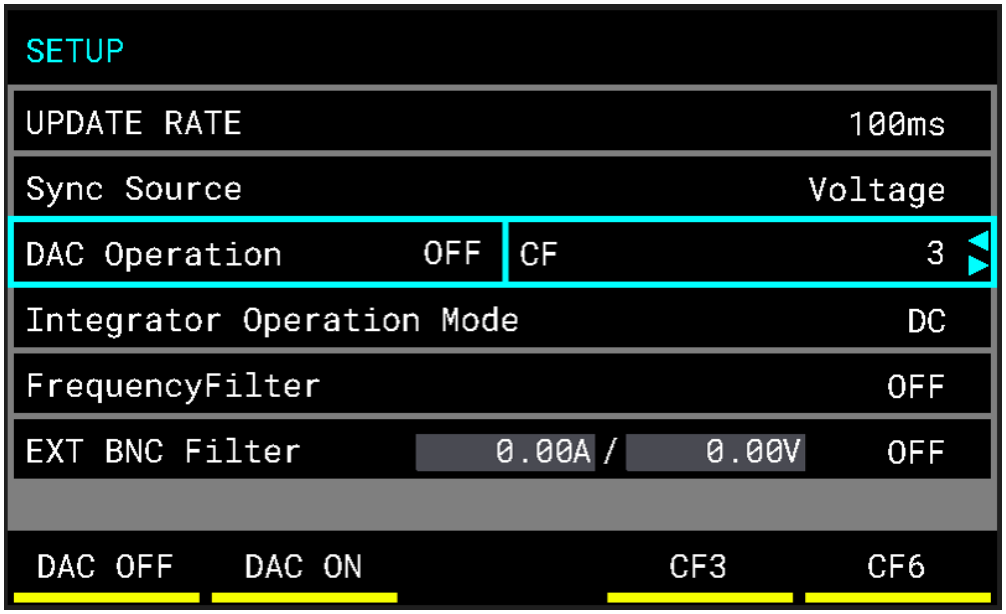


Figure DAC Operation and Crest Factor setting

5. **CF (Crest Factor)**
   The **Crest Factor (CF)** can be set to **3 or 6** and is an important parameter for analyzing **AC signals**, describing the waveform characteristics. It represents the **ratio between the peak value and the root mean square (RMS) value**, primarily used for **voltage evaluation**, but also applicable to **current measurements**.

   Since the crest factor indicates how much higher the peak value is compared to the RMS value, it helps assess signal properties and measurement accuracy.

   CF3: Sets the **maximum peak-to-RMS current ratio** to **300%**.
   CF6: Sets the **maximum peak-to-RMS current ratio** to **600%**.

   This setting is especially useful when measuring **devices with high current crest factors**, ensuring **accurate current measurements**

without frequent range switching. By reducing the need for manual adjustments, it improves **measurement efficiency, accuracy, and reliability**.

6. Integrator Operation Mode

The integrator mode allows users to perform power monitoring in either **DC** or **RMS** mode, enabling them to configure the desired measurement mode as needed. Additionally, **the synchronization source setting directly affects the segment duration during integrator operation**.

When using the integration function, the internal measurement chip **dynamically calculates the segment duration** based on the **synchronization source signal period**, ensuring that it closely matches the **UPDATE RATE**. If the integrator operates **without a synchronization source** or in **DC integration mode**, the segment duration will be determined by the **UPDATE RATE setting**.

For example, if the **UPDATE RATE is set to 100ms** and the voltage signal frequency is **55Hz**, the RMS integration update time will be **90.9ms**. The power meter automatically calculates the closest possible segment duration to **100ms**, ensuring that the measurement is synchronized with the complete signal cycle while maintaining the user-specified update rate as accurately as possible.

This mechanism ensures **both measurement stability and optimal panel update speed**, providing precise and reliable measurement results.

Note:

Once integration has started, the **integration operation mode** cannot be changed unless the integration process is first **terminated.**

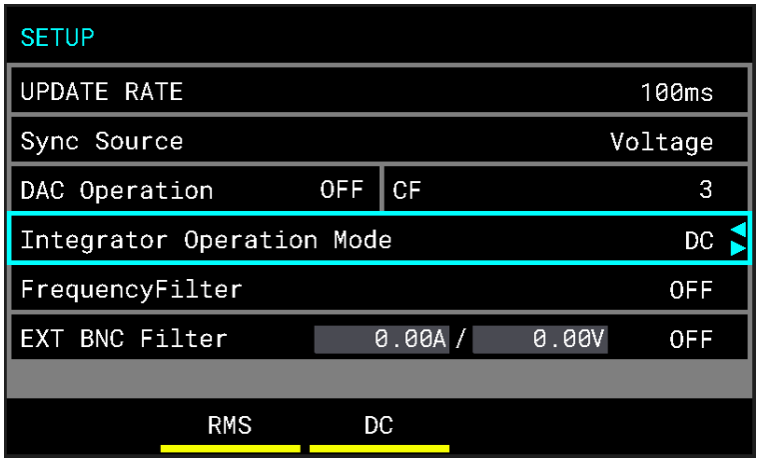


Figure Integrator Operation Mode Selection

7. Frequency Filter

Function:

When measuring signals with a **fundamental frequency of 50Hz or 60Hz** that contain **high-frequency components above 500Hz**, enabling the **Frequency Filter (ON)** will **filter out frequencies above 500Hz**, displaying only frequencies **below 500Hz**.

Important:

- The **Frequency Filter only affects frequency measurements** and does **not impact voltage, current, or power readings**.
- If the **fundamental frequency over 490Hz**, the **Frequency-Filter must be set to OFF**, as enabling it may **affect the bandwidth of voltage and current frequency meters**, preventing accurate frequency measurements.

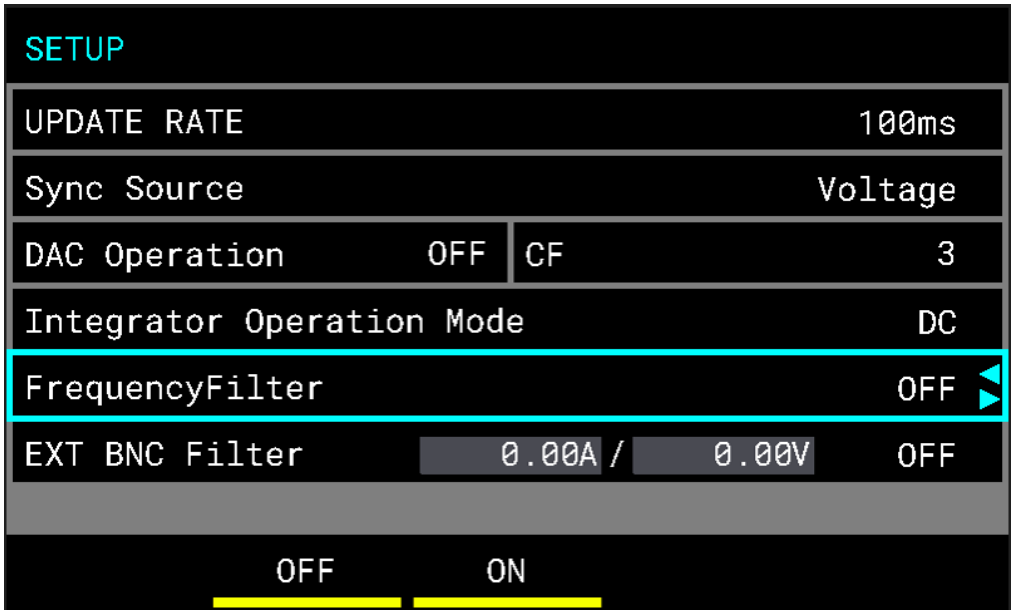


Figure Set Frequency Filter

8. EXT BNC Filter

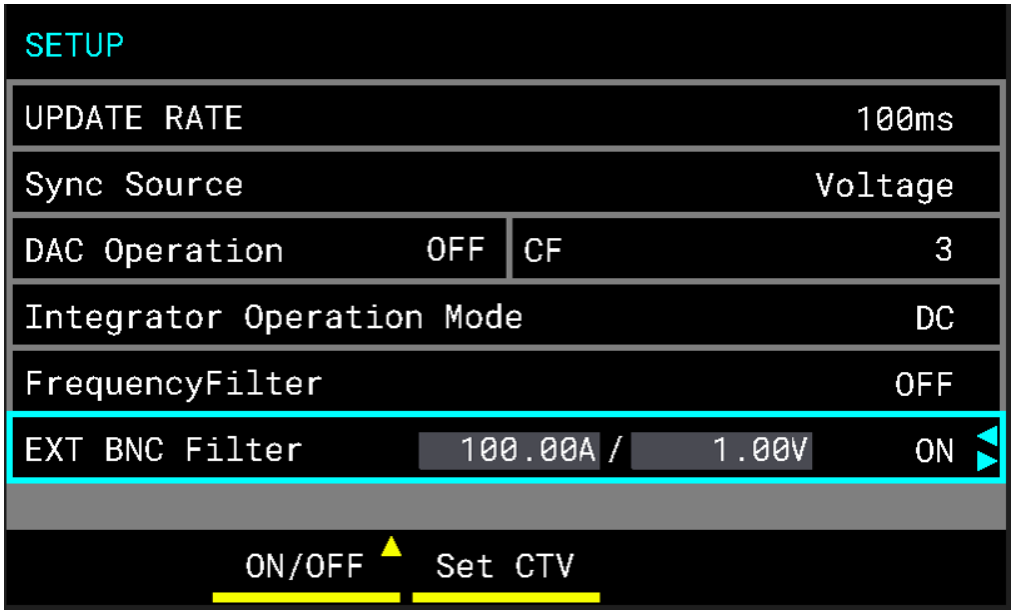


Figure Set EXT BNC Filter

When using a **clamp-type current transformer (CT)**, connect it to the **Sensor Input** on the **7140/7130**.

Press 

to manually configure the **current-to-voltage ratio** based on the specifications of the clamp-type current transformer.

If the **measured current is below 1% of the sensor's rated range**, press 

to turn **ON** the **EXT BNC Filter** for improved measurement accuracy.

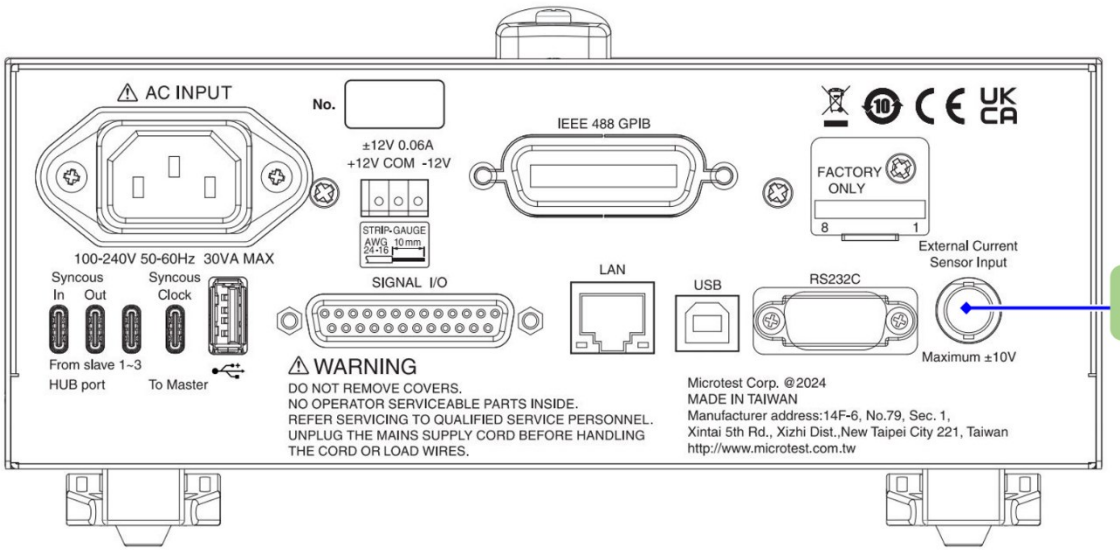


Figure BNC Connector

3.10 System Page Overview

1. Press 

+ 

to access the **System Page**.

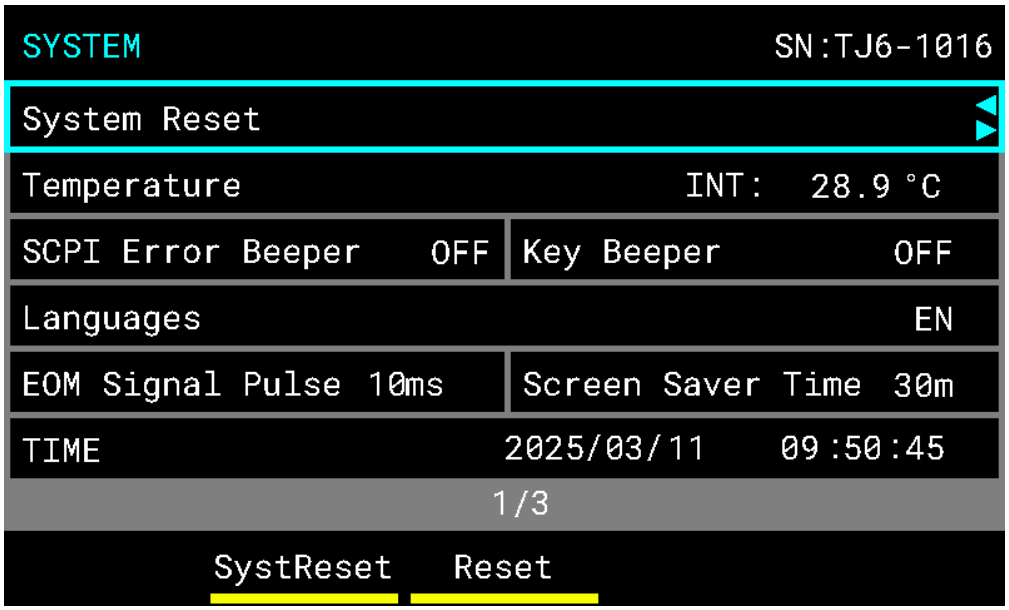
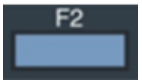


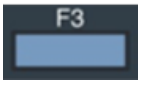
Figure System page

2. **System Reset**

Press 



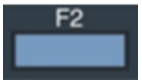
to display the confirmation window: **"System Reset? (Clear All Files)"**. Press **Enter** to confirm and reset the system, deleting all stored files.

Press 

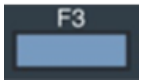


to display the confirmation window: **"Reset? (Keep Stored Files)"**. Press **Enter** to confirm and reset the system while keeping stored files

3. **Temperature (Internal Device Temperature)**

Press 



or 



to switch between **Celsius (°C) and Fahrenheit (°F)**.

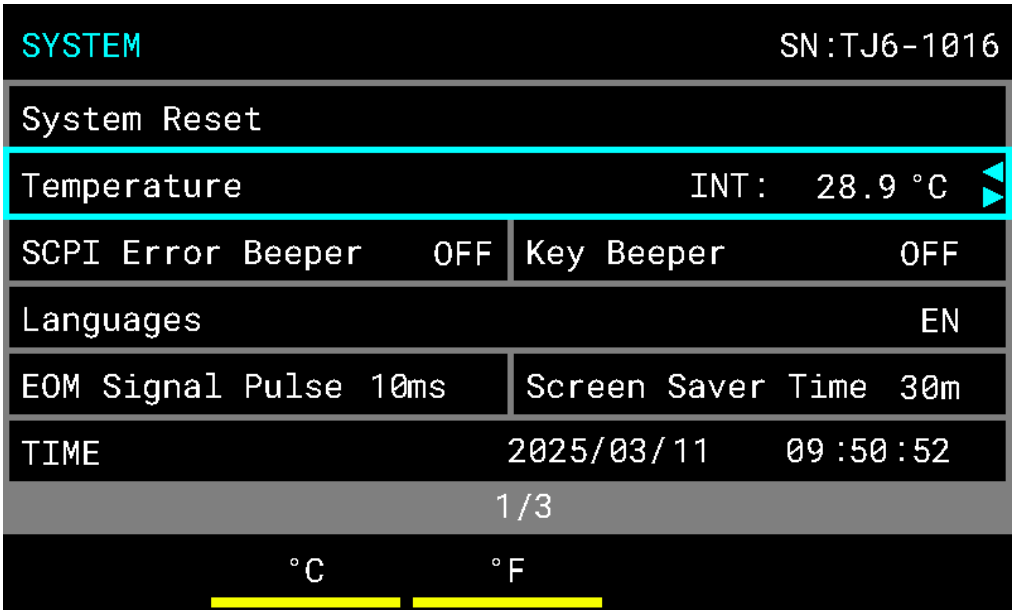


Figure Internal Device Temperature

4. **SCPI Error Beeper**

   When enabled, the device will emit a **beep sound** to notify the user when an SCPI command error occurs.

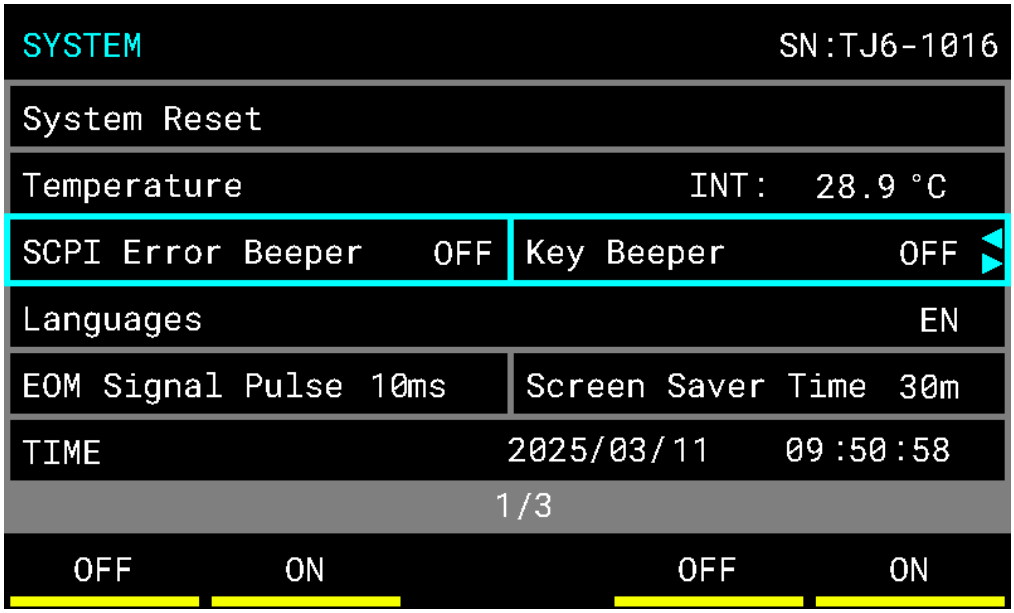


Figure SCPI Error Beeper

5. **Key Beeper**

   Allows enabling or disabling **key press sound feedback.**

   When enabled, the device will emit a **beep sound** upon pressing any key

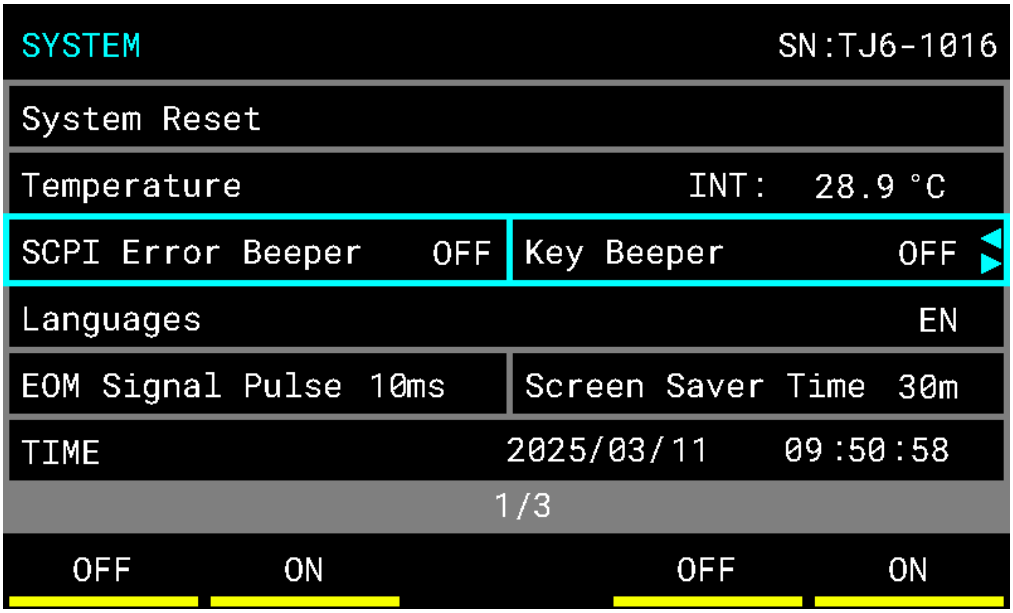
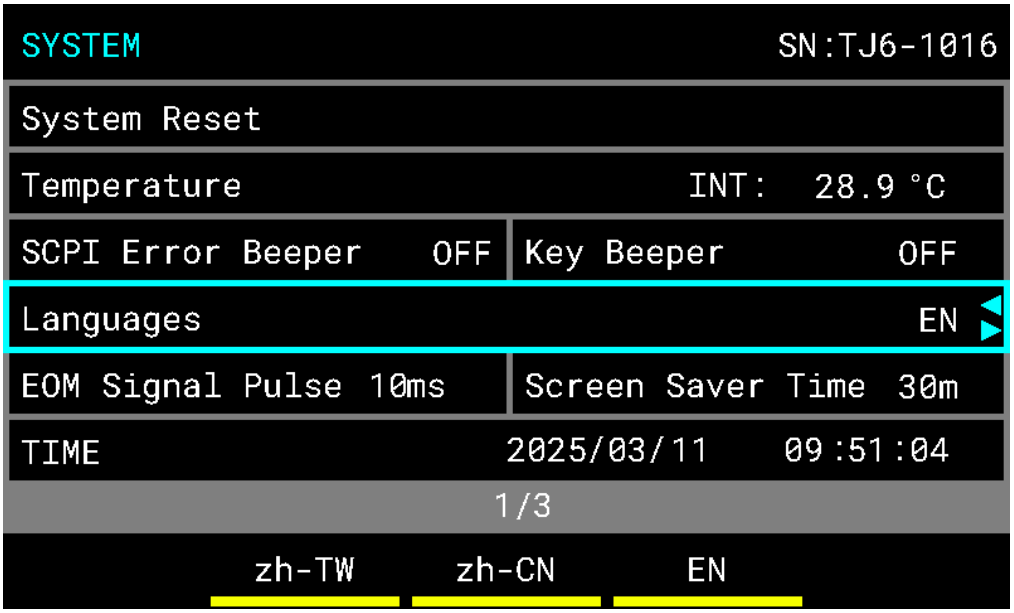


Figure Key Beeper

6. **Languages:**
   Sets the display language to zh-TW, zh-CN, EN



7. **EOM Signal Pulse & Screen Saver Time**

   Press 

   to set the **End of Measurement (EOM) signal output duration** for **SIGNAL I/O**, ranging from **1–40ms.**

   Press 

   to set the **Screen Saver activation time** to **OFF, 15, 30, or 60 minutes**

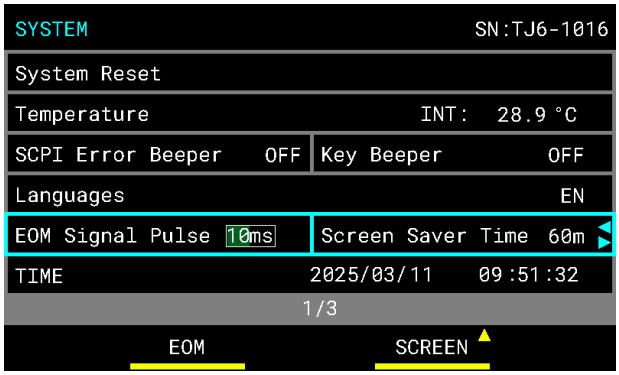


Figure Set EOM I/O time

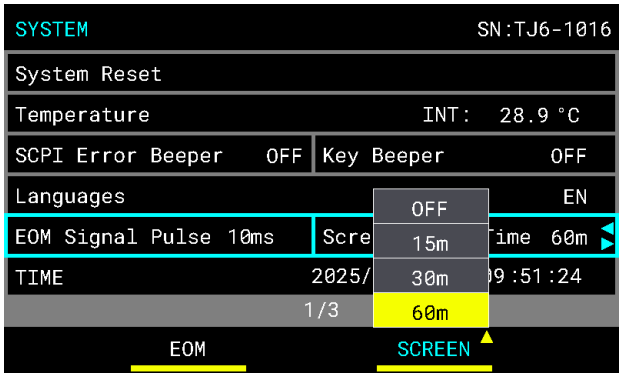
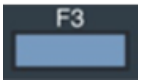


Figure Set Screen Saver Time

8. Time Setting

Press 



and use the   and **numeric keys** to adjust the **date and time**
(Factory default settings are pre-configured.)

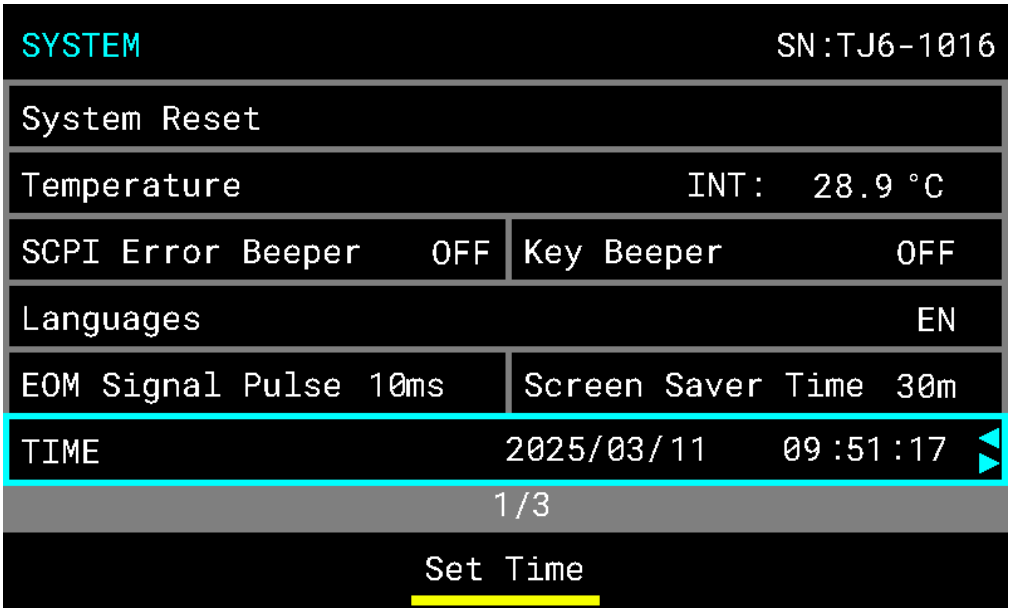


Figure Set System Time

9. LAN Setting

Press  navigate to **2/3 page** to edit **LAN settings.**

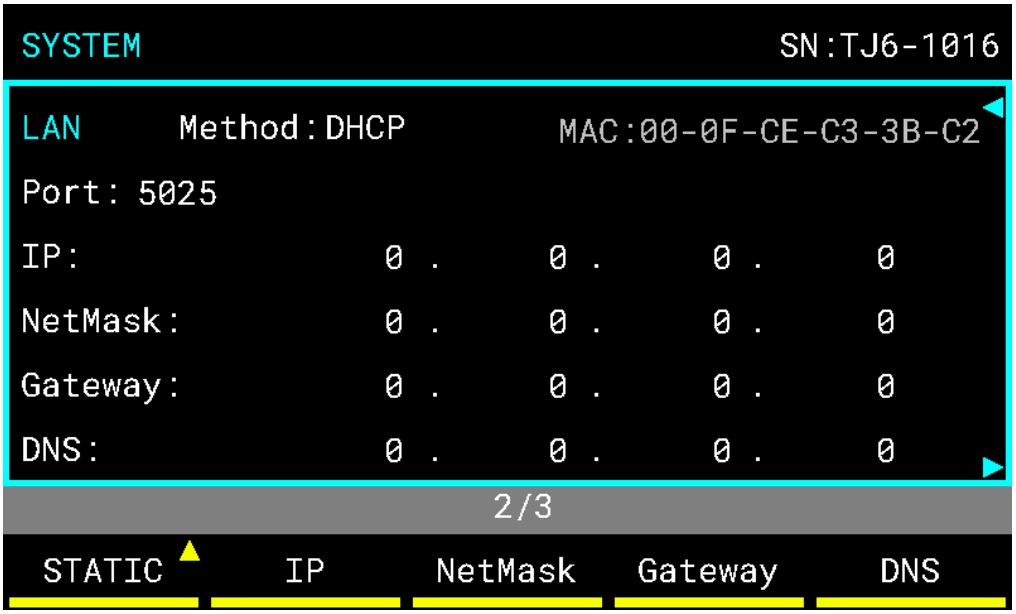


Figure Set LAN

Insert an **Ethernet cable** into the **network connector** and choose a connection type:

- **DHCP (Dynamic Host Configuration Protocol)**
- **STATIC (Static IP Address)**

If **DHCP** is selected, the system automatically assigns an **IP address, subnet mask, and gateway.**

If **STATIC** is selected, manually configure the following:

- **IP Address**
- **Net Mask (Subnet Mask)**
- **Gateway**
- **DNS (Domain Name System)**
- **Port (Range: 1–65535, default: 5025)**

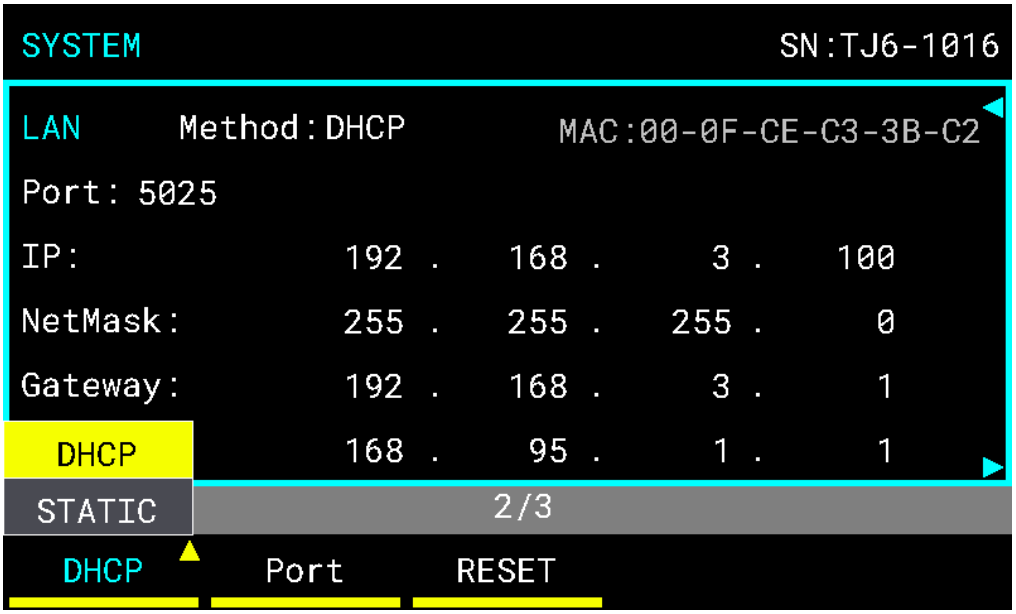


Figure Set LAN-Static

10. RS-232 Baud Rate Setting

Press  navigate to **3/3 page** to edit **RS-232 Baud Rate settings**.

Available baud rate options: **9600, 19200, 38400, 57600, 115200.**

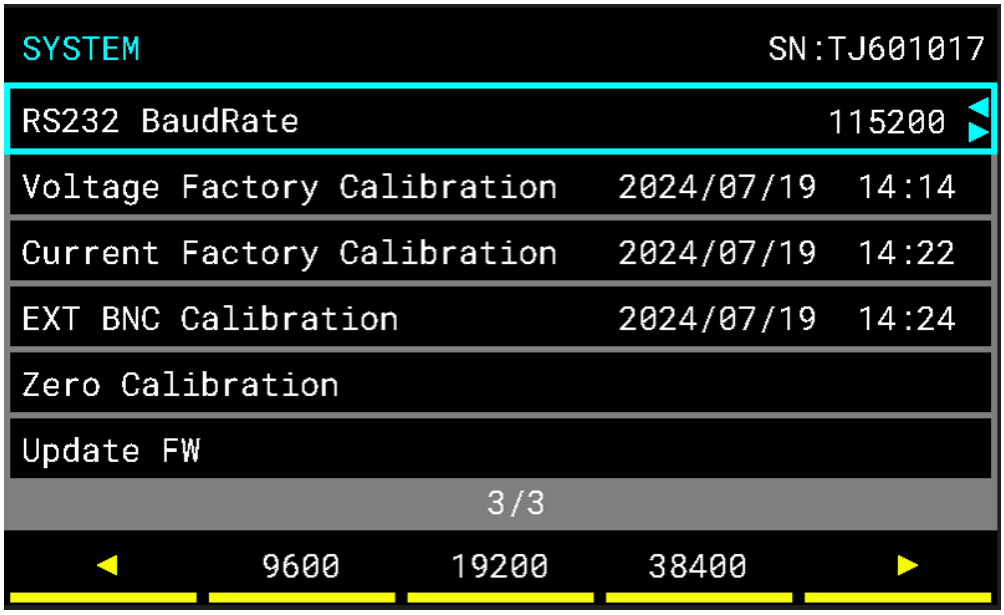


Figure RS-232 Baud-Rate

11. Voltage Factory Calibration

Displays the **factory-set voltage calibration gain data**.

12. Current Factory Calibration

Displays the **factory-set current calibration gain data**.

13. EXT BNC Calibration

Displays the **factory-set BNC calibration gain data**

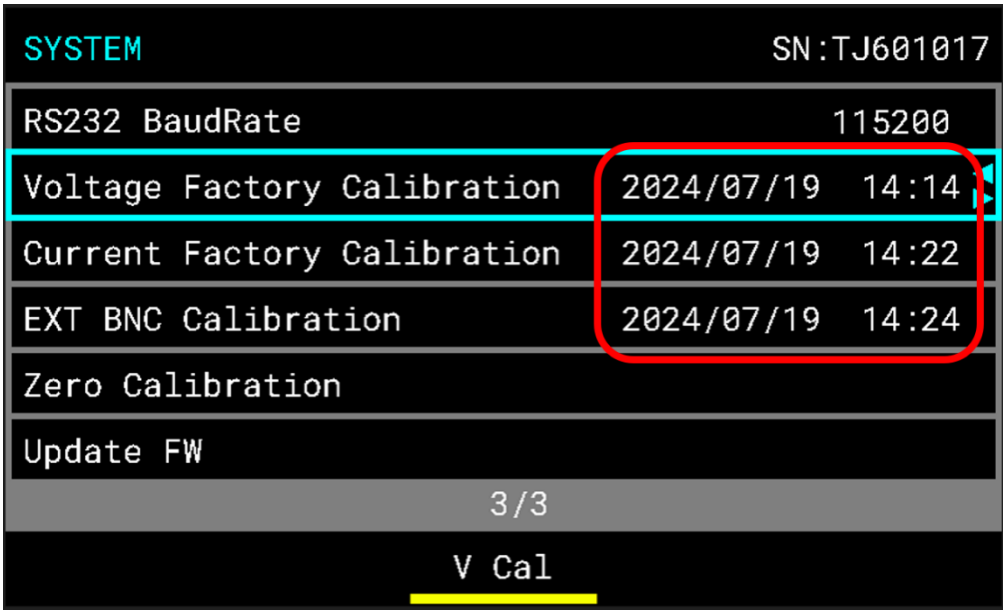
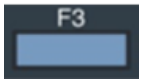


Figure Calibration Date and Time

14. Zero Calibration (Offset Calibration)

1. **Short-circuit V+ and V-** using a wire connection.
2. On the **7140/7130 front panel**, press 

+ 

to enter the **System Page**.
3. Navigate to **3/3 page** using the   and move the cursor to **Zero Calibration**
4. Press 



to execute the calibration.
5. Fac Info stores calibration values along with the serial number of the calibration equipment for calibration traceability.

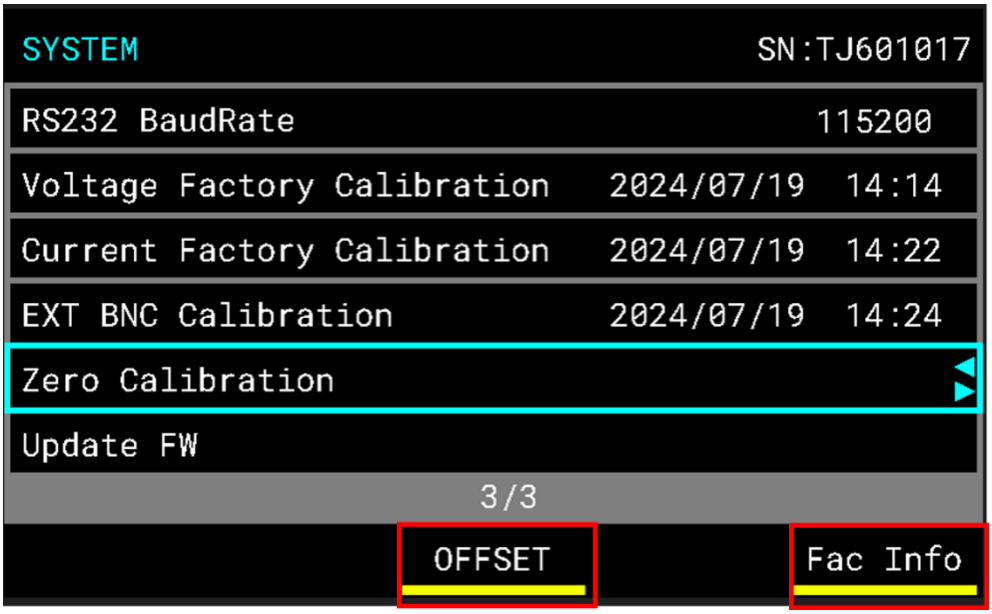


Figure Zero Calibration

15. Update FW (Firmware Update)

1. **Ensure** that the USB drive is formatted to **FAT32**.
2. **Extract the firmware update files** to the USB drive.
3. **Insert** the USB drive into the **rear USB port**.
4. **Verify the firmware update type** and select the corresponding update option:
   - **DSP**
   - **FPGA**
   - **MCU (**Do not power off during the update process.**)**

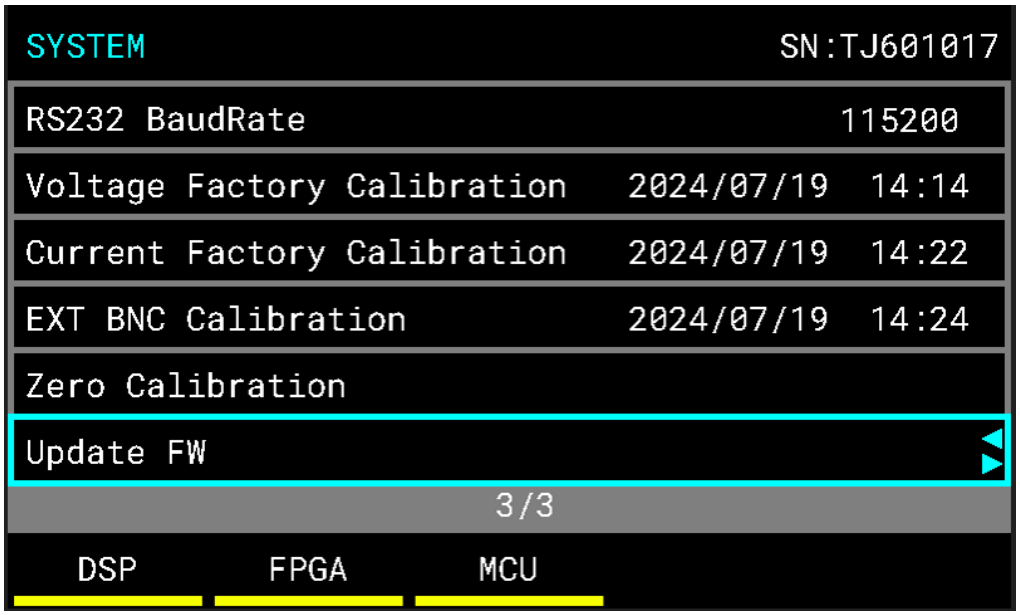


Figure Update Firmware

3.11 Signal I/O Overview

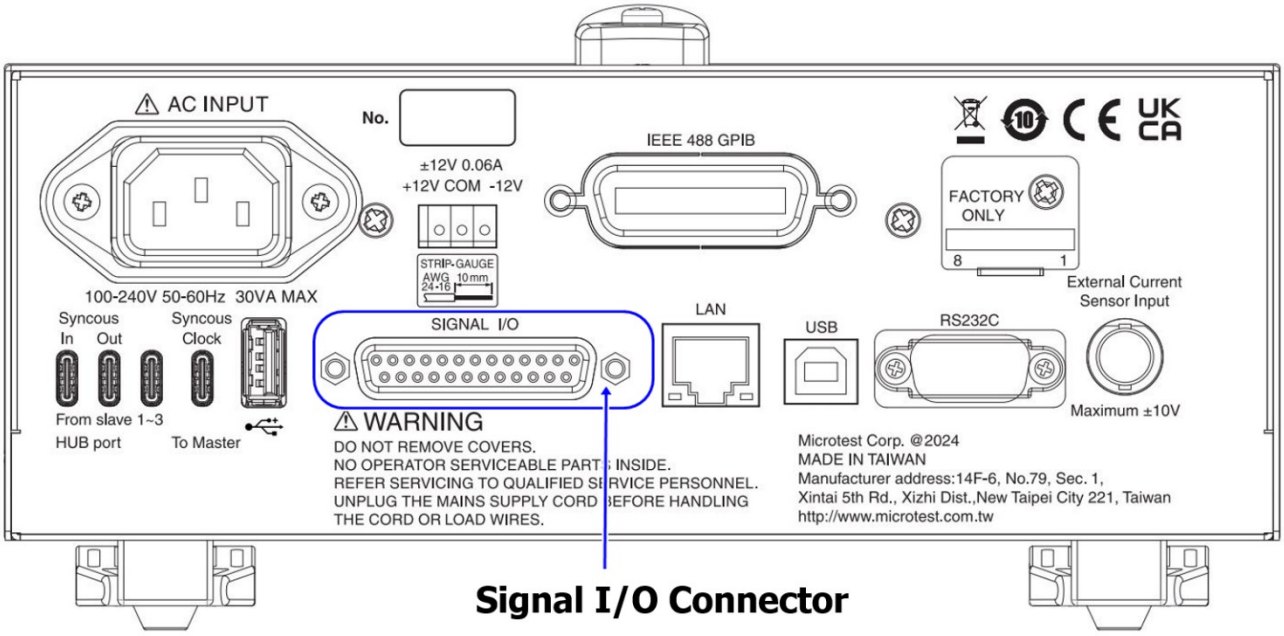
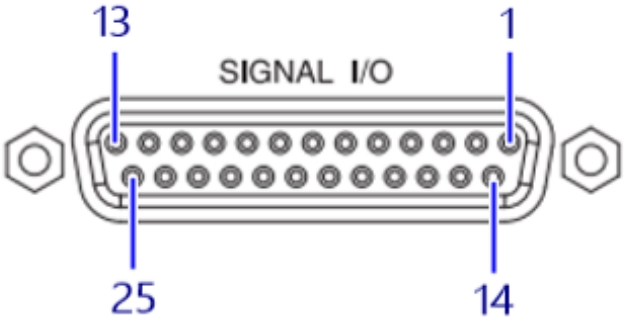


Figure Signal I/O Connector

Parameters	Specification
Signal I/O connector	D-SUB Connector VGA 25 Pin Female
Output Parameters	
Output Type	Open-collector output (4.5 VDC to 30 VDC)
Maximum Output Voltage	30 VDC
Output Saturation Voltage	Approx. 1.1 V (@ 25°C)
Maximum Output Current	400 mA (Total)
Input Parameters	
High-Level Voltage	4.5 V to 30 V
Low-Level Voltage	≤ 1 V
Low-Level Current	Max 3 mA
Minimum Input Pulse Width	5ms

Table Signal I/O Specification



Pin	Definition	Pin	Definition
1	CM8	14	PM0
2	CM7	15	PM1
3	CM6	16	PM2
4	CM5	17	PM3
5	CM4	18	STB
6	CM3	19	NC
7	CM2	20	TRIG-IN
8	CM1	21	EOM
9	INDEX	22	EXT VDD
10	Isolation COM	23	NC
11	NC	24	DAC-V OUT 0
12	NC	25	DAC-I OUT 0
13	DGND		

Table Signal I/O Pin Definition

3.12 RS-232 Interface Overview

When a computer is connected to the **RS-232C interface** using an **RS-232 cable**, it can send communication commands to control the **7140 or 7130** instrument.

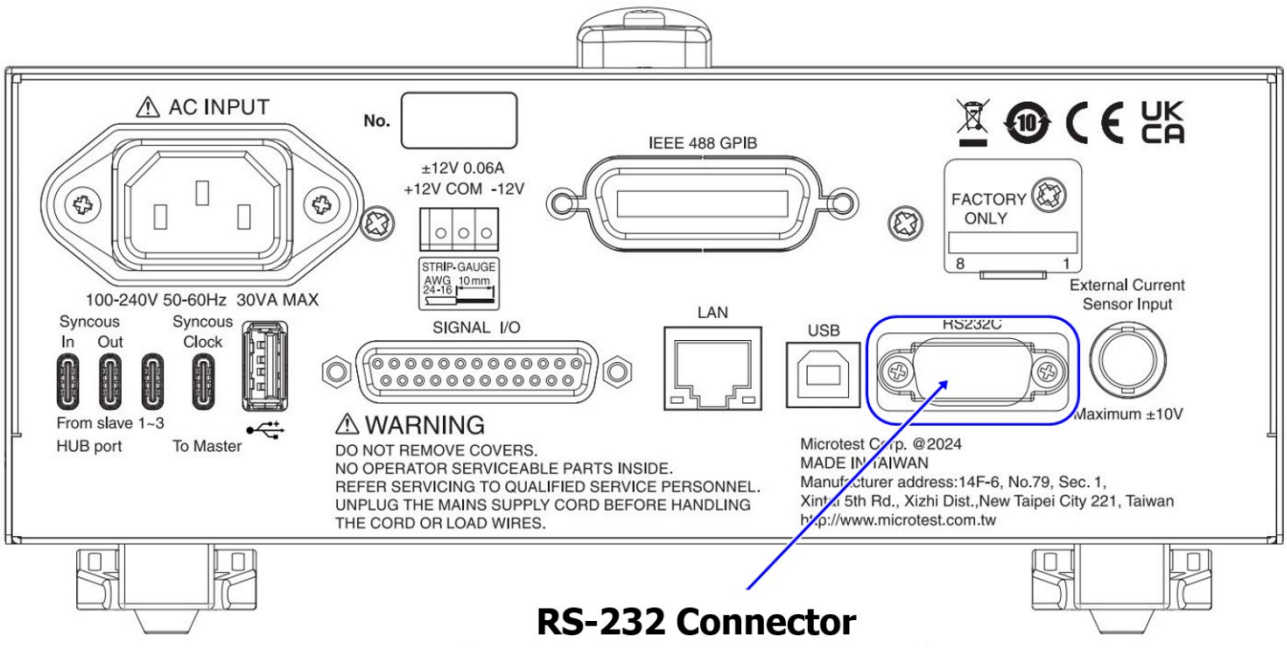
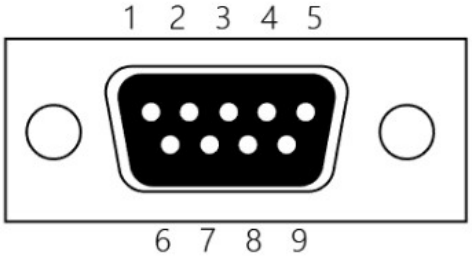


Figure RS-232 connector

1. Press SHIFT + HARMONIC SYSTEM to enter the **SYSTEM** screen, then press the ◄ ► to navigate to **page 3/3**.
2. Press the ◄ ► to move to **RS232 Baud Rate** and select the **baud rate**.

Parameter	Specification
Connector Type	D-SUB 9-pin connector
Baud Rate	9600, 19200, 38400, 57600, 115200 bps
Data Length	8-bit
Parity	None
Stop Bit	1-bit
Flow Control	None, Xon/Xoff

Table RS-232 Specification



Pin	Definition	Pin	Definition
1	Not Connected	6	Not Connected
2	RXD (Receive Data)	7	Not Connected
3	TXD (Transmit Data)	8	Not Connected
4	Not Connected	9	Not Connected
5	GND (Ground)		

Table RS-232 Pin Definition

3.13 USB Connector

Connect the 7140 or 7130 instrument to a PC via a USB cable using the USB port on the rear panel. Commands can be sent from the PC to control the instrument.

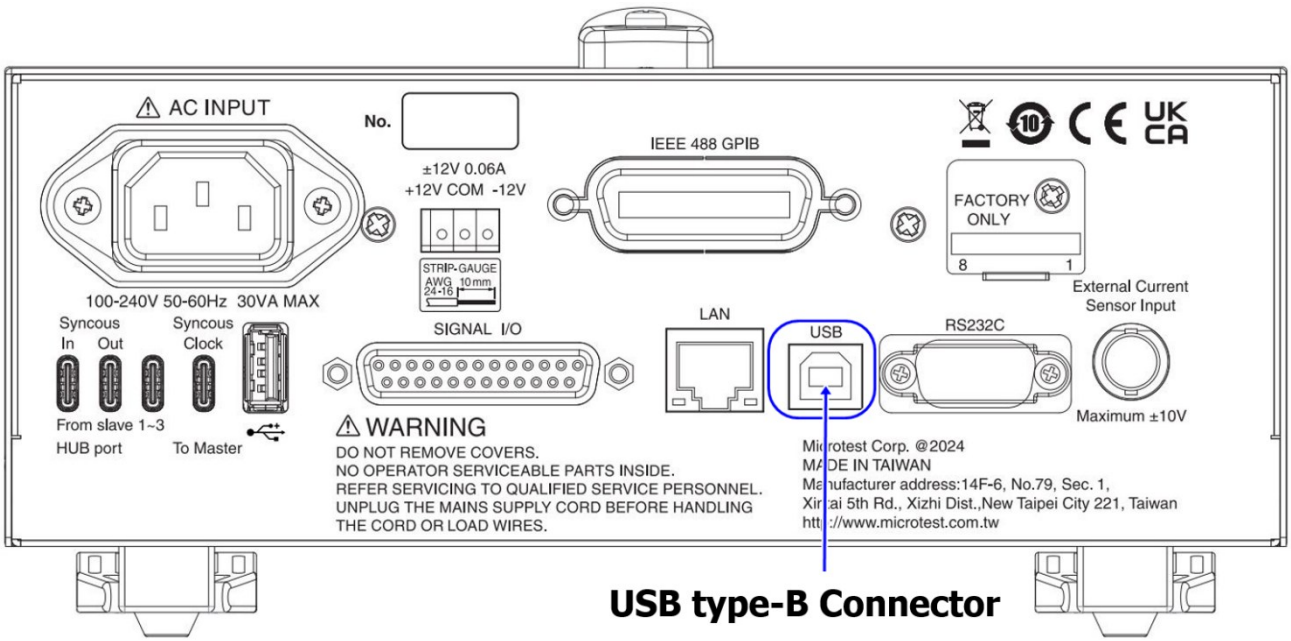


Figure USB type connector

Parameter	Specification
Connector Type	Complies with USB Specification 2.0.
Communication Speed	Up to 12 Mbps (Full Speed).
Device Class	Compliant with USBTMC.

Table USB Type-B Specification

3.14 LAN Port Specifications

A PC can connect to the **7140 or 7130** via a **network cable** by inserting the cable into the **LAN connector** on the instrument.

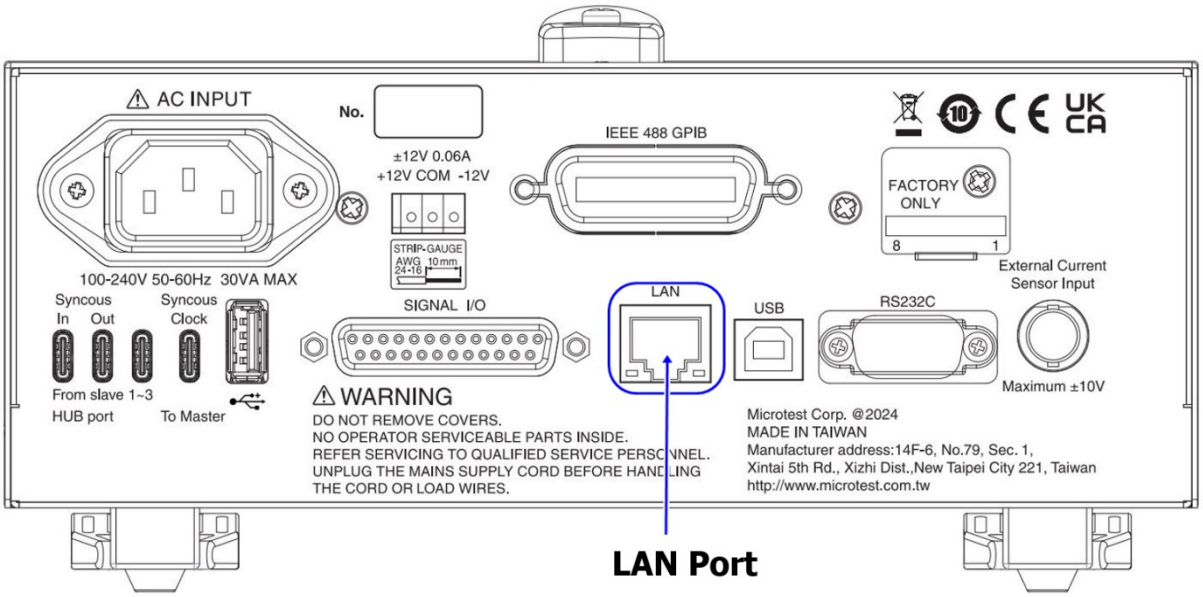


Figure LAN Port

LAN Connection Setup

1. Press SHIFT + HARMONIC SYSTEM to enter the **SYSTEM** screen, then press ◀ ▶ to navigate to **Page 2/3**.
2. Press F1 to select **DHCP**, then press F2 to enter **5025**.
3. When **DHCP** is selected, the **server automatically assigns an IP address, subnet mask, and gateway** to each client.

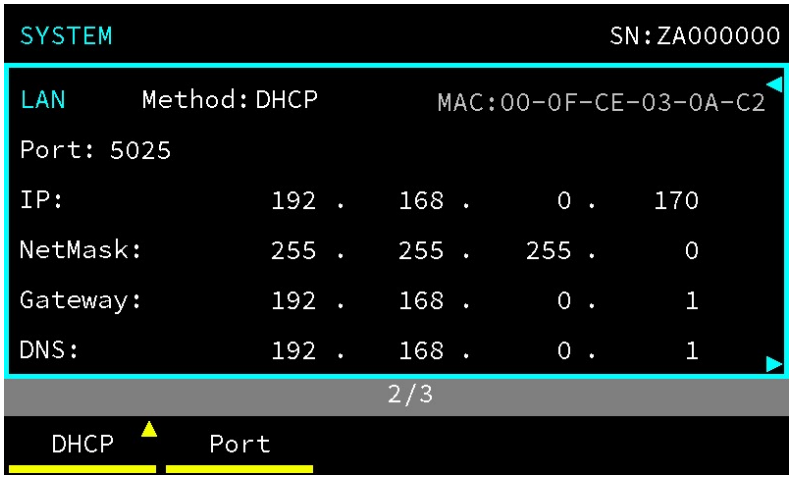


Figure LAN setting page

Revision History

Date	Description:	Version
2025-03-04	Translate from Chinese version 1.01	1.01
2025-03-14	Modified based on Chinese version 1.03.	1.03
2025-03-17	Add the current range error	1.04
2025-04-22	Add Trend mode USB save description.	1.05
2025-05-05	Add CATII information	1.06