Power Analysis Wavecorder

SPAW7000

Highest Measurement Accuracy: ±(0.01% of reading + 0.02% of range)

Bandwidth: DC, 0.1Hz - 5MHz

7 Power Channels + 2 Motor Channels

Various Plug-and-Play Capability Modules for Multiple Input Ranges and Accuracies

Simultaneous and Independent Analysis of 7-harmonic channels

Harmonic Analysis up to 500th Order

Instantaneous Power Measurement

X-Y Graph Display

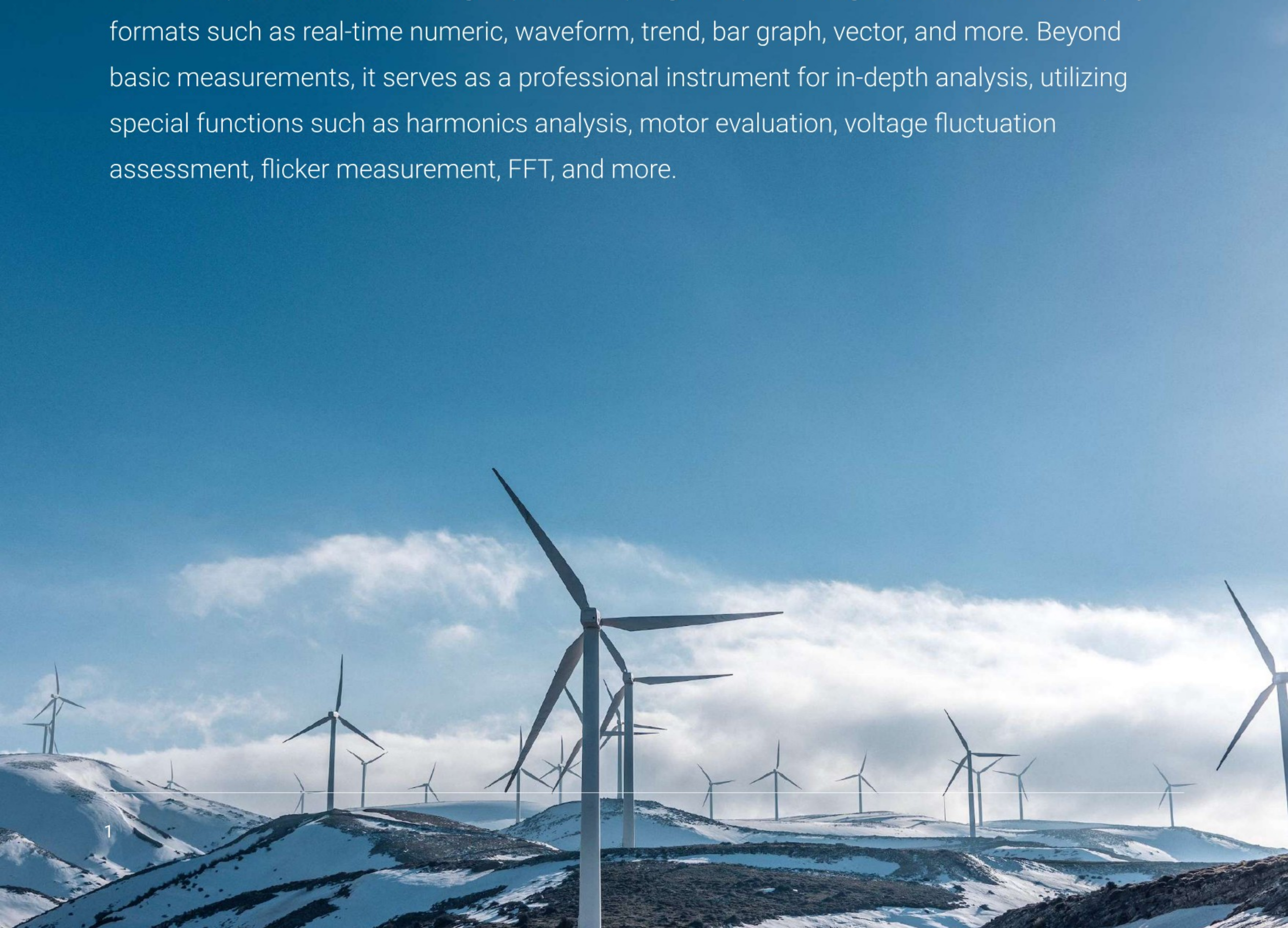
Data Update Rate up to 10ms

Performing Playback and Analysis

Mass Storage 512GB(1TB Optional)

INNO Instrument is a leading provider of high-end equipment with a focus on quality and innovation. Drawing from years of dedicated research and development, our company delivers top-notch products that span various industries, including electric power, energy resources, transportation, automobiles, and telecommunications. Our advanced, reliable, and comprehensive test and measurement solutions are sought after by R&D companies and manufacturers. Through systematic approaches, we address the intricate demands of our customers, actively contributing to the continuous development and updating of global industries.

The power analyzer is a versatile instrument designed for measuring parameters like voltage, current, power, and efficiency of transducers (frequency inverters), motors, and converters. Offering up to 7 power inputs and double motor inputs, it stands out for its diverse assembly modes of power boards and a range of measurement options for accuracy and range. Widely applicable in electric vehicles, new energy technology, inverters, motors, batteries, lighting, household appliances, and avionics, this product boasts powerful features. It excels in multi-channel input measurement, high-speed sampling, and presenting results in various display formats such as real-time numeric, waveform, trend, bar graph, vector, and more. Beyond basic measurements, it serves as a professional instrument for in-depth analysis, utilizing special functions such as harmonics analysis, motor evaluation, voltage fluctuation assessment, flicker measurement, FFT, and more.



Functional Advantages and Features

Various Types of Input Modules

Various modules with different voltage input ranges, current input ranges and accuracies are compatible with one power analysis wavecorder, up to 7 modules available to be installed. Users can select different modules with required technical specifications so as to meet the requirement of the instrument functions to be achieved. New modules are continuously developed.

Sensor Power Supply

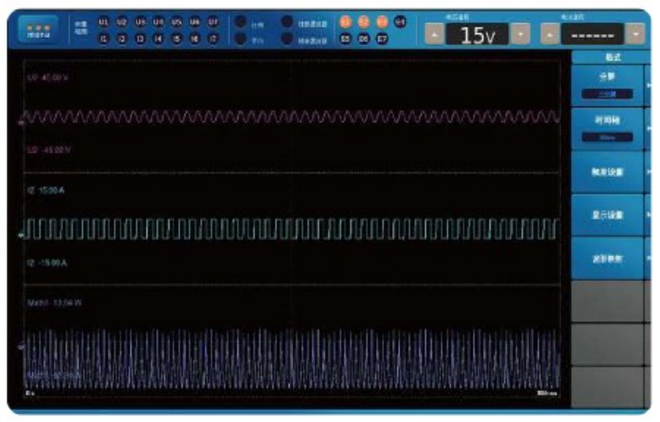
This power analysis wavecorder is technically equipped with user-friendly power supply connectors for sensor input, convenient for the users connect the power supply to the sensor directly, getting rid of the traditional connecting methods of power supply units.

User-friendly GUI

Equipped with high resolution large touch screen (12.1 inches) and with clear functional modules well-designed to suit the intuitive operations, this power analysis wave corder is easily operated by the users. In addition to press-keys and rotary knobs, users can connect a mouse for added convenience.
What make operations more convenient are the designs including one-button access to the parameters setup menu, various configured parameters displayed on one screen, and simultaneously viewing and setting the parameters.

Powerful Display Function

Large amount of information can be displayed on one large screen of high definition in various formats, such as numeric, waveform, bar, trend and vector.



Fast Switching Automatic Range

This instrument has the function of auto range, i.e. automatically changing the range according to the amplitudes of input signals. Traditionally, it costs too much time to change the range step by step, especially when the amplitude of signal changes largely, so that the data are lost without being measured.
When the amplitude of the input signal exceeds the previous one, the previous range can automatically increase to the maximum range and then adjust itself until the range matches with the measured data, shortening the period of switching ranges and reducing the chances of data lost.

Current Phase Compensation

This function is used for calibrating the measurement error caused by the phase difference in the measured circuit to ensure the accuracy of the measurement.
The phase calibration function enabled during measurement is used to compensate the phase difference of the current sensor(with)resolution of

0.01°), so that the power measurement is more accurate at high frequency or low power factor.

Update Rate up to 10ms

With data update rate at a range between 10ms to 20s, it is to ensure that this power analysis wavecorder can perform high precision computation at a high speed. The technology of advanced independent digital filter ensures the stability of the measurement values. It will automatically adjust the data update rate along with the changes of the frequency signal which changes from 0.1Hz, to ensure rapidity and accuracy of the data measurement.

Cycle-by-cycle Measurement

This instrument can use the Cycle-by-cycle measurement method to calculate the voltage, current, power, and other parameters for each cycle of the AC input signal of the synchronization source signal. Up to 3000 cycles of measurement can be achieved. When the measurement of the specified frequency is complete, the results will be displayed in order of measurement cycle. The measured results can be stored in the internal memory.

Integration Function

The integration function, including integrated power, integrated current, is used to calculate the electrical energy(Wh) or charge(Ah). There are two integration methods: Bought and Sold(power integration method is used for energy statistics in the grid), and Charge and Discharge(instantaneous power integration method is used for charge statistics in the battery).
Besides, users can enable the function of automatic range before integration starts, so as to greatly reduce the measurement error caused by unstable input signal during long-time integration operating.

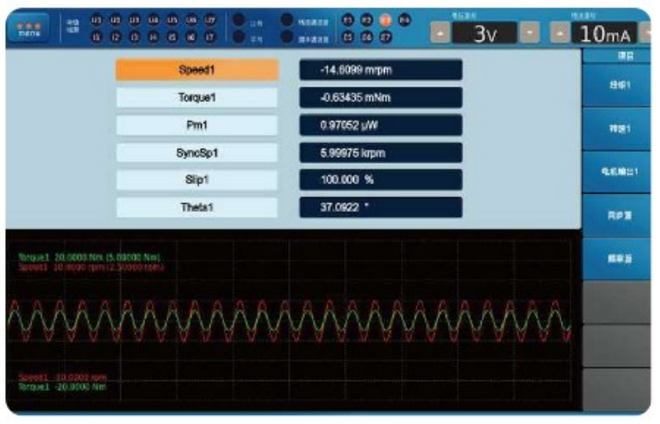
Harmonic Measurement Function

This instrument can simultaneously measure the voltage, basic harmonics, harmonic components and the total harmonic distortion(THD) in the mode of harmonic measurement and up to 500th harmonics canbe measured.
The Power spectrum and measured data of the harmonic of each order can be displayed on the screen.

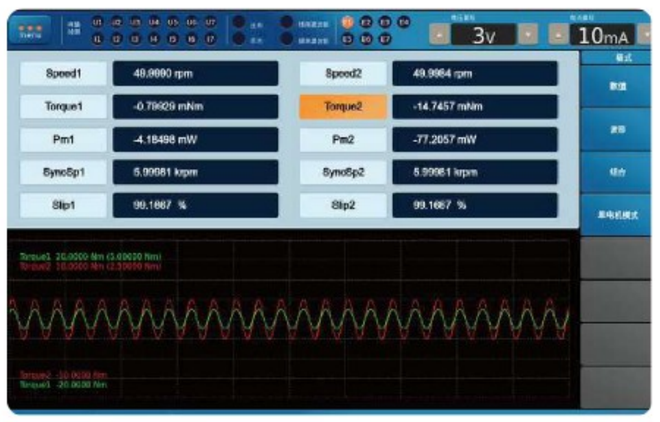
Harmonic measurement can be performed simultaneously on 7 power channels, and different PLL source can be selected, so that the efficiency of harmonic measurement can be improved in the areas such as invertor, robot, and lighting. Harmonic measurement up to 500th order can be performed on this this power analysis wavecorder.

Dual Motor Evaluation

The analog or pulse input signal of the motor can be connected to this power analysis wave corder for measuring the parameters such as the speed/direction, torque, synchronous speed, power, slip, and phase angle, and efficiency, which can be divided into two groups for measurement as well. Double-motor measurement mode is available, which is suitable for the application in electric vehicle.



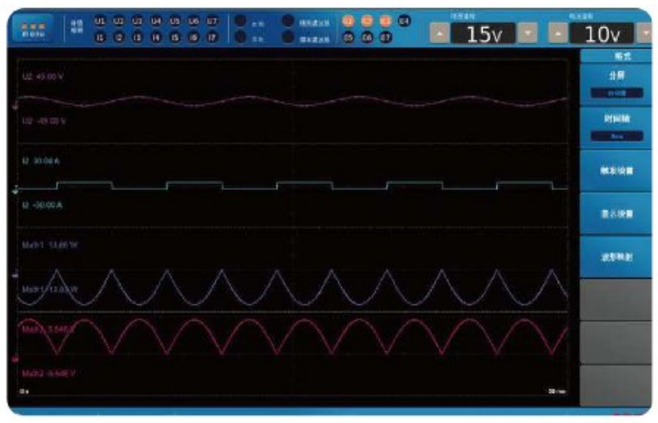
Single-Motor Mode



Dual-Motor Mode

Instantaneous Power Measurement

This power analysis wavecorder has the function of computing the display waveform to display the waveform of the data after computation completed. For example, the instantaneous power waveform can be obtained and displayed after multiplication performed between the voltage and current of the input signals.The data can be measured as well.



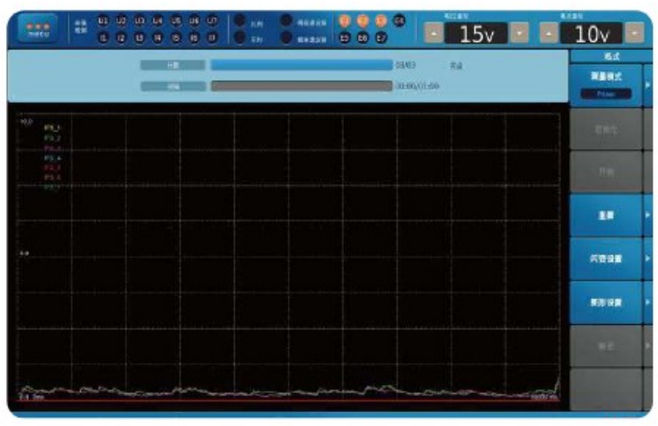
X-Y Graph Display Function

Users can view some measurement items from the X-Y Graph. For example, in waveform display, the custom 2-path inputs are respectively shown as X-axis and Y-axis, which can reflect the relative relationship between these 2 inputs, as basic for analyzing these 2 inputs.

FFT Function (Fast Fourier Transform)

Under FFT function, parameters such as sampling points and sampling ratio can be set, the frequency spectrum of input signal can be analyzed, so that those frequencies not able to be displayed can be viewed in harmonic measurement.

FFT Linear Display



FFT Logarithm Display

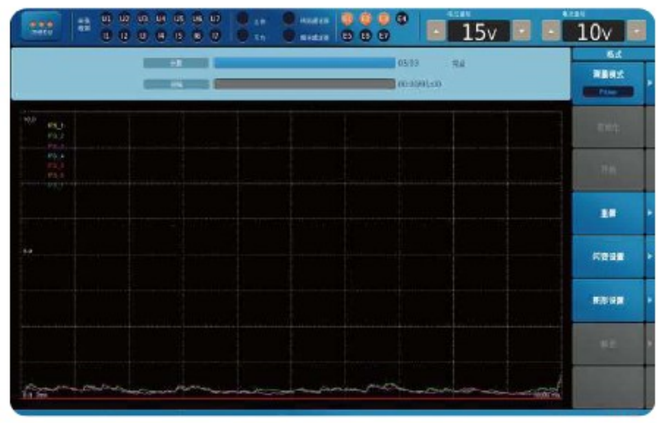
Mass Storage and Printing

This power analysis wavecorder stores the measured results and displayed formats (such as waveform) regarding voltage, current, power and others at real-time at a fast speed of 100 times per second, for further data analysis; Large capacity memory space inside the instrument. it really meet the storage requirements of high capacity and high efficiency.
Besides, the external printer can be connected to this power analysis wave corder via USB or LAN interface, for printing conveniently in site.

IEC Harmonics and Voltage Flicker

IEC harmonic measurement accords with IEC61000-4- 7 standard. The current harmonics containing the inter-harmonics can be measured and displayed. The voltage fluctuation and flicker can be measured, analyzed and judged as per the corresponding IEC standard.

4 Numeric Display in Flicker Measurement



Flicker ISF Graph Display

INNO PA Viewer Software

INNO SPAW7000 Viewer software is a PC application software. Users can remotely control the instrument from a remote PC, as it can display numeric, waveforms, single and double harmonics, trends, vectors, bar graphs, combinations, IEC harmonics, FFT, Flicker, motor, cycle analysis and XY Graph and LVRT display, save Raw data on the PC side, save and print IEC harmonic and flicker data reports.

Product Overview

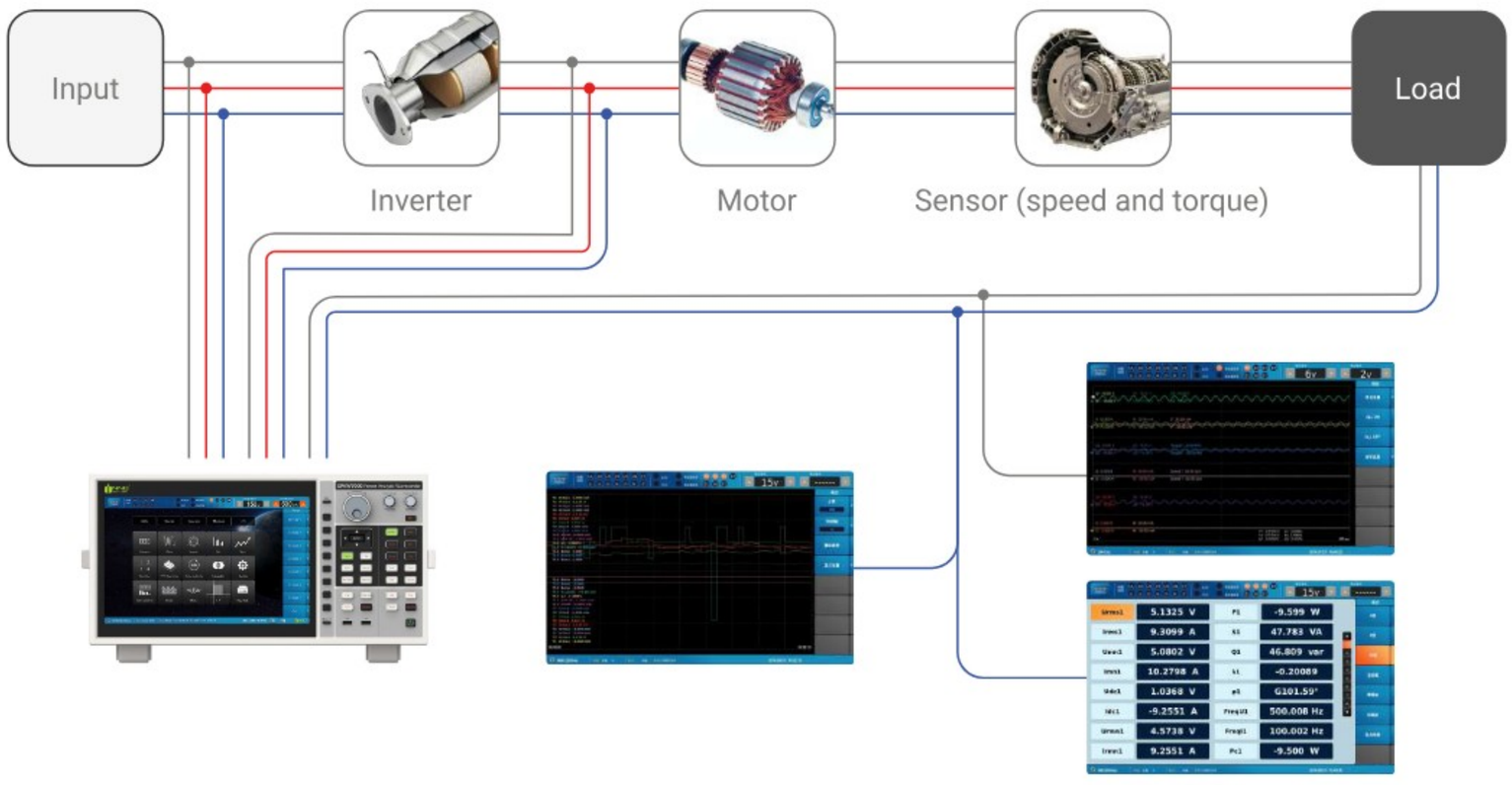
❶ ESC key
❷ Navigation keys
❸ Rotary knob (range)
❹ Sensor key
❺ Display selection keys
❻ Function execution keys
❼ Power switch
❽ Type A USB port
❾ Menu off key
❿ Menu key
⓫ Condition selection keys
⓬ Touch screen

❶ Voltage input terminal
❷ (Motor) Torque and Speed signal input connector
❸ GP-IB / RS-232 connector
❹ Terminal of master/slavesynchronized measurement
❺ EXT clock input connector
❻ Ethernet connector
❼ VGA connector
❽ Type B USB connector
❾ Power switch
❿ Power cord connector
⓫ Current input terminal
⓬ EXT current sensor input terminal
⓭ Power connector of sensor

Applications

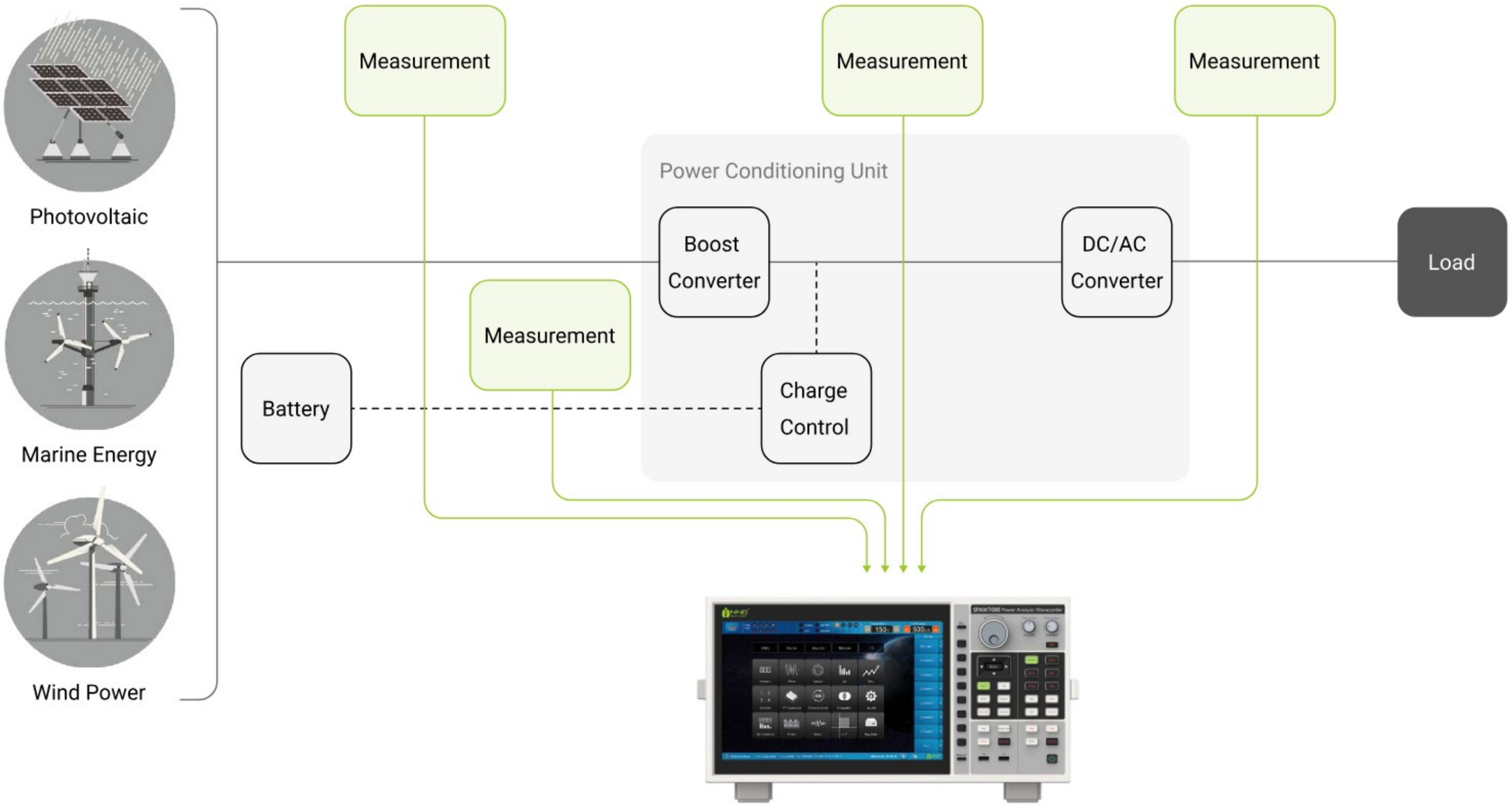
Evaluation of hybrid electric vehicles, frequency converters, and variable frequency motors

Equipped with 7 measurement channels and double-motor channels, this power analysis wavecorder SPAW7000 can measure and evaluate the voltage, current, power, efficiency of the inverter of the electric vehicle, charger, battery, motor, and so on. Double-motor channels meet the requirement of simultaneously measuring the power and efficiency of the drive motor and dynamotor. Besides, the integration function is available for evaluating the battery charging.



Energy efficiency conversion of new energy

With the progress of new energy used, the power quality is becoming increasingly prominent. This product can be used to effectively monitor and evaluate the power energy problem arising from harmonic or low voltage.
This power analysis wavecorder provides 7 elements of power measurement continent for measurement and analysis to the voltage, current, efficiency, harmonics of each node. It also has integration function available for evaluating and analyzing the conditions of Buy/Sell, Charge/Discharge for the system.



Home appliance performance testing

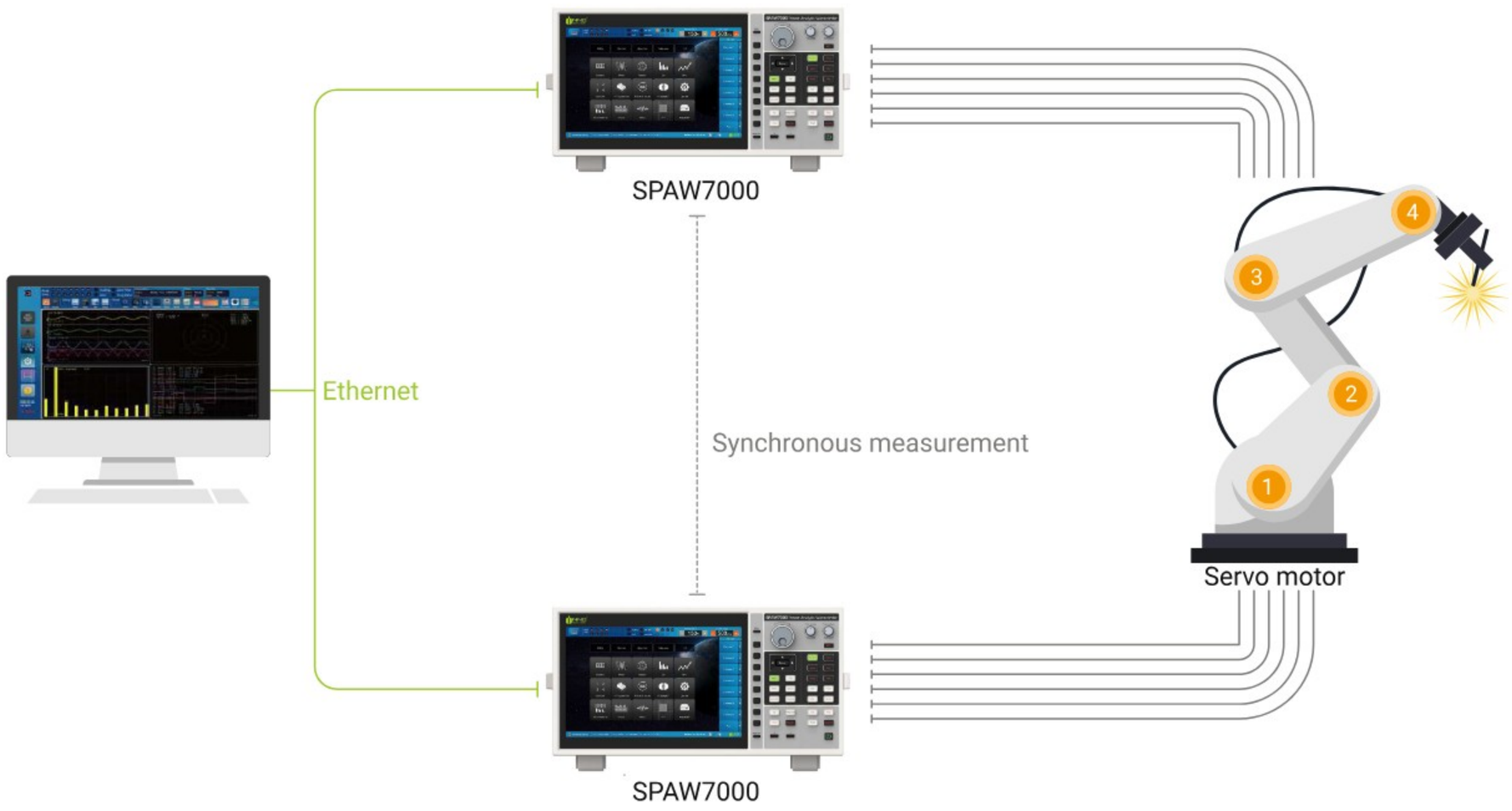
This power analysis wavecorder of SPAW7000 series can simultaneously test up to 7 pieces of appliances (home appliance of single phase) for measuring the voltage, current, power, frequency, power factor and harmonics. Besides, the IEC harmonics and Flicker measurement functions are available for measuring and evaluating the power quality as per IEC standard.

Measurement of aircraft power system

The frequency of the aviation AC power supply system generally are 400Hz or 800Hz, but it is very difficult for a common power analysis wavecorder to satisfy the requirement of measuring such frequency, especially measuring the harmonics. With 2Ms/s of sampling rate, this power analysis wavecorder can measure the harmonics of order up to 500th to meet the requirement, especially when at a frequency of 400Hz (fundamental harmonics).

Performance evaluation and testing of industrial robots

The fundamental components of an industrial robot include the servo motor, reducer, and controller. The servo motor enables multi-degree-of-freedom movement during the robot's operation, while the reducer ensures a stable output of large torque. The controller facilitates multi-axis drive synchronization control. All three components are indispensable for optimal performance. Industrial robots are equipped with multiple motors. To assess a robot driven by these motors, it is essential to measure the power consumption of all motors and controllers in various working states throughout the entire process. Additionally, for a comprehensive analysis of the control process and evaluation of the robot's transient characteristics, measurements of transient voltage, current, power, and variation trends are required. The collected data should be stored for further analysis. The SPAW7000 power analysis wavecorder features a sampling rate of up to 2MHz along with a waveform calculation function. It can measure instantaneous power and comes with a 512GB storage capacity, expandable up to 1TB. Furthermore, the device allows harmonic analysis of different PLL sources with 7 channels and simultaneous measurement of two motors. When two sets of SPAW7000 are synchronized, it becomes possible to measure the mechanical output parameters of four motors simultaneously. The SPAW7000 power analysis wavecorder is particularly well-suited for robot performance evaluation tests.



Technical Specifications

Signal Input

Items	Specifications
Input Terminal Type	**Voltage(U):** Plug-in terminal (Safety terminal) **Current(A):** binding post **External current sensor input:** Insulated BNC connector
Input Type	**Voltage:** Floating input, resistive potential method **Current:** Floating input, Shunt input method
Measurement Range (Voltage)	**05A12/40A13:** 15V, 30V, 60V, 100V, 150V, 300V, 600V, 1000V(CF3) 7.5V, 15V, 30V, 50V, 75V, 150V, 300V, 500V(CF6) **05A35/50A35:** 1.5V, 3V, 6V, 10V, 15V, 30V, 60V, 100V, 150V, 300V, 600V, 1000V(CF3) 750mV, 1.5V, 3V, 5V, 7.5V, 15V, 30V, 50V, 75V, 150V, 300V, 500V(CF6) **05A12V/ 40A13V:** 1.5V, 3V, 6V, 10V, 15V, 30V, 60V, 100V, 150V, 300V, 600V, 1000V(CF3), 1500V(CF2) 750mV, 1.5V, 3V, 5V, 7.5V, 15V, 30V, 50V, 75V, 150V, 300V, 500V(CF6), 750V(CF4) **05A35V/50A35V:** 1.5V, 3V, 6V, 10V, 15V, 30V, 60V, 100V, 150V, 300V, 600V, 1000V(CF3), 1500V(CF2) 750mV, 1.5V, 3V, 5V, 7.5V, 15V, 30V, 50V, 75V, 150V, 300V, 500V(CF6), 750V(CF4)
Measurement Range (Current)	• **Direct input** **05A12/ 05A12V:** 2mA, 5mA, 10mA, 20mA, 50 mA, 100mA, 200mA, 500mA, 1A, 2A, 5A(CF3) 1mA, 2.5mA, 5mA, 10mA, 25mA, 50mA, 100mA, 250mA 0.5A, 1A, 2.5A(CF6) **05A35/ 05A35V:** 10mA, 20mA, 50mA, 100mA, 200mA, 500mA, 1A, 2A, 5A(CF3) 5mA, 10mA, 25mA, 50mA, 100mA, 250mA, 500mA, 1A, 2.5A(CF6) **40A13/ 40A13V:** 100mA, 200mA, 500mA, 1A, 2A, 5A,10A, 20A, 40A(CF3) 50mA, 100mA, 250mA, 500mA,1A, 2.5A, 5A, 10A, 20A(CF6) **50A35/ 50A35V:** 1A, 2A, 5A, 10A, 20A, 50A(CF3) 500mA, 1A, 2.5A, 5A,10A, 25A(CF6) • **External current sensor input** 50mV, 100mV, 200mV, 500mV, 1V, 2V, 5V, 10V(CF3) 25mV, 50mV, 100mV, 250mV, 500mV, 1V, 2.5V, 5V(CF6)
Input Impedance	**Voltage** **05A12/40A13/05A12V/40A13V:** Input resistance:Approximately 4MΩ;Input capacitance:Approximately 10pF(paralleled with resistance) **50A35/05A35/50A35V/05A35V:** Input resistance:Approximately 2MΩ;Input capacitance:Approximately 15pF(paralleled with resistance) **Current** • **Direct input** **05A12/05A12V/05A35/05A35V:** When 2mA-10mA,Approximately10Ω When 20mA-200mA,Approximately 1Ω+Approximately0.28μH(resistance in series) When 0.5A-5A,Approximately 60mΩ+Approximately 0.25μH(resistance in series) **40A13/40A13V/50A35/50A35V:** When 100mA-1A,Approximately 110mΩ+Approximately 0.1μH(resistance in series) When 2A-10A,Approximately 8.5mΩ+Approximately 0.1μH(resistance in series) When 20A-40A,Approximately 3mΩ+Approximately 0.1μH(resistance in series)

Input Impedance	• **External current sensor input** Input resistance:Approximately 1MΩ
Instantaneous Continuous Maximum Allowable Input Value	**Voltage** **05A12/05A12V/40A13/40A13V:** Peak voltage of 3kV or RMS of 2kV, whichever is lower **05A35/50A35:** Peak voltage of 3kV or RMS of 1.5kV, whichever is lower **05A35V/50A35V:** Peak voltage of 3kV or RMS of 1.65kV, whichever is lower **Direct** • **Direct input** **05A12/05A12V/05A35/05A35V:** When 2mA-10mA,Peak current of 0.2A or RMS of 0.1A, whichever is lower When 20mA-200mA,Peak current of 4A or RMS of 2.5A, whichever is lower When 0.5A-5A,Peak current of 20A or RMS of 12A, whichever is lower **40A13/40A13V/50A35/50A35V:** When 100mA-1A,Peak current of 8A or RMS of 4A, whichever is lower When 2A-10A,Peak current of 80A or RMS of 40A, whichever is lower When 20A-40A/50A,Peak current of 100A or RMS of 55A, whichever is lower • **External current sensor input** Peak value less than or equal to 5 times the range
Continuous Maximum Common Mode Voltage (50/60Hz)	**Voltage input terminals:** 1000Vrms **Current input terminals:** 1000Vrms **External current sensor input connector:** 600Vrms
Rated Voltage to Ground	**Voltage input terminals:** CATII 1000V **Current input terminals:** CATII 1000V **External current sensor input connector:** CATII 1000V
A/D Converter	Simultaneous voltage and current input conversion **Resolution:** 16-bit **Conversion speed (sampling period):** Approximately 0.5μs
Automatic Range Function	**Range up(When one of the following conditions is met)** • Urms or Irms exceed 110% of the range • Upk or Ipk of the input signal exceed 330% of the range(660% for CF6) **Range down(When all the following conditions met)** • Upk or Ipk of the input signal is less than 300% of the lower range(600% or less for CF6)
Sensor Power Supply	**Power supply for sensor (output):** Mini DIN 8Pin **Output Voltage:** ±15V DC **Max output power:** 15W

Technical Specifications of Input Module

Input module	Range	Bandwidth(Voltage/Current)	Sampling Rate	Power accuracy ±(% of reading +% of range)
05A12	Voltage: 15V~1000V Current: 2mA~5A	DC, 0.1Hz~5MHz	2MHz	0.01+0.02
40A13	Voltage: 15V~1000V Current: 100mA~40A	DC, 0.1Hz~5MHz	2MHz	0.01+0.03
05A35	Voltage: 1.5V~1000V Current: 10m~5A	DC, 0.1Hz~5MHz	2MHz	0.03+0.05
50A35	Voltage: 1.5V~1000V Current: 1~50A	DC, 0.1Hz~5MHz	2MHz	0.03+0.05
05A35V	Voltage: 3V~1500V Current: 10mA~5A	DC, 0.1Hz~5MHz	2MHz	0.03+0.05
50A35V	Voltage: 3V~1500V Current: 1~50A	DC, 0.1Hz~5MHz	2MHz	0.03+0.05
05A12V	Voltage: 1.5V~1500V Current: 2m~5A	DC, 0.1Hz~5MHz	2MHz	0.01+0.02
40A13V	Voltage: 1.5V~1500V Current: 100mV~40A	DC, 0.1Hz~5MHz	2MHz	0.01+0.03

Measurement Conditions

Items	Specifications
Crest Factor	3 or 6
Measurement Period	Interval for determining the measurement function and performing calculations The measurement period is set by the zero crossing of the reference signal (When synchronization source is set to be None, measurement period becomes data update interval.) During harmonic measurement, the measurement period starts from the data point where update interval starts to the acquired data points of 1024 or 10240
Sync Source	U1~U7, I1~I7, EXT CLK, None
Wiring System	1P2W (single-phase, two-wire), 1P3W (single-phase, 3-wire), 3P3W (3-phase, 3-wire), 3P4W (3-phase, 4-wire), 3P3W (3V3A) (3-phase, 3-wire, 3-volt/3-amp measurement) However, the number of available wiring systems varies depending on the number of installed input elements
Line Filter	OFF, 0.1kHz-100kHz(increment: 0.1kHz), 300kHz,1Mhz
Frequency Filter	OFF, 100Hz, 1kHz
Scaling Factor	When inputting output from external current sensors, VT, or CT, set the current sensor conversion ratio, VT ratio, CT ratio, and power coefficient in the range from 0.0001 to 99999.9999
Accuracy Compensation	**Efficiency compensation:** Compensate for the loss caused by the measurement instrument during efficiency computation **Wiring compensation:** Compensate for the loss caused by the wiring **Two wattmeter method compensation:** Compensate for the power loss due to leakage current
Average Function Operation	**Exponential average:** Select an attenuation constant from the values of 2~64 **Linear average:** Select the number of averages from the values of 8~64 **Harmonic measurement:** Only exponential averaging is available
Data Update Rate	Select 10ms, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, or AUTO
Peak Hold	Hold the peak data(The displayed data will not be updated)
Single Measurement	Executes a single measurement and displays once data update during measurement hold
Null Function	**Purpose:** Compensate for DC offset **Target:** • Voltage and current of each input element (from U1 to U7, I1 to I7) • Rotation speed and torque
Zero Setting	**Purpose:** to make instrument measurement more accurate **Method:** Manual, Auto This device automatically performs zero level compensation after manual change of the range and initialization

Measurement Accuracy

Conditions: Temperature at 23±5˚C; Humidity at the range from 30%RH to 75%RH; Inputting sinusoidal wave; When the Power factor(λ) is set as 1, with common mode voltage 0V, crest factor CF3, line filter OFF, frequency filter ON, after 30 minutes preheating; Zero setting before wiring; Frequency f with unit kHz; within half a year after calibrated.

05A12/05A12V Modules

Accuracy ±(...% of reading+ ...% of range)

Frequency of input signal	Voltage	Current	Active Power
DC	0.01+0.02	0.01+0.02	0.01+0.02
0.1Hz≤f<30Hz	0.02+0.05	0.02+0.05	0.06+0.1
30Hz≤f<45Hz	0.02+0.05	0.02+0.05	0.05+0.05
45Hz≤f<66Hz	0.02+0.05	0.01+0.02	0.01+0.02
66Hz≤f<1kHz	0.02+0.05	0.02+0.05	0.04+0.05
1kHz≤f<10kHz	0.08+0.05	0.08+0.05	0.12+0.1
10kHz≤f<50kHz	0.25+0.1	0.25+0.1	0.3+0.15
50kHz≤f<100kHz	0.012*f+0.2	0.012*f+0.2	0.014*f+0.3
100kHz≤f<500kHz	0.009*f+0.5	0.009*f+0.5	0.012*f+2
500kHz≤f≤1MHz	(0.022*f-7)+1	(0.022*f-7)+1	(0.048*f-19)+2

40A13/40A13V Modules

Accuracy ±(...% of reading+ ...% of range)

Frequency of input signal	Voltage	Current	Active Power
DC	0.01+0.03	0.01+0.03	0.01+0.03
0.1Hz≤f<30Hz	0.03+0.05	0.03+0.05	0.08+0.1
30Hz≤f<45Hz	0.03+0.05	0.03+0.05	0.05+0.05
45Hz≤f<66Hz	0.01+0.03	0.01+0.03	0.01+0.03
66Hz≤f<1kHz	0.03+0.05	0.03+0.05	0.05+0.05
1kHz≤f<10kHz	0.1+0.05	0.1+0.05	0.14+0.1
10kHz≤f<50kHz	0.3+0.1	0.3+0.1	0.4+0.15
50kHz≤f<100kHz	0.012*f+0.2	0.012*f+0.2	0.014*f+0.3
100kHz≤f<500kHz	0.009*f+0.5	0.009*f+0.5	0.012*f+2
500kHz≤f≤1MHz	(0.022*f-7)+1	(0.022*f-7)+1	(0.048*f-19)+2

05A35/50A35/05A35V*/50A35V* Modules

Accuracy ±(...% of reading+ ...% of range)

Frequency of input signal	Voltage	Current	Active Power
DC	0.03+0.05	0.03+0.05	0.03+0.05
0.1Hz≤f<30Hz	0.05+0.05	0.05+0.05	0.08+0.1
30Hz≤f<45Hz	0.05+0.05	0.05+0.05	0.08+0.1
45Hz≤f<66Hz	0.03+0.05	0.03+0.05	0.03+0.05
66Hz≤f<1kHz	0.05+0.05	0.05+0.05	0.1+0.05
1kHz≤f<10kHz	0.1+0.08	0.1+0.08	0.2+0.1
10kHz≤f<50kHz	0.3+0.2	0.3+0.2	0.4+0.3
50kHz≤f<100kHz	0.012*f+0.2	0.012*f+0.2	0.014*f+0.3
100kHz≤f<500kHz	0.009*f+0.5	0.01*f+0.5	0.014*f+0.5
500kHz≤f≤1MHz	(0.024*f-7)+1	(0.024*f-7)+1	(0.048*f-17)+1

* Voltage and power above 1100V are reference values

Note: If the current between 1k~100kHz exceeds 30A, the current and power accuracy are for reference only.

Display Function

Items	Specifications
Display	12.1-inch TFT color LCD display
Screen Resolution	1280(horizontal)×800(vertical)dots
Type of Display	Numeric, Waveform, Vector, Bar, Trend, Combination(Multi-panel), X-Y Graph
Touch Screen	available

Harmonic Measurement Function

Items	Specifications
Measured souce	All installed elements
Method	PLL synchronization method
PLL source	U1~U7, I1~I7, EXT CLK
Frequency range	Fundamental frequency of the PLL source is in the range of 0.1 Hz to 2.6 kHz.

Sample Rate, Window Width, and Upper Limit of the Measured Order

Fundamental frequency	Window width	Upper limit of measured order	
		U, I,P, φ,φU,φI	Other measured value
15Hz - 40Hz	1	500	500
40Hz - 440Hz	2	500	500
440Hz - 1.1kHz	10	500	500
1.1kHz - 2.6kHz	25	500	500
2.6kHz - 4.8kHz	50	250	250
4.8kHz - 10.5kHz	50	100	100
10.5kHz - 20.5kHz	50	50	50
20.5kHz - 34kHz	50	25	25
34kHz - 99.9kHz	50	10	10

The maximum measured order is 100 at a dataupdate rate of 50 ms

FFT: 10240 points(data update interval 500ms, 1 s, 2 s, 5 s, 10 s, 20 s)

Sample Rate, Window Width, and Upper Limit of the Measured Order

Fundamental frequency	Window width	Upper limit of measured order	
		U, I,P, φ,φU,φI	Other measured value
0.5Hz - 40Hz	1	500	500
40Hz - 440Hz	2	500	500
440Hz - 1.1kHz	10	500	500
1.1kHz - 2.6kHz	25	300	300
2.6kHz - 4.8kHz	50	200	200
4.8kHz - 9kHz	50	100	100
9kHz -20kHz	50	50	50
20.5kHz - 50kHz	50	20	20
50kHz - 99.9kHz	50	10	10

The maximum measured order is 100 at a dataupdate rate of 50 ms

FFT: 10240 points(data update interval 500ms, 1 s, 2 s, 5 s, 10 s, 20 s)

Accuracy:
±(...% of reading+ ...% of range)

Fundamental frequency	Voltage/ Current	Upper limit of measured order
0.5Hz ≤ f < 30Hz	0.01 + 0.015	0.02 + 0.04
30Hz ≤ f < 45Hz	0.01 + 0.015	0.02 + 0.04
45Hz ≤ f < 66Hz	0.01 + 0.015	0.02 + 0.03
66Hz ≤ f < 1kHz	0.01 + 0.015	0.02 + 0.04
1kHz ≤ f < 10kHz	0.01 + 0.015	0.02 + 0.04
10kHz ≤ f < 50kHz	0.05 + 0.05	0.1 + 0.15
50kHz ≤ f < 100kHz	0.1 + 0.1	0.2 + 0.2
100kHz ≤ f < 500kHz	0.1 + 0.25	0.1 + 0.8
500kHz ≤ f ≤ 1MHz	0.35 + 1.5	0.5 + 3
05A35/50A35/05A35V/50A35V:		
0.5Hz ≤ f < 30Hz	0.01 + 0.02	0.02 + 0.05
30Hz ≤ f < 45Hz	0.01 + 0.02	0.02 + 0.05
45Hz ≤ f < 66Hz	0.01 + 0.02	0.02 + 0.05
66Hz ≤ f < 1kHz	0.01 + 0.02	0.02 + 0.05
1kHz ≤ f < 10kHz	0.01 + 0.02	0.02 + 0.05
10kHz ≤ f < 50kHz	0.05 + 0.08	0.1 + 0.2
50kHz ≤ f < 100kHz	0.1 + 0.15	0.2 + 0.3
100kHz ≤ f < 500kHz	0.1 + 0.3	0.1 + 1
500kHz ≤ f ≤ 1MHz	0.4 + 1.5	0.5 + 3.5
05A35/50A35/05A35V/50A35V:		

Waveform Calculation

Items	Specifications	
Display Item	Math1,Math2	
Waveform for Calculation	U1…U7, I1…I7, speed, torque	
Operators	**Four arithmetic operations:** (+),(-),(*),(/) Absolute value(ABS) Square(SQR) Square root(SQRT) Natural logarithm(LN)	Common logarithm(LOG10) Exponent(EXP) Negative (NEG) Average(AVG2, AVG 4, AVG 8, AVG 16, AVG 32, AVG 64)
Constants	K1~K8	

Cycle-by-Cycle Measurement Function

Items	Specifications
Measurement Items	**Power:** Urms, Irms(True rms voltage, True rms current), Urmn, Irmn(Rectified mean voltage or current), Umn, Imn(Rectified mean voltage or current calibrated to the rms value), Udc, Idc(Simple voltage or current average), Uac, Iac(AC current or voltage component), U+Peak, U-Peak, I+Peak, I-Peak(Peak value), CfU, CfI(Crest factor), P(Active power), Q(Reactive power), S(Apparent power), Phi(Phase difference), λ(Power factor), Pc(Corrected power) **Motor:** Speed 1(Rotational speed 1), Torque 1(Torque 1), Pm 1(Mechanical power 1) **Synchronous source:** Freq (Frequency)
Synchronous source	U1~U7, I1~I7, EXT CLK
Sync Source Frequency Range	0.1Hz~1kHz(EXT CLK) 1Hz~1kHz(U1~U7,I1~I7)
Cycle counts	From 10 to 3000
Time-out Time	From 0 to 3600s(when"0"is selected,it defaults to be time-out after 24 hours)

Storage Function

Item	Specification
File Naming	Date, number, self-defined
Save Format	ssf, csv
Storage Location	Internal SSD drive or external USB storage device
Properties of Internal Hard Drive	SSD, 512GB/1TB
Save Mode	Manual and automatic (save as csv format)
Stored Item Type	Numerical value, waveform, numerical value + waveform
Storage Time	1-9999999
Storage Interval	0 second-10,000 hours 59 minutes and 59 seconds; when set as “0:0:0”, it means the storage interval is same as the data update interval
Maximum Storage Period	It depends on the storage amount and storage medium

Raw Data Storage

Item	Specifications
Raw Data Storage	High-speed acquisition of raw data
Storage Time	Storage for up to 10min is supported
Data Storage Capacity	512GB/1TB
File Format	RAW format
Maximum Sampling Rate	2MS/s

Print Function

Item	Specification
Printing Type	Manual, automatic
Automatic Printing Mode	Printing regularly, synchronization with integration, event driven
Printer Connection	LAN, USB

Cursor Measurement Function

Item	Specification
Cursor Type	C1+, C2x
Cursor Applications	Waveform, tendency, bar graph or FFT calculation
Cursor Measurement Display Items	Waveform: Y+, Yx, ΔY, X+, Xx, ΔX Tendency: Y+, Yx, ΔY, X+, Xx, ΔX, D+, Dx Bar graph: Y+, Yx, ΔY, X+Order, XxOrder FFT calculation: Y+, Yx, ΔY, X+, Xx, ΔX

External Hardware Interfaces

Items	Specifications
External Clock Input	BNC connector; TTL level; Square waveform with a duty ratio of 50%.
Master-slave Synchronization Port	BNC connector; TTL level
Type A USB Interface	Conforms to USB Rev.2.0; 5 V; 500 mA (Power supply)

Communication Interface

Items	Specifications
Type B USB Interface	Conforms to the USB Rev.2.0; USBTMC-USB488(USB Test and Measurement Class Ver.1.0)
Ethernet Interface	RJ-45 connector; Conforms to IEEE802.3; Ethernet 1000BASE-T, 100BASE-TX, 10BASE-T
RS-232 Interface	9-pin, D-Sub (plug); Conforms to EIA-574, standard of 9-pin EIA-232(RS-232)
GP-IB Interface	Conforms to IEEE 488-1978 (JIS C 1901-1987), and IEEE St'd 488.2-1992

General Specifications

Items	Specifications
Dimensions	498.98mm*463.26mm*245mm
Rated Supply Voltage	From 100 to 240V AC
Allowable Supply Voltage	From 85 to 264V AC
Rated Supply Frequency	50/60Hz
Allowable Supply Frequency Range	From 48 to 63Hz
Maximum Power Consumption	300VA(When using 7 ×15W Current Sensor Power rating)
Preheating Time	Approximately 30 minutes
Operating Environment	**Temperature:** 5°C ~ 40°C **Humidity:** from 20% to 80%RH(no condensation)
Operating Altitude	2000m or less
Applicable Environment	Indoors
Storage Environment	**Temperature:** -25°C ~ 60°C **Humidity:** from 20% to 80%RH(no condensation)
Weight	About 19kg

Dimensions of the Instrument

Accessories

Current Sensor of SCTH Series

	DC	AC	Accuracy	Measuring bandwidth	Ratio KN	Resistance Rm	Aperture	Connector	Supply
SCTH60	0-60A	60Apeak	±(0.05% of rdg + 15μA)	DC-800kHz	1: 600	0-25Ω	Ø28mm	D-Sub 9 pin	±12V~±15V
SCTH200	0-200A	200Apeak	±(0.05% of rdg + 15μA)	DC-500kHz	1: 1000	0-25Ω	Ø28mm	D-Sub 9 pin	±12V~±15V
SCTH600	0-600A	600Apeak	±(0.05% of rdg + 15μA)	DC-300kHz	1: 1500	0-25Ω	Ø30.9mm	D-Sub 9 pin	±15V~±24V
SCTH1000	0-1000A	1000Apeak	±(0.05% of rdg + 15μA)	DC-300kHz	1: 2000	0-25Ω	Ø30.9mm	D-Sub 9 pin	±15V~±24V

Current Sensor of SCTX Series

	DC	AC	Accuracy	Measuring bandwidth	Ratio KN	Resistance Rm	Aperture	Connector	Supply
SCTX60	0-60A	60Apeak	±(0.01% of rdg + 10μA)	DC-800kHz	1: 600	0-25Ω	Ø28mm	D-Sub 9 pin	±12V~±15V
SCTX200	0-200A	200Apeak	±(0.008% of rdg +10μA)	DC-500kHz	1: 1000	0-25Ω	Ø28mm	D-Sub 9 pin	±12V~±15V
SCTX600	0-600A	600Apeak	±(0.008% of rdg +10μA)	DC-300kHz	1: 1500	0-12Ω	Ø30.9mm	D-Sub 9 pin	±15V~±24V
SCTX1000	0-1000A	1000Apeak	±(0.008% of rdg +10μA)	DC-300kHz	1: 2000	0-3Ω	Ø30.9mm	D-Sub 9 pin	±15V~±24V

Boxes

Model	Name	Schematic diagram	Purpose
PTB01	Test converter box of single phase connection		Used for switching for single phase circuit so that users can measure the power coefficient of the equipment quickly
PTB03	Test converter box of three-phase connection		Used for switching for single phase circuit so that users can measure the power coefficient of the equipment quickly
PTB02	External sensor connection fittings		Used for switching for single phase circuit so that users can measure the power coefficient of the equipment quickly

Connectors and Cables

Model	Name	Sample	Usage
PAC-1001	Fork terminal adapter		Used when attaching banana plug to binding post. Specification: 1000V, CAT II, 20A Color: red, black
PAC-1002	BNC Conversion adapter		Connector: Conversion between safety BNC and banana jack Specification: 600V, CAT III
PAC-1003	Safety adapter		Connector: Safety connector; Solder can be used for tightening the test cables. Specification: 600V, CAT II, 20A Color: red, black
PAC-1004	Safety adapter		Connector: safety connector, spring-hold type Specification: 600V, CAT II, 10A Color: red, black
PAC-1005	Safety clamp		Connector: hook shape connector Specification: 1000V, CAT III, 4A Color: red, black
PAC-1006	Large alligator adapter		Connector: safety connector Specification: 600V, CAT , 19A Color: red, black
PAC-1007	Small alligator adapter		Connector: safety connector Specification: 300V, CAT II, 15A Color: red, black
PAL-1001	Measurement lead		Connector: safety connector Specification: 1000V, CAT II, 32A , 600V, CAT III Color: red, black
PAL-1002	Safety BNC cable		Connector: BNC connector Specification: 1000V, CAT II, 600V, CATIII Color: black
PAL-1003	External sensor Cable		Connector: one BNC safety connector Specification: 300V, CAT II, 2A Color: black

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