Wireless Power Transmission

Fully Automated WPT Evaluation Testing

Complies with SAE J2954 Nov. 2017
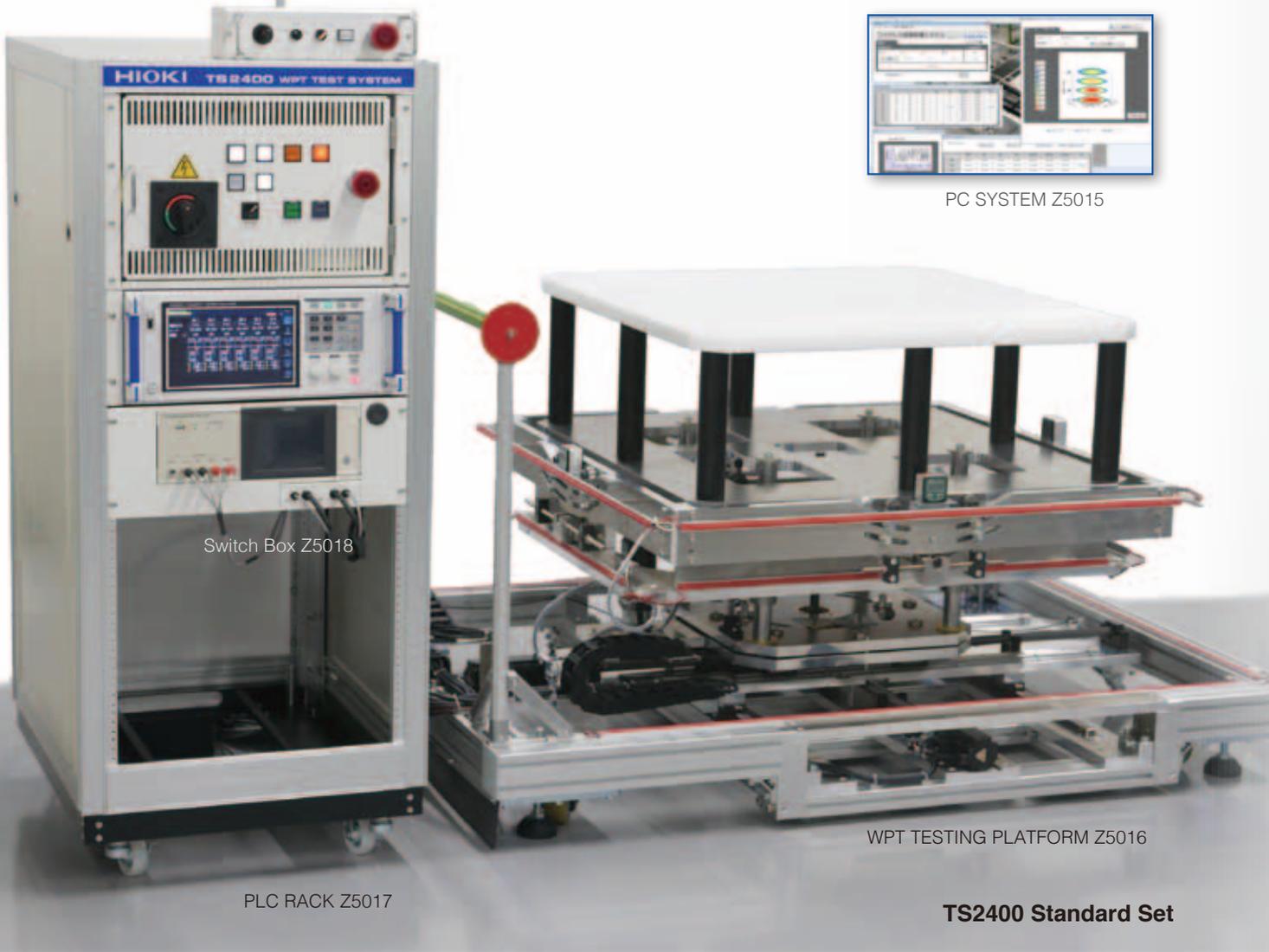
PC SYSTEM Z5015

Switch Box Z5018

PLC RACK Z5017

WPT TESTING PLATFORM Z5016

TS2400 Standard Set

## Integrating measurement with an XYZ stage for high-speed analysis of multi-type, multi-point measurement data

- Real-time generation of four types of characteristics graphs
- Position control for transmission coils of up to 31.5 in. in diameter
- Supports two types of efficiency measurement and simultaneous measurement of ambient conditions

Long-stroke design can be used with characteristics evaluation techniques that require large position shifts, for example the magnetic resonance method.

Not CE Marked

Automation of Three Essential Analysis Functions

1 Automatically generate 4 types of characteristics graphs, even while testing is still in progress

Hioki's analysis software integrates relative position data for the transmission coil with multiple measurement results, enabling you to generate graphs even as measurement is still being performed.

Graphs are easy to display—just select the type of graph and specify the display parameters.

3D graph generation using user-defined parameters
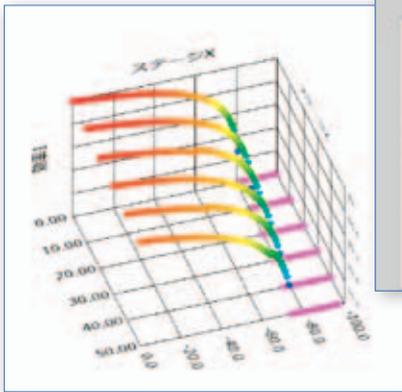
Easy-to-create Smith charts
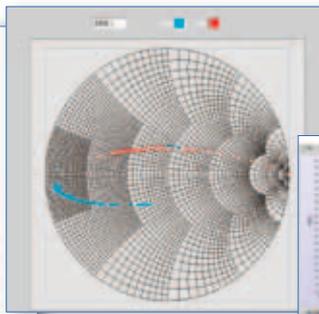
■ PC SYSTEM Z5015

Basic 2D graph
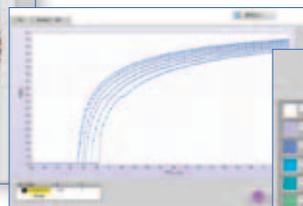
Detailed 3D contour
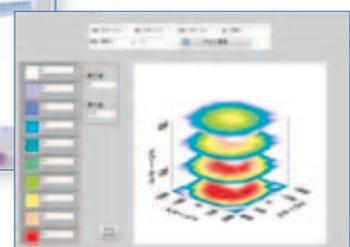
Switch freely among graphs.

2 Automatically measure and collect data

The TS2400 supports two types of efficiency measurement and simultaneously collects data describing ambient conditions.

■ PLC RACK Z5017

Power transmission efficiency

Power Analyzer PW6001

Conduct a detailed analysis after actually transmitting power

Harmonic vector display
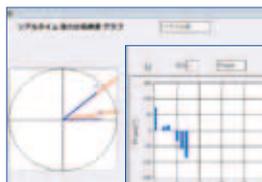
Harmonic monitor

Automatically measure with the Power Analyzer PW6001, which is ideal for harmonic analysis of WPT systems that use a fundamental frequency of 85 kHz, a standard for electric vehicles. The instrument can acquire all measurement parameters to facilitate not only efficiency measurement, but also harmonic analysis.

The software includes a real-time monitor designed specifically for the PW6001, which offers robust zero-power-factor measurement capability, so that you can display harmonic vectors along with graphs of voltage and current harmonics, helping facilitate even more accurate analysis.

Automatic coupling coefficient

Impedance Analyzer IM3570

Calculate efficiency without applying a high voltage

Automatic L_{SHORT} and L_{OPEN} measurement

OSB

L1

L2

Z5018   4-terminal-pair setup

Open/short box (OSB)
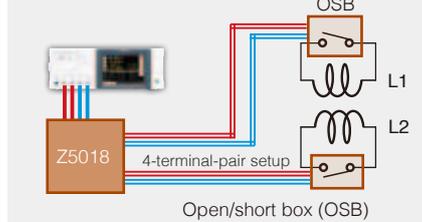
■ **SWITCH BOX Z5018**

Measure the coupling coefficient K of the transmission coil with the Impedance Analyzer IM3570 and calculate the system's efficiency. The Switch Box Z5018, which can be configured in a four-terminal-pair setup, can be used to automatically measure the coupling coefficient K using the open/short method defined by JIS C5321.

The TS2400 supports an accuracy guarantee that includes the measurement cables, which is difficult to achieve with standard automated systems. And since it can automatically measure the coupling coefficients $K1$ and $K2$ for the transmitting and receiving coil, respectively, the system makes it easy to acquire coil characteristics under actual operating conditions.

Data logging

Measure a range of ambient conditions

Voltage and temperature
Data Logger LR8431

Magnetic flux density
Magnetic Field HiTester FT3470

The TS2400 simultaneously measures safety-related parameters such as heat generation characteristics and human exposure and integrates them as evaluation data.

The TS2400 supports WPT evaluation by delivering reproducible measurement.

3. Automatically control large transmission coils with a diameter of up to 31.5 in.

Maximum speed of
3000 points/hr.

Long-stroke design
**XY: ±11.8 in.; Z: ±3.9 in.**

○Adjustable-angle stage

The angle of rotation of the movable stage can be adjusted in the X, Y, and Z directions, allowing accurate acquisition of characteristics relative to the transmission coil's angle.
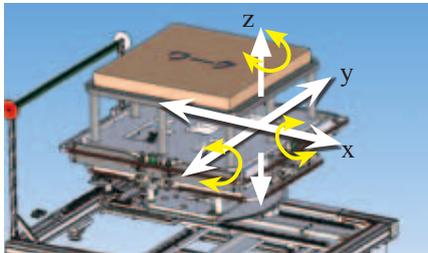
■ WPT TESTING PLATFORM Z5016
Non-magnetic XYZ stage designed specifically for use in WPT evaluation and featuring principal frame components made from non-magnetic materials
Large 35.4 × 35.4 in. table designed to accommodate magnetic resonance method testing in automotive applications
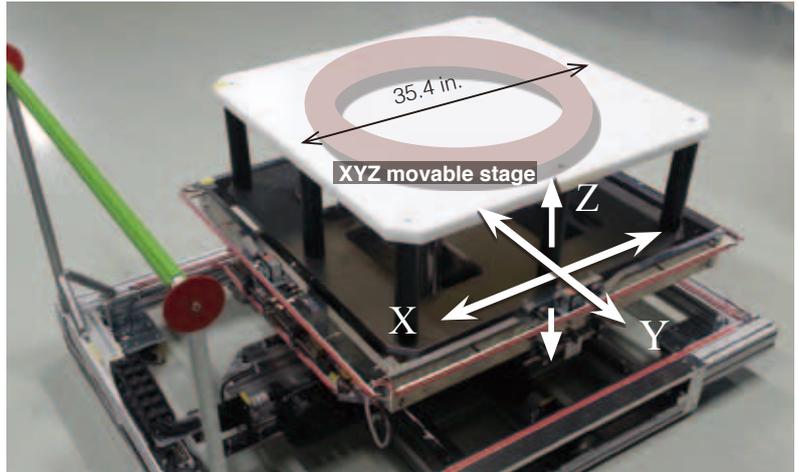
*Does not include mounting base for fixed coil.

User interface that integrates three functions

Automatic and Manual Testing

Manual measurement mode helps eliminate configuration mistakes.

Manual control panel
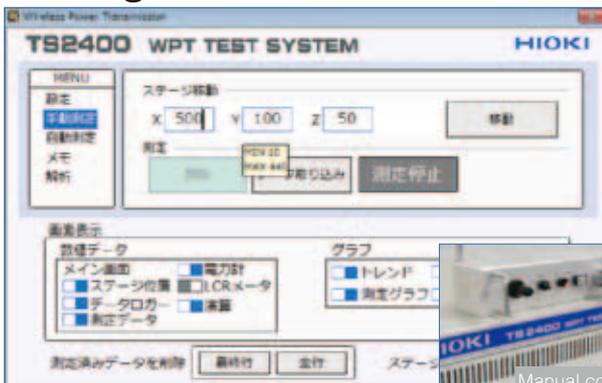
Manual measurement mode allows you to sample results from instruments while manipulating the position of the transmission coil (along the X-, Y-, and Z-axes) so that you can monitor measurement data in real time. The capability to easily perform pinpoint evaluation of new elements and to verify or correct the evaluation sequence helps dramatically reduce setup times.
Automatic measurement mode integrates transmission coil position control with the measurement sequence so that steps ranging from data collection to creation of characteristic graphs can be accomplished automatically. The system makes it easy to identify optimal conditions based on the transmission coil evaluation space and evaluation process, allowing fast acquisition of highly reproducible results (acquiring 3000 efficiency measurement points in as little as 60 min.).

Easy sequence configuration

Graphical sequence configuration eliminates the need for programming knowledge.

Sequence creation

*English edition will be released by the end of the year

The TS2400 provides a graphical settings menu that lets you build optimal evaluation sequences without knowledge of GP-IB control or other programming techniques. Simply enter settings as prompted by the **Workflow** feature to complete the configuration process. This intuitive approach requires only that you choose the desired operation timing (measurement interval) and the parameters you wish to acquire from a list as part of the guided **Sequence Creation** process. The result is that you can quickly and easily build wireless power transmission evaluation sequences that encompass numerous controlled devices such as power supplies and electronic loads and a large number of measurement parameters such as power and efficiency.

WPT TEST SYSTEM TS2400

Specifications

PC SYSYTEM Z5015

Operating system	Microsoft Windows 7 Professional 64–bit
Pre-installed software	WPT Evaluation Software SF2400
PC specifications	1.91 GHz 4-core/4-thread CPU, 4 GB RAM, 80 GB SSD or better
Displays	24" dual displays (display resolution: 1,920 × 1,080)
Collected data	PW6001 Power Analyzer As selected by user from all measurement parameters (total of 180)
	IM3570 Impedance Analyzer Inductance, capacitance, DC resistance, impedance
	IM3536 Impedance Analyzer Inductance, capacitance, DC resistance, impedance
	LR8431 Memory HiLogger Voltage, temperature
	FT3470 Magnetic Field HiTester Magnetic flux density
	Z5016 WPT Evaluation Stage Axis coordinates
Control parameters	Switch Box Z5018 Transmission/receive workpiece connection switching
	Electronic load device ON/OFF
	Workpiece power supply ON/OFF
Calculated parameters	Coupling coefficient K, mutual inductance Lm, efficiency, user-defined calculations (including scaling function)
Data refresh	200 ms (reference value), moving average processing (max. 100 values)
Graph generation	2D, 3D, 3D contour, Smith chart, trend graph
Power supply	100 to 240 V AC, 50/60 Hz, 180 VA (supplied from PLC Rack Z5017)
Dimensions and weight	7.1 (W) × 1.3 (H) × 4.8 (D) in. (excluding protruding parts), 1.8 lb. (180W × 33H × 121D mm , 0.8 kg)
Accessories	User manual, license dongle (USB), recovery media (USB), keyboard, mouse, AC adapter, monitor × 2

WPT TESTING PLATFORM Z5016 / PLC RACK Z5017

Automatically controlled axes	X, Y, Z (speed settings: FAST/MID/SLOW)
Manually adjusted axes (range)	X-axis θ (±10°), Y-axis φ (±5°), Z-axis ψ (±45°)
Range of movement	X-axis: ±11.8 in.; Y-axis: ±11.8 in.; Z-axis: ±3.9 in. Movement resolution: 0.0039 in.; positioning error: ±0.020 in.
Compatible workpiece	Max. dimensions: 31.5 (W) × 2.8 (H) × 31.5 (D) in. Max. weight: 220.5 lb.
Output power supply	Single-phase 100 V AC, 50/60 Hz, 500 VA
External I/O	Workpiece control output × 1, electronic load control output × 1, interlock output × 2, electronic lock input × 3
Power supply	Single-phase 200 V/220 V/230 V/240 V (specified at time of shipment from factory), 50/60 Hz, 3 kVA
Dimensions and weight	Z5016: 63.0 (W) × 35.4 (H) × 47.2 (D) in. , 771.6 lb. (1600W × 900H × 1200D mm , 350 kg) Z5017: 22.4 (W) × 49.2 (H) × 28.0 (D) in. , 220.5 lb. (570W × 1250H × 710D mm , 100 kg)

SWITCH BOX Z5018

Installation location	Embedded in PLC Rack Z5017
Measurement terminals	2-terminal clip × 2 (clips: gold-plated)
Compatible measurement terminals	0.20 in. or less
Characteristic impedance	50 Ω
Compatible instruments	IM3570, IM3536 (Accuracy guarantee applies exclusively to the IM3570.)

TS2400 equipment combinations

Set name	Equipment	Instruments
Standard	Z5015 + Z5016 + Z5017 + Z5018	PW6001, IM3570 (IM3536), LR8410, FT3470
Basic	Z5015 + Z5016 + Z5017	PW6001, LR8431, FT3470
Data Analysis	Z5015 only	----

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