The HIOKI Remote Measurement and Monitoring System 2300 provides remote monitoring and automatic measurement over the internet or intranets. Central monitoring systems for buildings, plants, annexed facilities and offices can be easily constructed to reduce labor costs for monitoring and measuring, increase the efficiency of maintenance tasks, and in applications that require foreknowledge and prevention of faults, as well as system preservation. In addition to being easier to operate, the easier and instant initial system construction and maintenance of the Remote Measurement System 2300 Series present great cost-reduction opportunities when compared to equipment previously available for remote control, centralized monitoring and energy monitoring.
Flexible Modular System Configuration

Power modules

- DC POWER MODULE 2362-20
  - INPUT 19V to 36V DC
  - POWER CORD 9239

- AC POWER MODULE 2361-20
  - INPUT 100V to 240V AC

Module bases

- MODULE BASE 2392-02
- MODULE BASE 2392-01
- MODULE BASE 2391-03
- MODULE BASE 2391-02
- MODULE BASE 2391-01

Various communication modules

- LAN MODULE 2353-20
  - 10BASE-T interface
  - Modbus/TCP Compatible
- LAN CABLE 9642
  - (for Model 2353-20)
  - Consists of a UTP straight-through cable and crossover adapter set

- WIRE MODULE 2352-20
  - RS-232C interface

- AIR MODULE 2351-20
  - Built-in SS 2.4GHz wireless device

ANTENNA CABLE 9761
- 1m
- 2m
- 5m

ANTENNA 9760
- 9760-03 Planar Antenna (Single reception)
- 9760-04 Planar Antenna (Diversity reception) Cable length: 1m

- ANTENNA 9760-01 Planar Antenna (All-weather type) Cable length: 90cm
- ANTENNA 9760-02 Planar Antenna (Pencil type) Cable length: 90cm

**Note:** Because standards and measurement conditions differ from country to country, please inquire with your local distributor or HIOKI for further details when purchasing.
- -20 for EU area, Korea
- -21 for USA, Canada
Measurement and Power Modules to Meet Your Needs

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUMIDITY MODULE 2301-20</td>
<td>Built with Dedicated Sensors</td>
</tr>
<tr>
<td>PT100 input 2ch</td>
<td>Temperature 2ch, Humidity 1ch</td>
</tr>
<tr>
<td>K,E,J,T,R input 2ch</td>
<td>Voltage and contact pulse input</td>
</tr>
<tr>
<td>PULSE MODULE 2304-21</td>
<td>DC voltage and current input 2ch</td>
</tr>
<tr>
<td>TC MODULE 2303-20</td>
<td>K,E,J,T,R and Pt100 input DC voltage and current input 8ch</td>
</tr>
<tr>
<td>MULTI-FUNCTION MODULE 2306-20</td>
<td>Logic signal (contact/voltage) input 8ch</td>
</tr>
<tr>
<td>INPUT MODULE (DI) 2341-20</td>
<td>Open collector output 8ch</td>
</tr>
<tr>
<td>OUTPUT MODULE (DO) 2342-20</td>
<td>Used in data collection and control of devices equipped with an RS-232C interface (such as certain HIOKI instruments or PLCs). For a list of compatible HIOKI instruments, please inquire with your local distributor or HIOKI.</td>
</tr>
<tr>
<td>RS LINK MODULE 2343-20</td>
<td></td>
</tr>
</tbody>
</table>

Options for Power Modules

- **VOLTAGE CORD 9019-02** (Red/black. Cable length: 3 m)
- **VOLTAGE CORD 9019-03** (Red/black/yellow. Cable length: 3 m)
- **VOLTAGE CORD 9019-04** (Red/black/yellow/blue. Cable length: 3 m)
- **CLAMP ON SENSOR CABLE 9661-01** Rating: 500 A
- **CLAMP SENSOR CABLE 9238** For 9695-02/-03. Cable length: 3 m

Professional Windows Software

**SMART SITE UTILITY PRO 9768**

Use this Windows application program to configure initial communications routing and settings, to verify communications status and to configure measurement settings. Also use it to monitor measurement values, to start and stop data recording, data collection and display of the acquired data lists and graphs, and to generate reports.

![Monitor screen](image) ![Viewer screen](image)
**Features of the Remote Measurement and Monitoring System 2300**

**Simple setup**
Initial setup of all the measurement and communication modules is performed by the Smart Site Utility Pro application.

To configure the modules, simply select those you want to add from the selection list with your mouse, and drag them into the appropriate trunks or branches.

When communication module settings have been completed, the measurement modules can be recognized from the PC, simplifying further setting procedures.

- Reduce costs and save time by bypassing complicated instrument setting procedures compared with competing systems such as PLC.
- Because of the simple operations, maintenance can be conducted without the need for any special training, and system expansion and relocation can be performed smoothly.
- Save on maintenance expenses by avoiding the need to call for outside contractors.

**Eliminate data loss caused by PC or communication circuit failure**

Each module functions as a data logger, with time stamps and individual data storage at specified intervals in its own internal memory, thereby unaffected by faults on the PC or communications circuit.

When the fault is corrected (by rebooting the PC or recovery of the communications circuit), data stored in the modules is automatically transferred to the PC.

**Data synchronization is maintained by the 2300’s internal clock (with periodic time calibration function)**

Systems employed by competitors, such as the polling (sequential data acquisition) method from above (PLC or PC), cannot maintain synchronization. Such synchronization is particularly important in power measurements.

The communication module manages the internal clocks of the slave measurement modules to maintain synchronization with its master internal real-time clock. Meanwhile, the communication module synchronizes itself with the PC’s clock when certain conditions are satisfied in the software. (*Partial data loss can occur due to time correction.)

The correct setting of the PC clock can be maintained by linking to a network time server (Windows function) on the internet or an intranet, or to a radio-controlled clock.

The correct setting of the PC clock can be maintained by linking to a network time server (Windows function) on the internet or an intranet, or to a radio-controlled clock.

PC Clock → Time-stamped data is automatically backed up

**Optimum solution for control over the Internet, mobile or wireless broadband network**

Communications with remote locations via public circuits (Internet, mobile or WLAN, etc.) are subject to interruptions. However, public circuits are economical, and services with fixed running costs have become widespread, with demand increasing.

A core concept in the development of the 2300 Series was to provide a communication system that would remain reliable even between remote sites using public circuits. Its specifications called for non-real-time data transfers, with the data to be stored in the memory of the instrument installed at the worksite and used as a data logger, and retrieved daily, weekly or whenever the application requires.

Although one can easily imagine systems in which the worksite instrument package consists of a control PC and PLC or other remote I/O signaling in order to provide such data logger functionality, this is unsuitable for most applications because of the uncertainties of the PC environment and long-term instability. The 2300 Series can take care of all of these problems.

**Send an E-mail Alarm to Your Mobile Phone**

The e-mail function of the LAN Module 2353-20 can send warning state notifications by e-mail through a mail server on the network (LAN or other communication circuits).

Warning e-mails can be sent to multiple pre-designated addresses, and even include customized messages to alert you of the nature of the alarm.

![Diagram showing data synchronization and data loss elimination](image-url)
**Extensible Local Bus**

Data transfer between the communications and measurement modules is provided over a CAN Bus. Up to 63 measurement modules can be connected to each communication module by drop wiring of shielded conductor pairs.

HIoki offers a maximum CAN Bus transfer rate of 500 kbps, while competitive local bus rates are considerably slower (typically 9.6 kbps), so the monitored value refresh rate and data acquisition speed are significantly faster.

Maximum CAN Bus wiring length is 100 meters for 500 kbps transfers.

**Large Internal Memory**

During continuous long-term measurement and monitoring, the maximum time span of measurement data that can be stored within each module is shown in the table below. When the internal memory becomes full during measurement, the oldest data is overwritten by newly acquired data.

**Measurement storage capacity per module model, and maximum recordable time span** (with endless recording* enabled)

<table>
<thead>
<tr>
<th>Modules</th>
<th>Module 2301 through 2305</th>
<th>Module 2306</th>
<th>Module 2311</th>
<th>Module 2321</th>
<th>Module 2331</th>
<th>Module 2332</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recording mode</strong>:</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td><strong>Recording interval</strong>:</td>
<td>1 s</td>
<td>2 s</td>
<td>5 s</td>
<td>10 s</td>
<td>15 s</td>
<td>30 s</td>
</tr>
<tr>
<td><strong>Maximum stored time span</strong>:</td>
<td>580 h</td>
<td>290 h</td>
<td>115 h</td>
<td>58 h</td>
<td>58 h</td>
<td>290 h</td>
</tr>
</tbody>
</table>

**How Data is Saved**

The sampling rate is once per second, and you can choose to record and store the instantaneous value captured at every set interval (see available intervals below), and/or the minimum, maximum and average RM S values within that interval, in the measurement module's internal memory. In addition, the interval at which to sample can be set for each measurement module can be set individually.

**Trend Recording to Manage Tendencies**

Monitor continuously with gapless calculation. The following values are calculated from waveform data each second during interval recording (one second is the shortest recording interval).

- Maximum, minimum, average, rms, peak-to-peak and peak values, and crest factor (peak/rms)

Trends in waveform data from a measurement object are normally tracked by monitored values or trend graphs.

**Enhanced Trigger Functions Acquire the Desired Waveforms**

Acquire waveforms at the specified sampling speed (up to 400 kS/s) when trigger criteria are met. Acquired waveforms can be up to 32 kWords long. Enhanced trigger functions make capturing waveform anomalies easy.

**Windows Application Program Displays Waveforms**

View waveform data and instrument setting information using our Smart Site Utility Pro 9768 Windows program.
Reliable Support for Mission-Critical System Construction

**Smart Site Utility Pro**

1. **Set up the Remote Measurement 2300 Series with Ease**
   Before starting measurement, use Smart Site Utility Pro to set up the communication route, check for a reliable network, and configure modules.
   
   - The Module List is verified simultaneously with network confirmation.
   - Communication route settings can be made simply using the map editor.
   - Configure module settings.

2. **Monitor and Retrieve Data in Real-Time**
   - Three monitor sizes are available and digital data can be displayed simultaneously.
   - A simple monitoring screen can be created by merely superimposing a background image representing the measurement site. You can import images in bmp, gif or jpeg format.
   - Based on the monitored data, real-time trend graphs can be plotted and displayed.

3. **Collect Data Periodically Using Simple Settings**
   - Simply select the option to periodically collect stored data, set the desired interval, and you’re ready to go.
   - Different recording intervals and recording modes for each module can also be set independently.
Smart Site Viewer offers high-speed data processing and strong graphic display capabilities

With the Smart Site Viewer, you can quickly display measurement data and also convert measured results into CSV format data. Simply select the data you want to display from the acquired measurement results. Multiple viewers can be opened simultaneously, each set up according to your application and viewing needs. Mix and match display conditions to create your own customized graph of the measurement results.

Update graphs periodically according to your desired refresh rate.

Automatically Generate Daily and Monthly Reports

Versatile daily and monthly reports can be automatically created by linking Smart Site Viewer with Excel. Reports are automatically output from the measurement data onto your favorite templates.
**Application Examples**

Here are some of the many ways the HIOKI 2300 Series is being used.

**Remote monitoring control systems for small and mid-size buildings**

Small and mid-size buildings are remotely managed using IP-VPN.

**Energy consumption survey (ESCO diagnostic and survey tool)**

The HIOKI 2300 Series serves as a tool for surveying energy consumption in buildings and factories. The internal memory of the measurement modules enables their use as loggers, and using a mobile phone, trends are captured right in the office so that reports are generated and action plans formulated smoothly.

**Multi-channel Leakage Current Monitoring Systems**

Multi-channel leakage current monitoring is performed by combining the Power Module 2332-20 and a CT (zero-phase current transformer). Also, contact point output from an existing leakage warning panel is received by the Input Module 2341-20, so that overall local leakage current monitoring can be managed by one system.

**Remote Monitoring of Heating Calorimeters**

Calorie pulses from calorimeters and temperature signals are applied to the 2300 Series and monitored from a control room in another building or at a remote office. The stored data facilitates timely maintenance.

**Office and Factory Central Monitoring System**

Besides measuring energy consumption within a factory, the 2300 Series monitors facilities annexed to the factory such as receiving and transformer equipment, as well as air-conditioning equipment. In environments where a LAN cannot be used, installation costs can still be minimized by using wireless devices or PBX lines. The 2300 Series is also used to monitor operating status and quality control in manufacturing plants.

**Monitoring the Temperature and Current Monitoring in Data Centers and Server Farms**

The HIOKI 2300 Series serves to protect and maintain mission-critical equipment such as servers and other information processing equipment, broadcasting and disaster prevention equipment that could cause serious losses if unexpectedly damaged. Equipment current consumption and temperature data are used for server management. The 2300 Series can also be reconstructed for 1U rack mounting.
Temperature and Humidity Monitoring Systems for Storage and Clean Rooms

The 2300 Series is used for monitoring temperature- and humidity-controlled storage and clean rooms, and is commonly paired with the Temperature and Humidity Sensor 9764-50 that boasts an extended operating life. Another attractive feature is the system’s usefulness for meeting ISO 9002 requirements for calibration and for generating calibration documentation.

Remote Monitoring of Manhole Pumps

The HIOKI 2300 Series has been used remotely to monitor the operating status of manhole pumps for device faults, efficiency, fault prevention and preventative maintenance by creating a database for analog data such as pump current and power consumption. Secure communication channels are implemented using IP - VPN or mobile network services.

Remote Data Collection and Monitoring of Co-generation and Fuel Cells

The HIOKI 2300 Series has been applied in the development of new energy technologies to monitor the operating status, capability evaluation and anomalies of the load-side equipment. As well as serving to maintain efficiency, the saved analog data provides feedback to the design and development teams for fault prevention and maintenance.

Measuring the Energy Consumption at Convenience Stores

To measure the details of energy consumption, input from each breaker on the distribution panel and flow meter (gas and water) is applied to a Power Module set up in the HIOKI 2300 Series. In addition, indoor and outdoor temperature and humidity, internal display case temperatures and outdoor insulation values are measured to analyze external influences on energy consumption. Analyze the collected data to facilitate energy conservation and cost reductions.

Remote Monitoring of Wind Power Generators and Plant equipment

The operating status and power generated at multiple wind power sites are monitored to spot anomalies from a remote office. Open ISDN and ADSL are used to communicate with the remote sites using secure protocols (Internet VPN or IP-VPN) for remote monitoring.

Single-point Management of Theme Parks and Outdoor Facilities

Take advantage of the 2300 Series’ flexible customizability to monitor equipment operating status and energy consumption at theme parks and outdoor facilities typically made up of numerous functional buildings spread around the site. In addition to using the existing LAN, existing PBX phone lines and wiring can be used for communication to minimize network construction costs.
Examples of remote communication using HIOKI Smart Site Series 2300

**Communication method 1: Using IPSec VPN over GPRS**
- When installing in the locations where internet is not available
- When use is only temporary
- When unauthorized access prevention is necessary

**Required configuration for communication:**
1. Offices
   - IPSec configurable Router or ISDN modem : 1
2. Remote site
   - IPSec configurable GPRS router : Per Site

**Communication method 2: Using the Internet**
- When constant connection is needed (and monthly service charge is fixed)

**Required configuration for communication:**
1. Offices
   - Ordinal internet connection : 1
2. Remote sites
   - Ordinal internet connection
     - + Static IP address : Per Site

**Communication method 3: Using Internet VPN**
- When constant connection is necessary (when monthly service charge is fixed)
- When unauthorized access prevention is necessary

**Required configuration for communication:**
1. Offices
   - Ordinal internet connection
     - + VPN router : 1
2. Remote site
   - Ordinal internet connection
     - + VPN router
     - + Static IP address : Per Site

**Communication method 4: Using IP-VPN**
- When constant connection is needed (when monthly service charge is fixed)
- More sophisticated method is required for unauthorized access prevention

**Required configuration for communication:**
1. Offices
   - Ordinal internet connection
     - + VPN router + modem : 1
2. Remote site
   - Ordinal internet connection
     - + VPN router + modem
     - + Static IP address : Per Site
In addition to existing wired networks, wireless communication can be used to connect neighboring sites. Typical communication methods available are described below.

**Communication Methods**

1. **Using an Existing LAN**
   - To use an existing LAN, specify an IP address for the LAN Module 2353-20.
   - Installation costs are minimized by using existing infrastructure.

2. **Wireless LAN**
   - Compatible with commonly available WiFi (802.11b/a/g) wireless LANs.
   - Installation costs can be minimized by employing wireless connections to sites that cannot otherwise be connected to a LAN.

3. **Construct Wireless Connections Using Industrial Wireless Devices**
   - Wireless connections can be made to a wired LAN using the LAN Module 2353-20 and the Air Module 2351-20 connected to the wired LAN.
   - The Air Module 2351-20 utilizes an ex-standard wireless protocol, ensuring excellent security. Because it is inaccessible to WiFi systems, unauthorized access is difficult.

4. **Constructing a Wireless Network**
   - Use the Air Module 2351-20 to construct a wireless network.
   - With an optional antenna, the network radius is about 60 meters indoors and 200 to 300 meters outdoors, with even greater distances achievable using higher gain antennas.
   - Relay stations can be employed to reliably extend wireless communication networking integrity - up to seven relay levels.
   - Security is assured by using a non-standard wireless protocol. Because it is inaccessible to WiFi systems, unauthorized access is difficult.

5. **Constructing a New LAN**
   - If an existing LAN is not available for use, one can be constructed.

6. **Using an Existing PBX**
   - If a LAN is not available, a communication system can be constructed using an existing PBX.
   - Construction costs are minimized by utilizing existing communication lines.
   - PBX usage has been declining with the introduction of internal mobile and IP telephones, so unused telephone lines can be effectively re-utilized.
   - Installing VDSL modems between the exchange equipment and the ends of the phone lines enables system applications using TCP/IP.
REMOTE MEASUREMENT & MONITORING SYSTEM 2300

PC Application Software

Systems can be constructed to customer specifications using various software applications offered by third-party developers.

**Major Functions and Features**

- **Complete compatibility with the 2300 Smart Site**
  - Modbus memory addresses are provided beforehand for the various 2300 Smart Site modules, so systems can be constructed without concern for Modbus memory addressing.
- **Distributed computing**
  - Clients such as OPC servers and SCADA clients can be controlled by separate PCs, enabling flexible support of systems configured with completely separate monitoring and communications nodes, and large-scale systems that require distributed processing.
- **Simultaneous access by multiple clients**
  - While monitoring with SCADA, one OPC server can execute custom logic in VB or logging by data collection applications. The OPC server sorts and communicates registered tag information even while being accessed by multiple clients, so throughput is not degraded.
- **OPCDA 3.0 Compatible**
  - The latest OPCDA 3.0 standard published in 2003 is supported, ensuring trouble-free operation even when using the latest SCADA.
- **Communication redundancy and simulation functions**
  - When a fault occurs in the communications route, the redundancy function can switch to an alternate route, or the simulation function can allow client development to proceed even if no controller is installed.
- **Ready for any SCADA**
  - OPC interconnection testing conducted by the OPC Council of Japan has confirmed smooth connections compatibility with the main SCADA as above.

The 2300 Smart Site can be connected to the programmable display devices of Digital Corporation, which are widely used at manufacturing sites. Digital's GP-PRO/PBIII C-Package 03 screen generation and logic program software supports the 2300 Smart Site. Of course, PC-less systems can be built, and systems that display data using the GP & GLC series equipped with a CF card slot can save recording data.

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## Smart Site Utility Pro Windows Program Specifications

<table>
<thead>
<tr>
<th>Module and Options</th>
<th>SMART SITE UTILITY PRO 9768</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Features</strong></td>
<td>Confirm initial settings and communication status for communications path and conditions. Monitor measurement values, start/stop data recording, acquire data, view acquired data in lists and graphs, create reports for standard software, and add options for more advanced functions.</td>
</tr>
<tr>
<td><strong>Major Functions</strong></td>
<td>Smart Site Utility functions • Comm. Module settings • Meas. module settings • Create monitor screen • Acquire and record data using PC • Monitor measurements • Alarm setting/mgmt. Smart Site Viewer functions • Load, print and display recorded data in graphs • Create reports (Excel format)</td>
</tr>
<tr>
<td><strong>Computer operating environment</strong></td>
<td>PC CPU: At least 1 GHz OS: Windows 2000/XP with .NET Framework 2.0, Internet Explorer 5.01 or later Memory: At least 512 MB Display Screen: up to 1024 x 768 dots, at least 65,536 colors Hard Disk: Free space: at least 30 MB (if .NET Framework 2.0 is not installed, an additional 500 MB is required). Additional space is required for saving recorded data. Interface: COM port, LAN</td>
</tr>
<tr>
<td><strong>Options</strong></td>
<td>SERVER/CLIENT OPTION 9768-01, LAN MODULE MAIL OPTION 9768-02, MODBUS SERVER OPTION 9768-03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module and Options</th>
<th>SERVER/CLIENT OPTION 9768-01</th>
<th>LAN MODULE MAIL OPTION 9768-02</th>
<th>MODBUS SERVER OPTION 9768-03</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Features</strong></td>
<td>Adds Server and Smart Site Client functions to Smart Site Utility Pro 9768.</td>
<td>Provides setting functions for sending e-mail from LAN Module 2353 to Smart Site Utility Pro 9768, to control e-mail sending and the network warning lamp for alarm events.</td>
<td>Adds Modbus server functions to Smart Site Utility 9768.</td>
</tr>
<tr>
<td><strong>Major Functions</strong></td>
<td>Optional Server function The following are added to Smart Site Utility Pro 9768: • The Server function provides measurement information to Smart Site Client (simultaneously monitors measurements from up to ten PCs) • A function to provide device usage information to Smart Site Client Smart Site Client functions • Measurement Monitor function (Measurements are acquired and displayed by communication with the installed Smart Site Utility Server option.) • Alarm function • Monitor screen creation function Smart Site Viewer functions • Print and view recorded data as graphs</td>
<td>The following setting functions are added to Smart Site Utility Pro 9768 for sending e-mail from LAN Module 2353. E-Mailing Functions • Register up to 20 e-mail destination addresses. • LAN Module 2353 can send e-mail notification when an alarm event occurs on a connected CAN Bus measurement module. • Supported protocols: SMTP, POP before SMTP • Test Mail sending function Network warning lamp control Notes: E-mail functions require a LAN Module 2353 with firmware version 2.35 or later. Compatible warning lamps are the Network Alert Lamp DN-1000 series from ISA Co., Ltd.</td>
<td>Modbus Server function Modbus/TCP communications enables acquisition of values from measurement modules for monitoring by other application programs.</td>
</tr>
<tr>
<td><strong>Computer Operating Environment</strong></td>
<td>Version 4.2 or later of the Smart Site Utility Pro 9768 application software, in addition to the basic operating requirements of Model 9768</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Module Specifications and Options

<table>
<thead>
<tr>
<th>Module and Options</th>
<th>HUMIDITY MODULE 2301-20</th>
<th>PT MODULE 2302-20</th>
<th>TC MODULE 2303-20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Special Characteristic</strong></td>
<td>Utilizes a temperature and humidity sensor that features longterm reliability to measure temperature and relative humidity</td>
<td>Platinum temperature measurement resistance input (Pt100)</td>
<td>Thermo couple input (K, E, J, T)</td>
</tr>
</tbody>
</table>

#### Input Channel

<table>
<thead>
<tr>
<th>Specifications</th>
<th>1 channel each of temperature and humidity</th>
<th>2 temperature channels of Pt100 (3-wire method)</th>
<th>2 temperature channels of thermo couple input (K, E, J, T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>-40.0 to 85.0 °C (0.1 °C resolution)</td>
<td>-100.0 to 300.0 °C (0.1 °C resolution)</td>
<td>Thermocouple: K,E,J</td>
</tr>
<tr>
<td>Humidity:</td>
<td>0.0 to 100.0% RH (0.1% RH resolution)</td>
<td>Main Unit Measurement Accuracy: ±0.1%rdg. ±0.4 °C</td>
<td>Measurement Range: 0.0 to 50.0 °C</td>
</tr>
<tr>
<td>(Displayable Range: -10.0 to 110.0% RH)</td>
<td></td>
<td></td>
<td>Resolution: 0.1 °C</td>
</tr>
<tr>
<td>Sensor Accuracy:</td>
<td>Temperature: -40.0 to -0.1 °C ±1.0 °C</td>
<td>Accuracy: ±0.3%rdg.</td>
<td>Measurement Accuracy: ±0.1%fs. ±2.0 °C</td>
</tr>
<tr>
<td></td>
<td>0.0 to 35.0 °C ±0.5 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35.1 to 70.0 °C ±1.0 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>70.1 to 85.0 °C ±2.0 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Humidity:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Specifications

<table>
<thead>
<tr>
<th>Measurable Parameters</th>
<th>Voltage Pulse Contact (non-voltage) Pulse</th>
<th>Voltage/Contact (non-voltage) Pulse</th>
<th>Voltage/Contact (non-voltage) Pulse (2 channels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Pulse</td>
<td>Detectable Current Range 10mA-p to 20mA-p Pulse Width: More than 12.5ms. Rise/Fall Speed: Less than 0.8ms.</td>
<td>VoltageContact (non-voltage) Pulse (2 channels)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse Interval: More than 25ms. (40Hz max.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(When using Clamp On Sensor 9766 in a less than AC50A/m magnetic field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filter: Effective on “Contact (non-voltage) Pulse” input (Can be set by commands) • For Mechanical Contact: Pulse Width: More than 20ms. Pulse Interval: More than 40ms. (Less than 25Hz Frequency) (No filter available on Current Pulse Input)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measurement Interval Accuracy: ±2dgt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display Range: Integrated value on each channel at each interval (16,000,000 max.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Module and Options

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<td><strong>Special Characteristic</strong></td>
<td>Utilizes a temperature and humidity sensor that features longterm reliability to measure temperature and relative humidity</td>
<td>Platinum temperature measurement resistance input (Pt100)</td>
</tr>
</tbody>
</table>

#### Input Channel

<table>
<thead>
<tr>
<th>Specifications</th>
<th>1 channel each of temperature and humidity</th>
<th>2 temperature channels of Pt100 (3-wire method)</th>
<th>2 temperature channels of thermo couple input (K, E, J, T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>-40.0 to 85.0 °C (0.1 °C resolution)</td>
<td>-100.0 to 300.0 °C (0.1 °C resolution)</td>
<td>Thermocouple: K,E,J</td>
</tr>
<tr>
<td>Humidity:</td>
<td>0.0 to 100.0% RH (0.1% RH resolution)</td>
<td>Main Unit Measurement Accuracy: ±0.1%rdg. ±0.4 °C</td>
<td>Measurement Range: 0.0 to 50.0 °C</td>
</tr>
<tr>
<td>(Displayable Range: -10.0 to 110.0% RH)</td>
<td></td>
<td></td>
<td>Resolution: 0.1 °C</td>
</tr>
<tr>
<td>Sensor Accuracy:</td>
<td>Temperature: -40.0 to -0.1 °C ±1.0 °C</td>
<td>Accuracy: ±0.3%rdg.</td>
<td>Measurement Accuracy: ±0.1%fs. ±2.0 °C</td>
</tr>
<tr>
<td></td>
<td>0.0 to 35.0 °C ±0.5 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35.1 to 70.0 °C ±1.0 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>70.1 to 85.0 °C ±2.0 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Humidity:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Specifications

<table>
<thead>
<tr>
<th>Measurable Parameters</th>
<th>Voltage Pulse Contact (non-voltage) Pulse</th>
<th>Voltage/Contact (non-voltage) Pulse</th>
<th>Voltage/Contact (non-voltage) Pulse (2 channels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Pulse</td>
<td>Detectable Current Range 10mA-p to 20mA-p Pulse Width: More than 12.5ms. Rise/Fall Speed: Less than 0.8ms.</td>
<td>VoltageContact (non-voltage) Pulse (2 channels)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse Interval: More than 25ms. (40Hz max.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(When using Clamp On Sensor 9766 in a less than AC50A/m magnetic field)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filter: Effective on “Contact (non-voltage) Pulse” input (Can be set by commands) • For Mechanical Contact: Pulse Width: More than 20ms. Pulse Interval: More than 40ms. (Less than 25Hz Frequency) (No filter available on Current Pulse Input)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measurement Interval Accuracy: ±2dgt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Display Range: Integrated value on each channel at each interval (16,000,000 max.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Module Specifications and Options

<table>
<thead>
<tr>
<th>Module and Options</th>
<th>POWER METER MODULE 2331-20</th>
<th>POWER METER MODULE 2332-20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Special Characteristic</strong></td>
<td>Clamp-on power meter for single-phase to three-phase 4-wire 100/200V AC installations. Demand measurements possible.</td>
<td>Clamp-on power meter for multi-circuit power measurement common to 100/200V AC voltage installations.</td>
</tr>
<tr>
<td><strong>Input Channels</strong></td>
<td>142W, 143W, 149W and 34W (Number of measurable circuits: 6 (at same voltage as the system))</td>
<td>Number of measurable circuits: 6 circuits (at same voltage as the system).</td>
</tr>
<tr>
<td><strong>Measurement Lines</strong></td>
<td>1 circuit of either 142W, 143W, 149W, 34W</td>
<td>Up to 6 circuits of 142W, or up to 3 circuits of 143W/34W</td>
</tr>
<tr>
<td><strong>Measurable Parameters</strong></td>
<td>Voltage, Current, Effective Power, Power Factor, Integrated Effective Power, Frequency</td>
<td>Voltage, Current, Effective Power, Reactive Power, Power Factor, Integrated Effective Power, Frequency</td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input Channel</strong></td>
<td>Rated Primary Line Current: 50A AC</td>
<td>Rated Primary Current: 100A AC</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>For POWER METER Module 2331-20 or POWER METER Module 2332-20</td>
<td></td>
</tr>
<tr>
<td><strong>Rated Primary Line Current</strong></td>
<td>50A AC</td>
<td>100A AC</td>
</tr>
<tr>
<td><strong>Output Voltage</strong></td>
<td>10mV AC/A</td>
<td>1mV AC/A</td>
</tr>
<tr>
<td><strong>Amplitude Accuracy</strong></td>
<td>±0.3% rdg. ±0.02% f.s. (f.s. = 50A, 45 to 66Hz, at Core Center Position)</td>
<td>±0.3% rdg. ±0.02% f.s. (f.s. = 100A, 45 to 66Hz, at Core Center Position)</td>
</tr>
<tr>
<td><strong>Phase Angle Accuracy</strong></td>
<td>Within ±2 degrees (45Hz to 5kHz)</td>
<td>Within ±2 degrees (45Hz to 5kHz)</td>
</tr>
<tr>
<td><strong>Amplitude Frequency Characteristics</strong></td>
<td>40Hz to 5kHz: Within ±1% (Deviation from accuracy)</td>
<td></td>
</tr>
<tr>
<td><strong>Influence of Conductor Position</strong></td>
<td>Within ±0.5% on any position inside the core (Deviation from center)</td>
<td></td>
</tr>
<tr>
<td><strong>Influence of External Magnetic Field</strong></td>
<td>Less than 0.1A equivalent against 400A/m AC magnetic field</td>
<td>Max. ±3% f.s. against 400A/m, 50/60Hz magnetic field</td>
</tr>
<tr>
<td><strong>Maximum allowable input</strong></td>
<td>60Amps cont. (45 to 66Hz, 50°C ambience)</td>
<td>130Amps cont. (45 to 66Hz, 50°C ambience)</td>
</tr>
<tr>
<td><strong>Temperature Coefficient</strong></td>
<td>0.02% rdg./°C</td>
<td>0.03% f.s./°C</td>
</tr>
<tr>
<td><strong>Measurable Conductor Diameter</strong></td>
<td>Up to 15 mm</td>
<td>Up to 46 mm</td>
</tr>
</tbody>
</table>
## Module Specifications and Options

<table>
<thead>
<tr>
<th>Module and Options</th>
<th>INPUT MODULE (DI) 2341-20</th>
<th>OUTPUT MODULE (Do) 2342-20</th>
<th>RS LINK MODULE 2343-20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Special Characteristic</strong></td>
<td>Capture contact/voltage signals from external device for monitoring</td>
<td>Outputs control signal, according to commands from above or based on measurement module data.</td>
<td>Remote monitoring and control of existing devices equipped with RS-232C. Connectable with Power HITESTERS 3331 and 3332, and compatibility with other HIOKI instruments planned.</td>
</tr>
<tr>
<td><strong>Input Channels</strong></td>
<td>8 contact points/voltage (active-low)</td>
<td>Open collector output: 8ch</td>
<td>External communication interface: RS-232C (5.76 kbps maximum communication speed)</td>
</tr>
</tbody>
</table>

### Specifications

- **Communication protocol:**
  - RS-232C
  - 2.4 GHz range SS wireless type, with wireless technologies
  - Communication module based on SS
  - Setting commands from PC applications

- **Input Channels:**
  - Eight (per-channel settings provided for thermocouple types K, E, J, T and R, RTD current.
  - Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or power and communication modules
  - For 2391-03: 13 (10 measurement module slots)
  - For 2391-02: 8 (5 measurement module slots)
  - For 2391-01: 3 (for relay and master station)

- **Features:**
  - Internal isolated power: none
  - External power supply: Between V IN and COM, 30 V DC max.
  - External sink current: 250 mA DC per channel
  - Maximum applied voltage 30 V DC

- **Specifications:**
  - Maximum Rated Voltage to Ground: ±50 V DC
  - Maximum Allowable Input: ±30 mA DC
  - Module and Options: AIR MODULE 2351-20*, WIRE MODULE 2352-20, LAN MODULE 2353-20
  - Communication module based on SS wireless technologies
  - Communication protocol: 2.4 GHz range SS wireless type, with wireless technologies
  - RS-232C
  - Communication module based on SS wireless technologies

- **Specifications:**
  - Number of connectable modules:
    - External communication: 99 total (with COM ID assigned to each module)
    - Internal communications: 63 total (with A MODULE ID assigned to each measurement module)
  - Sending commands from modules

- **NOTE:** Requires modification according to regional or national standards. Please contact HIOKI for further information.

<table>
<thead>
<tr>
<th>Module and Options</th>
<th>INPUT MODULE (DI) 2341-20</th>
<th>OUTPUT MODULE (Do) 2342-20</th>
<th>RS LINK MODULE 2343-20</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Special Characteristic</strong></td>
<td>AC power supply for measurement and communication modules</td>
<td>DC power supply for measurement and communication modules</td>
<td>AC power supply for measurement and communication modules</td>
</tr>
<tr>
<td><strong>Power voltage</strong></td>
<td>100 to 240 V AC</td>
<td>19 to 36 V DC</td>
<td>19 to 36 V DC</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>5V DC, 2.4A (supports up to 10 measurement modules)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Multi-Function Module 2306

**Features:**
- Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or current.
- Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or current.
- Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or current.

**Input Channels:**
- Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or current.
- Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or current.
- Eight input channels support multi-function measurements of temperature (thermocouple or RTD) or DC voltage or current.

**Specifications:**
- **Thermocouple:**
  - Measurement Object: K, E, J, T and R, RTD
  - Measurement Accuracy: ±0.25% rdg. ±1°C
- **RTD(3-wire):**
  - Measurement Object: Pt100, Cu100, Cu500, Cu200, Cu1000, Cu2000, Cu5000
  - Measurement Accuracy: ±0.25% rdg. ±0.5°C
- **DC Voltage(≤50000 counts):**
  - Measurement Object: 5 V, 10 V, 20 V, 50 V, 100 V
  - Measurement Accuracy: ±0.25% rdg. ±0.10 dgt.
- **DC Current(≤30000 counts):**
  - Measurement Object: 50 mA, 100 mA, 200 mA, 500 mA
  - Measurement Accuracy: ±0.25% rdg. ±0.10 dgt.

* Add standard junction compensation accuracy when using internal reference junction compensation.

**General Specifications:**
- Standard junction Compensation: Internal/External selectable (for thermocouple measurements)
- Standard junction Compensation Accuracy: 11°C
- Digital Filter: OFF, 50 Hz, 60 Hz, 10 Hz
- Sampling: 1/s (count with Digital Filter Off)
- 10/s (count with 10 Hz Digital Filter)
- Max. Allowable Input: ±10 V DC
- Current Measurement Terminals: ±30 mA DC
- Max. Rated Voltage to Ground: ±33 Vrms AC, 70 V DC
## Module Specifications and Options

### Module and Options

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performs gapless calculations on waveform data acquired once per second, for interval recording and continuous monitoring. Waveforms are acquired when trigger criteria are met.</td>
<td></td>
</tr>
</tbody>
</table>

### Input Channels

<table>
<thead>
<tr>
<th>Features</th>
<th>Two analog voltage channels and four 2-input logic channels (with Logic Probe 9320-01 or 9321-01)</th>
</tr>
</thead>
</table>

### Specifications

#### General Specifications

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges</td>
<td>50 V to 50 mV (in 10 ranges), each range up to 100%, resolution is 1/1600 of full scale for that range</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>1 MΩ ±1%</td>
</tr>
<tr>
<td>Input Configuration</td>
<td>Unbalanced (Floating)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>DC: ±0.5% f.s. (with 5-Hz filter)</td>
</tr>
<tr>
<td>Frequency Characteristic</td>
<td>DC to 40 kHz (-3 dB @ 40 kHz)</td>
</tr>
<tr>
<td>Max. Input Voltage</td>
<td>33 Vrms AC, 70 V DC</td>
</tr>
<tr>
<td>Max. Rated Voltage to Ground</td>
<td>33 Vrms AC, 70 V DC</td>
</tr>
<tr>
<td>Trigger Input</td>
<td>Threshold Levels: L = +0.0 V to +1.0 V, H = +2.5 V to +5.0 V</td>
</tr>
<tr>
<td>Trigger Output</td>
<td>Open-Collector, 30 V DC @ 500 mA max.</td>
</tr>
<tr>
<td>Trigger Output Timing</td>
<td>Continuous (Reset from PC application), Specified interval (Reset at 1 to 255 s, or from PC application), Output only during waveform acquisition</td>
</tr>
</tbody>
</table>

#### Functional Specifications (Calculation Value Recording)

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculation Value Recording</td>
<td>Performs gapless calculations on waveform data acquired once per second, for interval recording and continuous monitoring. Waveforms are acquired when trigger criteria are met.</td>
</tr>
<tr>
<td>Recording Interval</td>
<td>1 s to 60 min (in 15 ranges)</td>
</tr>
<tr>
<td>Calculation Values</td>
<td>Analog waveform maximum, minimum, peak-to-peak and peak values, crest factor (peak value/rms), average and rms values once per second</td>
</tr>
<tr>
<td>RMS Calculation</td>
<td>Every second for analog waveforms, instantaneous value for logic waveforms</td>
</tr>
</tbody>
</table>

#### Functional Specifications (Waveform Recording)

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waveform Recording</td>
<td>Performs gapless calculations on waveform data acquired once per second, for interval recording and continuous monitoring. Waveforms are acquired when trigger criteria are met.</td>
</tr>
<tr>
<td>Max. Recording Length</td>
<td>32 kWords per waveform (with two memory partitions)</td>
</tr>
<tr>
<td>Memory Partitioning</td>
<td>2, 4, 8, 16, 32 partitions</td>
</tr>
<tr>
<td>Sampling Rate</td>
<td>400 kS/s to 10 S/s (in 19 ranges)</td>
</tr>
<tr>
<td>Trigger</td>
<td>Analog (Level or Window), Logic, External, timed, by software, between channels, by calculated value</td>
</tr>
<tr>
<td>Pre- and Post-Trigger</td>
<td>Independently settable</td>
</tr>
<tr>
<td>Trigger Filter</td>
<td>Implemented by Output Module 2342</td>
</tr>
</tbody>
</table>

### Module and Options

<table>
<thead>
<tr>
<th>Features</th>
<th>Logic Probe 9320-01</th>
<th>Logic Probe 9321-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performs gapless calculations on waveform data acquired once per second, for interval recording and continuous monitoring. Waveforms are acquired when trigger criteria are met.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Input Channels

<table>
<thead>
<tr>
<th>Features</th>
<th>Four Channels (between probe tips and channels, common ground), Digital/Contact input switch (Contact inputs detect open-collector signals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Impedance</td>
<td>1 MΩ (for 0 to +5 V digital input), 500 kΩ or more (for &gt;5 to +50 V digital input)</td>
</tr>
<tr>
<td>Pull-Up Resistance</td>
<td>2 kΩ (Contact Inputs: internal pull-up to +5 V)</td>
</tr>
<tr>
<td>Contact Input Detection Impedance</td>
<td>1.5 kΩ or more (Open) and 500 Ω or less (Short), 3.5 kΩ or more (Open) and 1.5 kΩ or less (Short), 25 kΩ or more (Open) and 8 kΩ or less (Short)</td>
</tr>
<tr>
<td>Response Time</td>
<td>500 ms or less</td>
</tr>
<tr>
<td>Max. Input Voltage</td>
<td>0 to 150 VDC (max. between input terminals without damage)</td>
</tr>
<tr>
<td>Cable Length</td>
<td>1.5 m between devices, 30 cm input section</td>
</tr>
</tbody>
</table>

#### Output Detection (H)

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Detection (H)</td>
<td>170 to 250 V AC, ±70 to ±250 V DC (High range), 60 to 150 V AC, ±20 to ±150 V DC (Low range)</td>
</tr>
</tbody>
</table>

#### Output Detection (L)

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Detection (L)</td>
<td>0 to 30 V AC, 0 to ±43 V DC (High range), 0 to 10 V AC, 0 to ±15 V DC (Low range)</td>
</tr>
</tbody>
</table>

#### Response Time

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Time</td>
<td>Rise time 1 ms or less, Fall time 3 ms or less (at 200 V DC High range, 1000 V DC Low range)</td>
</tr>
</tbody>
</table>

#### Max. Input Voltage

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Input Voltage</td>
<td>250 Vrms (High range), 150 Vrms (Low range), max. between input terminals without damage</td>
</tr>
</tbody>
</table>

#### Cable Length

<table>
<thead>
<tr>
<th>Features</th>
<th>Waveform Module 2321</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Length</td>
<td>1.5 m between devices, 1 m input section</td>
</tr>
</tbody>
</table>
Specifications (External Dimensions)

With Model 2391 Installed

With Model 2392 Installed

Model 2306-20 connected to Model 2391

Model 2306-20 connected to Model 2391

(2391-02 and 2391-03 Module Bases have the same dimensions.)

(2392-01 and 2392-02 Module Bases have the same dimensions.)

(2392-01 and 2392-02 Module Bases have the same dimensions.)

All information correct as of Aug. 31, 2008. All specifications are subject to change without notice.

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