

# Medical Equipment and Systems



1 Nagoya Proton Therapy Center (left) and proton therapy treatment room (right)

## 1 Japan's First Spot Scanning Proton Therapy System at Nagoya Proton Therapy Center

In January 2014, the Nagoya Proton Therapy Center became the first clinic in Japan to treat patients using proton spot scanning. The new system operates alongside two existing treatment rooms that started treating patients in February 2013 and use a passive scattering system. This means that the Nagoya Proton Therapy Center now has three treatment rooms, two with rotating gantries and one with a fixed-nozzle system. The center is part of Nagoya City's "Quality Life 21 Johoku" program that fosters the health-care and welfare of its people. The newly installed spot scanning system is Hitachi's latest proton therapy system.

Compared to conventional passive scattering, spot scanning can target the proton beam more accurately on complex tumor shapes, reducing adverse effects on surrounding healthy tissue while still delivering a high dose to the tumor. Two other features of spot scanning are that it eliminates the need for patient-specific beam shaping collimators and compensators (which eventually become radioactive waste), and that its high proton usage factor minimizes the generation of harmful secondary radiation.

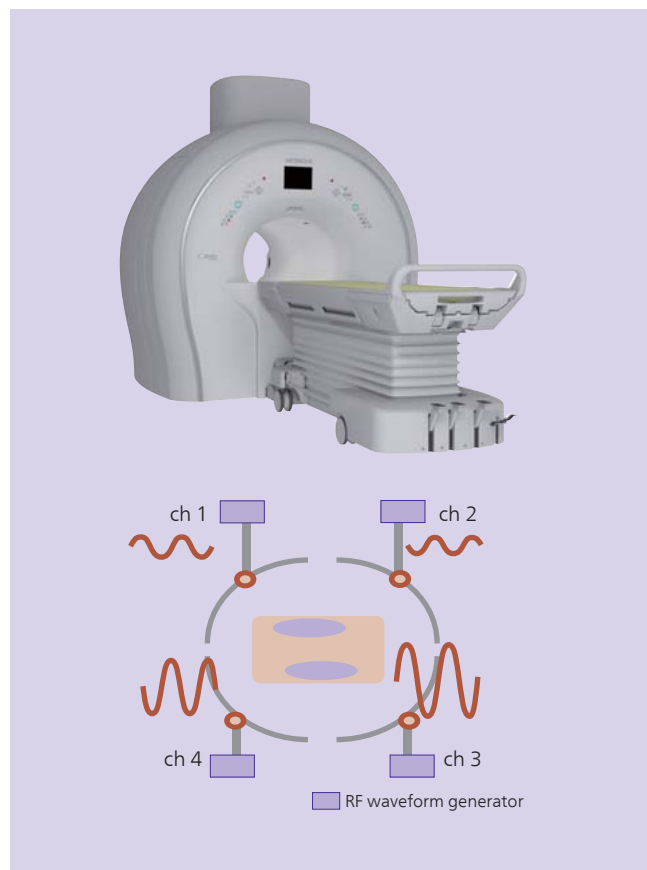
## 2 3T MRI System Superconducting MRI System

The 3T (tesla) MRI System superconducting magnet magnetic resonance imaging (MRI) system uses the same oval gantry bore shape that was highly rated in the 1.5T MRI System.

Since the body of the subject lying on the bed spreads out to the sides, 3T MRI System has been given a 74-cm-wide oval bore so that large-bodied or claustrophobic subjects do not feel oppressed by the equipment. Extending the exam space out to the sides also enables the subject on the bed to be moved sideways. This

movement enables imaging at the center of the magnetic field (the location providing the highest image quality) even when imaging off-center locations such as shoulder joints.

3T MRI System achieves high image quality by using a radio frequency (RF) irradiation coil enabling 4-channel, 4-port independent control. Since 3T MRI Systems are generally prone to



2 3T MRI System superconducting MRI system (top) and schematic diagram of RF irradiation coil with 4-channel, 4-port independent control (bottom)

non-uniform RF irradiation of the torso region, 3T MRI System acquires an RF map used to check the RF irradiation status during the exam. This map is used to control the irradiated RF waves by independently controlling the 4 channels to reduce RF irradiation non-uniformity, providing a highly uniform image.

Hitachi will continue to develop distinctive superconducting MRI systems driven by its original technologies.  
(Hitachi Medical Corporation)

### 3 Supria Full-body X-ray CT Diagnostic System

With seniors (those aged 65 and over) accounting for over 24% of Japan's total population in 2012, Japan's medical industry requires medical exam and treatment methods that meet their needs. Since the nuclear power plant disaster in 2011, the public has been increasingly worried about exposure to X-ray radiation, with the medical industry called on to reduce exposure to subjects and medical workers.

Supria\* is a recently developed 16-channel computed tomography (CT) system with an open and compact design concept enabled by a top-class aperture diameter (75 cm) and reduced gantry size. Consisting of just three units (one less than conventional models), it can be installed in exam rooms of limited space.

Supria features several advanced technologies used in higher-end 64-channel/128-slice CT systems, such as the image noise reduction technology that uses an iterative approximation-based reconstruction algorithm that is a promising approach to reducing exposure. Supria can provide high-definition images in little imaging time, with better operation than conventional models.

(Hitachi Medical Corporation)

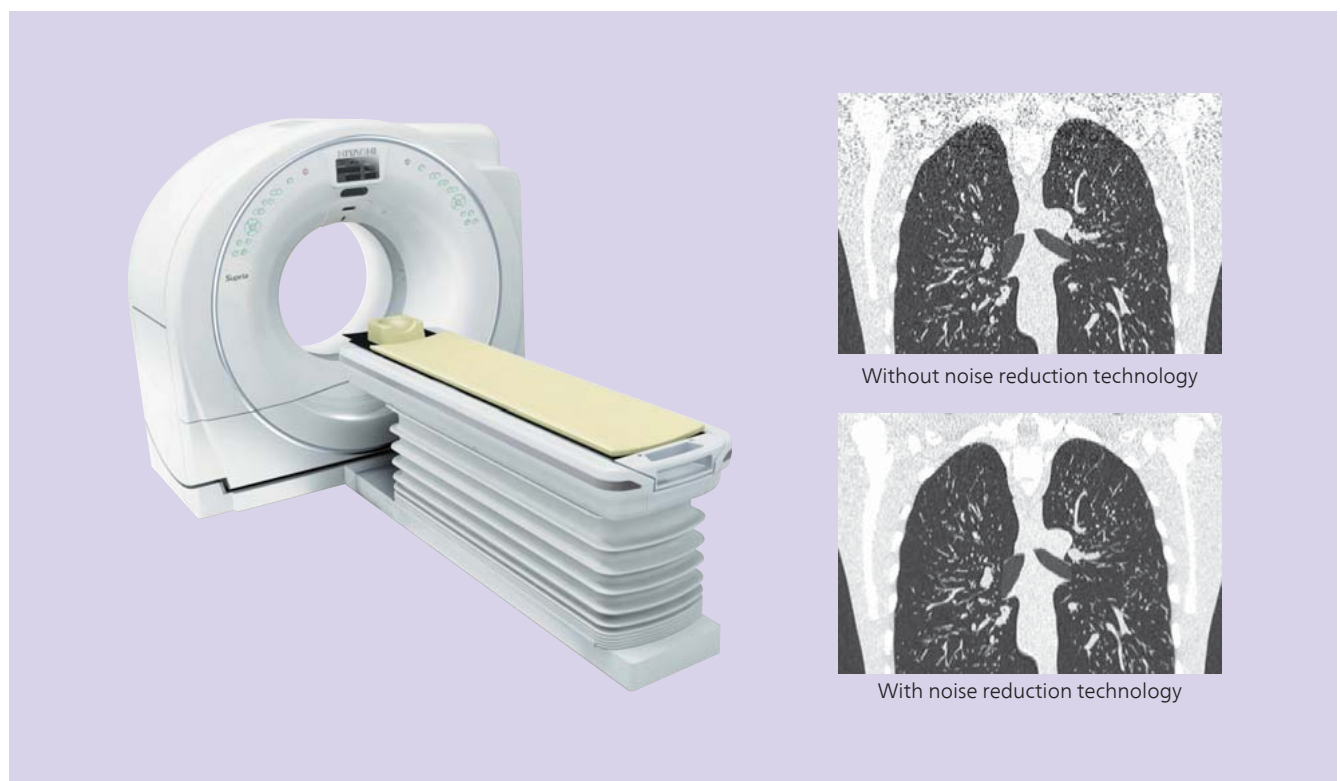
\* Supria is a trademark of Hitachi Medical Corporation.

### 4 ARIETTA 70 and ARIETTA 60 Diagnostic Ultrasound Systems —Visualize and Sense Ultrasound—

The ARIETTA 70 and ARIETTA 60\*<sup>1</sup> are Hitachi's latest diagnostic ultrasound systems. They were developed with the assistance of Central Research Laboratory, Hitachi, Ltd. and combine technologies from Hitachi Medical Corporation's HI VISION\*<sup>2</sup> series and the ProSound\*<sup>1</sup> series manufactured by the former Aloka Co., Ltd. These compact diagnostic ultrasound systems feature outstanding image quality achieved through a range of technical enhancements that extend from ultrasound signal generation to image processing.

Sensitivity and resolution are essential features for diagnostic ultrasound imaging and the new models achieve these through the use of multi-layered crystal technology in the probes and an optimized compound pulse wave generator<sup>+</sup> (CPWG<sup>+</sup>) as the front-end. To deliver the clearest possible images, the systems utilize the powerful signal processing technologies of the backend unit and incorporate a wide-field, high-contrast IPS-Pro\*<sup>3</sup> monitor. Each and every component of the imaging platform harmonizes to guarantee the high image quality and performance of the ARIETTA 70 and ARIETTA 60.

Real-time Virtual Sonography and Real-time Tissue Elastography\*<sup>2</sup> are now seen as essential requirements for diagnostic ultrasound examinations. As well as being a pioneer of this technology, Hitachi Aloka Medical, Ltd. has also upgraded these functions in the new systems. Another feature is a two-dimensional (2D) tissue tracking function for evaluating cardiac muscle movement and changes in phase. An extensive range of probes are available for the ARIETTA 70 and ARIETTA 60 to suit different clinical applications. Together, these features make the new diagnostic ultrasound systems suitable for a wide range of clinical purposes.



3 Supria 16-channel CT scanner (left) and comparison of image without/with noise reduction technology (right)



4 ARIETTA 70 (left) and ARIETTA 60 (right) diagnostic ultrasound systems

(Hitachi Aloka Medical, Ltd.)

\*1 ARIETTA and ProSound are registered trademarks or trademarks of Hitachi Aloka Medical in Japan and other countries.

\*2 HI VISION, Real-time Virtual Sonography and Real-time Tissue Elastography are registered trademarks or trademarks of Hitachi Medical Corporation in Japan and other countries.

\*3 See "Trademarks" on page 142.

## 5 Argus Safety-based Solutions for Safety Information Management Systems

Pharmaceutical companies are required to collect and evaluate drug safety control information, and report it to regulatory authorities. As drug development and sales have become increasingly globalized in recent years, pharmaceutical companies are

being called on for fast and accurate reporting to regulatory authorities in areas such as Japan, the USA and Europe.

The pharmaceutical industry has responded with increasingly widespread moves to implement new safety information management systems designed to enable unified management of safety control information for more efficient business operations and strategic analysis and evaluation of aggregated data.

Drawing on its experience with the start of Japan's domestic safety information management system, Hitachi has developed a solution based on Oracle\* Argus Safety. Argus Safety is a single-instance global package in use by many global pharmaceutical companies. Hitachi has implemented the first full operation of Argus Safety by a Japanese domestic pharmaceutical company. Hitachi offers the following advantages.

- (1) Thorough knowledge of Japan specific regulatory requirements and knowledge of product issues and solutions.
- (2) Certified as one of Oracle Diamond Partners, and able to solve problems rapidly while exchanging information directly with product developers.
- (3) Accumulated knowledge of past potential issues and solutions for key processes such as defining requirements, design, and data migration.

These solutions will be used to provide continued support for safety information management work done by pharmaceutical companies in future.

\* See "Trademarks" on page 142.

### Ability to deal with problems unique to Japan

- Thorough knowledge of Green Book information
- Knowledge of implementation states of other companies
- Experience in developing safety information management system for Japan from scratch

### Understanding of Argus specifications for Japan

- Understanding best-adapted version for Japanese specifications
- Understanding product issues
- Understanding unsatisfied regulatory requirements for Japan

### Key points of data migration

- Expertise in Argus data structure investigation
- Stockpile of control data investigation results
- Expertise in configuration and data migration correlations

### Expertise in working with Oracle Corporation

- Strengthening partnerships
- Periodic discussion of issues
- Experientially derived expertise in maintaining coordination within project as it progresses

### Understanding of potential issues

- Actual project experience leading to thorough knowledge of past issues with requirement definitions and basic design (CRP)
- Actual project experience leading to thorough understanding of past issues with data mapping and data conversion

### Stockpiles of solutions

- Possession of Argus target version solutions
- Stockpile of solutions driven by implementing resolutions to issues
- Stockpile of solutions driven by systems for resolving issues
- Understanding of issues requiring requested product improvements

CRP: conference room pilot

## 5 Hitachi advantages for Argus Safety implementation

# Measurement/Analysis Equipment



1 ChromasterUltra Rs UHPLC

## 1 ChromasterUltra Rs Ultra High Performance Liquid Chromatograph

Ultra high performance liquid chromatograph (UHPLC) is analysis instrument enabling high-precision measurement of the compositions and constituent quantities of liquid-soluble substances. UHPLC is able to greatly reduce analysis time relative to general-purpose liquid chromatographs. It can measure a wide range of specimens and components, and is important equipment for many analysis applications such as research and development and quality control in the pharmaceutical, chemical, food, and other industries.

The ChromasterUltra Rs UHPLC enables high resolution and high sensitivity during ultra-high-speed analysis, enabling high-speed analysis of trace impurities, an issue and demand in pharmaceutical research and development. The system's pressure resistance of 140 MPa is the highest in the world\*. This high value enables both ultra-high-speed analysis and use of mobile phases of substances prone to rising analysis pressure such as methanol, providing various analysis variations. The concurrently developed LaChromUltra II Series is a lineup of C18 columns with high resolution performance (50,000 theoretical plates). When combined with high system pressure resistance and a low dispersion system, it enables high resolution analysis and is an asset to analysis labs.

(Hitachi High-Tech Science Corporation)

\* As determined by Hitachi High-Technologies Corporation as at July, 2013, among models sold in Japan.

## 2 SU8200 Series Ultra-high-resolution Field-emission SEMs

Scanning electron microscopes (SEMs) are research and development tools for nanometer-size structure observations and material analysis and used by various organizations such as universities research institutes, and development and quality assurance departments in corporations.

SU8200 series have a new cold field emission (FE) electron gun ideal for ultra-high-resolution observation at low acceleration voltage. They can capture images that are brighter and have much better signal-to-noise (S/N) ratios than conventional electron guns. Signal detection enables discrimination between secondary electron (SE) detection (very good for surface potential contrast) and back-scattered electron (BSE) detection (very good for material compositional contrast), enabling high-contrast image capture of shape or composition information to meet the objectives. The series has greater specimen current than previous models, enabling electron back scattering diffraction (EBSD) analysis. The series also supports high spatial resolution analysis when performing energy dispersive X-ray spectrometry (EDX) using a low acceleration voltage.

The lineup's three models (SU8220, SU8230, and SU8240) are designed for different specimens and applications, assisting material development and research as tools that enable both cutting-edge material structure observations and analysis.

(Hitachi High-Technologies Corporation)



2 SU8200 series ultra-high-resolution field-emission SEMs





3 Automatic analyzer system

### 3 Advanced Dispensing Technology of Automatic Analyzer System

As medical treatments become more advanced and diverse, it is important for healthcare facilities to improve both patient service and administrative efficiency. In laboratories that need to obtain accurate measurement results faster and more efficiently, automatic analysis equipment needs to assure data quality, shorten measurement time, microscale reagent and sample volumes, and increase the number of measurement items.

The newly innovated medium-class automatic analyzer system that can be used as a mainstay model for medium-sized hospitals where huge demands and expectation in this category are observed. The system has maintained highly reliable performances being accumulated in previous models.

It uses a new mechanism control method and achieves a minimum specimen dispensing quantity of 1.0  $\mu\text{L}$ . The new control method achieves reproducibility far better than previous methods. Its key features are its specimen dispensing volume and the stability of the specimen quantity adhering to the probe outer walls. Microscaling of gathered sample quantities reduces the impact on pediatric or elderly patients. It also helps reduce quantities of reagents used, enabling a lower running cost and aiding future clinical tests.

(Hitachi High-Technologies Corporation)

### 4 EA1000VX X-ray Fluorescence Analyzer

An X-ray fluorescence analyzer enables non-destructive, rapid measurement of quantities of elements in solid, powder or liquid samples. Since it can be operated easily without special knowledge, it has been widely used by electronic device manufacturers and other companies around the world to screen for environmentally regulated substances since the 2003, announcement of European

regulations on hazardous substances [the Waste Electrical and Electronic Equipment (WEEE) directive and Restriction of the Use of Certain Hazardous Substances (RoHS) directive].

EA1000VX is an X-ray fluorescence analyzer dedicated to measure environmentally regulated substance in samples. It is developed to reduce cost of test for a sample by shortening total measurement time and by improved operation.

Its main features are as follows.

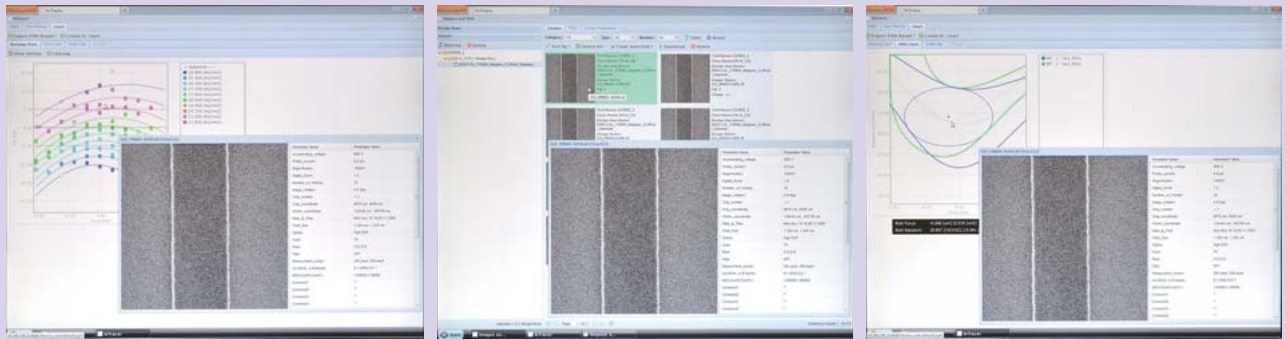
- (1) The use of the high-count-rate silicon drift detector combined with reduced overhead time by simultaneous setup of electrical and mechanical conditions greatly reduced total measurement time to about one-tenth compared to previous Hitachi model.
- (2) A function that automatically identifies measurement sample materials and an easy door operation mechanism reduce the operator's workload.
- (3) Improved analysis/management software facilitates multiple-equipment data base management, trend management, and result list output.

(Hitachi High-Tech Science Corporation)



4 EA1000VX X-ray fluorescence analyzer

# Semiconductor Manufacturing and Inspection Equipment



1 HI5000 metrology and analysis smart solution system

## 1 HI5000 Metrology and Analysis Smart Solution System

The increasing miniaturization of the semiconductor devices that support the global growth of smartphones and tablets has been achieved by continuing progress in device and process technologies, such as advanced lithography technology and topographic device structures. Hitachi has been developing various innovative solutions for fulfilling these demands.

Advances in lithography (technology for patterning extremely fine structure as narrow as 10-20 nm) requires more highly sensitive measurement/monitoring technology that not only manages dimensions but also detects two dimensional (2D) shape changes.

The HI5000 metrology and analysis smart solution system for advanced semiconductors is an application server-type system created from a platform consisting of a critical dimension (CD) measurement algorithm for a Hitachi critical dimension scanning electron microscope (CD-SEM), and a high-precision contour extraction technology that uses this algorithm. Using measurement results automatically acquired from the CD-SEM and using SEM image data, a re-measuring function, process window analysis function and 2D shape comparison function provide yield-improving solutions such as optical proximity correction (OPC), process condition setting, and process variation monitoring.

This system is promising for use as a solution platform that helps improve yields in more miniaturized and complex device generations with a minimum processing dimension of 20 nm

or less.

(Hitachi High-Technologies Corporation)

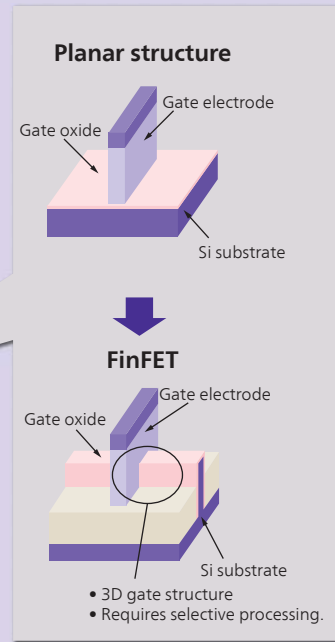
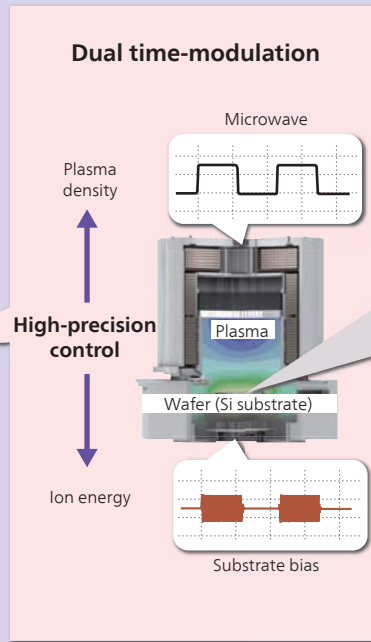
## 2 Dual Time-modulation High-precision Plasma Etching Control Technology

Transistor architectures have characteristically adopted a planar structure. While the conventional planar structure runs up against device scaling limits in 22-nm node devices, new 3D transistor architectures, such as fin-shaped transistors (FinFETs), offer ways of overcoming this scaling limitation. Hitachi has led the industry in the use of microwave electron cyclotron resonance (ECR) plasma etchers enabling miniaturized processing for semiconductor manufacturing. But processing for the new 3D structures requires profile control that can handle large steps (high aspects) and complex film structures, and selectivity that enables selective etching of only the film to be processed.

Dual time-modulation is a high-precision plasma etching control technology that can meet these needs. This technology creates wafer bias pulses for precise control of the conventional ion energy [wide range time-modulation (WR-TM)], creates pulses in the microwaves that generate the plasma, and can precisely control the plasma density. By optimizing each of these features, the technology enables high-precision processing adapted to 3D structures.

This technology is used in Hitachi's mainstay M-8000 series and M-9000 series, and can be retrofitted in equipment already delivered, enabling support for user needs.

(Hitachi High-Technologies Corporation)



2 Dual time-modulation system

### 3 RQ9000 Optical Media Tester

Used for final inspection in media manufacturing processes, this optical media tester tests for minute defects on media surfaces using optical technology. The continual increase of hard disk capacity and recording density is creating a need for faster, more precise media inspection processes.

RQ9000 contains two optical test units (for upper and lower media surfaces) mounted in a compact unit, and uses a laser beam to simultaneously scan the media top and bottom surfaces to detect defects. It enables a better media-surface inspection area

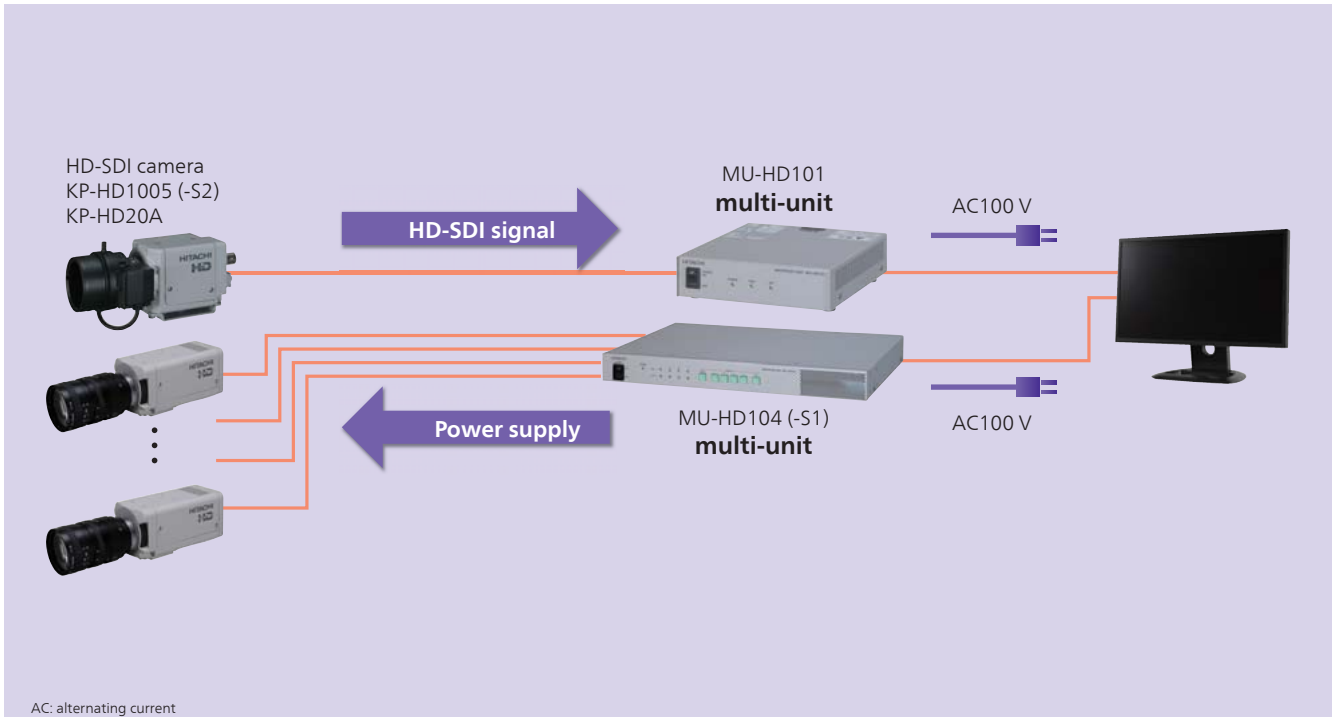
coverage rate than test devices with conventional magnetic heads, and shorter test times. Since the tester does not use a magnetic test head, it supports the thermally assisted recording method, a next-generation technology designed for greater recording density. The system has about the same dimensions as conventional devices, so can be used with handling equipment (used to supply and discharge media completely automatically) and glide test equipment (guaranteeing head floating) to construct the same types of test cells used by conventional equipment. RQ9000 is a media tester that supports media including next-generation thermally assisted recording media.

(Hitachi High-Tech Fine Systems Corporation)



3 RQ9000 optical media tester

# Electronic Equipment and Power Tools



1 Power superimposition function mounted in the multi-unit

## 1 Surveillance Camera System Supporting HD-SDI Broadcast Standard

Hitachi's new-interface surveillance camera system is supporting the high-definition serial digital interface (HD-SDI) broadcast standard. This system supports two camera outputs: a standard-type HD-SDI output, and a High-Definition Visually Lossless CODEC (HD-VLC)\*, which is a compressed output mode for long-distance transmission. HD-VLC uses a line-memory compression process to compress a 1.5-Gbit/s full HD signal to 270 Mbit/s, and achieves 300-m long-distance transmission (100 m for HD-SDI) on coaxial cable (5C-2V) with a delay of 16 ms or less. Integrated with the full HD video signal processing circuit on a single chip, the HD-VLC compression processing circuit is designed to reduce power consumption.

HD-VLC compression output mode is implemented in combination with an HD-SDI multi-unit (peripheral device). A power superimposition function mounted in the multi-unit supplies power by superimposing it on the coaxial cable transmitting the camera image.

Terrestrial digital broadcasting is rapidly switching to Hi-Vision\*. The HD-SDI surveillance camera system will facilitate the easy switch to Hi-Vision for analog cameras currently running in various environments.  
(Hitachi Kokusai Electric Inc.)

\* See "Trademarks" on page 142.

## 2 DH28PCY/DH28PBY Rotary Hammer Drills

Rotary hammer drills are generally used around the world for concrete drilling and light chipping work. The performance and functionality of rotary hammer drills have improved significantly in recent years, as drilling speeds have increased and low-vibration mechanisms have been added.

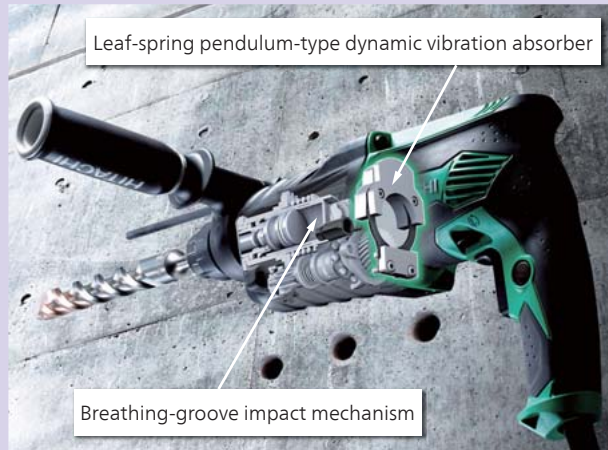
A change in the structure of the impact mechanism has given these models the fastest drilling speed in their class\*<sup>1</sup> and improved durability. The use of an original Hitachi leaf-spring pendulum-type dynamic vibration absorber enables a major reduction in vibrations. The main features are as follows.

- (1) Optimizing the breathing-groove impact mechanism and impact specifications enables the fastest drilling speed in this class (30% faster than previous models).
- (2) Improving the air cushioning effect greatly improves durability (twice as durable as previous models).
- (3) An original Hitachi leaf-spring pendulum-type dynamic vibration absorber (world-first\*<sup>2</sup>) enables the lowest level of vibrations in this class\*<sup>1</sup> (33% lower than previous models).  
(Hitachi Koki Co., Ltd.)

\*<sup>1</sup> As of June 2013, for 2-kg-class rotary hammer drills made by domestic Japanese power tool manufacturers (researched by Hitachi Koki Co., Ltd.).

\*<sup>2</sup> As determined by Hitachi Koki Co., Ltd.

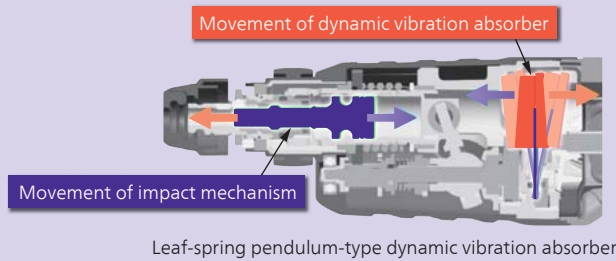




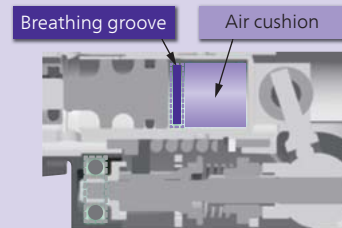
Drilling work



Chipping work



Leaf-spring pendulum-type dynamic vibration absorber



Breathing-groove impact mechanism

## 2 DH28PCY/DH28PBY rotary hammer drills

## 3 WH14DDL/WH18DDL Cordless Impact Drivers

Users demand cordless impact drivers that provide better work efficiency through higher performance, such as faster screw fastening speed, higher work volume on a single charge, and a more compact/lightweight design.

These cordless impact drivers are compact/lightweight models that dramatically improve fastening speed by means of an original high-efficiency Hitachi brushless motor and a feature called an active control system (ACS) that automatically controls the rotation speed and impact timing according to the work load. They can be run on high-capacity 4.0/5.0-Ah lithium ion batteries (developed to be the same size and mass as conventional 3.0-Ah batteries), providing much higher work volume on a single charge. The batteries feature an original multiple protection system developed by Hitachi (protecting against overloading,

over-discharging, and over-charging), giving them long life and compatibility with other tools. The main features are as follows.

(1) Hitachi's original brushless motor and ACS feature result in the fastest screw-fastening speed in the class\* (25% faster than conventional models).

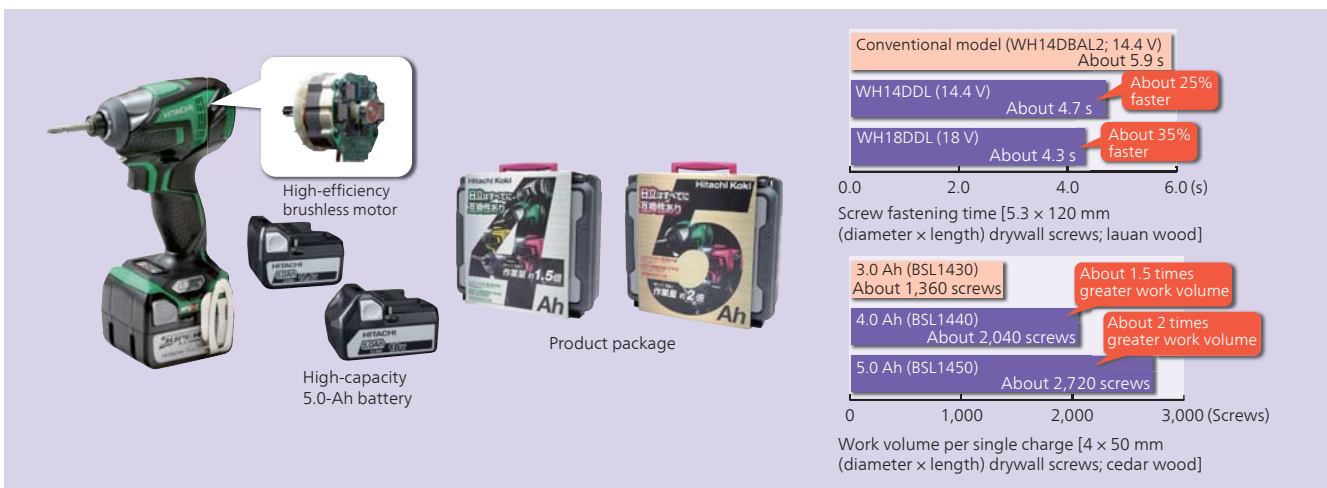
(2) Higher work volume on a single charge when run on a high-capacity lithium ion battery (about 1.5 times longer with 4.0-Ah battery; about twice as long with 5.0-Ah battery).

(3) Compact (128-mm overall length) and lightweight (1.3 kg) design, for excellent adaptability.

(4) Batteries feature an original multiple protection system developed by Hitachi, giving them long life and compatibility with other tools.

(Hitachi Koki Co., Ltd.)

\* As of August 2013, for 14.4-V/18-V cordless impact drivers made by domestic Japanese power tool manufacturers (researched by Hitachi Koki Co., Ltd.).



3 WH14DDL cordless impact driver (left) and comparison of screw fastening speed and work volume (right)