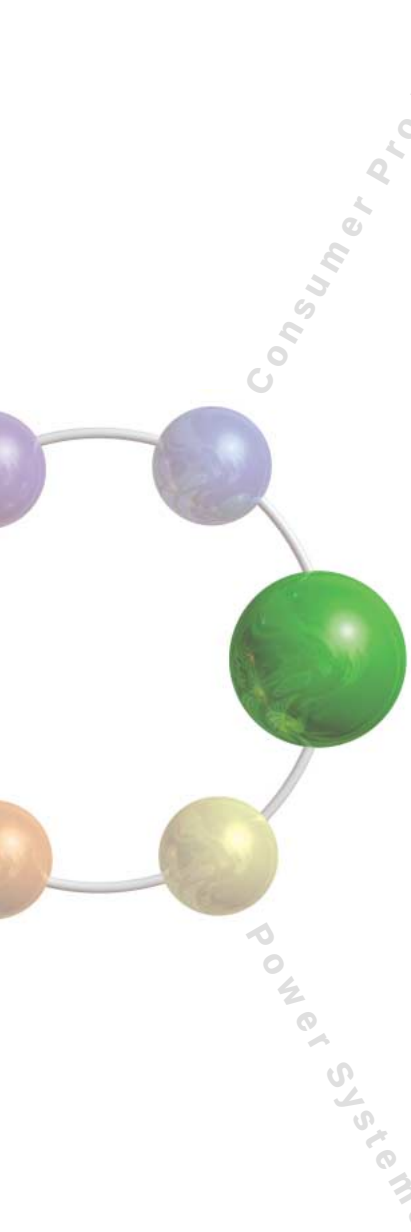


Industrial Systems

Environment
Public Facilities
Transportation
Building Systems
Science and Biotechnology
Health Care
Welfare
Industry
Steel and Chemical Plants
Semiconductor Manufacturing
and Inspection Equipment
Automobiles

Variable-speed Drive Screw Compressor HISCREW Vplus

The variable-speed drive screw compressor, the HISCREW Vplus of the Hitachi HISCREW 2000 series, with a newly designed air end, has had its air capacity expanded by 3% compared to the conventional type at the same power consumption. The HISCREW 2000 series can be divided into two groups, the constant speed drive M/S-type and the variable speed drive V-type with a highly efficient energy-saving inverter. The combination of innovative power saving and the PQ wide mode, which optimally controls discharged air capacity "Q" through variable operating pressure "P" over a wide range, has expanded the operating range of the compressor. This V-type of HISCREW 2000 series has had new function added, the PQ wide mode, and has been developed into the HISCREW Vplus. The Vplus offers the following three features:

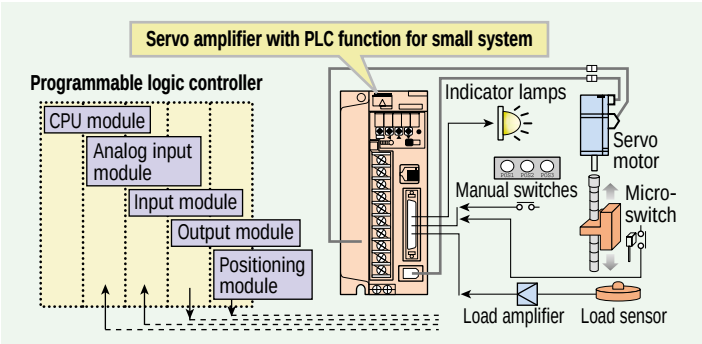
(1) The PQ wide mode can increase the capacity of discharged air by 6 to 14% more than the rated pressure, by utilizing the surplus energy created by lowering the operating pressure and driving inverter to automatically control the maximum rotating speed of the compressor.

(2) Although conventional compressors require mechanical modifications to make the operating pressure higher than the rated pressure, the operating pressure of the Vplus can be increased above the rated pressure through a few keystrokes on the instrument panel.

(3) The operating range has been lowered so that it is 0.05 MPa lower than conventional models, contributing to significant energy savings.

HISCREW Vplus screw compressors

Servo Amplifier with PLC Function



Servo amplifier with PLC function

Servo motor

Control system without PLC: Positioning with tactile force sensing

Servo drive with I/O control function can be performed by servo amplifier.
such as
- speed change through microswitch signal
- hold position through actual load sensor signal level (tactile force sensing)
- on-line modification of programmed operations via manual switches

Hitachi has developed a servo amplifier with programmable logic control through which the user can build up a control system for one axis movement and peripheral I/O control without the need for an additional controller. It is extremely efficient as the controller for small-scale integrated automatic devices, such as those in flexible gauges for cutters, in simple indexing tables, and it can even be used for positioning with tactile load force control.

This amplifier can handle 12 digital inputs, 8 digital outputs, 2 analog signal inputs, 1 serial port, and it can control a servo motor. A user registered program of up to 512 steps is available, with various sequential-control and motion-control commands. Programming language similar to Visual Basic* and a debugging tool incorporated with a servo analyzer function helps users to program their own applications quickly.

By optimizing the architecture, the user program is executed with a built-in interpreter (execution cycle is about 1 ms) without affecting the control system of the servo drive. Moreover, this special amplifier is exactly the same size as the standard one, which realizes downsizing of the customer's controller drastically.

* See "Trademarks" on page 87.

High Sensitive GPS: HGU7000-HD

Hitachi has provided a new technology that enables global positioning system (GPS) portable information terminals to work independently, even in busy downtown areas, where users are often indoors or surrounded by high-rise buildings.
Location-based information is going to be an important factor in our daily lives and in the field of security. The market for wireless communication devices with GPS, such as PDAs and cell phones, is exploding especially in location-based services (LBS).
The reception of weak GPS satellite signals in busy downtown areas has been poor and this has limited GPS device solutions.
Hitachi has solved this problem with an improved GPS device, which can detect weak signals that previously could not be detected. This unique device can sense weak GPS signals in indoor environments, and it has expanded the territory for LBS applications.
(1) The new GPS technology is sensitive to over -155 dBm (the higher the negative number, the more sensitivity.)
(2) The margin for error in the new technology varies depending on the environment, but it is accurate to within 1 m to 5 m outdoors, and to within 50 m indoors.
These new GPS terminals are not restricted by the environment or location resulting in many new applications that will create excellent business opportunities and develop additional new markets.

High sensitive GPS: HGU7000-HD

Explosives Trace-detection Systems

Explosives trace-detection systems

The Hitachi DS-110 and DS-1000 are advanced explosives trace-detection systems with greater sensitivity, selectivity, faster throughput, simple operation and fewer nuisance alarms than existing systems on the market.
Hitachi has used a unique approach to these substances with new detection methods, such as atmospheric pressure chemical ionization, three-dimensional quadruple mass spectrometry, counter-flow gas introduction and tandem mass spectrometry technique rather than conventional methods such as ion mobility spectrometry or chemiluminescence detection.
Further, as the DS-110 and DS-1000 do not require any radioisotope substances there are no limitations to their use.
Main specifications:
(1) Detectable explosives: NG, DNT, TNT, PETN, RDX, HMX, $AmNO_3$
(2) Explosive sensitivity: 0.3 ng TNT (DS-1000)
(3) Throughput: no less than 180 samples

New Energy-saving, Small-footprint UPS

New highly efficient, small-footprint UPS (400 kVA)

The new UPS (uninterruptible power system) was released, which meets the customer following needs.
These are reduced UPS installation space and expanded floor area, and reduced operational costs such as electricity charges and maintenance costs.
Its main characteristics are as follows:
(1) Availability and scope : the new UPS's rated voltage is 415 V and it is available in two models — 160 kVA and 400 kVA. It can also be expanded to 2,000 kVA (N+1 redundant system).
(2) Highly efficient and small footprint : the new UPS achieves a high-efficiency of 95% through transformer-less technology resulting in reduced electricity expenses including those for air-conditioning. The main body dimensions and weight have been reduced to about 50%.
(3) High expandability : the new UPS makes it easy to expand system capacity if necessary — just connect the UPS units in parallel. This is extremely reliable and enables expansion without power interruption to loads. Therefore, customers can reduce the initial cost.
(4) Economical maintenance : Adoption of long-life parts has reduced maintenance costs.

High-voltage Direct Drive Inverter for Rubber Mixers and Other Equipment

Rubber mixers, extruders and similar equipment generate sharp fluctuation in torque when rubber is supplied. Such equipment has traditionally used DC motors that are strong enough to handle this fluctuation, but recent calls for greater efficiency has created a need for AC motors requiring no maintenance of commutators and brushes.
In parallel with this move toward AC motors, Hitachi, Ltd. has developed a speed-sensor-less control technique for steep fluctuations in torque load not requiring speed sensors, and has applied it to "high-voltage direct drive inverter equipment" for driving high-voltage, large-capacity AC motors without the use of booster transformers. This inverter equipment for high-torque applications is now in use at many tire and rubber-product manufacturers.

External views of 2,000-kVA high-voltage direct drive inverter equipment (top) and cell inverter (bottom)

New Model of Personal Computers for Industrial Use

Hitachi has released a new model of personal computers for industrial use. It meets the need for long-term, stable operation in many fields such as factory automation, traffic control, and telecommunications through high-reliability, high-performance, and high cost-performance features.

Main features:

(1) High-reliability design: 24-hour continuous operation, 10-year usage period

(2) 3-year long-term stable supply after launch

(3) Pentium*4 processor (2.0 GHz), maximum 2G bytes of main memory, onboard LAN, hot-swap disk (RAID 1)

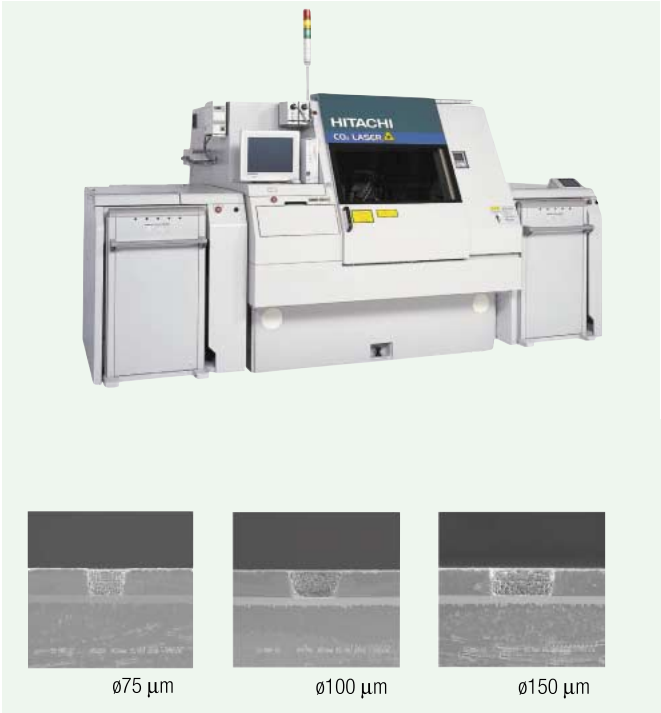
(4) Windows 2000*/Windows XP* preinstalled

(5) Conforms to UL, CSA, CE, and FCC overseas standards

*See "Trademarks" on page 87.

Personal computer for industrial use

Multi-beam CO_2 Laser-drilling Machine for Printed Wiring Boards



Multi-beam CO_2 laser drilling machine (LC-F series) (top) and cross sections of drilled via-holes (bottom)

Printed wiring boards with high-density interconnections and LSI substrates are manufactured with a build-up process, where a laser-drilling machine is used to drill connection via-holes between the conductor layers. To meet the demands for increased productivity and interconnection density, Hitachi has developed a new multi-beam CO_2 laser-drilling machine that has the following features.

(1) Original multi-beam system and enhanced routing-optimization program enabling parallel drilling with 1.5-1.9 times more productivity (i.e. holes per second) than a conventional single-beam laser drilling machine (LC-1F21).

(2) New digital servo-scanning system and fully digital, servo-controlled positioning table mechanism enable 1,000 points/s to 1,200 points/s (option) scanning and stable positioning with ±15-µm accuracy.

(3) Step-pulse drilling with individual laser shot energy control increases productivity, while minimizing number of shots.

(4) New CNC (computerized numerical control) system, H.MARK-30, offers users easy operation through GUI (graphical user interface) and mouse.

Printed-wiring-board Mechanical-drilling Machine with 300,000-min^{-1} Spindles

Mechanical-drilling technology is being developed that offers higher speed, higher feed-rate, and higher precision. It can achieve good via-hole quality even in high aspect-ratio drilling applications. Hitachi has introduced a new drilling machine with 300,000-min^{-1} spindles, the ND-Q Series, which is suitable for drilling high-density micro via-holes. The machine has three main features.

(1) A 300,000-min^{-1} high-speed multi-spindle drilling system with 2-mm shanks that can maintain high drilling speed even when micro via-hole drilling. It produces good-quality micro via-holes with high drilling efficiency and longer drill-bit life.

(2) Newly developed direct-drive-z-axis linear motors and a fully digital servo system produce high-speed motion. Combined with the high-speed spindles, this set-up doubles the high-density micro-via drilling productivity of the previous model (Hitachi-specific comparison).

(3) Each drilling station has a quick insert changer, a drill-bit-breakage detector, and a tool height detector. The automatic drill changer can also handle a capacity of 1,050 tools for 250 varieties of tools. Options include a drill-diameter checker, a dust-collection shutter, and a bushing-tip wear detector.

ND-Q series drilling machine with 300,000-min^{-1} spindles (top), 50-µm via-hole section view (bottom left) and direct-drive z-axis (bottom right)

Large-screen Display Communication System Delivered to Sewage Disposal Plant of the Tokyo Metropolitan Government Bureau of Sewerage

In April 2002, the sewage disposal plant of the Tokyo Metropolitan Government Bureau of Sewerage was given the important role of monitoring and controlling two pump stations in unison. At this time, to make operator monitoring and controlling operations more efficient, the plant took delivery of a large-screen display communication system from Hitachi.

Large-display communication system delivered to sewage disposal plant of the Bureau of Sewerage, Tokyo Metropolitan Government

First and foremost, this system features large graphic displays necessary for unified monitoring, and also provides simultaneous large-screen display of industrial television (ITV) images and screens on the CRT console. It incorporates a remote mouse function that enables multiple mouse cursors to be manipulated on the large-screen displays from the CRT console and interactive communication to be performed.

The large-screen display system delivered to this site performs only certain functions—it does not, for example, manipulate plant equipment at this time.

Main features:

(1) Adopts a multi-graphic board for multi-screen control enabling SXGA* (1,280 × 1,024 pixels) × 3 screens to be driven.

(2) Includes a remote-mouse exclusive control function to prevent erroneous operations.

(3) Integrates ITV camera control and video/audio input switching on the large-screen displays.

(4) Displays up to 9 windows of ITV camera images.

*See “Trademarks” on page 87.

Hitachi's Integrated Geomatics Solutions

In a ubiquitous information society, where information technologies permeate every aspect of our lives, it is essential that a wide range of geographical information, including regional, transport, and disaster prevention information, be provided in order to support more secure and more comfortable lives. Hitachi now offers geomatics solutions, which are integrated geographical information solutions that feature a four-dimensional GIS model, to support the ubiquitous information society from a variety of angles.

Main features:

(1) The employment of the four-dimensional GIS (4D-GIS) model, which incorporates the elements of height and time with conventional 2-D map technologies, thus enabling 3-D analysis as well as management of surface change histories and future plans using a map database

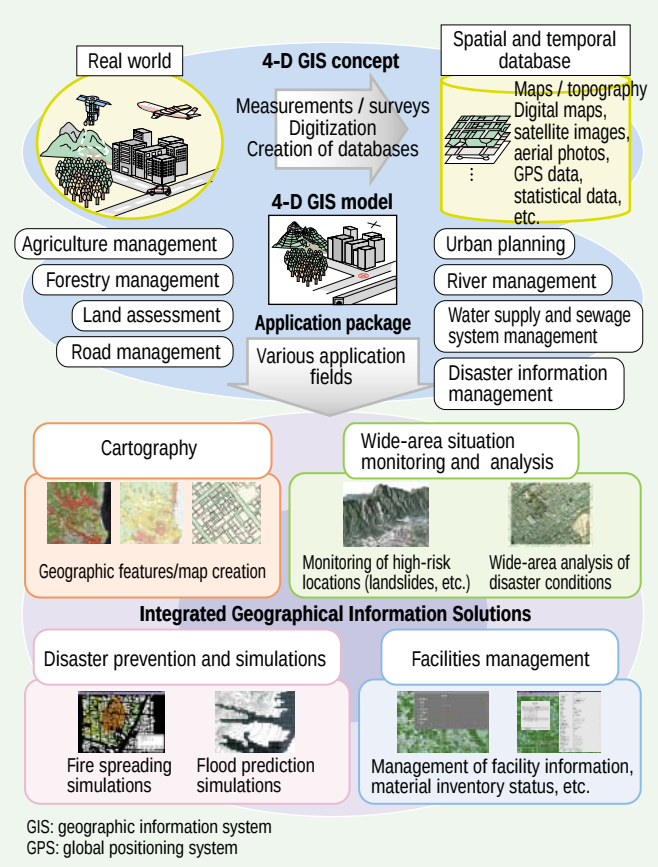
(2) The capability of seamlessly handling both maps and remote sensing imagery data, such as satellite images, which can be applied to such applications as map updates

(3) The extensibility to utilizing locational data from GPS, which enables real-time map updates and accommodates location services

(4) Adaptability to the Internet, intranets, and other Web environments

Main application fields:

Integrated GIS, land assessments, regional statistical analysis, farmland, forestry, water supply and sewage systems, disaster prevention, environment, creation of satellite image content, etc.

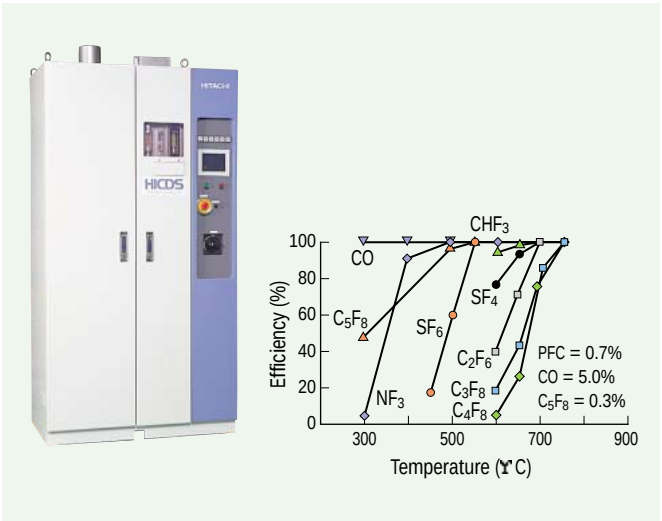


GIS: geographic information system
GPS: global positioning system

Outline of integrated geomatics solutions

PFC Catalytic Decomposition System

PFCs (perfluorocompounds) are used for many process applications throughout semiconductor and liquid crystal display (LCD) manufacturing. Since they were specified as greenhouse gases at the 3rd Conference of Parties to the United Nations Framework Convention on Climate Change (COP3, December 1997), it became vital to restrict their emissions. Since PFCs are very stable, it is very difficult to break them down before emission. Hitachi has solved this problem with a proprietary catalytic decomposition technology and PFCs can be broken down more than 99% at 750 °C with low operating and maintenance costs.



External view of PFC catalytic decomposition system and decomposition efficiency

The followings are characteristics of PFC catalytic decomposition system.

(1) More than 99% decomposition efficiency for various PFCs; CF_4, CHF_3, C_2F_6, C_3F_8, C_4F_8, C_5F_8, C_4F_6, CH_2F_2, SF_6, NF_3

(2) Low energy consumption

(3) Easy maintenance

(4) Low operating and maintenance costs

Hitachi received the 2002 Climate Protection Award made by the United States Environmental Protection Agency. Hitachi has delivered more than 140 PFC catalytic decomposition system units and is continuing to contribute to the environmental protection programs of semiconductor and LCD industries.

PBT Continuous Production Plant for Mitsubishi Chemical Corp.

Hitachi, Ltd. has completed the construction of a new continuous production plant for polybutylene terephthalate (PBT) for Mitsubishi Chemical Corporation that is located in Yokkaichi, Japan with a capacity of 60,000 tons per year. PBT is the engineering plastics widely used for electrical and electronic devices, and for automobile parts due to its superior dimensional stability, electrical insulation, chemical resistance and extended use at high temperature. The demand for PBT is increasing at 10% annually. Hitachi's technological know-how accumulated from polyethylene terephthalate (PET) plant has developed a new production process that involved the direct esterification of terephthalic acid and 1,4-butanediol. The plant houses Hitachi's unique polymerization reactors that can produce highly viscous PBT resin from 300 to 1,000 Pa·s. Mitsubishi Chemical Corp. started operating the plant in October 2002.

PBT continuous production plant for Mitsubishi Chemical Corp.

Antibody Therapeutics Manufacturing Plant for Chugai Pharmaceutical Co., Ltd.

External view of scaled-up main cell culture reactors

Hitachi, Ltd. constructed an antibody therapeutics manufacturing plant in September 2002 for Chugai Pharmaceutical Co., Ltd., a leading biotechnology company, at Utsunomiya, Japan.

This state-of-the-art fermentation and purification plant houses Japan's largest 10,000 liter mammalian cell culture reactors. Hitachi provided the engineering, procurement, construction and validation services complying with current good manufacturing practice (cGMP). Hitachi's in-depth knowledge, experience and R&D outcomes such as computerized fluid dynamics (CFD) helped to scale up the mammalian cell culture reactors successfully. Enhanced performance in processes is expected to be confirmed by Chugai and Hitachi in the near future.

DCR Steel Rolling Equipment Operating at POSCO

The DCR (double cold reduction) steel rolling equipment shipped to Pohang Iron and Steel Co., Ltd. (POSCO), in the Republic of Korea, began commercial operation in April 2002, and have been running smoothly since then.
The equipment in question, a two-stand tandem mill, achieves safe, high-quality operations through the adoption of a six-step universal crown mill and stall tension control. It is mainly used in the production of cans for food products and the tin "black plates" that are the main materials for these cans. The maximum rolling speed is 2,100 m/min. The changeover to small-diameter rolling and the introduction of high-precision plate thickness control technologies for extra-thin rolling have enabled rolling of ultra-thin materials up to 50 micrometers thick. Furthermore, servo-threading control and automation with superior coil handling enables one-man operation.

DCR steel rolling equipment at POSCO, and operating room with single operator (bottom right)

Hitachi Escalator and Moving Walk Demonstrating Outstanding Performance in China

New Guangzhou Baiyun International Airport (expected view) and 1200EX escalator

The New Guangzhou Baiyun International Airport (New Guangzhou Airport) is currently being constructed in Guangzhou, located in Guangdong Province of the People's Republic of China. The airport is scheduled to open in October 2003 as a gateway to southern China to satisfy the increasing demand for air transportation facilities caused by rapid economic growth in the district. With a total land area of 300,000 square meters and two 4,000-meter parallel runways extending from east to west, the airport will be able to cater to about 28 million passengers per year and move about 740,000 tons of cargo.
Hitachi will supply 16 escalators and 28 moving walks for the main terminal building, and 36 escalators for the concourses. The facilities are scheduled to be handed over to the airport authority after installation and final adjustment is done by Hitachi Elevator Engineering Co., (Hong Kong) Ltd., specialized in elevator-related sales and servicing.

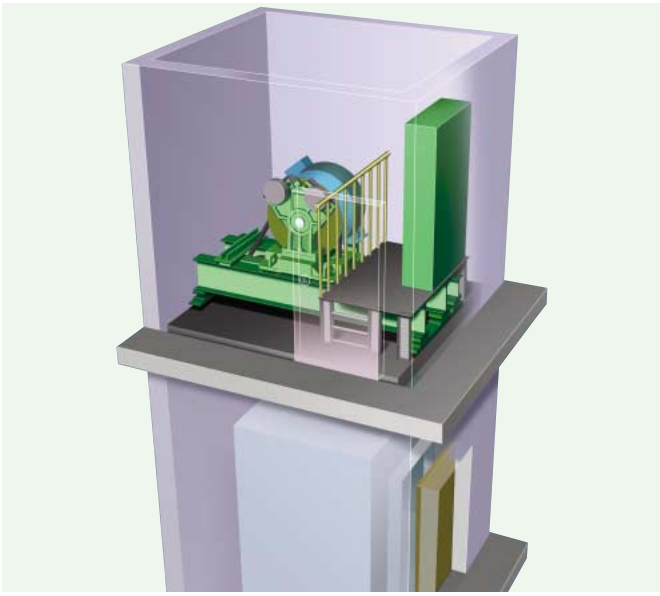
Compact Elevator with Space-saving Machine Room

It is possible to lay out elevator equipment within about half the space of a conventional machine room by using a downsized traction machine that utilizes a permanent magnet synchronous motor and a receiving control panel that has all maintainable components concentrated to one side. This increases the flexibility of floor layouts and the amount of rentable area to total floor area in high-rises with machine rooms on mid-level floors.

(1) Product characteristics
- Use of thin PM motor downsizes traction machine
- Maintenance space reduced by using thin control panel with maintainable components on one side

(2) Advantages
- This type of elevator increases the flexibility of floor layouts particularly when the machine room is installed on mid-level floors
- It increases the effective space of the building by halving the space required for the machine room

(3) Scope of application
- Load capacity: 750 - 1,600 kg
- Rated speed: 120 - 240 m/min



Structure of compact elevator

The Tohoku Shinkansen "E2-1000 Series" Train

The "E2-1000" series of cars, developed for the Tohoku Shinkansen bullet-train line extended to Hachinohe, was put into commercial operation by the East Japan Railway Company, Ltd., in December 2002.

It features the following improvements in comparison to the former "0" series. Passenger capacity has been improved by increasing the number of cars from eight to ten. In addition, external train noise has been reduced by adopting a low-noise single-arm pantograph and insulator. And significant weight saving on the car roof has resulted from the elimination of the pantograph cover.

Air-conditioning performance has been upgraded to provide improved coverage during the mid-summer months. At the same time, to ensure more even temperature distribution throughout the car interior, the shape and layout of the air-conditioner outlets have been modified.

To suppress shaking while the train is running and ensure better ride comfort, the lead and first-class cars are fitted with "full active suspension" and the other cars are fitted with "semi-active suspension." And dampers are set between the cars to curb the free movement of each car.

In regards to the car body, the use of an "aluminum double-skin" structure has lowered the interior noise. Moreover, the previous "inside plug" type sliding door on the main body has been replaced with a new sliding type, and to deal with possible audible noise coming from gap between the door and the side structure of the car body, the doorway has been redesigned.

The on-board automatic train control (ATC) equipment supports the new digital system as well as the standard analog system introduced to cover the new line between Morioka and Hachinohe; as a result, braking control is even smoother along that new stretch of line. Moreover, East JR is planning to introduce a "barrier-free" platform environment by means of audio assistance and other facilities.

The Tohoku Shinkansen "E2-1000 series" train

Digital Automatic Train Control (ATC) System for the Tohoku and Joetsu Shinkansens

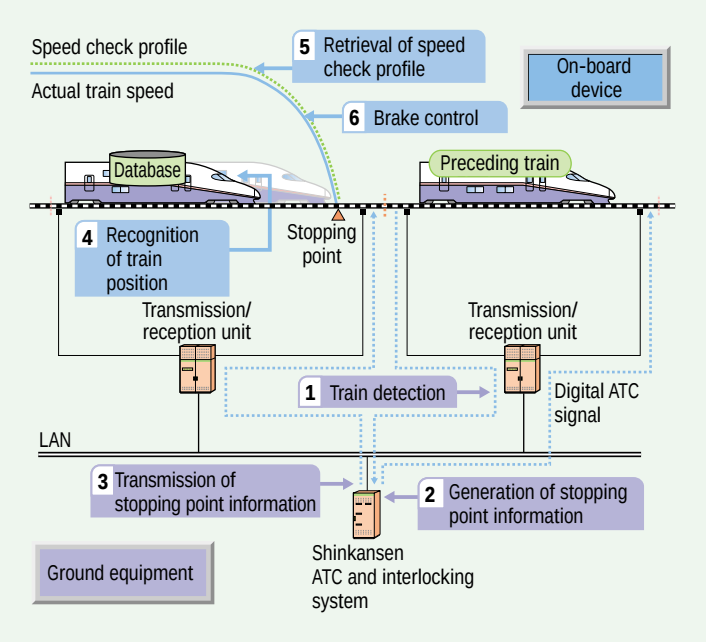
With the aims of combining high levels of safety and amenity, Hitachi, Ltd. and the East Japan Railway Company have collaboratively developed a new system — called digital Automatic Train Control (ATC) — for the next generation of ground-breaking Shinkansen trains. This system provides the flexibility to response to the even higher speeds of the future and introduces advanced technologies to satisfy the plan for improved reliability and maintainability. From now on, it is planned to put the ATC system into operation first on the Tohoku Shinkansen (between Tokyo and Morioka) line and then on the Joetsu Shinkansen line (between Tokyo and Niigata).

Main features:

(1) Reduced travel time and improved riding comfort

(2) Reduced cost by simpler ground equipment

(3) A flexible system with autonomous on-board device



Outline of the digital Automatic Train Control (ATC) system for the Tohoku and Joetsu Shinkansens

New Scanning Transmission Electron Microscope: HD-2300

HD-2300 scanning transmission electron microscope (STEM)

Hitachi developed new scanning transmission electron microscope (STEM), the HD-2300, as the successor to the HD-2000 “Ultra thin film evaluation system.” Automatic tuning functions such as focus, beam alignment, and field of view centering were developed to increase throughput for evaluation. Just like its predecessor, the HD-2300 enables to extract numerous kinds of information from the specimen. STEM images provide the internal structure, variations within substances and crystallographic information at atomic resolution. Scanning electron microscope (SEM) images reveal not only topographical views of the specimen surface, but also quasi-three dimensional structures up to about 1 μm from the surface. This characteristic allows a combined system of STEM/SEM and a focused ion beam (FIB) to be used to prepare pinpoint specimens preparation. An energy dispersive X-ray (EDX) analytical system can be mounted (option). Detector sensitivity is the highest of all commercial instruments at present. The ELV-2000 “Element view”(option) adds electron energy loss spectroscopic imaging capabilities. The ELV-2000 compatible digital camera (option) enables electron diffraction patterns to be observed. We expect the HD-2300 to be widely used in the research and development of nano and sub-nano areas.

High-resolution Variable Pressure SEM

The variable pressure SEM series that enables low vacuum observation is already being utilized by a number of customers and has earned a well observed reputation.
The S-4300SE/N is equipped with an SE (Schottky emission) electron gun and it permits observation of high-resolution images of non-evaporated specimens in the specimen chamber after it is adjusted to low vacuum conditions.
The S-4300SE/N is a high-resolution variable pressure SEM with the features described below.
(1) High-resolution image observation
The use of a high-brightness, high-stability SE electron gun provides a resolution of 1.5 nm at an accelerating voltage of 30 kV and 5 nm at an accelerating voltage of 1 kV in high vacuum mode.
The standard-equipped backscattered electron detector provides a resolution of 3.5 nm at an accelerating voltage of 30 kV in low vacuum mode (10 Pa).
Secondary electron image observation in the low vacuum mode is also available with the optional environmental secondary electron detector (ESED).
(2) Observation of non-evaporated specimens
The newly developed multiple-stage differential pumping system maintains the electron gun section at an ultrahigh vacuum (< $\times 10^{-8}$ Pa) and the specimen chamber at 10 to 1,000 Pa allowing observation of non-evaporated specimens.
(3) Highly stable electron beam
The SE electron gun can provide a highly stable electron beam making it an effective tool for analysis and observation over long periods of time.

General view of S-4300SE/N (large stage type)

SMASH and HTA Systems for “LaChrom Elite” Series HPLC

Pharmaceutical and food companies require HPLC (high performance liquid chromatography) analysis with smaller quantities of samples. In the field of quality control, faster analysis is also required to process large numbers of samples. Further, an HPLC system should conform to US FDA (Food and Drug Administration) regulations on electrical records, 21 CFR part 11.
To conform to these requirements, we developed a “LaChrom Elite” series HPLC, which was optimized for a wide range of flow rates. “LaChrom Elite” consists of a SMASH system, HTA system, and EZChrom Elite*.
SMASH is a semi-micro applicable standard HPLC system, which covers conventional LC to semi-micro LC for small quantities of samples. SMASH has good sensitivity and stability especially in the semi-micro region with a flow rate of 50 µL/min. Solvent consumption can be reduced drastically (e.g. to 5%).
HTA stands for High Throughput Analyzer and it can obtain accurate and precise results from many samples. An HTA system can employ high-response detectors with low noise and a high-capacity autosampler with large numbers of samples.
The chromatographic data station “EZChrom Elite for Hitachi” is a client/server system adapted for SMASH and HTA to centralize data and sample information. EZChrom Elite has functions to process electrical records so that pharmaceutical companies can conform with FDA regulations.

HTA system for “LaChrom Elite” series HPLC with high-response and high-throughput

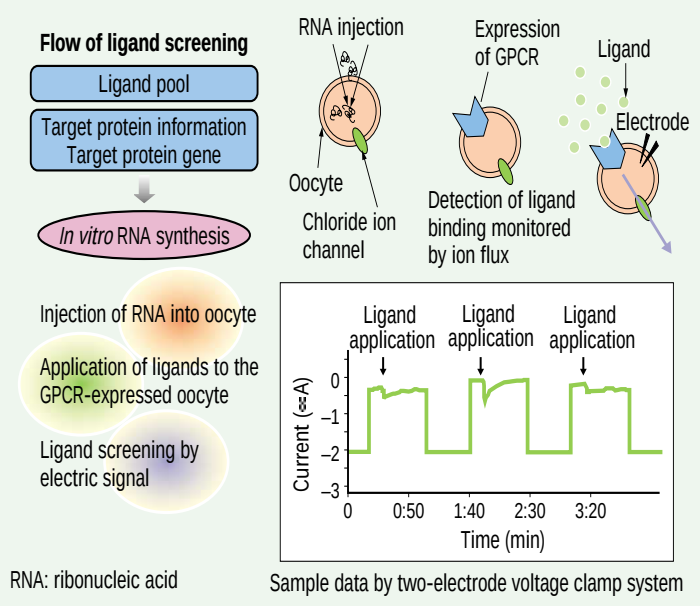
* See “Trademarks” on page 87.

"OOCYTEXPRESS Service" for Functional Analysis of Membrane Proteins Using an "Oocyte Protein Expression System"

Over half of all pharmaceutical products are in some way related to proteins that exist in cell membranes called G-Protein Coupled Receptors (GPCR). Recently, it has been said that the discovery of these protein ligands (active substances) will contribute to the development of new medicines.

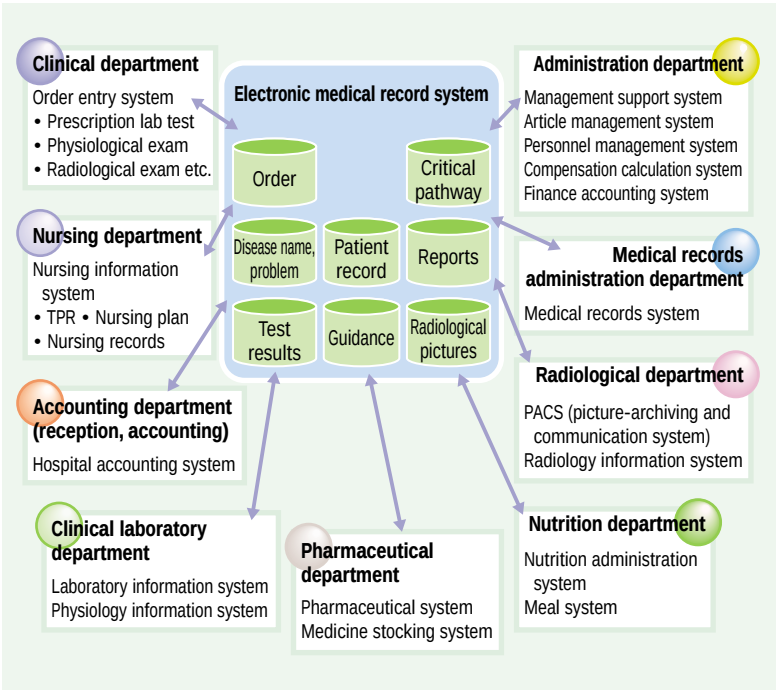
Hitachi, Ltd. has initiated a new ligand screening service, called the "OOCYTEXPRESS Service." This service, which will make use of oocytes from the Xenopus laevis (African clawed frog), combines technologies related to molecular biology and precision processing technologies accumulated at Hitachi's laboratories. The company has already begun providing this service to pharmaceutical manufacturers. Using an automated two-electrode voltage clamp system developed in-house, we have created a ligand screening service with the world's highest throughput for analysis using an oocyte protein expression system.

The unique feature of this analysis service is that it enables general technicians to conduct analysis operations that in the past could only be carried out by specially trained engineers, thus enabling contract service operations on an industrial scale. This analysis service also facilitates more efficient ligand searches.



Outline of OOCYTEXPRESS service

Electronic Medical Record System



Position of electronic medical record system

Japan's Ministry of Health, Labor, and Welfare has established the diffusion of electronic medical record systems as one target of the "Grand Design of Information Technology in the Health and Medical Fields" announced in December 2001. To contribute to this effort, Hitachi, Ltd. has developed and commercialized Hitachi's electronic medical record system having the following functions.

(1) Hyper flow sheet: Examination and treatment information such as critical pathway, TPR (temperature, pulse, respiration), test results, and prescription orders are shown on one screen. This is the most important function of an electronic medical record system enabling care plan and progress to be checked in real time, examination and treatment instructions to be issued in one place, and current status of actions to be understood. This facilitates efficient team treatment and helps to prevent errors in medical care.

(2) Patient records: Templates, schema, and other input support tools enable efficient input of medical records in POMR (problem-oriented medical record) format.

(3) Reports: Slips and forms that differ greatly from one hospital to another can be digitized according to each hospital's layout and circulation route can be specified.

Open-style High-magnetic-field Permanent Magnet Systems

Hitachi's open-type MRI system is a new-generation MRI system that has been constructed with an innovative new single pillar gantry structure and provided with the most powerful magnetic field through the use of permanent magnet technology and a very special opening (320°) that is wider than ever before. It is ranked in the highest class of Hitachi's permanent magnet MRI series featuring high quality images and superb functions. Innovative concepts are a hybrid design to integrate the highest utility of the open MRI system and excellent performance of the high magnetic field for the MRI system. Its performance transcends conventional MRI systems and will enable new markets to be exploited that are in competition with high field superconducting magnet systems.
It incorporates a rich variety of the latest advances in application software and provides the best solutions for cost-efficient operation, which is very important as we continue to contain healthcare costs. Hitachi's open-type MRI system is the very best MRI system available that is a true leader in this new imaging era.

Hitachi's open-type MRI system

Proton Beam Therapy System

PROBEAT in University of Tsukuba
Treatment started in November 2001. More than 170 patients had already been treated as of February 2003.

The Proton Beam Therapy (PBT) System is one of the most promising methods of cancer therapy. Due to the unique characteristics of the proton beam, which deposits most of its energy just before the stopping area, only the targeted lesion is heavily irradiated sparing the surrounding healthy tissues. This system provides painless treatment and therapy on an out-patient basis to ensure patients quality of life.
Hitachi has been developing commercial-use PBT systems based on the technologies of particle acceleration and related information systems. PROBEAT from the Proton Medical Research Center, Japan's University of Tsukuba is the first such achievement.
PROBEAT features are as follows:
(1) Compact synchrotron system that easily and accurately controls beam energy to provide a high-energy beam up to 250 MeV
(2) Two sets of rotating gantries and irradiation nozzles to emit precise irradiation from any angle
(3) Respiration synchronous irradiation system that minimizes unwanted radiation exposure to normal tissues
We are currently applying for Japanese governmental approval to have the Hitachi Proton Therapy System passed as a medical device.

Electron Beam Mask Writer: HL-7000M for 90-nm Node Reticle

Hitachi developed the electron beam mask writer HL-7000M for 90-nm node reticle production. New technologies, such as a novel electron beam optical column, a 1-nm address grid and improved proximity effect correction are used in the system. It has two electrostatic deflectors, a 50-kV electron gun and a maximum beam size of 2 µm × 2 µm. It can emit up to a current density of 20 A/cm^2. The writing strategy uses a variable shaped beam, vector scanning and continuous stage moving exposure. To comply with high volume data, it can accept a hierarchy data format which can effectively be compressed into a small file. The new storage area network (SAN) we adopted achieves high-speed data transfer and does not need a high-volume disc system.

General view of electron beam mask writer: HL-7000M

Dry Etching System for Non-volatile Materials

Dry etching system for mass fabrication of non-volatile materials (can be installed on 500, 600, and 700 series platforms)[Application wafer size: ϕ4" - ϕ12"]

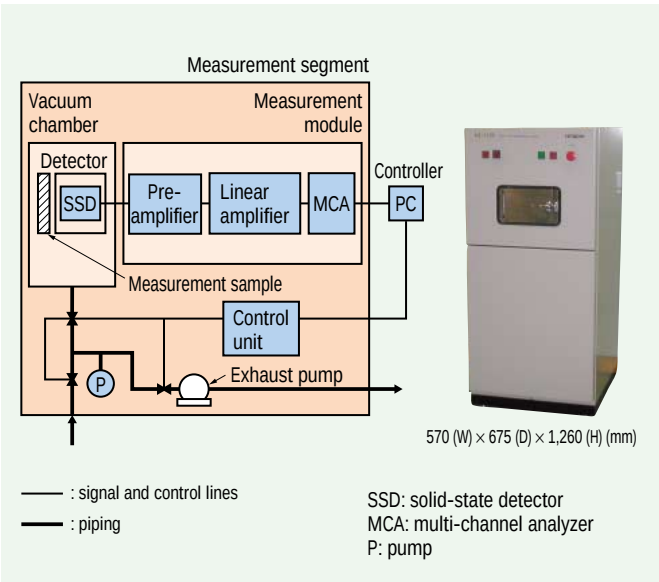
A dry etching system has been developed for high-precision processing of FeRAM, MRAM, magnetic heads, and other non-volatile materials in stable mass-production environments.
Main features:
(1) Excellent mass reproducibility with no adhesion of reaction products
Buildup and adhesion of reaction products on inner walls is prevented by using the electromagnetically coupled plasma (EMCP) method.
(2) Controllable and highly precise processing
The perfect plasma distribution tailored to each individual type of material is generated by a dual induction coil.

S-9360 CD-Measurement SEM

The Hitachi S-9360 Advanced CD-Measurement SEM has been developed for the sub-100 nm process control of semiconductor devices. It is compatible with 200- and 300-mm wafers, ArF photoresist wafers, as well as other charge sensitive wafers. It has a new automated column alignment function and a new built-in Hitachi real-time process monitor, which keeps track of process conditions at all times. These new features make the S-9360 the best available CD-SEM for a wide range of applications. The S-9360 is not only an R&D tool but also a next-generation mass production tool for the semiconductor industry.

General view of S-9360 CD-Measurement SEM

High-performance Micro α-ray Measurement System



KS-1100 micro α-ray measurement system
Configuration of measurement segment (left) and external view (right)

The KS-1100, a micro α-ray measurement system, measures micro alpha rays emitted by IC materials and other substances with high precision from among low energy ranges.
The most common method of measuring the alpha rays in a given material is to conduct an overall quantitative evaluation using a gas flow counter. Now, by increasing the surface of a solid-state detector and using direct detection within a vacuum chamber, Hitachi has made it possible to analyze even micro levels of alpha rays.
By analyzing the alpha rays emitted from these materials according to each level of energy, it is possible to significantly reduce the number of locations in which high-cost, low alpha-ray materials are required, and to accurately evaluate materials on production lines. In this way, users can look forward to increased quality and greater efficiency in product manufacturing processes.

Motorized 4-wheel Drive System

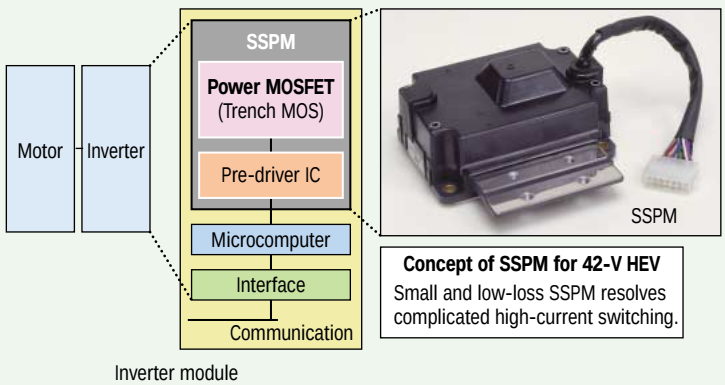
Hitachi developed a motorized 4-wheel drive system that assists the rear wheels through a DC electric motor powered by electricity generated by the water-cooled alternator. It requires no energy storage device such as a battery, and energy is only transmitted when it is needed.

The weight of a conventional mechanical 4WD can be cut 30%. The benefits of this system are not only the attainment of a flat floor but also better fuel economy. This is because no friction is generated when the clutch is off during 2WD. In winter tests, motorized 4WD has been highly evaluated for safer starting and cornering at low μ road than with viscous coupling, which transfers torque to the rear wheel after wheel racing has occurred.

This technology was introduced onto the market in September 2002.

Water-cooled alternator (left at top), DC motor (right at top), and control unit (bottom)

Small Low-loss Power Module for 42-V HEV Systems



MOSFET: metal-oxide-semiconductor field effect transistor

Schematic structure and photograph of SSPM

A 42-V hybrid electric vehicle (HEV) system is one solution to improving fuel efficiency in vehicles. The key issue in materializing the 42-V HEV system was how to switch the motor current of several hundreds ampere at high frequency (10 kHz), which was a huge technological challenge. We invented a small and low-loss sub-system power module (SSPM) that was able to switch high current smoothly.

The main technologies we developed are in innovative lower-inductance 6 in 1 module structure, fast and soft switching technology, and a 100-V class full custom predriver IC with many kinds of protection functions. This SSPM can also be used to control battery-operated forklift trucks.

We started sample shipment in August 2002.

High-pressure Fuel Injector for Direct Injection

Direct gasoline injection is one of the most effective methods of reducing automotive CO_2 emission, and it is expected to become widely used around the world. Hitachi has developed a fuel injector for direct gasoline injection. This injector has the following features.

(1) Compact design

Compact design, especially a small diameter, gives customers a large degree of freedom to mount it on engines.

(2) Wide dynamic range

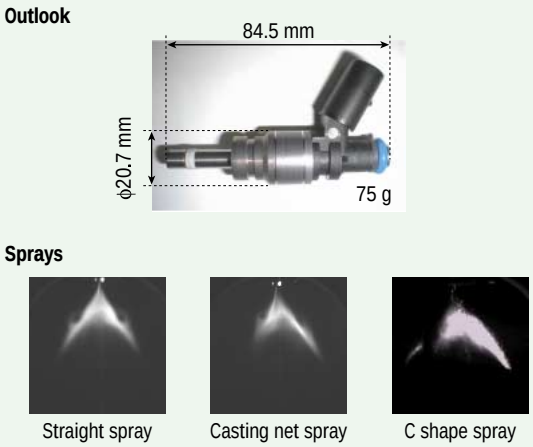
Optimized design using simulation technology has achieved high valve response and a wide dynamic range to control fuel flow rate.

(3) Best fuel sprays

Spray characteristics are greatly related to performance such as emissions, torque and fuel consumption, and the best spray for each engine is a key technology in direct gasoline injection. Hitachi developed the unique sprays that follow to supply the best to each customer's engine.

- Straight hollow cone spray
- Casting net spray
- C shape spray

In addition, Hitachi can select or design the very best spray for each customer's engine and combustion concept using our in-house code for combustion simulation.



Outlook (top) and sprays

Slotted Drop-in Mass Airflow Sensor

Cover

Sensor module without cover

Slotted drop-in mass air flow sensor

The mass airflow sensor is a sensor that measures the intake air mass that is drawn into an internal combustion engine. This sensor plays a key role in protecting the environment through controlling vehicle emissions. The slotted drop-in mass airflow sensor was developed to achieve higher performance and reliability. It is suited to modularization since the circuitry for the electronics is in-line with a sensing bypass passage so that the electronics can be located in the air passage. This gives auto-makers more freedom and/or flexibility in designing engine space.

We also developed our bypass technology further to minimize pulsation/back flow effects and temperature error as well as to protect sensor elements.

The followings are the main improvements over the conventional model.

(1) 35% weight reduction

(2) 20% reduction in cost

(3) 50% decrease in the pulsation/back flow effects

(4) Differential temperature characteristics error is less than 2% (80°C/20°C)

(5) Voltage and frequency output type are available.