We provide a total solution for customers with
the versatile software package and hardware system

REALGAIN

Find your Limits & Go beyond

REALGAIN

Contents

리얼게인

신뢰의 10년 100년 기업으로 거듭 나겠습니다.

REALGAIN began by localizing Science & Engineering software at Seoul National University research center of control measurement in the 1990s. in 1999, the company was established as a corporate body. Since then, we have strived to localize systems and equipment in the area of measurement, control, and communication in the power plant using IT-based and control measurement technology.

REALGAIN was certified for its technical skills by Westinghouse Electric Company(WEC) of the US, which provided most of the I&C systems in the power plant. Currently, we have signed an MOU with WEC and are supplying localized products.

Even now REALGAIN is continuously contributing to the development of the eco-energy industry of Korea with research and development, and through various solution development, we are doing our best to be a company that thinks of best value and environment.

General History

Laboratory composition

- Software, Hardware, Science and Engineering Professionals
- Masters and Doctorate holders in various fields
- In addition, we have established a co-research relationship with various universities

Research area

- System analysis of the rod control system
- System analysis of nuclear reactor protection system
- System analysis of ex-core nuclear instrumentation system
- Research related to the diagnosis of various valves such as AOV,MOV,SOV
- Localization of present nuclear power measurement and control equipment
- Development of system simulator
- Research related to diagnostic systems

1990 - 2007

1990-1999
- Developed the first domestic, wide use package, CEMTool(developed by Seoul National University ERC)

1999
- Founded REALGAIN (Dongjak-Gu, Seoul)

2000
- Founded R&D Division
- Appointed R&D Division as a military service exemption laboratory

2001
- Developed a high speed design system for controller and signal conditioner (domestically developed Korea's first and the world's 3rd)
- InnoBiz Certification

2002
- Developed lighting remote control system and installed in Jeonlla province

2004
- Qualified supplier for control rod control system equipment repair company
- Approved safety impact rating(T)

2005
- Developed coil current monitoring sensor
- Agreed separation filter panel localization development

2006
- Developed products for KHNP, released CEMTool 6.0 International edition
- Signed MOU with WEC
- Agreed to localize Korean standard type light isolation card
- Developed air-operated valve (AOV) integrity diagnostic equipment

2007
- Localized power plants Opto-Isolator Card and Filter Panel
- Approved control rod control facility maintenance service T grade

2008 - 2013

2008
- Recognized as an excellent cooperating company by KHNP
- Performed maintenance service of control rod systems in all Korean standard type nuclear power plants
- ISO 9001 Certification
- Exported ACTM sensor to WEC
- Appointed separation filter panel and Opto-Isolator card as development

2009
- Certified by KHNP to provide SOV diagnostic equipment
- Maintained WEC type control rod position indication system
- Order for digital control rod position indication system development
- Upgraded quality grade as maintenance service and equipment repair company

2010
- Selected to research the development of iron ball gun equipment by KHNP
- Certified by KHNP as a P.CB slot diagnostic equipment development company

2011
- Certified as a Local developer of in-core neutron detector for heavy water reactors
- Selected as a provider of electronic card slot measuring equipment by KHNP
- Developed WEC type Rod Control Monitoring System
- Developed Trouble Shooting diagnostic equipment for CEDMCS

2012
- Performed maintenance service of the rod control system in Shinkori 1 and Shinwolsong 1 power plant
- Developed diagnostic equipment for NPP safety system
- Developed DRPI(Digital Rod Position Indication) System
- Moved headquarter to Gangnam-Gu, Seoul

2013
- Opened a branch in Gijang-Gun, Busan
- Performed maintenance service of the rod control system, plant control system
- Develop, manufacture and deliver various facilities and equipment

2014 - 2018

2014
- Registered as a qualified maintenance company for 5 thermal power plants
  - DCS(Digital Control System) cards
  - Switchboard, automatic control supervisory panel and electrical control panel
- Developed an in-core neutron amplifier module
- Localized digital control rod position indication (DRPI) system

2015
- Supplied RCS Driving Coil Diagnostic equipment and 5 other items(Shinkori and UAE)
- Moved headquarter to Seongdong-Gu, Seoul

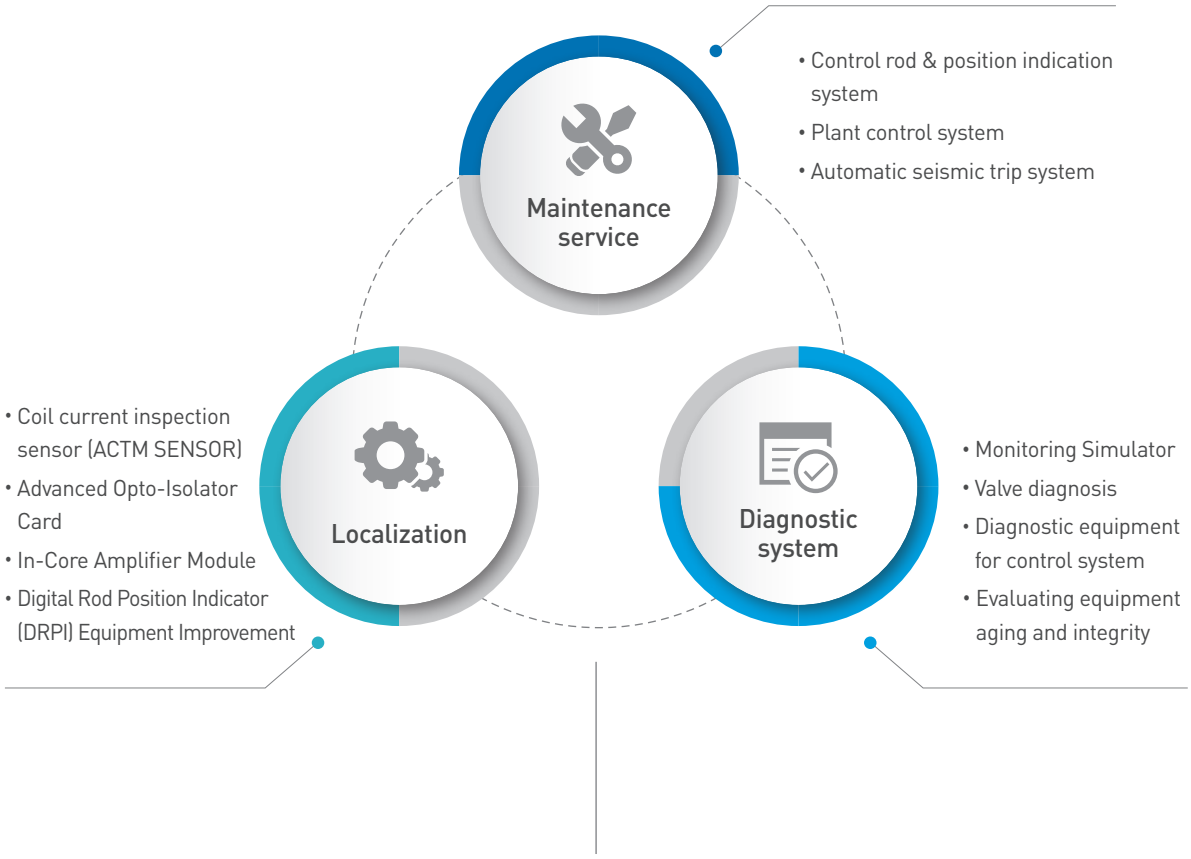
2016
- Supplied DPPS response time measurement equipment and 1 other item(UAE)
- Developed Sampler Electronics Ass'y for boric acid concentration meter

2017
- Supplied DRPI System(HANBIT) and customized PINPOINT Hardware & Software
- Performed maintenance service(rod control system, PCS, computer station for shutting down the reactor)
- Performed development task of SOV real-time monitoring system
- Performed development task of Integrated Diagnosis System for Power Plant Rotating Device Monitoring Sensor
- Maintained service of computer station for stopping reactor

2018
- Performed localization of ARP1400 electronic module CIM
- Developed and maintained an improved verification algorithm for the power plant control system of Hanbit unit 5,6 system
- Performed localization of the local control panel alarm system for the emergency diesel generator
- Performed localization of earthquake instrument calibration management system

Business Scope

Development of facilities and equipment in the measurement, control and communication fields of power plants using I&C and IT-based technologies



Research area

Analysis / Building

- Analysis of the rod control system
- Analysis of the nuclear reactor protection system
- Analysis of in-core and ex-core nuclear instrumentation
- Diagnostic system for valves such as AOV, SOV, MOV
- Localization of nuclear power measurement and instrumentation
- Design and manufacture of system simulators
- Other to diagnostic systems

+

Development / Improvement

- Localization of an advanced opto-isolator card for Korea standard nuclear power plant
- Development of a Sub-group Separation Filter Panel for the control rod system
- Development of Solenoid valve(SOV) fault prediction diagnostic equipment
- Improvement of opto-isolator card of safety stop system (CANDU nuclear plant)
- Development of P.C.B slot contact failure prediction diagnostic equipment
- Localization of an In-Core Amplifier Module

Vision

A company that evolves based on new challenges
and technologies for the present and for the better future

01 Strength

- **Technology** _ Localize control system equipment based on control measurement and IT technology
- **Customer trust** _ Supply multiple high-quality products to KHNP facilities
- **Customized Consulting** _ Obtain customer trust through customized solutions

02 Management Policy

- Cultivate talent to create future value
- Discover Blue Ocean through R&D investment
- Develop technology in collaboration with external institutions and industry

03 Talent

- **Change & Creativity** _ Creative thinking that can lead the rapidly changing future business
- **Owner spirit** _ Create new value through constant self-development

04 Future value

- **Localize equipment** _ Establishing and commercializing its own technology through continuous research and various application technologies
- **Customer diversification** _ Diversification of domestic customers and attracting foreign customers
- **Business diversification** _ Expansion of our maintenance business beyond diagnostic systems through technology/ product research. Development of products outside the power plant such as living convenience products.
- **Win-Win** _ Win-win management through customer value realization

Products

Diagnostic Equipment

PSA Diagnostic System

Performance Analyzer for Ex-Core Neutron Flux Monitoring System

Early Diagnostic Equipment for Poor Slot Contact of Electronic Cards

Diagnostic Equipment for the Control Rod Drive Coil

DPPS Digital Response Time Equipment

ACTM Sensor Diagnostic System

RCP Speed Measurement System Diagnostic Equipment

Valve Diagnostic Equipment

Site Air-Pressure Measuring Instrument Diagnostic Equipment

Solenoid Valve(SOV) diagnostic equipment

AOV Intelligent Diagnostic System

Monitoring Simulator

4-Axis Load Simulator

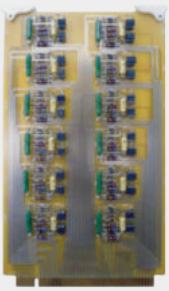
CEDM Coil Current Constant Monitoring System

RCMS

Real time Surveillance System for SOV

Localized Equipment

DRPI Equipment Improvement



Advanced Opto-Isolator Card

In-Core Amplifier Module

Coil Current Inspection Sensor(ACTM SENSOR)

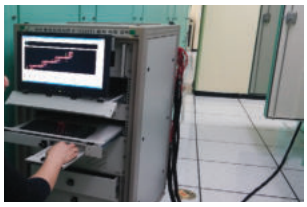
Sub-group Separation Filter Panel

Maintenance Service of Control Rod and Position Indication System


Power cabinet diagnosis and analysis


Control rod simulation drive test and analysis


Precise inspection of electronic card


RSPT operation waveform analysis

REALGAIN signed an MOU with WEC (Westinghouse Electric Company), to be a supplier of nuclear power plant control rods. REALGAIN has developed a diagnostic device for the inspection and maintenance of control rod control system through technological exchange and a localization of equipment. The data obtained from our accumulated experience in the field of maintenance service for the past 10 years has contributed to the safe operation of the plant. We have performed an optimized check of control rod control system, greatly improving the reliability of equipment.

REALGAIN based on its experience and technology has been making every effort to research more advanced diagnostic equipment for various control rod control systems(DRCS, CRCS, CEDMCS), and to localize equipment for them. Our aim is the professional and systematic inspection and maintenance of these systems.
We have continued to study high quality maintenance methods to achieve 1-cycle zero-defect goal.

Maintenancce Scope

Item	Content
Diagnosis of control rod driving coil and evaluation of its integrity	- Measurement of AC/DC resistance and inductance - Calculation of Q-Factor
Diagnosis of control rod position indicator(RSPT)	- Conducting dynamic function test and obtaining the data, analysis
Inspection of Sub-Group Logic Housing	- Inspection of connector, slot - Inspection of filter panel condenser - Inspection of the line between the filter panels
Inspection of power supply	- Inspection of ripple voltage - Inspection of internal elements(condenser, fuse) - Fluctuation test of line / load
Diagnosis of power cabinet(PSA, PCM)	- Inspection of setting value of power cabinet breaker trip - Inspection of internal main elements (SCR, diode, etc)
Precise inspection and correction of ACTM Sensor	- Output value measurement and calibration, precise visual inspection
Maintenance and inspection of PLC	- Inspection of the integrity of module
Precise inspection of electronic card	- Testing of individual function of electronic card (Check the integrity of individual elements and circuits) - Precise visual inspection
Function test of individual control rod	- Drawing out/Insertion driving test of control rod
Auxiliary equipment check	- Inspection and calibration of temperature setting value - Inspection of low voltage hold bus relay - Test contact point of input/output - Inspection of air blower, fuse and cable connection

Self-developed diagnostic equipment

- 4 axis load simulator (Control rod simulation drive)
- RSPT signal analysis
- Opto-isolator card
- Relay
- Control rod coil
- ACTM sensor
- Power cabinet(PSA, PCM)
- Power supply
- CEDMCS electronic card

General purpose electronic card diagnostics in operation

- Pinpoint II R
- Polar

Features

- Registered as a qualified supplier (Q grade) in control rod control system maintenance and service
- Secured expert maintenance know-how and technical expertise with unparalleled maintenance service experience for all domestic power plants
- Acquisition of data by sector and main facility aging trend management by data analysis based on the O/H experience of all the power plants

The power plants being maintained

HANBIT Power Plant
Unit 1·2·3·4·5·6

HANUL Power Plant
Unit 1·2·3·4·5·6

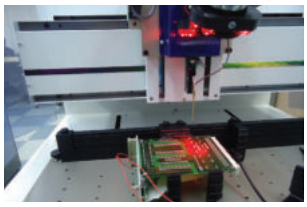
KORI Power Plant
SHIN KORI Unit 1·2 / KORI Unit 1·2·3·4

WOLSONG Power Plant
SHIN WOLSONG Unit 1· 2

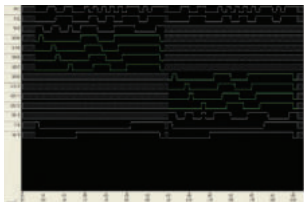
SAEUL Power Plant
SHIN KORI Unit 3, 4

Maintenance Service of Plant Control System(PCS)

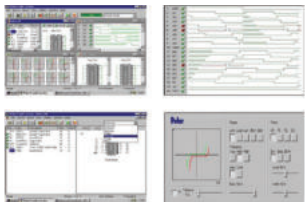
Precise inspection of electronic card using Pinpoint diagnostic equipment



Precise inspection of electronic card using Polar diagnostic equipment



Logic Implementation and Analysis by Pinpoint Diagnosis Equipment



ASA waveform analysis by Polar diagnostic equipment

The Nuclear Power Plant Control System is an essential system for safe operation of the power plant with control facilities for the operation of valves, pumps, breakers, and dampers in power plant site. The equipment configuration for control signal processing consists of a field cabinet (Mux. Cabinet), an electroic room control cabinet, the main control switch an indicator and a monitor. Signal transmission between devices consists of real wiring or optical communication.

We use self-developed diagnostic equipment and the latest electronic card inspection equipment (Polar, Huntron, PinPoint II R) to inspect electronic card, power supply, relay and optical communication, which are core components of Power Plant Control System (PCS), based on our accumulated technology during the planned maintenance period. Thereby we improve the reliability of operation of critical parts of power plants by performing systematic precise inspections, contributing greatly to safe operation of power plants.
The main electronic card check analyzes the unique input and output logic and builds a database of the normal input and output values by using pinpoint diagnosis equipment and performs function and characteristic test by comparing with the original design output value.
For electronic cards that cannot be analyzed with logic, Polar and Huntron diagnostic devices are used to perform ASA (Analog Signature Analysis) technique to check individual elements and circuit integrity. It is possible to perform preventive maintenance check by checking aging deterioration and characteristics change in advance.

Maintenancce Scope

Item	Content
Precise inspection of electronic card	- Analyze the characteristics of each part - Testing of individual function of electronic card and interlocking loop test(Check the integrity of Visual inspection - Visual inspection
Precise inspection of power supply	- Precision check (Fluctuation test of line / load, response time) - Inspection of internal elements(condenser, fuse) - Check integrity
Precise inspection of relay	- Contact test, operating voltage, return voltage characteristic test - Contact resistance measurement - Check drive coil integrity
Inspection of optical communication	- Optical communication card, optical module performance check - Check optical cable loss rate and connection status
Auxiliary equipment check	- Check component status - Check the FAN, Fuse, signal line, and terminal connection status - Support facility improvement

Self-developed diagnostic equipment

- Power supply
- Relay
- JIG for electronic card inspection

General purpose electronic card diagnostics in operation

- Pinpoint II R
- Polar
- Huntron

Features

- Preventative maintenance system that can detect aged deterioration and characteristics change early and take measures timely
- Quick and accurate cause analysis using diagnostic equipment in case of trouble
- Registered as a qualified supplier(Q grade)

The power plants being maintained

HANBIT Power Plant
Unit 5·6

HANUL Power Plant
Unit 1·2·3·4·5·6

KORI Power Plant
SHIN KORI Unit 1·2(Planning)

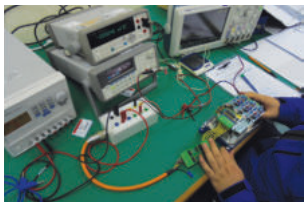
WOLSONG Power Plant
SHIN WOLSONG Unit 1
SHIN WOLSONG Unit 2 (Planning)

Maintenance Service of Automatic Seismic Trip System(ASTS)


MTP check and SW validity check


UPS integrity test


Response Time Test


Seismic Monitoring Sensor Calibration

The Auomatic Seismicc Trip System is a facility that has been implemented as a safeguard following the Fukushima nuclear accident that occurred during the East Japan Earthquake ('11. 03).

REALGAIN has adopted a specialized sensor calibration and high quality maintenance method by cultivating the skills and professional manpower.
We have been certified as a qualified sensor calibrator by the supplier of the seismic monitoring sensor, which is a core component.

The response time test, the trip test, and the variation rate test are separately performed for the seismic monitoring sensor, the electronic card, the power supply, the MTP, the UPS and the auxiliary equipment.
We perform comprehensive tests of the entire system (loop, function) to check the system's integrity. We provide technical support for the client's requirements based on accumulated experience.

Maintenancce Scope

Item	Content
Inspection of seismic monitoring sensor	- Sensor removal and installation, leveling - LPF measurement, response time test - Reference value adjustment and sensor calibration
Precise inspection of power supply	- Precision check (Fluctuation test of line / load, ripple voltage, etc) - Inspection of internal elements (condenser, fuse)
Inspection of electronic card	- Testing of individual function of electronic card and loop test (Check the integrity of individual elements and circuits) - Visual inspection
Inspection of MTP	- Trouble and Seismic LOG history management - Logic test / Sensor module functional test
Inspection of UPS	- Precision check(switchover response time, etc) - Load test/ Battery integrity test
Auxiliary equipment check	- Bypass, Defeat Check switch operation - Check component status - Check signal line, and terminal connection status - Configuration management(wiring, LOG, firmware version, BIOS, etc.)

Self-developed diagnostic equipment

- Electronic card simulated source generation test equipment

General purpose electronic card diagnostics in operation

- Pinpoint II R

Features

- Perform preventive maintenance by confirming aging deterioration and characteristics change in advance
- Acquired certification for calibration of seismic sensor from supplier

The power plants being maintained

HANBIT Power Plant
Unit 1·2

HANUL Power Plant
Unit 5

Digital Rod Position Indicator(DRPI) System

Model. RG-3601	**Classification.** PRODUCT
Application. Rod Position Indicator(DRPI) System	

Introduction

- After receiving the control rod position signal and processing the data, the control rod position and alarm state information are provided to the operator

Features

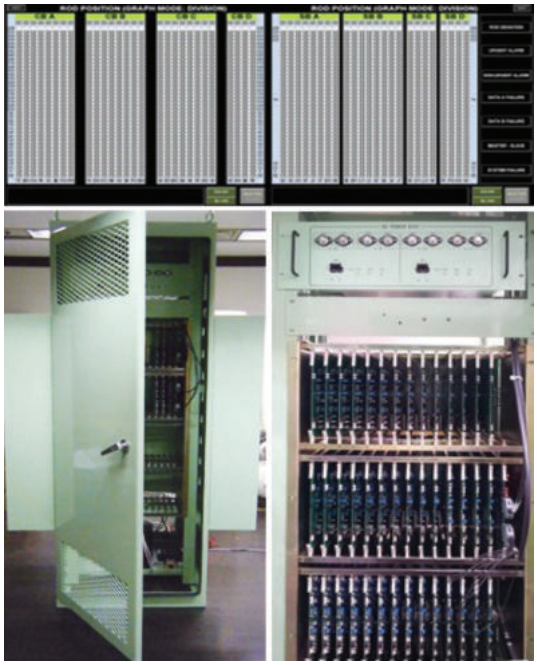
- Localization of existing facilities
- Improving reliability by configuring facilities based on VME system
- Increase efficiency of maintenance service by applying a commercialized hardware system with proven stability
- Utilizing highly reliable standardized communication method(RS-422)
- The system contains a redundant system. So if one becomes defective, there would still be a backup system capable of displaying control rod position information

Under application

- HANBIT Power Plant(Unit 1·2)
- KORI Power Plant(Unit 3·4)

Configuration

- Data cabinet
  - Power supply, Electronic card(Data I/O Card, D/E Card)
- Control cabinet
  - DC Power Box, Relay Box, Display PC
  - Control rod signal analysis software
  - Control rod position indication and monitoring software



Components ❶ Control Cabinet ❷ Data Cabinet ❸ Power supply & Electronic Card

* DRPI : Digital Rod Position Indicator

Real Time Surveillance System for SOV

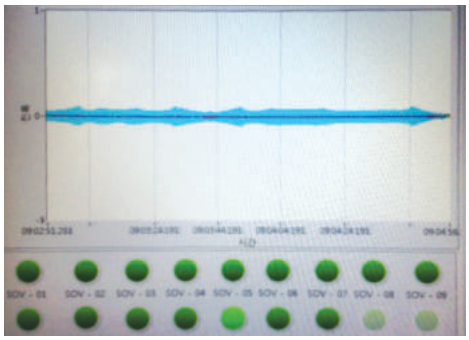
Model. RG-P0013	**Classification.** PRODUCT
Application. Monitor the operation current of the power plant solenoid valve and monitor the malfunction of the valve. Monitor the normal operation of the solenoid valve.	

Introduction

• The drive current of the solenoid valve is measured by a non-contact current sensor, and if the waveform of the drive current is different from the normal/expected drive current a primary alarm is generated. In addition, if the waveform matches that of a specific type of failure, a diagnosis of the valve failure can be made.

Features

• Sensing Solenoid Valve Power Current Feedback in real time
  - Most of the current valve control methods are only for output control, operational response is not feedback
  - Immediate real-time detection of abnormal operation due to valve
• Noncontact / indirect current measurement
  - Can be installed on existing equipment without changing system piping, wiring, electricity. electronic circuit
• Reduce disturbance effect due to magnetic shield structure of sensor (for DC) / increase accuracy
• Analysis of solenoid valve operation, performance, and function / Valve life prediction
  - Estimation of plunger fastening, operation delay, coil deterioration, power line, insulation, valve spring elastic state
  - Operation history recording through DB, long-term change monitoring, deterioration estimation, life prediction
  - Ensure facility reliability and stability by analyzing proper replacement cycle



Components

1. Signal acquisition module (coil current analysis / save)
2. Signal measurement / communication / panel control module
3. Power supply & Electronic Card
4. Remote monitoring system

Under application

• Real time surveillance system of SOV for water treatment

Communication

• TCP/IP

Configuration

• Hardware
  - Current signal acquisition module
  - Signal measurement panel module / Remote monitoring (signal analysis / history management) system
• Software
  - Real-time measurement monitoring / analysis, history management function / report function

* SOV : Solenoid Valve

Coil Current Inspection Sensor(ACTM SENSOR)

Model. RG-ACTM	**Classification.** PRODUCT
Application. Measure the current flowing through the control rod drive coil	

Introduction

- Output a voltage proportional to the current applied to the rod coil using a Hall sensor and Hall Effect

Features

- WH Type
  - Cause numerous warnings and alarms due to errors in the input-output relationship
- REALGAIN
  - Site optimized design and precise tuning to improve output accuracy (Stabilize customer system operation) (Exported to Westinghouse, the original producer)

Components

❶ Cabel Ass'y
ACTM board connection / Test Point / Output calibration

❷ Sensor Ass'y
Ferrite core / PCB & Hall sensor

Under application

- HANBIT Power Plant (Unit 3·4·5·6)
- KORI Power Plant (SHIN KORI Unit 1·2)
- HANUL Power Plant (Unit 3·4·5·6)
- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)

ACTM Sensor's characteristics comparison

Model	1 WH	2 KHNP Type	3 NEW WH Type
Size	55*27*12 mm	55*26*11 mm	55*26*13 mm
Bolt end	One way	Both ways	Both ways
Connector	6 Pin plastic connector	4 Pin SN type	6 Pin plastic connector
Fix cable	Manual	Automatic	Automatic
Fix Ferrite	PCB type	Hinge	Hinge
Install cable	No need to reinstall	No need to reinstall	No need to reinstall
Organization convenience	Low	Low	Low
Hall IC	Output fixing	Output variable	Output variable
Output accuracy	Low accuracy	High accuracy	High accuracy
Development and production	Developed & produced by WESTINGHOUSE	Developed & produced by REALGAIN	Co-developed by WESTINGHOUSE and REALGAIN, produced and exported by REALGAIN

❶ WH Type Sensor is the sensor that causes warning that is installed in present power plant

❷ KHNP Type is the sensor being installed on KHNP as the product developed by REALGAIN Co., Ltd technology laboratory through KHNP task

❸ New WH Type Sensor is the sensor developed based on compatibility with the present ACTM cable, instead of convenience of maintenance co-developed by WESTINGHPUSE and REALGAIN Co., Ltd.

* ACTM : Automatic CEDM Timing Module

Current Sensor

Model. RG-T0003	**Classification.** PRODUCT
Application. Monitoring solenoid valve, protection relay, current output, overcurrent, and other current measurement applications	

Introduction

- Current Detection Using Ferrite Core and Hall Effect.
  * Using ferrite cores with excellent magnetic field permeability, Concentrate the magnetic field and transform the concentrated magnetic field to voltage by Hall effect sensor. The converted voltage is proportional to current which generates a magnetic field.

Features

- The sensor can be mounted on the existing device with little interference without changing the circuit
- Applicable to AC and DC sensor & Custom made

Under application

- Solenoid valve integrity monitoring system in thermal power plant

Rating/Number of Channel

- 1CH/sensor

Configuration

Type	AC Sensor	DC Sensor
Range	0 ~ 100A	0 ~ 4A
	0 ~ 10A	0 ~ 10A
	0 ~ 3A (under development)	0 ~ 20A
	-	0 ~ 3mA
	-	0 ~ 30mA
	-	0 ~ 300mA

For AC(Related reactor control rod)

For AC(Universal Instrumentation Control)

For DC(Low current)

Components

1. Sensor
2. Cap(Hinge type)
3. Cap(detachable type)
4. Shield cap(disturbance shielding)

Advanced Opto-Isolator Card

Model. RG-2101	**Classification.** PRODUCT
Application. SCR Trigger signal control for control rod drive	

Introduction

• In order to drive the control rod, the 3-phase power signal applied to the anode and cathode of the SCR and the logic signal applied to the SCR gate for the SCR trigger are electrically separated

Features

• Local development
- Complementing the shortcomings of existing foreign products and improving reliability(Compensation for circuit damage due to heat generation)

• Major improvements
- Separate design to prevent deterioration of PCB element
- Noise and reliability improvement through improvement of PCB pattern
- Prevention of dielectric breakdown by foreign matter through conformal coating and 4-Layer PCB fabrication

* Meets product technical specifications and nuclear power plant technical specification requirements and test requirements

Under application

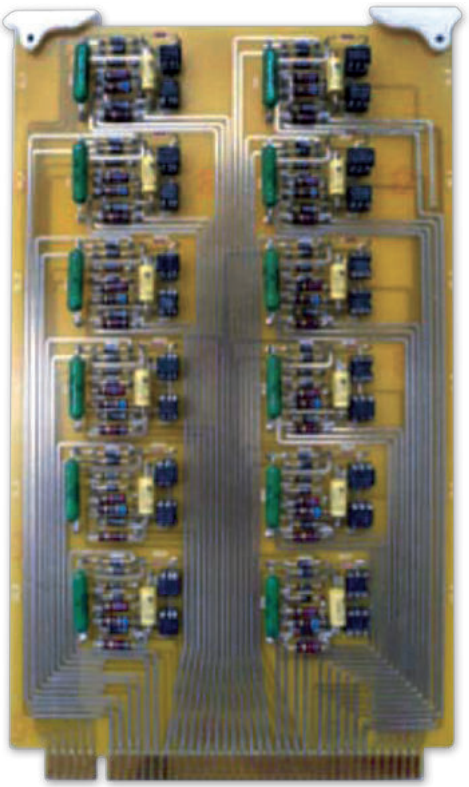
• HANBIT Power Plant(Unit 3·4·5·6)
• KORI Power Plant(SHIN KORI Unit 1·2)
• HANUL Power Plant(Unit 3·4·5·6)
• WOLSONG Power Plant(SHIN WOLSONG Unit 1·2)

Rating/Number of Channel

• 12CH(can drive one standard control rod)

Configuration

• Hardware
- Photo SCR, Photo Coupler, Diac, etc



In-Core Amplifier Module

Model. RG-4701	**Classification.** PRODUCT
Application. Control reactor power output of pressurized heavy water reactor type nuclear power plant	

Introduction

- Amplifier module converts the current generated from In-Core Flux Detector to voltage and measures the amplified output voltage

Features

- Current
  - Output linearity is low and output response time differs from set point
- REALGAIN
  - Improved output linearity, accuracy and reliability of the amplification module. Improvement in response time and full compatibility with other modules

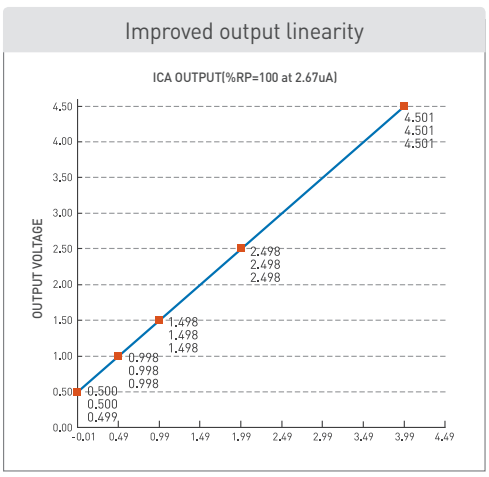
Under application

- WOLSONG Unit 1·2·3·4

Rating / Channel

- Number of Buffered Output : 2
- Output voltage range (0 ~ 150% R.P.) : 0.5 [V] ~ 4.5 [V]
- Output Impedance : 〈 10Ω
- Response time : 10 ms(factory set)

Improved output linearity



*** Certification**

- Environment-resistance test : IEEE-323-2003
- Electromagnetic Test : Reg. Guide 1.180-2003
- Seismic test : IEEE-344-2004

*** Specification**

- Part Number : RG-4701
- Size : 8.72" × 1.35" × 9.80"
- Supplying Power : 120 VAC ± 10%(60 Hz ± 2%)
- Detector input
  - Adjustment profit scope : 11
  - Current range(100% R.P.) : 440nA ~ 2.6 uA
- Others
  - Non-linearity(Percent) : 〈 0.5%
  - Insulation(Dielectric)
- DC. leak current @500V : ≤ 1 μA
- AC. leak current @500V, 60Hz : ≤ 1 mA

* ICA : In-Core Amplifier

Advanced CIM(Component Interface Module)

Model. -	**Classification.** PRODUCT
Application. Control signal of APR1400 Engineering Safety Features Control System (ESF-CCS)	

Introduction

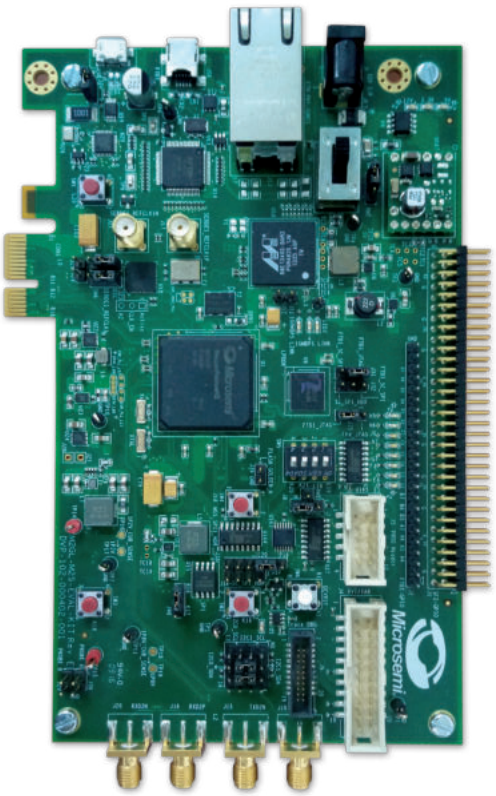
• Process command signal of various systems according to priority. Generate drive signal and receive feedback signal for controlling field devices

Features

• Local development
  - By dividing the functions of existing WEC products into controlled groups, reducing the number of components to be used, simplifying UNIVERSAL COMPONENT LOGIC and improving reliability
• Major improvements
  - Improved surge protection circuit
  - Added inrush current limit function
  - Added external signal noise prevention circuit
  - Enhanced self-diagnosis function
  - Increased the convenience of jumper setting

Configuration

• Feedback board
• Logic board



CEDMCS Simulator

Model. KP-1301	**Classification.** PRODUCT
Application. Mimic the function of the CEDMCS and thereby perform the diagnosis of the CEDMCS control card, as well as enabling the operators to practice the operation and maintenance of the CEDMCS using the simulator. Improve the understanding of the CEDMCS by allowing analysis of the signal delivery system between each control card of CEDMCS	

Introduction

- Consist of phase voltage converter for 240/139VAC three -phase 4-wire power supply, and a load tester that is a 4-axis control rod drive unit. Phase voltage converter converts 3-phase 480VAC to 240VAC and supplies it to the control rod control system.
  It is capable of implementing the same withdrawal and insertion as the field facility of standard type control rod control system.

Features

- Possible to operate the control rods by group and designed in order to easily grasp the reason for deviation between groups
- Possible to diagnose the breakdown of all cards
- Simulation function with arbitrary fault function mode
- Coil replacement / thermostat structure applied to detect aging and abnormal operation cause of control rod coil
- Unlike products from other vendors, our product can be driven without the load simulator connection
- Manual operation of the control rod using the joystick is possible, Graphic UI enables full signal flow identification
- Provides convenience of maintenance (easy hardware replacement structure and small / light weight)

Under application

- HANBIT Power Plant (Unit 3·4·5·6)
- HANUL Power Plant (Unit 5·6)
- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)

Components

- CEDMCS Simulator Module
- Control card fault diagnosis Function Module
- Phase voltage converter/PSA(power switch assembly)
- Logic Housing(Control rod drive logic card)
- Operator Module (Interfaces between operator and simulator)

LPMS Iron Ball Gun

Model. RG-4901	**Classification.** PRODUCT
Application. Test to check the integrity of the LPMS	

Introduction

• A device used to prevent damage to the power plant from loose parts in the reactor coolant system. It analyzes the sound generated by the impact of the loose parts and detects their location and mass.

Features

• Current
- A worker had to hit the steel ball hung by thread directly to the impact position. However, if the object to be tested is located at bottom of reactor or coolant pump, the worker is unable to perform the test due to high radiation levels.

• REALGAIN
- The automatic generation of a test impact using a steel ball installed in high temperature and high radiation areas. This system can be used during normal operation and the size of the impact can be adjusted remotely from main control room. There is a feature that can recover the steel ball.

Under application

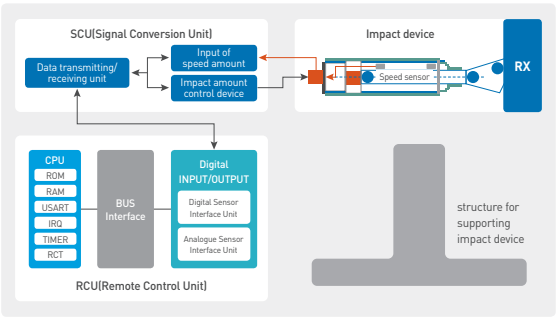
• Applicable to all Power Plant

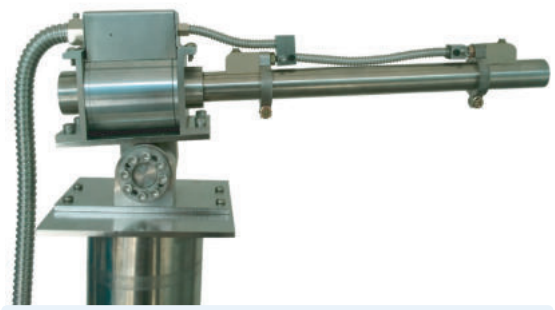
Configuration

• RCU (Remote Control Unit)
- The RCU is located at the central control room. It transmits impact data to the SCU, and carries out calibration of the size and speed of the steel before testing. It also contains all the controls and interfaces with other equipment.

• SCU (Signal Conversion Unit)
- The SCU drives the impact device according to commands from the RCU. It controls the type and speed of steel ball, and discharges the steel ball according to the received command.

• Iron Ball Gun
- LPMS Iron Ball Gun selects the steel ball, shoots it at a predetermined speed and collects the shot steel ball.





Components

❶ Impact device ❷ RCU(Remote Control Unit)
❸ SCU(Signal Conversion Unit)

* LPMS : Loose Parts Monitoring System

Speed Sensor and Acceleration Sensor Diagnostic System

Model. RG-P00800	**Classification.** DIAGNOSTIC System
Application. Check the integrity of the sensors (displacement, vibration and speed) used with large-scale rotary equipment such as power plant turbine, high pressure pump	

Introduction

- Speed/displacement sensor
  - After fixing the sensor, measure the output of the sensor while changing the rotational speed of the rotary gear
  - Measuring the output of the sensor according to the distance from the rotary gear while moving the position of the sensor
- Speed/acceleration sensor
  - After attaching the sensor to the diagnostic unit, measure the output of the sensor while changing the speed / acceleration.

Features

- Speed Pickup Sensor
  - Measure sensitivity by velocity
- Displacement Sensor
  - Measure sensitivity by distance
- Speed/acceleration Sensor
  - Measure sensitivity by frequency change

Under application

- Ulsan Oil-Fired & C.C power complex
- Applicable to all Power Plant

Rating/Number of Channel

- 1CH

Components

1. Speed Pickup Sensor & displacement Sensor measuring part
2. Speed & acceleration Sensor measuring part
3. Diagnostic Notebook

Control Element Drive Mechanism(CEDM) Coil Current Constant Monitoring System

Model. RG-5001	**Classification.** DIAGNOSTIC System
Application. Testing reliability of CEDM	

Introduction

- Analyze the waveforms of the current that flows through the control element by connecting coil current measuring equipment to the power cabinet

Features

- Local development
- Automatically analyzes the driving current in the control element accurately
- Isolation circuit design enables non-contact diagnostics
- Real time judgment without interference between power control box and drive coil connection facility (Enable remote waveform analysis using TCP / IP)

Under application

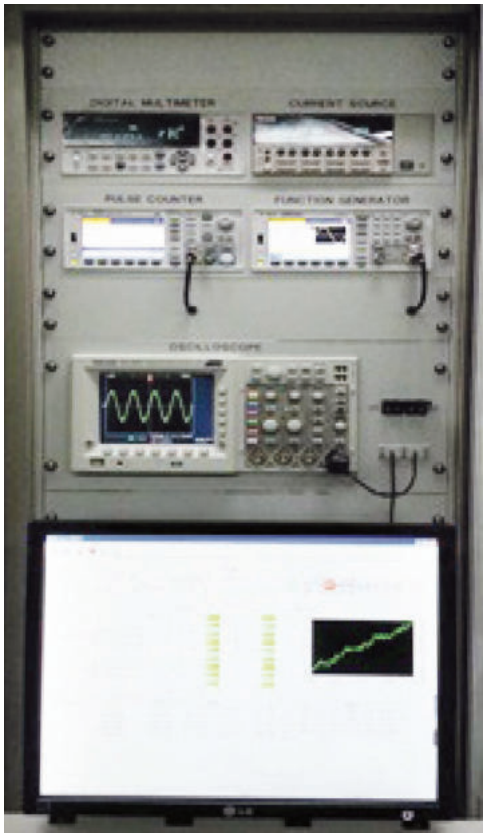
- HANUL Power Plant (Unit 1·2)
- KORI Power Plant (Unit 3·4)

Rating / Number of Channel

- 16CH

Configuration

- Hardware
  - Digital Signal Processing Module (Diagnostic Equipment Control Computer)
- Software
  - Standard CEDMCS Waveform Analysis Algorithm
  - Determination Algorithm



CPC Input·Output Simulation System

Model. KP-0701	**Classification.** DIAGNOSTIC System
Application. Equipment that simulates the input signals of multiple channels to test the CPCS, and tests the functions of the CPCS by monitoring the output signals	

Introduction

- Convert/generate the various process values entered by the user into the same signal as the site, and transfers it to the CPCS. the signal output from the CPCS is converted into a process value that can be confirmed by the user and displayed

Features

- Simulating CPCS operating condition and monitoring output value
- Measuring response time
- Performing control rod drop time test

Under application

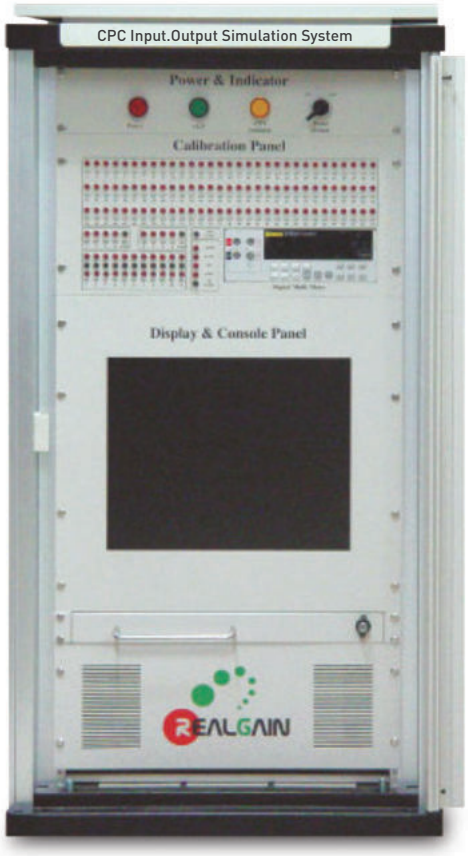
- HANUL Power Plant (Unit 3·4)

Rating/Number of Channel

- 87/14 (Input/Output)

Configuration

- Hardware
  - Computer for Simulation
  - Data Input·Output Module
  - CPC/CEAC Connector Panel & cable
- Software
  - CPC Input/Output simulation Function
  - CEAC Input/Output simulation Function



* CPC : Core Protection Calculator * CPCS : Core Protection Calculator System * CEAC : Control Element Assembly Calculator

DPPS Digital Response Time Equipment

Model. RG-3401	**Classification.** DIAGNOSTIC System
Application. PPS response time measurement	

Introduction

- Ensure that the operating time of the plant protection system (reactor protection system, engineering safety features operation system, diversity protection system) is measured and maintained within the operating time limit

Features

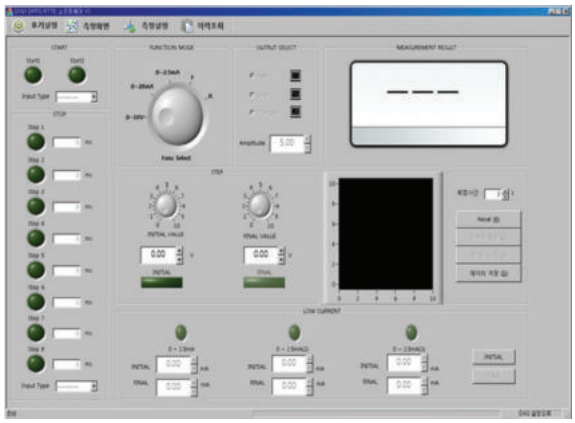
- Field transmitter response time measurement test
- DPPS response time measurement test
- DESFAS sub relay response time measurement test
- DPPS cabinet and RTSG response time measurement test
- CPC/CEAC response time measurement test
- RTD response time measurement test

Under application

- KORI Power Plant(SHIN KORI Unit 1·2)
- UAE Barakah Power Plant(BNPP)
- HANUL Power Plant(SHIN HANUL Unit 1·2)
- WOLSONG Power Plant(SHIN WOLSONG Unit 1·2)

Rating/Number of Channel

- Voltage Output :2
- Current Output : 3
- Trans Output : 1
- Resistor Output : 1
- Signal Conditioning : 8



Components

1. Diagnostic Controller
2. Voltage Output Module
3. Current Output Module
4. Signal Conditioning Module

* DPPS : Digital Plant Protection System * PPS : Plant Protection System * DESFAS : Digital Engineered Safety Features Actuation System

Performance Analyzer for Ex-Core Neutron Flux Monitoring System

Model. RG-1701	**Classification.** DIAGNOSTIC System
Application. Measure and analyze performance factors of ENFMS(Ex-Core Neutron Flux Monitoring System), Determines the progress of deterioration of the detector, and analyzes the data in order to establish the optimum replacement plan.	

Introduction

- By measuring the plateau curves and initial saturation curves of the detector, their gradient increase and operating high voltages are analyzed. In addition the corresponding progress of detector deterioration and damage is evaluated

Features

- Dedicated connector jig and automatic diagnosis / analysis algorithms for fast, accurate functional tests

Under application

- HANBIT Power Plant(Unit 1·2·5·6)
- KORI Power Plant(Unit 1·2·3·4, SHIN KORI Unit 1·2)
- HANUL Power Plant(Unit 1·2·3·4·5·6)
- WOLSONG Power Plant(SHIN WOLSONG Unit 1·2)

Configuration

- Measurement & Diagnosis
- Data Acquisition
- History management Function
- Computer for diagnosis

Components

1. Oscilloscope
2. Digital Multi Meter
3. Programmable Current Source
4. Programmable Pulse Counter
5. Programmable Signal Generator
6. Computer for diagnosis

* ENFMS : Ex-Core Neutron Flux Monitoring

RCP Speed Measurement System Diagnostic Equipment

Model. RG-3001	**Classification.** DIAGNOSTIC System
Application. Preventing the breakdown of the RCP speed measurement system through sensor tests	

Features

- Secures reliability of RCP facility by Linearity test for output of displacement sensor, variability of input range for pulse shaper and threshold voltage adjusting test
- Performance checking of reserve stocks of the RCP speed measurement system modules is possible
- Trend analysis of data obtained through systematic history management of measured data makes preventive maintenance possible
- By using small sized rotating disk for diagnosis which copies the function of the RCP rotating disk at the plant, it is possible to conveniently test the performance of the speed measuring module even at the maintenance shop

Under application

- HANUL Power Plant (Unit 5·6)
- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)

Configuration

- Sensor Test on RPM
- Pulse Shaper Measurement
- High Speed DAQ System
- Computer for diagnosis

Sensor Test on RPM

Pulse Shaper Measurement

Components

1. Servo system (Motor & Drive)
2. Slot rotating disk and servo system
3. High Speed DAQ System
4. Computer for diagnosis

* RCP : Reactor Coolant Pump

Relay Diagnostic Equipment

Model. RG-4601	**Classification.** DIAGNOSTIC System
Application. **Analyze the aging status** and integrity of the different types of relays and relay cards used in the power plant	

Features

- Detailed functional diagnosis of the relevant system is possible
- Frequency domain analysis and curve fitting, etc can be visualized in 2D and 3D graphs
- Allow the examination of spare parts and the acceptance testing of relays
- Allows for the analysis of trends in measurement data and preventive maintenance based on them

Under application

- HANUL Power Plant (Unit 1·2·3·4)

Configuration

- Hardware
  - Computer for diagnosis
  - Data Input / Output Module
  - Programmable AC / DC Power Supply
- Software
  - Temperature of coil variable, Zero point and data analyzing software
  - Operating voltage / Return voltage / Operating time analysis program
  - History Management Function

Components

1. Control switch & indicator
2. 17 inch PC(panel type)
3. PCB module & power supply

RSPT Diagnostic System

Model. KP-0501	**Classification.** DIAGNOSTIC System
Application. Testing the integrity of the on-site RSPT. Evaluation of RSPT spare parts for abnormality before installing the control rod	

Introduction

- Determine the integrity of the RSPT and whether to replace it by acquiring and diagnosing the output waveform of the RSPT when pulling out/inserting control rod during preventive maintenance of the power plant

Features

- During the waveform diagnosis test, the entire data set is acquired while performing the group (MG) operation. And the waveform is displayed in a graph in real time, so that any abnormality is immediately identified, minimizing the diagnostic time
- Possible to diagnose the integrity of RSPT before installation through spare parts diagnosis

Under application

- HANUL Power Plant (Unit 3·4·5·6)
- HANBIT Power Plant (Unit 3·4·5·6)
- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)
- KORI Power Plant (Unit 1·2·3·4)

Rating/Number of Channel

- 32Ch simultaneous measurement and graph displaying

Configuration

- Hardware
  - Computer for diagnosis
  - Data acquisition module
  - Measurement Jig
  - Spare parts diagnostic
- Software
  - RSPT waveform diagnostics software (measurement, diagnosis, history, report generation)

Components
1. Indicator
2. Computer for diagnosis
3. Power Supply & I/O terminal

* RSPT : Reed Switch Position Transmitter

Air Operated Valve(AOV) Intelligent Diagnostic System

Model. KP-0901	**Classification.** DIAGNOSTIC System
Application. Fault diagnosis of I/P converter, Positioner, and Actuator	

Features

- Subject : I/P converter, Positioner, and Actuator of valve
- Test Items : 5 point test, response test, RAMP test
- Measurement data: 5 points Test output, response time
- Analysis Data : Hysteresis Graph and Analysis, Margin, Dynamic Error, Linearity

Under application

- HANUL Power Plant(Unit 1·2·3·4)
- HANBIT Power Plant(Unit 3·4)
- WOLSONG Power Plant(SHIN WOLSONG Unit 1·2)
- KORI Power Plant(Unit 3·4 / SHIN KORI Unit 1·2)

Rating/Number of Channel

- 220VAC
- Pressure input : channel 5
- Current output : channel 2

Configuration

- Hardware
  - Diagnostic equipment
  - Pressure sensor : 5
  - Jig & signal cable
- Software
  - AOV Diagnostic program
  - AOV Analysis program

Components

1. Diagnostic equipment
2. Pressure sensor
3. Jig & signal cable
4. Diagnostic equipment storage
5. Jig & signal cable storage

Solenoid Valve(SOV) Diagnostic Equipment

Model. RG-2701	**Classification.** DIAGNOSTIC System
Application. Diagnose the integrity of SOVs	

Introduction

• Compares input to output with instrument

Features

• Current
  - Disassemble SOV and diagnose it on the Test Bench, which may cause pollution or damage to the connection during disassembly and reassembly
• REALGAIN
  - Diagnose the installed SOV without requiring disassembly.
  - Intuitive user interface makes it easy to use
  - Easy to transport and move diagnostic equipment
  * Developed in collaboration with KHNP

Under application

• HANUL Power Plant (Unit 5·6)
• WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)
• KORI Power Plant (Unit 1·2 / SHIN KORI Unit 1·2)

Configuration

• LCR Meter
• AC/DC variable power
• Current measurement Module

Power Converting Module(PCM) Diagnostic Equipment

Model. RG-P0017	**Classification.** DIAGNOSTIC System
Application. Diagnose the integrity of the PCM in the power plant	

Introduction

- Check the electronic components of the PCM for planned preventive maintenance

Features

- Diagnose the installed PCM without disassembly
- Test Items : The aging of SCR, Capacitor-Resistor, Sampling Resistor

Under application

- HANBIT Power Plant (Unit 3·4·5·6)

Configuration

- Hardware
  - Diagnostic equipment
  - Jig & signal cable
  - Data I/O Module
- Software
  - History management program
  - PCM measurement program

Components

1. DMM and current supply
2. LCR Meter
3. High Voltage Power
4. Power control

Site Air-Pressure Measuring Instrument Diagnostic Equipment

Model. RG-1901	**Classification.** DIAGNOSTIC System
Application. Perform acceptance test and integrity test for 6 types of pneumatic measuring instruments such as valve positioner before installment by using this performance diagnostic equipment, preventing failure in advance. Utilize history management DB for systematic maintenance	

Introduction

- Monitoring and analyzing output by simulating input of valve in use in the field

Features

- Disassemble spare parts and faulty valves on site and check the integrity using the performance diagnostic equipment test table.
- Checking the input/output of each valve
- Display Input / output graph of each valve & characteristics
- Check the integrity of passive elements

Under application

- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)
- HANUL Power Plant (Unit 3·4)
- KORI Power Plant (Unit 1·2 / SHIN KORI Unit 1·2)
- UAE BNPP

Rating / Number of Channel

- 220VAC
- High pressure output channel :1
- Low pressure output channel :1
- IP signal output : 1
- Precision pressure output : 1
- Pressure sensor : 4

Configuration

- Test Bench : 1
- Air-compressor : 1
- Valve measurement and diagnostic programs
- History management program

Components

1. Air-compressor
2. Air-pressure control equipment
3. Controller
4. Measuring equipment
5. Power
6. I/O port
7. Compressor
8. Teat table

Diagnostic Equipment for the Control Rod Drive Coil

Model. KP-0102	**Classification.** DIAGNOSTIC System
Application. Diagnose the integrity (aging) of the control rod coil of the nuclear reactor	

Features

- Current
  - Measure manually the value of the DC-Resistance. In the event of a fatal damage, a change in value causes inaccurate diagnosis of integrity
- REALGAIN
  - Diagnose the aging of coil before fatal damage, by measuring not only the DC-Resistance but also the AC-Resistance, inductance value and Q-factor. It eases the analysis and allows for the historical management of data

Under application

- HANBIT Power Plant (Unit 1·2·3·4·5·6)
- HANUL Power Plant (Unit 1·2·3·4·5·6)
- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)
- KORI Power Plant (Unit 1·2·3·4 SHIN KORI Unit 1·2)

Configuration

- Control rod driving coil diagnosis function
- LCR Meter for diagnosis
- Relay Module for diagnosis
- Software for analyzing coil variable temperature, zero point and data
- Computer for diagnosis
- History Management program

Electronic Card Diagnostic Equipment for DRPI

Model. RG-2501	**Classification.** DIAGNOSTIC System
Application. Functional test of data encoding electronic card for DRPI	

Introduction

• Analyze the input/output of each electronic card, and determine the integrity of the electronic card by checking output and the alarm signal. Compare normal and abnormal signal input

Features

• Current
- Detailed input/output function of each individual card cannot be confirmed

• REALGAIN
- Main and additional function for individual electronic card can be tested separately (Display I/O, Computer I/O, Data I/O, etc)

Under application

• KORI Power Plant (Unit 3·4)
• HANBIT Power Plant (Unit 3·4)

Configuration

• Hardware
- Signal generator
- Data acquisition module (DAQ)
- Signal synchronization module (Trigger/Sync.)
- Signal analysis device
  * Detect electronic card specific signal and alarm by applying I/ O signal connection jig between electronic card installation part and diagnostic hardware

• Software
- Function definition for electronic cards
- Original design signal definition
- Diagnosis algorithm
- Generation of diagnosis history/DB/report

Components

❶ Signal analyzer
❷ Test monitor
❸ Signal generator & DAQ
❹ Power supplier Unit

* DRPI : Digital Rod Position Indicator

RMS Flow Calibration Diagnostic Equipment

Model. RG-P0015	**Classification.** DIAGNOSTIC System
Application. Used for data aquisition, caibration and diagnosis of the RMS gas flow transmitter	

Introduction

- Input the flow rate to be calibrated to LPDU and obtain the output value from LPDU to determine whether or not there is an abnormality

Features

- Disassemble spare parts and faulty flowmeters on site to check the integrity
- Easy to transport(portable)
- Check the flow meter input/output
- Provides aging discrimination algorithm through history management

Under application

- KORI Power Plant(SHIN KORI Unit 1·2)
- HANUL Power Plant(SHIN HANUL Unit 1·2)
- WOLSONG Power Plant(SHIN WOLSONG Unit 1·2)

Rating/Number of Channel

- 220VAC
- Flow control output channel : 1
- Flow acquisition channel : 2

Configuration

- Hardware
  - Diagnostic equipment
  - Jig & signal cable
  - Data I/O Module
- Software
  - Automatic and manual diagnostic programs
  - History management program
  - Calibration program

LVDT Diagnostic Equipment

Model. RG-P0005	**Classification.** DIAGNOSTIC System
Application. Diagnosis of the power turbine speed sensor and position sensor	

Introduction

- Inspection using signal conditioner excitation signal / output
- Inspection using approval source data supplied by sensor manufacturer

Features

- Check for dedicated sensors applied to each power plant

Under application

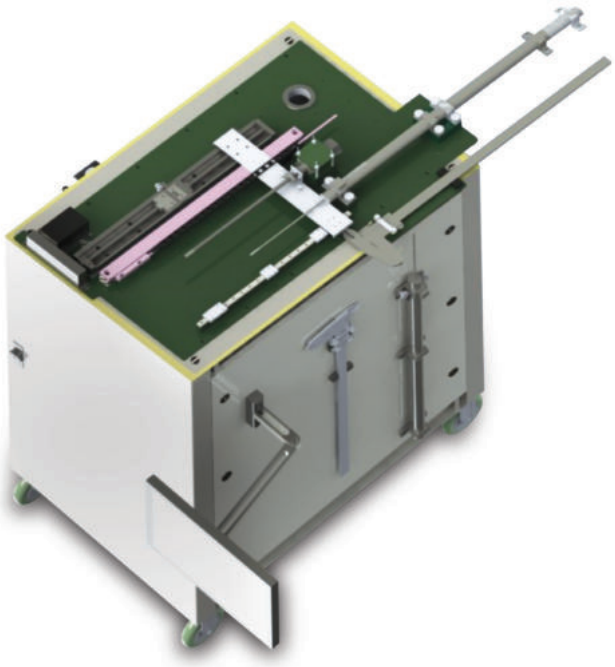
- HANUL Power Plant(SHIN HANUL Unit 1·2)

Rating/Number of Channel

- LVC4000 for turbine
- GP, GH sensor for turbine
- Passive VRS Magnetic Speed Sensor type

Configuration

- Hardware
  - Speed sensor jig and check device
  - Jig and check device for position sensor LVC4000
  - Jig and check device for position sensor GP, GH
- Software
  - Speed sensor test program
  - Position sensor LVC4000 test program
  - Position sensor GP, GH test program
  - History management program



Components

1. Speed test check
2. Position LVC4000 test inspection
3. Position GP, GH test check
4. PC and auxiliary tool(Level machine, vernier, replacement aids

PIN POINT Electronic Card Diagnostic Equipment

Model. RG-P0002	**Classification.** DIAGNOSTIC System
Application. Diagnose the integrity of electronic cards	

Introduction

- Analyze the input/output of the electronic card, check the output signal against the input signal, and check the integrity of the electronic card

Features

- Diagnose the integrity of digital and analog electronic card (implementation of operation loop)
- Check the integrity of microprocessor, firmware, SW (FPGA, FID) Logic
- Main and additional function for individual electronic card can be tested separately
- Early detection of aging deterioration and changes in characteristics (preventive maintenance system), timely action
- Identify the cause quickly and accurately when a problem occurs
- Can be applied to all electronic cards through development of separate JIG

Under application

- WOLSONG Power Plant (SHIN WOLSONG Unit 1·2)
- HANBIT Power Plant (Unit 3·4·5·6)
- HANUL Power Plant (Unit 1·2·3·4·5·6)
- KORI Power Plant (Unit 1·2 / SHIN KORI Unit1·2)
- SAEUL Power Plant (SHIN KORI Unit 3·4)

Configuration

- Hardware
  - Diagnostic equipment(Pinpoint IIR)
  - JIG
- Software
  - Diagnosis algorithm
  - Generation of diagnosis history/DB/report

Components

❶ Diagnostic equipment

- PC for diagnosis (Embedded)
- Digital Multi Meter (Embedded)
- Shorts Locator (Embedded)
- Counter Timer (Embedded)
- Oscilloscope (Embedded)
- LCR Bridge (Embedded)
- Waveform Generator (Embedded)
- Parameter Test Unit (Embedded)

❷ JIG & signal cable

On-site Panel Directed Variable Automatic Recognition Equipment

Model. RG-S0001	**Classification.** DIAGNOSTIC System
Application. Real-time image recording and monitoring of on-site panel. Monitoring and change diagnosis by extracting numerical value from image.	

Introduction

- Determine the adequacy by recording real-time image of on-site panel, extracting numerical value from image, and monitoring it, thereby easily determine the faulty parts and contribute to safe operation

Features

- Establish DB for detecting the cause of the failure mode Systematic and forecasting maintenance

Under application

- KORI Power Plant(SHIN KORI Unit 1·2)

Components

- Signal acquisition computer(Signal processing and data storage)
- Industrial camera
- Camera tripod

AC 160 Hot Panel

Model. RG-P0014	**Classification.** DIAGNOSTIC System
Application. Integrity testing of ABB's AC160 PLC components	

Features

- AC160 PLC Hot Panel Functional Test
- Long-Run test for PLC module
- Possible to install AC160 processor OS and application program for processor module (PM646A)

Under application

- Kori Power Plant (SHIN KORI Unit 1)
- Wolsong Power Plant (SHIN WOLSONG Unit 1)

Configuration

- Hardware
  - DUT : ABB PLC module
  - Keyboard : Industrial PC, Monitor
  - DAQ System (PXI Type)
  - Signal Conditioning Module
  - Communication card
  - Relay Matrix module
  - Power Supply (SMPS)
  - Digital Multi-meter
  - Oscilloscope
  - Electric Load
- Software
  - Function diagnosis software
  - Hot-Panel Software

Fuse Performance Diagnostic Equipment

Model. RG-3501	**Classification.** DIAGNOSTIC System
Application. Inspection and Diagnosis of Fuse Characteristics in the Power Plant	

Introduction

- Fuse Function Test
  - Prediction of short-circuit current by taking into consideration characteristics of each fuse
- Fuse Aging Test
  - Non-destructive reliability test simulating actual use conditions of fuse
- Fuse Holder Test
  - Data History management after measuring dimension and elasticity of fuse holder(notification of replacement recommendation)

Features

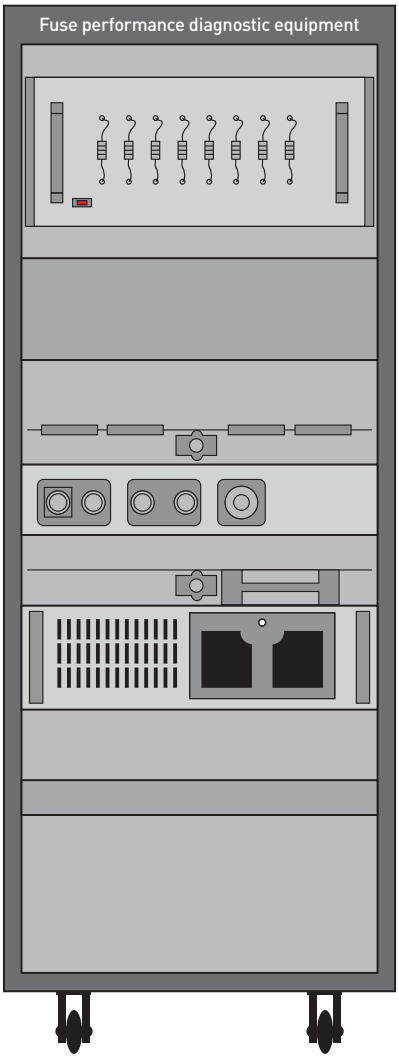
- Execute long run test by simulating actual operating situation(Judge reliability of fuse)
- Predictive maintenance using quantitative measurement data

Under application

- KORI Power Plant(SHIN KORI Unit 1·2)

Configuration

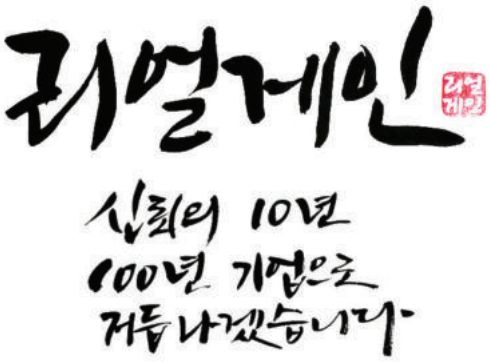
- Main Control Panel
- LCD Touch Panel
- AC/DC Programmable Power
- Oscilloscope



Components

1. Fuse Test Jig
2. Power system
3. Diagnostic PC/Monitor
4. DC Power supply


REALGAIN



REALGAIN CO.,LTD.

HEAD OFFICE

A-301, Seoul Forest SK V1 TOWER, 5, Seongsuil-ro 8-gil, Seongdong-gu, Seoul, 04793, Republic of Korea

TEL +82-2-885-4781 **FAX** +82-2-885-4782

BUSINESS PLACE

204-Ho, 43, Jangansandan 3-ro, Jangan-eup, Gijang-gun, Busan, 46034, Republic of Korea

TEL +82-51-714-6010 **FAX** +82-51-727-6017