



HiCMS

Hyosung intelligent
Condition Monitoring System



www.hyosungpni.com

Global Top Energy, Machinery & Plant Solution Provider

 **HYOSUNG CORPORATION**
Power & Industrial Systems Performance Group

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· Products (models) listed in this catalogue are subject to production cessation and specification changes without notice. Please be sure to check their availability before you purchase.
· Do not disassemble or repair the product on your own for maintenance/inspection purposes. To ensure your safety, please contact our technicians.

About HYOSUNG



Hyosung Power & Industrial Systems PG is a division under Hyosung which consists of seven performance groups(PGs). In addition to establishing itself as a world-class manufacturer of electrical equipments, green technology and industrial machineries, Hyosung is also the largest producer of tire cords and spandex in the global market and the second largest supplier of ATMs in the USA.

01 Our Business

Brief introduction of Hyosung Power & Industrial Systems

Hyosung Power & Industrial Systems Performance Group

Hyosung Power & Industrial Systems Performance Group(PG), a comprehensive energy solution provider, boasts world-leading technology in the global power industry and has secured a competitive capability on par with that of top competitors in transformers, switchgears, motors, generators, gear units, industrial machineries, industrial pumps, and wind energy business.

With globalization as one of our top priorities, we have achieved outstanding increase in sales over the past few years thanks to the enhancement in Hyosung's quality, technology, and brand recognition among overseas clients, which include North America, Europe, the Middle East, and Asia. We expect such robust performance, marked by an increasing number of orders from the overseas market, to continue in the future.

At the heart of our capability to grow as a comprehensive energy solution provider is our global organization structure. Hyosung Power & Industrial Systems PG is divided into four business areas or performance units(PU), depending on the types of flagship products : Power Systems PU, Industrial Machinery PU, HYOSUNG GOODSPRINGS PU, and the Wind Energy Business Division.

Power Systems Performance Unit

Hyosung's Power Systems PU provides a full spectrum of power generation, transmission, and distribution services, from design and engineering to the maintenance of equipment. Power System PU has been building up on cutting-edge information technology resources and developing substation automation systems, such as power monitor and control systems, and early detection and prevention systems.

Such vast product assortment and technical know-how is based on our product development history. In 1992, Hyosung was the first in Korea, and the sixth in the world, to develop a 765kV ultra-high voltage (UHV) transformer, and, in 1999, was the first in the world to manufacture the 2-breaker 800kV gas insulated switchgear (GIS). Those technological achievements gave Hyosung world-wide recognition as one of the global major manufacturers.

The Power systems PU is continuously striving to secure competitiveness in every aspect of quality, technology, sales, services, and management, in order to satisfy customer needs globally and become a top-tier company in the world by providing customers with the best quality products and services in the power systems sector.



HiCMS(Hyosung intelligent Condition Monitoring System)

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02 Sustainability

Our sustainability principles are the backbone of the way we design and manufacture products

Quality Assurance

Hyosung strives for excellence. We believe excellence can only be achieved through absolute quality and value for customers. In order to create quality products, we believe that all of the actions of every single employee must be focused in the highest level of quality. In order to achieve such levels, we have implemented a quality assurance policy and programs that make our philosophy into a reality. Our Quality Assurance Policy was founded based on the management policy of the president and meets the demands of ISO 9001. As a globally active company, we are committed to comprehensive and quality management through three quality strategies: quality management system, customer-focused management system, and concentration on core competencies.

The comprehensive quality management system ensures that we completely comply with all compliances and applicable legislation, codes, and standards in addition to implementing efficient operation of our management resources to eliminate unnecessary waste. Our customer-focused management system clarifies and simplifies our first priority which is customer satisfaction. All of our work is aimed to exceed customer needs and provide exceptional value through quality standards, flexibility, and innovation. Finally, we concentrate on our core competencies for strict quality control and continual improvement which provides quality products and cost-saving to our clients via advancement in technical capacity and technological innovation. We implement our policy via a Quality Management Team manages research laboratories, including the Measurement Standard Laboratory, the Chemical Analysis Laboratory and the Material Analysis Laboratory to maintain a strict control over quality.

Environment Protection Policy

Hyosung understands the impact of Hyosung's activities in the environment and works to protect the environment from pollution, manages the environmental impacts of Hyosung's products and technologies, and prevents future pollution and harmful effects in the environment by investing in environmentally-friendly products and solutions.

Based on this eco-philosophy of shared responsibility, Hyosung has implemented a comprehensive environmental protection program that aims to minimize our impact on the environment and conserve resources. Our environmental policy fulfils all requirements of the ISO 14001.

03 R&D

Inspiring innovation, creation and expertise

Hyosung R&D Center identifies innovation, creation, and expertise as core value, and concentrates on world class R&D activities in the 21st century with a philosophy aspiring after customer satisfaction, quality priority, and performance orientation. Hyosung pursues to be the world's best company in the field of heavy electrical machinery, industrial & electrical electronics engineering, and energy system. Ever since establishment in 1978, R&D Center had led the development of domestic technology. Along with the Anyang and Changwon labs, the group has endeavored to produce core technology and world-class products in the areas of heavy electrical machinery, energy system, electrical electronics engineering, and industrial automation system.

Research Areas

Hyosung R&D Center engages in the activities in the field of energy system, solution & service, applied electrical and electronic technology, basic core technology, technology of improved reliability, core components, and new materials.

Energy System

- Renewable energy (wind system, wind turbine, wind PCS, solar system, PV PCS, fuel cell, co-generation)
- Electric Vehicle (EV charger, EV motor)

Solution & Service

- Power facility diagnosis algorithm and system
- Power facility lifecycle evaluation system
- Service solution for remote diagnosis for prevention

Applied Electrical & Electronic Technology

- Power conversion system
- Flexible AC transmission system and high voltage direct current
- Power quality solution

Basic Core Technology

- Fortified technology in structural dynamics, electromagnetics, heat transfer analysis, etc.
- Skills for system simulation, analysis and evaluation
- Business support technology

Technology with Improved Reliability

- Test data analysis and testing facility
- Analysis of lifecycle and cause of error
- Reliability assessment (environment-friendliness, durability, long-term degradation, and more)

Core Components and New Materials

- Organic and inorganic insulation materials
- Silicon forming technology
- Intelligent sensor (facility diagnosis, CT, PT, VT, LA, and more)

Overview of HiCMS Series

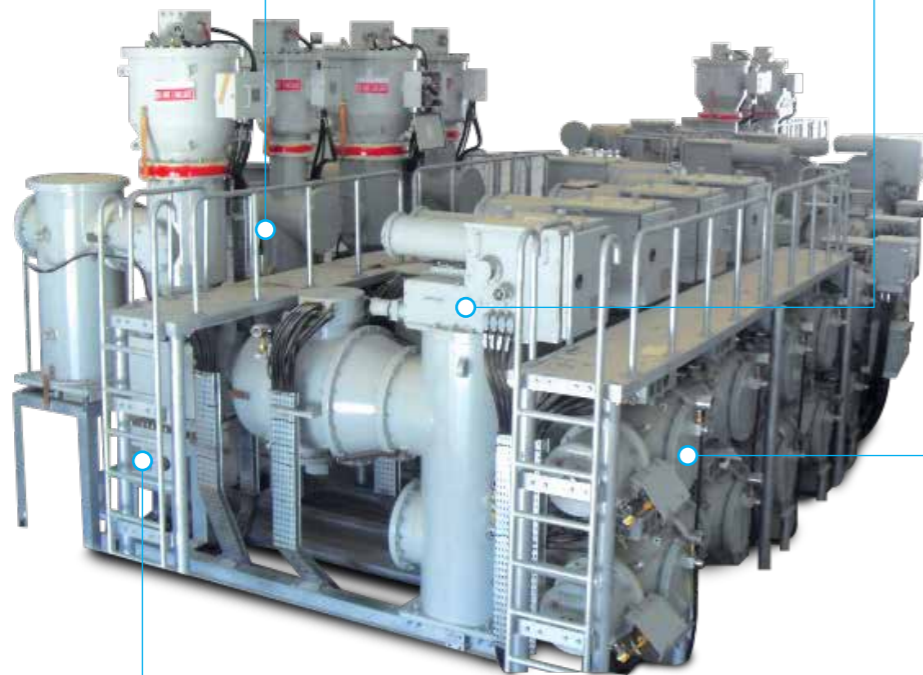
GIS Condition Monitoring Solution

Total Monitoring System
GM-3000

- Monitor UHF PD, SF₆ Gas density, CB operation and LA condition
- Provide accurate diagnosis result and alarm

Portable PDM Device
GM-100

- Rapid and easy application on-site
- Reliable external noise elimination



Entry Level PDM System
GM-500

- Cost effective on-line PDM
- Compact and easy installation

On-line UHF PDM System
GM-4000

- High sensitive on-line PDM solution
- Advanced analysis algorithm

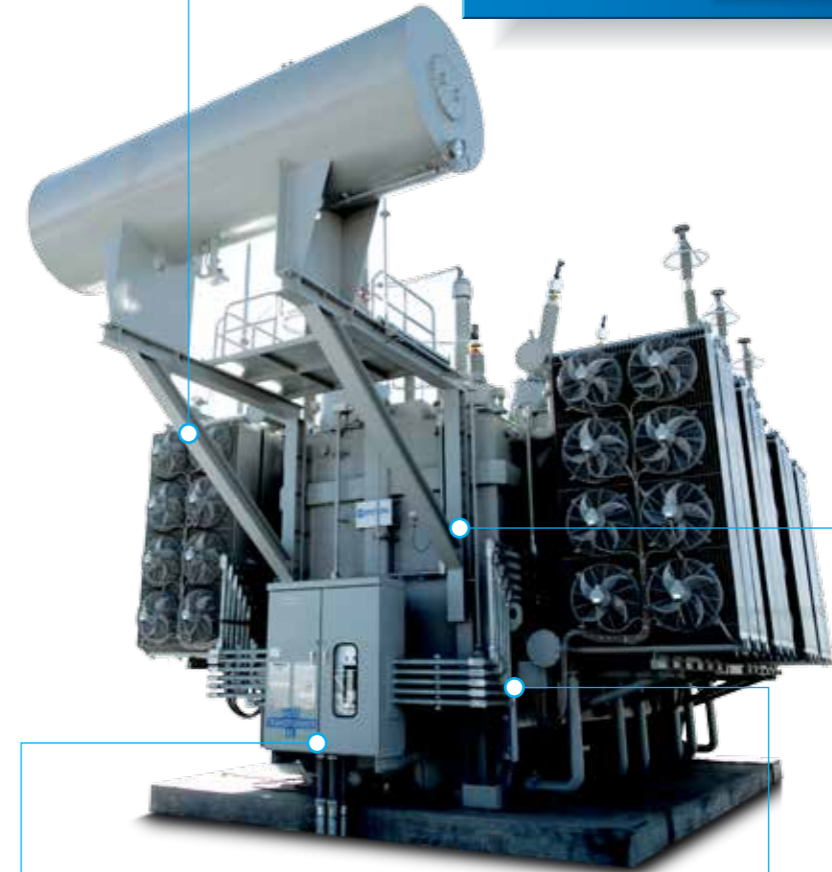
Transformer Condition Monitoring Solution

Total Monitoring System
TM-2000

- Monitor DGA, PD, OLTC, WTI/OTI, Fan/Pump condition, hot spot etc.
- Provide accurate diagnosis result and alarm

On-line DGA System
TM-200

- Monitor 8 critical gases
- Diagnosis based on unique algorithm



On-line UHF PDM System
TM-1000

- High sensitive on-line PDM solution
- Location estimation of PD

Portable PDM Device
TM-100

- Rapid and easy application on-site
- Location estimation of PD

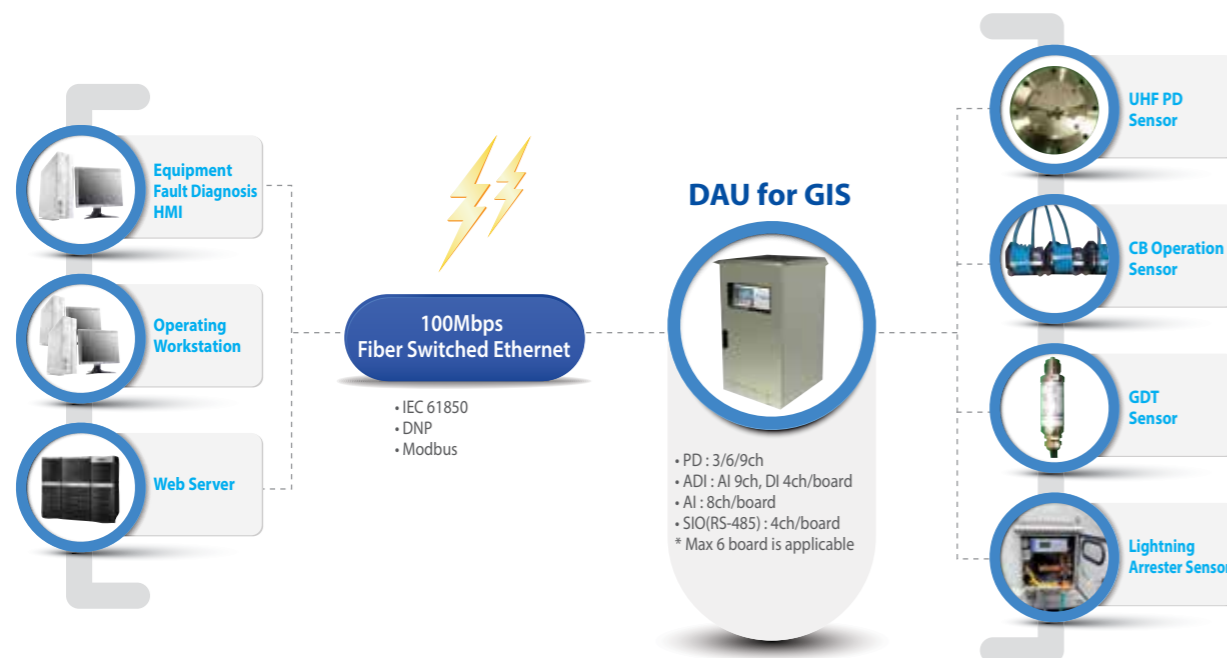
GIS Monitoring & Diagnosis Solution

On-line GIS Total Monitoring System HiCMS GM-3000

UHF PD | Lightning Arrester Degradation Monitoring | SF₆ Gas Density | Operating Characteristics of CB

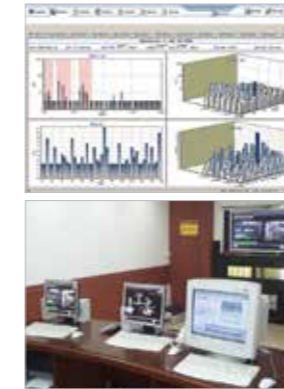
Items	Specification	Note
Operating Temperature	-25 ~ 60°C	
Operating Humidity	10 ~ 90%	
Number of PD Input Channel	9ch	
Detection Frequency Bandwidth	100~2,000MHz	
Detection Sensitivity	Less than 1pC	
Calibration Signal	1GHz, -50dBm	Watch dog for RF module
Analog / Digital Module	Analog : 9ch, 4 ~ 20mA Digital : 4ch, dry contact	Gas density and CB monitoring
SIO Module	RS-485, 4ch	LA monitoring
Size	19 inch / 4U	

System Configuration



Components

HMI



- HMI is an interface display where various pieces of information obtained from the field is transmitted via communication with the station controller; various data and trends are displayed; obtained information is categorized into databases; equipment condition/status is diagnosed via diagnostic algorithms; equipment service life is forecast and monitoring schedules are proposed based on data analysis; malfunctioning areas are indicated during an accident; and solutions to eliminate failure are suggested. HMI is the state-of-the-art diagnostic solution that combines the latest computing and digital technologies.

Station Controller (Main Unit)



- The station controller receives equipment condition-monitoring data from the DAU (Data Acquisition Unit) which compiles raw data measured from the sensors installed in the field, and transmits the information to upper-tier HMI through the internal communications controller.
 - » Offers system redundancy
 - » Provides easy-to-use interface with other facilities, through multi-protocols
- The station controller converts and processes the data collected from the communication controller and transmits them to upper-tier HMI. It also analyzes the control instructions from upper tiers and delivers them to lower-tier DAU.
 - » Configures individual communication channels between lower-tier systems
 - » Enables peer-to-peer communication between upper-tier and lower-tier systems, respectively, and allows self diagnosis
 - » Controls communication error (critical data backup and restoration)
 - » Connects to Ethernet (10/100 Mbps) and serial devices (RS-232/422/485)
 - » Supports multi-protocols (e.g., DNP 3.0, Modbus, Modbus Tcp)
 - » Allows system database downloading from upper-tier hosts
 - » Offers system stability through redundancy
 - » IEC 61850 Protocol is applicable

DAU (Local Unit)

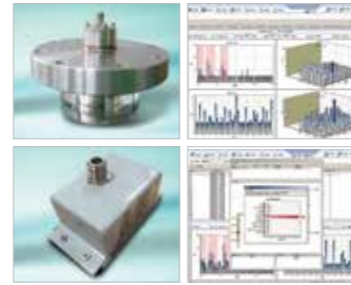


- Based on diagnostic algorithms optimized for the transformer/GIS, DAU attains data from various sensors and delivers the information needed for alarm and diagnosis.
 - » Adopts high-performance DSP chip and conducts high-speed real-time A/D conversion
 - » Stores data for 24 hours during a communication failure
 - » Capable of optic and serial (RS-232/422/485) communication
 - » Detects problems and issues alarms in accordance with its internal algorithm
 - » Capable of integration monitoring of various sensors is possible

Monitoring and Diagnosis Items

Partial Discharge

- Through the analyzer installed in the field, UHF signal, generated when partial discharge occurs in GIS, is captured, and the PD magnitude (pC), cause, location, tendency, and risk are analyzed to provide reasonable data on the operating condition.
- Monitoring time and service life can be forecast, and a warning (message) is issued and monitoring instructions are provided when the set limits are reached.
- Features such as PRPD (Φ -q-n), PRPS (Φ -q-t), and noise masking are offered selectively.
- External noise sensor for noise elimination (Optional)



Lightning Arrester Degradation Monitoring

- The total leakage current and 3rd harmonic leakage current of the lightning arrester are monitored constantly, and at the same time the trend can be identified.
- When the threshold value are reached, a warning (message) is issued, and the information on monitoring time and remaining service life is provided.



SF₆ Gas Density

- Using gas density sensors, the pressure of SF₆ gas (GIS insulation medium) is monitored, and a sensor is mounted in each gas section to monitor the gas-tightness.
- During internal flash over, though very rare, the instantaneous rise in pressure is identified to locate where failure has occurred and to allow prompt maintenance.



Operating Characteristics of CB

The measurement of the current and operating time of trip coil, the current and operating time of close coil, the operating time of mechanical aux. contact and CB traveling curve are measured to find if there is any problem with the control circuit, control pressure or CB, if there is any delayed operation in the hook/pilot/main valve, any problems with CB due to abrasion/deformation.



High-end Level On-line UHF PD Monitoring System for GIS HiCMS GM-4000

The Hyosung HiCMS GM-4000 is a on-line continuous monitoring system for assessing the insulation condition of GIS. This PDM shall continuously detect and record the PD signals generated by all PDs in the GIS. Using this new system, operator can prevent unexpected failure of GIS.



Features

- High sensitive PD monitoring solution based on UHF PD detection technique
- Continuous and real time monitoring of PD signals
- Real PD discrimination is possible using noise elimination technique
- Advanced algorithm provide the precise analysis
- Rugged and reliable for the external surge on site

Specification

Item	Specification
Detection frequency bandwidth	100 ~ 2,000MHz
Input range	-80 ~ -20 dBm
No. of Input channel	3Ch / 6Ch / 9Ch
Sensor type	Internal and external type sensor
Detection sensitivity	Less than 1pC
Operating temp.	-30 ~ +80°C
Case dimension	400 x 500 x 210mm
IP rating	IP 66

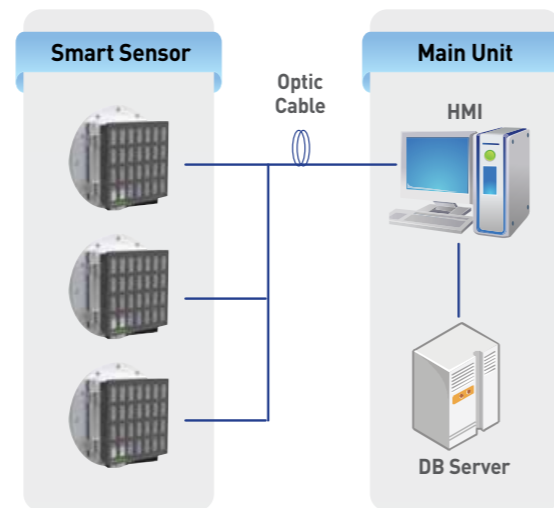
Entry-level On-line UHF PD Monitoring System for GIS HiCMS GM-500

The HiCMS GM500 (Smart sensor) developed by HYOSUNG continuously monitors the power equipment and automatically discriminates PD cause using UHF PD detection techniques. This monitoring device is very compact and has competitive price because it is an all-in-one system composed of PD sensor, noise sensor, RF circuit, signal processing H/W and communication module. This solution is aimed at providing reliable power equipment operation and reducing maintenance cost by unexpected failure.



Features

- High sensitivity and excellent reliability
- Robustness to external noise using noise gating technology
- Has Ultra wide-band characteristics



<System configuration>

Specification

Item	Specification	Note
Input frequency range	100MHz ~ 2,000MHz	
Input signal level	-80 dBm ~ -20 dBm	
Minimum sensitivity	Less than 1pC	
Self test pulse generator	1GHz, -50dBm	Watch dog for RF module
Number of CH	2ch/Unit	1ch : PD detection 2ch : Noise detection
Operating temperature	-30°C ~ 80°C	
Operating humidity	30% ~ 95%	
IP rating	IP 66	

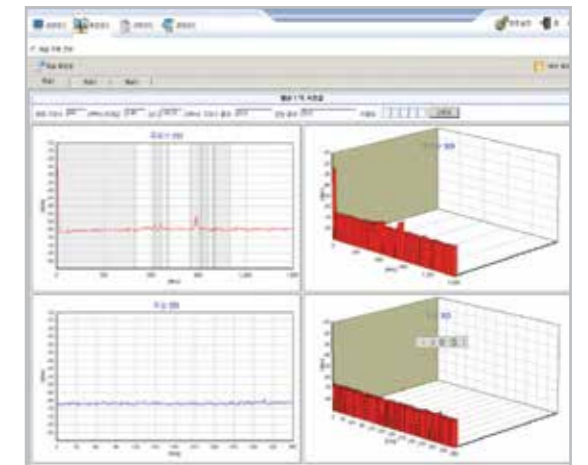
Portable UHF PD Monitoring System for GIS HiCMS GM-100

The HiCMS GM100 is a versatile, portable UHF partial discharge (PD) analyzer. This device detects and records the UHF PD signal generated by defects in the GIS. Using the internal and external type sensors, it will provide the early warning of unexpected failure before complete breakdown occurs.



Features

- Partial Discharge(pC) measurement for each compartment of GIS
- Location estimation of Partial Discharge position
- Analysis algorithm to classify both PD and background noise. (Free moving particles, spacer crack, void in insulator, floating electrode, Protrusion, Cellular phone Noise, etc..)
- Using noise masking technology, reliable diagnosis is possible.
- Risk assessment of Partial Discharge (5step Guidance Alarm)
- Fully protected against surge and transient overvoltage



Specification

Item	Specification
Detection bandwidth	100 ~ 2,000MHz
No. of Input channel	3 or 9 Channel
Sensor type	Internal and external type sensor
Supply voltage	100 ~ 230VAC / 50 ~ 60Hz
Synchronization	PT signal or internal
Operation temp.	-10 ~ 50°C
Weight	about 20kg
Case dimension	538 x 406 x 211mm

Transformer Monitoring & Diagnosis Solution

On-line Transformer Total Monitoring System HiCMS TM-2000

Main Views for the System



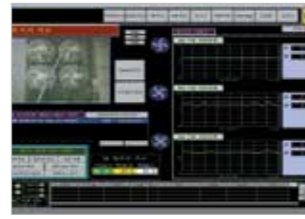
For transformer oil degradation (dissolved gas) measurement

- » Views gas-specific history and tendency
- » Views on-site installation
- » Displays dissolved-oil alarms/events



For transformer oil temperature measurement

- » Constantly monitors transformer oil temperature
- » Compares differences between outside and transformer oil temperatures for monitoring purposes
- » Follows trends in temperature on a daily/weekly/monthly basis



For cooling fan/pump motor current measurement

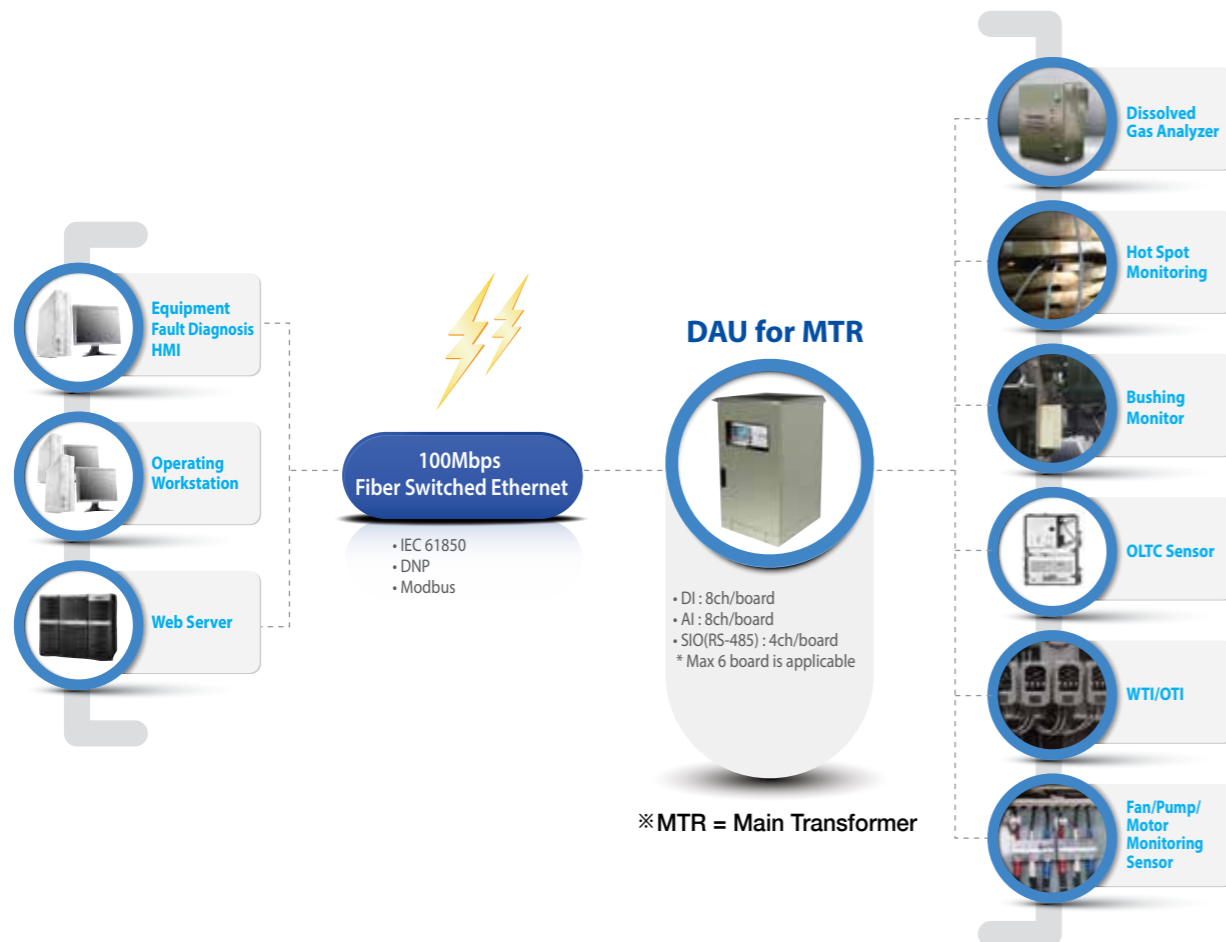
- » Indicates operating current and time for fan motors
- » Shows fan motor operation status
- » Displays motor current-related events



For web-based transformer status measurement

- » Monitors oil temperature, dissolved gas and other parameters remotely by using internet browsers
- » Conducts real-time comprehensive analysis of trends and history

System Configuration



Monitoring and Diagnosis Items

Transformer Oil Degradation (Dissolved Gas)

- Perform real-time measurement of the amount of H₂, CO, C₂H₂ and C₂H₄ etc., generated in the transformer tank
- Issues an alarm when the amount of dissolved gas exceeds the set limits or shows an abrupt change
- Perform self-diagnosis and issues alarms in the event of sensor failure



Hot Spot Monitoring

- Robust fiber optic temperature sensors which were installed on insulation spacer or surface of coil provide the exact temperature of hot spot directly
- Using the real time temperature, efficient transformer operation is possible



On-line Bushing Monitor

- Bushing monitoring system provide real time information of bushing condition
- Install coupling units on bushing of power transformer in order to measure PD activity and capacitance



OLTC Monitoring

- Indicates the present value and trend for contact wear, torque, OLTC temperature, and operating frequency
- Issues alarms and presents inspection messages when the threshold value are exceeded



Transformer Oil / Winding Temperature

Indicates for each tank the present value and trend for top oil temperature, ambient temperature, load current, average oil temperature increase, and winding Hot-spot temperature



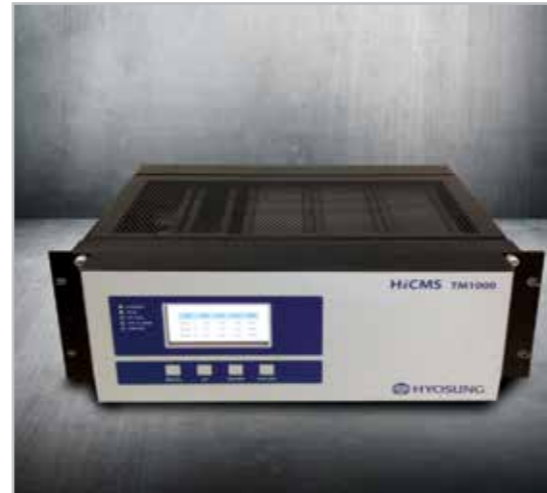
Cooling Fan / Pump Motor Operating Condition

Diagnoses the operating condition of transformer fans and pumps and the operating status of current fans and pumps, issues alarms when current exceeds the threshold value, and operates the TM-2000 system to inform the operator about what has caused the problem (e.g., power failure, motor failure, overload)

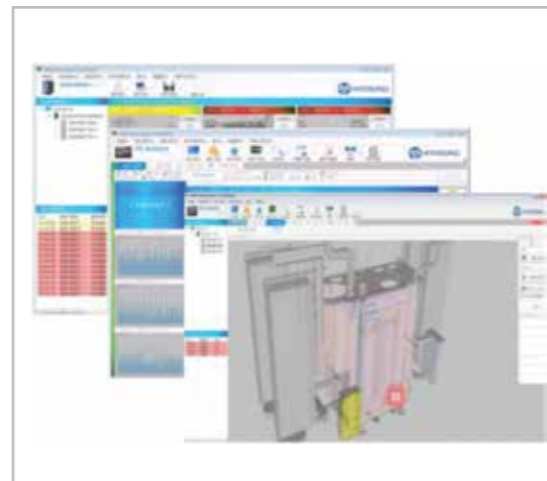


On-line UHF PD Monitoring System for Transformer HiCMS TM-1000

The HiCMS TM1000 is a monitoring system for assessing the condition of transformers in the field. The system is an on-line partial discharge (PD) monitoring system for power transformers. By monitoring the in-service partial discharge, the insulation performance can be reliability assessed over time and proper maintenance can be taken before a failure occurs.



<DAU>



<HMI>

Features

- High sensitive PD detection for transformer based on the UHF PD measurement technique
- Location estimation of Partial Discharge position in transformer using the time of flight method.
- Analysis algorithm to classify both PD and background noise.
- Using noise masking technology, reliable diagnosis is possible.
- Fully protected against surge and transient overvoltage

DAU Specification

Item	Specification
Detection frequency bandwidth	300 ~ 1,500MHz
Input signal level	-85 ~ 0dBm
Detection sensitivity	Less than 1pC
No. of Input channel	12ch
Operation temp.	-25 ~ 60°C

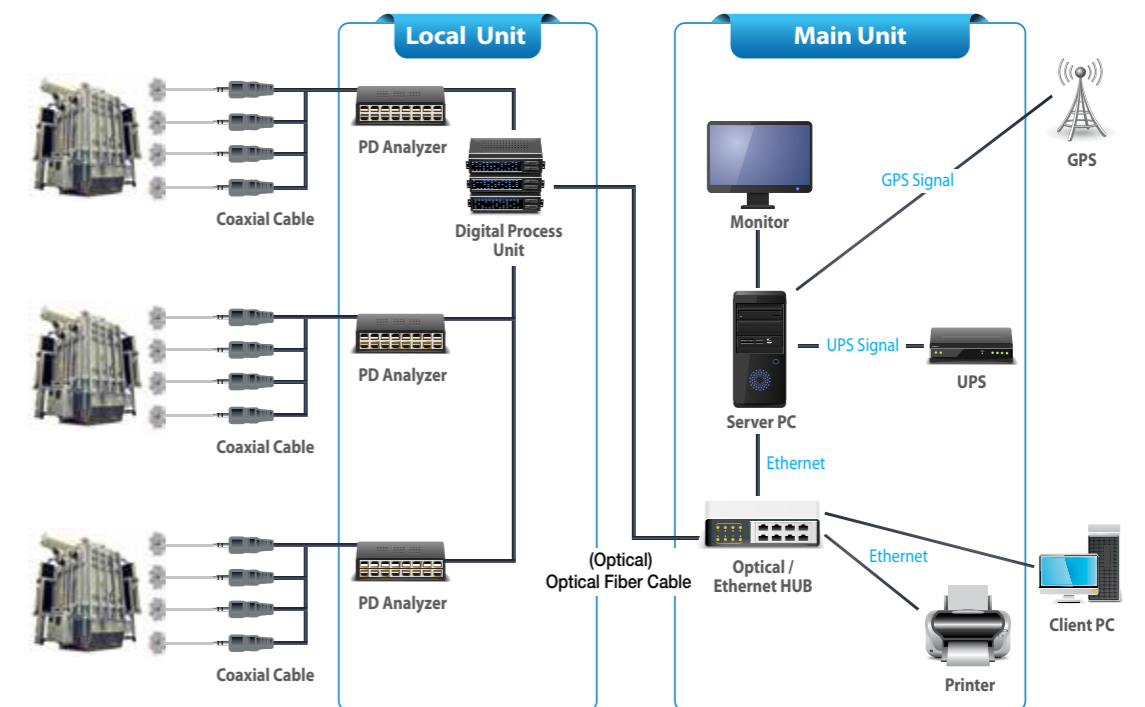


<UHF PD sensor>

UHF PD Sensor Specification

Item	Specification
Detection bandwidth	300 ~ 1,500MHz
Sensor type	Monopole type sensor
Sensor install position	Drain valve
Sensitivity	49.8 mV at 50pC
Withstand pressure	0.5 Mpa (5.098 kgf/cm ²)
Maximum temperature	120°C

System Configuration



On-line DGA System for Transformer HiCMS TM-200

The HiCMS TM200 is an on-line DGA monitoring system for assessing the condition of transformers in the site. DGA (dissolved gas analysis) of transformer oil is the best indicator of a transformer's overall condition. The HiCMS TM200 base on Hyosung's new analysis algorithm provides the most reliable DGA condition assessment available.



Features

Prevent Transformer Failures

Continuous trending of key fault gases gives early and immediate notification of incipient faults that can lead to transformer failure. It provides the important and timely information you need to maintain the reliability of your transformer fleet.

Minimal Maintenance

(If Transfix used) No carrier gases or calibration gases required. It reduces running costs and site visits. Also when installation performed, no outages required which reduces expense and inconvenience for user.

Communications

Two separate channels for remote communications, local USB connection and Ethernet connection provided. Communication protocols supported include MODBUS®, MODBUS/TCP, DNP3.0, IEC61850®. Modules available for connection via RS232, RS485, Ethernet, PSTN modem and GSM or CDMA wireless modems.

Hyosung DGA Algorithms

- Advanced Gas Ratio Method : Optimum gas ratios selected for improvement of diagnosis accuracy and Optimum gas-ratio combinations for improvement of diagnosis accuracy.
- Advanced % Gas Methods : Fault diagnosis by four % gases and Fault diagnosis by two of four % gases.

Lower Costs Through CBM*

Only comprehensive on-line monitoring can provide the information that enables continuous transformer condition assessment. Comprehensive analysis of key fault gases and other key parameters enables intelligent management of transformers, extending their useful life. CBM* (Condition Based Maintenance)

Gas Analysis

Oil sampling is continuous and gas analysis intervals are user-selectable from 1 hours to 4 weeks. All data is date and time stamped and up to two years of data is stored in memory. Automatic schedule acceleration when rate of change alarm limit is exceeded (Default : 1 hr).

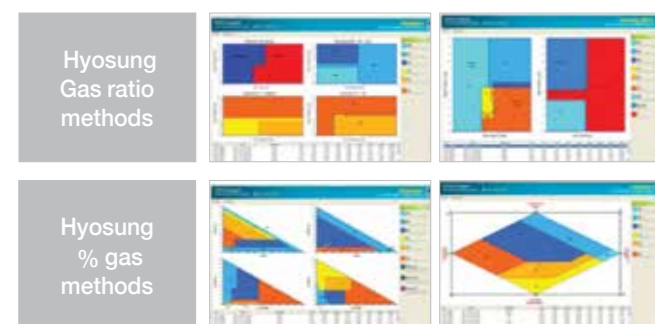
DGA Software

HiCMS TM 2000 software and services offer simple yet powerful analytical tools for transformer monitor control, data presentation and analysis as well as management functions. The application software, included with each transformer monitor product, is used to locally or remotely control, retrieve, store, and view data.

DGA Algorithm Accuracy

Regarding IEC TC 10 / IEEE Data 122 Case, Test results of Hyosung and International DGA algorithms are below

Diagnostic Algorithm	Unresolved Diagnosis (%)	Wrong Diagnosis (%)	Accuracy Rates (%)
Hyosung	0.0	3.2	96.8
Key Gas	3.2	38.7	58.1
Dornenburg	15.1	1.1	83.9
Rogers	37.6	17.2	45.2
IEC	17.2	16.1	66.7
Duval Triangle	0.0	12.9	87.1
Diag. Code (Japan)	8.6	48.4	43.0



Technical Specification

PARAMETER (Compound)	VALUES (Measurement range)
Hydrogen (H ₂)	5 - 5,000 ppm
Carbon Monoxide (CO)	2 - 50,000 ppm
Carbon Dioxide (CO ₂)	20 - 50,000 ppm
Methane (CH ₄)	2 - 50,000 ppm
Acetylene (C ₂ H ₂)	0.5 - 50,000 ppm
Ethane (C ₂ H ₆)	2 - 50,000 ppm
Ethylene (C ₂ H ₄)	2 - 50,000 ppm
Water (H ₂ O)	0-100% RS (given in ppm)
Oxygen (O ₂)	150 - 50,000 ppm, ±10%
Nitrogen (N ₂)	10 - 130,000 ppm, ±15%
Accuracy**	1± 5% or ± LDL (whichever is greater)

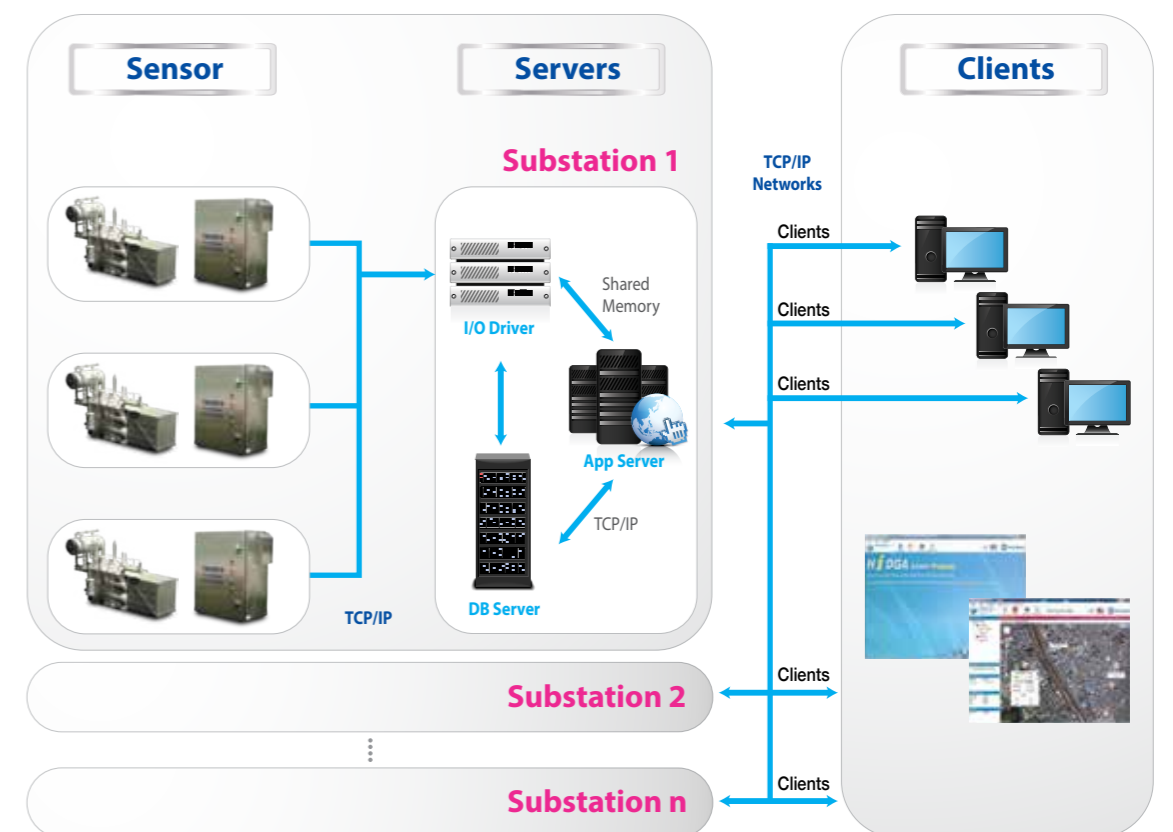
** Accuracy quoted is the accuracy of the detectors during calibration.

Environmental

PARAMETER (Compound)	VALUES (Measurement range)
Temperature Range	-40 to 55°C (-40 to 131°F)
Oil Temperature Range	-40 to 120°C (-40 to 248°F)
Power Supply	90 - 250 VAC; 47 - 63Hz; 150W (8A max)
Operating Humidity	10 - 95% RH non-condensing
Enclosure	IP55
Weight	78 kg (172 lbs)
Single Phase Alarm Relays	NO and NC provided, 5A 250 VAC, 5A 30 VDC.
Measurement Frequency	Variable - 1 per hour to 1 every 4 weeks



System Configuration



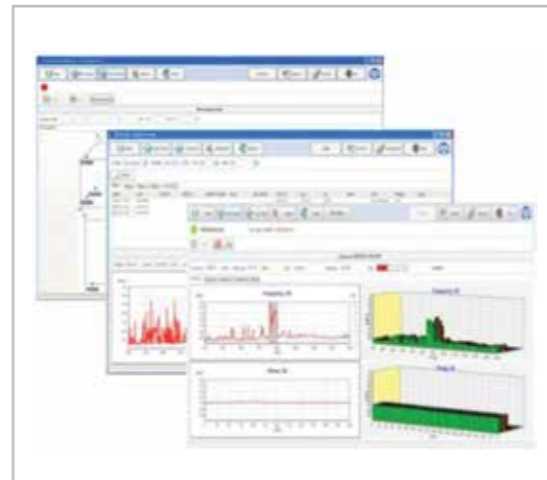
Portable UHF PD Monitoring System for Transformer HiCMS TM-100

The HiCMS TM100 is the portable UHF PD analyzer suitable for monitoring of PD activity in transformer. This device detects and records the UHF PD signal generated by defects in the transformer without outage. Using the Hyosung's unique algorithm, TM 100 determine the defect cause and location, then it will provide the early warning of unexpected failure before complete breakdown occurs.



Features

- Partial Discharge(PC) measurement for each compartment of transformer.
- Analysis algorithm to classify both PD and background noise.
- Location estimation of Partial Discharge position in transformer using the time of flight method.
- Convenient and handy through light weight, compact size and battery operation.
- Fully protected against surge and transient overvoltage



Specification

Item	Specification
Detection bandwidth	300 ~ 1,500MHz
Input signal level	-85 ~ 0dBm
No. of Input channel	4ch
Sensor type	Monopole type sensor
Sensor install position	Drain valve
Supply voltage	90 ~ 264VAC / 50 ~ 60Hz
Synchronization	PT signal or internal
Operation temp.	-25 ~ 55°C
Weight	about 20kg
Case dimension	411 x 322 x 168mm

Total Integrated Condition Monitoring Solution with Web & Mobile HiCMS Smart HMI

The HiCMS SmartHMI is a monitoring system for assessing the condition of transformers, GIS, Cables, Switchgears in the substation. The web and mobile access are available within substation network. This total integrated solution brings about the efficient enhancement not only in the operation of substation but also in cost-saving of maintenance.



Features

Highly Integrated Monitoring Solution

Smart HMI system provides total monitoring solution with all kind of power apparatus including transformer, GIS, Cable and Switchgear in the substation for the operators and asset managers. The existing condition monitoring system for each asset must be installed before SmartHMI. SmartHMI is the integrated software of all existing condition monitoring system. It is "One solution for All equipment"

Condition Based Maintenance

Given its online diagnostic capabilities, and ability to set alarms, the system can provide advanced notification of impending failure. Thus better decisions can be made earlier. The operators have all their assets and the entire system constantly in one view of real-time monitoring base.

Advanced Analysis Tools

Using internationally recognized algorithms approved by IEEE and IEC, the best possible diagnosis of fault conditions can be realized. The Dissolved Gas Analysis, TMS tools or UHF PD Analysis are available techniques for the Transformer monitoring in SmartHMI. GIS condition monitoring tools include the partial discharge, circuit breaker operation, leakage current of lightning arrester, gas density analysis. Cables and other assets assessment tools are provided on request. Alarming set-points can be setup from the beginning and modified over time as the assets' normal operating conditions are learned.

Web & Mobile Access

This system complies with the state-of-art mobile and web technology. The operators are able to access effects on the condition of their assets immediately and remotely, anywhere and anytime with their smart phone(android or i-phone) or PC web-browser. It is the most effective in providing visibility and insight into the substation asset management

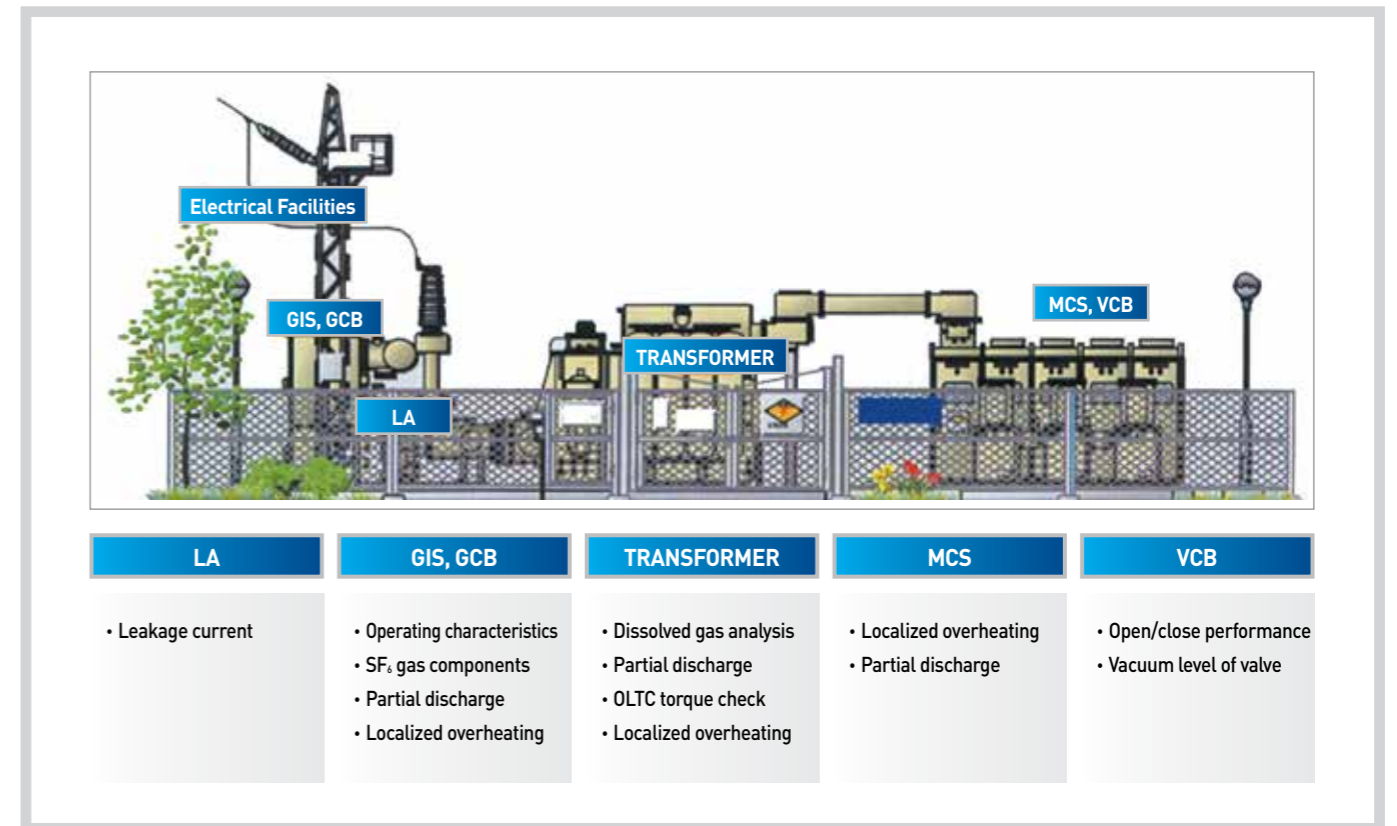
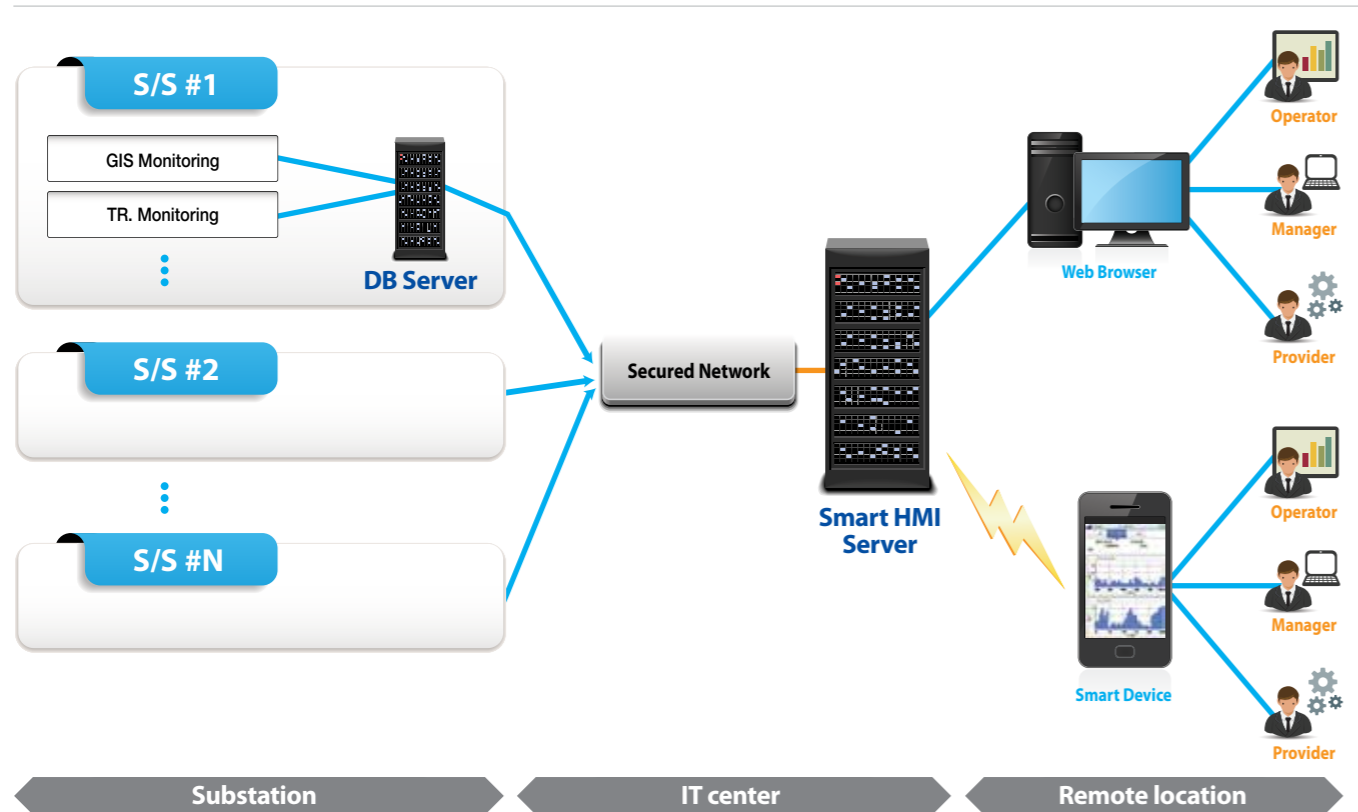
Maximized Network Security

To prevent unauthorized access, misuse or modification of substation network, Network Security is the most crucial aspect. With user authentication process, strong firewall and network separation are the minimum requirements of SmartHMI. Communication between SmartHMI Server and client(mobile phone apps or Web-browser of operator's PC) using substation network is encrypted to maintain security.



On-site Inspection Service

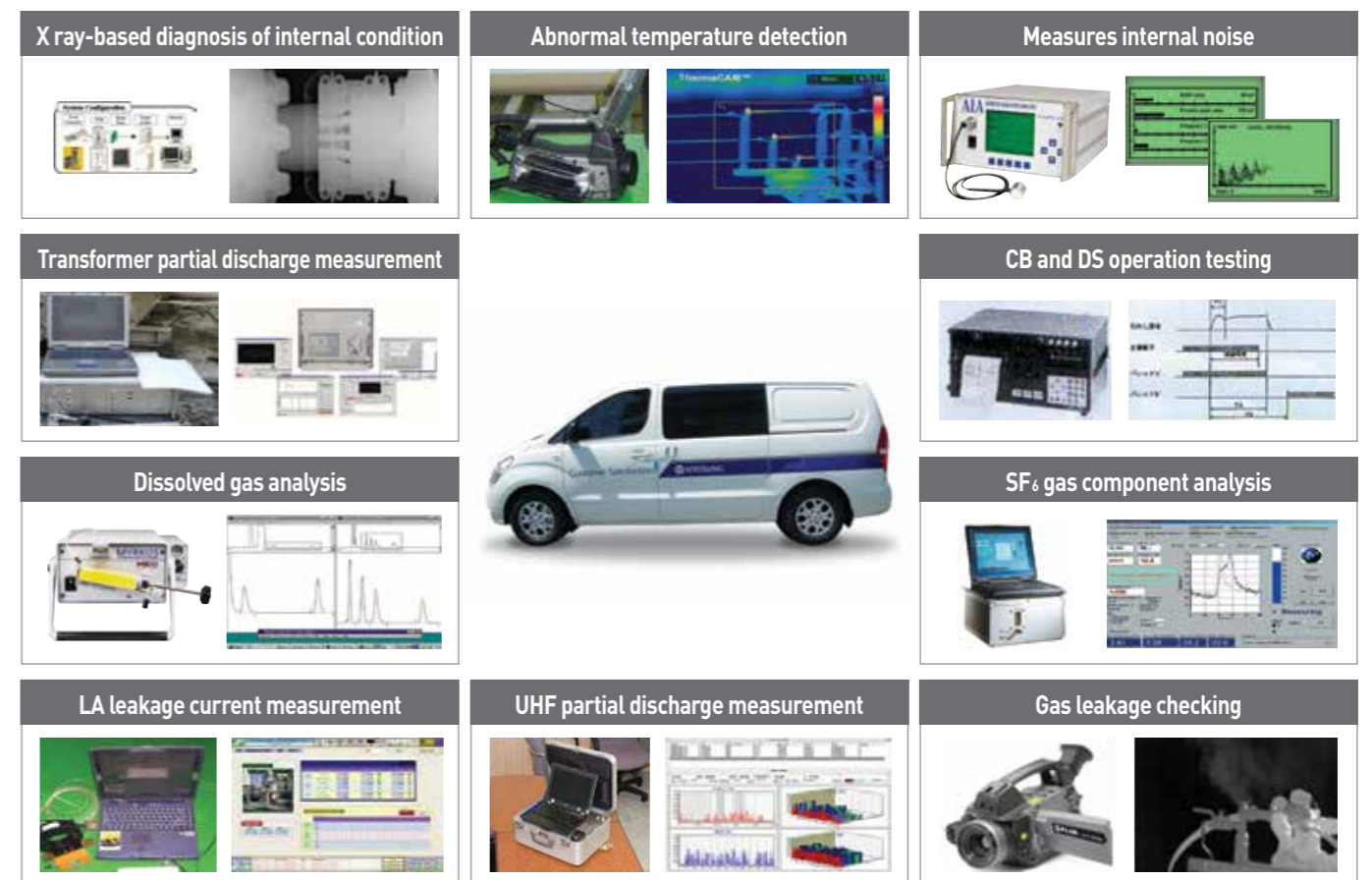
Typical Layout



Display Mode of Web HMI



Display Mode of Mobile Device



Global Network



DOMESTIC

TEXTILE & INDUSTRIAL MATERIALS

- ULSAN PLANT** (Nylon/Polyester chips, Nylon fibers, Polyester fibers, Tire cords, Aramid)
- GUMI PLANT** (Spandex, Polyester fibers)
- ANYANG PLANT** (Rolled carpets, Automotive carpets, Nylon BCF)
- EONYANG PLANT** (Steel cords, Bead wires)
- DAEJEON PLANT** (Tile carpets, PP BCF)
- DAEGU PLANT** (Dyeing)
- JEONJU PLANT** (Carbon fibers)

POWER & INDUSTRIAL SYSTEMS

- CHANGWON PLANT** (Transformers, Circuit breakers, Motors)
- SEJONG PLANT** (PV inverter, STATCOM, Welding machine)
- HGS CHANGWON PLANT** (Pumps)

CHEMICALS

- YONGYEON PLANT 1** (PP/DH, NF₃)
- YONGYEON PLANT 2** (TPA, Polyketone)
- YONGYEON PLANT 3** (TAC films, PET films)
- GUMI PLANT** (Polyester films, Nylon films)
- OKSAN PLANT** (TAC films, Coating films)

TRADING / INFORMATION & COMMUNICATION

- GUMI PLANT** (ATM)
- GWANGJU FROZEN STORAGE**

NORTH AMERICA

U.S.A

- Hyosung Holdings U.S.A., Inc. (Headquarter)
- Hyosung Holdings USA, Inc. (Houston Office)
- Hyosung U.S.A., Inc. (Headquarter)
- Hyosung U.S.A., Inc. (Decatur Plant)
- Hyosung U.S.A., Inc. (L.A. Office)
- GST LLC - South Hill
- HICO America Sales and Technology, Inc.
- Nautilus Hyosung America, Inc.
- Nautilus Hyosung GSC (Global Software Center)

CENTRAL & SOUTH AMERICA

BRAZIL

- Hyosung Do Brasil Ltda.
- Hyosung Brasil Ltda.
- Hyosung Brasil Industria E Comercio De Fibras Ltda.

MEXICO

- Hyosung Corporation Oficina de Mexico
- GST Automotive Safety Components International S.A. de C.V.

PANAMA

- Hyosung Corporation Panama Office

AFRICA

SOUTH AFRICA

- GST Automotive Safety South Africa (Proprietary) Limited

ASIA

CHINA

- Hyosung Chemical Fiber (Jiaxing) Co., Ltd.
- Hyosung Chemicals (Jiaxing) Co., Ltd.
- Hyosung International Trade (Jiaxing) Co., Ltd.
- Hyosung Spandex (Jiaxing) Co., Ltd.
- Hyosung Spandex (Guangdong) Co., Ltd.
- Hyosung Composites (Guangdong) Co., Ltd.
- Hyosung Financial System Co., Ltd
- Hyosung Spandex (Zhuhai) Co., Ltd.
- Hyosung Spandex Corporation Shaoxing Office
- Hyosung Spandex Corporation Zhangjiagang Office
- Hyosung Spandex Corporation Fujian Office
- Hyosung Spandex Corporation Qingdao Office
- Zhangjiagang Xiao-sha coil Service Co., Ltd.
- Hyosung Sumiden Steel Cord (Nanjing) Co., Ltd.
- Hyosung Steelcord (Qingdao) Co., Ltd.
- Baoding Hyosung Tianwei Transformer Co., Ltd.
- Nantong Hyosung Transformer Co., Ltd.
- Beijing Hyosung Computer Technology Co., Ltd.
- GST Automotive Safety (Changshu) Co., Ltd.
- Hyosung Corporation Beijing Office
- Hyosung Corporation Chongqing Office
- Hyosung Corporation Guangzhou Office
- Hyosung Corporation Shanghai Office
- Hyosung Corporation Wuhu Office

HONG KONG

- Hyosung International (HK) Ltd.

INDIA

- Hyosung Corporation India Pvt. Ltd.,
- Nautilus Hyosung India Office

INDONESIA

- Hyosung Corporation Jakarta Office
- Nautilus Hyosung Indonesia Office

JAPAN

- Hyosung Japan
- Hyosung Japan Osaka Branch

MALAYSIA

- Hyosung Corporation Kuala Lumpur Office

MYANMAR

- Myanmar Hyosung Co., Ltd.

PHILIPPINES

- Hyosung Corporation Manila Office

SINGAPORE

- Hyosung Singapore Pte, Ltd.

TAIWAN

- Hyosung (Taiwan) Corporation
- Hyosung Corporation Kaohsiung Office

THAILAND

- Sumiden Hyosung Steel Cord (Thailand) Co., Ltd.
- Hyosung Corporation Bangkok Office

U.A.E.

- Hyosung Corporation Dubai Office
- Hyosung Corporation - Abu Dhabi Office

VIETNAM

- Hyosung Vietnam Co., Ltd.
- Hyosung Dong Nai Co., Ltd.
- Hyosung Corporation Hochiminh Office

QATAR

- Hyosung Corporation Qatar Office

SAUDI ARABIA

- Hyosung Corporation Saudi Arabia Office

EUROPE

GERMANY

- Hyosung Corporation Frankfurt Office
- Lloyd Dynamowerke GmbH & Co. KG (LDW)
- GST GmbH - Maulburg
- GST GmbH - Murg
- GST GmbH - Bad Säckingen

ITALY

- Hyosung Europe S.R.L.

LUXEMBOURG

- Hyosung Luxembourg S.A.
- Hyosung Wire Luxembourg S.A.

POLAND

- GST Automotive Safety Poland Sp.z o.o.

ROMANIA

- GST Automotive Safety RO S.R.L.

RUSSIA

- Hyosung Corporation Moscow Office
- Hyosung Russia LLC

SPAIN

- Hyosung Corporation Barcelona Office

TURKEY

- Hyosung Istanbul Tekstil Ltd Sti
- Hyosung Corporation Istanbul Office