

ISAAC

SIEMENS ENERGY Advanced Partner

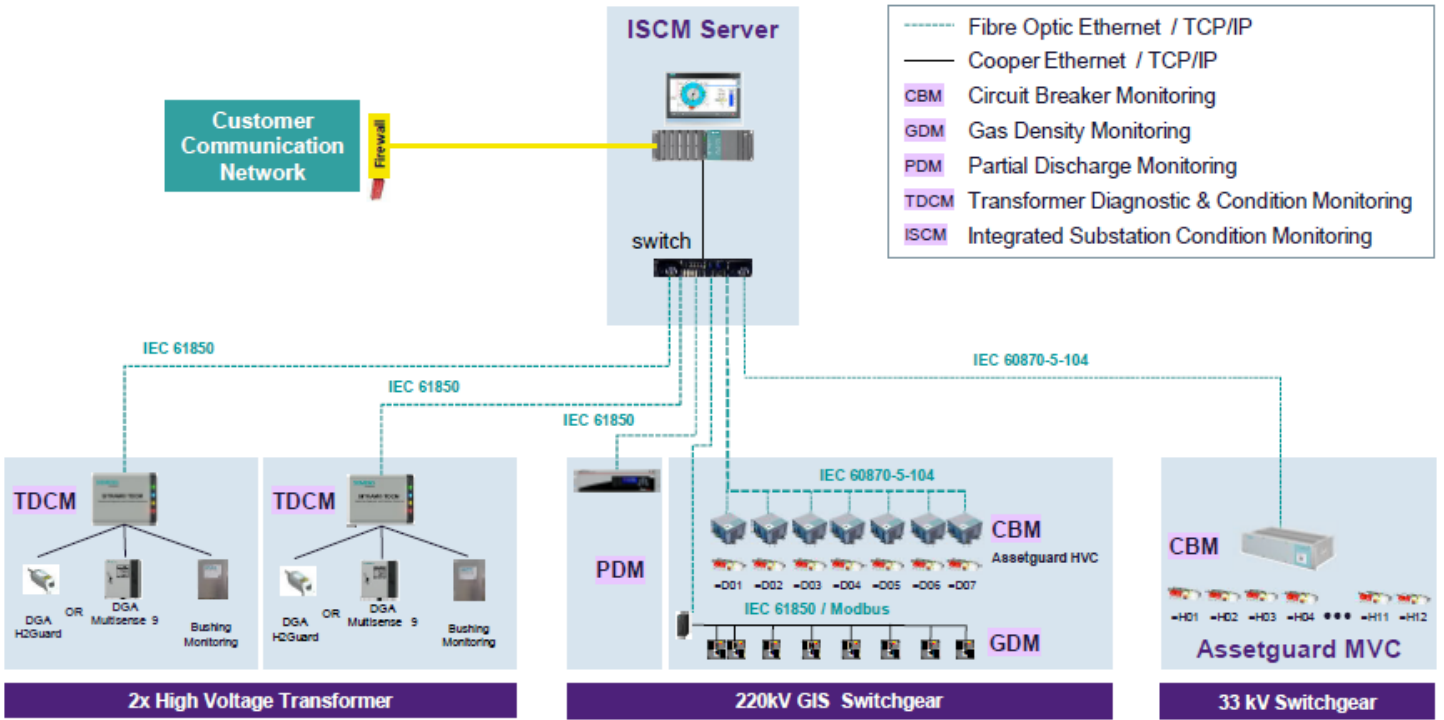
ISAAC PDS

이삭피디에스(주)는 IoT 센서를 기반으로 GIS, 변압기, 배전반, 케이블 제품의 사고를 예방하기 위한 전력기기 예방진단 솔루션을 보유하고 있으며, 이러한 기술을 활용한 BEFORE SERVICE 확보를 목표로 합니다.

초고압 전력기기의 예방진단제품 설계와 기술 개발로 통합 솔루션을 제공할 예정입니다.

2024 회사소개서

ISCM: Typical Architecture in a substation



변압기 예방진단



변압기 유증가스분석장치
(1중, 3중, 5중, 9중)
SITRAM MULTISENSE 외



변압기 PD 감시장치
TRANSMAX 1000



변압기 부싱감시장치
SBMS



변압기 감시진단장치
TDCM
(Transformer Diagnostic & Condition Monitoring)



OLTC 감시장치

GIS 예방진단



GIS 부분방전감시장치
ASSETGUARD PDM
(Partial Discharge Monitoring)



GIS CB감시장치
ASSETGUARD CBM
(Circuit Breaker Monitoring)

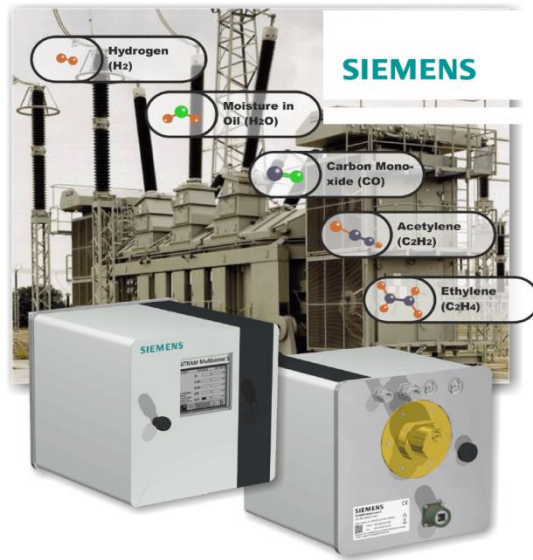


GIS 가스밀도감시장치
ASSETGUARD GDM
(Gas Density Monitoring)



변압기 예방진단 솔루션

변압기 유중가스 분석장치 / Gas Analysis device for Oil-filled Transformer



SITRAM H2Guard
드레인 밸브 부착형 DGA
1종(H₂)

SITRAM Multisense 5
드레인 밸브 부착형 DGA
5종(H₂, CO, C₂H₂, C₂H₄, H₂O)

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 전력연구원 송변전설비연구원 P/L 이종진 jg.lee@kepco.co.kr

문서번호 전력차(송변)-1527 경기도 군포시 군포힘단산업1로 15
 이삭엔지니어링
 시 행 일 2022. 7. 18. 수신 이삭엔지니어링
 참조 15881

제목 유중가스 분석장치 성능시험 결과 알림

- 귀 사의 무궁한 발전을 기원합니다.
- 귀사에서 요청한 유중가스 분석장치 성능시험과 관련하여 전력연구원에서 실시한 시험 결과를 아래와 같이 알려드립니다.

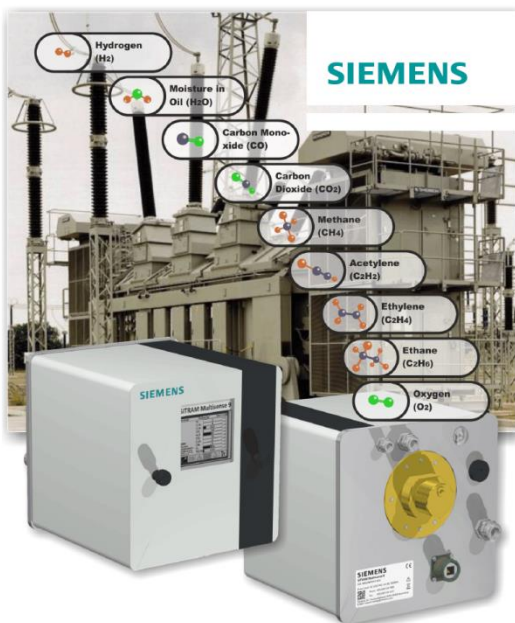
가. 신청사 : 이삭엔지니어링(주)
 나. 시험대상 : SITRAM Multisense 5(#88409, #88450)
 다. 시험기간 : 2021. 5. 23(월) - 2022. 7. 18(월)
 라. 적용규격 : 한전일반구매규격(GS-6625-0073)
 마. 시험결과 : 합격

분석장비 유형	검출대상 가스	시험 항목	성능시험 결과
3종 가스 검출장치	H ₂ , CO, C ₂ H ₂	오차 10% 이내	합격

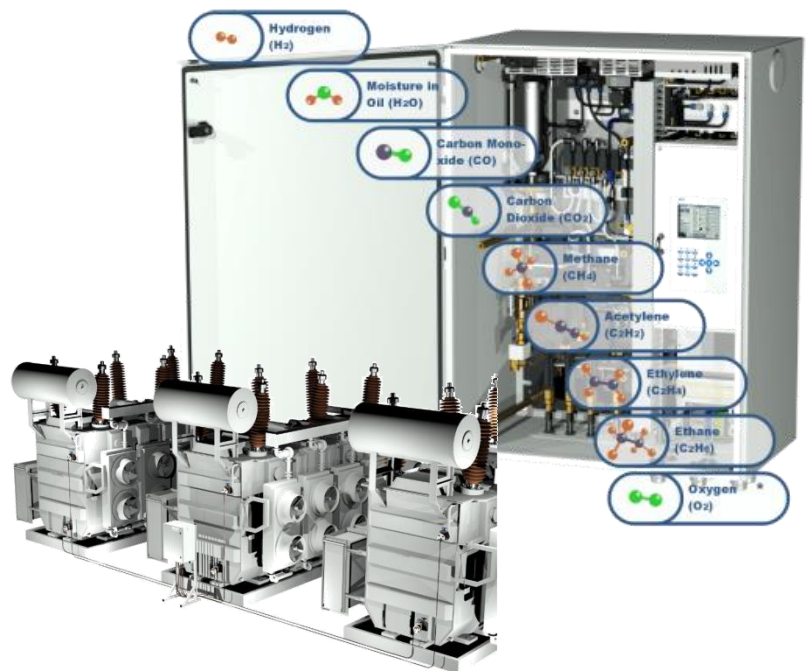
사. 시험료 : 6,306,300 원(부가세제외)
 ○ 시험료 납부계좌 : 농협중앙회 478-01-002271 한국전력공사. 끝.

전력연구원장

변압기 유중가스 분석장치 / Gas Analysis device for Oil-filled Transformer



SITRAM Multisense 9
드레인 밸브 부착형 DGA
9종(H₂, CO, CO₂, CH₄, C₂H₂,
C₂H₄, C₂H₆, O₂, H₂O)



SITRAM Multiense 9-3
오일 순환형 멀티탱크 DGA
9종(H₂, CO, CO₂, CH₄, C₂H₂,
C₂H₄, C₂H₆, O₂, H₂O)

변압기 예방진단 솔루션

변압기 유중가스 검출장치 / Gas Monitor for Oil-filled Transformer



HiPDS-PDS-GM2-H
드레인 밸브 설치형 DGA
2종(H₂, CO, 수분)



HiPDS-GM3-L
오일순환형 DGA
3종(H₂, CO, C₂H₂, 수분)



TGM-3i
드레인 밸브 삽입형 DGA
3종(H₂, CO, C₂H₂, 수분)

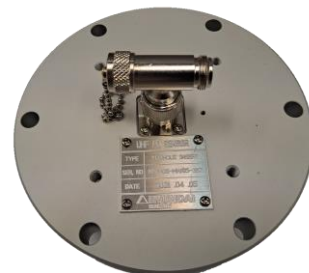


KEPRI-TGM3-L
오일순환형 DGA
3종(H₂, CO, C₂H₂, 수분)

변압기 부분방전 검출용 UHF 센서



MS-PDS-DV500
Drain valve type UHF PD sensor



MS-PDS-MH165
Window type UHF PD sensor

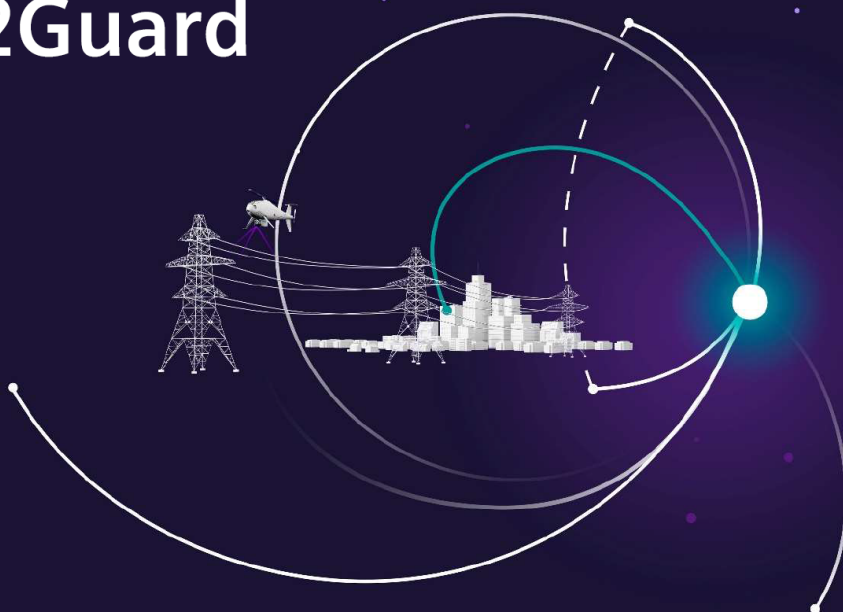
1. SITRAM H2Guard (1/2)

SIEMENS
ENERGY

SITRAM H2Guard

Monitoring & Diagnostics

[siemens-energy.com/t-service](https://www.siemens-energy.com/t-service)



Introduction

Among the reasons for transformer outages, failures related to the winding have the highest rank. In case of present partial discharge phenomena which are also referred to as "sparking" the transformer oil produces internal gases along this problematic process of insulation capability loss.

One reason for the statistical outcomes in researched failure rates could be that the transformer oil is usually tested accordingly offline by classical analysis in oil laboratories. This procedure is not always trivial and only an incomplete picture can be drawn because of the nature of non-continuous test approaches.

With the SITRAM H2Guard, the new online DGA system (DGA: dissolved gas analysis), Siemens Energy offers a versatile single gas monitoring system for hydrogen measuring.

Features

SITRAM H2Guard enables asset managers to check the condition of the transformer oil in a continuous way and having the advantages of trending and histories functionalities.

The asset condition data allows a thorough evaluation and can reveal developing equipment issues before they become a problem.

SITRAM H2Guard allows:

- Use as a stand-alone system, or in combination with superior monitoring platforms
- Easy integration into existing SCADA landscapes through standard communication and protocol interfaces.

The actual miniature sensing element is located in the probe tube which should be fully inserted into the liquid phase of the insulating oil at suitable locations at the transformer tank or the pipe system.

Benefits

- Improved scheduling of maintenance work and downtimes, repairs, adequate personnel support
- Extensible system
- Fast detection and reliable alarming
- Very durable & minimum maintenance in comparison with other products
- Easy to install/uninstall
- Interoperability and simple operation
- Price attractive ownership with quick amortization considering classical assessment approaches



1. SITRAM H2Guard (2/2)

Transmission Service for Transformer.

Scope of Work / Deliverables

- Standard electrical and mechanical connection kit or individual mechanical connection kit on request
- Optional external sensors e.g., for measurement of humidity or temperature on request
- Turnkey installation and communications services
- Expert analysis of monitoring data and customer support
- On-site training courses for operation and maintenance of our systems
- Design, installation, and commissioning of all necessary equipment.

Technical Details

The SITRAM H2Guard has an advantageous compact solid-state design involving the chemical elements Palladium (Pd) combined with Nickel (Ni) in a thin film alloy which catalyzes the molecular hydrogen into atoms which are picked up by the Palladium and bound into the metallic lattice inside the film.

During this process of binding the hydrogen from oil the bulk electrical properties of the alloy are changed and used as measurement basis.

Therefore, based on this measurement principle there is no need in consumables like reference gases which are used in gas chromatography, also no need for sensor element replacement, such in a classical membrane which is used in e.g. fuel cell sensor approaches based on the electrochemical principle or the thermal conductivity detection (TCD).

All in all, by that, the used sensor technology in SITRAM H2Guard becomes very robust operating and in case of support, Siemens Energy global service network is always happy to help.

Measuring Demands*

Range	25 – 5000ppm
Accuracy	20% of reading or 25ppm, whichever is greater
Repeatability	10% of reading or 15ppm, whichever is greater
Response Time	< 60min (90% of step change)
Cross-Sensitivity	< 2% to other gases CO, CO ₂ , CH ₄ , C ₂ H ₂ , C ₂ H ₄ , C ₂ H ₆ , C ₃ H ₈ , etc.

*For better understanding please refer to the details in the system manual.

SITRAM H2Guard – General Data

Supply Voltage / Power Consumption	110 to 240 VAC, 50-60Hz / max. 50 W
Ambient Operating Conditions	-40°C...+70°C, indoor/outdoor also in harsh EMC areas, 5%...95%RH (non-condensing) for complete operating temperature, 100% RH for gross of operating temperature range
Operating Conditions	• Pressure and vacuum withstanding Oil temperature, pressure: ≤ 105°C / ≤ 3bar
Physical Dimensions and Weight	Tube > ¾" NPT / 3.5", System > L:406 W:127 H140 mm (L:16.0 W5.0 H5.51 inch), 2.3kg
Ingress and Corrosion Protection	<ul style="list-style-type: none"> • IP67 (IEC 60529) • C5M (a.o. ISO 12944) • Weather and UV resistant powder coat (AAMA 2604) • Cast aluminum enclosure (UNS A03280) with a stainless steel probe tube (316 type)
Resistance to Shock and Vibration	Among others tested on basis of: <ul style="list-style-type: none"> • DIN EN 60068-2-6 – Shock and Vibration • DIN EN 60068-2-64 –Vibration Environmental Test • DIN EN 60068-2-27 – Shock Test for Transformer Environment Additional performed tests such as extended, aggressive vibration dwell at 50 and 60 Hz.
Data Rate	Maximal 1 measurement value per second, Self-calibration: 2h every 12h
Output Relays	Four "Form C" relays with NO, NC, and COM terminals are available for use
Analogue I/O	Supported functionality is dependent on firmware version* <ul style="list-style-type: none"> • 2 inputs, standard: 0-20mA (e.g., for connection of additional external sensors e.g. humidity) • 3 outputs, standard 0-20mA (first output is reserved to report hydrogen) *CLI or Software configurable I/O (current- or voltage input optional, current ranges)
Communication	<ul style="list-style-type: none"> • Serial RS-232 and RS-485, Mini-USB, Ethernet • Protocols: Modbus over Ethernet or serial
Memory	<ul style="list-style-type: none"> • Existing Micro-SD slot (support is dependent on firmware version) • Also sufficient data storage capability on internal flash memory
Display and Status LED Indication	<ul style="list-style-type: none"> • Multi-line OLED monochrome graphics display (orange text on black background) • Three bright discrete LEDs (red, yellow, green)

2. SITRAM Multisense 5 (1/6)



SIEMENS
Ingenuity for life

Customer Services for Transformers

SITRAM Multisense 5



Monitoring and Diagnostic

Introduction

In their average lifetime of 40 years, transformers endure various stresses that can contribute to a multiplicity of failures (electrical, thermal, chemical or mechanical). Transformer failures may cause e.g. costly damages of primary and secondary equipment, outages, environmental cleanup charges and a loss of reputation.

DGA (Dissolved Gas Analysis) monitoring with *SITRAM Multisense 5* helps utilities to avoid transformer failures.

SITRAM Multisense 5 indicates deviations and upcoming faults by analyzing the concentration of four dissolved key gases in transformer insulating oil, besides moisture. This helps to predict and prevent four major fault types:

Overheated oil (monitoring C_2H_4)
Partial discharge (monitoring H_2)
Overheated cellulose (monitoring CO)
Arcing in oil (monitoring C_2H_2)

Features

- Robust, NDIR measurement technology without moving parts or reference gas
- Easy installation directly at transformer
- Display and keypad enabling comprehensive configuration and setup without additional computer

- Easy to understand due to simple setup
- Compact, robust design (IP55)
- High accuracy enabling comprehensive early warning
- Various communication options
- Optional high- and low voltage bushing sensors for bushing monitoring applications from Siemens via communication interface
- Optional: 5 digital outputs, 5 digital opto-coupler outputs, 5 analog outputs, 10 analog inputs
- Monitoring functions:
 - Voltage and current monitoring (via voltage and current transformers / transducer)
 - Temperature monitoring: bottom and top oil temperature, ambient temperature (via additional temperature sensors)
 - Cooling stage / tap changer position monitoring (e.g. via current transducer)
 - Free configuration of analog inputs, free allocated to any additional sensor
 - Calculation of Hot-Spot (acc. IEC 60076), Loss-of-Life, Ageing Rate

Benefits

- Monitoring of key gases inside the transformer oil, enabling recognition of all various failure types

- Avoidance of serious costs due to failures or outages
- Cost savings thanks to scheduled and efficient transformer maintenance works
- Is easy to mount on a transformer valve (Installation without operational interruption)
- Uses advanced software (the unit and via PC)

Scope of work

- Configuration and administration of each individual Multisense unit
- Data and configuration read out of Multisense units
- Processing and visualization of data
- Read out (trend or table)
- Online functions (online sensors, extraction status and process flow)
- Further processing of the processed data (Excel, CSV, clipboard and printing)
- Storage of the processed data and unit configuration
- Automatic data read out and alerting by e-mail



Gas Analysis device for Oil-filled Transformer

2. SITRAM Multisense 5 (2/6)

- Standard electrical and mechanical connection kit, individual mechanical connection kit on request
- Installation flange (different ventilation sizes available)
- Turnkey installation and communications services (optional)
- On-site training courses for operation and maintenance for our systems
- Expert analysis of monitoring data and customer support (optional)

Technical Details

Operation Principle

- Miniaturized gas sample production based on headspace principle
- No membrane, negative pressure proofed
- Patent on oil sampling system (EP 1 950 560 A1)
- Near-infrared gas sensor unit for CO , C_2H_2 and C_2H_4
- Micro-electronic gas sensor for H_2
- Thin-film capacitive moisture sensor H_2O
- Temperature sensors (for oil and gas temperature)
- Optional nominal voltages of auxiliary supply: 120 V -20% +15% AC 50/60 Hz or 230 V -20% +15% AC 50/60 Hz or 120 V -20% +15% DC or 230 V -20% +15% DC

	Range	Accuracy
H_2	5-10000 ppm	$\pm 5\%$ or $\pm LDL$ (whichever is greater)
C_2H_2	1-10000 ppm	$\pm 5\%$ or $\pm LDL$ (whichever is greater)
CO	10-10000 ppm	$\pm 5\%$ or $\pm LDL$ (whichever is greater)
C_2H_4	1-10000 ppm	$\pm 5\%$ or $\pm LDL$ (whichever is greater)
H_2O	0 - 100%	$\pm 3\%$ or $\pm LDL$ (whichever is greater)

* Accuracy quoted is the accuracy of the detectors during calibration

- Power consumption: max. 350 VA
- Housing: aluminum, W 263 x H 263 x D 327.5 mm
- Weight: approx. 13,5 kg
- Operation temperature (ambient): -55°C - +55°C (below -10°C display function locked)
- Oil temperature (inside transformer): -20°C - +90°C
- Storage temperature (ambient): -20°C - +65°C
- Oil Pressure: up to 800 kpa (negative pressure allowed)
- Connection to valve: G 1½" DIN ISO 228-1 or 1½" NPT ANSI B 1.20.1
- Safety: CE certified, Isolation protection: IEC 61010-1:2001, Degree of protection: IP-55

Fault gas measurement

SITRAM Multisense 5 is executed in two steps: gas extraction (headspace technique) and gas detection (non-dispersive infrared radiation method). It measures the concentration of dissolved gases in the oil.

Discover Siemens comprehensive Transformer monitoring and sensor portfolio to get more information about Siemens comprehensive monitoring package for transformers, please contact your local partner or our Customer Support Center.

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*(Charges depending on provider)

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Gas Analysis device for Oil-filled Transformer

2. SITRAM Multisense 5 (3/6) 변압기 설치 사진



Gas Analysis device for Oil-filled Transformer

2. SITRAM Multisense 5 (4/6) 변압기 설치 사진



Gas Analysis device for Oil-filled Transformer

2. SITRAM Multisense 5 (5/6) 변압기 설치 사진



미금변전소 / 현대변압기(154kV)



미금변전소 / 현대변압기(154kV)



미금변전소 / 현대변압기(154kV)



미금변전소 / 현대변압기(154kV)



미금변전소 / 일진변압기(154kV)



신진천변전소 / 일진변압기(154kV)

Gas Analysis device for Oil-filled Transformer

2. SITRAM Multisense 5 (6/6) 변압기 설치 사진



마천변전소 / 효성변압기(154kV)



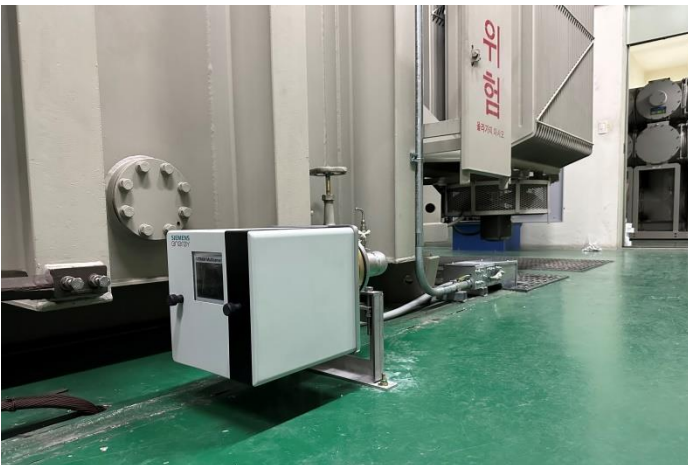
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마천변전소 / 효성변압기(154kV)



차릉변전소 / 현대변압기(154kV)



차릉변전소 / 현대변압기(154kV)



차릉변전소 / 효성변압기(154kV)

3. SITRAM Multisense 9 (1/2)



Customer Services for Transformers

SITRAM Multisense 9 Monitoring and Diagnostic

Introduction

In their average lifetime of 40 years, transformers endure various stresses that can contribute to a multiplicity of failures (electrical, thermal, chemical or mechanical). Transformer failures may cause e.g. costly damages of primary and secondary equipment, outages, environmental cleanup charges and a loss of reputation.

DGA (Dissolved Gas Analysis) monitoring with *SITRAM Multisense 9* helps utilities to avoid transformer failures.

SITRAM Multisense 9 indicates deviations and upcoming faults by analyzing the concentration of eight dissolved gases in transformer insulating oil (mineral and ester oil), besides moisture. This helps to predict and prevent eight fault types:

- High temperature thermal faults, overheated oil by monitoring C_2H_4
- Partial discharge, thermal faults, power discharges, galvanized parts, stainless steel, sunlight by Monitoring H_2
- Low & medium temperature thermal faults by monitoring CH_4
- Thermal fault involving cellulose, slowly from oil oxidation by monitoring CO
- Normal aging, thermal fault involving cellulose by monitoring CO_2

- Hot spot, low-energy discharge, high energy discharge (arc) by monitoring C_2H_2
- low & medium temperature thermal faults, local over heating by monitoring C_2H_6
- Exposure to atmosphere (air), leaky gasket (under vacuum), air breathing conservator, leaky bladder by monitoring O_2

Features

- Robust, NDIR measurement technology without moving parts or reference gas
- Easy installation directly at transformer - One man work
- Display and keypad enabling comprehensive configuration and setup without additional computer
- Easy to understand due to simple setup
- Compact, robust design (IP55)
- High accuracy enabling early diagnostic
- Optional: Various communication options, 13 digital outputs, 5 digital optocoupler outputs
- Optional: 10 analog outputs, 10 analog inputs
- Ambient humidity: 0-95%
- Monitoring functions:

- Voltage and current monitoring (via voltage and current transformers / transducer)
- Temperature monitoring: bottom and top oil temperature, ambient temperature (via additional temperature sensors)
- Cooling stage / tap changer position monitoring (e.g. via current transducer)
- Free configuration of analog inputs, free allocated to any additional sensor
- Calculation of Hot-Spot (acc. IEC 60076), Loss-of-Life, Ageing Rate

Benefits

- Monitoring of all diagnostic gases inside the transformer oil, enabling recognition of all various failure types
- Avoidance of serious costs due to failures or outages
- Cost savings thanks to scheduled and efficient transformer maintenance works
- Uses advanced software (the unit and via PC)
- Maintenance free system



3. SITRAM Multisense 9 (2/2)

Scope of work

- Configuration and administration of each individual Multisense unit
- Data and configuration read out of Multisense units
- Processing and visualization of data
- Read out (trend or table)
- Online functions (Status and process flow)
- Diagnostic functions (Duval triangle)
- Further processing of the data (Excel, CSV, clipboard and printing)
- Storage of the processed data and unit configuration
- Automatic data read out and alerting by e-mail
- Standard electrical and mechanical connection kit, individual mechanical connection kit on request
- Installation flange (different ventilation sizes available)
- On-site training courses for operation and maintenance for our systems
- Optional: Turnkey installation and communications services.
- Optional: Expert analysis of monitoring data and customer support

Technical Details

Operation Principle

- Miniaturized gas sample production based on headspace principle
- No membrane, negative pressure proofed proprietary
- proprietary oil sampling system
- Near-infrared (NDIR) gas sensor

Gas/Moisture-in-Oil Measurement		
Measuring Quantity	Range	Accuracy*
Hydrogen H ₂	5 ... 10.000 ppm	±5% or ± LDL (whichever is greater)
Carbon Monoxide CO	20 ... 10.000 ppm	±5% or ± LDL (whichever is greater)
Carbon Dioxide CO ₂	20 ... 20.000 ppm	±5% or ± LDL (whichever is greater)
Methane CH ₄	1 ... 5.000 ppm	±5% or ± LDL (whichever is greater)
Acetylene C ₂ H ₂	1 ... 10.000 ppm	±5% or ± LDL (whichever is greater)
Ethylene C ₂ H ₄	1 ... 10.000 ppm	±5% or ± LDL (whichever is greater)
Ethane C ₂ H ₆	1 ... 10.000 ppm	±5% or ± LDL (whichever is greater)
Oxygen O ₂	1000 ... 50.000 ppm	±10% or ± LDL** (whichever is greater)
Moisture	1 ... 100 %	±3% or ± LDL (whichever is greater)

* Accuracy quoted is the accuracy of the detectors during calibration

** LDL for O₂ is 100 ppm for special cases

- Temperature sensors (for oil and gas temperature)
- Optional nominal voltages of auxiliary supply: 120 V -20% +15% AC 50/60 Hz or 230 V -20% +15% AC 50/60 Hz or 120 V -20% +15% DC or 230 V -20% +15% DC
- Power consumption: max. 350 VA
- Housing: aluminum: W 263 x H 263 x D 327.5 mm
- Weight: approx. 15 kg
- Operation temperature (ambient): -55°C - +55°C (below -10°C display function locked)
- Oil temperature (inside transformer): -20°C - +90°C
- Storage temperature (ambient): -20°C - +65°C
- Oil Pressure: up to 800 kpa (negative pressure allowed)
- Safety: CE certified, Isolation protection: IEC 61010-1:2001, Degree of protection: IP-55

Fault gas measurement

SITRAM Multisense 9 is executed in two steps: gas extraction (headspace technique) and gas detection (non-dispersive infrared radiation method). It measures the concentration of dissolved gases in the oil.

Discover Siemens comprehensive Transformer monitoring and sensor portfolio. To get more information about Siemens comprehensive monitoring package for transformers, please contact your local partner or our Customer Support Center.

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*(Charges depending on provider)

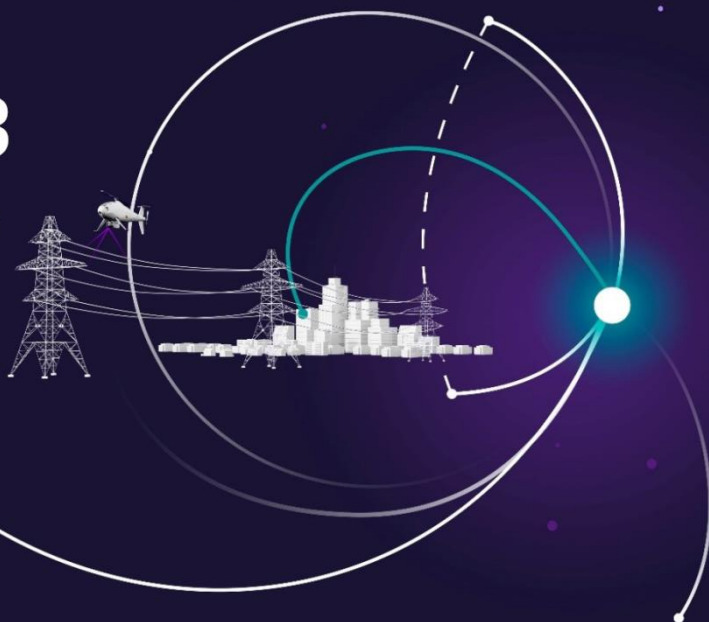
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4. SITRAM Multisense 9-3 (1/4)

SIEMENS
energy

SITRAM Multisense 9-3

Multi-Gas-in-Oil Analysis System for monitoring a bank of three single phase transformers located next to each other



siemens-energy.com/gt-service

Introduction

The Multisense 9-3 is designed for multi-gas-in-oil analysis on a bank of three single phase transformers located next to each other. This new wall mounted system allows for the individual measurement of Moisture in Oil (H₂O) and the key gases Hydrogen (H₂), Carbon Monoxide (CO), Carbon Dioxide (CO₂), Methane (CH₄), Acetylene (C₂H₂), Ethylene (C₂H₄), Ethane (C₂H₆) and Oxygen (O₂) dissolved in transformer oil utilizing a sampling system that samples oil from each tank via three separate oil channels expertly engineered to provide negligible mixing of oil.

As Hydrogen (H₂) is involved in nearly every fault of the insulation system of power transformers and Carbon Monoxide (CO) is a sign of an involvement of the cellulosic / paper insulation the presence and increase of Acetylene (C₂H₂) and Ethylene (C₂H₄) further classifies the nature of a fault as overheating, partial discharge or high energy arcing.

It is further equipped with digital outputs for the transmission of alarms or the execution of control functions (e. g. control of a cooling system of a transformer):

- 10 digital relay outputs (optional)
- 5 digital opto-coupler outputs (optional)

Key Advantages

- Hydrogen (H₂), Carbon Monoxide (CO), Carbon Dioxide (CO₂), Methane (CH₄), Acetylene (C₂H₂), Ethylene (C₂H₄), Ethane (C₂H₆) and Oxygen (O₂)
- Moisture-in-oil (H₂O) measurement
- Monitor three tanks with one Multisense 9-3
- Communication interfaces ETHERNET 10/100 Mbit/s (copper-wired / RJ 45 or fibre-optical / SC Duplex) and RS 485 to support MODBUS[®]RTU/ASCII, MODBUS[®]TCP
- Optional 2G/3G modem with external adhesive antenna
- Optional IEC 61850 modem for SCADA connection



4. SITRAM Multisense 9-3 (2/4)

Technical data Multisense 9-3

General

Optional nominal voltages of auxiliary supply:	120 V -20% +15% AC 50/60 Hz ¹⁾ or 230 V -20% +15% AC 50/60 Hz ¹⁾ or 120 V +15% DC ¹⁾ or 230 V -20% +15% DC ¹⁾ Other nominal voltages on request!
Power consumption:	max. 900 VA
Housing:	Mild Steel
Dimensions:	W 600 x H 800 x D 400 mm
Weight:	approx. 80 kg
Operation temperature: (ambient)	-55°C ... +55°C (below -10°C display function locked)
Oil temperature: (in the transformer)	-20°C ... +105°C
Storage temperature: (ambient)	-20°C ... +65°C
Connection to valve:	All Valves possible / pipe with diameter of 6mm connectable without adapters 2 valves necessary (in/out) / max. distance 30m

Safety

	CE certified
Insulation protection:	IEC 61010-1:2011-07
Degree of protection:	IP-65

Measurements

Gas/Moisture in oil Measurement		Accuracy ²⁾³⁾
Measuring quantity	Range	
Hydrogen H ₂	5 ... 2.000 ppm	± LDL, ± 5%
Carbon Monoxide CO	1 ... 5.000 ppm	± LDL, ± 5%
Carbon Dioxide CO ₂	20... 10.000 ppm	± LDL, ± 5%
Methane CH ₄	2 ... 5.000 ppm	± LDL, ± 5%
Acetylene C ₂ H ₂	0.5... 5.000 ppm	± LDL, ± 5%
Ethylene C ₂ H ₄	1 ... 5.000 ppm	± LDL, ± 5%
Ethane C ₂ H ₆	1 ... 5.000 ppm	± LDL, ± 5%
Oxygen O ₂	0 ... 50.000 ppm	± 10 % ± 1000 ppm
Moisture H ₂ O (a _w)	0 ... 100 %	± 3 %
Moisture in Mineral Oil	0 ... 100 ppm	± 3 % ± 3 ppm
Moisture in synt. Esther ⁵⁾	0 ... 2.000 ppm	± 3 % of MSC ⁶⁾

Operation principle

- Miniaturized gas sample production based on headspace principle (no membrane, negative pressure proofed)
- Patent-pending oil sampling system (EP 1 950 560 A1)
- Near-infrared gas sensor unit for CO, C₂H₂ and C₂H₄
- Near-infrared gas sensor unit for CO₂, CH₄ and C₂H₆
- Micro-electronic gas sensor for H₂ and O₂
- Thin-film capacitive moisture sensor H₂O
- Temperature sensors (for oil and gas temperature)

Analog and digital outputs (optional)

12/24/36 x Analog DC outputs		Default concentration (Free assignment)
Type	Range	
1 x Current DC	0/4 ... 20 mADC	Hydrogen H ₂
1 x Current DC	0/4 ... 20 mADC	Carbon Monoxide CO
1 x Current DC	0/4 ... 20 mADC	Carbon Dioxide CO ₂
1 x Current DC	0/4 ... 20 mADC	Methane CH ₄
1 x Current DC	0/4 ... 20 mADC	Acetylene C ₂ H ₂
1 x Current DC	0/4 ... 20 mADC	Ethylene C ₂ H ₄
1 x Current DC	0/4 ... 20 mADC	Ethane C ₂ H ₆
1 x Current DC	0/4 ... 20 mADC	Oxygen O ₂
1 x Current DC	0/4 ... 20 mADC	Moisture in Oil H ₂ O
1 x Current DC	0/4 ... 20 mADC	Free programmable

12/24/36 x Digital outputs		Max. Switching capacity (Free assignment)
Type	Control voltage	
12/24/36 x Relay	12 VDC	220 VDC/VAC / 2 A / 60 W

Communication

- RS 485 (proprietary or MODBUS[®] RTU/ASCII protocol)
- ETHERNET 10/100 Mbit/s copper-wired / RJ 45 or fibre-optical / SC Duplex (proprietary or MODBUS[®] TCP protocol)
- 2G/3G modem with external adhesive antenna (optional) (proprietary protocol)
- IEC 61850 modem (Option)

Notes

¹⁾ 120 V ⇒ 120 V = 120 V_{min} 120 V +15% = 138 V_{max}
 230 V ⇒ 230 V -20% = 184 V_{min} 230 V +15% = 264 V_{max}

²⁾ Related to temperatures ambient +20°C and oil +55°C

³⁾ Accuracy for moisture in oil for mineral oil types and accuracy quoted is the accuracy of the detectors during calibration process, under controlled laboratorial conditions

⁴⁾ Default jumper configuration: Current

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[siemens-energy.com/gt-service](https://www.siemens-energy.com/gt-service)

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Gas Monitor for Oil-filled Transformer

5. HiPDS-GM2H (1/3)

INTEGRICT

HiPDS Gas Monitor 2

유입변압기 가스 모니터



Product Overview

변압기와 같은 유입기기의 절연물로 사용되는 절연유, 절연지, 프레스 보드, 절연테이프 등은 변압기 과부하 또는 고장으로 발생하는 열 또는 ARC에 의해 분해되면서 수소 (H2) 및 탄화수소 가스가 발생하게 됩니다

HiPDS-GM2는 변압기 유증가스 중 수소 (H2) 와 일산화탄소 (CO), 수분 (Moisture)을 실시간 On-line으로 측정 감시하여 변압기의 내부 열화 및 절연이상 상태를 사전에 감지하여 대형 사고를 미연에 방지하고 이를 통해 변압기의 적절한 운영 상태를 확보할 수 있게 해주는 변압기 절연유 열화감시 및 분석 장치입니다.

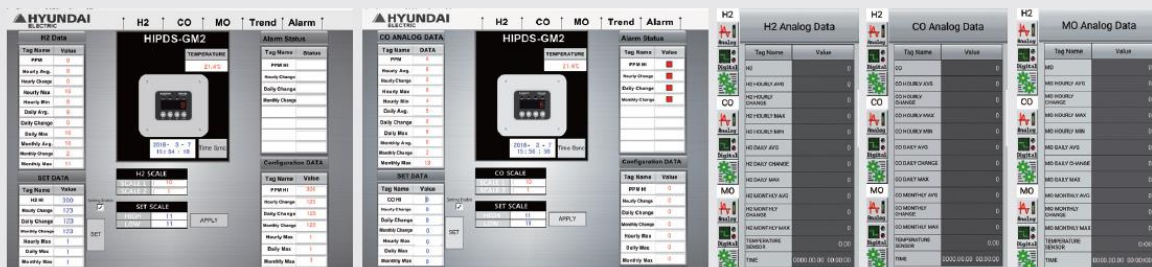
특히, 이상 징후 및 열화가 예상되는 기존 변압기 또는 노후 변압기에 설치할 경우, HiPDS-GM2는 초기 이상 상태를 정확하게 사전에 실시간으로 감시하여 변압기 운영 상태를 개선하고 변압기 수명 연장에 도움을 줍니다.



Features

- 온라인 (On-Line) 실시간 가스 및 수분 검출을 통한 변압기의 갑작스런 사고 예방
- 전용 HMI 기능 보유로 편리한 감시기능(OPTION)
- 스마트폰 감시기능(OPTION)
- 변압기 드레인 밸브에 직접 설치하는 방식으로 편리한 유지보수
- 단일 밸브 적용으로 신설 및 운전 중인 변압기 설치 비용 절감
- 펌프 및 냉각 팬 등 구동부품이 사용되지 않은 설계로 높은 장기 신뢰성

Applications



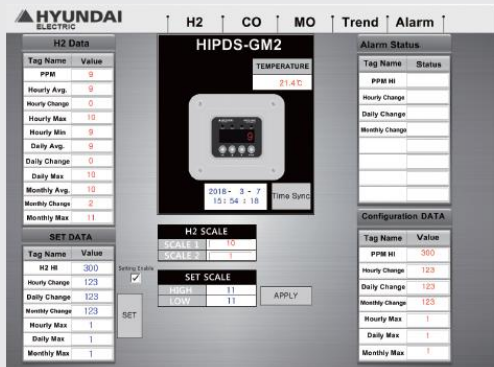
Exclusive HMI Application

Smartphone Application

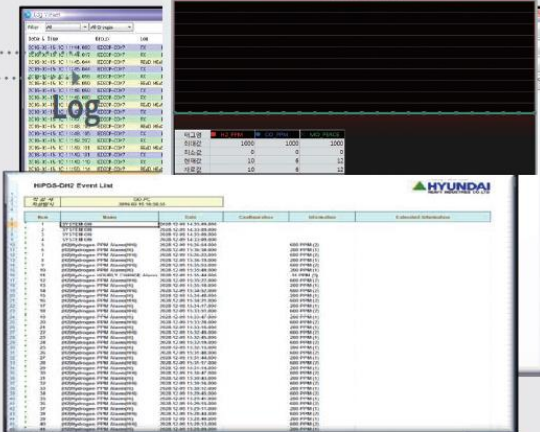
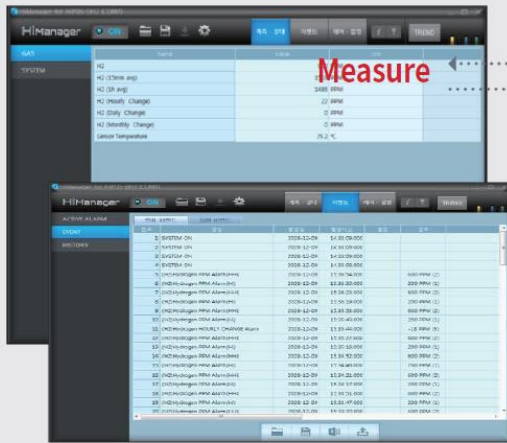
Gas Monitor for Oil-filled Transformer

5. HiPDS-GM2H (2/3)

HMI Picture & Manager Application



Alarm
Trend

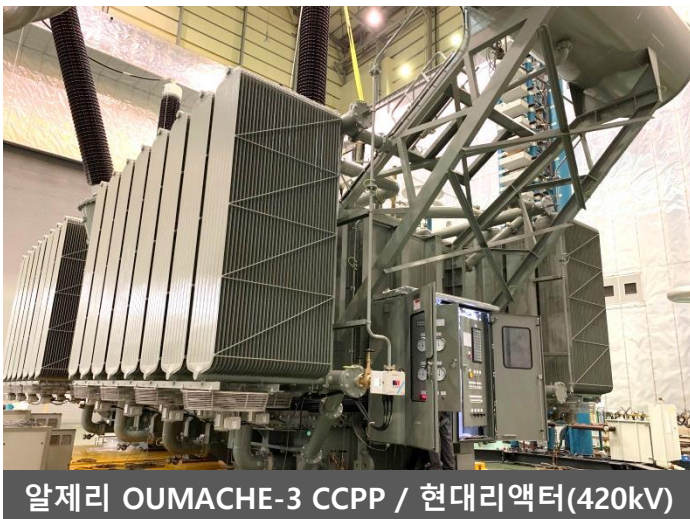


Technical Specifications

Hydrogen	Measurement range	25-5000 ppm
	Accuracy	20% of reading or 25 ppm
Carbon monoxide	Measurement range	0-10,000 ppm
	Accuracy	20% of reading or 25 ppm
Moisture	Water activity	0...1 aw
	Accuracy at 20°C	±0.02 aw(0... 0.9 aw), ±0.03 aw (0.9...1 aw)
Operating temperature range		-40°C~ 55°C
Storage temperature range		-40°C~ 80°C
Oil temperature measurement range		-40°C~ 105°C
Alarm relays		3 relays
Communication protocols		Modbus / RS485
Weight, Size		8kg, 235mm(H) x 260mm(W) x 203mm(D)
Warranty		1 year

Gas Monitor for Oil-filled Transformer

5. HiPDS-GM2H (3/3) 변압기 설치 사진



6. HiPDS-GM3-L (1/3)

INTEGRICT

HiPDS-GM3-L

유입변압기 가스 모니터

제품 개요

변압기와 같은 유입기기의 절연물로 사용되는 절연유, 절연지, 프레스 보드, 절연테이프 등은 변압기 과부하 또는 고장으로 발생하는 열 또는 ARC에 의해 분해되면서 수소 (H₂) 및 탄화수소 gas와 같은 유증가스가 발생하게 됩니다.

HiPDS-GM3-L은 변압기 유증가스 중 수소 (H₂) 와 일산화탄소 (CO), 아세틸렌 (C₂H₂), 수분 (Moisture)을 실시간 On-line으로 측정 감시하여 변압기의 내부 열화 및 절연이상 상태를 사전에 감지하여 대형 사고를 미연에 방지하고 이를 통해 변압기의 적절한 운영상태를 확보할 수 있게 해주는 변압기 절연유 열화감시 및 분석 장치입니다.

위 장치는 오일 순환형 구조설계를 적용해 측정 정확도를 향상시켰으며, 가스 전처리가 필요한 타 분석 방법과 달리 가스 선택성이 우수한 가스센서를 적용한 단순구조 형태입니다.

특히, 탈기 모듈 공유로 인한 손쉬운 가스 확장성이 가능한 분석 장치입니다.



〈HiPDS-GM3-L〉

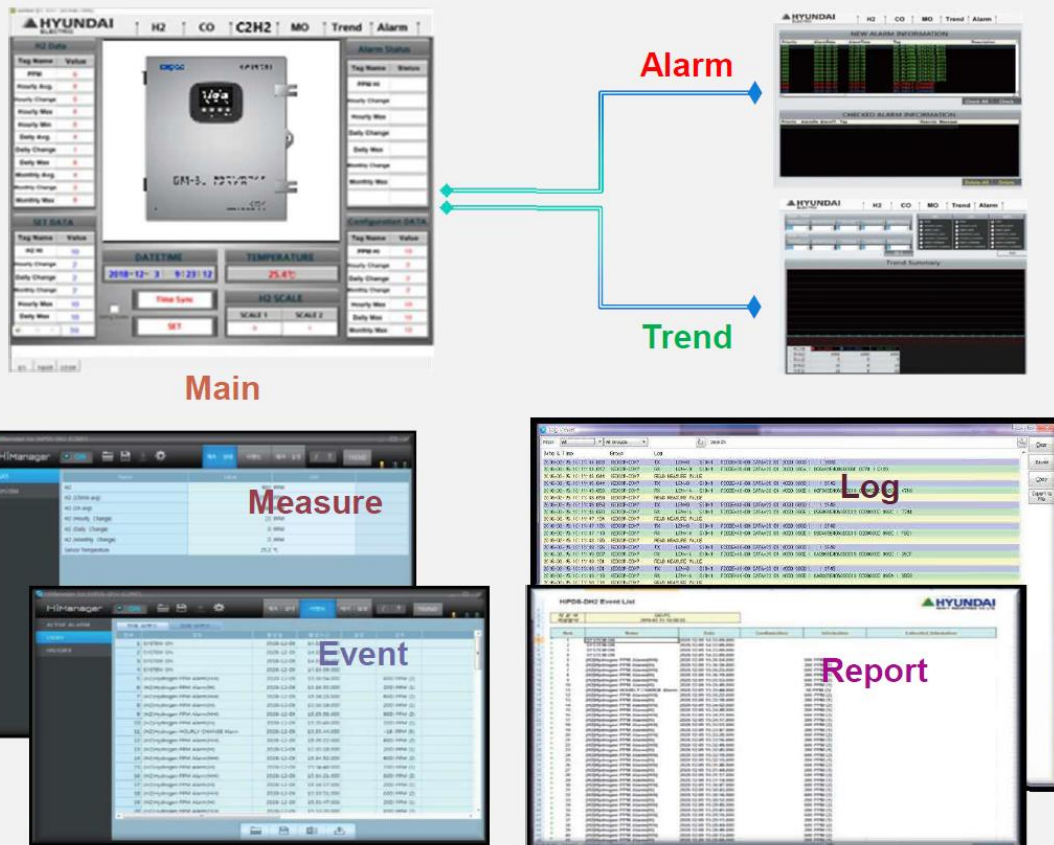
특징

- 온라인 (On-Line) 실시간 가스 및 수분 검출을 통한 변압기의 갑작스런 사고 예방
- 전용 HMI 기능 보유로 편리한 감시기능 (Option)
- 오일 순환형 구조설계로 측정 정확도 향상
- 분석 장치 고장시 알람 기능
- 탈기모듈 공유로 인한 간편한 가스 확장성 보유
- 수소, 일산화탄소, 아세틸렌, 수분 모니터링

Gas Monitor for Oil-filled Transformer

6. HiPDS-GM3-L (2/3)

HMI Picture & Manager Application



Technical Specifications

Hydrogen	Measurement range	5-5,000 ppm
	Accuracy	±10% of reading or ±5 ppm
Carbon monoxide	Measurement range	5-5,000 ppm
	Accuracy	±10% of reading or ±5 ppm
Acetylene	Measurement range	5-5,000 ppm
	Accuracy	±10% of reading or ±5 ppm
Moisture	Measurement range	0 - 100 ppm
	Accuracy	±2 ppm (0 – 90 ppm), ±3 ppm (90 – 100 ppm)
Operating temperature range		-40°C ~ 55°C
Storage temperature range		-40°C ~ 80°C
Oil temperature measurement range		-40°C ~ 120°C
Gas extraction		Oil immersed PTFE
Oil circulation		10 – 75 ml/min
Alarm relays		5 relays
Communication protocols		Modbus TCP
Weight, Size		40kg, 745mm(H) x 426mm(W) x 460mm(D)
IP rating		IP 54

Gas Monitor for Oil-filled Transformer

6. HiPDS-GM3-L (3/3) 변압기 설치 사진



7. KEPRI-TGM3-i (1/2) 전력연구원 기술이전

Gas Monitor for Oil-filled Transformer KEPRI-TGM-3i

Product Overview

절연유, 절연지, 프레스 보드, 절연테이프와 같은 유입기기의 절연물들은 변압기의 과부하 또는 고장으로 발생하는 열 또는 ARC에 의해 분해되면서 수소(H₂)나 탄화수소 등의 가스를 발생시키게 됩니다.

KEPRI-TGM-3i는 변압기 유중가스 중 수소(H₂)와 일산화탄소(CO), 아세틸렌(C₂H₂), 수분(Moisture)을 실시간 On-line으로 측정 감시하여 변압기의 내부 열화 및 절연 이상 상태를 사전에 감지하여 대형 사고를 미연에 방지하고, 이를 통해 변압기의 적절한 운영 상태를 확보할 수 있게 해주는 변압기 절연유 열화감시 및 분석 장치입니다.



< KEPRI-TGM-3i >

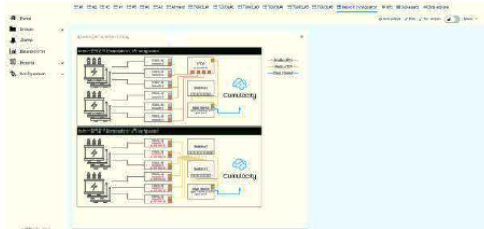
Features

- 온라인(On-Line) 실시간 가스 및 수분 검출을 통한 변압기의 갑작스런 사고 예방
- 전용HMI 기능 보유로 편리한 감시기능(OPTION)
- 스마트폰 감시기능(OPTION)
- 변압기 드레인 밸브에 직접 설치하는 방식으로 편리한 유지보수
- 단일 밸브 적용으로 신설 및 운전 중인 변압기 설치비용 절감

Gas Monitor for Oil-filled Transformer

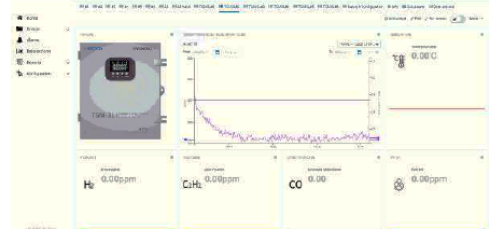
7. KEPRI-TGM3-i (2/2) 전력연구원 기술이전

HMI Picture & Manager Application



< Main >

Alarm
Trend

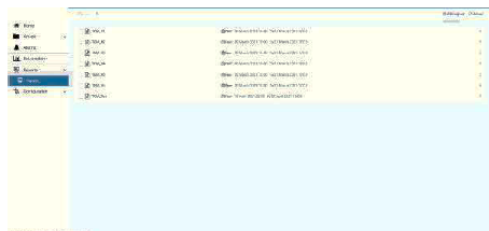


< Trend >



< Event >

Measure
Log



< Report >

Technical Specifications

Hydrogen	Measurement range	25-3,000 ppm
	Accuracy	20% of reading or LDL
Carbon monoxide	Measurement range	25-10,000 ppm
	Accuracy	20% of reading or LDL
Acetylene	Measurement range	5-1,000 ppm
	Accuracy	20% of reading or LDL
Moisture	Measurement range	0...1 aw
	Accuracy	±0.02 aw(0...0.9 aw),±0.03 aw(0.9...1 aw)
Operating temperature range		-40°C~ 50°C
Storage temperature range		-40°C~ 80°C
Oil temperature measurement range		-40°C~ 105°C
Alarm relays		5 relays
Communication protocols		Modbus TCP
Weight, Size		16kg, 210mm(H) x 240mm(W) x 220mm(D)
Warranty		1 year

Gas Monitor for Oil-filled Transformer KEPRI-TGM-3L

Product Overview

절연유, 절연지, 프레스 보드, 절연테이프와 같은 유입기기의 절연물들은 변압기의 과부하 또는 고장으로 발생하는 열 또는 ARC에 의해 분해되면서 수소(H₂)나 탄화수소 등의 가스를 발생시키게 됩니다.

KEPRI-TGM-3L은 변압기 유증가스 중 수소(H₂)와 일산화탄소(CO), 아세틸렌(C₂H₂), 수분(Moisture)을 실시간 On-line으로 측정 감시하여 변압기의 내부 열화 및 절연 이상 상태를 사전에 감지하여 대형 사고를 미연에 방지하고, 이를 통해 변압기의 적절한 운영 상태를 확보할 수 있게 해주는 변압기 절연유 열화감시 및 분석 장치입니다.



Features

- 온라인 (On-Line) 실시간 가스 및 수분 검출을 통한 변압기의 갑작스런 사고 예방
- 전용 HMI 기능 보유와 클라우드 기반 데이터 관리로 편리한 감시기능 (Option)
- 오일 순환형 구조설계로 측정 정확도 향상
- 분석 장치 고장 시 알람 기능
- 탈기 모듈 공유로 인한 간편한 가스 확장성 보유
- 수소, 일산화탄소, 아세틸렌, 수분 모니터링

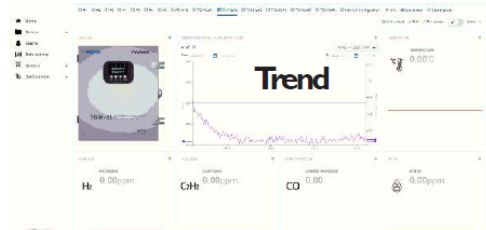
Gas Monitor for Oil-filled Transformer

8. KEPRI-TGM3-L (2/2) 전력연구원 기술이전

HMI Picture & Manager Application



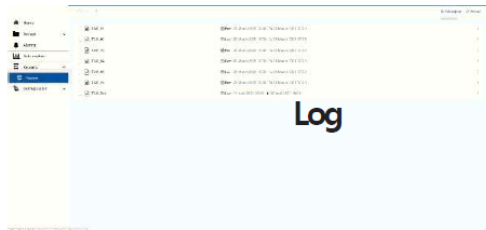
< Main >



< Trend >



< Event >



< Report >

Technical Specifications

Hydrogen	Measurement range	25-3,000 ppm
	Accuracy	10% of reading or LDL
Carbon monoxide	Measurement range	10-10,000 ppm
	Accuracy	10% of reading or LDL
Acetylene	Measurement range	5-1,000 ppm
	Accuracy	10% of reading or LDL
Moisture	Measurement range	0...1 aw
	Accuracy	±0.02 aw(0...0.9 aw), ±0.03 aw(0.9...1 aw)
Operating temperature range		-40°C~ 50°C
Storage temperature range		-40°C~ 80°C
Oil temperature measurement range		-40°C~ 105°C
Alarm relays		5 relays
Communication protocols		Modbus TCP
Weight, Size		16kg, 210mm(H) x 240mm(W) x 220mm(D)
Warranty		1 year

Partial Discharge Sensor for Transformer MS-PDS-DV500

Product Overview

절연유, 절연지, 프레스 보드 등의 절연물이 사용되는 유입변압기에서는 절연물의 제조 불량 혹은 경년 열화로 인하여 절연내력 약화로 초기 부분 방전이 발생할 수 있으며, 사용 시간에 따라 이러한 부분 방전은 절연 내력을 더욱 약화시켜 예측하지 못한 대형 사고를 일으키게 됩니다.

UHF PD 측정 센서(MS-PDS-DV500)는 변압기의 절연 열화를 사전 검출하는 시스템과 연결하여 변압기 내부 부분 방전(Partial Discharge)를 측정하는 센서로서, 변압기 드레인 밸브 삽입형 센서입니다.

위 장비는 UHF 대역의 신호를 검출하여 측정 감도를 향상시켰으며, 외부 노이즈 저감에 있어 우수한 센서입니다.



<MS-PDS-DV500>

Features

- 실시간 부분 방전 측정을 통한 전력설비의 실시간 상태 진단
- 운전 중에도 설치가 가능하여 설치 비용 절감
- 변압기 드레인 밸브에 직접 설치하는 방식으로 편리한 유지 보수
- UHF 대역 측정 방식을 이용하여 감도 향상 및 외부 노이즈 저감

Partial Discharge Sensors

9. MS-PDS-DV500 (2/3) 변압기 부분방전 검출용 UHF 센서

Technical Specification

Weight, Size	4.8 kg, Φ 155mm X 543.6mm
Connector	N-type (Female)
Temperature	-55 ~ +120°C
Frequency Range	300MHz ~ 1800MHz
Impedance	50 Ω
Return Loss(S11)	Standard S11 Loss \pm 3dB
Sensor Hydro Pressure	7bar (0.7MPa) JIS F7400

Return Loss (S11)



Gas Monitor for Oil-filled Transformer

9. MS-PDS-DV500 (3/3) 변압기 설치 사진



현대중공업 / 사내변전소(154kV)



현대중공업 / 사내변전소(154kV)



현대중공업 / 사내변전소(154kV)



현대중공업 / 사내변전소(154kV)

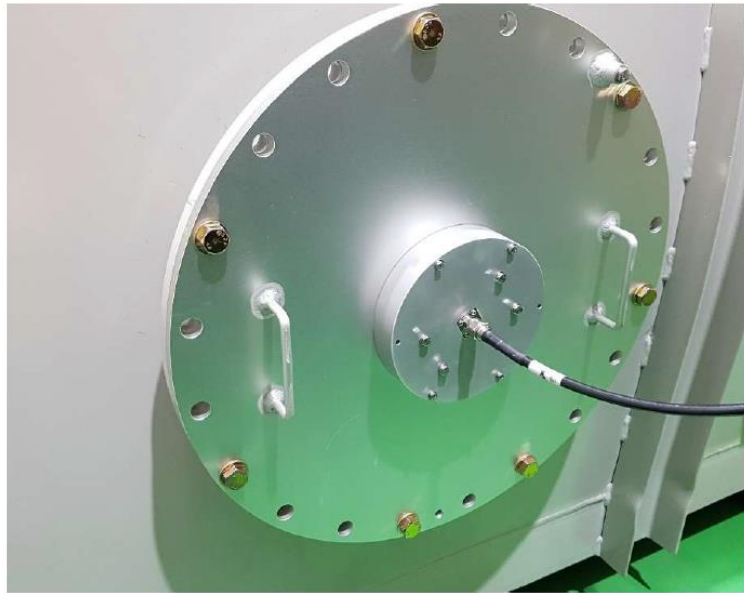
Partial Discharge Sensor for Transformer MS-PDS-MH165

Product Overview

절연유, 절연지, 프레스 보드 등의 절연물이 사용되는 유입변압기에서는 절연물의 제조 불량 혹은 경년 열화로 인하여 절연내력 약화로 초기 부분 방전이 발생할 수 있으며, 사용 시간에 따라 이러한 부분 방전은 절연 내력을 더욱 약화시켜 예측하지 못한 대형 사고를 일으키게 됩니다.

UHF PD 측정센서(MS-PDS-MH165)는 변압기의 절연 열화를 사전 검출하는 시스템과 연결하여 변압기 내부 부분 방전(Partial Discharge)를 측정하는 센서로서, 변압기 맨홀 설치형 센서입니다.

위 장비는 UHF 대역의 신호를 검출하여 측정 감도를 향상시켰으며, 외부 노이즈 저감에 있어 우수한 센서입니다.



<MS-PDS-MH165>

Features

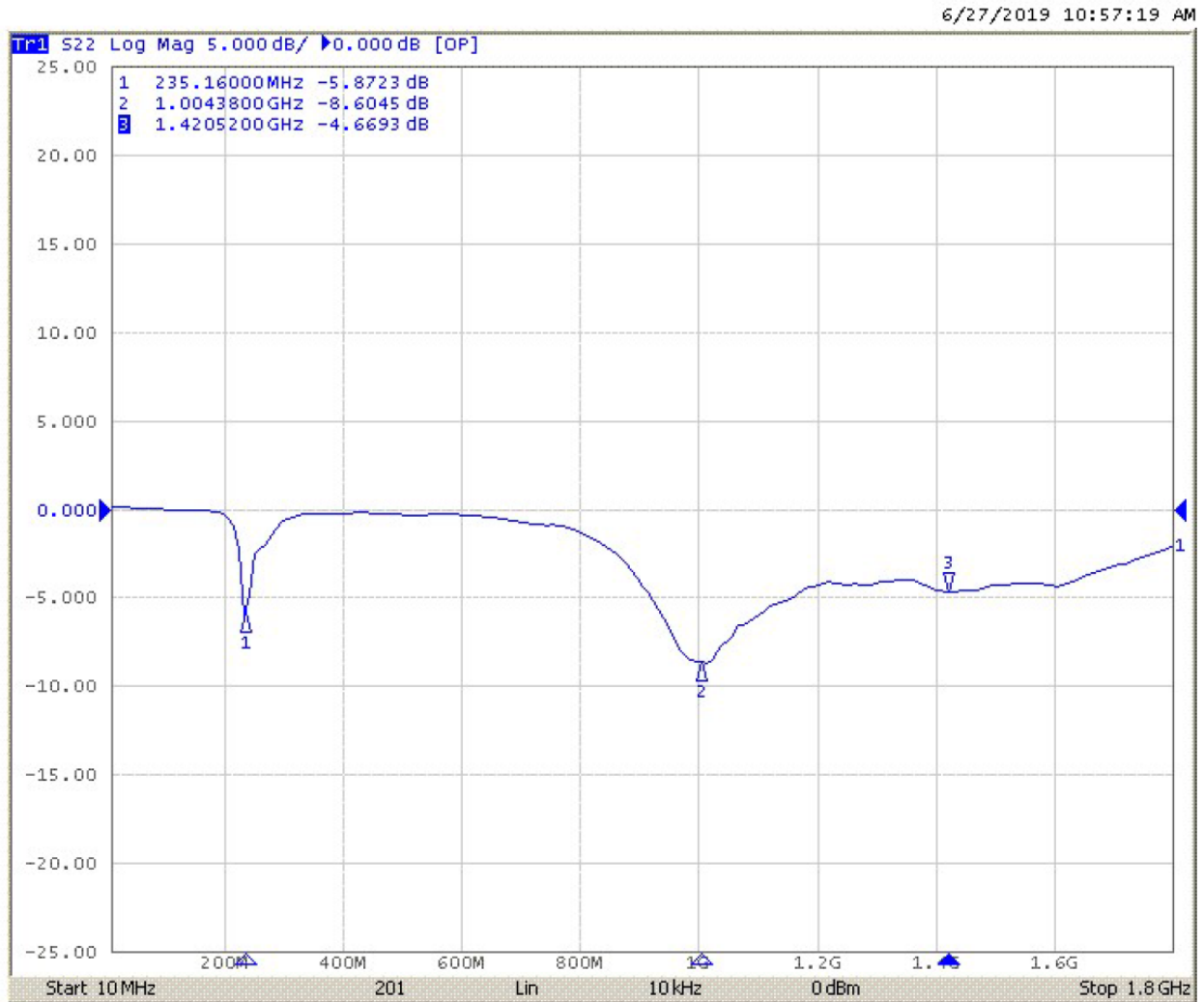
- 실시간 부분 방전 측정을 통한 전력설비의 실시간 상태 진단
- 변압기 맨홀에 설치하는 방식으로 편리한 유지 보수
- UHF 대역 측정 방식을 이용하여 감도 향상 및 외부 노이즈 저감

10. MS-PDS-MH165 (2/3) 변압기 부분방전 검출용 UHF 센서

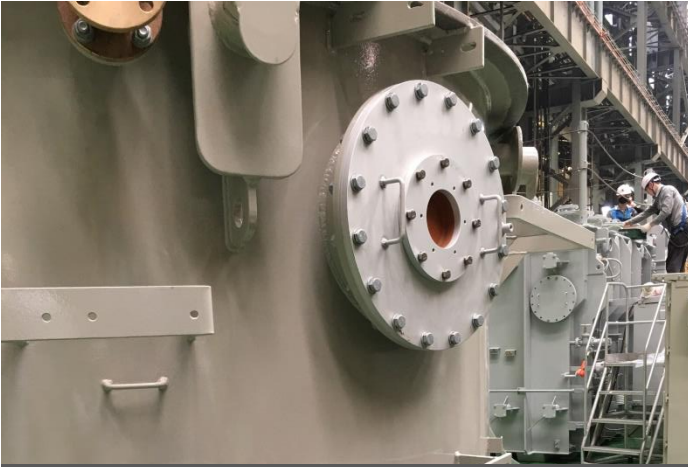
Technical Specification

Size	Flange Part : $\Phi 165 \times 25$ mm Sensor Part : $\Phi 110$
Connector	N-type (Female)
Temperature	-55 ~ +70°C
Frequency Range	300MHz ~ 1800MHz
Impedance	50 Ω
Return Loss(S11)	Standard S11 Loss ± 3 dB
Sensor Hydro Pressure	7bar (0.7MPa) JIS F7400

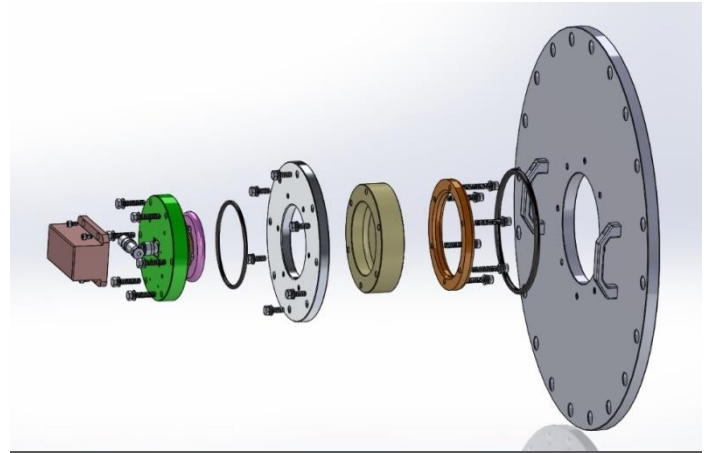
Return Loss (S11)



10. MS-PDS-MH165 (3/3) 변압기 설치 사진



변압기 점검창

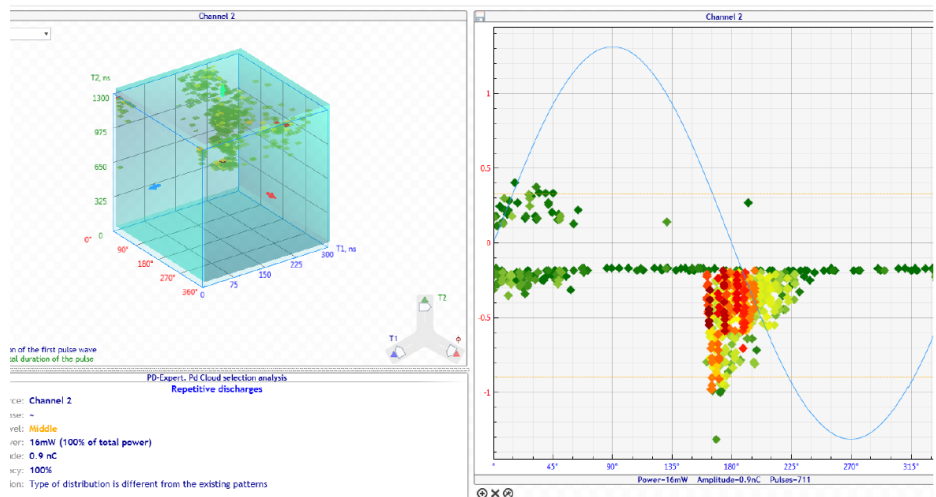


변압기 점검창 조립도

11. Transformer Partial Discharge Monitor (1/2)

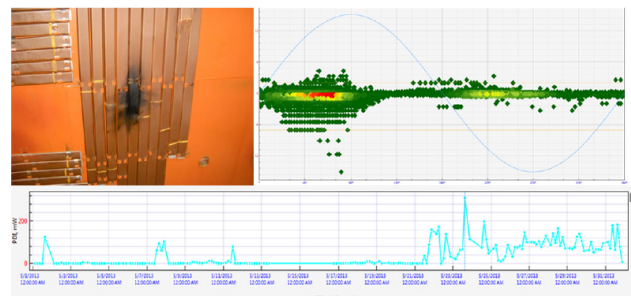


TRANSFORMER PARTIAL DISCHARGE MONITOR



PD is caused by highly stressed areas due to insulation defects, movement of energized parts or design errors where low level discharges regularly occur. Some types of PD are not a problem, but other types can develop into surface tracking or insulation failure which can lead to bushing or transformer failure.

1. The TDM-3F system utilizes continuous electrical measurement, and shares existing sensors with the bushing monitor.
2. Detects PD in the bushings and transformer.
3. HF and UHF frequency measurements eliminate interference from outside noise.
4. Smart algorithms identify the following PD types and severity:
 - Internal discharge;
 - insulation defects near energized parts;
 - insulation defects near grounded parts;
 - cavities and voids;
 - floating discharge;
 - corona;
 - conductive particles;
 - surface discharge.
5. We also offer a portable PD monitor for fleet testing and troubleshooting.



11. Transformer Partial Discharge Monitor (2/2)

Technical data

General TDM-3F / Busing Monitor ZVCM-1001M

Supply voltage:	85 ... 264 V AC / 47 ... 63 Hz or 120 ... 370 V DC
Power consumption:	max. 50 VA
Cabinet:	Stainless steel 304
Dimensions:	
Panel	
PD only	W 13" x H 18" x D 5½"
PD + Busing Monitor	W 21" x H 21" x D 5½"
Enclosure	
PD only	W 16½" x H 21½" x D 6½"
PD + Busing Monitor	W 24½" x H 24½" x D 9½"
Weight:	
Panel	
PD only	approx. 15 lb
PD + Busing Monitor	approx. 30 lb
Enclosure	
PD only	approx. 35 lb
PD + Busing Monitor	approx. 50 lb
Operation temperature:	-40°C ... +65°C
Storage temperature:	-40°C ... +85°C
Input frequency:	
HF	< 20 MHz
UHF	0.3 ... 1.5 GHz
Input voltage:	± 10 V
PD resolution:	1 deg.
Time resolution:	10 ns
Dynamic range:	65 dB

Measurements

Measurements		
	Measuring Quantity	Range
TDM-3F	PD intensity	0 ... 5000 mW
	PD amplitude	0.02 ... 100 nC
	PD amplitude	± 10 V
ZVCM-1001M	Leakage current	0 ... 140 mA
	Power factor	0 ... 100%
	Capacitance	100 ... 5000 pF
	Phase angle of imbalance current	0 ... 360 °
	GEO-magnetic induced current	0 ... 100 A DC or 0 ... 300 A DC

TDM-3F Features

- separates noise pulses and partial discharges while comparing their frequency and time of arrival
- uses phase resolved partial discharge (PRPD) and time frequency analysis (PD-Cloud)
- has the database of the most often defects "fingerprints" which can be upgraded with new diagnostic information
- uses special algorithms to estimate if the received data is authentic
- makes reports on the condition of the insulation of the high-voltage equipment

General Bushing sensor VBS / VBC

Voltage range: (Bushing primary)	69 ... 765 kV AC
60 Hz voltage: (on the tap at monitoring)	max. 2.5 kV AC
60 Hz voltage: (in the tap at opened or mistakenly cut coax cable)	max 120 V AC
Power frequency current: (through bushing insulation)	max 140 mA AC, RMS
Housing:	Aluminium
Dimensions:	Size is different on the voltage
Weight:	Weight is different on the voltage. (approx. no more than 2 lb)
Operation temperature:	-55°C ... +90°C
Storage temperature:	-50°C ... +55°C
Installation environment:	Outdoor, no corrosive agents in the air
Type of capacitor tap:	Any manufacture

Digital Outputs

		Max. Switching Capacity
TDM-3F	1 x Digital Output 1 x Relay	250 V / 10 A AC or 125 V / 8 A DC
ZVCM-1001M	2 x Digital Outputs 2 x Relays	250 V / 10 A AC or 125 V / 8 A DC

Communication

TDM-3F

- USB Type B / Ethernet TCP IP (Proprietary protocol)
- MODBUS RTU / MODBUS TCP

ZVCM-1001M

- RS 232 — Screw terminals and USB Type B (Proprietary protocol)
- DNP3 Serial / TCP or MODBUS® RTU/TCP (Option)

12. Bushing Monitoring System (1/4)



SIEMENS
Ingenuity for life

Customer Services for Transformers

Siemens Bushing Monitoring System

 Monitoring & Diagnostics

Benefits

- Improved scheduling of maintenance work and downtimes, repairs, adequate personnel support
- Maintenance downtimes and outage costs can be minimized
- Early detection of a degradation of bushing insulation and internal layer breakdown

Scope of work / deliverable

- Bushing sensors with connection cable
- Siemens Bushing Monitor System including mounting plate, power supply, circuit breaker, terminals and wiring
- Optional cabinet IP 55 (higher specifications available)
- On-site training courses for operation and maintenance of the systems
- Design, installation and commissioning of all necessary communications equipment to connect the bushing monitoring system to your network.

Introduction

Among the reasons for transformer outages, bushing failures rank considerably high. One reason could be that these bushings are usually tested offline to measure capacitance, dissipation factor and power factor.

With its new online Bushing Monitoring System, Siemens enables asset managers to check the condition of critical equipment such as power transformers and reactors without having to shut down facilities first. The asset condition data allows a thorough analysis and can reveal developing equipment issues before they become a problem.

Features

The new Siemens Bushing Monitoring System can be used as a standalone system, or in combination with Siemens' trusted transformer condition monitoring system. This follows the principle that it is always better to integrate multiple measurement results into an overall picture, rather than founding the analysis on measurements of individual sensors.

For ease of operation, the Siemens Bushing Monitoring System software provides alarm set-points, graphical displays and algorithm-based alarms that maximize response without triggering false alarms.

The software can be individually adapted by our engineers to suit any type of installation.

Siemens Bushing Monitoring System allows:

- Monitoring power factor/dissipation factor and capacitance at nominal voltage
- Universal applicability for each condenser bushing type and other OEMs
- High accuracy measurement by using parallel measurements of up to six bushing leakage currents
- Comprehensive online condition monitoring system for transformer and bushings
- Different versions with 3, 6, 9 or 12 bushing sensors



12. Bushing Monitoring System (2/4)

Technical details

The Siemens Bushing Monitoring System is designed to be permanently installed, monitoring the condition of condenser bushings, CVTs (capacitor voltage transformers) and free standing CTs (current transformers) as well as potential transformers. To this end, up to six leakage currents are being measured online, the power factor and capacitance values are tested, and the entire system is being monitored. The Siemens Bushing Monitoring System incorporates three measurement modes for standard and two for optional configurations:

Standard configuration with six current inputs:

- Sum of three current tests
- Adjacent phase reference test
- Phase comparison
- Optional configuration with inputs of three voltages and three currents; reference test (three bushings and three CVTs)
- Optional configuration with six voltage inputs, CVT reference test (six CVTs)

Should the sensor become disconnected from the bushing monitoring system, the adapter design prevents a harmful overvoltage developing on the bushing.

By establishing communications between the Siemens Bushing Monitoring System and Siemens Transformer Monitoring, a comprehensive transformer and bushing monitoring system is available as a package solution.

The Siemens Bushing Monitoring System has two programmable output relays with alarm changeover contacts. Its built-in programmable scheme logic, allows operators to:

- Measure AC leakage currents of fundamental harmonic (ΔC)
- Measure phase angle ($\Delta\%PF$) between two currents
- Measure phase angle ($\Delta\%PF$) between currents of adjacent phases (three-phase mode)

Measurements		
Measuring quantity	Range	Accuracy
Leakage current	0 ... 140 mA AC	$\pm 1.5\%$ of reading
Power factor/Dissipation factor	0 ... 100 %	$\pm 0.045\%$ absolute
Capacitance	100 ... 5000 pF	$\pm 1.0\%$ of reading
Phase angle of imbalance current	0 ... 360°	$\pm 1.0\%$ of reading
General data Siemens Bushing Monitoring System		
Supply Voltage	85 ... 264 V AC / 47 ... 63 Hz or 120 ... 370 V DC	
Power consumption	Max. 24 VA	
Dimensions	1 Data Acquisition Units (up to 6 channels) W 420 x H 595 x D 153 mm 2 Data Acquisition Units (up to 12 channels) W 610 x H 686 x D 229 mm	
Operation temperature	-40°C ... +65°C	
Output relays	Potential-free changeover contacts	
Communication	- RS-232 – screw terminals and RJ45 (proprietary protocol) - Optional DNP 3 serial or MODBUS® RTU Controller	

- Measure magnitude and phase angle of imbalance current of three Y-connected bushings
- Generate Alarm in case the measured values exceed the threshold

These analysis methods provide stable imbalance current and capacitance values, but in some cases the power factor data can be affected by temperature and power system voltage fluctuations, particularly on lower voltage bushings.

If these conditions exist, the Siemens Bushing Monitor can be supplied with smoothing algorithms to eliminate any cyclical variation in the data, or the unsmoothed data can simply be evaluated for trends rather than instantaneous data points.

Changes in bushing condition can be easily detected with either approach.

The Siemens Bushing Monitor can also be configured for comparison or reference mode analysis in addition to the full leakage current magnitude and phase angle data. These analysis modes provide the highest available power factor and capacitance accuracy without the need for data smoothing algorithms.

Using proprietary algorithms, the Siemens Bushing Monitoring System software evaluates all available analysis modes to eliminate false alarms and ensure that bushing deterioration is detected early on.

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Subject to change without prior notice. The information in this document contains general descriptions of the technical options available, which may not apply in all cases.

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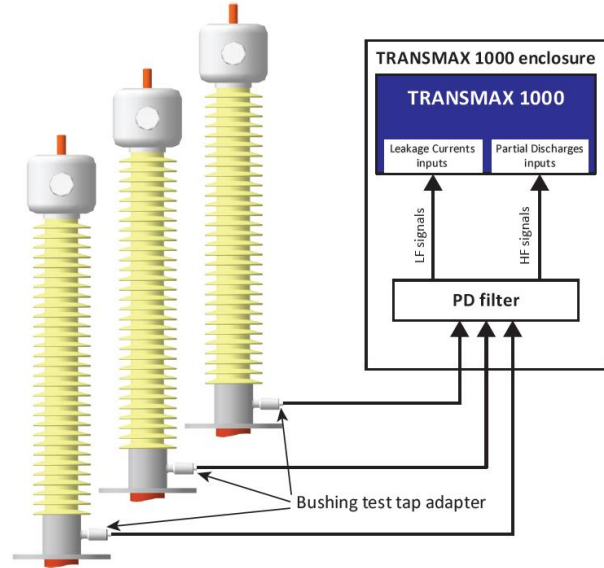
*(Charges depending on provider)

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Partial Discharge Monitoring for TR

12. Bushing Monitoring System (3/4)

ZTZ Sentinel TRANSMAX 1000



Technical data

Supply voltage	85 ... 264 V AC / 47 ... 63 Hz 120 ... 370 V DC 95 ... 370 V DC (optional)
Power consumption	max. 50 VA
Cabinet	Stainless steel 304
Dimensions	
Panel:	W 21" x H 21" x D 5 1/2"
Enclosure:	W 24 1/2" x H 24 1/2" x D 9 1/2"
Weight	
Panel:	approx. 30 lb
Enclosure:	approx. 50 lb
Operation temperature	-40 °C ... +65 °C
Storage temperature	-40 °C ... +85 °C
PD frequency	
HF	<20 MHz
Input voltage	± 10V
PD resolution	1 deg.
Time resolution	10 ns
Dynamic range	65 dB

Output parameters

Leakage current	0 ... 140 mA
Power Factor	0 ... 100%
Capacitance, C1	100 ... 5000 pF
Phase angle of Imbalance current	0 ... 360°
PD intensity	0 ... 5000 mW
PD amplitude	0.02 ... 100 nC ± 10 V

Bushing sensor information

Voltage range (bushing primary)	69 ... 765 kV AC
60 Hz voltage (on the tap at monitoring)	max. 2.5 kV AC
60 Hz voltage (on the tap at opened or mistakenly cut coax cable)	max. 120 V AC
Power frequency current (through bushing insulation)	max. 140 mA AC, RMS
Housing	Aluminum

Dimensions	Size is different on the voltage
Weight	Weight is different on the voltage (approx. no more than 2 lb)
Operation temperature	-55 °C ... +90 °C
Storage temperature	-50 °C ... +55 °C
Installation environment	Outdoor, no corrosive agents in the air
Type of the capacitor tap	Any manufacture

Additional sensors

Load current	3 inputs
Temperature	3 inputs
Ambient temperature	1 input
Ambient humidity	1 input

Communication options

- Proprietary protocol (Serial or TCP/IP)
- RS-485 (Modbus, DNP3, etc.)
- Ethernet (Modbus TCP, DNP Ethernet, IEC61850, etc.)

12. Bushing Monitoring System (4/4)

ZTZ Sentinel TRANSMAX 1000

Monitoring for PD, PF and GIC All In One Package

Bushing failures are one of the most common cause causes of catastrophic transformer failures. Online monitoring allows Engineers and Asset Managers to detect incipient deterioration of bushing condensers before damage progresses to a dangerous level, where failures can occur.

Partial discharge (PD) is caused by defective insulation in high stress areas, movement of energized parts or design errors where low-level discharges occur. While some types of PD may not present a problem, but others can develop into surface tracking or insulation failure, which can lead to bushing or transformer failure.

Some bushing defects cannot be detected with offline or online power factor (PF) measurement, however those defects are detected with a partial discharge monitor. The ZTZ Sentinel TRANSMAX 1000 combines two different approaches which increase reliability of bushings fault determination. The ZTZ Sentinel TRANSMAX 1000 simultaneously acquires up to six bushing inputs and calculates bushing power factor from each them using sophisticated algorithms. The PD activity in the bushings is monitored in parallel with the power factor calculations.

The ZTZ Sentinel TRANSMAX 1000 system utilizes the same test tap sensors for the measurement of the leakage current and partial discharge.

The power factor monitoring system employs several smart algorithms that supports calculations of multiple data sets simultaneously. Existing substation configuration allows the following algorithms are implemented:

- Adjacent phase algorithm shows relative PF
- Proprietary High to low algorithms allow additional to adjacent phase data set evaluation
- Reference and comparison algorithms show Real power factor
- Our sum of three current algorithm is implemented as a supplement to the main algorithms to further advance the usefulness of the received data.

Employing multiple data points eliminates the appearance of false alarms.

The ZTZ Sentinel TRANSMAX 1000 has extra inputs for monitoring other transformer parameters like load currents (3 inputs), transformer temperature (3 inputs), ambient temperature as well as humidity. These parameters provide a more reliable analysis regarding the bushings' condition.

The 6-Channel ZTZ Sentinel TRANSMAX 1000, provide full-time monitoring, communications and supplies bushing and/or CCVT data to the network over a wide variety of connections, protocols and controllers.

The ZTZ Sentinel TRANSMAX 1000 also has the unique capability of monitoring GIC events, trends and potential damage to the transformer. The data collected by this equipment is first in class and provides an approach that integrates a Hall Effect CT sensor mounted on the lead from the neutral ground bushing. In addition, the device monitors harmonics using the data from the bushing sensors.

The advantage of this approach is NO additional hardware needs to be installed to record reliable data. This makes for easy retro fits of existing transformers in the field.

ZTZ Sentinel TRANSMAX 1000 with GIC option
Outputs:

- Power Factor – 3 algorithms simultaneously 0 – 100%
- Leakage Current Magnitude 0-140 mA
- Capacitance C1 100 – 5,000 pF
- PD intensity 0 – 5,000 mW
- PD amplitude 0.02 – 100 pC – ($\pm 10V$)
- DC Current -500 to +500
- Accuracy ± 0.5 FS
- Harmonic Attenuation > 60

FOR MORE INFORMATION ON GIC VISIT OUR WEBSITE
FOR AN EDUCATIONAL PRESENTATION ON THIS TOPIC!

Rev. 11-18



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13. Online Transformer Diagnostic and Condition Monitoring Systems (1/2)



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SITRAM® TDCM

Online Transformer Diagnostic and Condition Monitoring Systems

Introduction

Worldwide around over 70% of transformers have been in service more than 25 years. The average life of power transformers in operation is exceeding the design-life in an increasing number of cases.

Yearly, new equipment comes to the grid to support new consumers' demand or replace end-of-life units, guaranteeing the reliability and smooth grid operation.

Nowadays, the need for grid digitalization, performance optimization and maintenance costs are playing a major role in the market.

Therefore, Siemens developed SITRAM®TDCM as technically advanced and cost effective transformer online monitoring system, providing reliable early fault diagnostics and supporting precise operational needs.

Features

SITRAM®TDCM provides online transformer data from the comprehensive modules, early faulty diagnostic, with prognoses and recommendations.

SITRAM®TDCM can be applied on all transformers, from any manufacturer, of any age. This flexibility is due to OEM experience from Siemens, applied in matters of engineering models that represent the various transformers and sub-components behaviors.

Also, SITRAM®TDCM is used in several applications such as:

- Industrial transformers and reactors;
- Transmission and distribution transformers;
- Generator transformers;

Depending on the customer needs, the system can be applied in stand-alone solutions, as well multi-transformers and multi-substations.

Benefits

The SITRAM®TDCM System has the advanced analysis technology that, when effectively used, assists strategies for mitigation of fault risks, as well as the use of maintenance resources.

The SITRAM®TDCM is also assisting in the:

- Optimization of the maintenance process, allowing condi-

tion based maintenance;

- Identification of incipient faults¹, with the opportunity of preventive corrective actions that may avoid costs of a catastrophic fault;
- Potential reduction of insurance indemnity for transformers defects or failures;
- Intensification on operative conditions knowledge, during normal situations and overloaded needs;
- Maximization of availability of the transformers, by means of forecasting specific operational scenarios.

Scope of Delivery / Deliverable

SITRAM®TDCM is delivered as cubicle or totally integrated at transformer, with all sensors installed and commissioned, depending on customers' requirements.

Also, the package of required sensors, like SITRAM H2Guard and Siemens Bushing Monitor can be part of the scope, in the most flexible ways.



¹ The incipient fault identification, according to studies performed by independent entities, is about 60% of the typical transformers faults.

13. Online Transformer Diagnostic and Condition Monitoring Systems (2/2)

Transforming data into reliable recommendations. Flexible and scalable solution!

Technical Details

The SITRAM®TDCM system measures, stores, and correlates indicative values from transformers and by processing data generates diagnostics, prognostics, and recommended actions and trends of incipient faults.

SITRAM®TDCM perfectly applies several transformers' models and includes family based evaluation and comparison.

A comprehensive list of evaluation models is provided such as:

- Bushing Health Condition
- Load Tap Changer Condition
- Cooling System Condition
- Intelligent Cooling Control
- Transformer Thermal Hydraulic Modeling
- Insulation Moisture Model
- Ageing and Life Expectancy
- Dissolved Gases and Multi-Gases evaluation
- Oil Volume
- Core Hotspot GIC Estimation
- Dynamic Overload Guide
- Static Overload Guide
- Models comparison
- Family of equipment evaluation

Other models, functionalities, and communication requests can be provided in short period of time.

Each monitored transformer receives several sensors to be installed in its main tank, as well as in its tap-changer equipment. All data acquired by each sensor are centralized into the SITRAM®TDCM panel, which also is installed on transformer's main tank, and processed right there on the field. Those processed data remain stored in its memory and are published on a web page which can be accessed through an Ethernet port with RJ45 connector, optional wireless interface.

The system is compatible with sensors with Ethernet, serial, analog, and digital interfaces. Data is acquired by communication drivers and signal filters specially developed for the system, without the use of additional third-party software.

Within these aspects, the increased reliability of the data acquired raises the trending and diagnosis quality, aiming the mitigation of false positive alarms.

Additionally, the system accesses may be available at the Customer's Intranet. Optionally selected data may be transferred via Modbus-TCP / DNP3-TCP / IEC 60870-5-104 or others, to have the interface with supervision and control systems.

SITRAM®TDCM as part of Siemens Services Long-term Program (LTP)

Siemens provides additionally maintenance service contracts supported by Siemens Transformers Experts at the Siemens Diagnostics and Operations Center during the Service Contract duration.

Supervision of your assets, recommendations and thorough primary asset investigation can be realized, applying further OEM evaluation methodologies in combination with SITRAM®TDCM features.

With a history of more than 150 years, Siemens built a major expertise in the field of T&D equipment. Starting with a dissolved gas analyzer only, up to our SITRAM®TDCM, Siemens can provide you additional transformer condition knowledge. As you can expect, we will give the required support to keep the system running for years.

To enjoy Siemens comprehensive remote services offering, the installation of a Siemens On-Line Monitoring System, including sensors, e.g. DGA, Bushing Monitoring, is required.



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14. Assetguard PDM (1/3) GIS 부분방전 검출장치



Assetguard PDM



Partial Discharge Monitoring
(for high voltage Gas-Insulated Switchgear)

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Introduction

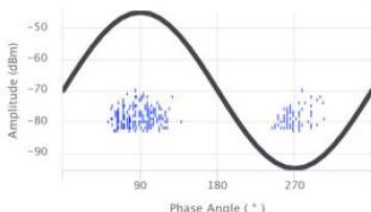
The majority of failures at GIS are in coincidence with partial discharge from an early stage of the particular failure. Detecting and analyzing those partial discharges via the emitted UHF signals is the method of choice for failure detection in gas-insulated switchgear.

Siemens Assetguard PDM is a highly accurate online condition monitoring system for GIS, analyzing the UHF signals for severity and type of fault, providing a comprehensive early warning system for GIS failures and is compliant with "IEC TS 62478: High Voltage Test Techniques – Measurements of partial discharges by electromagnetic and acoustic methods".

Features

Assetguard PDM is a modular system to cover all sizes and manufacturers of GIS substation. It can operate with internal and external UHF sensors, has superior qualities regarding environmental, electromagnetic and ingress protection - so is perfect for retrofit or new switchgear, indoor or outdoor installation.

Assetguard PDM performs the UHF signal analysis in terms of observing the intensity



as well as providing diagnostic results

regarding the source of partial discharge by usage of the built-in neural network for pattern recognition.

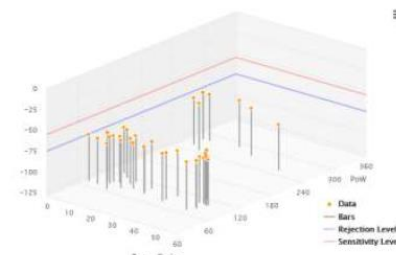
Besides alarming using state-of-the-art communication protocols, an individual and interactive single-line diagram allows to quickly localize and qualify those alarms - facilitating the web based user interface. Furthermore the alarms are easily forwarded to Siemens Customer Support Center for expert involvement.

The web-based user interface presents its information, including live data and diagnostic results simultaneously for various users on different locations even on mobile devices.

Partial Discharge experts can use the built-in user interface features to assess historical data. This data can also be exported and provided to a remote expert from Siemens for asset condition reports or on-site condition assessments.

Benefits

- Early warning in case of evolving dielectric failure



- Expert system that gives diagnostic of reason for partial discharge sources
- Avoidance of unplanned outages and support of maintenance planning
- Facilitate the integration (e.g. in SCADA Systems or Asset Management Platforms) and usability in current utilities networks;
- Easy involvement of Siemens Customer Support
- Seamless combination with Assetguard products for gas density and circuit breaker monitoring

Scope of Work / Deliverable

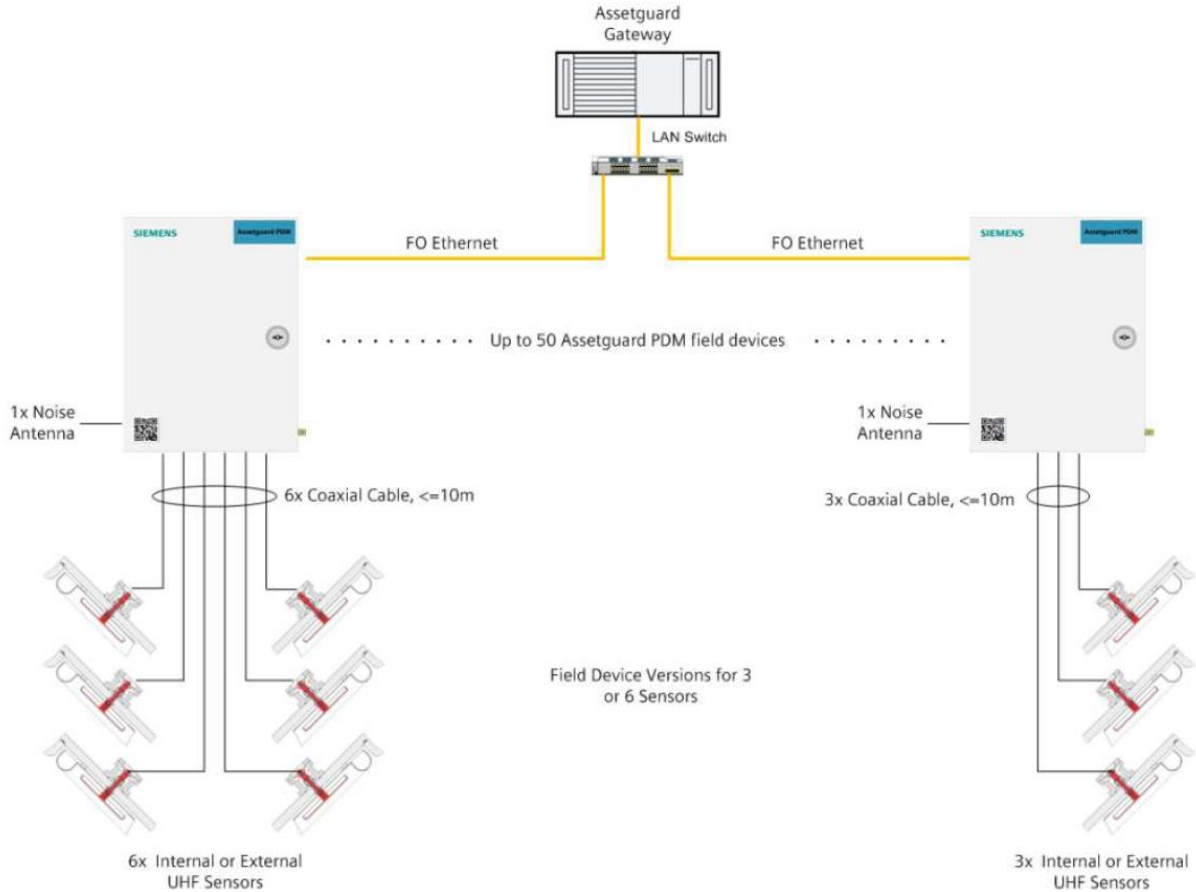
- Optional external UHF sensors for retrofit installations
- Assetguard PDM field devices for signal acquisition
- Assetguard Gateway to integrate the data from the PDM field devices and optional gas density or circuit breaker field devices
- Web based user interface
- Central cubicle containing Assetguard Gateway and further needed network and communication components



Partial Discharge Monitoring for GIS

14. Assetguard PDM (2/3) GIS 부분방전 검출장치

Technical Details



Measurement Characteristics		Field Device Properties	
UHF detection sensitivity	-85 dBm	Input Channels	3 or 6 PD UHF channels and 1 noise detection input
Dynamic Range	60dBm typical	Enclosure Dimensions	400 x 300 x 225 mm
Frequency response	145MHz to 1700 MHz, selectable Gain and Filter Bands	Environmental Conditions	Operating temperature -25°C to +55°C Humidity: <=93%RH non-condensing
Acquisition	12-bit A/D resolution @ 5kS/s	Shock resistance	Vibration (1g) and shock (15g) tested
PD event type analysis	Neural Network with pattern recognition	EMC Standards	Immunity for usage in power station or substation environment, IEC 61000-6-5
Noise Management	Noise cancellation and Noise pattern recognition	Ingress Protection Rating	IP 54
Self-Test	End-to-end signal chain self test and cable detection		

Selected Gateway Features	
Communication Protocol	IEC 61850, DNP3, Volt-Free Contact, API
Historical Data Storage	Min. 2 Years
PD analysis Features	Web based user interface: PRPD heatmap & 3D view, trend analysis, multi-channel comparison

For more information please contact our Customer Support Center:
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Partial Discharge Sensor

14. Assetguard PDM (3/3) GIS 부분방전 검출용 UHF Sensor



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Assetguard PDM

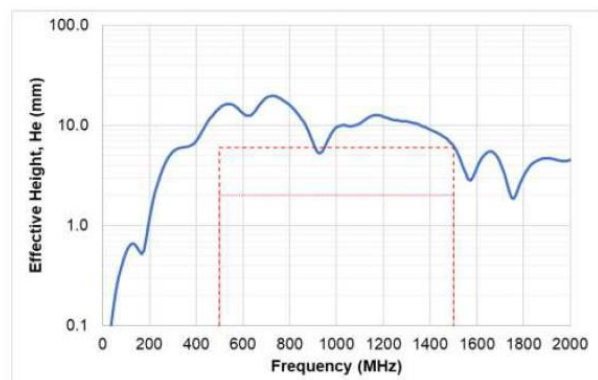


Partial Discharge Monitoring
UHF Sensor

Specification

Requirement

Frequency Range	500MHz – 1500MHz
Mean Effective Height	12mm
Ingress Protection Rating	IP65
Output Connector	N-type, 50Ω
Temperature Range	-30°C to +70°C
Maximum Working Humidity	100%
Weight	1 kg
Dimensions	169mm x 78mm x 57mm



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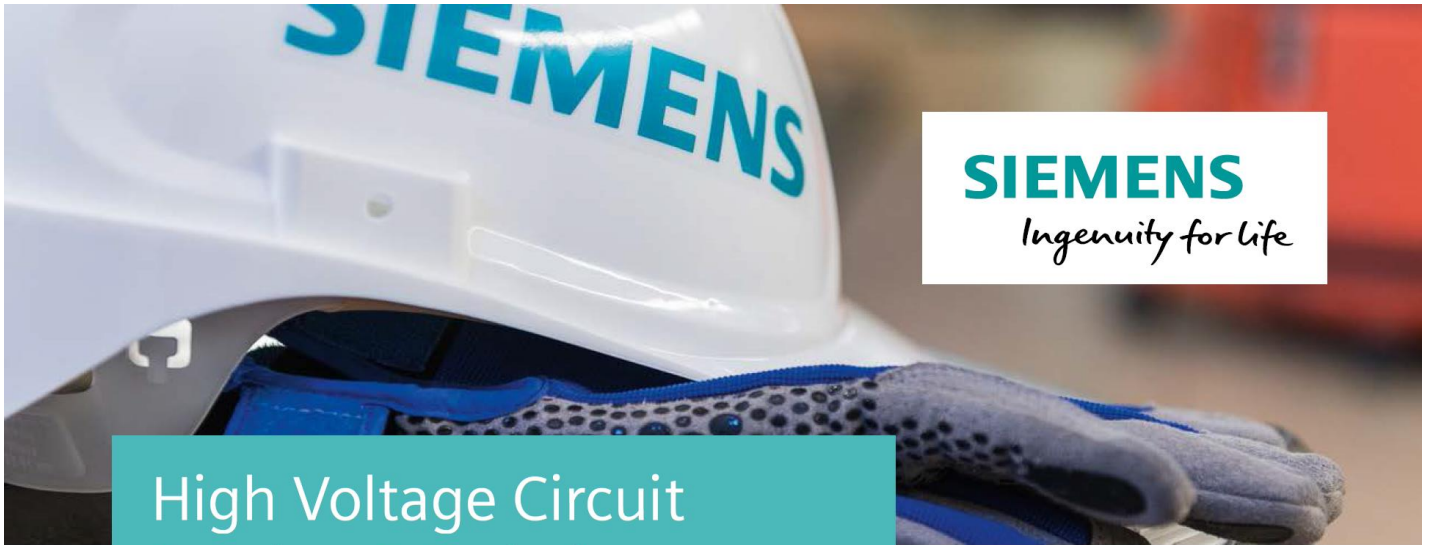
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15. Assetguard HVC (1/2) GIS 차단기 동작특성 분석장치



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High Voltage Circuit Breaker & Switchgear Monitoring with Assetguard HVC

- Supports condition-based maintenance.
- Instant diagnosis and data for condition assessments.
- Cost effective solution.
- Low installation costs, suitable solutions for retrofit & self-installation.

Scope of Work / Deliverable

Each Assetguard HVC comprises:

- External sensors included (e.g. current transducer, current transducer hall effect).
- Optional external sensors on request (e.g. for measurement of humidity or temperature and for SF₆ Gas monitoring).
- Turnkey installation and communications services.
- Expert analysis of monitoring data and customer support.
- On-site trainings for operation and maintenance of our systems.
- Design, installation and commissioning of all necessary equipment.

Introduction

The reliability of HV switching devices (circuit breakers, disconnectors, earthing switches) is generally high, but, due to lifetime extension trend and changed maintenance policies, care should be taken to keep an acceptable reliability level also in those situations. This is a challenge when the components, like the drives, are exposed to hazardous and severe environmental condition. Especially when the switching devices are not operated continuously, mechanical parts may not work in proper way due to dirty and stuck condition.

Assetguard HVC is a condition monitoring system for AIS and GIS switching devices. The system is divided into a distributed structure in which a base unit monitors a set of specific signals coming from the switch and acts, as communication master of a riser network, with remote auxiliary units (optional) for specific on-board equipment measurement purposes.

The monitored parameters are interrupted currents, switching times, current consumption of the coils and drives and insulation gas density of the switching devices. In addition, Siemens Assetguard HVC takes care of the service reliability of the circuit breakers, monitoring also the tripping and closing functionalities and main contacts wear.

Features

The main features for Assetguard HVC are:

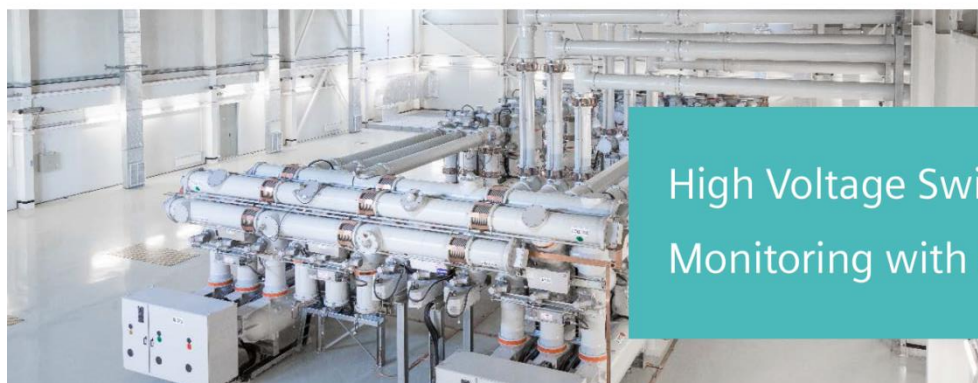
- Transmission of **alarms** in case of anomalies, **warnings** if switchgear is losing functionalities, **information** in case the switchgear needs maintenance.
- All components integrated in a single housing (power supply, data acquisition, fiber optic communication, data storage and a web server inside a central node unit).
- Predefined or customized measuring kits are supplied to be installed in each circuit breaker cabinet.
- Combined hardware and digital filter for better noise immunity performances. Integration into SCADA (if required).

Benefits

- Supports circuit breakers to over-reach their assigned technical life.
- Reduction of risks for consequential damages.
- Reduction of probability for unexpected outages.
- Reduction of intensive periodical and manual measurements.
- Safe operation of monitoring system guaranteed due to no changes of protection wiring or concepts.



15. Assetguard HVC (2/2) GIS 차단기 동작특성 분석장치



High Voltage Switchgear Monitoring with Assetguard HVC

Technical Details

The methods of Assetguard HVC

At each switching command, a measurement is started. The measurement ends when the switching operation has been completed. Data are recorded internally in the memory of Assetguard HVC node unit. Data are diagnosed by comparing recorded data with customer's configured thresholds. Any alarm is communicated via the integrated webserver, via hard-wired contacts and with the integrated protocols.

This info is elaborated within the Main Data Unit (MDU) using dedicated knowledge modules in order to detect defects in coils behavior, to suggest maintenance needs in the mechanical drive, to evaluate contact wear (Arcing I2t) and incorrect operations due to operating voltage problems. Assetguard HVC guarantees also the monitoring of the auxiliary circuit voltage, the closing coil and the tripping coil currents by means of high-resolution waveforms.



Half rack (wall mounted)



19" Full rack

In details:

- Operating times of the individual poles in opening and closing in tenths of a millisecond on these monitorable operations.

(Open / Close single, CO, O - CO)

- Peak current during opening in kA tenths.

- Further calculations on opening operations as (current summation interrupted and counter number of operations).

- SF₆ gas density / temperature per switch/pole:

- Continuous monitoring of the density value compensated in temperature or pressure (based on sensor).
- Detection of gas leaks with indication of the remaining time at the appearance of the first alarm threshold.

- Current absorbed by charge-spring motors or pumps:

- Number of daily starts and total hours of operation.
- Current consumption in steady state.
- Threshold for maximum current absorbed when fully operational.

- Curves of the currents absorbed by the opening and closing coils during operation performed.

- In option, travel curve encoder + disconnectors and earthing switch monitoring + additional input channel (e.g. SF₆ GIS compartments).

Technical Data

Assetguard HVC is designed to withstand the harsh electrical, mechanical and climate environment at the substation, while providing the necessary demands of comprehensive hardware and software for a monitoring device.

- Electrical safety according to EN 60529, EN 61010-1 and EN 60255-5.
- Power supply port and each channel has a dielectric withstand capability of 3 kV RMS for 60 s and 5 kV 1.2/50 μ s impulse.
- Electromagnetic compatibility (EMC) according to EN61000 and EN 55011:
 - Level 3 electrostatic and electromagnetic immunity.
 - 4 kV surge immunity.
- Environmental strength according to EN 60068:
 - Operating temperature -30°C to 70°C.
 - Humidity 10 - 95%.
- Protection class IP 20.
- Measurement resolution 12 bit at 10 kS/s (16-bit version available upon request).

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16. Assetguard GDM (1/2) GIS Gas 밀도 분석장치



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Assetguard GDM



Gas Density Monitoring
for Gas Insulated Equipment

can connect up to 48 sensors providing a cost efficient channel per device ratio. Multiple field devices can be seamlessly resulting in a full SF₆ inventory management system capable of providing:

Introduction

The recent European and North American legislation has focused on greenhouse gases such as SF₆, with the target of reducing emissions to 0,5% per annum. As a result, gas density monitoring is essential to improve leakage visibility, notwithstanding the superior performance of modern Gas Insulated Switchgear (GIS).

The Siemens Assetguard GDM takes care of the actual SF₆ gas condition and helps manage a more dynamic and extensive network where conventional routine inspections are not viable such as offshore installations.

Features

- With its state-of-the-art web-based user interface, it provides Single Line Diagram view (SLD) for easy localization
- Gas density measurement with high accuracy, recognition of trends and prediction of intervention dates
- Overall SF₆ gas inventory
- Data storage for expert analysis
- Alarm forwarding to Siemens Customer Support Center
- Easy navigation to investigate actual condition or an alarm status
- Simultaneous access of different users, even on mobile devices without disturbing other systems for control, protection and automation
- Reuse of graphical web elements in other applications
- Multi-language and user based permissions

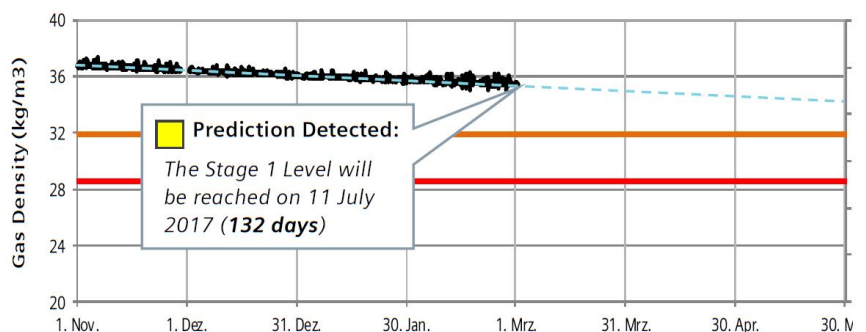
Benefits

- Early warning in case of SF₆ gas leakage (Time to next Alarm)
- Gas Lost Report for asset managers
- Facilitate the integrability (e.g. in SCADA Systems or Asset Management Platforms)
- Easy involvement of Siemens Customer Support
- Integration of monitoring gas zones in one single HMI

Scope of Work / Deliverable

Assetguard GDM has been specifically designed for Gas Density Monitoring in harsh substation environments. Besides complying to superior EMC and environmental standards, the sensors operate with a 4 to 20 mA current loop technology for high noise immunity. A single Assetguard GDM field device

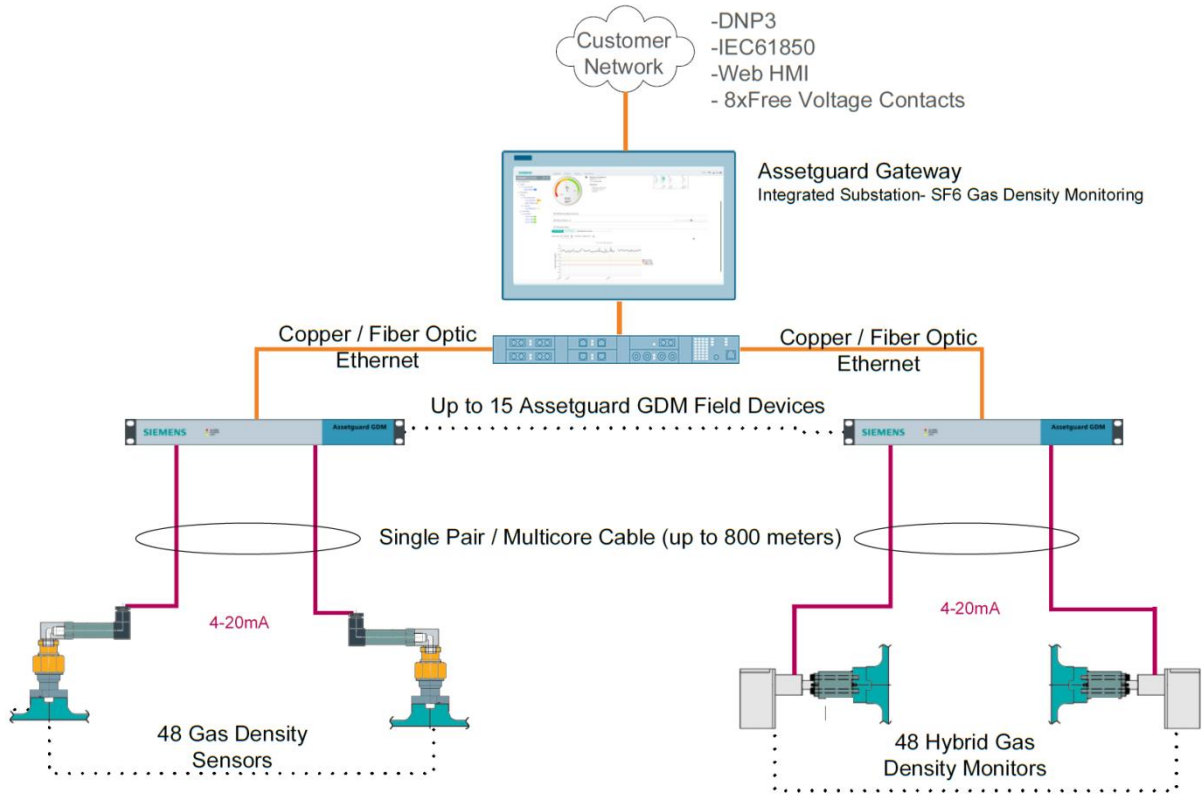
- Optional Gas Density Sensors (4-20mA)
- Assetguard GDM Field Devices for signal acquisition (48 Channels / device)
- Assetguard Gateway to integrate the data from the GDM field devices and optional partial discharge and circuit breaker field devices
- Web based User Interface
- Central Cubicle containing Assetguard Gateway and further needed network and communication components
- NTP Time synchronization
- Communication Protocols (Slave DNP3, IEC61850)
- Uninterrupted Power Supply for the Gateway (Buffering time 5 minutes)
- 8x Free Voltage Contacts



In-built Calculation of Predictions (time to next Alarm).

16. Assetguard GDM (2/2) GIS Gas 밀도 분석장치

Technical Details



Measurement Characteristics		Field Device Properties	
Acquisition	12-bit A/D resolution @ 16 Samples / second	Input Channels	48 Channels for Sensors with an analogue output (4-20mA) per Device
Self-Test	End-to-end signal chain, broken cable detection	Enclosure Dimensions	480 x 310 x 225 mm
Gas Density Alarms	Warning, Stage 1 (Low-Pressure), Stage 2 (Block-out), Time to next Alarm (next 90 days), Overpressure	Environmental Conditions	Operating Temperature: -25°C to 55°C; Humidity: ≈93%RH non-condensing
		EMC Standards	Immunity for usage in power station or substation environment, IEC 61000-6-5
		Ingress Protection Rating	IP 20
Selected Gateway Features			
Communication Protocol	IEC 61850, DNP3, Rest API, Volt-Free Contacts		
Historical Data Storage	Min. 5 years		
Gas Density Analysis	Time to next Alarm (Predictions), Gas Loss report (kg)		

For more information please contact our Customer Support Center:

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17. PDS-VMU (1/3) GIS 개폐기 점접 화상감시시스템

ES/DS Vision Monitoring Unit for GIS

PDS-VMU

Product Overview

GIS의 ES/DS는 밀폐구조로 육안 동작 확인이 불가하며, 개폐 상태를 잘못 확인한 상태에서 단로기 및 접지개폐기의 구동부 이상 및 오작동이 발생할 경우 대형사고로 이어질 수 있다.

ISAAC-PDS-VMU는 GIS의 ES/DS측 점검창에 설치되어 단로기와 접지개폐기의 상태를 실시간으로 확인 가능하다. 따라서, 점검자는 카메라를 통해 단로기와 접지개폐기의 OPEN/CLOSE 동작이 정상적으로 수행되었는지 육안으로 확인이 가능해져서 ES/DS 내부 결함이나 오동작으로 인한 사고를 미연에 방지할 수 있다.



< ISAAC-PDS-VMU >



< Control & Display Panel >

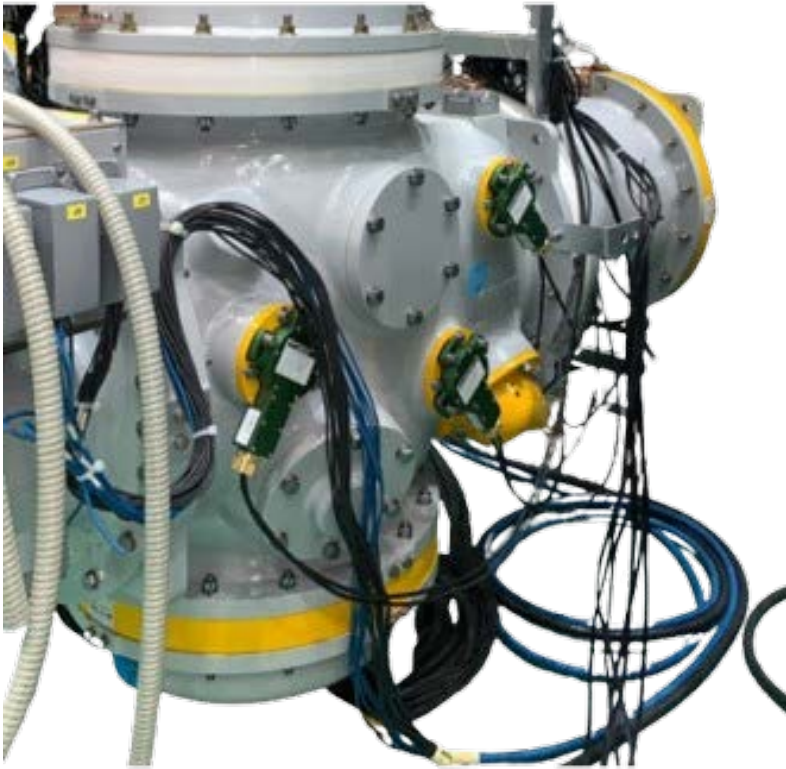
- 조이스틱과 버튼을 사용하여 카메라 선택
- Bay당 7대의 카메라로 구성 (최대 60대)
- 영상 데이터는 모니터에 Display

Features

- 단로기 및 접지스위치 위치를 실시간 화상 감시
- 점검 혹은 유지보수 시 점검자의 안전 확보
- 실시간 감시로 이상 발생 시 즉시, 원인분석 및 대처 가능
- 최대 60대의 카메라 접속 기능
- LED의 개별 ON/OFF를 통한 각 부위별 시야 최적화
- 전용 UI 기능 보유로 편리한 감시기능

17. PDS-VMU (2/3) GIS 개폐기 점접 화상감시시스템

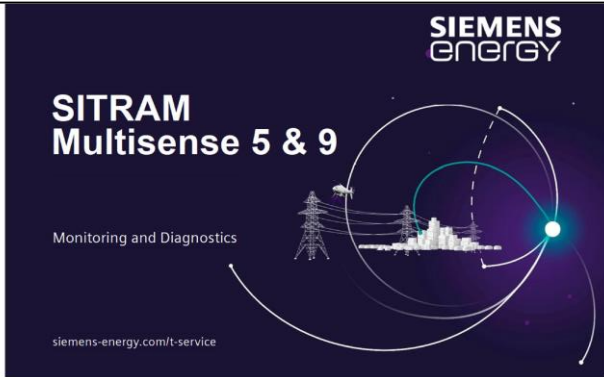
Applications



Technical Specifications

Camera Resolution	720 p
Input Camera Channel	60 CH (Max)
Display	HDMI 1.4a
Storage Memory	8GB
USB	USB2.0 X 3
Application	Exclusive HMI Application (메인보드 탑재)

18. Participation of SITRAM® Multisense Training Course (1/2)



Training Certification for Mr. JungHan Kim

Hereby we confirm the successful participation of Mr. JungHan Kim on the certification program for SITRAM monitoring products in Nurnberg, Germany during the period from 10th till 13th of October 2022.

The certification program included the following area:

- **Multisense 5 & 9:** Detailed information on installation, configuration, commissioning and maintenance of SITRAM Multisense 5 & 9

Mr. JungHan Kim is authorized and approved to execute installation, configuration, commissioning and maintenance work on the above mentioned monitoring portfolio.

This certificate is valid for three years from issuance date and can be extended with approval. The minimum requirement to keep this certification valid is, that Mr. JungHan Kim at least executes four Multisense 5 or 9 installations every year.

Hartmut Limprecht

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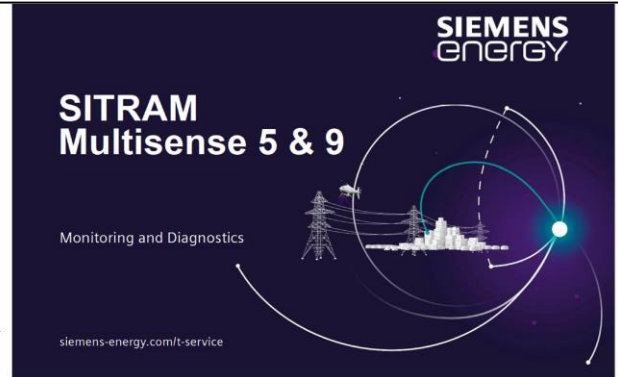
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The certification program included the following area:

- **Multisense 5 & 9:** Detailed information on installation, configuration, commissioning and maintenance of SITRAM Multisense 5 & 9

Mr. YeonPoong Kim is authorized and approved to execute installation, configuration, commissioning and maintenance work on the above mentioned monitoring portfolio.

This certificate is valid for three years from issuance date and can be extended with approval. The minimum requirement to keep this certification valid is, that Mr. YeonPoong Kim at least executes four Multisense 5 or 9 installations every year.

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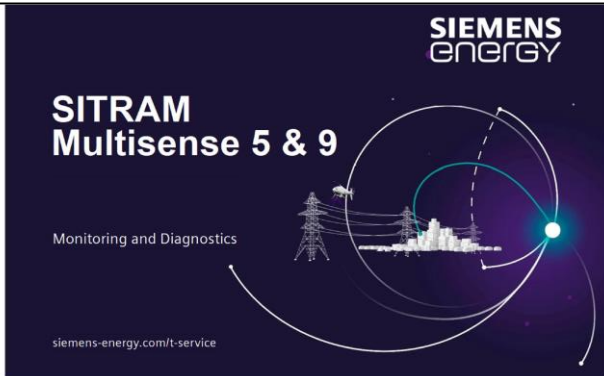
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The certification program included the following area:

- **Multisense 5 & 9:** Detailed information on installation, configuration, commissioning and maintenance of SITRAM Multisense 5 & 9

Mr. ByeongHo Lee is authorized and approved to execute installation, configuration, commissioning and maintenance work on the above mentioned monitoring portfolio.

This certificate is valid for three years from issuance date and can be extended with approval. The minimum requirement to keep this certification valid is, that Mr. ByeongHo Lee at least executes four Multisense 5 or 9 installations every year.

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18. Participation of SITRAM® Multisense Training Course (2/2)





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