To the future with **GABO**

We respect individual's characteristics, develop advanced technology that leads our era to fulfill customer's satisfaction by providing a valuable service. We promise to provide customer with a credible products and contribute to make a better society.

GABO Co., LTD.

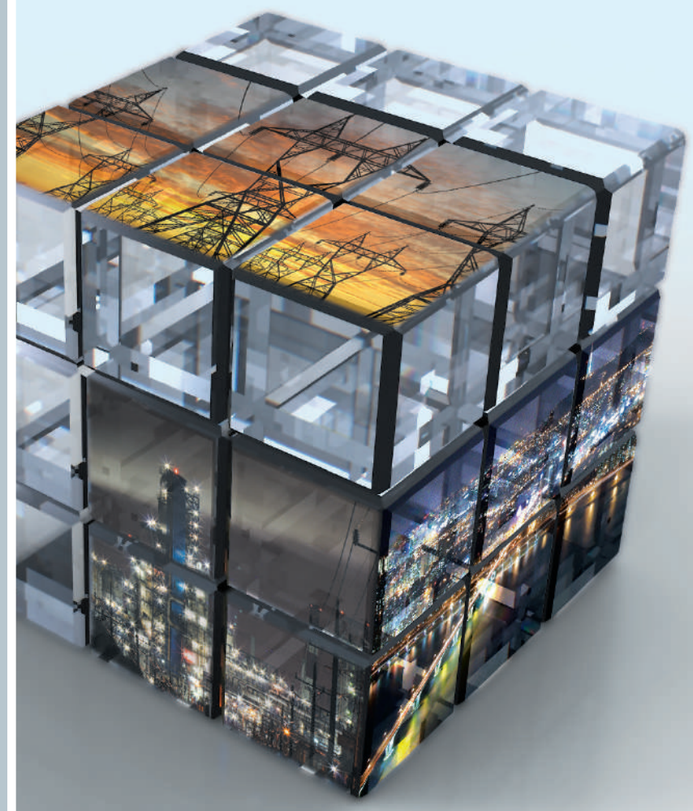
262, Sihwa-ro, Danwon-gu, Ansan-si, Gyeonggi-do, 425-836, Korea

Tel : 82-31-540-2200 Fax : 82-31-541-5840

URL : http://www.gabos.kr

To the future with **GABO**

We create a future value of the Power Industry.



To the future with **GABO**

We create a future
value of the Power Industry.

Prologue

GABO Co., LTD
is a company manufacturing products used in professional fields related with protection relay and control system.
Now, GABO is involved in power generation, power transmission and general power industry including power transformer substation, power monitor control, solar power generation control, remote plant control and water quality remote control & control system.

Professionals with solid academic and field experiences in power industry are providing total services like accurate designs, innovative products, and advanced engineering.

Since founded in 2003,
GABO has been highlighted as a company of excellence, providing products to KEPCO (Korean Electric Power Corporation), Korea Hydro & Nuclear Power Co., LTD, POSCO and many other related companies like heavy electric device suppliers and general plants.

CEO's Message

It says that a person feels satisfied
when he is aware of his goal and strives to attain it.
With higher goals and clear vision,
GABO Co., LTD is trying to make a brighter future.

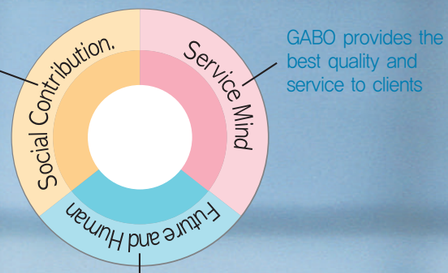
In twenty first century, we are facing
uncertainties and rapid changes.
Flexible ideas and rational decisions are
required in order to survive in this era.
Through growth and development,
we will do our best to establish
Win-Win situation with our clients.

We will satisfy our clients by understanding
and being aware of what our clients need,
and by providing best products with best quality.
Also we will understand and study the needs of
clients in advance to prepare and become
a company with trust gained from clients.

With unity, each member in GABO Co., LTD
will strive for one goal to make a better company,
which compensates our participants
rationally as much as possible.

CEO Seungwon, Oh

GABO puts value on people. GABO is providing a right direction to lead them to a better way.

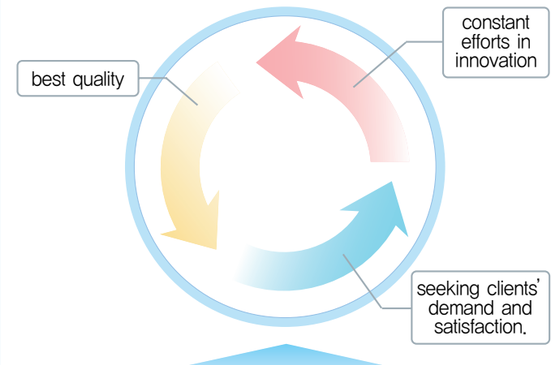


We respect individual's characteristics, develop advanced technology that leads our era to fulfill customer's satisfaction by providing a valuable service. We promise to provide customer with a credible products and contribute to make a better society.

M MISSION

THE BEST LEADING COMPANY IN OUR FIELD

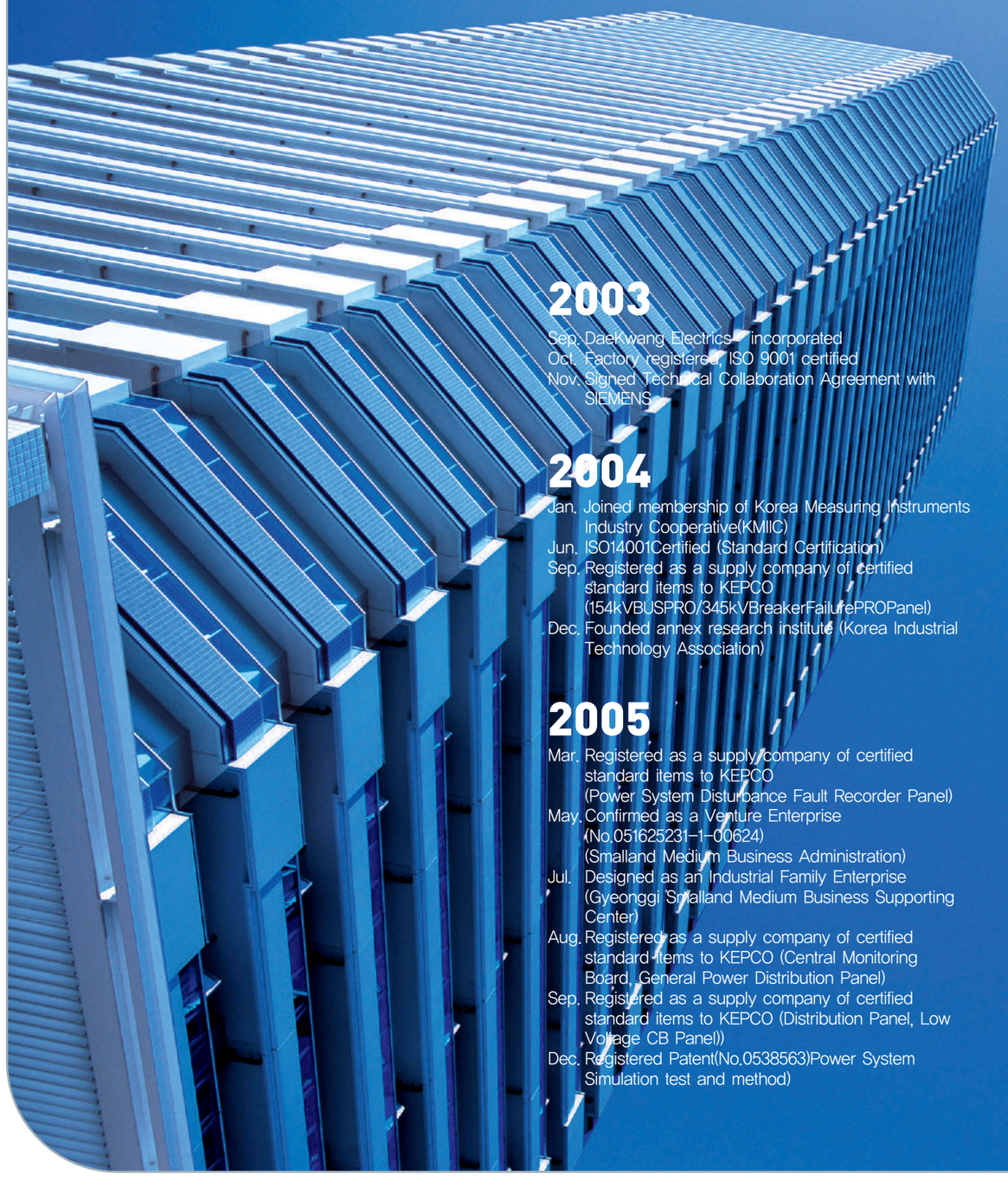
V VISION



C CORE VALUE

- Synergy of engineering technology of Siemens and manufacturing know-how of GABO
- Experienced professionals with excellent work ethics and attitude
- Fast reaction and vitality embedded in GABO's culture
- Clients' satisfaction with products and services

Company History



2003

Sep. DaeKwang Electrics incorporated
Oct. Factory registered, ISO 9001 certified
Nov. Signed Technical Collaboration Agreement with SIEMENS

2004

Jan. Joined membership of Korea Measuring Instruments Industry Cooperative(KMIIC)
Jun. ISO14001Certified (Standard Certification)
Sep. Registered as a supply company of certified standard items to KEPCO (154kVBUSPRO/345kVBreakerFailurePROPanel)
Dec. Founded annex research institute (Korea Industrial Technology Association)

2005

Mar. Registered as a supply company of certified standard items to KEPCO (Power System Disturbance Fault Recorder Panel)
May. Confirmed as a Venture Enterprise (No.051625231-1-00624) (Smalland Medium Business Administration)
Jul. Designed as an Industrial Family Enterprise (Gyeonggi Smalland Medium Business Supporting Center)
Aug. Registered as a supply company of certified standard items to KEPCO (Central Monitoring Board, General Power Distribution Panel)
Sep. Registered as a supply company of certified standard items to KEPCO (Distribution Panel, Low Voltage CB Panel))
Dec. Registered Patent(No.0538563)Power System Simulation test and method)

2006

Oct. Selected as a Technical Inno-biz Enterprise (SmallandMediumBusinessAdministration)
Nov. Registered as a supply company of certified standard items to KoreaWestern power Co., Ltd (Fault Recorder PNL, 345kV Protection Relay Panel)
Dec. Selected as a Management Inno-biz Enterprise (GyeonggiSmallandMediumBusinessAdministration)

2007

Jan. Registered as a supply company of certified standard items to KEPCO (154kVM.TransformerProtectionPanel)
Jan KOMIPO selected item, registered as an equipment supplier (Fault recorder)
Jul. Registered as a supply company of certified standard items to Korea East-West Power Co., Ltd (Fault Recorder PNL,345kV Protection Relay Panel)
Jul. Confirmed as a promising Small and Medium Sized Enterprise(GyeonggiProvincialGovernment)
Aug. Registered Information & Communication Works Business(GyeonggiProvincialGovernment)
Nov. Registered Software Business (KoreaSoftwareIndustryAssociation)
Dec. Renamed company name as GABO Co., Ltd.

2008

Sep. Registered as Korea Electric Power Company (KEPCO)credited item supplier (345 kV transmission line protection panel)
Sep. Registered as Korea Electric Power Company (KEPCO)credited item supplier (154 kV transmission line protection panel)
Aug. Korea Service Quality excellent company certification [Ministry of Knowledge Economy]
Feb. Small Business cooperation accreditation award [head of Department of Small Business Administration]

2009

Sep. Registered as Posco construction facility device supplier [F/R: fault recorder device]
Jun. Registered as Korea Electric Power Company (KEPCO)credited item supplier [fault dispatching prevention panel]
Feb. Registered as Korean Water Nuclear Atomic Power Co., Ltd auxiliary device supplier [F/R: fault recorder device]
Jan. Registered as Korea Electric Power Company (KEPCO)credited item supplier [154 kV local PCM current differential method & 3 connector [ratio, power ratio] transmission line protection panel]

2010

Dec. Registered as Hyundai Construction Co.,Ltd partner company [protection relay panel]
Dec. Patent : # 10-1003814 [incoming panel sensing electrical current fault & control]
Nov. Registered as Korea Electric Power Corporation (KEPCO)credited item supplier [154 kV Sh.C Bank Protection panel]
Oct. Patent: # 10-0991493 [multi breaker reclosing digital protection panel & its control method]
July. Registered as Korea Electric Power Corporation (KEPCO) general item supplier [client transmission protection panel]
Apr. Selected as an academic organizing supplier company [Human Resources Development Service of Korea]

2011

Oct. New practical device : registered # 20 - 0456484 [double screw generator device]
Oct. Patent: # 10-1072388 [generator rolling over top of the tract]
Sep. Registered as electrical construction company [Gyeonggi bureau]
Sep. Registered as an excellent company for development of human resource [human resource department, education science technology department,Ministry of Knowledge Economy, Korean federation of small business]
Jul. Patent: # 10-1050083 [water power generator device]
Jun. Registered as Korea Electric Power Corporation (KEPCO) general item supplier (Substation integrated control panel)

2012

Jun. Registered as Korea Electric Power Corporation (KEPCO) credited item supplier (154 kV transmission line protection IED panel, 154 kV, bus protection IED panel, 154 kV local transmission line IED panel)
Oct. GS certified: 12-0175 [345 kV central control protection panel v 1.2 [345 kV SICS HMI v 1.2]]
Dec. registered as Posco construction facility device supplier [electriccontrol,remotecontrolfacility]

2013

Mar. Utility model right registration: # 20-0465849 (power generating device using discharged water
July. Performance certificate (154 kV substation integrated control system v 1.2, 345 kV substation integrated control system v 1.2)
Oct. Awared as a Merit enterprise for developing excellent capital goods.

INDEX

TRANSMISSION LINE PROTECTION RELAY PANEL

TRANSMISSION LINE PROTECTION RELAY PANEL

Transmission line Protection Relay panel-1A transmission line, installed in wide area for its characteristics, is a power system facility that transfers power from generation to a customer.

Thus, compared to other power system facilities, transmission lines face more frequent accident rate due to natural disasters such as thunder and snow storm. It is important due to its effect on power transfer and degree of stability when there are changes of power flows. Thus it needs a protection function with stability of protective system.

In Korea, transmission line voltage levels are mainly 154 kV and 354 kV. In order to support development of the industry which needs electrical power, 756 kV line also constructed and operated.

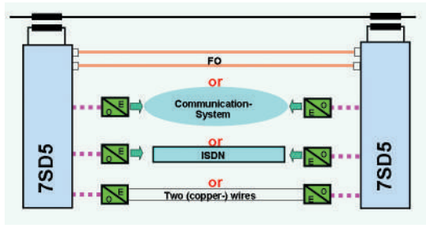
In transmission line protection panel, there is a function that uses PCM current differential function (87T) and back-up function which uses 3 steps (zone 1, 2, 3) distance protection scheme.

GABO's transmission line protection panel has a combination of main protection relay (7SD522) and back-up protection relay (7SA522) made from SIEMENS.

PCM COMMUNICATION FUNCTION

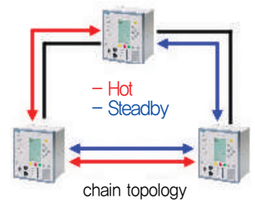
Through communication between relays at both ends, it checks differential current of transmission lines, deciding any existence of accidents.

Therefore multi-functional support of communication is a very important factor to support flexible application of current differential protection function.



REDUNDANCY OF COMMUNICATION LINE (RING/ CHAIN)

Local/Remote communication line enables redundancy. In 2 terminal systems, it offers as main/ back-up line. In 3 or more terminals it offers Ring/ Chain Topology.



chain topology

MULTI TERMINAL TRANSMISSION LINE PROTECTION FUNCTION

By providing general 2 terminal transmission line protections and multi terminals more than 3 terminals protection function, we provide facility's credibility and efficiency in operation.

345 [KV] TRANSMISSION LINE PROTECTION PANEL

345 [kv] transmission line protection panel
Due to high voltage level, 345 [kv] transmission line protection panel is applied with duplication system.

In order to guarantee credible function, it has redundancy by having two transmission lines.
(Protection panel composed of current differential relay and distance relay)

SHORT TRANSMISSION LINE PROTECTION PANEL

Along with development of the industry and urban areas, transmission lines have been buried in underground as built in short distance. That could cause problems of independence characteristics setting and disturbance in credibility of function.

Hence, a short transmission line protection panel has two types of protection relays, main and back-up. Like main protection relay, it uses current differential functions. And back-up protection relay uses distance protection function and current differential function.

TRANSMISSION LINE PROTECTION PANEL TECHNICAL SPECIFICATION/STANDARD

Index	Item		Specification	
			Current differential relay	Distance relay
Rating	Power Supply	Voltage Input	DC : 125 [V], AC : 230 [V] (Frequency 50/60 [hz])	
		Power Consumption	15 [W], 15 [VA]	
	Analog	Current	1 [A]. Burden : 0.05 [VA]	
			5 [A], Burden : 0.3 [VA]	
		Power	80/125[V], Power Consumption ≤ 0.1[VA]	
	Digital input		Number of digital input : 8/16/24 Voltage Range : 88 ~300 [VDC]	8/16/22/24
	Digital output		Number of digital Output : 7~31 Allowable Current : Continous (5[A]), 30[A](0.5[sec])	15~43
Communication	Communication port		RS-232, RS-485, Ethernet, FO(Fiber Optic)	
	Protocol		Profibus, DNP3.0, IEC61850, TCP/IP	
Time Synchronization			DCF77/IRIG-B/SNTP	

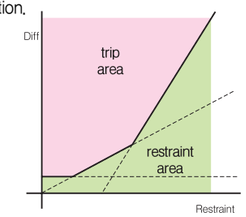
TRANSMISSION LINE PROTECTION RELAY PANEL-2

DIFFERENTIAL CURRENT RELAY(7SD5x)

- For a remote PCM communication between relays located at both ends, CCITT G. 703 and IEEE C37.94 standard applied.
- Designed to meet redundancy communication function for maintenance of protection function when a communication error occurs.
- In 3 or more terminals, a redundancy communication function offers Ring/ Chain Topology.
- In multi terminal differential current protection, it supports up to 6 terminals.
- Differential current protection could be applied also on transmission line including a transformer.
- Built in high sensitive protection function for detecting high impendence ground fault.
- Applied with synchronizing differential protection through communication delay time compensation between relays located in remote ends.

CHARACTERISTICS OF CURRENT DIFFERENTIAL PROTECTION

According to the ratio of restraint current and differential current, it is divided into trip area and non-trip area. In restraint current, it offers stable restraint current factor by considering current transformer error, synchronization error and CT saturation.



MAIN FUNCTION

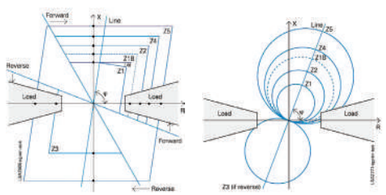
- Current differential function (an independent protection function on each phase)
- Auto compensation function on difference between CT ratios
- Current transformer open detection possible both in one pole/ three pole
- Fault location function
- Function to prevent mal-function through many fault detection
- Selection of one pole/three pole trip function
- Event recording function (trip, alarm, fail, etc)
- Using any portable computing device, setting and fault analysis function (Analysisprogram(DIGSI),comradefileconversionfunctionispossible)
- PCM telecommunication function between remote end relays.
- Charging current compensation function
- Auto-reclosing function
- User defined logic (CFC-continuous function chart)
- Self diagnosis function
- Metering function (current, voltage, active power, reactive power)

CHARACTERISTICS OF DISTANCE RELAY (7SA5x)

- Distance protection which could be applied up to 3 terminals transmission lines network
- Distance protection having 5+1 zone which could be set as forward/reverse and non- directional protection zone
- Polygonal characteristics and MHO characteristics selection
- Prevention of impedance over-reach by heavy load current
- Selection of mutual impedance compensation on parallel transmission line
- Built in high sensitive protection function for detecting high impedance ground fault
- Detection of current transformer saturation and compensation of errors occurring

CHARACTERISTICS OF 5+1 ZONE IMPEDANCE

By calculating impedance using voltage and current, 5+1 impedance zone which divided into forward and reverse direction could be provided. Also as characteristic curve, both polygonal characteristics and MHO characteristics are built-in to provide selections to users.



MAIN FUNCTION

- 5+1 step distance protection function (independent protection function on each phase)
- Auto reclosing function
- Weak source protection function
- Power Swing Blocking/ Out of Step Tripping
- STUB protection function
- Synchronization detection function and single pole/multi pole auto reclosing function
- Single pole/ multi pole current transformer open detection function
- Additional various fault detection functions
- Selectable One pole/ 3 poles Trip function
- Metering function (current, voltage, active/reactive power, etc)
- Event recording function (Trip, Alarm, Fail, etc)
- Using any portable computing device, setting and fault analysis function (Analysis program (DIGSI), comrade file conversion function is possible)
- Out of step detection
- Directional comparison protection
- Switch-onto-fault protection
- User defined logic (CFC-continuous function chart).
- Fault location function
- Self diagnosis function

BUSBAR PROTECTION RELAY PANEL-1

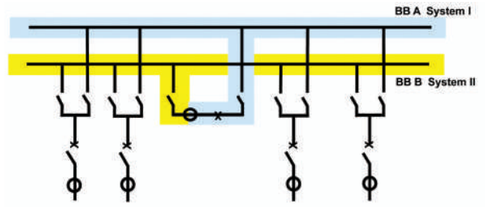
BUSBAR PROTECTION RELAY PANEL

In a Power System, substation is an assembly of technology and facility that carry out major functions such as distribution of power, up-down transform voltage and protection and control of system.

Within system, a busbar offers as an important function of which power gets concentrated and distributed through transmission lines. Thus in a busbar, an effect of fault goes on whole substation, which can lead into a severe black out accident by large fault current. In order to prevent this, multiple circuit breaker and switch gear are composed as parts of double busbar protection.

DOUBLE BUSBAR STRUCTURE

With the importance of busbar, in a double busbar structure, protection system is divided into Bus 1 and Bus 2 protection zone. Each of them protects system separately so as to save outage time when there is maintenance and accident. Also through incoming and outgoing current of whole busbar, Check Zone protection function checks internal fault.

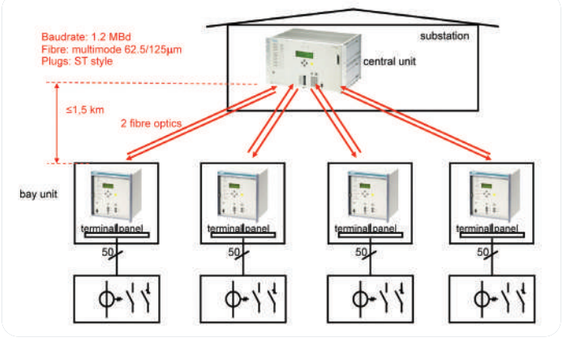


Main protection used in busbar protection includes current differential relay (87T). And backup protection includes under voltage protection relay using primary and secondary side's voltage transformer (VT) input source.

GABO's busbar protection panel has main protection relay including Central Unit (7SS522) combined with Bay Unit (7SS525) made from SIEMENS. By having accumulated knowledge in manufacturer technology of protection panel, and with experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate credible products.

BUSBAR PROTECTION SYSTEM CONFIGURATION

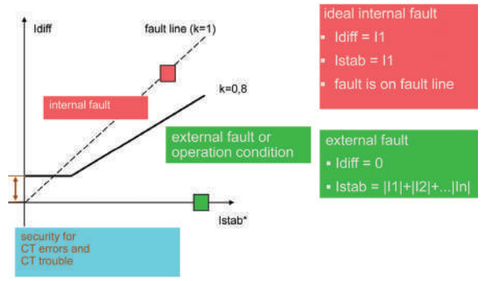
Busbar protection system is organized into Central Unit and Bay Unit. A Bay Unit measures current and control switchgear of each bay. And Central Unit checks internal fault of busbar by obtaining information from each Bay Unit.



BUSBAR PROTECTION RELAY PANEL-2

CENTRAL UNIT & BAY UNIT (7SS5x)

- Digital Protection Relay with 32 Bit high-speed microprocessor.
- Substation system configuration in graphics by using DIGSI software.
- Supports up to 12 Bus zones, and up to 12 Bus couplers.
- Selectable up to 48 Bus Units, and many Bus bar Protection.
- Independent and separate setting of Bus Zone and Check Zone.
- Accurate detection on internal/external fault by using a differential current protection.
- Offers selectable protection zone (Bus zone, Check zone) of multiple busbar system.
- Control and measurement of each Bay unit in Central unit.
- Enhancement of stability and speed of a system through fiber-optic connection.
- Stable activation through ratio current differential characteristics.
- Auto-compensation functions on current transformer ratio mismatch.
- Convenient function such as Remote setting/ Fault analysis by software.



DIFFERENTIAL CURRENT PROTECTION CHARACTERISTICS CURVE

Depending on a ratio between restraint current and differential current, it is divided into trip zone and non-trip zone. A restraint current has a stable restraint property that which compensates a current transformer error and CT saturation.

CENTRAL UNIT & BAY UNIT (7SS5x) MAIN FUNCTIONS

- Current differential protection (independent protection function on each phase)
- Breaker Failure protection
- Prevention of mal-operation by using CT saturation detection
- Current transformer ratio mismatches compensation through setting
- Circuit breaker status check function through low current detection
- End fault protection between current transformer and circuit breaker
- High speed tripping function
- User defined logic (CFC-continuous function chart).
- Function to prevent mal-function through many fault detection.
- Self-diagnosis
- Selection possible to one pole/three pole trip function
- Metering (current, voltage, active/ reactive power, etc)
- Event recording function (trip, alarm, fail, etc)
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

CU & BU (7SS5X) TECHNICAL SPECIFICATION/STANDARD

Index	Item		Central Unit	Bay Unit
Rating	Power Supply	Voltage Input	DC: 48/60, 110/125,220/250 [V]	
		Power Consumption	35 [W], 135 [W]	16 [W]
	Analog	Current	1 [A]. Burden: 0.1 [VA] 5 [A], Burden: 0.2 [VA]	
	Digital input		Number of digital input: 12 Voltage Range: 88 ~300 [VDC]	20 (10) 88~ 300 [VDC]
	Digital output		Number of digital Output: 16+1 Allowable Current: Continous (5[A]), 30 [A] (0.5 [sec])	5+1+1 Continuous (5[A], 30 [A] (0.5 [sec])
Communication	Communication port		RS-232, RS-485, Ethernet, FO (Fiber Optic)	RS-232, FO (Fiber Optic)
	Protocol		Profibus, DNP 3.0, IEC 61850, IEC 60870, TCP/IP	
Time Synchronization			DCF 77/IRIG-B/SNTP	

TRANSFORMER PROTECTION PANEL

TRANSFORMER PROTECTION PANEL

Transformer protection panelPower transmission is done through remote route between power station and receiving-end. And the efficiency of transmission is directly related to an economic feasibility.

Thus, generation voltage is stepped up and transmitted to receiving-end through remote grid. At a receiving-end, through stepping down, a power gets supplied while caring safety of distribution network and power customer.

This process of step up and step down is done by power transformer that which is one of the power facilities. Power transformer is important because it influences efficiency, safety, and stability of power transmission.

Power transformer is not only one of expensive power facilities which need long time for maintenance and contains multiple potential problems. Problem of power transformer can lead outage of power customer. Thus power transformer protection is directly related to power quality issue, making reliability important.

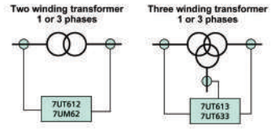
Protection relay needed for protection of transformer has current differential function as main protection. And for back up protection, over current protection is used in each primary side and in secondary side. Especially in secondary side, for NGR protection, ground over voltage protection relay is applied.

GABO's transformer protection panel has a main protection relay 7UT6x made from SIEMENS, in order to guarantee reliability. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

TRANSFORMER PROTECTION SYSTEM CONFIGURATION

Transformer protection relay measures current of primary and secondary current, and by using the measurement, it calculates restraint current and differential current. Thus transformer protection relay decides any existence of transformer internal/external fault by using ratio current differential relaying function.

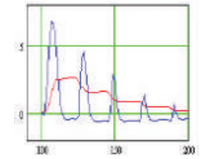
In a transformer, depends on number of winding, it is divided into 2 winding and 3 winding transformer. And current differential relaying function gets calculated by sum of all winding's current.



TRANSFORMER MAGNETIZING INRUSH CURRENT DETECTION

A magnetizing inrush current occurs when circuit breaker gets closed and transformer becomes initially energized.

This magnetizing inrush current occurs in primary side and does not pass on to secondary side, which causes differential current between two sides. The differential current function needs a function that prevents mal-operation caused by magnetizing inrush current.



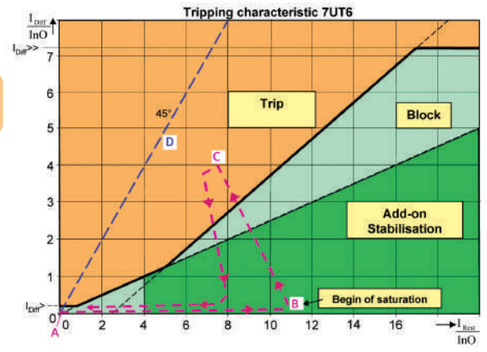
TRANSFORMER PROTECTION RELAY (7UT6x)

- Digital Protection Relay with 32 Bit high-speed microprocessor.
- Up to 5 winding transformer current differential protection.
- Stable Dual-Slope characteristics.
- Phase shift automatic compensation by using 12 Matrix.
- Automatic compensation on primary and secondary currency mismatch by using transformer's a rated current.
- Magnetizing inrush current detection through second harmonic blocking element.
- Current auto-compensation to CT saturation and CT ratio error, tap changer.
- Convenient function such as Remote setting/ Fault analysis by software.

TRANSFORMER PROTECTION RELAY (7UT6x) RATIO DIFFERENTIAL CHARACTERISTICS CURVE

A ratio current differential characteristic for transformer protection is divided into trip area and non-trip area by ratio between restraint current (scalar sum) and that of differential current (vector sum).

In case of transformer protection, it uses phase compensation decided from primary and secondary winding connection. Phase compensation uses vector group such as 30 [deg] x 12 in order to compensate phase difference and to prevent mal-operation by zero sequence current.



TRANSFORMER PROTECTION RELAY (7UT6x) TECHNICAL STANDARD/SPECIFICATION

Index	Item		Specification	Remarks
Rating	Power Supply	Voltage Input	DC: 125 [V], AC: 230 [V] (Frequency 50/60 [hz])	Selectable
		Power Consumption	20 [W], 28 [VA]	
	Analog	Current	1 [A]. Burden : 0.05 [VA] 5 [A], Burden : 0.3 [VA]	
		Power	80/125 [V]. Power Consumption ≤ 0.3 [VA]	
	Digital input		Number of digital input : 3~29 Voltage Range : 88 ~300 [VDC]	Selectable
	Digital output		Number of digital Output: 4~24 Allowable Current : Continous (5[A]), 30 [A] (0.5 [sec])	
Communication	Communication port		RS-232, RS-485, Ethernet, FO (Fiber Optic)	Selectable
	Protocol		Profibus, DNP 3.0, IEC 61850, TCP/IP	
Time Synchronization			DCF 77/IRIG-B/SNTP	Selectable

CIRCUIT BREAKER FAILURE PROTECTION PANEL

CIRCUIT BREAKER FAILURE PROTECTION PANEL

Circuit breaker is composed as one of electrical power system. As an expensive switch gear, it not only breaks a load current but also a fault current, serving as a practical implementing role in system management, control, and protection.

Thus credibility of circuit breaker activation is directly related to a credibility of other systems connected with. Due to this, effort to prevent circuit breaker and protection system fault should be improved.

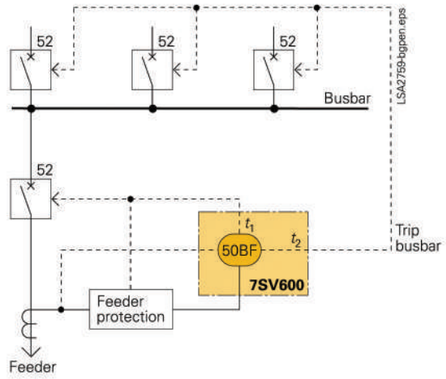
Recently, credibility of circuit breaker activation has been improved by development of GIS (Gas Insulation Switchgear). As diagnosis and protection of circuit breaker continuously evolved, at present, various types of verified systems have been applied.

Protection relay for 345 [kV] circuit breaker failure protections uses both over current protection function for diagnosis of circuit breaker condition and circuit breaker failure initiation function (BFI) by circuit breaker control command. Thus it is composed into and applied to a system in order to prevent spread of fault, using both circuit breaker trip commands by protection system and detection of circuit breaker's abnormal condition.

GABO's 345 [kV] circuit breaker failure protection panel has a protection relay (7SV600) made from SIEMENS, in order to guarantee reliability. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

CIRCUIT BREAKER FAILURE PROTECTION SYSTEM CONFIGURATION

Circuit Breaker failure protection system detects current flowing through a circuit breaker and an initiating signal for circuit breaker trip command, in order to monitor activation condition of a circuit breaker.
When circuit breaker failure gets detected, in order to prevent expansion of fault, circuit breaker failure protection system trips peripheral circuit breakers located nearby circuit breaker with fault.



BREAKER FAILURE PROTECTION RELAY (7SV6x) SPECIFICATION

- Digital Protection Relay with 16 Bit microprocessor.
- Independent high sensitive current detection on each phase.
- Independent indication on each phase / 3 phase common initiation detection.
- 2-out-of-4 current detection function
- Single- Stage, Two- Stage time delay.
- Remote end transfer trip.
- Zero Sequence, negative sequence current compensation

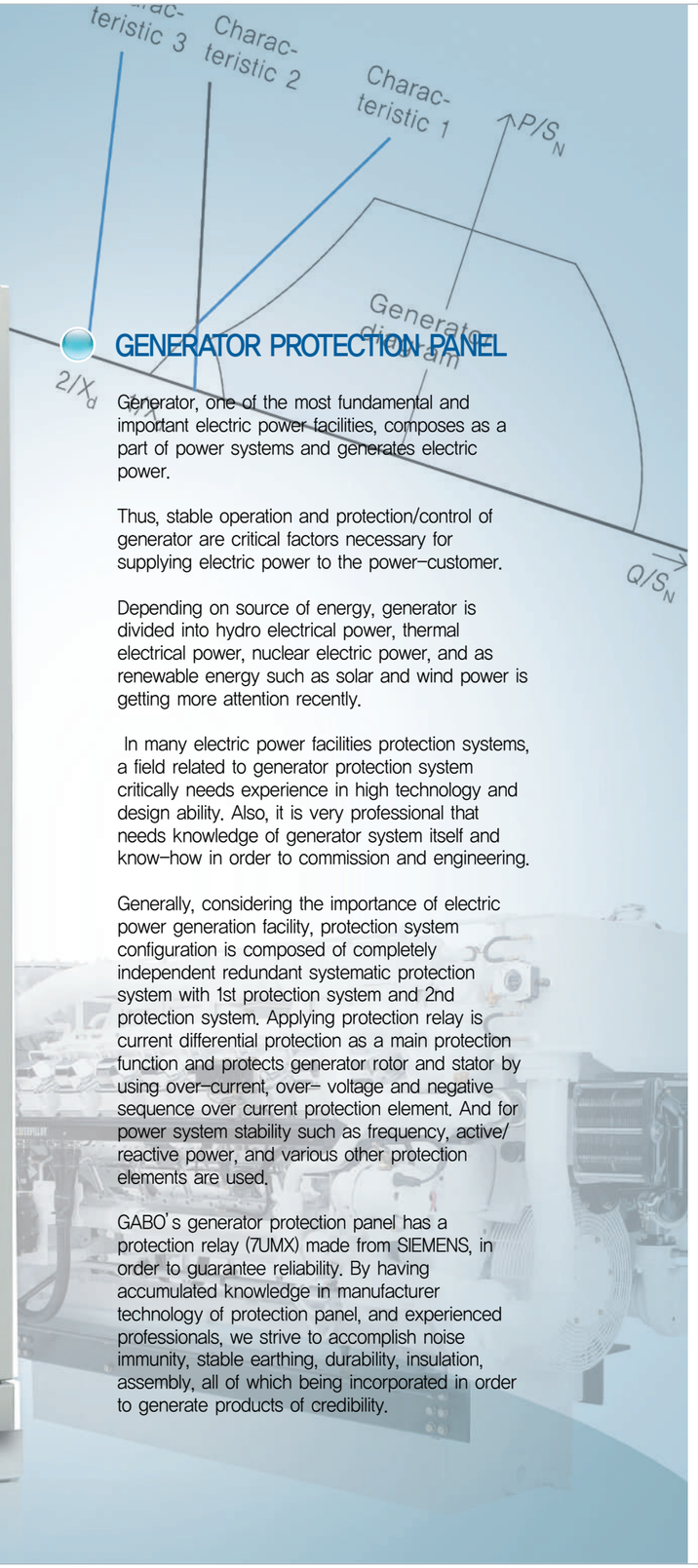
CIRCUIT BREAKER FAILURE PROTECTION RELAY (7SV6x) MAIN FUNCTION

- Circuit breaker failure (current/ circuit breaker condition observation) detection function.
- Remote end transfer trip.
- End Fault protection.
- User defined logic (CFC-continuous function chart).
- Function to prevent mal-function through many fault detection.
- Self-diagnosis
- Selection possible to one pole/three pole trip function
- Metering (current, voltage, active/ reactive power, etc)
- Event recording function (trip, alarm, fail, etc)
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

CIRCUIT BREAKER TECHNICAL SPEFICATION/STANDARD

Index	Item		Specification	Remarks
Rating	Power Supply	Voltage Input	DC: 125 [V], AC: 230 [V] (Frequency 50/60 [hz])	Selectable
		Power Consumption	4 [W]	
	Analog	Current	1 [A]. Burden: 0.1 [VA] 5 [A], Burden: 0.2 [VA]	
	Digital input		Number of digital input: 3 Voltage Range: 24 ~250 [VDC]	Selectable
	Digital output		Number of digital Output: 4 Allowable Current: Continous (5[A]), 30 [A] (0.5 [sec])	
Communication	Communication port		RS-485	Selectable

GENERATOR PROTECTION PANEL-1



GENERATOR PROTECTION PANEL

Generator, one of the most fundamental and important electric power facilities, composes as a part of power systems and generates electric power.

Thus, stable operation and protection/control of generator are critical factors necessary for supplying electric power to the power-customer.

Depending on source of energy, generator is divided into hydro electrical power, thermal electrical power, nuclear electric power, and as renewable energy such as solar and wind power is getting more attention recently.

In many electric power facilities protection systems, a field related to generator protection system critically needs experience in high technology and design ability. Also, it is very professional that needs knowledge of generator system itself and know-how in order to commission and engineering.

Generally, considering the importance of electric power generation facility, protection system configuration is composed of completely independent redundant systematic protection system with 1st protection system and 2nd protection system. Applying protection relay is current differential protection as a main protection function and protects generator rotor and stator by using over-current, over- voltage and negative sequence over current protection element. And for power system stability such as frequency, active/reactive power, and various other protection elements are used.

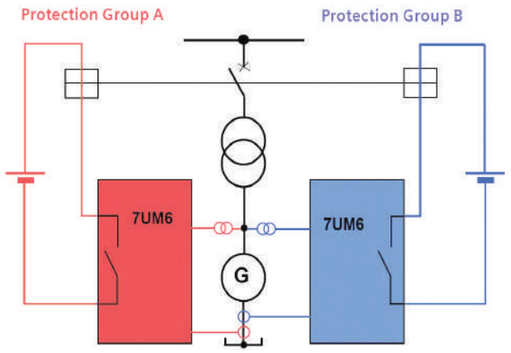
GABO's generator protection panel has a protection relay (7UMX) made from SIEMENS, in order to guarantee reliability. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

GENERATOR PROTECTION SYSTEMS CONFIGURATION

In a generator protection system, composition is different according to the kind of power generation facility, scheme of protection and protection philosophy that has been maintained in each country.

Generally, main protection is used with a current differential protection between primary and secondary winding for detecting generator's internal fault. And depending on system configuration and experience in design, main protection zone for generator protection could include step-up transformer.

Considering performance and reliability of system, redundant system composed of first protection and second protection has been used.



FLEXIBILITY OF FIELDS APPLIED

A generator protection panel with application of 7UMx developed by SIEMENS could be used in not only generator protection but also in motor, shunt reactor and transformer protection.

Thus, it could be used in a protection of electric power generation facility with step-up transformer, also in pumped storage power plant having characteristics of generator and motor, guarantee to provide economy and credibility of system.

GENERATOR PROTECTION TECHNICAL STANDARD/SPECIFICATION

Index	Item		Specification	
			Current differential relay	Distance relay
Rating	Power Supply	Voltage Input	DC: 125 [V], AC: 230 [V] (Frequency 50/60 [hz])	
		Power Consumption	15 [W], 15 [VA]	
	Analog	Current	1 [A]. Burden : 0.05 [VA] 5 [A], Burden : 0.3 [VA]	
		Power	0~200 [V]. Power Consumption ≒ 0.3 [VA]	
	Digital input		Number of digital input : 7/15 Voltage Range : 88 ~300 [VDC]	8/16/22/24
	Digital output		Number of digital Output : 12/20 Allowable Current : Continous (5[A]), 30 [A] (0.5 [sec])	15~43
Communication	Communication port		RS-232, RS-485, Ethernet, FO (Fiber Optic)	
	Protocol		ModBus, Profibus, DNP 3.0, IEC 61850, TCP/IP	
Time Synchronization			DCF 77/IRIG-B/SNTP	

GENERATOR PROTECTION PANEL-2

GENERATOR PROTECTION PANEL APPLICATION

A generator protection panel is designed accordingly to various protections scheme in which fitted into each kind of electric power generation facility. Our generator protection panel with 7UMx, can be applied for protection of following various generator facility.

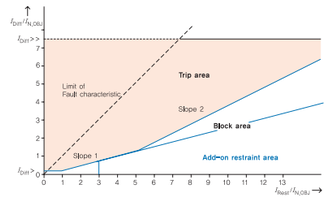
- Hydro power generation plant protection.
- Pumped storage power generation plant protection.
- Diesel power generation plant protection.
- Gas turbine power generation plant protection.
- Steam turbine power generation plant protection.
- Self power generation facility protection.
- Wind turbine power generation plant protection.
- Renewable energy power generation plant protection.

GENERATOR PROTECTION RELAY (7UMx)

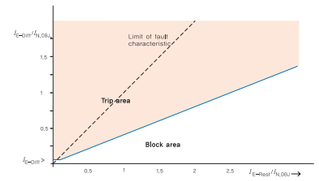
- Provides various applications with multiple protection function.
- Protection function including electric power generator/ motor/ transformer.
- 100 % Stator earth fault protection using third-harmonic element.
- Stator earth fault protection using 20 Hz voltage element.
- Impendence protection element (distance protection element).
- Differential current protection element for ground fault.
- Restricted earth fault protection.
- Out-of-Step detection function.
- High sensitive earth fault of rotor detection function.
- Voltage input circuit fault detection function.

CURRENT DIFFERENTIAL PROTECTION CHARACTERISTICS

Depending on ratio between differential current and restraint current, it is divided into trip area and non-trip area. In restraint current, stable restraint characteristics is provided considering current transformer error, synchronization error, and CT saturation. Differential current protection function provides distinguished trip characteristics in order to detect a phase-to-earth fault and a phase-to-phase fault of a power generator.



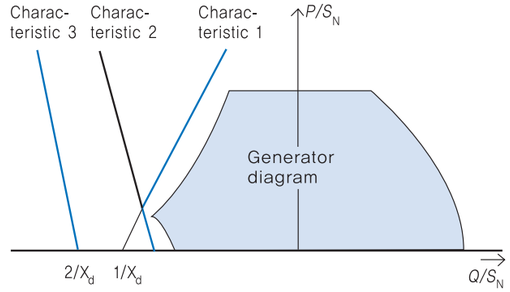
〈SHORT CHARACTERISTICS〉



〈EARTH CHARACTERISTICS〉

EXCITATION SYSTEM FAULT PROTECTION

Excitation system fault protection uses impendence/admittance detection element by utilizing generator's terminal voltage and current. For a credible detection, characteristics of 3-step protection zone are provided.



ELEMENTS OF PROTECTION RELAY (7UMx)

- Current differential protection (87G/87T/87M).
- Ground fault of stator winding protection.
- High sensitive stator/rotor ground fault protection.
- Stator overload protection.
- Over current/ over voltage protection.
- Frequency protection.
- Active/ reactive power protection.
- Over Excitation protection.
- Excitation system fault (exciter loss) protection.
- Negative phase sequence detection.
- Circuit breaker failure protection.
- Impedance protection.
- Out of step protection.
- Circuit breaker trip coil supervision protection.
- Self-diagnosis.
- Metering (current, voltage, active/ reactive power, etc)
- Event recording function (trip, alarm, fail, etc)
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

FAULT/EVENT RECORDING PANEL

FAULT/EVENT RECORDING PANEL

A power system composes of various electric facilities such as electric power generator, switch gear, circuit breaker, transmission line, distribution line, and electric load. It is distributed through wide spread area and its characteristics changes in real-time basis depending on operating and load condition.

Considering an effect of power system's fault to the industry and maintenance period, through its prompt restoration and recurrence prevention through an analysis of a cause should be important. Also during a system operation, such solution is needed to prevent any system fault through analysis of electric signal status

Thus in a power system industry, system monitoring, analysis and fault preventions are getting more attention. Through acquiring data about which operational state of each power system facility and protection/ control system, a data analysis and prevention will be implemented.

A fault recording panel is used for analysis of trouble's cause and operation status of system. When a power system has an abnormal condition (fault, power swing, disturbance, etc), it utilizes by recording and analyzing not only activation status of system's protection and control device, but also electric data (voltage, current, frequency, active/reactive power, power factor, etc).

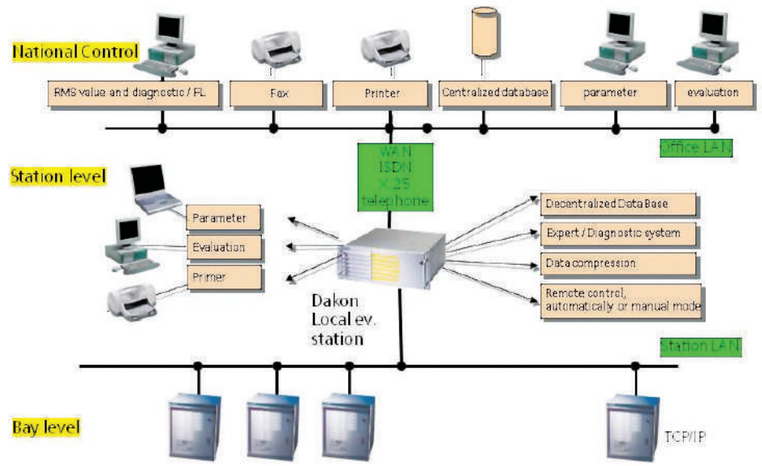
GABO's fault recording panel has a digital fault recorder (SIMEAS-R) made from SIEMENS, in order to guarantee a reliability. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

FAULT/EVENT RECORDING SYSTEM CONFIGURATION

Fault recording system is composed of SIMEAS-R (fault recording device), software (OSCOP-P) for monitoring and operating, a printer, and an industrial computer for a system operation.

Depending on user's purpose, a system configuration could be applied in various ways. Communication network for remote monitoring supports serial, Modem and TCP/IP.

Also, time synchronization could be done by using GPS signal. Time synchronization function of each device enhances an accuracy of analyzing a cause of fault/event.

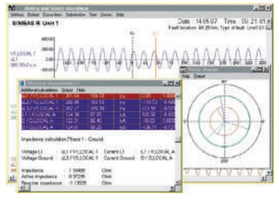


FAULT/EVENT RECORDER (SIMEAS-R)

- Digital Fault Recorder with 32 Bit microprocessor.
- GPS time synchronization.
- Record 1700 fault/event data per second.
- 256 [Sample]/ 1 [cycle] sampling frequency.
- PC Card Slot Type II.
- Ethernet LAN (TCP/IP).
- Gain control of analog channel.
- Signal assignment for Binary Input
- Large capacity memory saving device.
- Parallel port (LPT 1) for printer.

FAULT/EVENT RECORDER MAIN FUNCTION

- A synchronizing storage recorder for 32 analog inputs and 64 digital inputs.
- Auto operation mode/ manual operation mode.
- Event data recording trigger setting through scheduler/ event setting.
- 3 kinds of operation mode (normal, locked, test).
- Remote control and setting by using OSCOP-P at Local PC.
- Calculation of power quality through using SICARO-PQ software.
- PMU (Phase Measurement Unit) optional.
- Self-diagnosis.



FAULT RECORDER TECHNICAL STANDARD/SPECIFICATION

Index	Item		Specification	Remarks
Rating	Power Supply	Voltage Input	DC: 125 [V], AC: 230 [V] (Frequency 50/60 [hz])	Selectable
		Power Consumption	40 [W], 70 [VA]	
	Analog input		32 [ch] 1 [A], Burden: 0.1 [VA] 5 [A], Burden: 0.2 [VA]	Selectable
	Digital input		Number of digital input: 64 Voltage Range: 24 ~250 [VDC]	Selectable
Communication	Communication port		LPT1,RS-232, RS-485, Ethernet	Selectable

MINI RTU PANEL

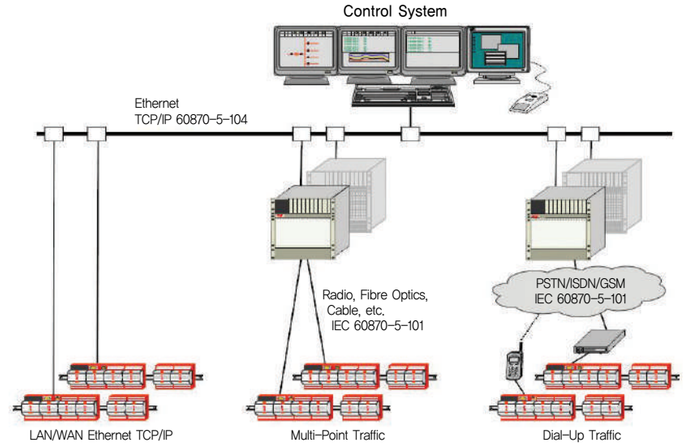
MINI RTU PANEL

Operation systems of generation and substation have protection system and monitor/control/ measurement system for electric power facility. In these systems, system for monitor/control/ measurement has been changed in large from a previous analog type to a recently developed digital type. Also for a stable system operation, expensive facility has been used. Especially RTU (Remote Terminal Unit) has been variously applied for its purpose as an essential device, providing interface between electrical power facility and operation system's HMI (Human Machine Interface). This interface involves a system monitoring of electric power facility, a control of an operation system, sending/ receiving of various electric operating information from/to remote end. Through an optimization that fulfills customer's requirements, Mini-RTU Panel guarantees an economy and flexible application depending on a purpose of a facility, done by applying a concentrated mini RTU.

Mini-RTU implements monitoring/control/measurement function at an operating workstation through telecommunication. Since it enables module's flexible combination, economical and optimal system configuration could be made in order to satisfy customer's requirement.

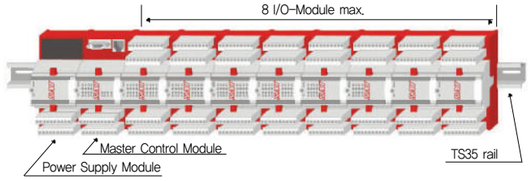
MINI RTU PANEL SYSTEM CONFIGURATION

Number of maximum module: up to 10 EA
Essential composition: Power supply Module/ Master Module
User selectable: up to 8 EA Module (quantity and types).



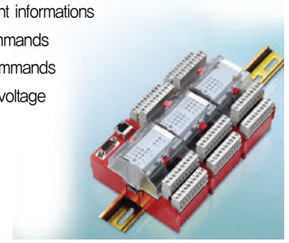
MINI RTU PANEL MECHANICAL DESIGN

Number of maximum module: up to 10 EA
Essential composition: Power supply Module/ Master Module
User selectable : up to 8 EA Module (quantity and types).



MAIN FUNCTIONS

- Monitoring of I/O modules for failure.
- Monitoring of the communication for failure.
- Acquisition and processing of local peripherals (monitor direction)
  - · Acquisition of single-point informations
  - · Acquisition of double-point informations
  - · Acquisition of counting pulses
  - · Acquisition of currents, voltages, frequencies
- Processing and output to local peripherals (control direction).
  - · Output of single-point informations
  - · Output of single commands
  - · Output of double commands
  - · Output of current & voltage setpoint values



TECHNICAL STANDARD/SPECIFICATION

Item	Module	Type	Specification	Remark
Rating	Master Control Module	CP-6020	V.28	Selectable
		CP-6040	Ethernet	
	Power Supply Module	PS-6630	24 ~ 60 VDC	Selectable
		PS-6632	110 ~ 220VDC	
	Analog Input Module	AI-6300	number of input: 4 input range : ±20mA / ±10V	Selectable
		AI-6307	number of input : 4 input range : ±5mA / ±10V	
		AI-6310	number of input : 4 input range: Pt100 / Ni100	
	Analog Output Module	AO-6380	number of input : 4 output range : ±20mA/±10mA/±10V	
	Digital Input Module	DI-6100	number of input : 16 input range : 24 ~ 60 VDC	Selectable
		DI-6101	number of input : 16 input range : 110 / 220 VDC	
		DI-6102	number of input : 16 input range : 24 ~ 60 VDC 1ms	
		DI-6103	number of input : 16 input range : 110 / 220 VDC 1ms	
		DI-6104	number of input : 16 input range : 220 VDC	
	Digital Output Module	DO-6200	number of input : 16 output range : 24-60 VDC	Selectable
		DO-6212	number of input : 8 output range : 24-220VDC/230 VAC	

GIS_LOCAL CONTROL PANEL

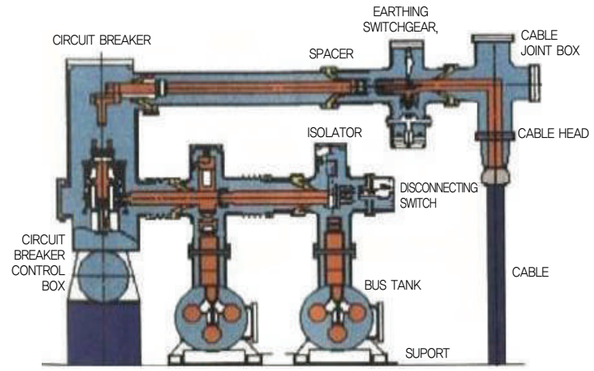
GAS INSULATED SWITCHGEAR

Followed from a development of the industry, power consumption has been increased and led a large capacity and extra-high voltage of power systems. Thus stability and credibility of electric power facility is very important issue. Due to difficulty in procurement of an industrial site for power generation plants, excessive amount of expenditure in maintenance, safety issue, trends in making extra-high voltage electric power facility has been changed. Main circuit system for power supply has been concealed and enclosed while a control system has been changed to a electronic digital type. Also in issue regard to insulation, previous air or oil insulated substation facility has been changed to a gas insulated substation facility.

GIS (Gas Insulated Switchgear)
GIS is concealed facility that has switching facility such as circuit breakers, disconnection switch and transformers, arresters and busbar etc, in metal tanks.
Its charging part is supported by a Spacer. And an inside of tank is filled with SF6gaswhichhasexcellentinsulating andarc-suppressingperformance.

GIS SYSTEM CONFIGURATION

1. Circuit Breaker
   A type of switchgear, it could open and close not only a normal load operation but also a faulty system. Moreover, a circuit breaker could open both normal load current, and fault current.
2. Disconnection switch
   It is a switchgear device used when circuit transition, sectionalizing, disconnecting no-load devices from circuits. Therefore it always performs its operation in no-load status.
3. Earthing Switchgear
   Earthing on GIS is impossible since it is concealed by metals. Thus earthing switchgear is installed for earthing circuits after an outage.
4. Local Control Panel
   It is an installed panel for control/monitor of GIS' main devices such as circuit breakers, disconnection switches, and earthing switchgear. Also it includes an interlock circuit for prevention of disoperation when controlling those devices.

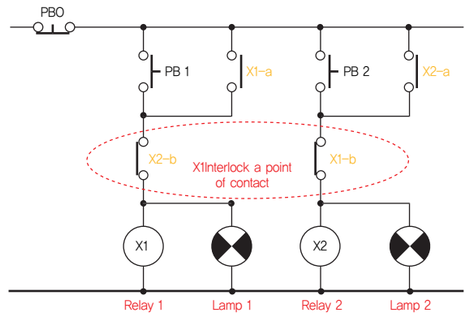


LCP MAIN FUNCTIONS

1. Control of switchgear (Circuit breaker, disconnection switch, earthing switch)
2. Monitoring status of switchgear and its damping gas, etc.
3. Interlock circuit for prevention of disoperation.
4. Interface between protection panel and GIS main devices.

WHAT IS AN INTERLOCK?

It is a circuit for a protection of facilities and a safety of operator. By using a contact for device status, it checks and locks activation of facilities related to each other.



TECHNICAL STANDARD/SPECIFICATION

	Item	Specification	Remarks
Rating	controlled power	DC : 110V or 125V or 220V	Selectable
		AC : 120V or 220V	
	Current	1 or 5A	
	Voltage	AC63.5V or 66.4V or 110V or Higher	
Environment	Allowed Tempearture	-25˚ ~ 40˚C	Selectable
structure	Allowed location	Indoor or Outdoor type	Selectable

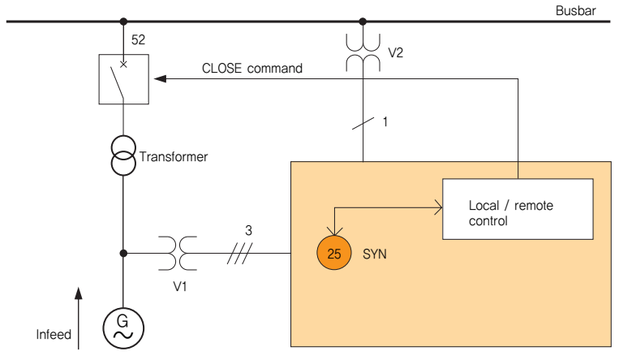
BAY CONTROL PANEL

BAY CONTROL PANEL

An operation system of generation/substation implements mainly three functions, protection, monitor/control and measurement. To delve into each function, protection function is provided by protection relay. Monitor/control function is for switchgear like circuit breaker and disconnection switch, and it also monitors voltage, current and electric physical properties.
For a technology related to operation system, technology has been developed from analog to a digital due to a development of a computer technology. Recently, along with a development of telecommunication, a telecommunication technology based on an international protocol has been applied to electric power operation system.
BCU (Bay Control Unit) is a digital device (called IED, intelligent Electronic Device) attached with a communication, a protection, a control and monitor functions. These days, it supports IEC 61850 protocols widely applied as an international standard in fields of substation automation. BCP (Bay Controller Panel) performs as an interface between monitoring/control systems and controlled facility. It enhances economy and credibility through BCU attached on BCP, having flexible digital control function and communication function. BCP implements control/monitoring/measurement function as a RCP does by using enunciator and meter.
Bay Control Panel lets implementation of control and status monitor on circuit breaker, disconnection switch and earthing switch at workstation through telecommunication. Also when a circuit breaker closes, having synchronization check function enables more stable operation of circuit breaker. GABO's Bay Control unit has a Controller Unit (6MD66) made from SIEMENS installed independently in each breaker. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

BAY CONTROL PANEL SYSTEM CONFIGURATION

Bay Control panel system configuration is formed to implement controlling and status monitoring for a circuit breaker, a disconnection switch and an earthing switch. When circuit breaker closes, closing gets possible after synchronization check on voltage of both ends of circuit breakers (Through PT inputs at both ends of circuit breakers). Bay control panel obtains current and voltage value from CT and PT. Then at operating workstation level, a monitoring becomes possible.

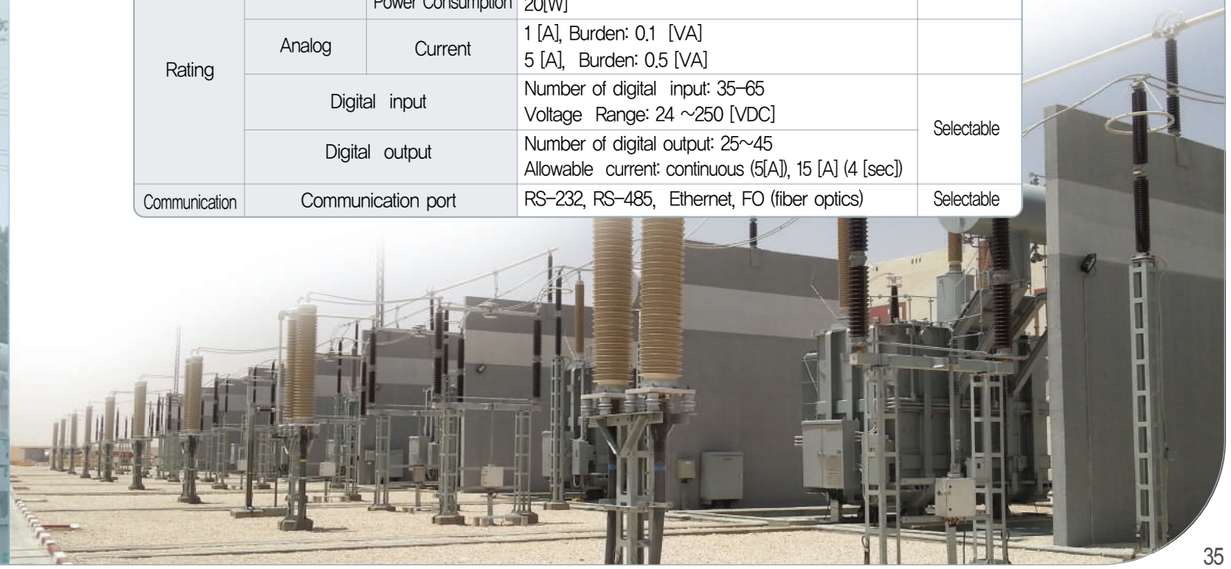


BAY CONTROL UNIT MAIN FUNCTION

- Synchronization Check function
- User defined logic (CFC-continuous function chart).
- Self-diagnosis
- One pole/ three pole trip selection
- Metering (current, voltage, active/reactive current, apparent electric power, frequency, power factor)
- Event recording (trip, alarm, fail, etc)
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

TECHNICAL STANDARD/SPECIFICATION

Index	Item		Specification	Remarks
Rating	Power Supply	Voltage Input	DC : 24~48VDC/60VDC/110VDC/220~250VDC	Selectable
		Power Consumption	20[W]	
	Analog	Current	1 [A], Burden: 0.1 [VA] 5 [A], Burden: 0.5 [VA]	
	Digital input		Number of digital input: 35-65 Voltage Range: 24 ~250 [VDC]	Selectable
	Digital output		Number of digital output: 25~45 Allowable current: continuous (5[A]), 15 [A] (4 [sec])	
Communication	Communication port		RS-232, RS-485, Ethernet, FO (fiber optics)	Selectable



SPS-SPECIAL PROTECTION SYSTEM

SPS-SPECIAL PROTECTION SYSTEM

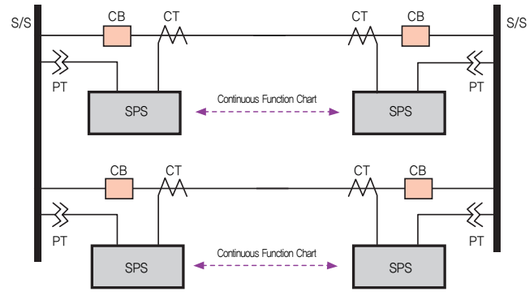
A formation of a power system has a structure that transfers a power from a power source located in suburban area to an urban area that needs a large amount of power demand. A transmission network has parallel dual lines for a power transmission in order to avoid an outage when fault occurs, however as a power customer getting increased there is a dangerous factor which can generate an outage in nationwide when a fault occurs in a transmission network. Thus when medium to large fault occurs there could be an accident in both lines of transmission network, generating a severe problem in stability of power system due to a transmission network or an over current of a generator. Such as solution is needed for maintenance of current distribution and balances in power customer, and a Special Protection System is used for this purpose.

A special protection system maintains power system's stability when a serious fault occurs in power system and constantly supplies power by estimating a maximum current. It is used for a prevention of transition instability at generating end and for a prevention of voltage instability at a power customer's end. Thus, protection functions such as over-current detection, current detection, negative sequence over current detection, over/under voltage detection, ground over voltage detection, and breaker activation detection are used. Especially current detection function maintains stability through a prompt activation by detecting an open state of facing end through detection function of power change ratio.

GABO's Special Protection function has a main protection relay 7SJ64 made from SIEMENS, in order to guarantee reliability. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

SPECIAL PROTECTION SYSTEM CONFIGURATION

A system configuration of Special Protection System shows when dual circuit breaker opens due to a fault in parallel dual circuit transmission network configuration, it implements a function set as to detect any problems. It implements protection factor through calculation of dual circuit voltage, current input, and receives an information of state of a breaker, in which performs as protective role by monitoring in real time basis any existence of fault in transmission lines and operation state.



SPS- SPECIAL PROTECTION SYSTEM PROTECTION RELAY PANEL (7SJ64)

CHARACTERISTICS

- Digital Protection Relay with 32 Bit high-speed microprocessor.
- Flexible function (protection functions through inputs of voltage, current, frequency, power etc)
- User define logic through CFC (continuous function chart)
- Text/ Graphic LCD selection for HMI
- Multi-function relay through electric computation through voltage, current and power.
- Supports various protocol (DNP 3.0 PROFIBUS, IEC-61850 etc) for monitor/control
- Visual synchronization through IRIG-B/ DCF 77
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

MAIN FUNCTIONS

- Over current detection (True RMS detection including harmonic wave).
- Power current detection (power ratio change detection).
- Breaker Failure protection
- Directional over current detection (True RMS detection including harmonic wave).
- Negative phase over current detection.
- Over/ under voltage detection.
- Frequency detection.
- Over load current detection.
- Self-diagnosis
- Metering (current, voltage, active/reactive power, etc)
- Event recording (trip, alarm, fail)
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Contrade File conversion function) becomes possible.

TECHNICAL STANDARD/SPECIFICATION

Index	Item		Specification	Remarks
Rating	Power Supply	Voltage Input	DC: 125 [V], AC: 230 [V] (Frequency 50/60 [hz])	Selectable
		Power Consumption	7/9 [W], 15/23 [VA]	
	Analog nput	Current(CT)	1 [A], Burden: 0.05 [VA] 5 [A], Burden: 0.3 [VA]	
		Power(PT)	100 [V]. Power Consumption ≤ 0.3 [VA]	
	Digital input		Number of digital input: 8~48 Voltage Range: 88 ~300 [VDC]	Selectable
	Digital output		Number of digital output: 6~30 Allowable current:continuous (5[A]), 30 [A] (0.5 [sec])	
Communication	Communication port		RS-232, RS-485, Ethernet, FO (fiber optics)	Selectable
	Protocol		Profibus, DNP 3.0, IEC 61850, TCP/ IP	
Time Synchronization			DCF 77/IRIG-B/ SNTP	Selectable

SHUNT CAPACITOR BANK PANEL

SHUNT CAPACITOR BANK

Shunt Capacitor Bank is generally used electric power facility that enhances an efficiency of power transmission, constantly maintains a voltage of power system through compensation on reactive power. Along with a difficulty in building a new power generation plant and rapid increase of power demand, an effort for demand management and to maximize usage efficiency of transmission/substation facility has been executed by installing more large capacity Shunt Capacitor Bank every year. Thus, for a stable operation of a power system, an application of professional and credible protection system for Shunt Capacitor Bank has been more conspicuous.

Protection relay for 154 [kv] Sh.C Bank has a mixed protection function for a compartment of the Capacitor Bank such as a reactor, condenser combined with series/parallel, and neutral Register. Protection functions such as over-current detection, unbalance detection for a fault detection of each phase of condenser having 2 parallel structures, negative sequence over current detection, over/under voltage detection, and ground over current detection are used. Especially in over current detection, a detection function uses True RMS over current detection including a harmonic wave emitted from Sh.C Bank.

GABO's 154 [kv] Sh.C Bank has a main protection relay 7SJ64 and 7SJ62 made from SIEMENS, in order to guarantee a reliability. By having accumulated knowledge in manufacturer technology of protection panel, and experienced professionals, we strive to accomplish noise immunity, stable earthing, durability, insulation, assembly, all of which being incorporated in order to generate products of credibility.

SHUNT CAPACITOR BANK PROTECTION SYSTEM CONFIGURATION

Depending on a scheme of a Bank, protection functions are different in Sh.C protection system. Generally it is composed with serial reactor, condenser combined with serial/parallel, and neutral point Register. Thus, in three factors which form Sh.C Bank, if any fault occurs, it is sensed as an internal fault. Then a breaker opens. And if external fault occurs, it performs obligation of protection keeping a normal operation by distinguishing it with an internal fault.

154kV SH.C BANK PROTECTION RELAY (7SJ62, 7SJ64)

CHARACTERISTICS

- Digital Protection Relay with 32 Bit high-speed microprocessor.
- Flexible function (protection functions through inputs of voltage, current, frequency, power etc)
- User define logic through CFC (continuous function chart)
- Text/ Graphic LCD selection for HMI
- Multi-function relay through electric computation through voltage, current and power.
- Supports various protocol (DNP 3.0 PROFIBUS, IEC-61850 etc) for monitor/control
- Visual synchronization through IRIG-B/ DCF 77
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

MAIN FUNCTIONS

- Over current detection (True RMS detection including harmonic wave).
- Directional over current detection (True RMS detection including harmonic wave).
- Negative phase over current detection.
- Unbalance detection on each phase of Sh.C Bank.
- Over/ under voltage detection.
- Frequency detection.
- Over load current detection.
- Self-diagnosis
- Metering (current, voltage, active/reactive power, etc)
- Event recording (trip, alarm, fail)
- Using any portable computing device, setting and fault analysis function (analysis program (DIGSI), Comrade File conversion function) becomes possible.

TECHNICAL STANDARD/SPECIFICATION

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		Power(PT)	100 [V]. Power Consumption ≤ 0.3 [VA]	
	Digital input		Number of digital input: 8~48 Voltage Range: 88 ~300 [VDC]	Selectable
	Digital output		Number of digital output: 6~30 Allowable current: continuous (5[A]), 30 [A] (0.5 [sec])	
Communication	Communication port		LPT1,RS-232, RS-485, Ethernet	Selectable
	Protocol		Profibus, DNP 3.0, IEC 61850, TCP/ IP	
Time Synchronization			DCF 77/IRIG-B/ SNTP	Selectable

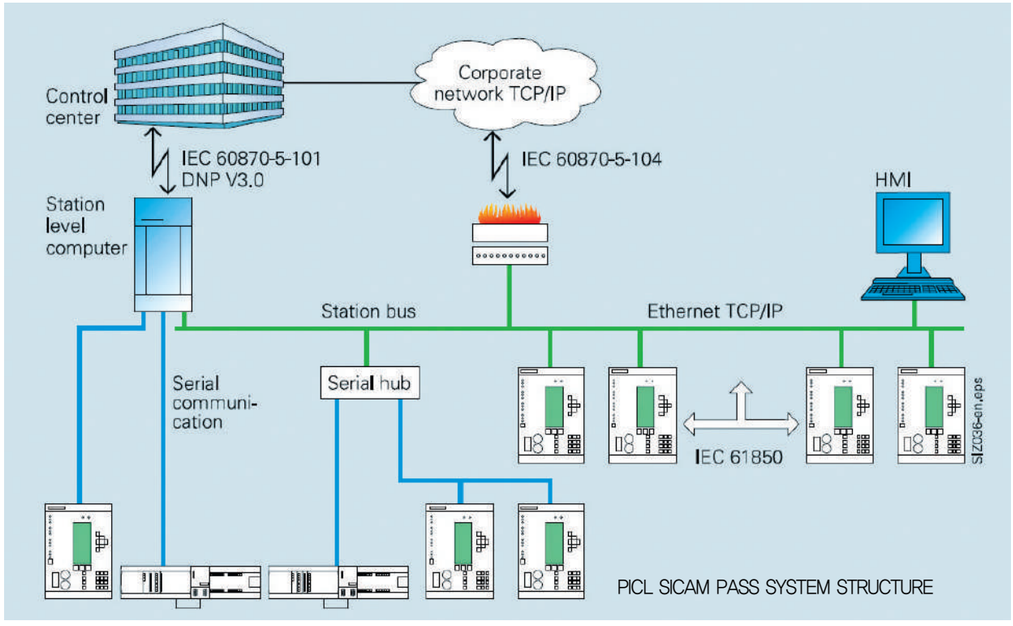
BUSINESS FIELD SYSTEM

ELECTRICAL EQUIPMENT CONTROL & MONITORING SYSTEM (ECMS)-1

ELECTRICAL EQUIPMENT CONTROL & MONITORING SYSTEM (ECMS)

For some years now, power generation and distribution have been undergoing major changes. The innovation cycles (where operating equipment and communication media are concerned) are getting ever shorter, and the market is becoming increasingly deregulated.

SICAM PAS (Power Automation System) meets all the demands placed on a distributed substation control system – both now and in the future. Amongst many other standardized communication protocols, SICAM PAS particularly supports the IEC 61850 standard for communication between substations and IEDs. SICAM PAS is an open system and – in addition to standardized data transfer processes – it features user interfaces for the integration of system-specific tasks and offers multiple automation options.



PICL SICAM PASS SYSTEM STRUCTURE

Providing an innovative solution such as various tasks to a distributed information system, our ECMS is an adequate system for fields of manufacturing fields, power plants, and substations. Designed as an open system compatible with wide-spread used communication standards, SICAM PAS product is modular. As elaborate Human-Machine Interface (HMI) development software, SICAM PAS CC provides many options for various system maintenance and management with various operation options.

Through Simple Network Management Protocol (SNMP), rapid fault detection and a credibility of operation are provided, plus DNP 3.0 and other different communication regulations. And it applies to power plants and control monitoring systems of substation, so as to provide an economical solution that enhances efficiency of each electrical power facilities.

ELECTRICAL EQUIPMENT CONTROL & MONITORING SYSTEM (ECMS) -2

SYSTEM OVERVIEW, APPLICATION AND FUNCTIONALITY OF SICAM PAS

- SICAM PAS is an energy automation solution: its system architecture makes it scalable.
- SICAM PAS is suitable for operating a substation not only from one single station level computer, but also in combination with further SICAM PAS or other station control units.
- Communication in this network is based on a powerful Ethernet LAN.
- SICAM PAS controls and registers the process data for all devices of a substation, within the scope of the data transfer protocols supported.
- SICAM PAS enables integration of a fully graphical process visualization system directly in the substation.
- SICAM PAS simplifies installation and parameterization of new devices, thanks to its intuitive user interface.
- SICAM PAS is notable for its online parameter setting features, particularly when the system has to be expanded.
- SICAM PAS features integrated testing and diagnostic functions.
- Its user-friendliness, its operator control logic, its orientation to the Windows world and its open structure ideally suit users' requirements.

SYSTEM ARCHITECTURE

SICAM PAS works on industrial-standard hardware with the Microsoft Windows operating systems. The advantages of this platform are low hardware and software costs, ease of operation, scalability, flexibility and constantly available support. With the powerful real-time data distribution system, applications can be allocated among several computers, thus boosting performance, connectivity and availability.

A database system stores and organizes the data basis (e.g. configuration data, administrative status data, etc). The device master function for communication with Intelligent Electronic Devices (IEDs) supports a large number of well established protocols.

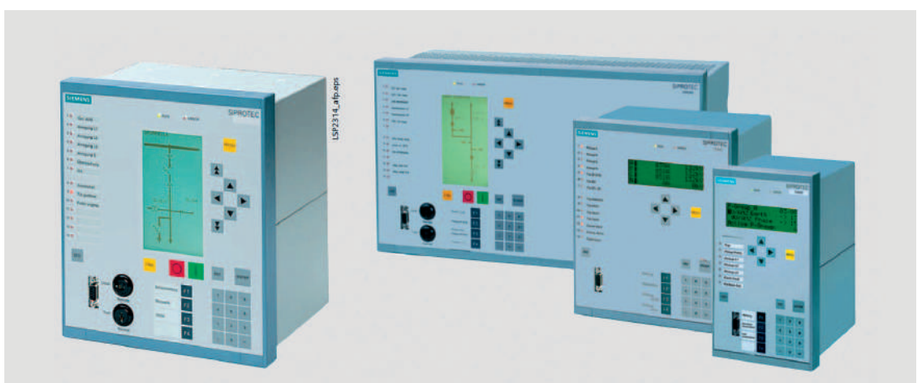
The SICAM PAS data normalization function allows conversions such as measured-value filtering, threshold value calculation and linear characteristics.

SICAM PAS CC is used for process visualization. Specifically designed for energy applications, it assists the operating personnel in optimizing the operations management.

It provides a quick introduction to the subject matter and a clearly arranged display of the system's operating states. SICAM PAS CC is based on SIMATIC WinCC, one of the leading process visualization processes that is used in industrial automation worldwide.

To facilitate incident analysis, the fault recordings from protection units are retrieved and archived automatically during operation. This is particularly supported for the standard protocols IEC 61850 and IEC 60870-5-103, but also for PROFIBUS FMS (SIPROTEC 4).

Fault recordings are visualized and evaluated with the program Comrade View as standard.
Alternatively, SIGRA 4 with its additional functions can also be used.



PIC 2 SIPROTEC 4 BAY CONTROL UNIT AND PROTECTION UNIT WITH LOCAL CONTROL FUNCTION

COMMUNICATION

DEVICE INTERFACES AND COMMUNICATION PROTOCOLS

In a substation which configure and operate with SICAM PAS, various types of protection units, IEDs, bay control units, measured-value recorders and telecontrol units from a wide range of manufacturers can be used.
SICAM PAS offers a large number of commercially available communication protocols for recording data from various devices and through differing communication channels.

Available Protocols

- IEC 61850
  IEC 61850 is the communication standard for interconnecting the devices at the bay and station control levels on the basis of Ethernet. IEC 61850 supports the direct exchange of data between IEDs, thus enabling switching interlocks across bays independently of the station control unit, for example.
- PROFIBUS FMS
  Most SIPROTEC 4 bay controllers and protection units can be connected to the SICAM PAS station unit via PROFIBUS FMS.
- IEC 60870-5-103
  Protection units, IEDs, bay control units, measured-value recorders and transformer controllers from many manufacturers support the IEC 60870-5-103 protocol can therefore be connected directly to SICAM PAS.
- IEC 60870-5-101
  The IEC 60870-5-101 protocol is generally used to connect telecontrol units. The 'balanced' and 'unbalanced' traffic modes are supported. Automatic dialing is also supported for the connection of substations with this protocol. SICAM PAS can establish the dial-up connection to the substation either cyclically or as required (e.g. for command output).
- IEC 60870-5-104
  Furthermore, connection of substations is also suppor ted by the TCP/IP-based IEC 60870-5-104 protocol.
- PROFIBUS DP
  PROFIBUS DP is a highly powerful field bus protocol.
  For example, it is used for industrial automation and for automating the supply of electricity and gas. PROFIBUS DP serves to interface multifunctional measuring instruments such as SIMEAS P (I, V, P, Q, p.f).
- ILSA PROTOCOL
- MODBUS MASTER
- DNP 3.0

SYSTEM CONTROL CENTER CONNECTIONS, DISTRIBUTED PROCESS CONNECTION AND PROCESS VISUALIZATION

- SICAM PAS operates on the basis of Microsoft Windows operating systems. This means that the extensive support, which Windows offers for modern communication protocols, is also available with SICAM PAS.
- SICAM PAS was conceived for easy and fast integration of conventional protocols.
- Standardized TELECONTROL PROTOCOLS
  IEC 61870-5-101
  IEC 60870-5-104
  DNP V3.00, TG8979, CDT
- SICAM PAS can also be set up on computers networked with TCP/IP. Here, one computer performs the task of the so-called Full Server.
- SICAM PAS allows use of the SICAM PAS CC process visualization system for central process control and monitoring.
- SICAM PAS allows use of the SICAM PAS CC process visualization system for central process control and monitoring. For industrial applications, it is easy to configure an interface to process visualization systems via OPC (object linking and embedding for process control).
- SICAM PAS can be configured as an OPC server or as an OPC client. The SICAM PAS process variables – available with the OPC server – can be read and written with OPC clients working either on the same device or on one networked by TCP/IP. The OPC server is included in the basic system.
  The OPC client is available as an optional package.
  A typical application could be the connection of SIMATIC programmable controllers.

ELECTRICAL EQUIPMENT CONTROL & MONITORING SYSTEM (ECMS) -3

FURTHER STATION CONTROL ASPECTS

During e.g. maintenance work or for other operational reasons, information exchange with the control centers or the substation itself can be blocked with the telecontrol blocking and bay blocking functions.

The telecontrol blocking function can also be configured for specific channels so as to prevent the transfer of information to one particular control center during operation, while transfer continues with other control centers. The bay blocking and telecontrol blocking functions act both in the signaling and the command directions.

Channel-specific switching authority also makes it possible to distinguish between local control (SICAM PAS CC) and remote control for the switching direction, but also between control center connections.

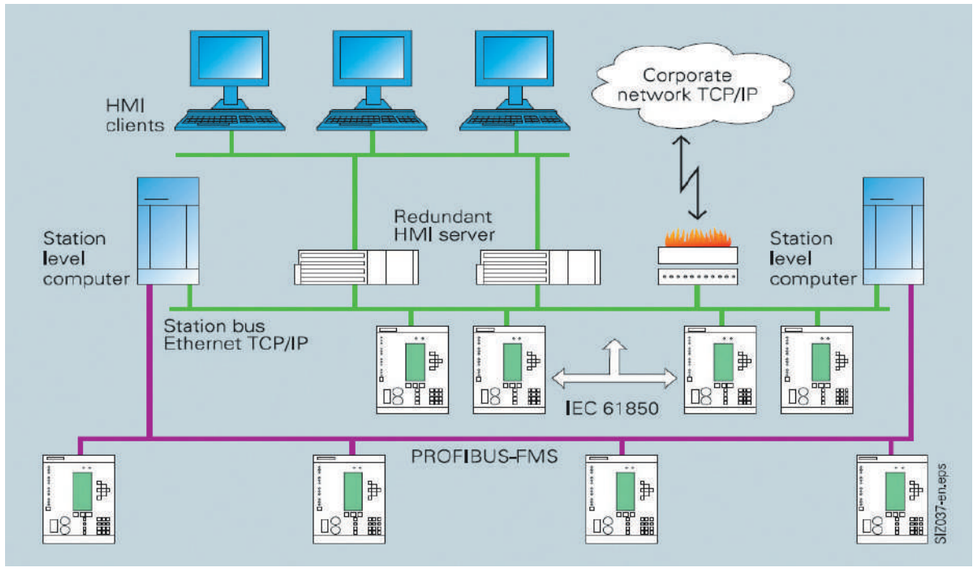
Circuit-breakers can be controlled in synchronized/unsynchronized mode.

AUTOMATION TASKS

Automation tasks can be configured in SICAM PAS with the CFC (Continuous Function Chart), which conforms to IEC 61131. In this editor, tasks are configured graphically by wiring function blocks. SICAM PAS comes with an extensive library of CFC function blocks, developed and system-tested especially for energy automation.

SICAM PAS features comprehensive redundancy functions to boost the availability of the station automation system:

SICAM PAS CC communicates simultaneously with both redundant station control units.
A redundant structure is also possible for process visualization with SICAM PAS CC and fault-record archiving with SICAM PQ Analyzer



PIC 3 STATION LEVEL COMPUTER AND HMI SERVER REDUNDANT STRUCTURE

SCOPE OF INFORMATION

The amount of information to be processed by SICAM PAS is essentially determined by the following factors:

· Computer network concept (multiple-computer network or single-station system)
· Performance data of the hardware used
· Performance data of the network
· Size of the database (RDBMS)
With a distributed PAS system using a Full Server and up to 6 DIPs, a maximum of 350 IEDs and 20,000 data points can be supported.

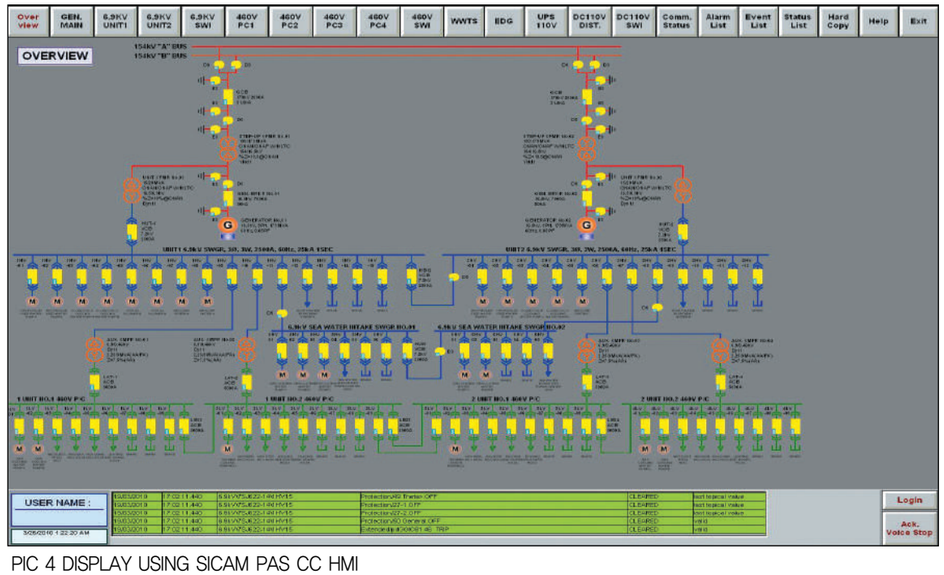
PROCESS VISUALIZATION PROCESS WITH SICAM PAS CC HMI

In the operation of a substation, SICAM PAS is used for configuration purposes and as a powerful data concentrator. SICAM PAS CC serves as the process visualization system.

In the signal lists, the original time stamps are logged in ms resolution as they occur in the devices. With every signal, a series of additional data is also presented to provide information about causes (spontaneous, command), event sources (close range, local and remote), etc. Besides process signals, command signals are also logged.

IndustrialX-Controls are used to control and monitor the switching devices. These switching device objects support four different forms of presentation (IEC, DIN, SINAUT LSA, SICAM) for circuit-breakers and disconnectors. It is also possible to create bitmaps (defined for a specific project) to represent the switching devices, and to link them to the objects. For informative visualization, not only nominal and spontaneous flashing are supported, but also the display of various device and communication states (e.g. up-to-date/not up-to-date, bay and telecontrol blocking, etc.).

Connected with SCAM PAS units, switching devices are directly or controlled by "SELECT BEFORE OPERATE" mode. Topological Coloring is used for a single line image process, and through internet control and monitoring are implemented. A calculated value analysis by using SICAM VALPRO function, a fault record data collection and saving function in protection relay by using SICAM RECPRO function can be implemented.



PIC 4 DISPLAY USING SICAM PAS CC HMI

SCAM PAS CC is based on SIMATIC WinCC, it has the following impressive features:
- Multilingual capability
- All operation and monitoring functions on-board. These include not only the graphics system for plant displays and the signaling and archiving system for alarms and measured values, but also a reporting and logging system.
- Open standards for easy integration
- Using any external tools, archived data can be accessed through a series of open interfaces (such as SQL and ODBC) for further editing.
- Manufacturer-independent communication with lower-level controllers (or with applications such as MS Excel) is supported with OPC (OLE for Process Control).
- Visual Basic for Applications (VBA), VBScript or ANSI-C creates an ideal scope for project-specific solutions.
- Expandable with options and add-ons such as
  - WinCC/Dat@Monitor
    Serves to display and evaluate current process states and historical data on office PCs, using standard tools such as the Microsoft Internet Explorer or Microsoft Excel
  - WinCC/Web Navigator
    Is an option with SIMATIC WinCC for controlling and monitoring systems over the Internet, a company Intranet or a LAN
  - WinCC/Connectivity Pack
    The functions of the two OPC servers HDA and A&E, and of the WinCC OLE-DB provider are ensured by the WinCC/Connectivity Pack.
  - Alarm Management System ACC
    With the aid of the Alarm Management System ACC, messages from the WinCC signaling system can be forwarded automatically to radio call receivers.

ELECTRICAL EQUIPMENT CONTROL & MONITORING SYSTEM (ECMS) -4

OVERVIEW OF OPERATOR CONTROL PHILOSOPHY AND USER INTERFACE

The SICAM PAS user interface is based on customary Windows technology, which enables you to navigate in the familiar Windows environment both when configuring the system and during ongoing operation. The system distinguishes between configuration and operation of a substation. In SICAM PAS, these two tasks are firmly separated by two independent programs.

THE SICAM PAS UI – CONFIGURATION program is used to create and edit a project-specific configuration. To enhance clarity, several views are distinguished:

- Configuration
- Mapping
- System topology
- Device templates.

A common feature of all views is that they have an Explorer window that shows the system configuration in a clearly arranged tree structure. As in the Windows Explorer, you can open individual levels of this tree structure to work in them.

You work through the necessary steps in the data window on the right. Here, you set parameters, select information and define assignments to a user-specific, process-oriented system topology.

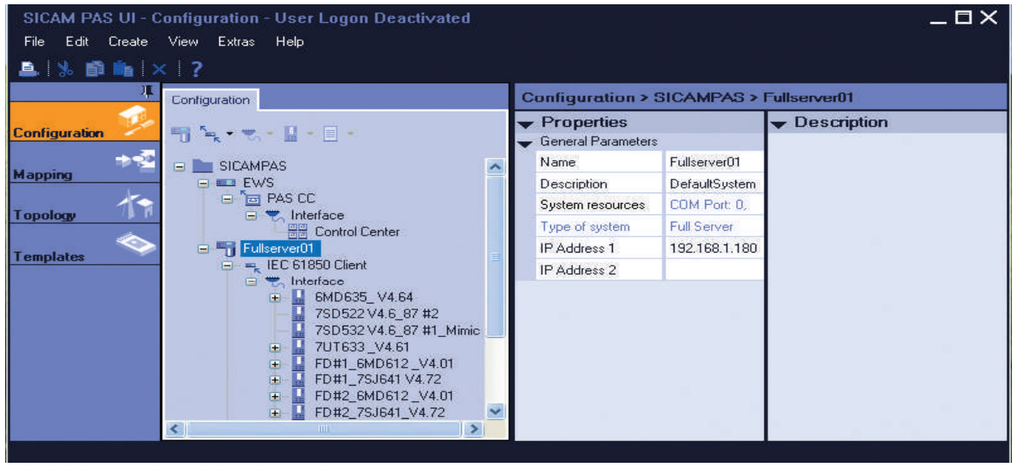
The user interface is uncomplicated and structured according to the task definition, so as to enable intuitive working and to simplify changes. The user interface assists the editing process by displaying parameter descriptions and messages when incorrect parameters are entered.
In the tabular views for information assignment and allocation to the system topology, configuration is made easy by extensive sorting and filtering mechanisms, multiple choices and Drag &Drop.

To ensure data consistency and to avoid redundant data input, SICAM PAS UI provides extensive import and export functions for the exchange of configuration data, e.g. with the bay control level and with process visualization.

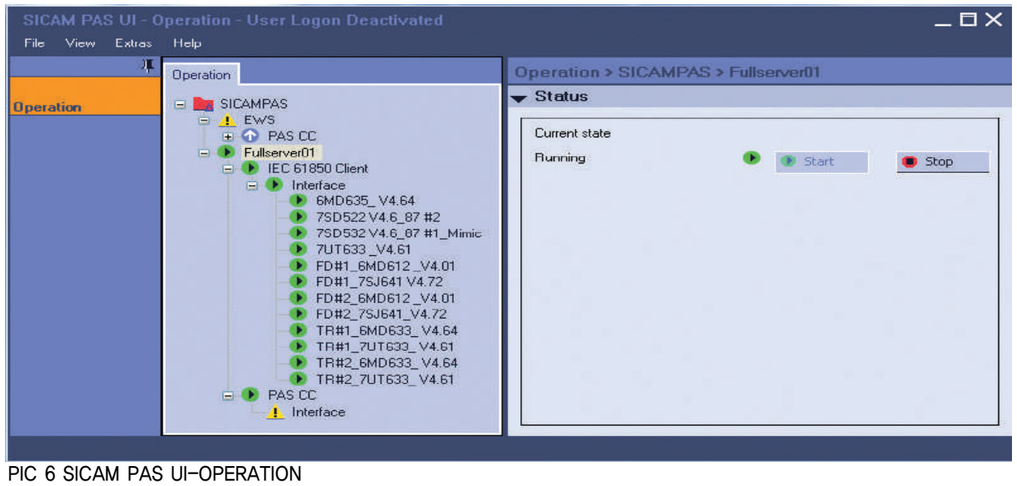
THE SICAM PAS UI – OPERATION program features a series of editing and diagnostics views for monitoring and controlling a substation.
IN THE OPERATION MANAGER, you check and control the states of individual data connections.
IN THE SCADA VALUE VIEWER you can see incoming values in a clearly arranged form and perform operator control actions for test purposes.

SYSTEM REQUIREMENT

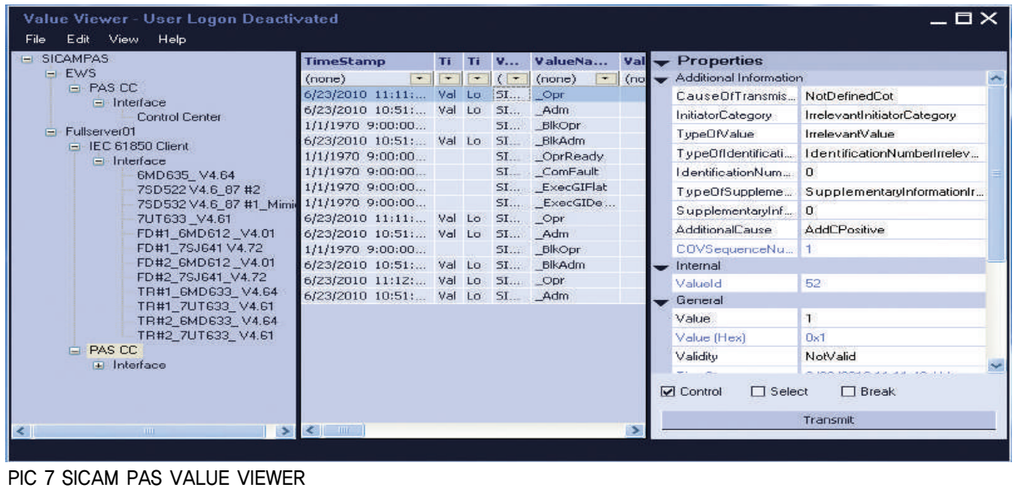
- STATION UNIT
  - 1.86 GHz Intel mobile processor (Yonah processor)
  - 2 x 2 GB compact flash cards
  - Industrial Grade and Error Correction
  - One card for system and SICAM PAS & DatabaseB
  - One card for fault records and other write actions
  - 2 GB RAM
  - 2 x 10 – 1000 MB/s Ethernet RJ45
  - VGA interface
  - up to 8 ComPorts (expandable externally)
  - 6 USB 2.0 ports
  - Hard reset button
  - Status LEDs
  - One binary output contact used for live signal
  - additional up to 64 binary inputs / outputs for station level related signalling
- SICAM PAS OPERATION SYSTEM
  - MICROSOFT WINDOWS XP PROFESSIONAL
  - MICROSOFT WINDOWS 7 PROFESSIONAL
  - MICROSOFT WINDOWS 2003 SERVER
  - MICROSOFT WINDOWS 2008 SERVER
  - MICROSOFT WINDOWS XP EMBEDDED
- SICAM PAS CC OPERATION SYSTEM
  - MICROSOFT WINDOWS XP PROFESSIONAL
  - MICROSOFT WINDOWS 7 PROFESSIONAL
  - MICROSOFT WINDOWS 2003 SERVER
  - MICROSOFT WINDOWS 2008 SERVER



PIC 5 SICAM PAS UI–CONFIGURATION

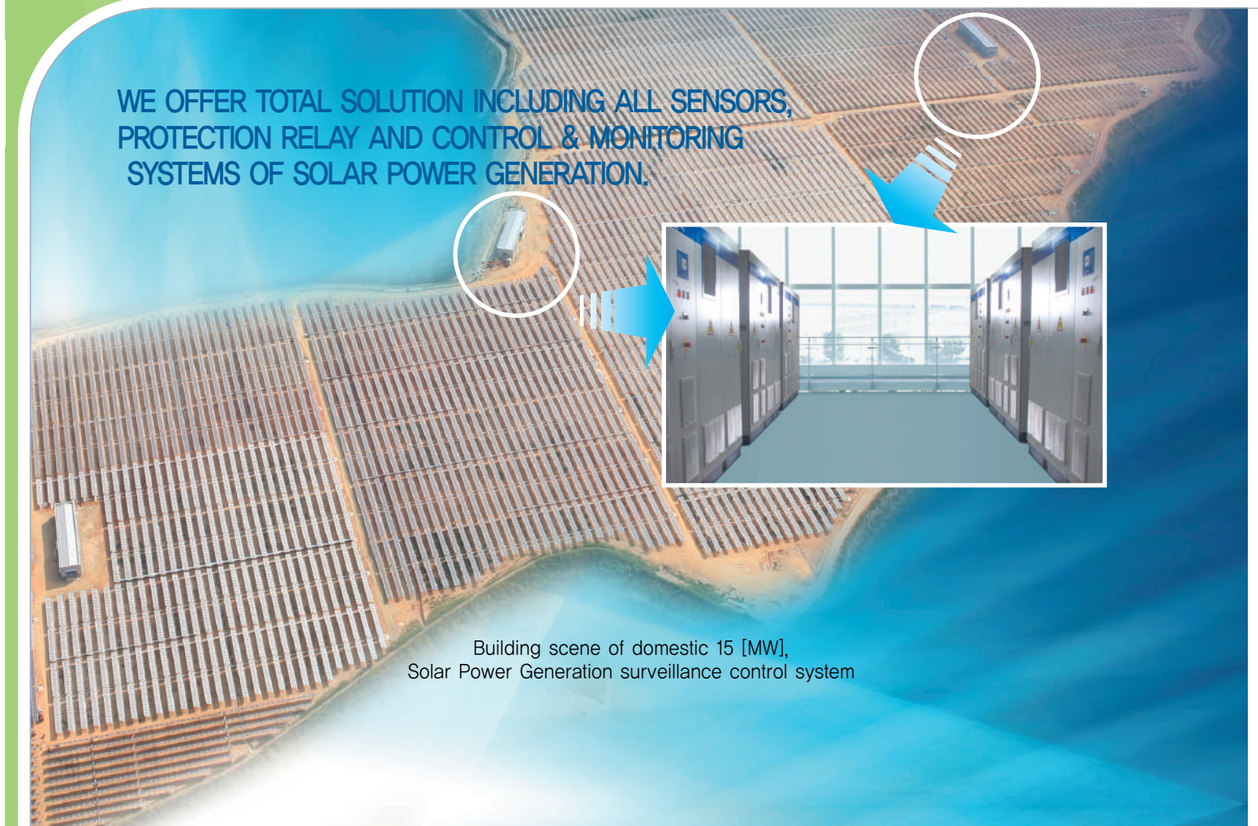


PIC 6 SICAM PAS UI–OPERATION



PIC 7 SICAM PAS VALUE VIEWER

SOLAR POWER GENERATION CONTROL AND MONITORING SYSTEM



Building scene of domestic 15 [MW],
Solar Power Generation surveillance control system

SYSTEM CONNECTION OF SOLAR POWER GENERATION

SOLAR BATTERY MODULE

GENERATION

KEPCO
POWER SYSTEM

CONTROL & MONITORING SYSTEM

SOLAR POWER GENERATION CONTROL AND MONITORING SYSTEM

We aim for an efficient operation management of Solar Power Generation facility (module, inverter, low voltage relay, high voltage relay, etc). The most pertinent surveillance and control system is made when Solar Power Generation facility gets constructed.
Our Solar Power Generation control and monitoring system guarantees fast action and repairs when trouble happens with an analytic system and real-time collection of field generation information.

UP-TO DATE AND HIGH PERFORMANCE SOFTWARE

- provides a stable total Solar Power Generation management system by selecting the best HMI software.

ENHANCING EFFICIENCY OF GENERATION

- By having a web server and through real-time remote control of problems, prompt understanding and action gets performed
- Sends SMS when a malfunction occurs
- Supports web synchronization of all real-time data

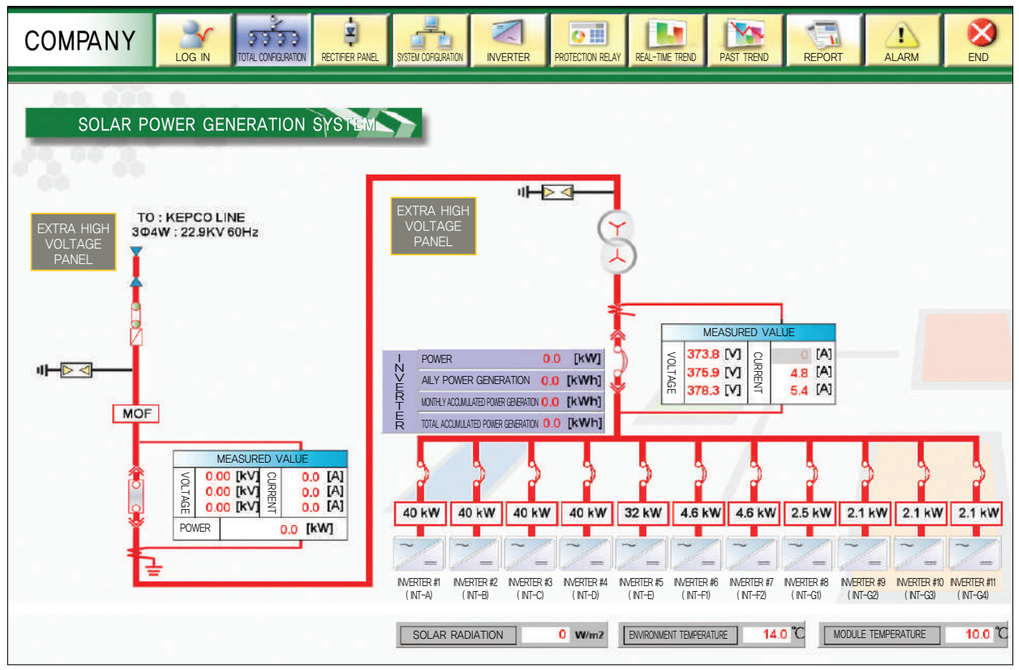
UP-TO DATE AND HIGH PERFORMANCE SOFTWARE

- Data monitoring and control of real time generation facility.
- Supports language (Korean), enhancing understanding of operator with manual written in Korean.
- Data exchange (Report) to office product (MS-Excel)

AUTO-OPERATION SYSTEM

- When constructed, by linking with existing system, it makes auto control and monitoring system infrastructure
- Total Solar Power Generation management system infrastructure. HMI display configuration

HMI DISPLAY CONFIGURATION



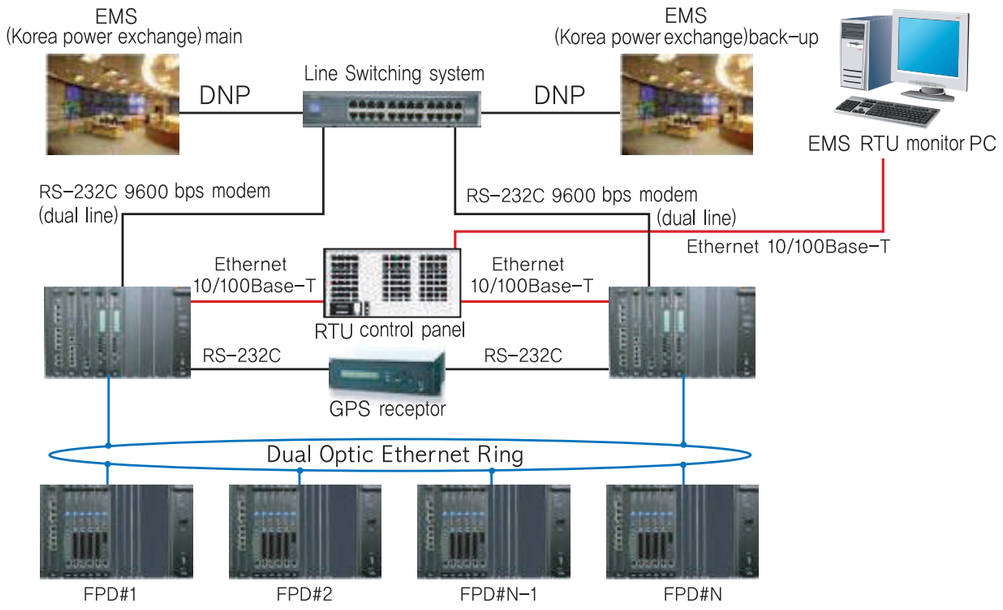
EMS RTU (REMOTE TERMINAL UNIT)-1

EMS RTU

Made for a remote surveillance, measureing and control, EMS-RTU is made for Power system management facility, and it enables an open interface, a high performance, a highly credible distibuted installation, and a remote management.

This device is organized with a main processing device, a field processing device and system management system. And in each control side, it is composed of an operation processing, a communication, input-output control and power.

SYSTEM CONFIGURATION



FUNCTION

- **High Performance & High Credibility**
  Module protection
  Parallel processing
  Redundancy
  Module unit Expansion
- **Distributed installation**
  Network communication method
  Distributed operation
  IED link
- **Remote management**
  Remote monitoring terminal equipment connection
  SMS (system management system)
  Software DLL (Down Line Load)
  Internet based remote management
- **Open Interface**
  International standard protocol connection
  Time Synchronization priority
  System security management
- **Communication function**
  Connection with EMS (energy management system)
  Multi-Protocol and Multi-Tasking
- **System diagnosis function**
  System Self-diagnosis and System Simulation Test
  Cold/ Warm Restart, Application
- **Standard Time synchronization function**
  System total time synchronization
  GPS standard time reception

MPD (Main Processing Device)

MPD receives commands from EMS and deciphers them in order to implement pertinent replies and processing. Also, it is attached with function that manages system configuration device. Main functions are system self-diagnosis, configuration, database management, communication schedule management, protocol conversion, communication with EMS/ I/O module, HMI connection with System Management System and Time Synchronization management.

MAIN PROCESSING UNIT

As a MPD's main processing module, a MPU board controls and manages all functions of RTU, and can operate in parallel with two MPUs and MMB (MPU Memory Board) in each MPD.
As a SBC (single board computer) for a VMEbus, MPU board is designed adequately to be used as a system control board in a VME bus system.
Using Intel's [XP 425 Microprocessor), high performance processing is possible. MPU is attached with 256 Mbyte SDRAM, 512 KB EPROM, 16 MB Flash Memory, 8KB NVRAM/RTC, two 10/100 Ethernet Port and two serial ports, for enabling various applications.
Communication port
System Bus structure: Uses International Standard Bus VME Bus (IEEE 1014)
LED Display: PWR, RST, RUN, F/L, VME, SCN, OFA, OFB, LAN 1/2/3/4 (Link, Active), CONSOLE & S1~ S4 (TX/RX)

CPU	32BIT IXP 425 533MHz
Memory	SRAM 8MB, SDRAM 256MB, EPROM 512KB, FLASH 16MB, NVRAM 8KB
O.S	Real Time Multi Task O.S(VxWorks)
Communication PORT	RS-232C 2Port Ethernet 4Port(100MBps 2Port, 10MBps 2Port)
System Bus Structure	Uses International Standard Bus VME Bus (IEEE1014)
LED Display	PWR, RST, RUN, F/L, VME, SCN, OFA, OFB LAN1/2/3/4(LINK, ACTIVE), CONSOLE&S1~S4(TX/RX)
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VMEbus Master Interface High speed DMA supports, for VME 32 Standard Watch-Dog Timer Battery Backup function

SIO-A : SERIAL INPUT OUTPUT - ADVANCED

SIO-A board is a VMEbus board developed by using Intel's [IXP 425 CPU] high-speed 32bit microprocessor.
As a Single Board Computer, it is designed as the most adequate Slave Processing Board in VME bus system. Through high performance 32 Bit data processor, it is a controller board of which offers high credibility. Attached with a protocol conversion function with various high level HOSTs, it is responsible for communication interface. With them, connecting DATA with MPU through sharing memory on VMEbus side.
Using four Ethernet ports, simultaneous connection is possible.

CPU	32BIT IXP425 533MHz
MEMORY	SDRAM 64MB, EPROM 512KB, FLASH 16MB, NVRAM 8KB
Communication PORT	Ethernet 4Port (10/100MBps), RS-232C 2Port
System Bus structure	Uses International Standard Bus VME
LED Display	PWR, RST, RUN, VME, 1~8(TX/RX)
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. High speed DMA supports, for VME 32 Standard Watch-Dog Timer

SIO-B : SERIAL INPUT OUTPUT - BASIC

SIO-B board is a VMEbus board developed by using Intel's [IXP 425 CPU] high-speed 32bit microprocessor.
As a Single Board Computer, it is designed as the most adequate Slave Processing Board in VME bus system. Through high performance 32 Bit data processor, it is a controller board of which offers high credibility. Attached with protocol conversion function with various high level HOSTs, it is responsible for communication interface with them, connecting DATA with MPU through sharing memory on VMEbus side.
Using eight serial ports on back side of a board, a simultaneous connection with multiple HOSTs is possible.

CPU	32BIT IXP425 533MHz
MEMORY	SDRAM 64MB, EPROM 512KB, FLASH 16MB, NVRAM 8KB
Communication PORT	RS-232C 10Port, Ethernet 2Port (10MBps)
System Bus structure	Uses International Standard Bus VME Bus (IEEE 1014)
LED Display	PWR, RST, RUN, VME, 1~8 (TX/RX)
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. High speed DMA supports, for VME 32 Standard Watch-Dog Timer

EMS RTU (REMOTE TERMINAL UNIT)-3

FPD (Field Processing Device)

Depending on installation condition, FPD is installed as same place as MPD, or it could be dispersed in power generation or switchyard field. It accommodates interface of surveillance points and control points, and collects and generates digital, analog, and pulse information. Internal communication between MPD and FPD is applied with 100 Mbps optical fiber Ethernet based network communication of redundant ring method. And FPD's module is composed to meet demands of users. It can accommodate up to sixteen input/output modules.

CPU MODULE

As a major processing module of FPD, a CPU module implements communication with MPD, accommodates I/O function modules responsible of input/output of a field in order to control data input/output of data with a field.
Using Intel's IXP425 Microprocessor, it could process high performance processing. Attached with 256 Mbyte SDRAM, 512 KB EPROM, 16 MB Flash Memory, 8 KB NVRAM/RTC, two 10/100 Ethernet port, and two Serial Port, it enables various applications.

CPU	32BIT IXP 425 533MHz
MEMORY	SRAM 8MB, SDRAM 256MB, EPROM 512KB, FLASH 16MB, NVRAM 8KB
O.S	Real Time Multi Task O.S (VxWorks)
Communication PORT	RS-232C 2Port Ethernet 4Port(100MBps 2Port, 10MBps 2Port)
System Bus Structure	Uses International Standard Bus VME Bus (IEEE1014)
LED Display	PWR, RST, RUN, F/L, VME, SCN, OFA, OFB LAN1/2/3/4(LINK,ACTIVE), CONSOLE & S1~S4(TX/RX)
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VMEbus Master Interface High speed DMA supports, for VME 32 Standard Watch-Dog Timer Battery Back Up function

DIGITAL INPUT MODULE

DIM has functions of electric facility breaker open and shut, alarm state, relay auxiliary contact on/off state monitoring, SOE function. It detects electric facility's block and open and shut state of each relay by using optical isolation method, and transmits this data to common control module. A state of breaker's open and shut having a reclosing function, relay's auxiliary state monitoring such as an alarm state rapidly detects On-Off, Off-On, On-Off-On, Multi-Off state in order to transmit data of which was ordered from SOE function.

CPU	32BIT TMS320C32
MEMORY	1MB SRAM, 128KB EPROM, 4KB DPRAM, 32KB EEPROM
Input points	32 Points / Module
Input Signal	Dry Contact
Monitoring Voltage	48V DC
SOE Resolution	1msec
Debounce Time	4~64msec (modification available)
LED Display	PWR, RST, RUN, VME, S1, S2, 상태표시 1~32
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VME 32 Standard, VMEbus Slave Interface Watch-Dog Timer
Insulation method	Photo Coupler

DIGITAL OUTPUT MODULE

DOM is activated when upper HOST does remote control, and a control output is a pulse signal using Dry-Contact point. It is used when a Trip/Close of same voltage performed and it is not activated when more than two breakers are chosen simultaneously.

CPU	32BIT TMS320C32
MEMORY	1MB SRAM, 128KB EPROM, 4KB DPRAM, 32KB EEPROM
Output points	16 Point / Module
Input Signal	Relay Contact
제어 Holding Time	100ms ~ 6000ms(조정가능)
Controlling Voltage	24V DC
LED Display	PWR, RST, RUN, VME, S1, S2, OPR, RLY, 출력 1~32
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VME32 Standard, VMEbus Slave Interface Watch-Dog Timer Check before Operate function
Insulation method	Primary and Secondary division by Relay Output side is insulated electronically (Photo Coupler insulation)

ANALOG INPUT MODULE

AIM converts analog signal attained from electricity facility to digital signal which is sent to MPD. And its input is supplied at conversion device.

CPU	32BIT TMS320C32
MEMORY	1MB SRAM, 128KB EPROM, 4KB DPRAM, 32KB EEPROM
Input Points	16 Point / Module
Input Signal	can be selected between 0~1 mA, 4~20 mA, 0~5V
Output Signal	16 BIT Digital
LED Display	PWR, RST, RUN, VME, S1, S2
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VME 32 Standard, VMEbus Slave Interface Watch-Dog Timer

EMS RTU (REMOTE TERMINAL UNIT) -4

ANALOG OUTPUT MODULE

AOM is used for generator's output control. A control output is an analog value (Set Point), and it is combined with a control facility (DCS). A control output maintains its current value until next command. A set of point output module displays information received from center device into decimal number, and sends output of control and alarm signals.

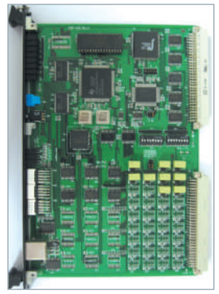
CPU	32BIT TMS320C32
Memory	1MB SRAM, 128KB EPROM, 4KB DPRAM, 32KB EEPROM
Output points	4 Point / Module
Input Signal	4~20mA, 0~5V
Designated output	16BIT Digital
Controlling range	Approximately 10 % can be modified in each output.
LED Display	PWR, RST, RUN, VME, S1, S2
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VME 32 Standard, VMEbus Slave Interface Watch-Dog Timer
Insulation method	Photo Coupler insulation

PULSE INPUT MODULE

PIM is used for pulse data processing. Pulse data is generated at electricity facility (e.g.: generation capacity). Similar to digital data, it uses and processes an Optical Isolation method. Data changed in its state is saved and integrated within current. Followed from EMS command signal, it transmits and processes data.

CPU	32BIT TMS320C32
Memory	1MB SRAM, 128KB EPROM, 4KB DPRAM, 32KB EEPROM
Input points	8 Point / Module
Input Current	less than 6 mA
Input Voltage	DC 48 V (Pulse Count)
Debounce Time	4 ~ 64ms
LED Display	PWR, RST, RUN, VME, S1, S2
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VME 32 Standard, VMEbus Slave Interface Watch-Dog Timer
Insulation method	Photo Coupler insulation

PULSE OUTPUT MODULE



POM is used when a generator automatically sends calculated fluctuation value at EMS. And it is sent as pulse-width signal using a contact point without an application of check before operation function.

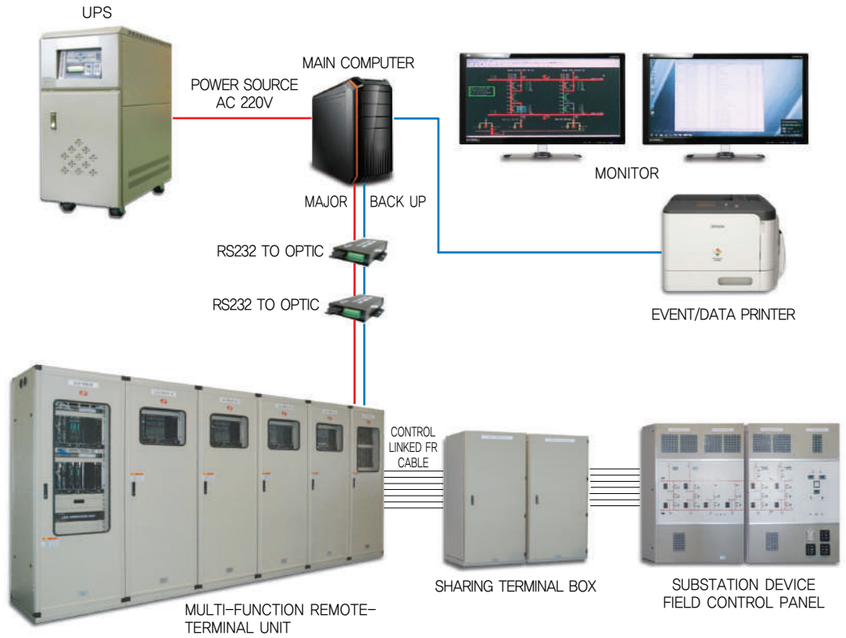
CPU	32BIT TMS320C32
Memory	1MB SRAM, 128KB EPROM, 4KB DPRAM, 32KB EEPROM
Output points	4 Point / Module
Output relay burden	DC 125V, 0.5A (Dry Contact)
Activation method	Direct Operate
Relay activation time control range	200ms~ 1.4 sec (variable 200ms STEP)
LED Display	PWR, RST, RUN, VME, S1, S2
Remarks	32 Bit CPU with high speed processing capability CMOS Component with a low power technology. VME 32 Standard, VMEbus Slave Interface Watch-Dog Timer

SUBSTATION INTEGRATED CONTROL PANEL-1

SUMMARY

This system is a total system for extra high voltage substations such as 154 kv and 345 kV, connecting to electric power facilities in industrial fields. It provides and analyzes information of electric power facility's operation, which is needed by an operator. Via control terminal, it also controls electric facility (circuit breaker, switchgear, etc) from remote end.

SYSTEM CONFIGURATION



SUBSTATION INTEGRATED CONTROL PANEL-2

MAIN EQUIPMENTS

1. Main Computer
   The most optimal substation integrated control system HMI software embedded into the most updated workstation. It collects and analyzes information real-time basis from remote devices, implementing an accurate control of facilities. Also applied with open architecture system standard, it guarantees extension and flexibility.

2. Event/Data Logger
   It is a device that records information about contents of alarms generated from electric power facility and records history of operator's controlling. Printing is possible by manually or automatically through event printer and data printer.

3. RTU (Remote Terminal Unit)
   Obtaining information status of field devices (ON/OFF status of circuit breakers or switchgear) or measurement information (current, voltage, power, etc). RTU sends information to host computers (NEMS, SCADA, substation monitor control devices), analyzes command information sent from host computer in order to control specific devices.
   Also measuring CT, PT to generate multiple power information (current, voltage, active/reactive power, frequency, power factor, etc)

4. Mosaic switchboard panel
   It forms a power system on a single board in a single line diagram. Through sharing monitor, control, measurement line of field's devices with RTU, when RTU malfunctions, this panel enables normal operation, control, monitoring.

MAIN CHARACTERISTICS

1. High performance and High Reliability
   - Most updated H/W device and S/W
   - Redundancy communication function
   - Power/communication surge protection function.

2. Supports various communication method
   - Network communication (TCP/UPD)
   - Serial communication

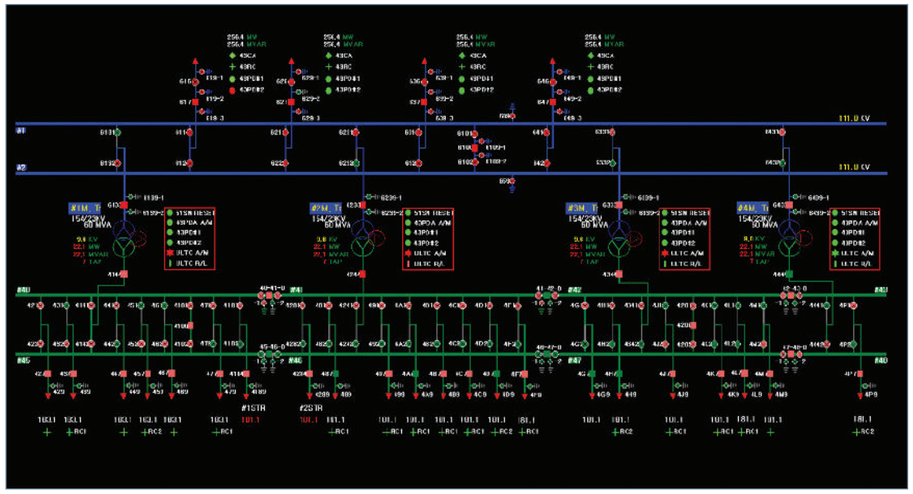
3. Remote management
   - Remote management functions (monitor/control/measurement) for power facility.

4. Open interface
   - International Standard protocol linked function (DNP 3.0)
   - Time synchronization priority function
   - System security management function

5. System diagnosis function
   - CPU Board error malfunction diagnosis function
   - EISA interface error malfunction diagnosis function
   - Event Keyboard error malfunction diagnosis function

6. time synchronization function
   - Total System time synchronization (Host or HMI based)
   - GPS standard time (GPS) signals reception.

MAIN FUNCTION



1. Monitor function
   - Monitors facility status on Circuit breaker, Switchgear, relay, etc

2. Measurement function
   - Offers real-time measurement (BUS, BAY, TR etc voltage, current, active/reactive power)

3. Control function
   - Controls binary condition of circuit breaker, switchgear, switch, transformer Tap Position
   - Major controls on different phases.

4. Record function
   - History of record, alarm generation and management field work for monitor, measurement, control activation

5. Alarm processing function
   - Alarm signal and processing function on real-time basis when there is change in circuit breakers' open and close status, calculating value exceeds critical value, malfunction of device and monitoring element.
   - Visual, auditory alarm processing on each rating of events.

6. Calculation function
   - Through measured values, it can calculate Power Factor, energy absorbed (MWH), deviation on each phase, etc.

7. Pointer management function
   - Management functions for monitor/measurement/calculation/device/virtual points.

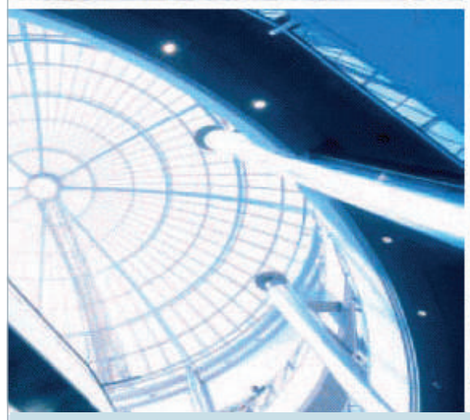
8. Reporter function
   - Report measuring values by various standards, it sorts values in periods (emergency, daily, monthly, quarterly, yearly, etc).
   - Automatically creats reports following configured period.

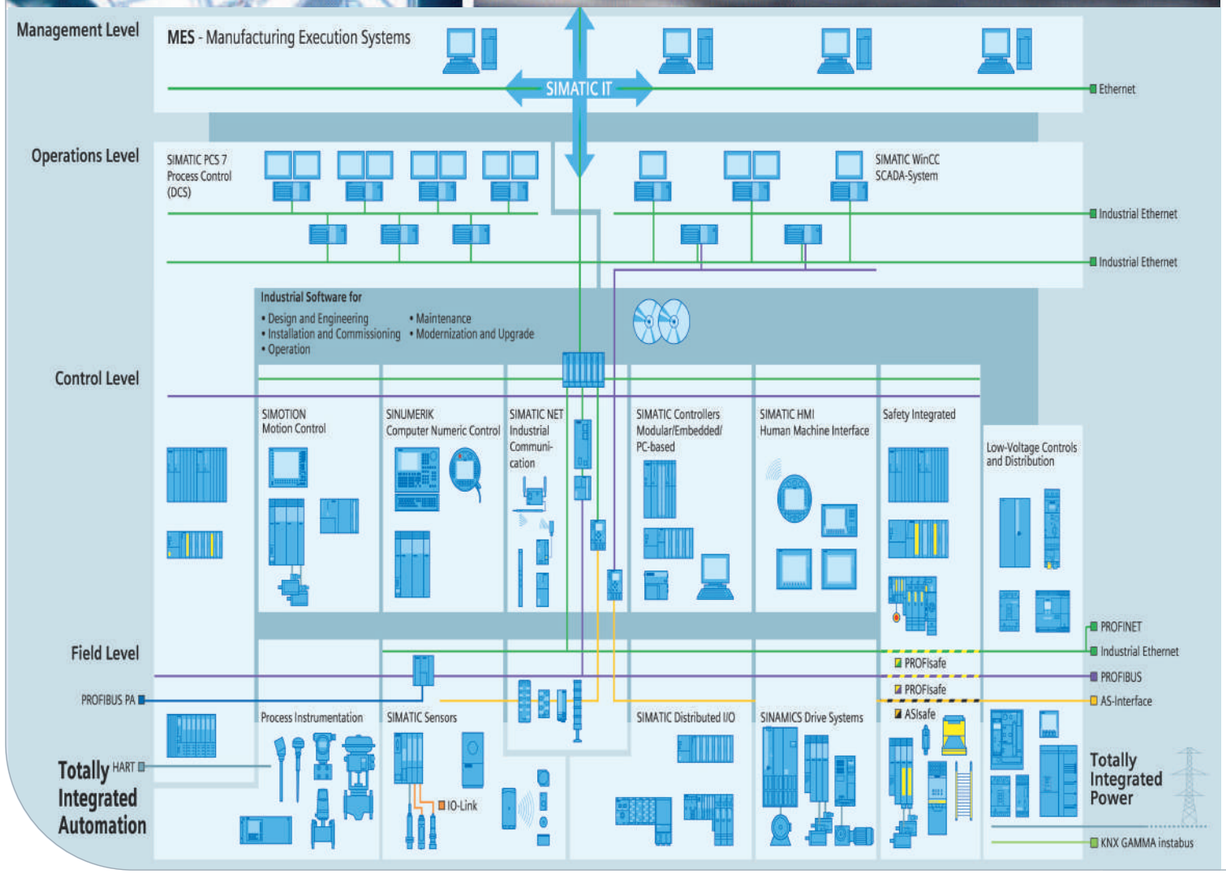
9. Back-up function
   - Automatically backs up event records and each type of reports saved in data base.
   - Automatic back-up processing that follows configured period.

10. Security function
    - System management for limiting access from unauthorized system user.
    - System authority management on system unit system.
    - Various solution of security S/W and H/W that protect system from virus or other malignant program.

11. Graphic functions
    - Displays standard symbol for various electric facilities in substation.
    - Graphic edit program and viewer for visual information following status of point/difference of measured values.

PLC FIELD CONTROL SYSTEM





PLC FIELD CONTROL SYSTEM

PLC systems used in various fields and processing industry are produced by multiple different manufacturers. With many years of experience in designs and accumulated technologies, our company mainly makes MELSEC PLC, GLOFA PLC, SIEMENS PLC systems used in processing industries
Considering user convenience, we construct the most pertinent manufacturer's PLC fitted into demands of field. it includes factory automation using MELSEC PLC, water purification and sewages processing system measurement and control system using GLOFA PLC. Also using software having many functions required by SIEMENS' SIMATIC S7– 200, S7–300, S7–400 PLC control panel designs and automation project, we aim to materialize HMI system.

ENGINEERING IMPLEMENTATION

Facility diagnosis field study and proposal preparation
System selection fitted into a size of factory and process
Operator's review, basic & detail design, hardware panel design and manufacturing
Software design and programming
Facility management, fulfillment review, materialization and supervising
Operator management and educations for mechanics

SIEMENS SIMATIC S7 SERIES PLC

- PLC platform of which could be extended to module methods that could be used in all detail automation solution such as large capacity production capacity frame work
- Configuration and Programming through STEP 7. Networking through MPI and SIMATIC NET
- Excellent activation time and function as spending less than 0.5 ms response time

S–200

- mini size system configuration
- module method micro system
- fast, low cost and efficient solution usage possible

S–300

- middle size system configuration
- Production engineering focused and wide–use PLC
- Includes counting, speed calculation, PID

S–400

- large size system configuration
- Powerful PLC for production and process engineering
- Less than 0.5 ms deterministic response time
- Used for all detail automation solution such as large capacity production framework

MEASURING DEVICE– WATER TMS

MEASURING DEVICE

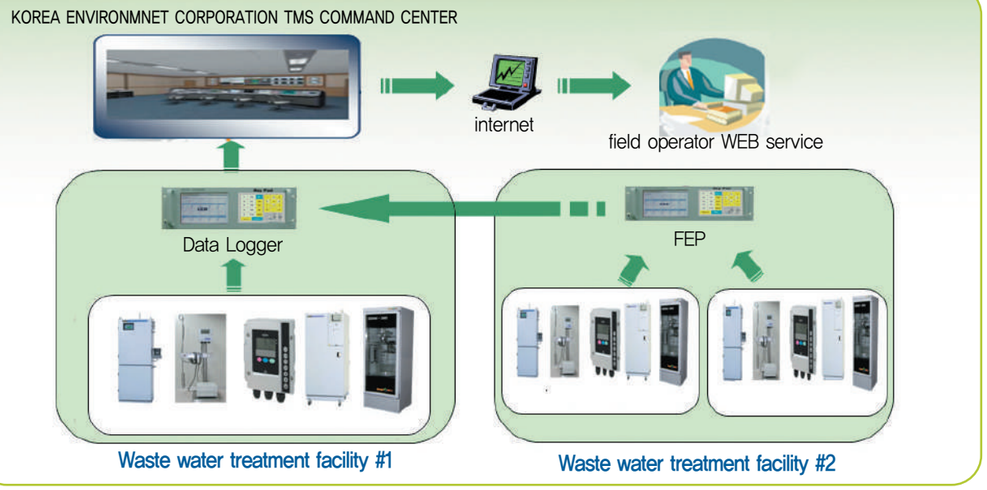
We supply various water analyzers to industrial fields. Flow meters and other measuring devices and technology with excellent quality to domestics water treatment plants, sewage processing facility. We strive to be the best, choosing pertinent devices fitted in users' demands and fulfilling our responsibilities in design and construction.

WATER ANALYZER

FLOW METER

WATER TMS SYSTEM

TMS implemented by government's water quality environment preservation policy, is for maintenance of discharging water quality environment through measuring data transmission and data accumulation in regard to a discharge of pollutant facilities.
Based on an experience of accumulated and various system building and quality certification system in a public field and environmental field, we provide a comprehensive TMS.



MAIN FUNCTION

- Data collection : through using measuring device and 232/485 port, data collection is done based on Department of Environment serial automatic measuring device communication standard specification.
- Data transmission and DB saving : Defined by the Department of Environment, measuring signal calculation and control program embedded data collection function (real time data processing function, transmission data creation), send 5 minutes, 60 minutes to a real time data water quality TMS command center's server. In each item, maximum 30 days data is divided and saved in every 5 min/60 min.
- Data search/ Alarm processing : Monitoring state of measuring facility and remote control, real time/ background data search, graph inquiry, report printing

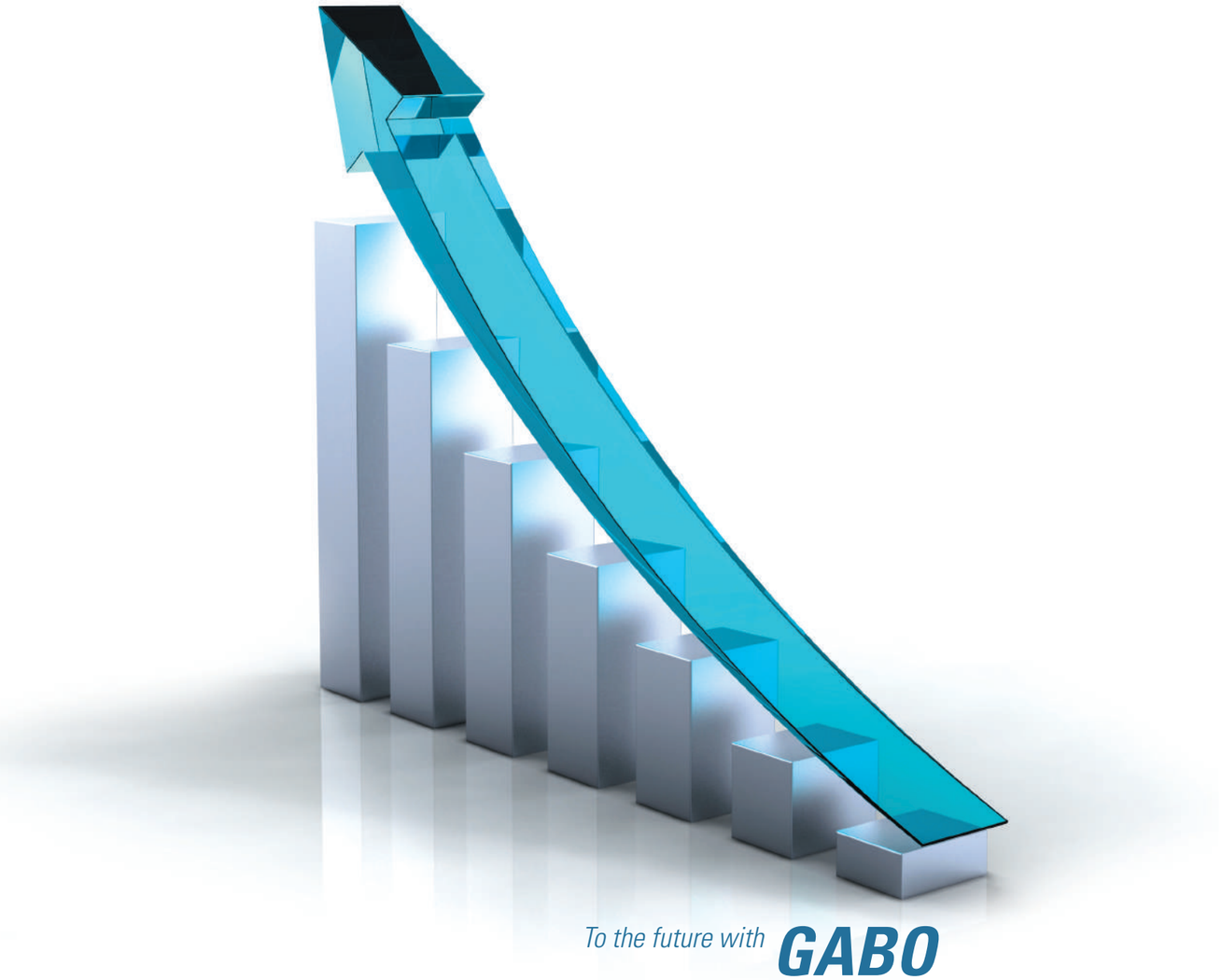
SYSTEM CONSTRUCTION

- Water sampling facility installation : dewatering outlet (main/back-up) for sampling, for water purification, pump for water disposal and each transferring piping line installation.
- Measuring facility installation : basic construction for measuring facility location selection, construction specification review, design and construction
- Electricity and emergency facility installation: Power facility, back-up power facility, sampling pump control panel and protection, lighting control system, insulation facility, lighting control protection, Earthing system, surge protection, firefighting facility.
- Measuring device installation : COD, TN/TP, pH, SS, BOD, SS, Auto Sampler
- Transmission system construction : Data Logger and communication device construction
- MMI system : Convenient user access MMI software function materialization and development
- Business management : Process and Plan for putting a man power
- Technology transfer and after service : education and training plan, technology transfer content and plan for management support

MMI SYSTEM DISPLAY

GABO

Co.,LTD will make a future value of a power industry.



To the future with **GABO**

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