Right choice for ultimate yield

LSIS strives to maximize customers' profit in gratitude of choosing us for your partner.

GIMAC-Ⅳ User Manual

HIGH MEASURING ACCURACY

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LSIS

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Safety caution

Please read carefully before product being taken into service to ensure safety and proper operation of GIMAC-IV

- Please keep the safety caution to prevent any accident may happen by using the products incorrectly.
- Safety caution is classified with caution and danger and indication of them as follows.

⚠ **Caution**	Not following the instruction may result in serious injury or eve death
⚠ **Danger**	Not following the instruction may result in serious injury or property damage

- Symbols used in this manual indicate as follows ;

⚠	This symbol is for warning the hazardous condition so that the procedure with it shall be read carefully and observed for your safety.
⚠	This symbol indicates that not following the procedure identified with it may result in the electric shocks or any accidents in the specific condition.

- This instruction shall be kept in the nearest place of GIMAC-IV.

⚠ Warning

- **Please do not operate, inspect, and install by yourself.**
- **Please do not wiring operation when it is applied with power or on the operation** ; it may result in electric shock.
- **Please do not all the wiring operation with the live bus bar** ; it may result in electric shock or fire and property damage by charging voltage of current transformer.
- **Please put to earth** ; it may result in electric shock.
- **Please do not attempt to disassemble even when the power not applied** ; it may result in electric shock by charging current remained in the product.
- **Please do not short-circuit the secondary part of PT**; it may result in fire.
- **Please do not disconnection the secondary part of CT**; it may result in fire or explosives.
- **Please do not wire or operate with wet hands** ; it may result in electric shock.

Safety caution

- Please do not use any damaged cable; it may result in electric shock.
- Please use the ring terminal when wiring the cable; it may result in electric shock by bare wire.
- Please work after wearing safety gear.
- Please work after installing the safety caution sign.
- Please perform the withstanding voltage test or the insulation resistance test of the switchboard installed with products after disconnecting all input, output wires.

⚠ Caution

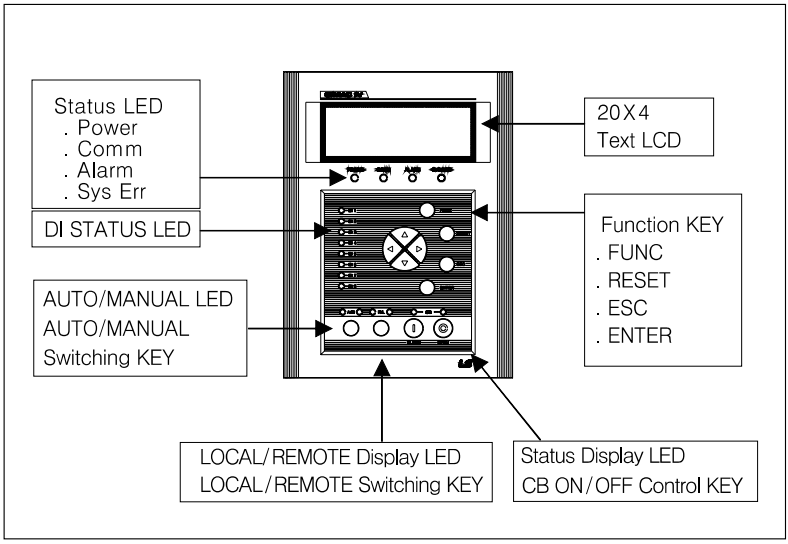
- Safety caution for installation & terminal wiring
  - Apply the rated voltage to the power supply terminal ; it may result in property damage or fire.
  - Please keep away product from screws, metals, water, or oil ; it may result in fire.
  - Please keep the rated load and polarity for input & output contacts ; it may result in property damage or fire.
  - Please wire to the terminal block after checking the terminal number ; it may result in property damage or fire.
  - Please assemble terminal cover after wiring the terminal.
  - Specialist help shall be sought for the installation and maintenance of product ; it may result in malfunction or accident.
  - Please use aux. relay for closing/opening of breaker; it may result in the burn of inside relay if the breaker controlled directly.
  - Please replace communication card after disconnecting the power supply. Be careful with all DOs as they are returned with the initial state when the power supply disconnected.
- Inspection item before power supply being applied
  - Check the voltage or polarity of control power supply.
  - Check the wiring condition of input / output terminal.
- Caution for storage & handing
  - Please store dry & clean place.
  - Please do not throw or put force on it during transport ; it may result in malfunction or wrong operation.
  - Please do not load over 10 stories.
- Caution for disposal
  - Please dispose of it in accordance with industrial waste regulation.

1. The characteristic of GIMAC-IV

- GIMAC-IV is the digital integrated equipment for metering various values, analyzing harmonics, controlling power factor automatically, Demand Controller, ON/OFF function of breaker, and monitoring the fault condition of protection relay.
- GIMAC-IV has obtained remarkable reliability by upgrading the additional functions and dimension of GIMAC-II which has been manufactured and used at the real field over 10years.
- GIMAC-IV performs the high accuracy by 0.2% error rate for various measurement items such as voltage, current, phase through 128 sampling per 1 cycle as it is embedded with DSP for metering the values with the high performance and high speed.
- GIMAC-IV displays the basic measurement items such as voltage, current as well as phase data so that it makes easy to check wrong connection and the condition of load.
- The APFC function of GIMAC-IV can control up to 8 units of condenser and power factor by auto/manual control or circulation control.
- The Demand Controller function of GIMAC-IV can control up to 8 units of condenser and demand by auto/manual control or circulation control.
- GIMAC-IV prevents the wrong measurement of frequency caused from unusual frequency included in the voltage such as Noise, Sag, and Swell through integrated Digital Filter.
- GIMAC-IV has obtained the high reliability with the function of SBO(Select Before Operate) for the user's password setting change and the control.
- GIMAC-IV has improved safety by stopping the control of PF and Demand in case of as it is with self-diagnosis failures for monitoring the faults(wrong connection, disconnection, and unusual frequency) and memory.
- GIMAC-IV provides the user's past fault records by saving 300 events occurred recently.
- Various measurement data and events are displayed on the 20x4 Character LCD for the user's convenience.

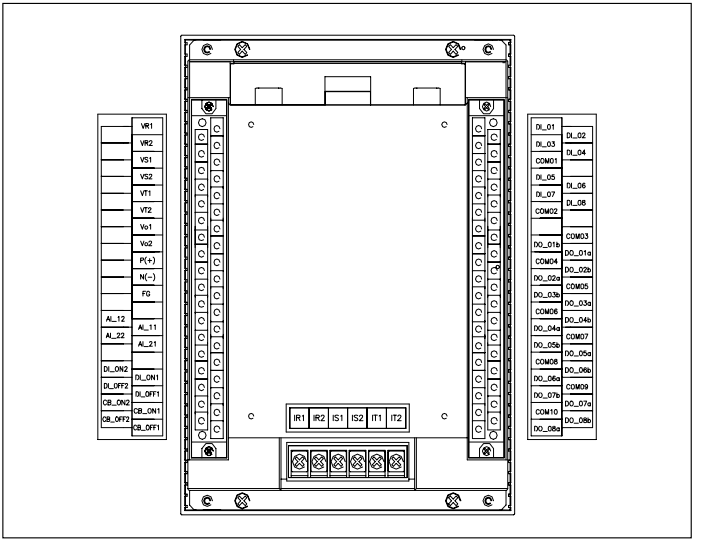
2. External view and configuration

2.1 External view and configuration



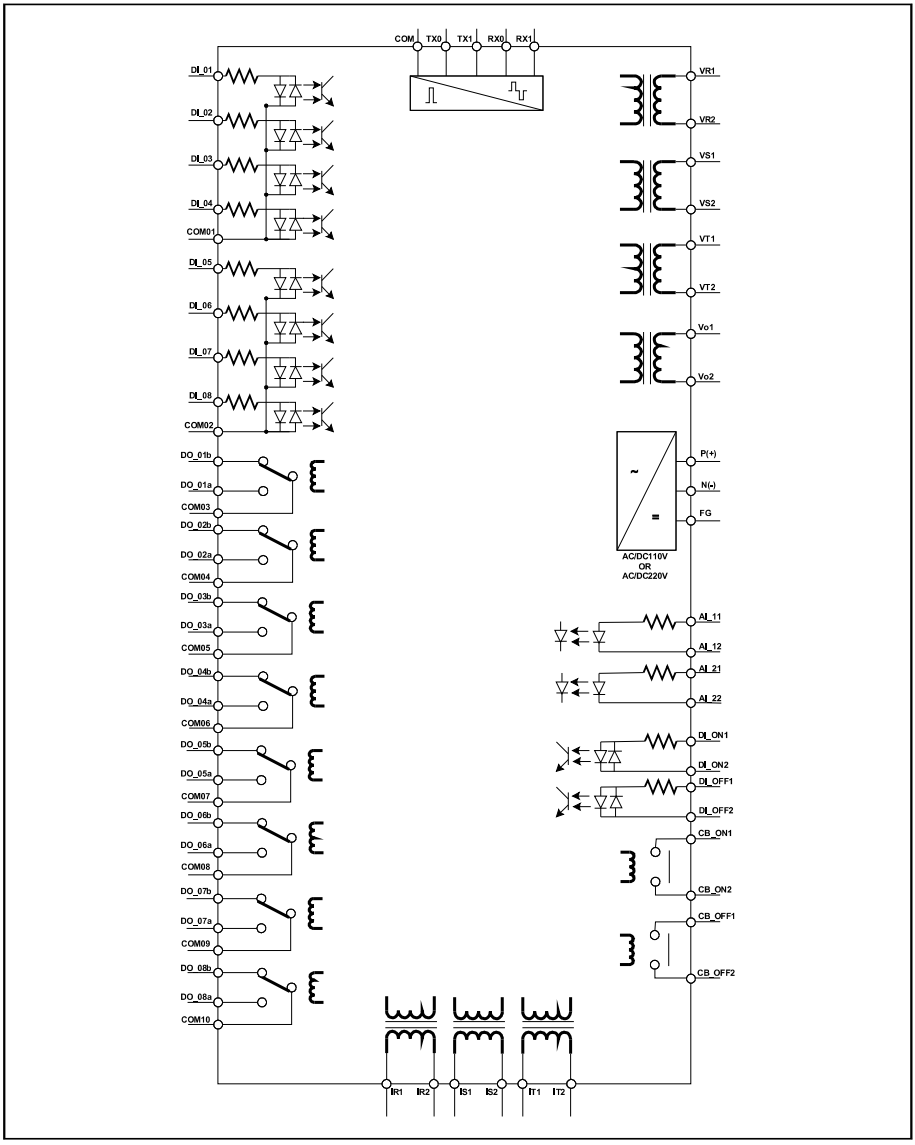
The type of KEY	Applicable Menu	Basic Function
Direction key (up & down)	Normal display tree	Move between items(Voltage→Current)
	Setting menu tree	Move between items or change setting value
Direction key (left & right)	Normal display tree	Move to lower display (Phase voltage→Line voltage)
	Setting menu tree	Move between items or change of setting value
FUNC KEY	Normal display Tree	Move to setting menu
	Setting menu tree	Move to normal display menu
ENTER KEY	Saving confirmation menu	Saving of changed data
	Password input menu	Putting a password
ESC KEY	Setting menu tree	Move to upper menu
	Saving confirmation menu	Cancel to save the changed data
RESET KEY	SYS ERR Menu	Back to Screen
	Except above menus	Turing back of FAULT, ALARM RESET & ALARM DO
R/L KEY	All menus	Switching of LOCAL/REMOTE
A/M KEY	All menus	Switching of AUTO/ MANUAL
CLOSE/OPEN KEY	All menus	Manual control of circuit breaker

2.2 The configuration of terminal



The name of terminal	Use	Remark
Vx1 ~ Vx2	Voltage input terminal	
Ix1 ~ Ix2	Current input terminal	
P(+), N(−)	Control power supply input terminal	⚠ Please do earth
FG	Ground terminal	
AI_11, AI_12	AI(DC4 ~ 20 mA) (+)polarity Input terminal	
AI_21, AI_22	AI(DC4 ~ 20 mA) (−)polarity Input terminal	
DI_ON1, DI_ON2	Input terminal for ON condition of breaker	
DI_OFF1, DI_OFF2	Input terminal for OFF condition of breaker	
CB_ON1, CB_ON2	Output terminal for ON condition of breaker	
CB_OFF1, CB_OFF2	Output terminal for OFF condition of breaker	
DI_01,DI_02,DI_03,DI_04	Input terminal of DI1 ~ 4	
COM01	Input common terminal of DI1 ~ 4	
DI_05,DI_06,DI_07,DI_08	Input terminal of DI5 ~ 8	
COM02	Input common terminal of DI5 ~ 8	
DO_x a	“a” contact output terminal of DO x	
DO_x b	“b”contact output terminal of DO x	
COM03 ~ COM10	COM terminal of DO 1 ~ 8	

2.3 Internal structure



3. Ratings

3.1 Standard using condition

This product shall be used under standard using condition except the extra condition specified.

1) Temperature
   - The normal use : -10℃ ~ 55℃
   - The storage : -25℃ ~ 70℃
2) Humidity : Under 80% (Shall not reach the dew point)
3) Using condition
   - Altitude : Under 2,000m
   - Shall be no abnormal vibration or impact
   - The ambient air shall not be severely polluted

3.2 Input ratings

Type	Use range	Remark
Connection type	3P4W, 3P3W(Y), 3P3W(DELTA), 1P3W,1P2W	
The rated frequency	50Hz or 60Hz	Separate use for 50Hz,60Hz
Measuring voltage	10~230V	Applied voltage at both ends of PT
Zero phase Measuring voltage	2.2~230V	Applied voltage at both ends of PT
The range of measuring current	0.05~6A	
The rated current of CT	5A	
The control power supply of ratings	AC/DC 110V or AC/DC 220V	Separate use for 110V, 220V
Digital Input power supply	AC/DC 110V or AC/DC 220V	
The number of Digital Input	Common DI:8ea, Breaker DI:2ea	
PT&CT Input burden	Under 1VA for each	
Zero phase voltage burden	1VA	
Power consumption	Normally Under 10W Operation : Under 30W	

3.3 Output ratings

Type		Use range	Remark
Relay for breaker Note1)	Contact switching capacity	AC230V 16A / DC30V 16A	Resistance load cosΦ =1
	Max. switching capacity	3680VA, 480W	
	Contact switching capacity	AC230V 8A / DC30V 8A	Inductance load (cosΦ=0.4, L/R=7ms)
	Max. switching capacity	1840VA, 240W	
Relay for signal	Contact switching capacity	AC230V 12A / DC25V 12A	Resistance load cosΦ=1
	Max. switching capacity	2760VA, 300W	
	Contact switching capacity	AC230V 6A / DC25V 6A	Inductance load (cosΦ=0.4, L/R=7ms)
	Max. switching capacity	1880VA, 150W	

Note1) Relay for circuit breaker shall be opened with no voltage.

3.4 Noise ratings

GIMAC-IV is fully observed with the noise rating standard as follows.

Item	Condition	Applicable standard
Insulation resistance	500V, Over 10㏁	KEMC1110, 1120
Power frequency withstand voltage	AC 2kV (1kV)	KEMC1110, 1120
Lighting impulse withstand voltage	5kV(3kV)	IEC60255-22 IEC61000-4
Vibrating surge voltage	2.5~3kV	IEC60255-22 EN61000-4
Surge Immunity	Control power supply, Transformer:6kV 5times Signal:3kV 5times	IEC60255-22 EN61000-4
Fast Transient Burst	Control power supply, Transformer: 4kV 3mins Signal:1kV 3mins	LSIS EMC Standard
Impulse Noise Immunity	Control power supply, Transformer: 3kV 10mins Signal:1kV 10mins	LSIS EMC Standard
Static electricity ESD	Air : 8kV Contact : 6 kV	IEC60255-22 IEC61000-4
Radio frequency Radiated Susceptibility	10V/m	IEC60255-22
Radio frequency Conducted Susceptibility	10V	IEC60255-22
Electromagnetic wave conduction	0.15~0.5MHz : 79(66) dBuV 0.5~30MHz : 73(60) dBuV	IEC60255-22

4. Measuring function & Allowable error

4.1 Measurement item & Accuracy rate

Type	Measuring item	Detailed measuring item	Accuracy	Remark
Voltage	Line voltage	Vab, Vbc, Vca	0.2%	F/S
	Phase voltage	Va, Vb, Vc	0.2%	F/S
	Zero phase voltage	Vo, Vo_max	0.5%	F/S
	Normal voltage	V1(No accuracy)	Measuring from1.1V	
	Reverse voltage	V2(No accuracy)	Measuring from1.1V	
Current	Line current	Ia, Ib, Ic	0.2%	F/S
	Normal current	I1(No accuracy)	-	
	Reverse current	I2(No accuracy)	-	
Phase	Phase per 3P3W	∠VabIa, ∠VabIb, ∠VabIc, ∠VabVbc, ∠VabVca	0.5°	
	Phase per 3P4W	∠VaVb, ∠VaVc ∠VaIa, ∠VbIb, ∠VcIc	0.5°	
Electricity	Active power	Pa(ab), Pb(bc), Pc(ca), ΣP	0.5%	F/S
	Reactive power	Qa(ab), Qb(bc), Qc(ca), ΣQ	0.5%	F/S
	Apparent power	Sa(ab), Sb(bc), Sc(ca), ΣS	0.5%	F/S
Electric energy	Active electric energy	WHa(ab), WHb(bc), WHc(ca), ΣWH	0.5 %	F/S
	Reactive electric energy	VARHa(ab), VARHb(bc), VARHc(ca), ΣVARH	0.5%	F/S
	Reverse active electric energy	rWHa(ab), rWHb(bc), rWHc(ca), ΣrWH	0.5%	F/S
Frequency	Frequency	Frequency F(Hz)	0.05Hz	
Power Factor	Power Factor(PF)	PFa(ab), PFb(bc), PFc(ca), PF	Following phase error	
Harmonics	Harmonic voltage	Va(ab), Vb(bc),Vc(ca) of 1^{nd}~63^{th} Harmonics & THD	-	-
	Harmonic current	Ia, Ib, Ic of 1^{nd} ~ 63^{th} Harmonics & THD, TDD, K-Factor	-	-
Demand	Active power	Peak demand	-	-
	Current Demand	Peak demand	-	-
AI	AI	4~20mA	0.5%	F/S

4. Measuring function & Allowable error

4.1 Measurement item & Accuracy rate

4.1.1 Voltage

1) The voltage applied to PT inside product (PT ratio : 1.000)
   - Phase voltage (Line voltage) : 10 ~ 230V
   - Normal voltage, Reverse phase voltage : 1.1 ~ 230V
   - Zero phase voltage : 2.2 ~ 230V
2) Accuracy (Standard: Voltage applied to PT)
   - Phase voltage : F/S 0.2%
   - Line voltage : F/S 0.2%
   - Zero phase voltage : F/S 0.2%
   - Normal voltage, Reverse phase voltage : No standard for measuring accuracy

4.1.2 Current

1) The current applied to CT inside product (CT ratio : 1) : 0.05 ~ 6A
2) Accuracy : F/S 0.2%
3) Normal voltage, Reverse phase voltage : No standard for measuring accuracy

4.1.3 Phase

1) Phase error between voltage and current
   - Voltage over 30V, Current Over 0.5A : 0.5°
   - Angle other than specified above : 1°
2) Phase error between voltages
   - Voltage over 30V : 0.5°
   - Angle other than specified above : 1°

4.1.4 Active power, Reverse active power, Apparent power, Active electric energy, Reverse active electric energy

1) Error : F/S 0.5%

4.1.5 Reactive power, Reactive electric energy

1) Error : F/S 0.5%

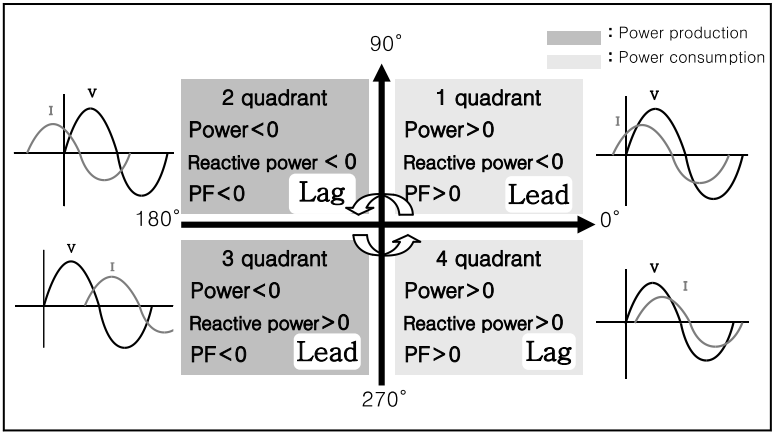
The meaning of signal with electric energy & reactive power

1) “+” : Indication of power consumption
   Active and reactive power occurs and active and reactive electric energy are accumulated when PF exists in active power on the 1 & 4 quadrants and reactive power on the 3 & 4 quadrants

4.1 Measurement item & Accuracy rate

2) "–" : Indication of power production
Reverse active and reactive power occurs and reverse active electric energy are accumulated when PF exists in active power on the 2 & 3 quadrants.

4.1.6 Power factor



1) PF error : Following phase error.
2) Marking method of PF (Shall be no confusion with the mark of PF specified in picture above)
- In case of Lead : "–" mark
- In case of Lag : "+" mark
- On the 1& 4quadrant : "(F)" mark indicating electricity consumption
- On the 2& 3quadrant : "(R)" mark indicating electricity production

4.1.7 Frequency

1) Measuring range : 45 ~ 70 Hz
2) Measuring error : 0.05 Hz
3) Excluding any frequency out of measuring range

4.1.8 Harmonics & THD, TDD, K-Factor

1) Measuring : 63 harmonics
2) Accuracy : No standard

4.1.9 AI

4. Measuring function & Allowable error

4.1 Measurement item & Accuracy rate

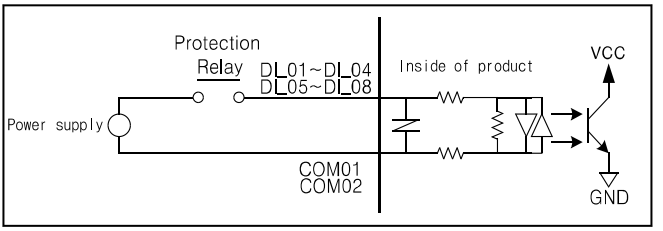
1) The number of PORT : 2 PORT
2) Measuring range : DC 4 ~ 20 mA
3) Error : F/S 0.5 %
4) No measuring and indication for less than 4 mA

Type		Unit	Marking method			Remark
			Indication		Measuring range	
Voltage		kV	under10	X.XXX	10.00 V ~ 999.99 KV	
		V	more than10	XXX.XX		
Current		kA	under10	X.XXX	0.050 A ~ 999.99 KA	
		A	more than10	XXX.XX		
Phase		°	under10	X.XXX	0.000 ~ 360.00	
			more than10	XXX.XX		
Power	(Reverse) Active power	W	under10	±X.XXX	0.000 W ~ ±99999.9 MW 0.000 VAR ~ ± 99999.9 MVAR 0.000 VA ~ ±99999.9 MVA	"–" mark indicating the reverse
		KW				
		MW				
	Reactive power	VAR	more than10	±XXXX.XX		
		KVAR				
		MVAR				
	Apparent power	VA	more than 10000 M	±XXXXX.X		
		KVA				
		MVA				
Electric energy	(Reverse) Active electric energy	WH	under10	X.XXX	0.000 Wh ~ 99999.9 MWh 0.000 VARh ~ 99999.9 MVARh	Reset to the "0" in case of electric energy over 100,000
		KWH				
		MWH	more than10	XXXX.XX		
	Reactive electric energy	VARH				
		KVARH	more than 10000 M	XXXXX.X		
		MVARH				
PF		–	–	±X.XXX		+: lag –: lead
Unbalanced factor, Unbalanced rate		%	under10	X.XXX	0.000 ~ 100.00	
			more than10	XXXX.XX		
Harmonics, THD		V, A	under10	X.XXX	0.000 ~ 999.99 kV	
			more than10	XXXX.XX		
AI		mA	–	X.XXX	4.000~20.00 mA	

5. DI/DO & Indication function

5.1 The function of DI

5.1.1 Wiring diagram



5.1.2 De-bounce Time : 100msec (It can be recognizable in case DI input Signal is being held at least 100msec.)

5.1.3 COM1 for DI 1~4, COM2 for DI 5~8

5.1.4 Power supply : AC/DC 110V

5.1.5 Maximum consumption current : MAX 5mA

5.2 The function of DO

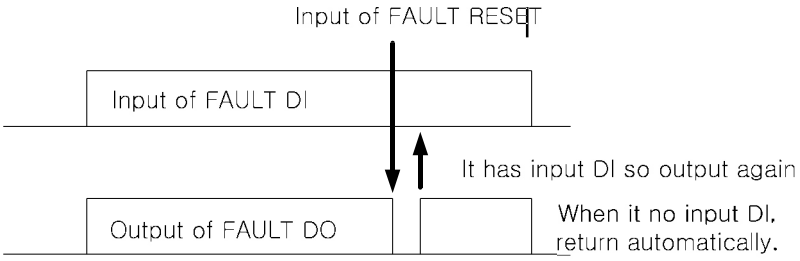
5.2.1 DO control authority

Type	DO control		CB control	Remark
	AUTO	MANUAL		
LOCAL	KEY : X Communication : X	KEY : O Communication : X	KEY : O Communication: X	
REMOTE	KEY : X Communication : O	KEY : X Communication : O	KEY : X Communication : O	

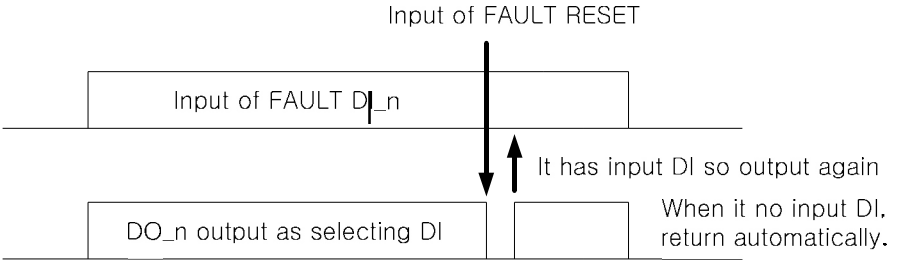
5.2.2 DO Control

DO setting state	Output condition	Output method	Return condition
FAULT DO A)	Input of FAULT DI	LATCH output of “a” contact	Return in case of cancel of FAULT DI input
DI DO B)	Input of FAULT DI	LATCH output of “a” contact	Return in case of cancel of correspond to DI input
LATCH DO C)	Input of FAULT DI	LATCH output of “a” contact	Return in case of FAULT RESET command input
RESET DO D)	Input of FAULT RESET	LATCH output of “a” contact for 500msec	No condition for return
ALARM DO	ALARM EVENT	LATCH output of “a” contact	Return in case of cancel of ALARM EVENT or FAULT RESET command input
LOCAL/ REMOTE	R/L state of GIMAC-IV	LATCH output of “a” contact in the condition of remote	No condition for return
D/C 1 LOAD 1 DO controller	Following D/C control condition	LATCH output	Following D/C control condition
D/C 1 LOAD 2 DO controller	Following D/C control condition	Pulse output of “a” contact	Following D/C control condition
APFC 1 BANK 1 DO controller	Following APFC control condition	LATCH output	Following APFC control condition
APFC 1 BANK 2 DO controller	Following APFC control condition	Pulse output of “a” contact	Following APFC control condition

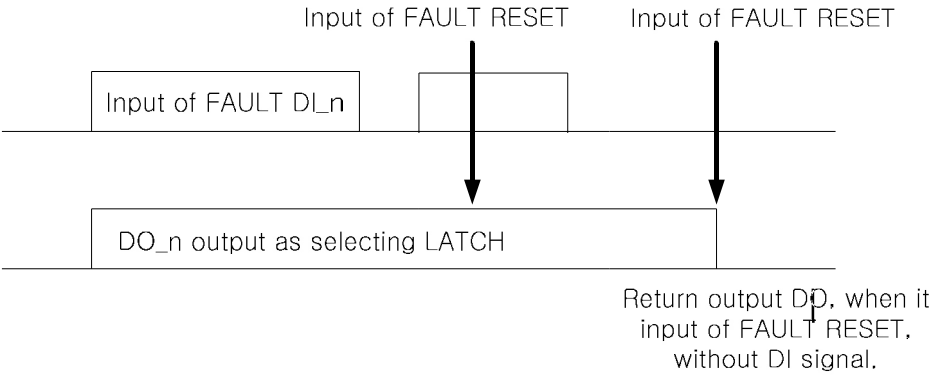
A) Detailed function explain FAULT DO



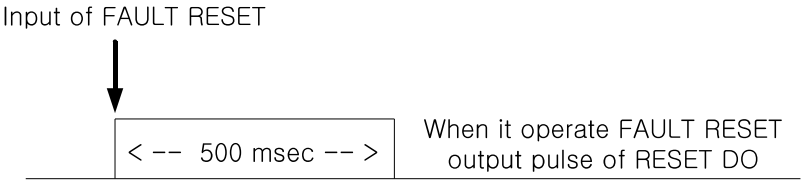
B) Detailed function explain DI DO



C) Detailed function explain LATCH DO



D) Detailed function explain RESET DO



5.2 The function of DO

DO setting state	Output condition	Output method	Return condition
FAULT DO	Input of FAULT DI	LATCH output of "a" contact	Return in case of cancel of FAULT DI input or FAULT RESET command input
ALARM DO	ALARM EVENT	LATCH output of "a" contact	Return in case of cancel of ALARM EVENT or FAULT RESET command input
LOCAL/ REMOTE	R/L state of GIMAC-IV	LATCH output of "a" contact in the condition of remote	No condition for return
D/C 1 LOAD 1 DO controller	Following D/C control condition	LATCH output	Following D/C control condition
D/C 1 LOAD 2 DO controller	Following D/C control condition	Pulse output of "a" contact	Following D/C control condition
APFC 1 BANK 1 DO controller	Following APFC control condition	LATCH output	Following APFC control condition
APFC 1 BANK 2 DO controller	Following APFC control condition	Pulse output of "a" contact	Following APFC control condition

5.3 The function of LED indication

5.3.1 The indication of FAULT

The setting state of DI	Normal	Abnormal (Input of FAULT DI signal	Reset after troubleshooting		Troubleshooting after reset	
			Troubleshooting	RESET	RESET	Troubleshooting
FAULT DI	OFF	Blink	Blink	OFF	ON	OFF

5.3.2 The indication of ALARM LED

Type	Normal	EVENT	RESET before troubleshooting of EVENT	Troubleshooting of EVENT
ALARM LED	OFF	Blink	ON	OFF

5.3.3 The indication of SYSTEM ERROR

Type	Normal	EVENT	RESET before troubleshooting of EVENT	Troubleshooting of EVENT
Sys Err LED	OFF	Blink	ON	OFF

6. Self-diagnosis

6.1 Frequency ERROR

6.1.1 Condition : Applying the rated frequency by±5Hz

6.1.2 Indication

1) LCD : Display of "FREQUENCY ERROR"

2) LED : Blinking of Sys Err LED

6.1.3 Operation : APFC and Control part of D/C is stopped in case of ERROR

6.1.4 Return condition : RESET or the phenomenon will be disappeared automatically

6.1.5 Others : No consideration for the sample value measured out of the frequency measuring range

6.2 Connection ERROR

6.2.1 Condition : The case the phase rotating direction of voltage is not counterclockwise (S-phase is less than T-phase)

6.2.2 Indication

1) LCD : Display of "WIRING ERROR"

2) LED : Blinking of Sys Err LED

6.2.3 Operation : APFC and Control part of D/C is stopped in case of ERROR

6.2.4 Return condition : RESET or the phenomenon will be disappeared automatically

6.2.5 Others : Only applicable to 3 Phase-4 wire and 3 Phase-3 wire

6.3 Voltage ERROR

6.3.1 Condition

1) In case single phase of voltage is not measured
(Exception : Being considered as normal in case the both voltage and current are 0)

6.3 Voltage ERROR

A phase voltage : 110V, B phase voltage : 0V, C phase voltage : 110V
B phase current is displayed with nominal value

2) The current is measured even if all phase voltage are "0"
A phase voltage : 0V, B phase voltage : 0V, C phase voltage : 0V
A phase current : 0.05A, B phase current : 0A, C phase current : 0A

6.3.2 Indication

1) LCD : Display of "**VOLTAGE ERROR**"
2) LED : Blinking of Sys Err LED

6.3.3 Operation : APFC and Control part of D/C is stopped in case of ERROR

6.3.4 Return condition : RESET or the phenomenon will be disappeared automatically

6.4 Breaker control ERROR

6.4.1 Condition : No change for 500m sec after commanding the control of breaker to open/close

6.4.2 Indication

1) LCD : Display of "**CB CONTROL ERROR**"
2) LED : Blinking of Sys Err LED

6.4.3 Return condition : RESET

6.5 DO control ERROR

6.5.1 Condition : No change of DI for 500m sec after commanding the open/close control of DO set by pulse output

6.5.2 Indication

1) LCD : Display of "**DO CONTROL ERROR**"
2) LED : Blinking of Sys Err LED

6.5.3 Return condition : RESET

6.6 DPRAM TEST ERROR

6.6.1 Condition : Defects found with reading and writing function as a result of DPRAM inspection when booting after RESET

6.6.2 Indication

1) LCD : Display of "**DPRAM TEST ERROR**"
2) LED : Blinking of Sys Err LED

6.6.3 Return condition : RESET

6.6.4 Contact to the nearest SVC in case of DPRAM TEST ERROR as Detailed examination is needed for H/W or for using condition.

Type	The condition of EVENT	The content of operation with ERROR
Frequency ERROR	Detecting the frequency exceeding the setting frequency by±5Hz	Display of "FREQUENCY ERROR" on the LCD monitor The blinking of SYSTEM ERROR LED The stop of APFC and control part of D/C Return to normal monitor when RESET or clear the ERROR
Wrong connection ERROR	S-phase voltage is less than T-phase in 3 phase wiring system (Wrong connection of S & T phase voltage)	Display of "WIRING ERROR" on the LCD monitor The blinking of SYSTEM ERROR LED The stop of APFC and control part of D/C Return to normal monitor when RESET or clear the ERROR
Voltage ERROR	1. Voltage not being measured even for one phase 2. The current is measured even if all phase voltages are "0"	Display of "VOLTAGE ERROR" on the LCD monitor The blinking of SYSTEM ERROR LED The stop of APFC and control part of D/C Return to normal monitor when RESET or clear the ERROR
Circuit breaker control ERROR	No change within 500m sec after commanding the control of circuit breaker	Displaying "CB CONTROL ERROR" on the LCD monitor Blinking of SYSTEM ERROR LED Return to normal monitor when RESET
DO control ERROR	No change of DI within 500m sec after commanding DO which is set by pulse output	Display of "DO CONTROL ERROR" on the LCD monitor Blinking of SYSTEM ERROR LED Return to normal monitor when RESET
DPRAM ERROR	Defects found with reading and writing as a result of DPRAM inspection while booting after RESET	Display of "DPRAM TEST ERROR" on the LCD monitor Blinking of SYSTEM ERROR LED Return to normal monitor when RESET Need a closer inspection

7. APFC : Auto Power Factor Controller

7.1 Definitions

7.1.1 Max. Power Factor : The maximum value of aimed PF. Open the condenser when PF exceeding max.PF

7.1.2 Min. Power Factor : The minimum value of aimed PF. Close the condenser when PF is under min.PF

7.1.3 Alarm Power Factor : Alarm going off when PF is less than alarm PF set

7.1.4 DELAY TIME : Controlled if it is being kept during the delay time with meeting the control condition

7.1.5 DEAD TIME : Condenser control is being prohibited during this time considering charging time after closing condenser BANK or discharging time after opening it

7.2 Control condition

7.2.1 Open condition of condenser : Open the condenser when PF which exceeds Max.PF is being kept during delay time

7.2.2 Closing condition of condenser : Close the condenser when PF under Min.PF is being kept during delay time

7.3 Setting item

7.3.1 MAX. PF : 0.95 ~ -0.90 ("-" indicating lead phase)

7.3.2 Min. PF : 0.50 ~0.95

Note) If the max.PF and min.PF are set in the same value, it may result in malfunction as there is no room for product to operate. Please set them with margin by min. 0.05.

7.3.3 Alarm PF : 0.00 ~0.90

7.3.4 DELAY TIME : 3 ~ 300 sec (STEP 1 sec)

7.3.5 DEAD TIME : 3 ~ 300 sec (STEP 1 sec)

7.3 Setting item

7.3.6 Condenser BANK Setting

1) Setting of BANK control RELAY : DO 1 ~ DO 8
2) Setting of the condenser capacity : NONE ~ 9,999 MVA
3) Setting of Alarm RELAY : DO1 ~ DO 8
4) EVENT setting & EVENT control setting
   - LOW CURRENT : Set whether to get EVENT occurred or set the control in case the average current of 3 phase is 1A
   - UNDER VOLTAGE : Set whether to get EVENT occurred or set the control in case phase voltage (3 phase 3 wire, line voltage) is under 80V.
   - OVER SWITCH : Set whether to get EVENT occurred or not when ON COUNT of relay for the control of condenser is over 500times.
   - OVER PF : Set whether to get EVENT occurred or not when over Max. PF.
   - UNDER PF : Set whether to get EVENT occurred or not when over Min. PF.

7.4 PF Control Sequence

7.4.1 Combination control : The control method being used when all the capacity of condenser are set.

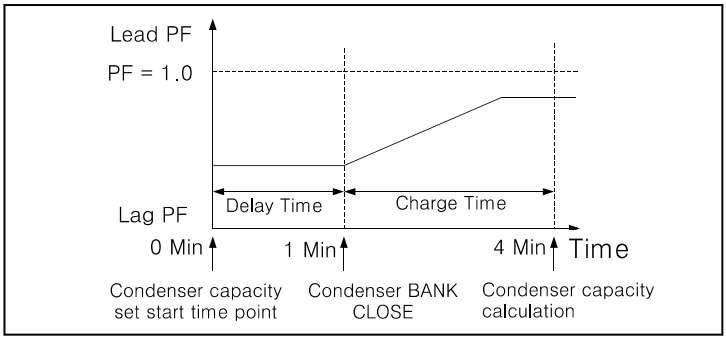
The method is for the control by combining the necessary condenser to the capacity after calculating the necessary reactive power for the present power factor to put it within the aimed power factor

7.4.1.1 The condenser capacity setting

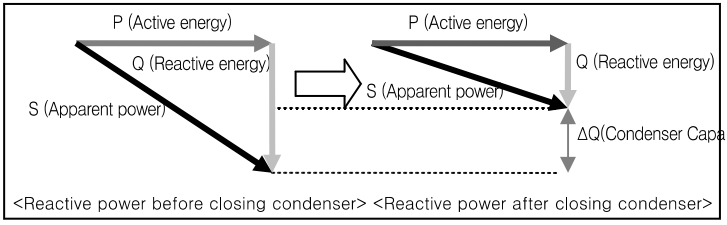
7.4.1.1.1 MANUAL : Setting the condenser capacity by manual

7.4.1.1.2 AUTO : Setting the condenser capacity by automatic calculation which has the charging time for 3 mins and delay time for 1 min.

7.4 PF Control Sequence



< Calculating method of condenser Capacity by AUTO >



The condenser capacity is the difference between reactive before closing condenser and reactive after closing condenser.

Note 1) There shall be no change of load to get the correct condenser capacity when calculating it automatically.

Note 2) Circulation control is recommended in case size of capacitor banks is all the same

7.4.2 Circulation control : The control method being used when condenser capacity is not set.

7.4.2.1 The sequence of circulation control

Open the condenser which has been closed first and close the condenser which has been opened last.

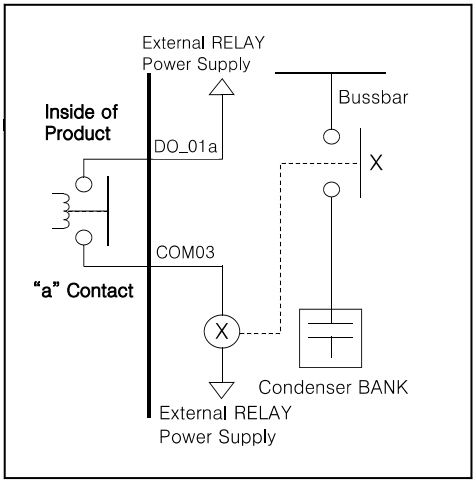
7.5 APFC EVENT

Type	The condition of EVENT	EVENT Setting	The content of EVENT	Control setting for EVENT	Control operation state when setting control
ZERO VOLTAGE	Input voltage being maintained with 0V during DELAY TIME	Unable to set (DEFAULT)	1. ZERO VOLTAGE EVENT 2. Occurred OVER PF, UNDER PF, ALARM PF EVENT CLEAR	No corresponding control	
ZERO CURRENT	Input current being maintained with 0A during DELAY TIME	Unable to set (DEFAULT)	1. ZERO CURRENT EVENT 2. Occurred OVER PF, UNDER PF, ALARM PF EVENT CLEAR	No corresponding control	
ALARM PF	PF being maintained under the set ALARM PF during DELAY TIME	Unable to set (DEFAULT)	1. Blinking of ALARM LED 2. Output of ALARM DO 3. ALARM PF EVENT	No corresponding control	
REVERSE CURRENT	Reverse power being maintained during DELAY TIME (In case PF is in the 2 or 3 phases)	Unable to set (DEFAULT)	1. Blinking of ALARM LED 2. Output of ALARM DO 3. REVERSE CURRENT EVENT	Unable to set (DEFAULT)	Put all condensers in the LATCH condition (Not controlled by AUTO)
LOW CURRENT	Average input current less than 1A being maintained during DELAY TIME	Possible to set	1. Blinking of ALARM LED 2. Output of ALARM DO 3. LOW CURRENT EVENT	Possible to set	Put all condensers in the LATCH condition (Not controlled by AUTO)
UNDER VOLTAGE	Phase voltage (line voltage in case of 3Phase-3 wire) less than 80V being maintained during DELAY TIME	Possible to set	1. Blinking of ALARM LED 2. Output of ALARM DO 3. UNDER VOLTAGE EVENT	Possible to set	Put all condensers in the LATCH condition (Not controlled by AUTO)
OVER SWITCHING	ON COUNT of DO set by condenser BANK exceeding 500times	Possible to set	1. Blinking of ALARM LED 2. Output of ALARM DO 3. OVER SWITCH EVENT	No control	
OVER PF	PF over set Max. PF being maintained during DELAY TIME	Possible to set	1. Blinking of ALARM LED 2. ALARM DO Output 3. Occurring OVER PF EVENT	No control	
UNDER PF	PF less than Min. PF being maintained during DELAY TIME	Possible to set	1. Blinking of ALARM LED 2. ALARM DO Output 3. Occurring UNDER PF EVENT	No control	

7.6 BANK Setting & Wiring

7.6.1 The setting of 1 BANK 1 RELAY " a " contact

1) Wiring diagram for BANK Setting (ON -> DO1a, OFF -> DO1-)

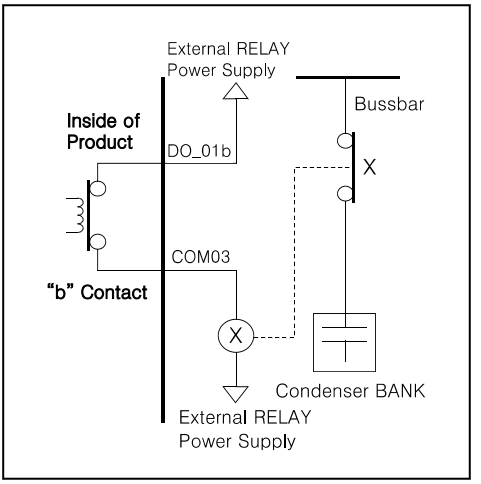


2) Condenser BANK closed with the operation of internal RELAY
3) Using "a" contact of internal RELAY
4) Shall be cautious with automatic opening of condenser BANK due to the external RELAY released when disconnecting the power supply of GIMAC-IV
5) Please use the external RELAY(The exciting current) compatible to internal RELAY
   Note) 3.2 clause : Shall be in accordance with the signal relay of output rating

7.6 BANK Setting & Wiring

7.6.2 The setting of 1 BANK 1 RELAY " b " contact

1) Wiring diagram for BANK Setting (ON -> DO1b, OFF -> DO1-)



2) BANK opened with the operation of internal RELAY

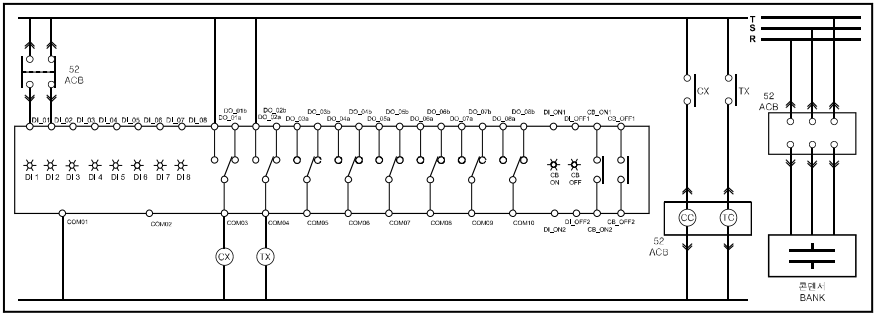
3) Using "b" contact of internal RELAY

4) BANK closed automatically by the external RELAY excited when disconnecting power supply of GIMAC-IV

7.6 BANK Setting & Wiring

7.6.3 The setting of 1 BANK 2 RELAY

1) Wiring diagram for BANK Setting (ON -> DO1a, OFF -> DO2a)



2) Using 2 RELAYS to control 1 condenser BANK

3) Control the 500msec pulse output when controlling the condenser BANK

4) Using “a” contact of internal RELAY

5) Even if disconnecting the power supply of GIMAC-IV, the condenser BANK not being opened or closed

8. The function of DEMAND CONTROLLER

8.1 Terminology

1) Target demand power(Wt) : The target demand power control set by user
2) Demand time : The unit of time for calculating demand power
3) Demand watt : The average power of demand time
4) Standard power(Wt(t)) : The target power which correspond to current demand time
5) Current power(Wc(t)) : The demand power which correspond to current demand time
6) Estimated power(We(t)) : The estimated power which correspond to the result of current power change
7) Max Demand watt : The highest demand power
8) Period Time : The time interval to judge the condition for a control
9) Delay Time : The delay time which shall be kept with meeting the control condition to execute the control
10) Control start time : The time when the control is started

8.2 Basic calculation

1) Current power : Accumulated electric energy after demand time started*1hr/Demand time
2) Standard power : Target power*Elapsed time/Demand time
3) Estimated power : Current power + The quantity of current power change per hour * The remainder of demand time

8.3 Setting items

1) Demand Time : 5~60min (step 5 min)
2) Start Time : 0 ~ Demand Time (step 1 min)
3) Period Time : 10~60sec (step 1 sec)
4) Delay Time : 1~(Period Time – 1)sec (step 1 sec)

8.3 Setting items

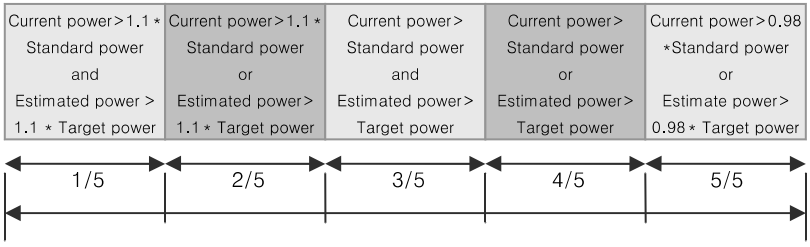
5) Target power (Wt setting)
6) Load setting
- Load number : 0~8 EA
- Alarm number : 0~2 EA
- RELAY setting : ON RELAY, OFF RELAY
- The setting of Alarm RELAY

8.4 The type of Alarm

1) The first Alarm : The estimated power exceeding the target power
2) The second Alarm : The current power exceeding standard power

8.5 The condition of load breaking

The load breaking is started in case following conditions are satisfied during Delay Time ; Start Time is passed and condition of the GIMAC-IV is in AUTO.
1) 0 T ~ 1/5 T : Wc(t)>1.1*Wt(t) and We(t)>1.1Wt
2) 1/5 T ~ 2/5 T : Wc(t)>1.1*Wt(t) or We(t)>1.1Wt
3) 2/5 T ~ 3/5 T : Wc(t)>Wt(t) and We(t)>Wt
4) 3/5 T ~ 4/5 T : Wc(t)>Wt(t) or We(t)>Wt
5) 4/5 T ~ 5/5 T : Wc(t)>0.98*Wt(t) or We(t)>0.98Wt
(T : DEMAND TIME which is set)



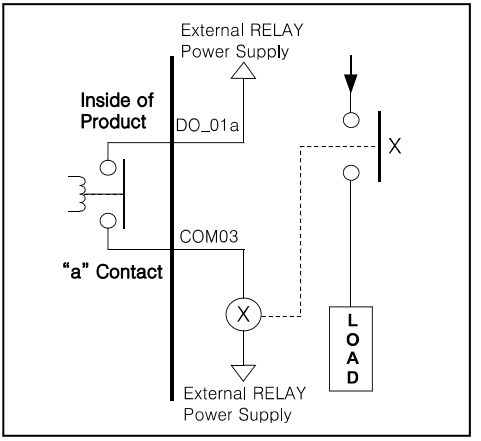
8.6 The load breaking sequence of DEMAND CONTROLLER

STEP 1 : The start of period time after elapsing control start time
STEP 2 : Judging whether the control condition is sufficient or not for each period time
STEP 3 : Breaking the loads which are closed first and set last from the setting order of DO in case delay time is being kept with meeting the control condition
STEP 4 : The return of all loads interrupted after demand time

8.7 The load setting & wiring

8.7.1 The setting of 1 LOAD 1 RELAY "a" contact

1) The wiring diagram of LOAD setting (ON->DO1a, OFF->DO1-)



2) The load being closed with the operation of internal RELAY
3) Using "a" contact of internal RELAY
4) The loads being interrupted automatically by releasing of excited external RELAY when disconnecting the power supply of GIMAC-IV

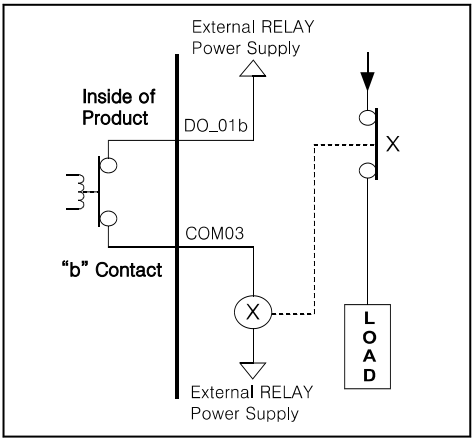
8.7 The load setting & wiring

5) Please use the external RELAY(the exciting current) compatible to internal RELAY

Note)6.1 clause : Shall be in accordance with the signal relay of output ratings

8.7.2 The setting of 1 LOAD 1 RELAY "b" contact

1) The wiring diagram of LOAD setting (ON->DO1b, OFF->DO1-)



2) The load being interrupted with the operation of internal RELAY

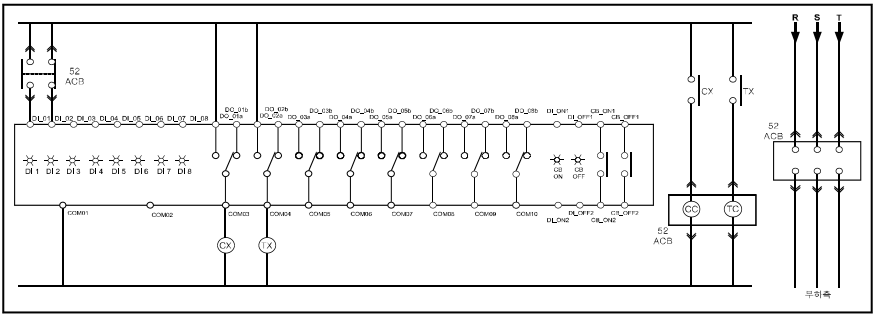
3) Using "b" contact of internal RELAY

4) The load being closed automatically by the external RELAY excited When disconnecting power supply of GIMAC-IV

8.7 The load setting & wiring

8.7.3 The setting of 1 LOAD 2 RELAY

1) The wiring diagram of LOAD setting (ON->DO1a, OFF->DO2a)



2) The method of using two relays to control one load

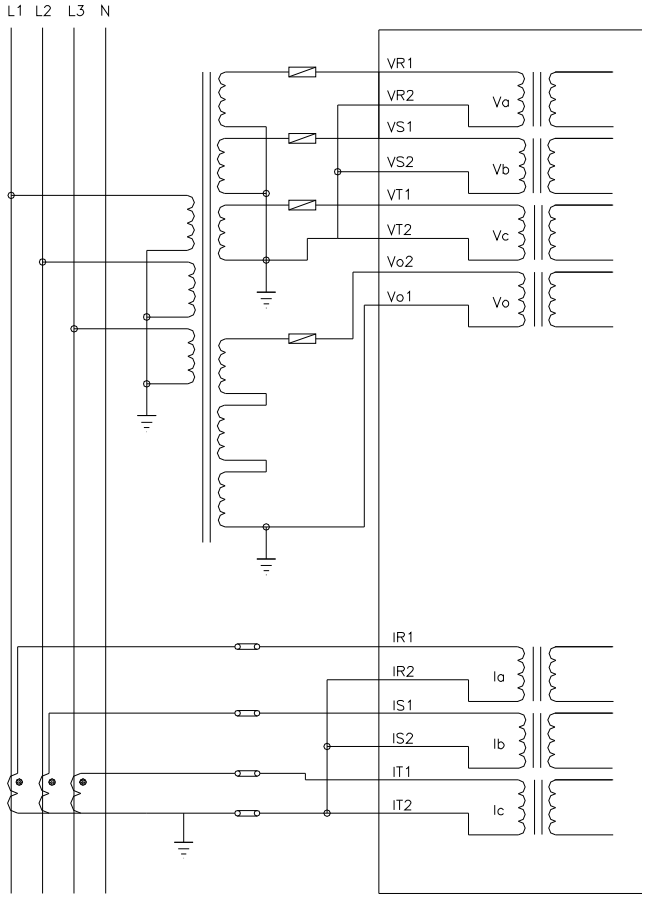
3) Control the 500msec pulse output in case of load control

4) Using “a” contact of internal RELAY

5) No switching of load even for disconnecting power supply of GIMAC-IV

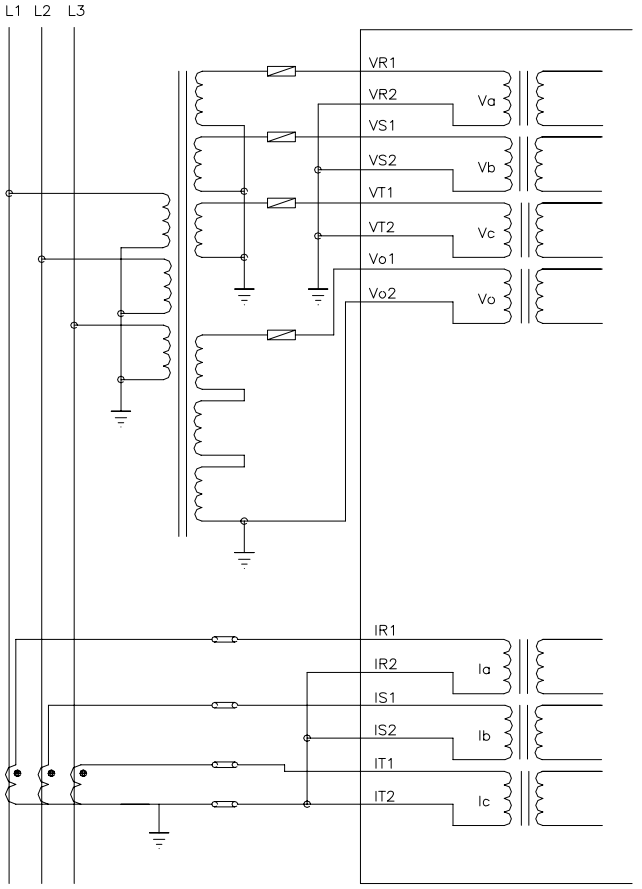
9. Wiring diagram

9.1 The wiring diagram of CT/PT with 3P4W connection



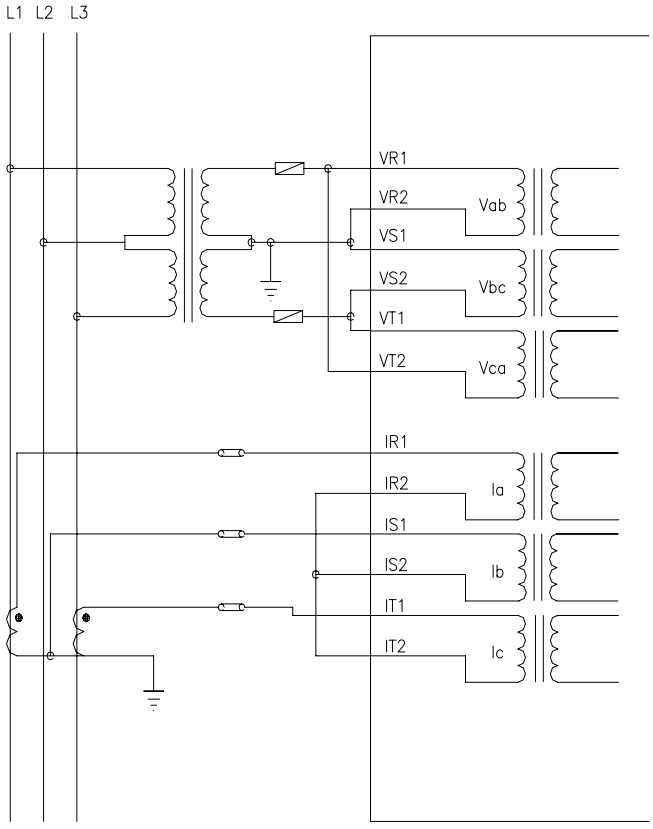
The wiring diagram of 3P4W Connection

9.2 The wiring diagram of CT/PT with 3P3W Y connection



Wiring diagram of 3P3W Y-connection

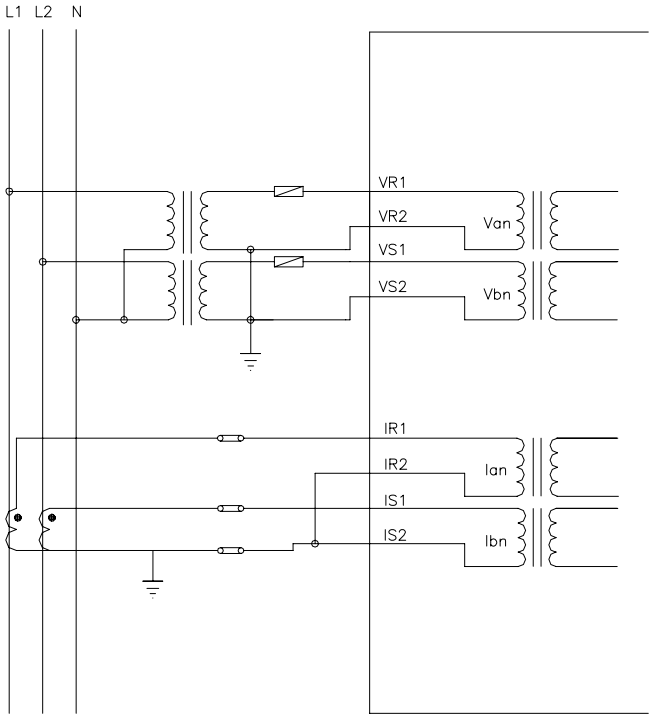
9.3 The wiring diagram of CT/PT with 3P3W Delta connection



The wiring diagram of 3P3W DELTA (2PT, 2CT)

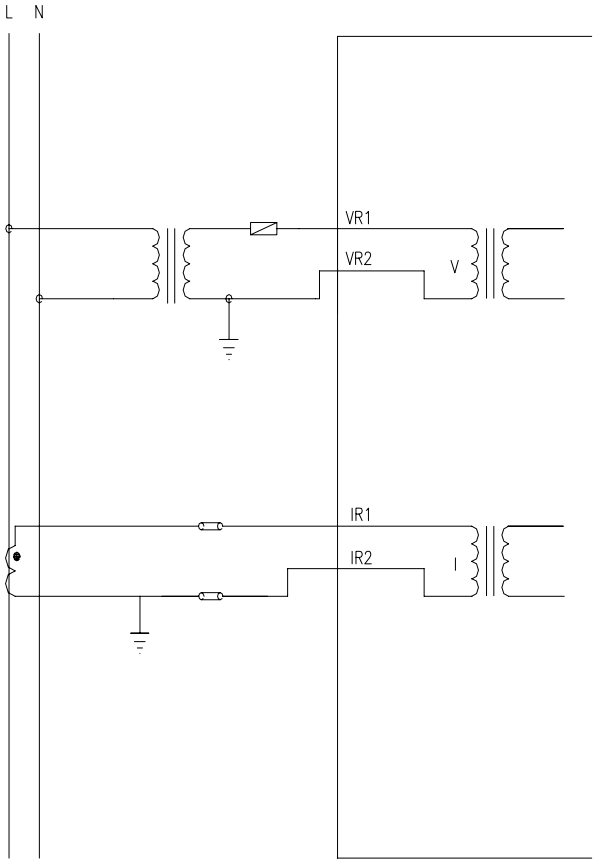
※Use with the balanced load. There might be error with unbalanced load.

9.4 The wiring diagram of CT/PT with 1P3W connection



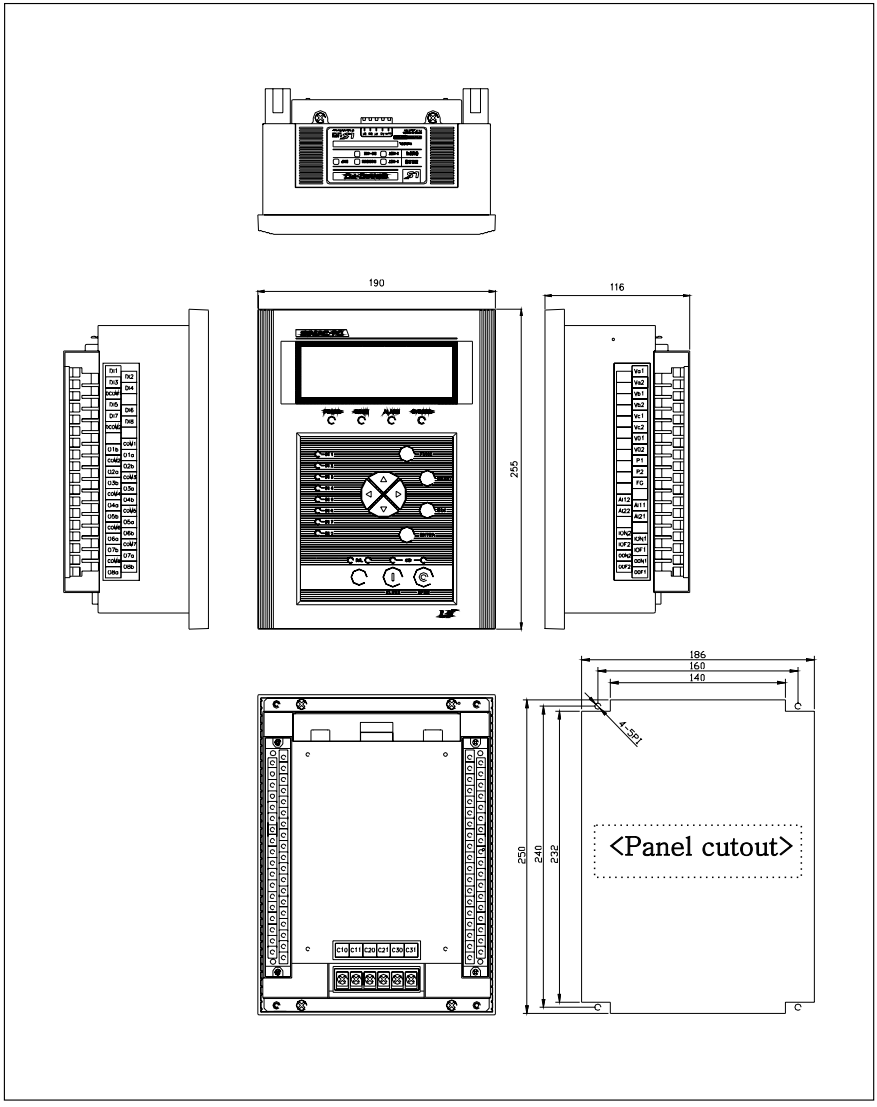
The wiring diagram of 1P3W Connection

9.5 The wiring diagram of CT/PT with 1P2W connection

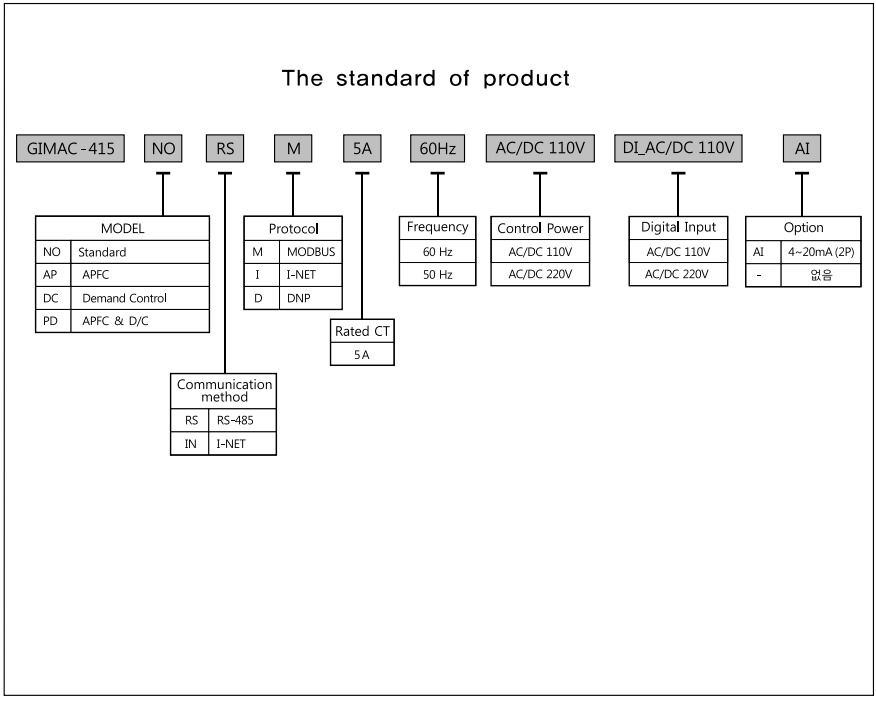


The wiring diagram of 1P2W Connection

10. External dimension



11. Ordering information



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