



**AGC-300**

(144 × 144 × 109.5mm/approx.1.0kg)

#### ■ **USE**

This product is multi-function generator controller to control synchronizing, load distribution, constant power factor, constant voltage, constant frequency and operating unit number in parallel operation between commercial and generator and between generators.

This product can be used for wide range, such as normal power generation and emergency power generation, cogeneration, etc.

#### ■ **FEATURES**

- ▶ Small-sized thin type, panel mounting controller (DIN144 × 144).
- ▶ Generator operating unit number is up to 8 units.  
It is most suitable for system which is possible for expansion (1 unit for each).
- ▶ Stable operation in line with system can be realized with easy setting/switching of operational requirements (Setting of start, separation and switching of day/night are possible).
- ▶ Safe controller with synchronizing check relay to consider incoming reverse power prevention and generator overload prevention.

# § Generator Digital CONTROLLER §

## Automatic Generator Controller

AGC-300

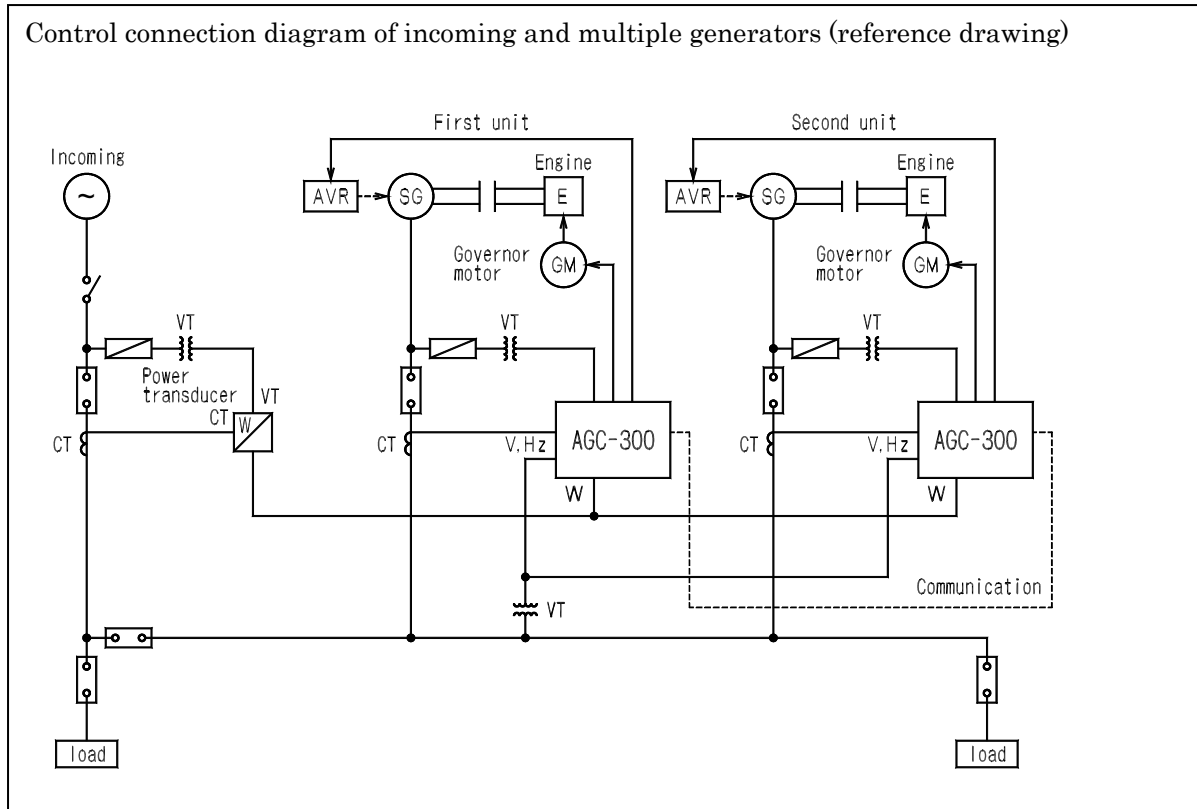
### ■ STANDARD SPECIFICATION

1	Operating method	Parallel operation of incoming and generator	Incoming constant , generator proportional distribution , unit number control/generator power factor constant
		Single operation (generator only)	Generator proportional distribution, rated frequency control, unit number control/reactive power distribution, rated voltage control
2	Generator 3-phase input	Measures voltage, current, frequency, power, reactive power, power factor.	AC110V 5A 3 50/60Hz each 0.5VA
3	Bus voltage input	Measures voltage and frequency.	AC110V 1 50/60Hz 0.5VA
4	DC input	Measures incoming power (T/D input)	DC4-20mA (approx. 50 )/0-200W (AC110V 5A 50/60Hz)
5	Input for control (8 circuits)	Control start	Voltage input : DC24V (operating current: 10mA)
		Incoming start	
		Synchronizing start	
		Distribution start	
		Cut-in start	
		Forced separation	
		Designation of preceding generator	
		Control changeover	
6	Control output (10 circuits)	Governor increase signal (65R)	1a contact photo MOS relay output MAX. DC24V, 90mA
		Governor decrease signal (65L)	
		AVR increase signal (90R)	
		AVR decrease signal (90L)	
		Start command signal	
		Separation command signal	1a contact photo MOS relay output MAX. DC24V, 100mA or DC110V, 50mA
		Light fault	
		Closing command (25)	
		Synchronizing check signal	
Alarm			
7	Communication	Communication among controllers	RS-485
8	Control power	Power supply of controller	AC100/110V (85-127V) 50/60Hz 10VA and DC110V (80-143V) 9W or DC24V (20-28V) 9W. (Specify)
9	SW input	Address	Digital switch
		Setting value input/measuring display	Push switch
		Setting value registration	
		Digit shift	
		Setting value increase	
		Display changeover	
		Function changeover (ALS/APFR/ALS+APFR)	Slide switch
		Generator heavy load (ON/OFF)	
		Incoming control changeover (mode 1/mode 2)	
		Generator control changeover (mode 1/mode 2)	
		Closing direction changeover (FAST/FREE/SLOW)	
		Setting change (ON/OFF)	
Item code	2 digits 7 segments display (orange)		
10	Display	Measuring /setting data	2 digits 7 segments display (orange), LED × 2 (orange)
		Phase difference display	LED × 24 (yellow), LED × 1 (green)
		State display	LED × 10 (green), LED × 1 (yellow), LED × 2 (red)

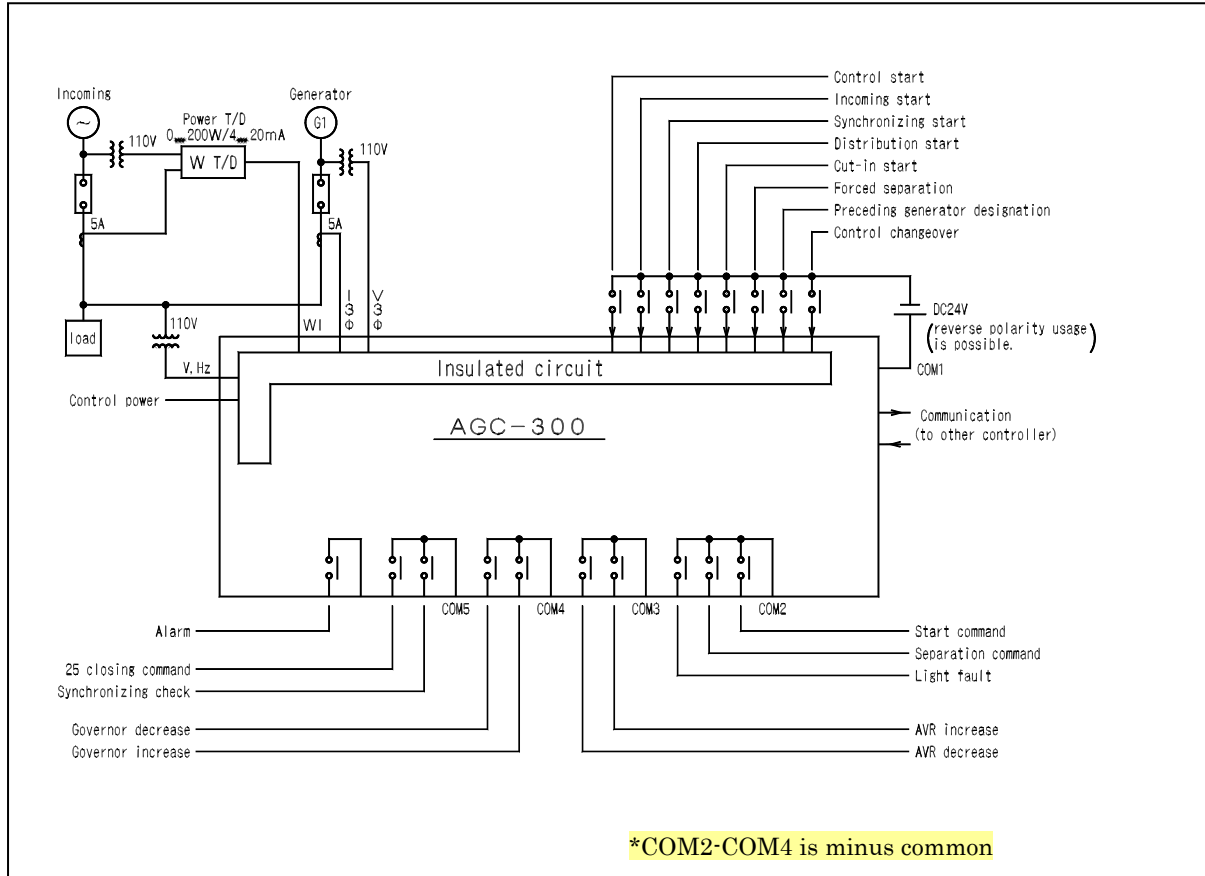
■ **PERFORMANCE**

Item		specification	
Tolerance	Synchronizing	Voltage difference	± 0.5%
		Frequency difference	± 0.03Hz
		Measured phase difference	± 1 °
		Closing phase difference	± 5 °
	Distribution control	Power detection	± 1.0% % against rated power ( at 1/2 to F/S of T/D full scale)
		Power factor detection	± 3 ° (when load current is 10% or more, power factor is LEAD0.5-1-LAG0.5)
		Reactive power detection	± 1.0% % against rated reactive power
		Current detection	± 1.0% % against rated current
		Frequency detection	± 0.1% % against rated frequency
		Voltage detection	± 1.0% % against rated voltage
	Common	Pulse width	± 10% ± 0.1s % against setting value
		Control delay time	± 10% ± 0.1s % against setting value
Strength	Excess voltage strength	AC input	2 times (10sec.) of rated voltage 1.2 times continuation
		AC power	1.5 times (10sec.) of rated voltage 1.2 times continuation
		DC power	1.5 times (10sec.) of rated voltage 1.3 times continuation
	Excess current strength	AC input	40 times (1sec.) of rated current 1.2 times continuation
		DC input	2 times (10sec.) of rated current 1.2 times continuation
	Insulation resistance	30M or more at DC 500Vmegger	Between electric circuit and outer case (earth); between each other of bus voltage input, generator voltage input, generator current input, power input, for-control input, T/D input, for-control output, governor control output, voltage control output and communication line.
	Withstand voltage	AC2000V 50/60Hz 1min.	Between electric circuit and outer case (earth); between each other of bus voltage input, generator voltage input, generator current input, power input, DC input, for-control input and communication line.
		AC500V 50/60Hz 1min.	Governor control output, AVR control output and other control output
	Impulse withstand voltage	5kV 1.2/50 μ S	Between electric circuit and outer case (earth) 5kV 12/50 μ S
	Vibration	False operation	16.7Hz, peak-to-peak 1mm, 10mins for X.Y.Z direction each
Impact	durability	294m/S <sup>2</sup> (30G), 3 times for X.Y.Z direction each	
Operating temperature/humidity range		-10 - +55 , 30 - 85%RH (no condensation)	
Storage temperature range		-25 - 70	
Exterior color/mass		Munsell N1.5(black), approx. 1.3kg.	

Control connection diagram of incoming and multiple generators (reference drawing)



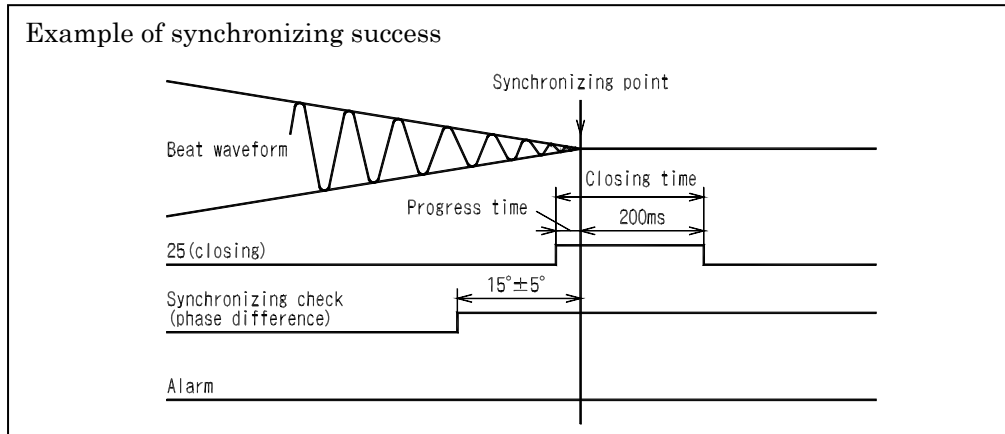
■ CONFIGURATION DIAGRAM OF INPUT/OUTPUT



### ■ CONTROL FUNCTION

#### ▶ Synchronizing control

1. Synchronizing control starts with synchronizing start input after establishing voltage and frequency of generator. LED bar of phase angle validation is ON in compliance with phase difference.  
( marking in center is synchronizing point.)
2. When voltage is within  $\pm V$  and frequency is within  $\pm F$ , 25 closing command is outputted before progress time from synchronous point after control. Contact ON time is progress time  $\pm 200$ ms
3. When phase difference exceeds  $10^\circ$  or progress time +200ms with synchronous point being passed in spite of 25 closing command output, 25 closing command can be OFF. Reset of alarm is executed by start signal being OFF.



#### ▶ Distribution control

Power distribution control/rated frequency control/generator power factor constant control/reactive power distribution control/rated voltage control are selected by each start input.

##### (1) Power distribution (start/separation requirement is included)

Heavy load OFF: incoming constant control priority mode  
Heavy load ON: generator heavy load operation priority mode

Incoming + Generator	Generator only
incoming constant value=WMI	incoming constant =0, incoming measured value = 0
power distribution (proportional distribution) Load for each generator = $\frac{\text{Total load} - \text{WMI}}{\text{Generator rated total}}$	power distribution (proportional distribution) Load for each generator = $\frac{\text{Total load}}{\text{Generator rated total}}$
start Common: When total load exceeds WHI and continues for TS sec. continuously, 1 <sup>st</sup> generator starts to operate. Heavy load OFF: Following generator starts to operate when total load exceeds WMI+WHG × operating generator unit number (no timer) Heavy load ON: Following generator starts to operate when total load exceeds WHI+WHG × operating generator unit number and continues for TS sec.	start (heavy load ON/OFF common) Following generator starts to operate when total load exceeds (WHG- H) × operating generator unit number (no timer).
separation Heavy load OFF: Last generator separates when total load is below WMI+WMG × remaining generator unit number and continues for TB sec. after separation. Heavy Load ON: Last generator separates when total load is below (WHI- M)+WMG × remaining generator unit number after separation. Common: Last generator separates when total load is below WHI- M and continues for TB sec.	separation (heavy load ON/OFF common) Last generator separates when total load is below (WMG- H) × remaining generator unit number and continues for TB sec. after separation.

(2) Rated frequency constant

Incoming + Generator	Generator only
-	Rated frequency control is executed on all unites almost simultaneously after power distribution

(3) Power factor constant

Incoming + Generator	Generator only
Generator power factor is controlled to be constant value (power factor is calculated by kW and kvar)	Reactive power distribution (proportional distribution) $\text{Each generator reactive power load} = \frac{\text{Total reactive power}}{\text{Generator rated reactive power total}}$

(4) Rated voltage constant

Incoming + Generator	Generator only
-	Rated voltage control is executed on all units almost simultaneously after reactive power distribution.

► Unit number control

Start command output

When total load exceeds pre-calculated start power, start command is outputted to generator during standby.

Separation control

When total load gets below the pre-calculated separation power, last generator of operation sequence can be separated and controlled.

Separation command output

When generator load during separation control reaches separation power (WLG), separation command is outputted.

Cut-in start

Any generator can start to operate regardless of load condition of other generator/starting sequence by cut-in start designation.

Forced separation

Separation of any generator regardless of separation sequence is possible by forced separation command. When there is stand-by generator, separation is possible after start. When there is no stand-by generator, separation is possible (only at parallel operation with incoming).

■ OTHER FUNCTIONS

Synchronizing check function (synchronizing control)

When phase difference between bus and closing generator is within 15° in F/ V, synchronizing check relay signal is outputted.

Phase difference delay detection function (synchronizing control)

Frequency difference (0.05 or less) between bus and closing generator and phase difference becomes almost constant; governor pulse is outputted 3 sec. later in order to speed up synchronizing control.

- When closing direction is FAST or FREE, governor increase signal is outputted.
- When closing direction is SLOW, governor decrease signal is outputted.

Mean value measuring control (power distribution control)

Incoming power can be measured and controlled in mean value by setting mean time TAI second.

Incoming reverse power prevention control (power distribution control)

When incoming is below min. power value (WLI), output decrease command (65L max. pulse output) is outputted to all generators. When reverse power continues, error display/light fault are outputted.

Power factor neutral zone changeover current value (generator power factor constant control)

When power factor neutral zone changeover current value (CHA) is below the load current, power factor neutral zone is .

When power factor neutral zone changeover current value (CHA) exceeds the load current, power factor neutral zone is × 2.

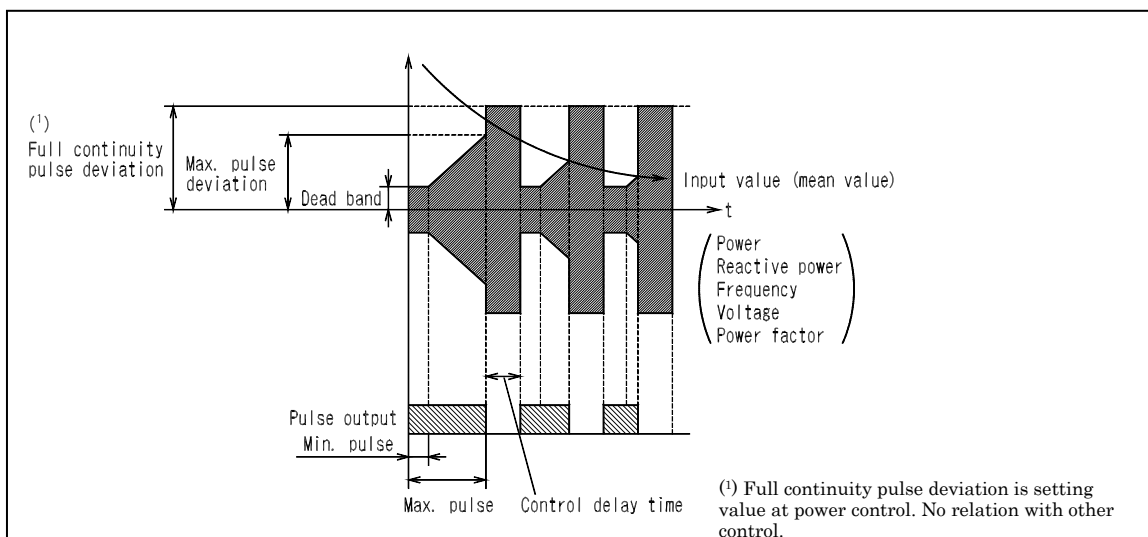
Power factor control cut current value (generator power factor constant control)

When generator load current is below the power factor control cut current value (CTA), power factor control is stopped.

Governor abnormality detection/AVR abnormality detection (distribution control)

When generator does not reach the target value even though governor signal (65R/65L) or voltage signal (90R/90L) are outputted 60 times in same detection, error display/light fault are outputted as governor abnormality/AVR abnormality. Control continues even though error is detected.

■ PULSE OUTPUT WAVEFORM



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### ■ DISPLAY & SETTING

#### State display of equipment

Power supply: ON when control power is applied.  
 During control: ON when control start input is applied.  
 Error: ON when input range error occurs.

#### Control state display

V: ON when voltage difference is within closing permissible voltage differences at synchronizing control. ON when rated voltage is within dead band at distribution control.

F: ON when frequency difference is within closing permissible frequency at synchronizing control. ON when rated frequency is within dead band at distribution control.

WI: ON when incoming power is within dead band.

WG: ON when generator power distribution is within dead band.

: ON when phase difference is within 15° (synchronizing check) at synchronizing control. ON within dead band at power factor control.



#### Measuring data/setting data display

Measuring mode/setting mode can be changed over with measuring /setting key. Item code no. and data for each mode are displayed.

#### Synchronizing detection (phase difference) display

When in center is phase difference 0°, SLOW in left direction and FAST in right direction. LED is ON in 15° interval of phase difference.

#### Output state display

25: ON at 25 closing signal output.

Light fault: On when light fault (A/D error, setting value error, communication error, input designation miss) occurs.

Alarm: On when alarm (memory error/synchronizing error, etc.) occurs.

#### Address changeover switch

Setting of equipment address.

#### Changeover and measuring/setting data-change

Switch for display changeover of measuring data/display changeover or setting data and setting value change. Can be executed by 5 key switches (refer to instruction manual.)

#### Function changeover switch

Setting of distribution control function.

ALS: Power distribution control.

APFR: Generator power factor control.

ALS+APFR: Power distribution and generator power factor control.

#### Heavy load changeover switch

ON/OFF setting of generator heavy load control.

#### Control changeover switch (3 items)

Setting of control when control changeover input is applied.

· Incoming mode changeover switch

mode 1: setting value no changeover ; mode 2: changeover control (setting value )

· Generator mode changeover switch

mode 1: setting value no changeover ; mode 2: changeover control (setting value )

· Closing direction changeover switch, changeover of synchronizing direction.

FAST: random closing FAST closing

FREE: FAST closing SLOW closing

SLOW: random closing SLOW closing

#### Setting changeover switch

Setting change is possible (ON); setting change is not possible (OFF).



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No.	Setting description	Sign	Initial value	Possible setting range	Synchronizing control	Parallel w/incoming	Generator only	Note
						Power distribution control + generator power factor control	Power distribution control + frequency, voltage control	
20	Synchronous closing control	Closing permissible voltage difference	V	5%	1-10%	×	×	Setting value of synchronizing control; setting is possible regardless of other control.
21		Voltage control pulse	VPW	0.5S	0.1-1.0S	×	×	
22		Closing permissible frequency difference	F	0.1Hz	0.1-0.3Hz	×	×	
23		Governor control pulse width	FPW	0.5S	0.1-1.0S	×	×	
24		Voltage pulse output	PI1	2S	1-5S	×	×	
25		Circuit breaker progress time	25	50mS	10-310mS	×	×	
26	Closing output continuation frequency	25N	1 time	0: no limit 1: 1 time 2: 2 times 3: 3 times		×	×	
27	Incoming power transducer full scale	WFSI	1200kW	10-9999kW	×		×	Setting value of incoming T/D input sensitivity. Setting is required for parallel w/incoming
28	Incoming power measuring mean time	TAI	2S	0-120S	×		×	Setting is possible as required.
29	VT ratio of generator 3-phase input	VT	60	1-9999				Setting of VT/CT of generator.
30	CT ratio of generator 3-phase input	CT	50	1-9999				
31	Bus rated voltage (VT secondary)	V	110V	90-120V				Setting of rated voltage and rated frequency of bus.
32	Bus rated frequency	F	50Hz	49.0-51.0Hz 59.0-61.0Hz				
33	Incoming max. power	WRI	600kW	10-WFSI	×		×	Setting item regarding incoming power constant control. There is following limit except possible setting range mentioned in the left: WHI - M - WI WMI WLI + WI % against WRI
34	Generator start power	WHI	90%	20-95%	×		×	
35		WHI						
36	Incoming constant control power	WMI	50%	10-87%	×		×	
37		WMI						
38	Incoming min. power	WLI	20%	1-50%	×		×	
39		WLI						
40	Generator separation possible deviation	M	10%	5-70%	×		×	
41		M						
42	Incoming power dead band	WI	10%	3-30%	×		×	
43		WI						
44	Power control max. pulse time	THW	3.0S	0.5-5.0S	×			Setting of control speed.
45	Power control min. pulse time	TLW	0.3S	0.1-1.0S	×			
46	Frequency control dead band	FC	1.0%	0.2-5.0%	×	×		Setting item of frequency control at generator only operation.
47	Frequency control max. pulse time	THF	3.0S	0.5-5.0S	×	×		
48	Generator rated power (generator max. operation power)	WRG	1500kW	10 · (VT × CT)kW MAX.9999kW	×			Setting item of following unit start power and separation possible power. There is following limit except possible setting range mentioned in the left: WHG - WG WMG % against WRG
49		WRG						
50	Following unit start power	WHG	100%	70-100%	×			
51		WHG						
52	Generator separation possible power	WMG	80%	50-95%	×			
53		WMG						
54	Generator min. power	WLG	10%	1-40%	×			
55	(at generator only connection) Following unit start deviation & separation possible deviation.	H	20%	1-40%	×	×		
56	Generator power dead band	WG	2%	1-30%	×			
57		WG						
58	Reactive power control max. pulse time	THQ	3.0S	0.5-5.0S	×			Setting of control speed
59	Reactive power control min. pulse time	TLQ	0.3S	0.1-1.0S	×			
60	Voltage control dead band	VC	2.0%	0.5-5.0%	×	×		Setting item of voltage control at generator operation only.
61	Voltage control max. pulse time	THV	3.0S	0.5-5.0S	×	×		
62	Generator rated reactive power	QRG	750kvar	50 · (VT × CT)kvar MAX.9999kvar	×			Setting value of generator rated reactive power.

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No.	Setting description	Sign	Initial value	Possible setting range	Synchronizing control	Parallel w/incoming	Generator only	Note
						Power distribution control + generator power factor control	Power distribution control + frequency, voltage control	
63	Generator constant control power factor value	cos	LAG90%	LEAD95-100- LAG70%	×		×	Setting item at generator power factor control.
64	Power factor control dead band		3 °	2-10 °	×		×	
65	Power factor control dead band changeover current value	CHA	30%	10-60%	×		×	
66	Power factor control cut current value	CTA	10%	1-10%	×		×	
67	Generator following unit start detection timer	TS	60S	0-120S	×		×	Timer setting.
68	Generator separation possible detection timer	TB	30S	0-60S	×			
69	Governor control delay time	TGDL	2S	0-20S	×			Setting of control speed.
70	AVR control delay time	TADL	2S	0-20S	×			
71	Incoming max. pulse power deviation	WTHI	50%	50% fixed value	-	-	-	
72	Generator full continuity pulse power deviation	WTRG	50%	10-70%	×			
73	Generator max. pulse power deviation	WTHG	30%	10-50%	×			
74	Max. pulse frequency deviation	FTH	10%	10% fixed value	-	-	-	
75	Max. pulse power factor deviation	TH	60 °	60 ° fixed value	-	-	-	
76	Max. pulse voltage deviation	VTH	10%	10% fixed value	-	-	-	
77	Governor abnormality detection	GAV	1	1: ON 2: OFF				Setting of with or without governor abnormality detection.
78	Generator parallel operation unit no.	Parallel unit no.	1 unit	1-8 units				Setting of generator operation unit no.
79	Display automatic OFF time	TDSP	10 min.	1-10 min. 0: continuation				7 segment LED is OFF.

### Display item list

No.	Display description	Unit	No.	Display description	Unit
01	Bus voltage	V	08	Generator power factor	%
02	Bus frequency	Hz	09	Generator frequency	Hz
03	Incoming power	kW	10	Voltage difference	%
04	Generator voltage	V	11	Frequency difference	Hz
05	Generator current	A	12	Incoming mean power	kW
06	Generator power	kW	13	Equipment address	-
07	Generator reactive power	kvar			

### ■ TERMINAL ARRANGEMENT DRAWING

No.	Input terminal	No.	DO/communication/power supply terminal
1	Bus voltage input (P1)	12	25 closing command
2	Bus voltage input (P2)	13	Synchronizing check
3	Generator voltage input (P1)	14	COM5
4	Generator voltage input (P2)	15	alarm
5	Generator voltage input (P3)	16	
6	Generator current input (1S)	17	TRXP, TRXN, TRXT, communication among control equipments
7	Generator current input (1L)	18	
8	Generator current input (3S)	19	
9	Generator current input (3L)	20	Control power (+ )
10	Incoming power T/D input (+ )	21	Control power ( - )
11	Incoming power T/D input ( - )	22	F.G.

# § Generator Digital CONTROLLER §

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### ■ CONNECTOR ARRANGEMENT DRAWING

DI/DO terminal	No.		No.	DI/DO terminal	
NC	50		49	NC	DI
Control start	48		47	Control start	
Incoming start	46		45	Incoming start	
Synchronizing start	44			Synchronizing start	
Distribution start	42			Distribution start	
Cut-in start	40			Cut-in start	
Forced separation	38			Forced separation	
Preceding generator designation	36			Preceding generator designation	
Control changeover	34			Control changeover	
COM1	32			COM1	
NC	30		NC	DO	
NC	28		NC		
NC	26		NC		
NC	24		NC		
Start command	22		Start command		
Separation command	20		Separation command		
Light fault	18		Light fault		
COM2	16		COM2		
AVR increase	14		AVR increase		
AVR decrease	12		AVR decrease		
COM3	10		COM3		
Governor increase	8		Governor increase		
Governor decrease	6		Governor decrease		
COM4	4		COM4		
NC	2		1	NC	

HIF3 BA-50PA-2.5DS  
(Hirose)

Conformity connector: HIF3 BA-50D-2.54C  
HIF3 BA-50D-2.54R

### ■ DIMENSIONS

