User's Manual

AC POWER REGULATOR

1 PHASE

type : HN 8200 SERIES

(VER #1.35)

HANA CONTROL ENGINEERING CO.,LTD.
HANA POWER ELECTRONICS CO.,LTD.

CONTENTS

1. General Specification

This AC power regulator HN8200 has power input voltage of AC 220/380[V] and uses frequencies of 50/60[Hz]. This regulator is widely used for controlling phase and period of resistive (R : heater) and conductive reactance (L : transformer) load within the scope of load capacity 7 ~ 190 [kW].

The characteristics of HN8200 DRIVE UNIT are as follows.

1) It is a power regulator for single phase resistive (R : Heater) and conductive reactance (L : Transformer) load, and it can be selected phase control or zero-crossing & multi-cycle control by DIP(Dual In-line Package) switch.

2) Stable characteristic is secured by insuring the period of delaying cycle at initial zero-crossing for the stable control during power on.

3) Fixed stable voltage and current are secured to loads by adopting PID feedback of voltage and current loop for the power control of load.

4) Sufficient consideration is given to the detection of abnormality and protection of this device and AC loads.

1. Detection of abnormality of load and drive
2. Detection of load current limit (alarm to maximum/minimum value)
3. Detection of drive 160% instant over current
4. Detection of deficit voltage
5. Detection of drive heat sink

5) This device has applied manifold input/output terminal that allows compatible configuration with peripheral control unit and the command input used controlling voltage can be diversely selected from 4~20[mA], 0~16[mA], 0~20[mA] of current and 1~5[V], 0~5[V], 0~10[V] of voltage.

6) This device has reliability because it has high resistance to noise from external power shock. Also the digital signal control input terminals (RUN. RESET) are made of isolation structure to facilitate the configuration of system.

7) The structure of the device is easy for installation, check-out, and repair.

2. Standard Specification of Device

2.1 Standard Specification of Device

[Table 2-1]

TYPE	NORMAL POWER [kW]		OUTPUT CURRENT [A]	Figure of Device [Figure 4-1,2]
	AC 220[V]	AC 380[V]		
HN8200-A	7	13	35	SP82SS
HN8200-B	11	19	50	SP82S
HN8200-C	17	30	80	SP82MM/F
HN8200-D	22	38	100	SP82MM/F
HN8200-E	26	45	120	SP82M/F
HN8200-F	33	57	150	SP82M/F
HN8200-G	44	76	200	SP82M/F
HN8200-H	55	95	250	SP82L/F
HN8200-I	66	114	300	SP82L/F
HN8200-J	77	133	350	SP82L/F
HN8200-K	88	152	400	SP82L/F
HN8200-L	99	171	450	SP82L/F
HN8200-M	110	190	500	SP82L/F

☞ Loads with capacity over these are produced on order

2.2 Technical Standard Specification

[Table 2-2]

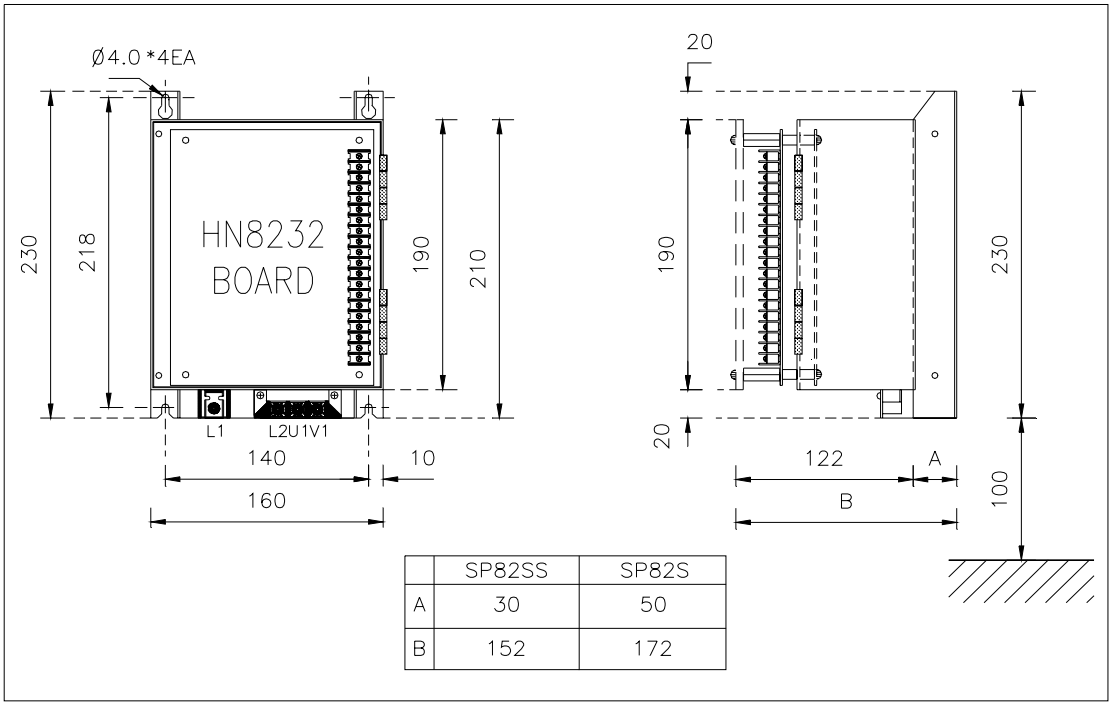
Specific Data	Electrical Specification
Single phase power input and frequency range	AC 220[V] ± 10% AC 380[V] ± 10% 50/60[Hz] ± 2%
Alarm to max/min load Alarm to current	Depending on the limit value of load current
External RUN	Input terminal for load control operation signal (DC 24[V])
External RESET	External input terminal for clearing fault (DC 24[V])
External power setting voltage and current	Voltage of 1~5[V], 0~5[V], 0~10[V] and current of 4~20[mA], 0~16[mA], 0~20[mA]
Controlling current	Able to control within rated current using 0 ~ +10[V] I-AUX input
Standard of 2nd power	Using 0 ~ ±10[V] U-AUX input
Output RELAY	I LIMIT RELAY and FAULT RELAY Contact point capacity : AC 220[V], 3[A]
Allowed temperature - Normal temperature - Preservation temperature	Change of current in response to ambient temperature 0~40[°C] (When it is over 60[°C], allowed temperature decrease by 1.2% in response to 1[°C] increase) -25 ~ +75[°C]

3. Installation

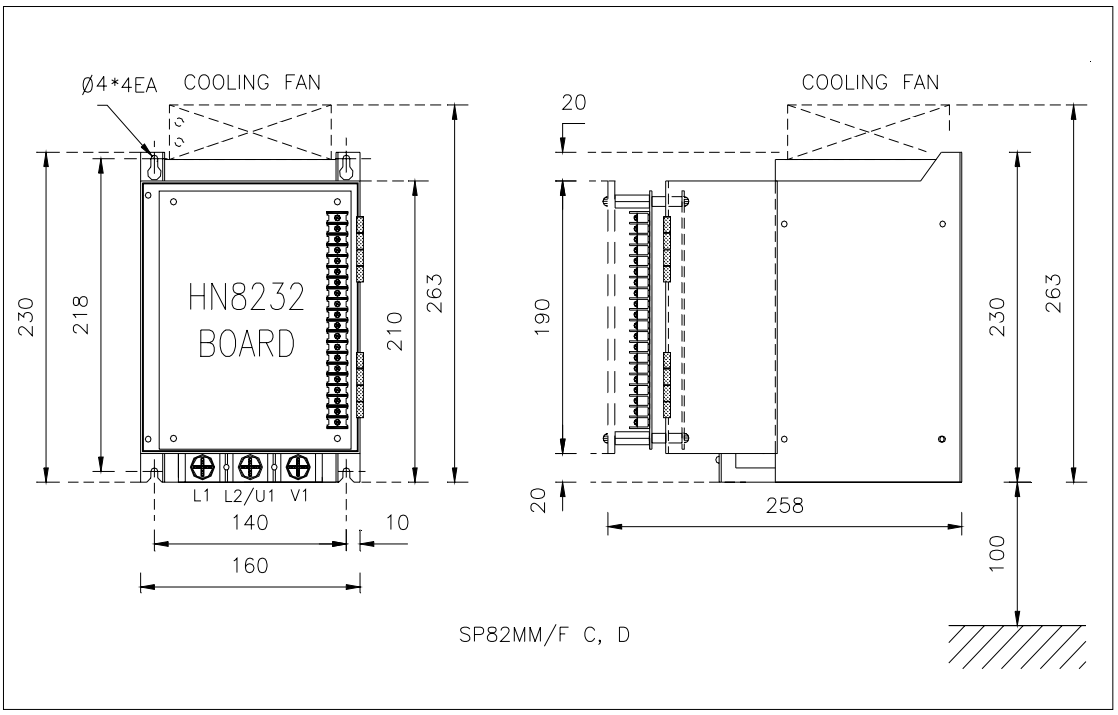
- Install the device vertically so the air can circulate from the lower part to the upper part through heat sink hole.
- Separate the device from heat sources. If the device is installed in a cabinet, the cabinet must be made in a way allowing induction of exterior air and the protection cover must be open on top.
- 10 [cm] or more open space is needed on the top, bottom, right, and left of the drive.

4. Dimension of Device

[Figure 4-1]

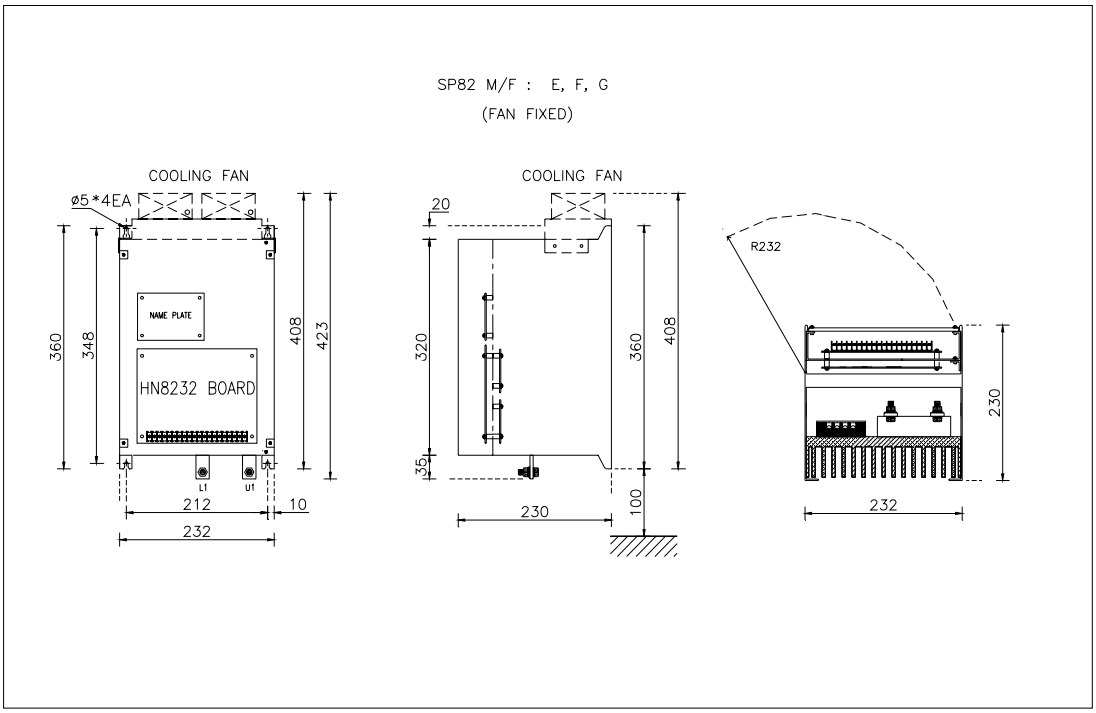


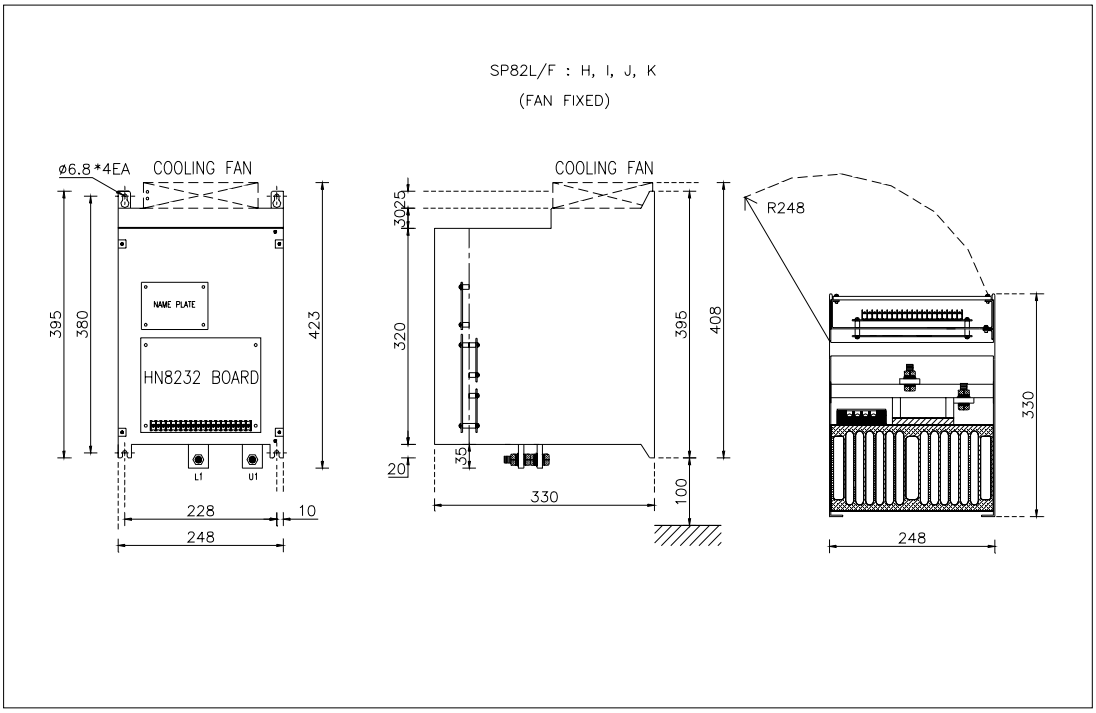
	SP82SS	SP82S
A	30	50
B	152	172



☞ Dimension can be changed to improve the product.

[Figure 4-2]



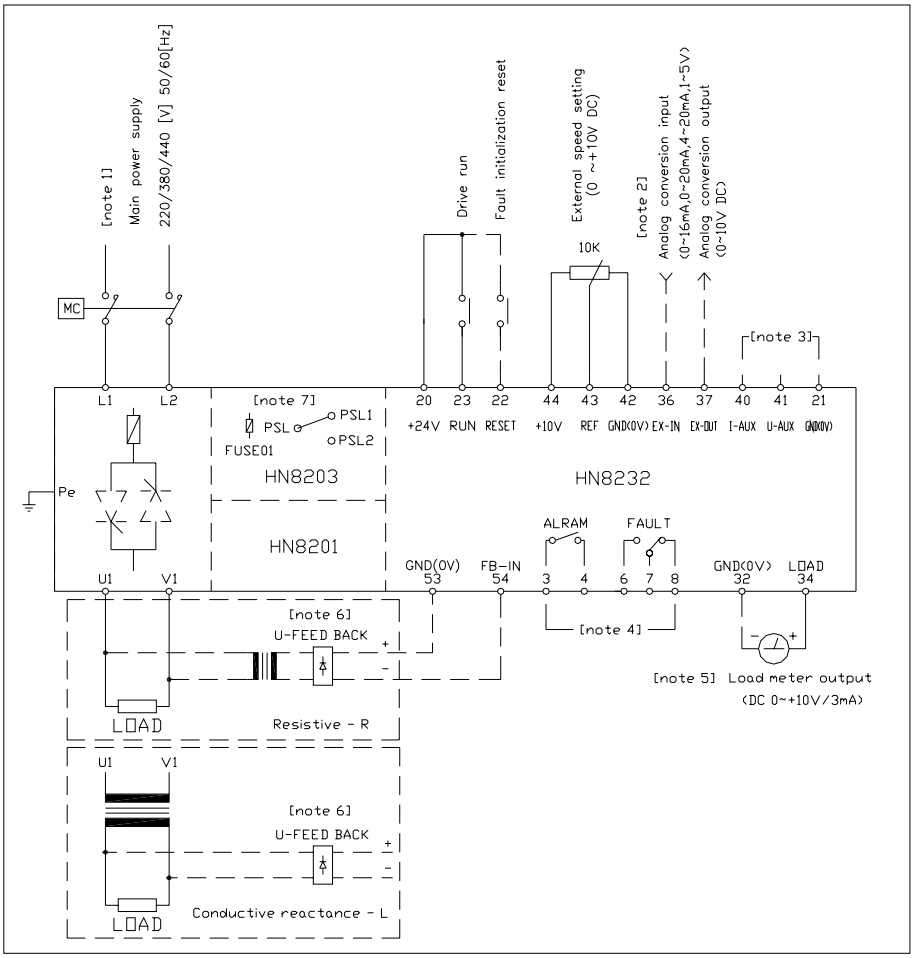


☞ Dimension can be changed to improve the product.

5. Wiring Diagram of Device

5.1 Standard Wiring Diagram

[Figure 5-1]



[note1] Main power : Power that coincides with the rated voltage specified on drive panel must be supplied.

[note 2] This is an input/output terminal conversing analog signals. (see Table 5-2)

[note 3] This is an input/output terminal applying analog signals. (see Table 5-2)

[note 4] Use it for configuring an external electric circuit. (contact capacity AC 250[V],3[A])

[note 5] Load current output is for digital meter.

[note 6] Use it for external feedback.

[note 7] As control fuse rated 1[A] use.

[note 8] Power for cooling fan. (HN8200-C type from above application)

[note 9] Control power : it must be composed of the same voltage and same phase. (HN8200-E type from above application)

[note 10] Main fuse is applied in the HN8200-A,B type and the capacity above that must be fitted at external.

[Caution] Control signal wire must be shielded wire for covering and only one terminal must be treated with covering shield.

5.2 Explanation on the Function of Terminal Panel

[Table 5-2]

Terminal Number	Terminal Name	Function and Electric Specification
L1 L2	Main power	AC voltage input terminal for single phase main power supply
U1 V1	Output voltage	Single phase AC voltage output terminal of load
Control Board [8232]		
3 4	ALARM	Load limit current detection relay contact terminal (NO)
6 7 8	FAULT	Abnormality detection relay contact terminal for load and drive (NO,NC)
20	+24[V]	Power supply for control signal for +24[V]
21	EXT GND	External_Ground : 0[V] terminal for isolating from external
22	RESET	External reset terminal for relieving FAULT
23	RUN	Power control operation signal input terminal
32	GND (0[V])	GND terminal
34	LOAD	Load current output terminal (0~+10[V], 3[mA])
36	EXTERNAL_IN	Analog conversion input terminal (0~16[mA], 0~20[mA], 4~20[mA] for current and 0~10[V], 0~5[V], 1~5[V] for voltage)
37	EXTERNAL_OUT	Analog conversion output terminal (0~+10[V])
40	I-AUX	External auxiliary current control terminal (0~+10[V])
41	U-AUX	External auxiliary voltage control terminal (0~±10[V])
42	GND (0[V])	GND terminal
43	REF	Voltage input terminal for main voltage command (0~+10[V])
44	+10[V]	Main voltage command + reference voltage
53	GND (0[V])	GND terminal
54	F.B-IN	Voltage feedback input terminal

6. Explanation of Drive Configuration

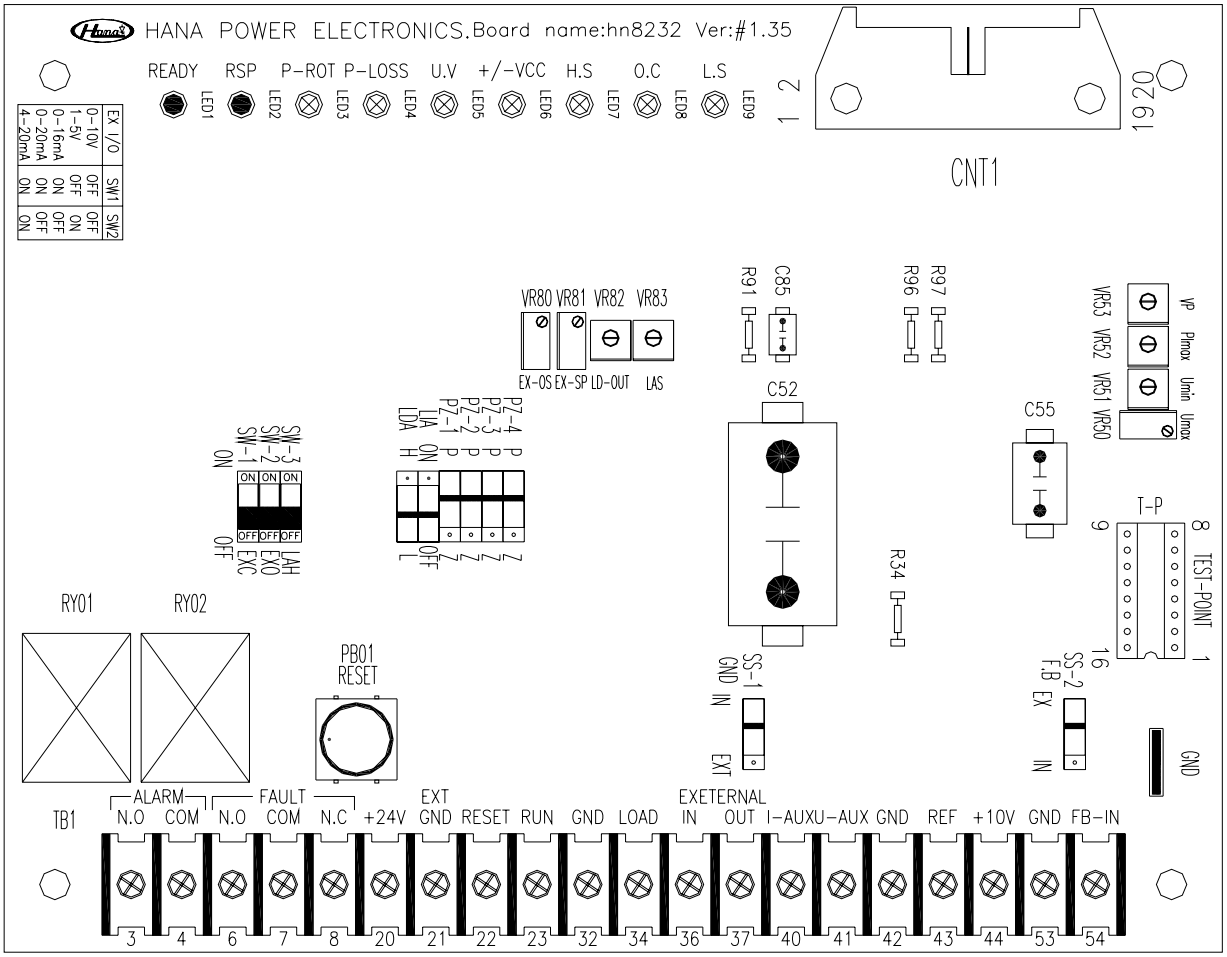
6.1 Preliminary Inspection

1) This drive is a product that satisfies most general operation conditions. Verify the compatibility among supplied power, drive, and load by inspecting the specifications on the panel of device.

2) Confirm whether wiring is done as shown in the wiring diagram. Also, verify that the conditions of terminal connection and the linkage of connecting parts are good.

6.2 Reference Location Map of Selection Switch and Trimmer

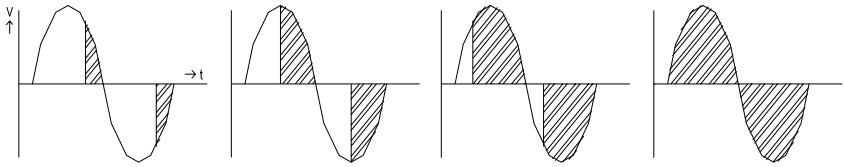
[Figure 6-1]



6.3 Characteristics of Phase Control and Zero-Crossing/Multi-Cycle Control

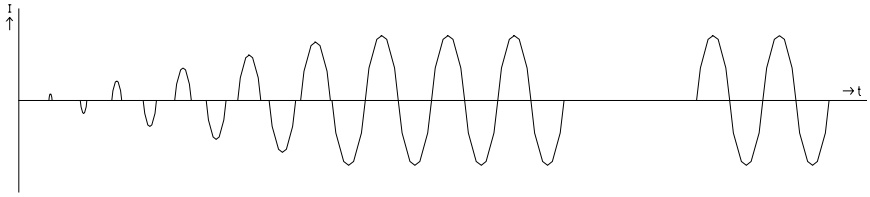
6.3.1 Characteristics of Phase Control

- Control the phase angle in α0° ~ α180°

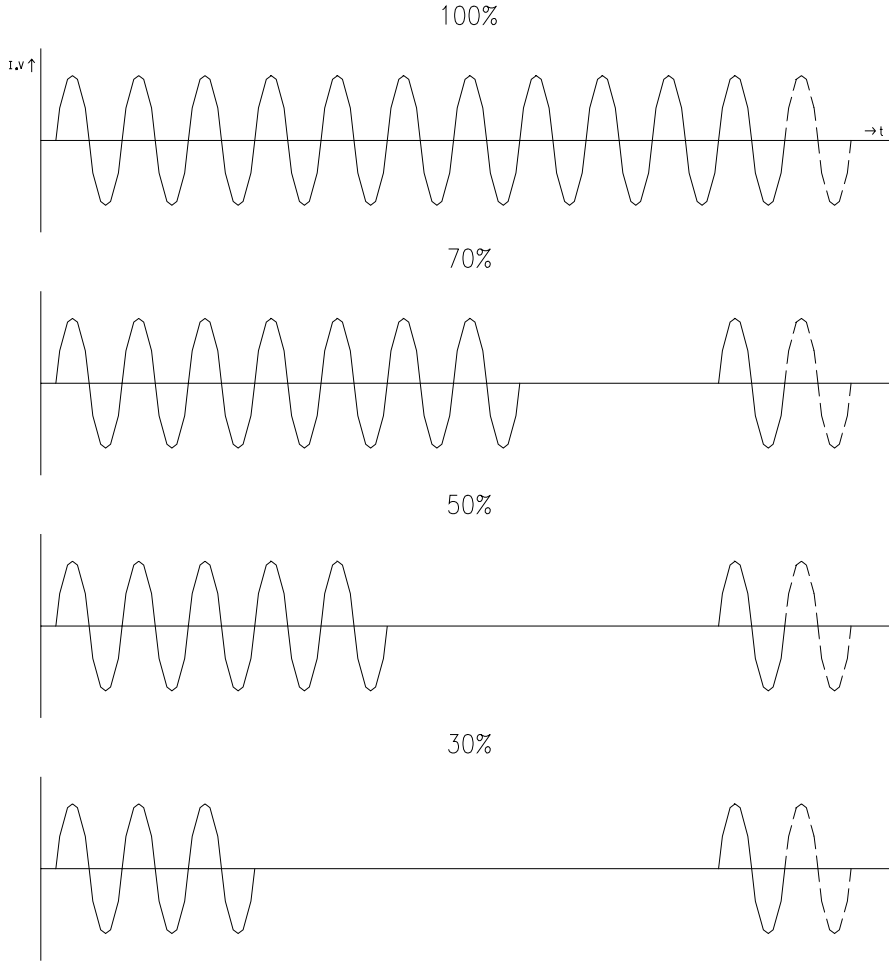


6.3.2 Characteristics of Zero-Crossing/Multi-Cycle Control

- This control can secure zero-crossing initial delay cycle period during initial operation (at power on) in order to guarantee the stability of control and prevent a saturation of transformer. (initial phase control)



- Characteristics of zero-crossing/multi-cycle control



6.4 Functions of Selection Switch

[Caution] Select a selection switch when the main power and the control power are not on.

[Table 6-4]

Switch	Switch Function	Explanation on Functions of Selector Switch	
SW1	Select analog conversion input (EX-IN/TB1 No.36,37) (EXC)	ON	OFF
		Current input 0~16/0~20/4~20[mA]	Voltage input 0~5/0~10/1~5[V]
SW2	Conversion input OFFSET switch (EX-IN/TB1 No.36,37) (EXO)	ON	OFF
		4~20[mA]/1~5[V]	0~16[mA]/0~20[mA] 0~5[V]/0~10[V]
SW3 (LAH)	Holding load limit alarm relay output (LATCH) (LAH)	ON	OFF
		Alarm holding (LATCH) output	Alarm instant output
SS-1 EXT_GND	Internal/external ground select switch (Digital input GND)	IN	EXT
		Internal ground select	External ground select
SS-2 EXT_F.B	Internal/external feedback input select	IN	EXT
		Internal feedback input select	External feedback input select
LDA	Load limit alarm select (LDA)	H	L
		Maximum limit alarm	Minimum limit alarm
LIA	Load limit alarm relay output select (LIA)	ON	OFF
		Max/min alarm (ALARM and FAULT relay output)	Max/min alarm (ALARM relay output)
PZ1 PZ2 PZ3 PZ4	Phase, zero-crossing/multi-cycle control select	P	Z
		Phase control	Zero-crossing/ multi-cycle control

6.5 Explanation on the Function of Trimmer

VR50 : Umax - Setting for maximum load voltage due to feedback

VR51 : Umin - Setting for minimum load voltage due to feedback

VR52 : PImax - Setting for the maximum operation current of the device

VR53 : VP - Setting for the gain of amplification ratio of voltage regulator

VR80 : EX-OS - Setting analog conversion input offset

VR81 : EX-SP - Setting analog conversion output value

VR82 : LD-OUT - Setting output voltage (0~10[V]) for load meter (No.34)

VR83 : LAS - Setting for alarm of maximum and minimum load current

6.6 Explanation on the Adjustment of Device

- When 0~5[V], 0~10[V] input will be applied to analog conversion input terminal TB36, select SW1[EXC], SW2[EXO] to all OFF and adjust VR81[EX-SP] to make input value from the maximum to become DC +10[V] in output terminal TB37.

- When 1~5[V] input will be applied to analog conversion input terminal TB36, select SW1[EXC] to OFF, SW2[EXO] to ON and adjust VR80[EX-OS] to make input value from 1[V] to become DC 0[V] in output terminal TB37 and also adjust VR81[EX-SP] to make input value from 5[V] to become DC +10[V] in output terminal TB37.

- When 0~16[mA], 0~20[mA] input will be applied to analog conversion input terminal TB36, select SW1[EXC] to ON, SW2[EXO] to OFF and adjust VR81[EX-SP] to make input value from 16[mA] & 20[mA] to become DC +10[V] in output terminal TB37.

- When 4~20[mA] input will be applied to analog conversion input terminal TB36, select SW1[EXC], SW2[EXO] to all ON and adjust VR80[EX-OS] to make input value from 4[mA] to become DC 0[V] in output terminal TB37 and also adjust VR81[EX-SP] to make input value from 20[mA] to become DC +10[V] in output terminal TB37.

6.7 Explanation on the Adjustment of Device at Phase Control

- Though this device is set to default at shipping, it can be readjusted according to the following when there is a need for readjustment on the site.

- Select switch of phase control (P) and zero-crossing/multi-cycle control (Z) - PZ1, PZ2, PZ3, PZ4 - are all selected to phase control (P) from the conditions where power is not supplied in device.

6.7.1 Setting Maximum Voltage (Umax) by Voltage Feedback

- Verify that the location of switch SS-2 should have been becoming "IN" when internal feedback is selected.

- Verify that the location of switch SS-2 should have been becoming "EXT" when external feedback is selected and then verify that the polarity of voltage(F.B) is correctly wired according to the wiring diagram. (No.53 of terminal board TB1 is plus, and No.54 is minus)

- Set the external voltage command to the minimum value (0[V]).

- Turn on the load operation signal RUN terminal (TB1 No.23).

- Set the external voltage command to the minimum value (0[V]) and adjust trimmer Umin(VR51) to set to the minimum voltage value of load. (clockwise : increase voltage, counterclockwise : decrease voltage)

- Slowly raise the external voltage command to reach to the maximum value (+10[V]) and adjust trimmer Umax(VR50) to set to the maximum voltage value of load. (clockwise : increase voltage, counterclockwise : decrease voltage)

※ When the voltage of the load is unstable during the setting of the maximum voltage, adjust VP(VR53) to stabilize the voltage and set Umax (VR50).

[caution] In setting the maximum voltage, the drive output voltage (U1,V1) must not exceed the rated voltage of load.

6.7.2 Setting Voltage Loop Gain (VP)

In case that the feedback voltage of load is unstable, adjust as following.

- Set the external voltage command to 5[V] in operating device and then observe feedback voltage of test point (TP7) by oscilloscope in repeating ON/OFF of command.

- Adjust trimmer VP(VR53) to reach the setting voltage as soon as possible without excessive delay.

※ The value of condenser C85 (reference value : 0.68[μF]) must be changed in case the adjusting is not well done because the adjusting range of time constant of VP is different according to the type of the load and the reactance value.

6.7.3 Setting the Maximum Operational Current Value (PImax)

- The setting for the maximum operational current of drive is determined by the actual load current, and is set by trimmer PImax (VR52). (clockwise : increase the set current, counterclockwise : decrease the set current)

※ PImax (VR52) is set to the rated current of device at production.

6.7.4 Setting the Alarm Value of Maximum and Minimum Load Current

- Select alarm to maximum current : select DIP switch (LDA) to H.
The method of setting maximum current of load : setting external voltage command to reach rated voltage of load in operating device and then LED9(L.S) is slowly lighted up if trimmer LAS(VR83) is slowly turned in counterclockwise. At that time from initial lighting, adjust trimmer LAS(VR83) to turn back in clockwise about 5%.

- Select alarm to minimum current : select DIP switch (LDA) to L.
The method of setting minimum current of load : setting external voltage command to reach rated voltage of load in operating device and then LED9(L.S) is slowly lighted up if trimmer LAS(VR83) is slowly turned in clockwise. At that time from initial lighting, adjust trimmer LAS(VR83) to turn back in counterclockwise about 5%.

- Alarm relay RY01 will be operated if the load current is more(maximum alarm) or less(minimum alarm) than the setting value of LAS(VR83). At that time in case that the alarm output should be used as holding output, turning switch SW3(LAH) on. Reciprocally, in case that the alarm output should be used as instant output, turning switch SW3(LAH) off.

- Select maximum/minimum alarm output of load : select DIP switch (LIA) to ON.
Maximum/minimum alarm of load are displayed on ALARM and FAULT relay.

- Select maximum/minimum alarm output of load : select DIP switch (LIA) to OFF.
Maximum/minimum alarm of load are displayed on ALARM relay.

6.8 Explanation on the Adjustment of Device at Zero-Crossing/Multi-Cycle Control

- Though this device is set to default at shipping, it can be readjusted according to the following when there is a need for readjustment on the site.

- Select switch of phase control (P) and zero-crossing/multi-cycle control (Z) - PZ1, PZ2, PZ3, PZ4 - are all selected to zero-crossing/multi-cycle control (Z) from the conditions where power is not supplied in device.

6.8.1 Setting the Aalarm Value of Maximum and Minimum Load Current

- Select alarm to maximum current : select DIP switch (LDA) to H.
The method of setting maximum current of load : setting external voltage command to becoming maximum period in operating device and then LED9(L.S) is slowly lighted up if trimmer LAS(VR83) is slowly turned in counterclockwise. At that time from initial lighting, adjust trimmer LAS(VR83) to turn back in clockwise about 5%.

- Select alarm to minimum current : select DIP switch (LDA) to L.
The method of setting minimum current of load : setting external voltage command to becoming maximum period in operating device and then LED9(L.S) is slowly lighted up if trimmer LAS(VR83) is slowly turned in clockwise. At that time from initial lighting, adjust trimmer LAS(VR83) to turn back in counterclockwise about 5%.

- Alarm relay RY01 will be operated if the load current is more(maximum alarm) or less(minimum alarm) than the setting value of LAS(VR83). At that time in case that the alarm output should be used as holding output, turning switch SW3(LAH) on. Reciprocally, in case that the alarm output should be used as instant output, turning switch SW3(LAH) off.

- Select maximum/minimum alarm output of load : select DIP switch (LIA) to ON.
Maximum/minimum alarm of load are displayed on ALARM and FAULT relay.

- Select maximum/minimum alarm output of load : select DIP switch (LIA) to OFF.
Maximum/minimum alarm of load are displayed on ALARM relay.

7. Trouble Inspection and Remedial Measures

[Caution] When inspecting or carrying out remedial measures in the device, turn off the power.

7.1 Explanation on LED DISPLAY Function (8232)

[Table 7-1]

LED Number	Name	Explanation on Function	Inspection and Remedial Measures
LD1	DRIVE READY	Normal status of load and drive and preparation for operation	Light on when normal
LD2	RSP LOCK	Drive stop and hold	Light off when drive operates
LD3	PHASE ROT	----------	----------
LD4	PHASE LOSS	----------	----------
LD5	UNDER VOLT	Reduction of rated voltage by less than 15%	Verify power supply voltage
LD6	+/- VCC	Abnormality in drive power circuit	Voltage check +15, -15[V] ±13≤±VCC≤ ±17[V] scope
LD7	HEAT SINK	Overheating at heat sink of drive (except HN8200-A,B)	Check cooling fan
LD8	OVER CURRENT	Temporary exceeding of drive rated current by 1.6 times	Check load status (short) and external voltage setting
LD9	HI/LOW ALARM	Exceeding(HI)/deficiency(LOW) of load current set by LAS	Check load status (short or open) or LAS setting value

☞ When conducting inspection or remedial measure, refer to a person in charge of drive at Hana Control Engineering.

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