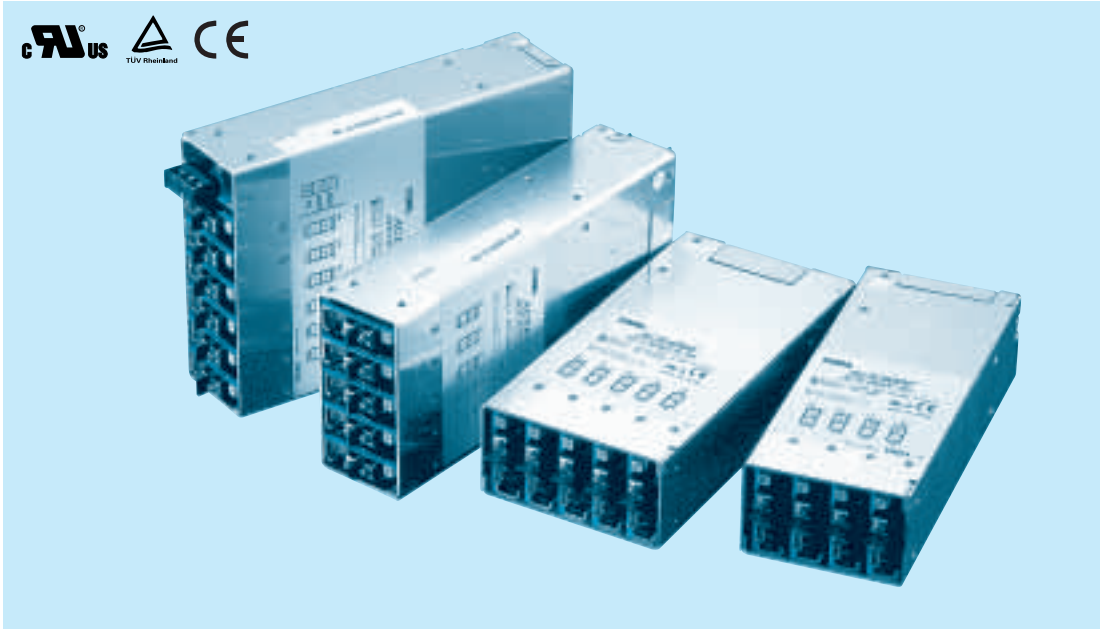
COSEL Modular power supply

ACE

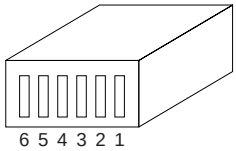
Ordering information

AC □ - □ □ □ □ □ □ - □ □ - □ □

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩



① Abbreviation type name of ACE series
② Abbreviation power of ACE series
3 : ACE300F
4 : ACE450F
6 : ACE650F
9 : ACE900F
③ Slot 6 Output module
④ Slot 5 Output module
⑤ Slot 4 Output module
⑥ Slot 3 Output module
⑦ Slot 2 Output module
⑧ Slot 1 Output module
⑨ Parallel code
⑩ Option (series code)
Refer to instruction manual 5.1 Safety : UL2601-1, EN60601-1 Refer to instruction manual 7. for details.



Slot

✻The number of slot is different depending on the model.
✻Empty slot is code:0

ACE

SPECIFICATIONS

	MODEL		ACE300F	ACE450F	ACE650F	ACE900F
INPUT	VOLTAGE[V]		AC85 - 264 1φ / DC120 - 350 (option=-U AC70 or DC100 - refer to instruction manual 5)			
	FREQUENCY[Hz]		47 - 63			
	CURRENT[A]	AC100V ✻1	3.7typ	5.7typ	8.0typ	11typ
		AC200V ✻1	2.0typ	3.1typ	4.2typ	5.7typ
	POWER FACTOR	AC100V ✻1	0.99typ			
		AC200V ✻1	0.95typ			
	INRUSH CURRENT [A]	AC100V ✻2	15typ			
		AC200V ✻2	30typ			
	EFFICIENCY[%]	AC100V ✻1	74typ	75typ	77typ	77typ
		AC200V ✻1	78typ	78typ	80typ	80typ
	LEAKAGE CURRENT[mA]	AC100V ✻3	0.5max			
		AC230V ✻3	0.95max			
OUTPUT	NUMBER OF SLOT		4	5	5	6
	TOTAL OUTPUT[W]	AC90 - 150V ✻4	250	400	600	800 (Peak 1k)
		AC170 - 264V ✻4	300	450	650	900 (Peak 1k)
	START-UP TIME[ms]		500max (ACIN100V, Io=100%)			
	HOLD-UP TIME[ms] ✻1		20typ (ACIN100V, Io=100%)			
FUNCTION	AUXILIARY POWER (AUX)		12V 0.1A (Only for Remote ON/OFF) (option=-J 5V0.1A)			
	ALARM (PR)		FAN alarm, LINE alarm			
ISOLATION	INPUT-OUTPUT, RC, AUX		AC3,000V 1minute, Cutoff current=10mA, DC500V 50MΩ min (At Room Temperature)			
	INPUT-FG		AC2,000V 1minute, Cutoff current=10mA, DC500V 50MΩ min (At Room Temperature)			
	OUTPUT, RC, AUX(PR)-FG ✻5		AC500V 1minute, Cutoff current=100mA, DC500V 50MΩ min (At Room Temperature)			
ENVIRONMENT	OPERATING TEMP.,HUMID. AND ALTITUDE ✻4		-20 to +70℃, 20 - 90%RH (Non condensing) 3,000m (10,000feet) max			
	STORAGE TEMP.,HUMID.AND ALTITUDE		-20 to +75℃, 20 - 90%RH (Non condensing) 3,000m (10,000feet) max			
	VIBRATION		19.6m/s² (2G) , 10 - 55Hz, 3minutes period, 60minutes each along X, Y and Z axis			
	IMPACT		196.1m/s² (20G) , 11ms, once each X, Y and Z axis			
SAFTY AND NOISE REGULATIONS	AGENCY APPROVALS		UL60950, C-UL (CSA60950), EN60950, EN50178, Complies with DEN-AN (At only AC input) UL2601-1, EN60601-1 (At only AC input) (Refer to instruction manual 7)			
	CONDUCTED NOISE		Complies with FCC-B, VCCI-B, CISPR22-B and EN55022-B			
	HARMONIC ATTENUATOR		Complies with IEC61000-3-2			
OTHERS	CASE SIZE ✻6		103X63.5X254mm (WXHXD)	127X63.5X254mm (WXHXD)	127X63.5X279mm (WXHXD)	177.5X63.5X254mm (WXHXD)
	WEIGHT[kg]		1.7max	2.2max	2.4max	3.0max
	COOLING METHOD		Forced cooling (built-in)			

✻1 In case of modular power supply, the value changes by composing and load factor of installed ouput modules.
The values in specifications mean each the model are composed of voluntary modules that are 5V (code : C), 12V (code : E), 24V (code : H) and the output power is total ouput wattage under the prescribed conditions. ✻2 More than 3sec. to restart. Io=100%
✻3 Complies with IEC60950 and DEN-AN 60Hz and 100% load. ✻4 Refer to instruction manual 4.2 Derating in detail.
✻5 Each output module, RC and AUX are isolated. ✻6 Case size contains neither the terminal blocks, screw nor. ✻ A sound may occur from power supply at pulse loading.

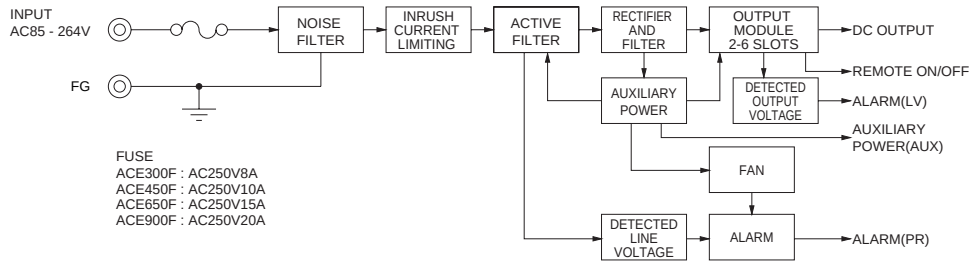
Output module specifications

ITEM	CODE	150W suitable single output										50W suitable single output					75W dual output			
		A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	Y*7	W*7	Z*7	9*7
Number of slots used		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
VOLTAGE[V]		+2	+3.3	+5	+7.5	+12	+15	+18	+24	+34	+48	+3.3	+5	+12	+15	+24	±5	±12	±15	±24
MINIMUM CURRENT[A]		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CURRENT1[A]		26	26	26	18	13	10	8.5	6.5	4.5	3.2	10	10	5	4	2.5	3	3.2	2.5	1.6
CURRENT2[A]		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	4.2	3.5	2.5
PEAK CURRENT[A] *1		—	—	—	—	14	12	10	8	5.5	4	—	—	—	—	—	—	5	4	—
LINE REGULATION[mV]max		20	20	20	36	48	60	72	96	120	192	20	20	48	60	96	20	48	60	60
LOAD REGULATION1[mV]max *5		40	40	40	100	100	120	120	150	180	300	40	40	100	120	150	250	600	600	600
LOAD REGULATION2[mV]max *6		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	500	750	750	750
RIPPLE [mVp-p]max	0 to +50℃ *2	80	80	80	120	120	120	120	120	120	150	80	80	120	120	120	80	120	120	120
	-20 to 0℃ *2	140	140	140	160	160	160	160	160	160	300	140	140	160	160	160	140	160	160	160
RIPPLE NOISE [mVp-p]max	0 to +50℃ *2	120	120	120	150	150	150	150	150	150	350	120	120	150	150	150	120	150	150	150
	-20 to 0℃ *2	160	160	160	180	180	180	180	180	180	400	160	160	180	180	180	160	180	180	180
TEMPERATURE COEFFICIENT[mV]max	0 to +50℃	50	50	50	90	120	150	180	240	300	480	50	50	120	150	240	50	120	150	150
DRIFT[mV]max *3		20	20	20	36	48	60	72	96	120	192	20	20	48	60	96	20	48	60	60
OUTPUT VOLTAGE SETTING[V]		2.00–2.20	3.25–3.45	4.99–5.30	7.20–7.80	11.5–12.5	14.4–15.6	17.3–18.7	23.0–25.0	33.0–35.0	46.0–50.0	3.25–3.45	4.99–5.30	11.5–12.5	14.4–15.6	23.0–25.0	4.99–5.30	11.5–12.5	14.4–15.6	23.0–25.0
OUTPUT VOLTAGE ADJUSTMENT RANGE[V] *4		1.60–2.60	2.60–3.60	4.00–5.50	6.00–8.20	9.00–13.2	13.2–16.5	16.5–19.2	19.2–26.4	27.2–37.4	38.4–52.8	2.60–3.60	4.00–5.50	9.00–13.2	13.2–16.5	19.2–26.4	4.99–6.00	9.60–13.2	13.2–16.5	19.2–26.4
OVERCURRENT PROTECTION[A]		Works over 105%min of rated current or 101%min of peak current. Automatic recovery.																		
OVERVOLTAGE PROTECTION[V]		3.00–4.80	4.00–5.25	Works at 115 - 140% of rated voltage								4.00–5.25	Works at 115 - 140% of rated voltage				6.90–8.40	13.8–16.8	17.25–21.0	27.6–33.6
FUNCTION		Remotesensing, remote ON/OFF, alarm (LV)										Remote ON/OFF, alarm (LV)								

ITEM	CODE	300W suitable single output										100W insulation dual output						150W dual output		★
		2A	2B	2C	2D	2E	2F	2G	2H	2J	2K	S *8		T *8		U *8		Q*7	V*7	I
Number of slots used		2	2	2	2	2	2	2	2	2	2	1		1		1		1	1	1
VOLTAGE[V]		+2	+3.3	+5	+7.5	+12	+15	+18	+24	+34	+48	V_1:+5	V_2:+5	V_1:+5	V_2:+12	V_1:+5	V_2:+24	±12	±15	Input module Refer to Instruction manual 6 Input.
MINIMUM CURRENT[A]		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
CURRENT1[A]		60	60	60	40	25	20	17	14	10	7	10	5	10	4.2	10	2.1	6.4	5.5	
CURRENT2[A]		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	7	
PEAK CURRENT[A] *1		—	—	—	—	34	27	23	20	14	10	—	—	—	—	—	—	10	8	
LINE REGULATION[mV]max		20	20	20	36	48	60	72	96	120	192	20	20	20	48	20	96	48	60	
LOAD REGULATION1[mV]max *5		40	40	40	100	100	120	120	150	180	300	40	40	40	100	40	150	600	600	
LOAD REGULATION2[mV]max *6		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	750	750	
RIPPLE [mVp-p]max	0 to +50℃ *2	80	80	80	120	120	120	120	120	120	150	80	80	80	120	80	120	140	140	
	-20 to 0℃ *2	140	140	140	160	160	160	160	160	160	300	140	140	140	160	140	160	200	200	
RIPPLE NOISE [mVp-p]max	0 to +50℃ *2	120	120	120	150	150	150	150	150	150	350	120	120	120	150	120	150	230	230	
	-20 to 0℃ *2	160	160	160	180	180	180	180	180	180	400	160	160	160	180	160	180	350	350	
TEMPERATURE COEFFICIENT[mV]max	0 to +50℃	50	50	50	90	120	150	180	240	300	480	50	50	50	120	50	240	120	150	
DRIFT[mV]max *3		20	20	20	36	48	60	72	96	120	192	20	20	20	48	20	96	48	60	
OUTPUT VOLTAGE SETTING[V]		2.00–2.20	3.25–3.45	4.99–5.30	7.20–7.80	11.5–12.5	14.4–15.6	17.3–18.7	23.0–25.0	33.0–35.0	46.0–50.0	4.99–5.30	4.99–5.30	4.99–5.30	11.5–12.5	4.99–5.30	23.0–25.0	11.5–12.5	14.4–15.6	
OUTPUT VOLTAGE ADJUSTMENT RANGE[V]		1.60–2.60	2.60–3.60	4.00–5.50	6.00–8.20	9.00–13.2	13.2–16.5	16.5–19.2	19.2–26.4	27.2–37.4	38.4–52.8	4.99–5.50	3.00–5.50	4.99–5.50	7.50–13.2	4.99–5.50	15.0–26.4	9.60–13.2	13.2–16.5	
OVERCURRENT PROTECTION[A]		Works over 105%min of rated current or 101%min of peak current. Automatic recovery.																		
OVERVOLTAGE PROTECTION[V]		3.00–4.80	4.00–5.25	Works at 115 - 140% of rated voltage																
FUNCTION		Remotesensing, remote ON/OFF, alarm (LV)										Remote ON/OFF						Same as W,Z		—

*1 Operating condition of peak current : Peak current is less than 10sec., duty is less than 35% and average current is less than rated current. (rated current2 at Module W, Z, 9, Q and V)
*2 Measured by 20MHz oscilloscope or Ripple-Noise meter (Equivalent to KEISOKU-GIKEN : RM101). Ripple and Ripple Noise is measured by using measuring board with capacitor of 22μF within 150mm from output terminal.
*3 Drift is changed in DC output for an eight hour period after half-hour warm-up at 25℃, with the input voltage held constant at the rated input/output.
*4 When the output voltage of module A is used less than 2.0V, keep minimum output current 2.6A.
*5 It is a value from 0 to rated output current1. The current on non-measurement side is fixed.
*6 It is a value from 0 to rated output current2. The current on non-measurement side is fixed.
*7 The sum of +power and -power must be less than output power(Y:50W, W:76.8W, Z:75W, 9:76.8W, Q:153.6W, V:165W).
*8 Ratings of V_2 can draw up to 50% of rated current at the time of 0A in load of V_1. (Only module S,T,U. refer to instruction manual 4.2 for details.)
* Each output of module Y-Z, 9, Q and V is a ground common type (not isolated),each output of module S,T and U is isolated.
★ For ACE300F,450F and 650F , input and output terminals can be set at the same side if Input module (code:I) is installed instead of the most left module.
* Modules which can correspond to medical electrical equipment (UL2601-1, EN60601-1) are all modules except module S, T and U. Refer to instruction manual 7. for details.

Block diagram



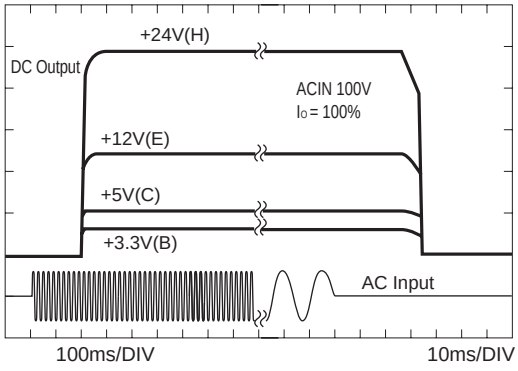
Basic Characteristics Data

Model	Circuit method	Switching frequency [kHz]	Input current [A]	Rated input fuse	Inrush current protection	PCB/Pattern			Series/Parallel operation availability	
						Material	Single sided	Double sided	Series operation	Parallel operation
Input module of ACE300F	Active filter	80	3.7∗1	250V 8A	SCR	FR-4		Yes	No	No
Input module of ACE450F	Active filter	80	5.7∗2	250V 10A	SCR	FR-4		Yes	No	No
Input module of ACE650F	Active filter	80	8.0∗3	250V 15A	SCR	FR-4		Yes	No	No
Input module of ACE900F	Active filter	80	11∗4	250V 20A	SCR	FR-4		Yes	No	No
Output module A–K	Forward converter	120	–	–	–	FR-4		Yes	Yes∗5	Yes∗7
Output module 2A–2K	Forward converter	120	–	–	–	FR-4		Yes	Yes∗5	Yes∗7
Output module L,M,N,P,R	Forward converter	120	–	–	–	FR-4		Yes	Yes∗5	No
Output module Y,W,Z,9,Q,V	Forward converter	120	–	–	–	FR-4		Yes	Yes∗6	No
Output module S,T,U	Forward converter	120	–	–	–	FR-4		Yes	Yes∗6	No

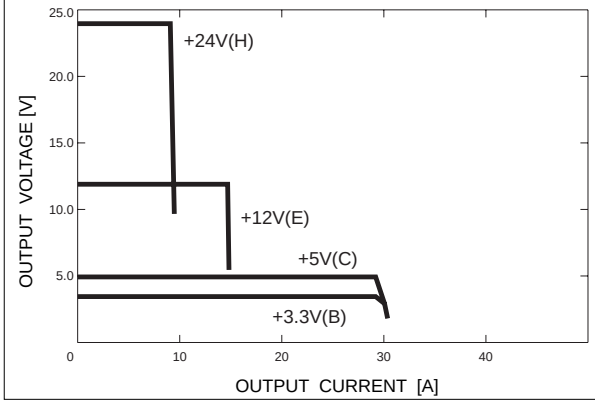
ACE

∗1 Input current is based on Model AC3-HEEC-00 outputs 250W at AC100V.
∗2 Input current is based on Model AC4-HHECC-00 outputs 400W at AC100V.
∗3 Input current is based on Model AC6-HHECC-00 outputs 600W at AC100V.
∗4 Input current is based on Model AC9-HHEECC-00 outputs 800W at AC100V.
∗5 Series operation is possible with the same output modules.
∗6 Series operation is possible, but series bar cannot be set by the series code.
∗7 Parallel operation is possible with the same output voltage module.

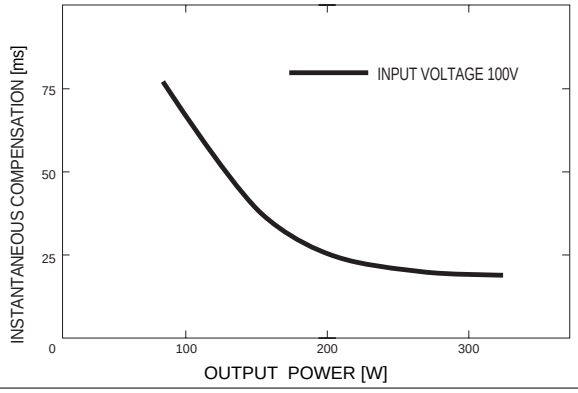
●RISE TIME & FALL TIME



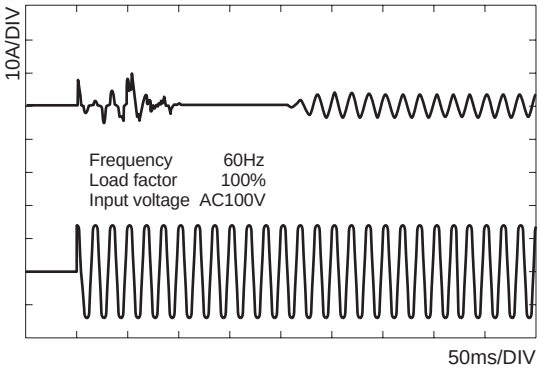
●OVER CURRENT CHARACTERISTICS



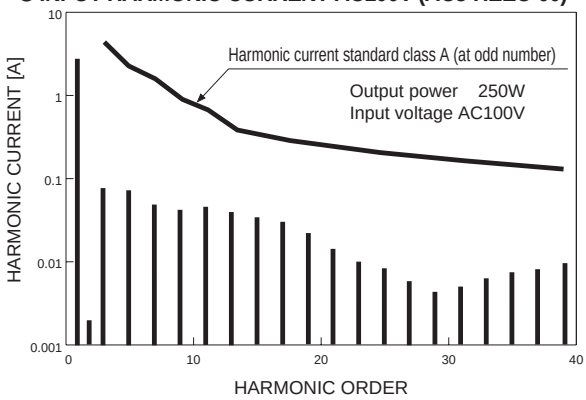
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC3-HEEC-00)



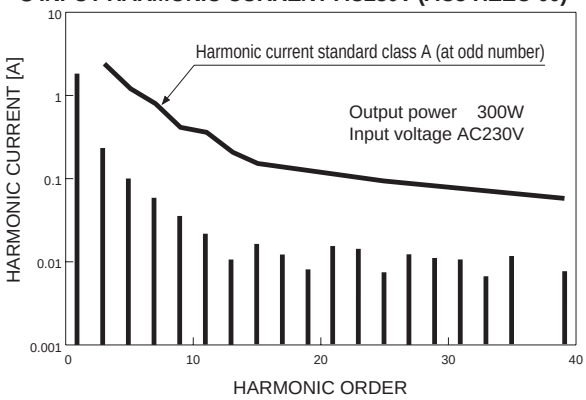
●INRUSH CURRENT (AC3-HEEC-00)



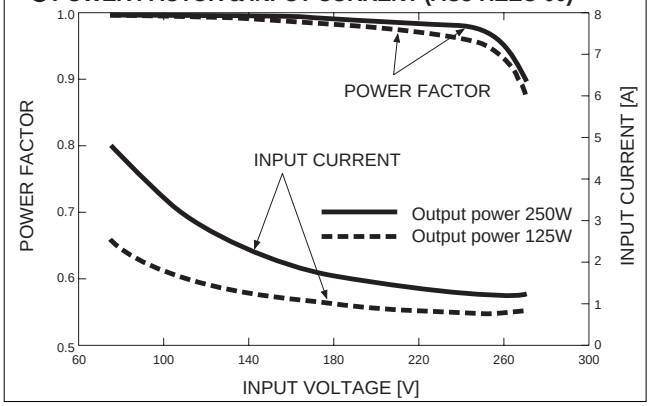
●INPUT HARMONIC CURRENT AC100V (AC3-HEEC-00)



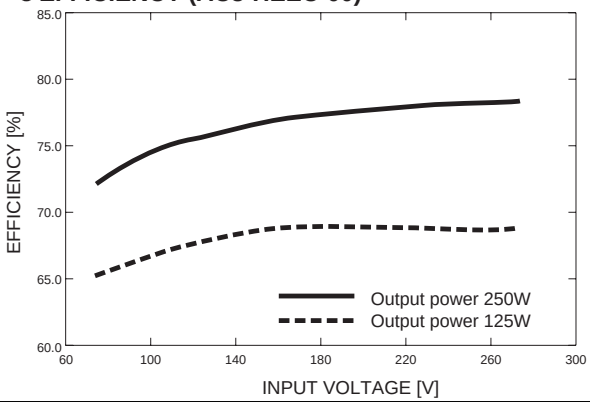
●INPUT HARMONIC CURRENT AC230V (AC3-HEEC-00)



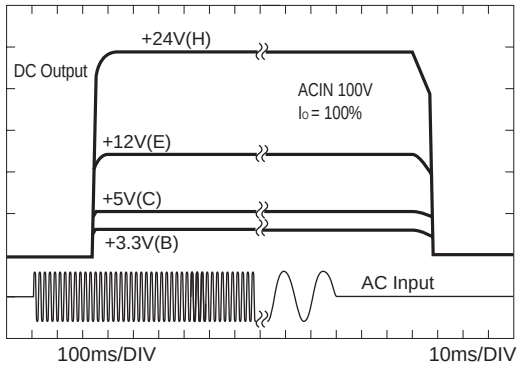
●POWER FACTOR & INPUT CURRENT (AC3-HEEC-00)



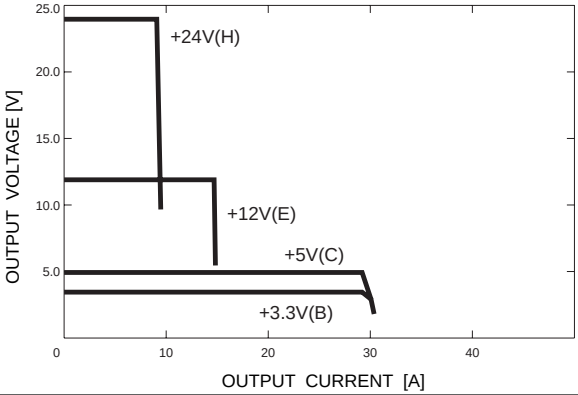
●EFFICIENCY (AC3-HEEC-00)



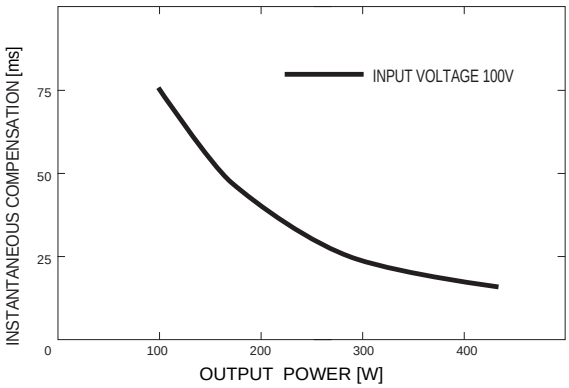
●RISE TIME & FALL TIME



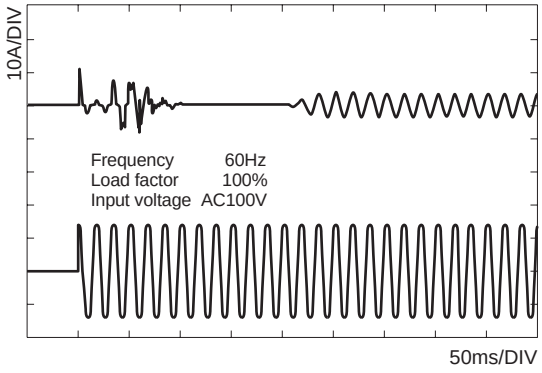
●OVER CURRENT CHARACTERISTICS



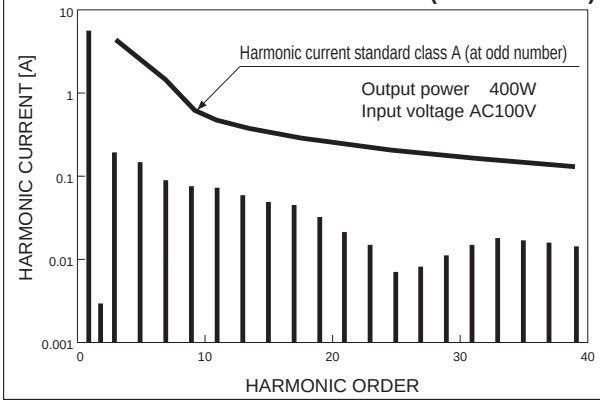
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC4-HHECC-00)



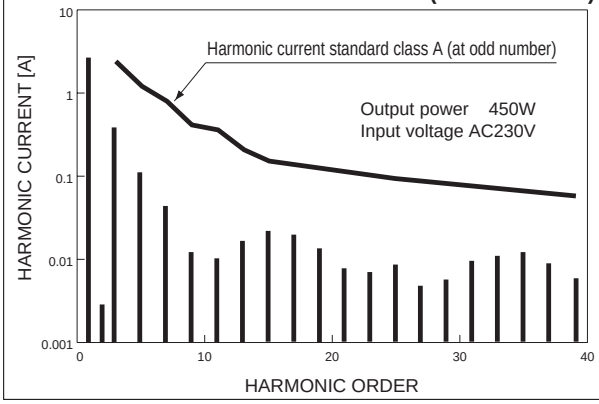
●INRUSH CURRENT (AC4-HHECC-00)



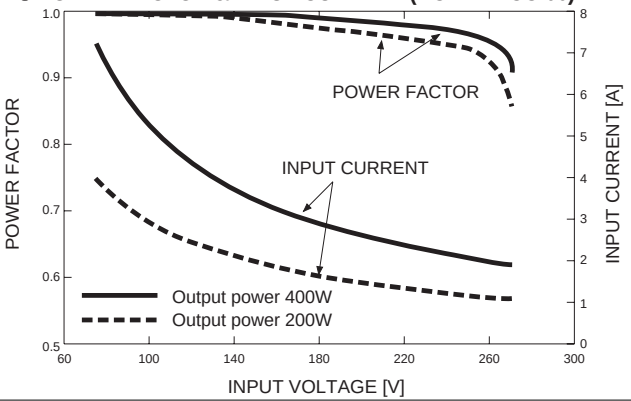
●INPUT HARMONIC CURRENT AC100V (AC4-HHECC-00)



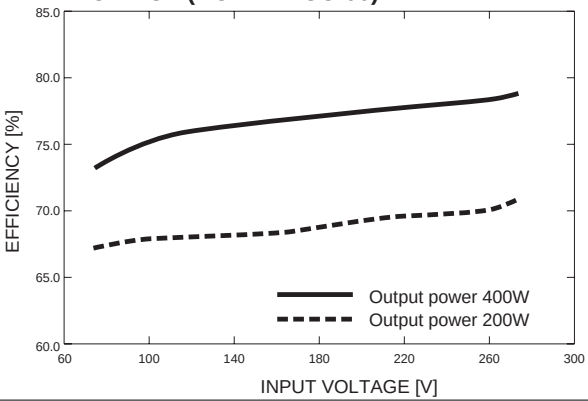
●INPUT HARMONIC CURRENT AC230V (AC4-HHECC-00)



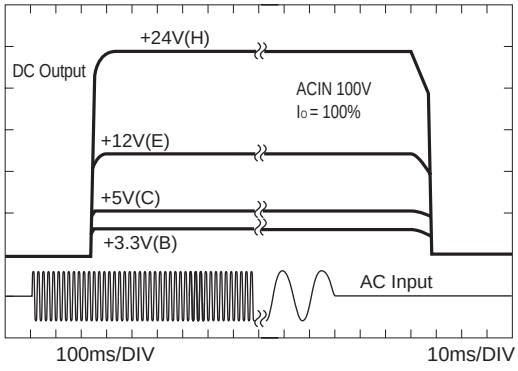
●POWER FACTOR & INPUT CURRENT (AC4-HHECC-00)



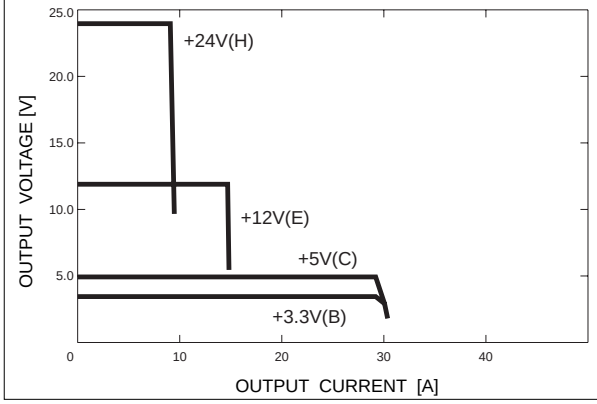
●EFFICIENCY (AC4-HHECC-00)



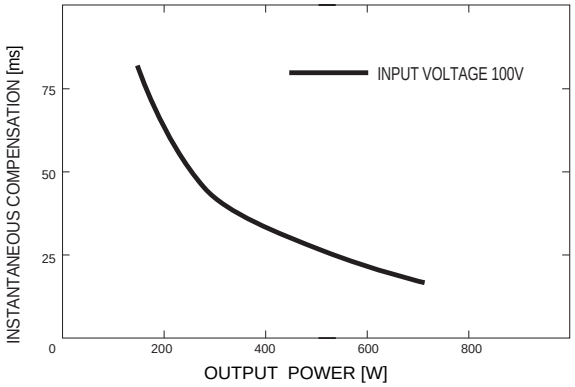
●RISE TIME & FALL TIME



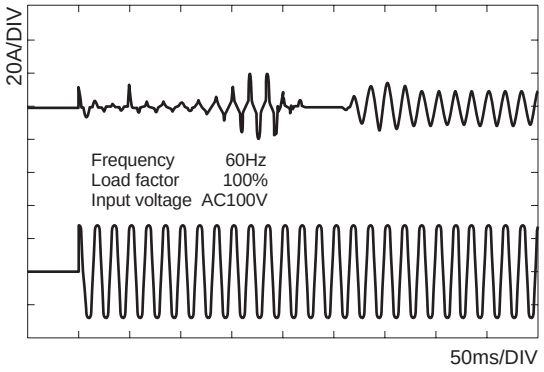
●OVER CURRENT CHARACTERISTICS



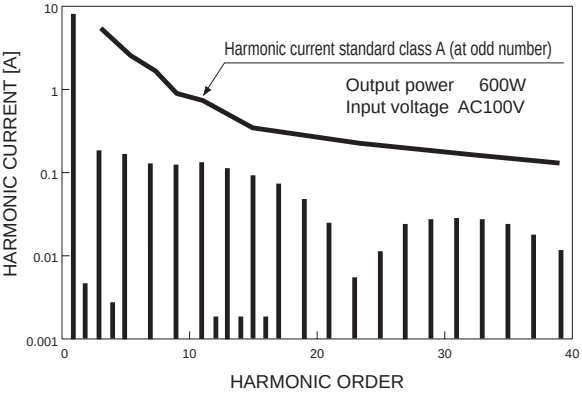
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC6-HHECC-00)



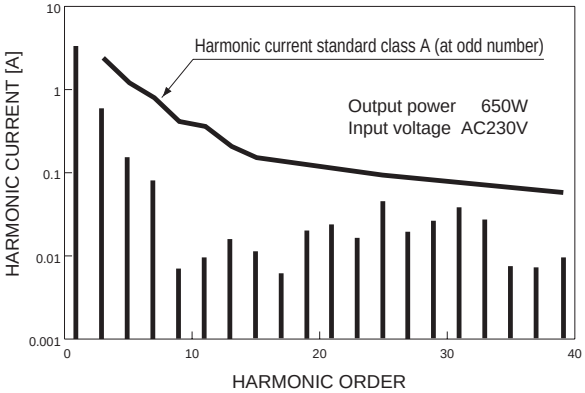
●INRUSH CURRENT (AC6-HHECC-00)



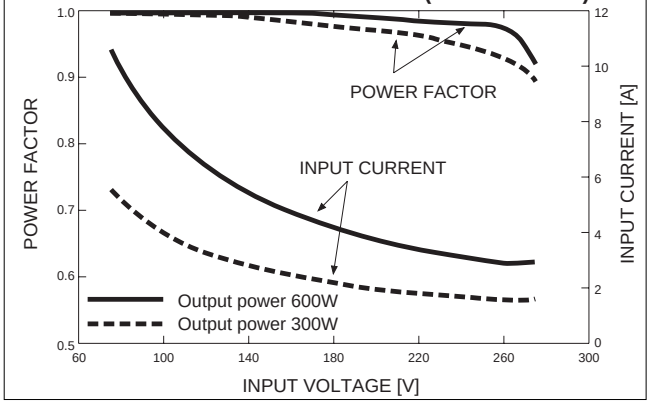
●INPUT HARMONIC CURRENT AC100V (AC6-HHECC-00)



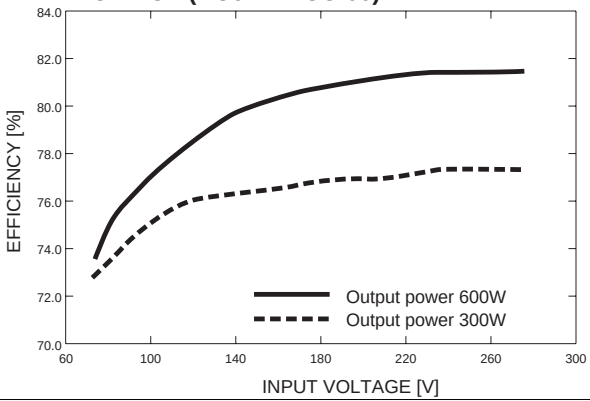
●INPUT HARMONIC CURRENT AC230V (AC6-HHECC-00)



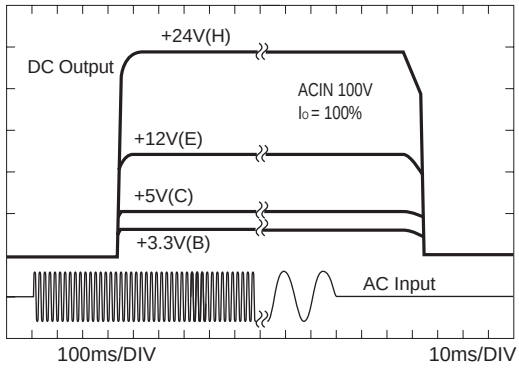
●POWER FACTOR & INPUT CURRENT (AC6-HHECC-00)



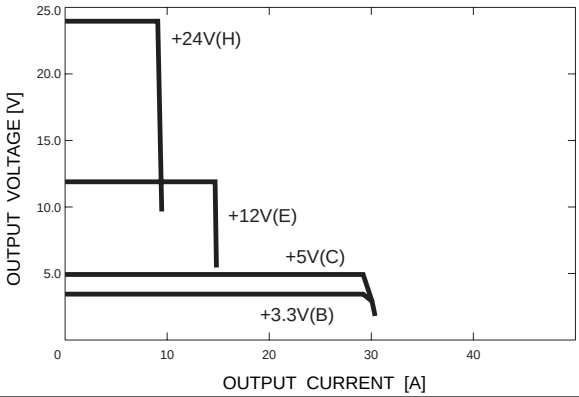
●EFFICIENCY (AC6-HHECC-00)



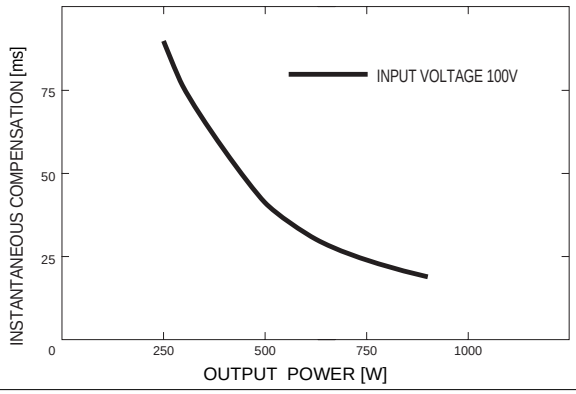
●RISE TIME & FALL TIME



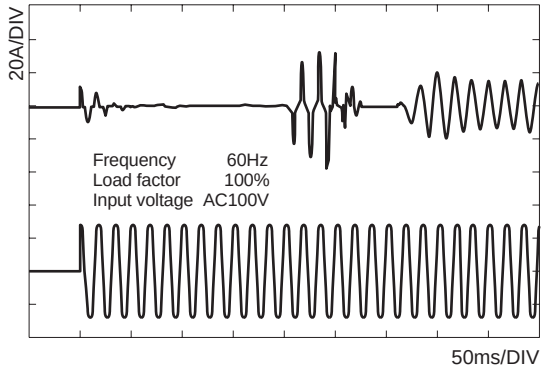
●OVER CURRENT CHARACTERISTICS



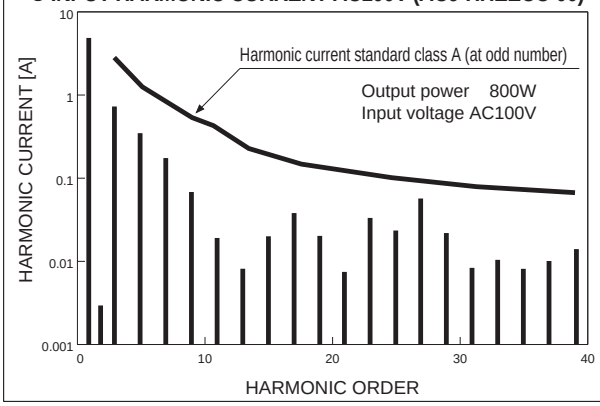
●INSTANTANEOUS INTERRUPTION COMPENSATION (AC9-HHEECC-00)



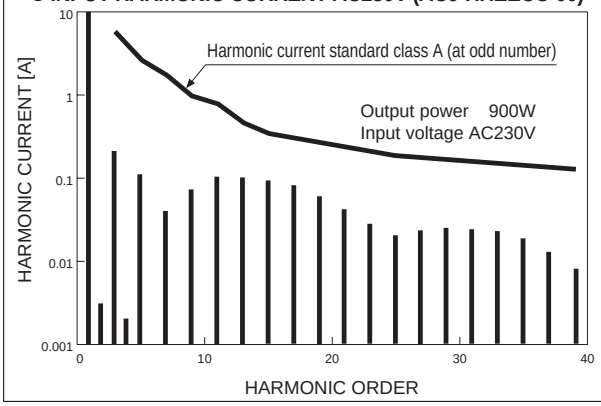
●INRUSH CURRENT (AC9-HHEECC-00)



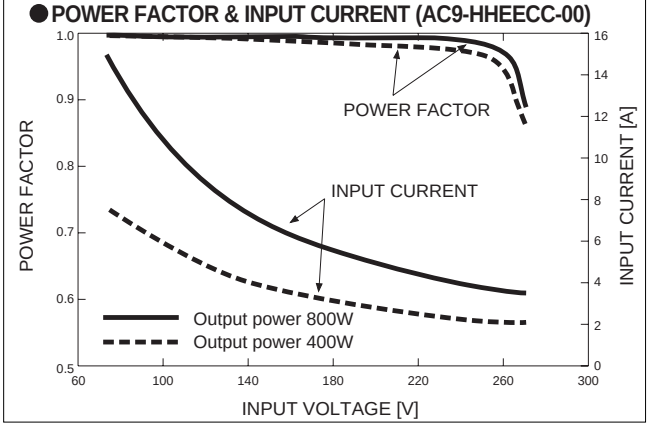
●INPUT HARMONIC CURRENT AC100V (AC9-HHEECC-00)



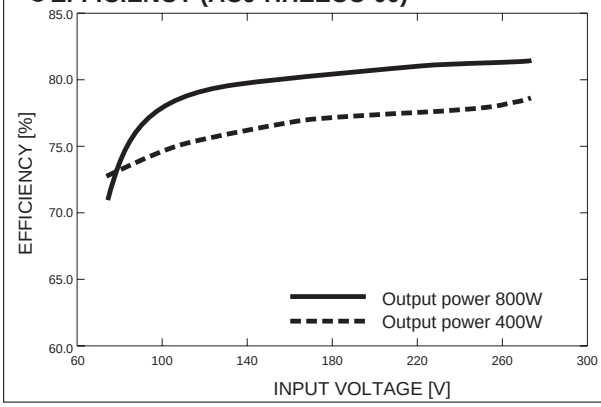
●INPUT HARMONIC CURRENT AC230V (AC9-HHEECC-00)



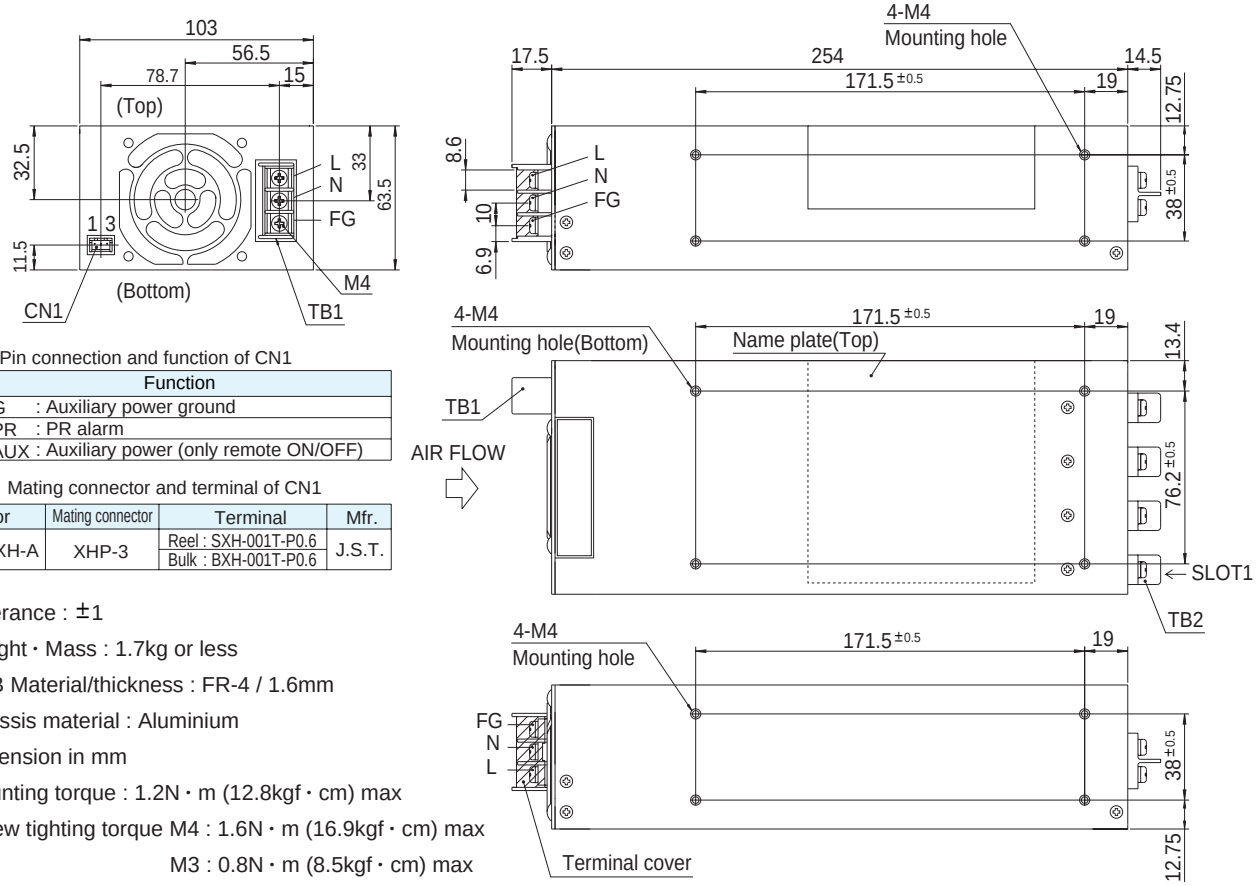
●POWER FACTOR & INPUT CURRENT (AC9-HHEECC-00)



●EFFICIENCY (AC9-HHEECC-00)



ACE300F external view



Pin connection and function of CN1

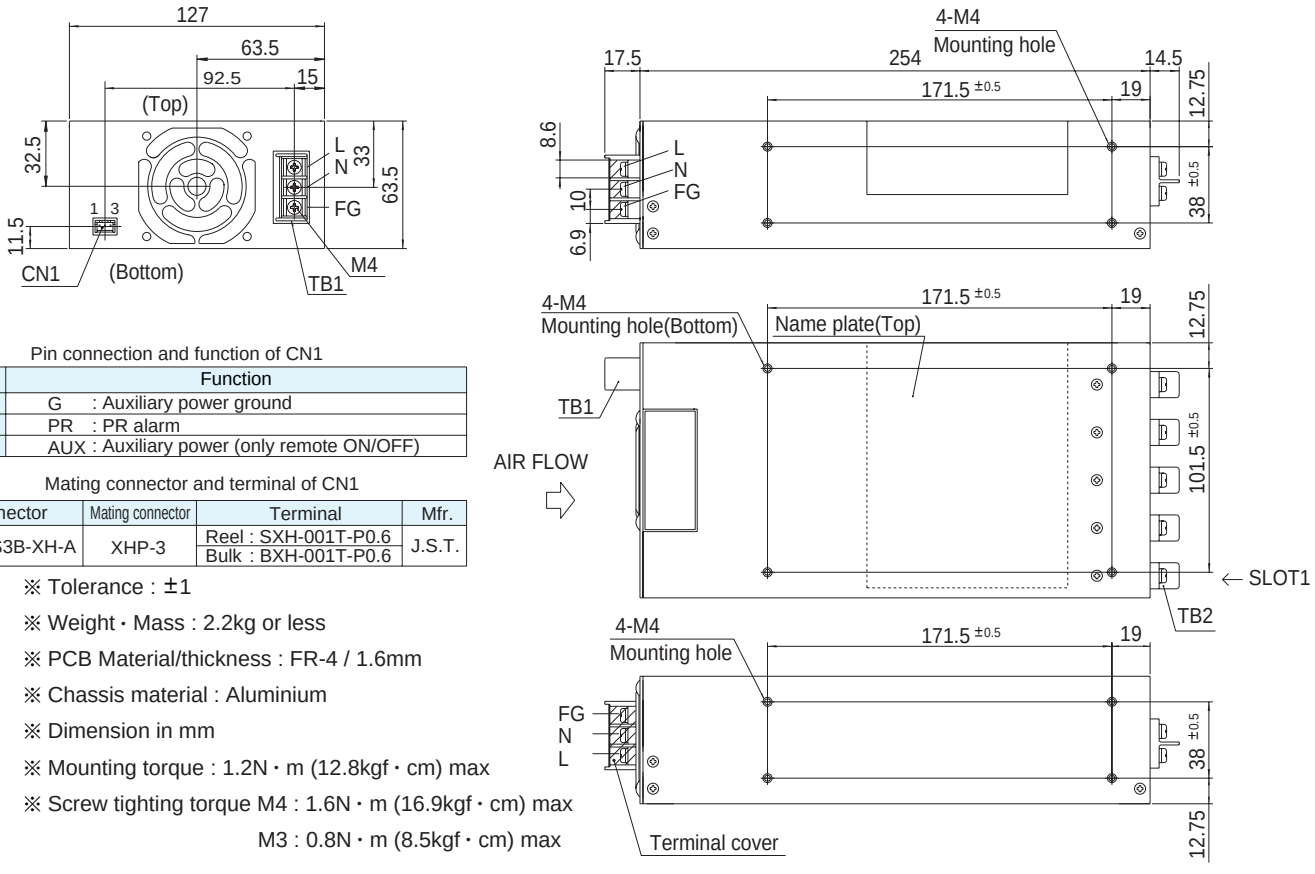
Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

Mating connector and terminal of CN1

Connector		Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	Reel : SXH-001T-P0.6 Bulk : BXH-001T-P0.6	J.S.T.

※ Tolerance : ±1
※ Weight・Mass : 1.7kg or less
※ PCB Material/thickness : FR-4 / 1.6mm
※ Chassis material : Aluminium
※ Dimension in mm
※ Mounting torque : 1.2N・m (12.8kgf・cm) max
※ Screw tighting torque M4 : 1.6N・m (16.9kgf・cm) max
M3 : 0.8N・m (8.5kgf・cm) max

ACE450F external view



Pin connection and function of CN1

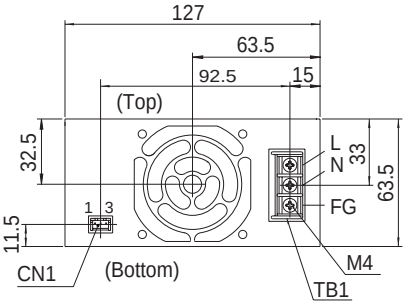
Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

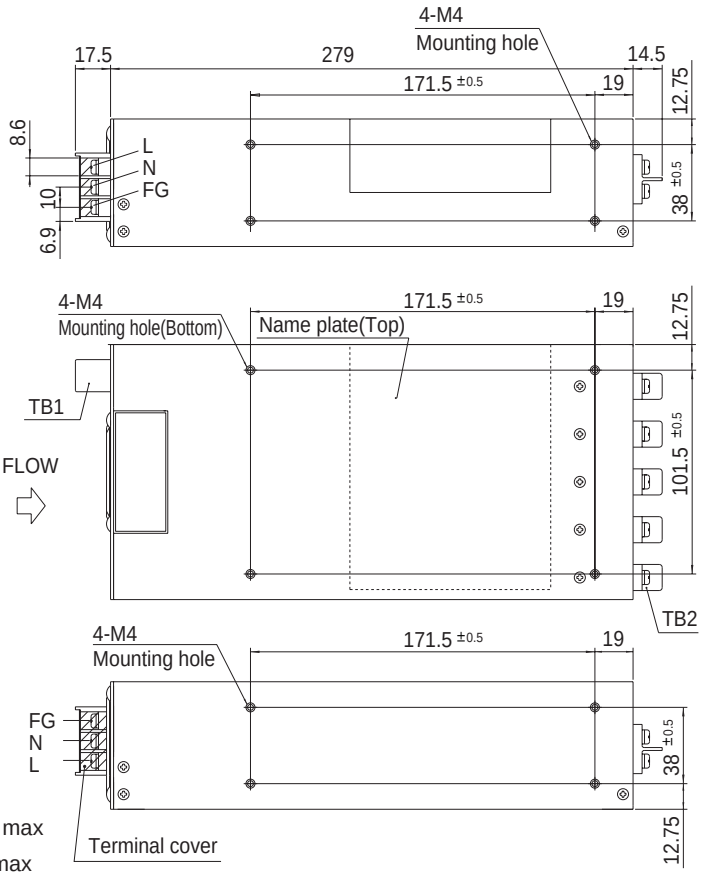
Mating connector and terminal of CN1

Connector		Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	Reel : SXH-001T-P0.6 Bulk : BXH-001T-P0.6	J.S.T.

※ Tolerance : ±1
※ Weight・Mass : 2.2kg or less
※ PCB Material/thickness : FR-4 / 1.6mm
※ Chassis material : Aluminium
※ Dimension in mm
※ Mounting torque : 1.2N・m (12.8kgf・cm) max
※ Screw tighting torque M4 : 1.6N・m (16.9kgf・cm) max
M3 : 0.8N・m (8.5kgf・cm) max

ACE650F external view





Pin connection and function of CN1

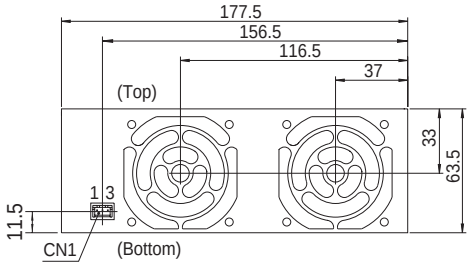
Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

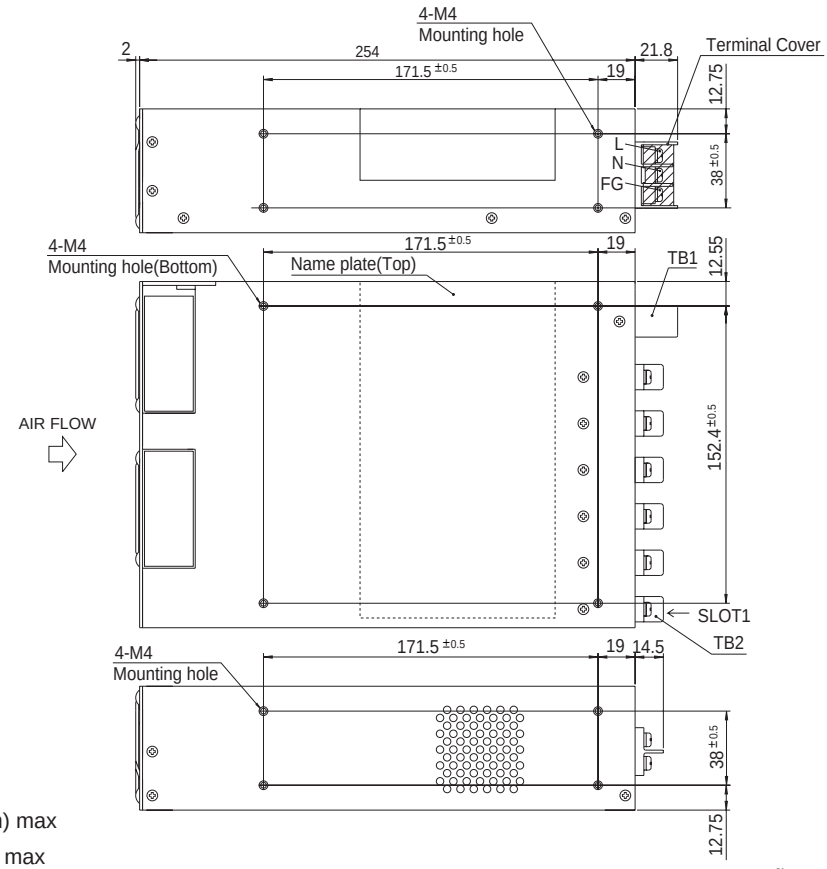
Mating connector and terminal of CN1

Connector		Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	Reel : SXH-001T-P0.6 Bulk : BXH-001T-P0.6	J.S.T.

※ Tolerance : ±1
※ Weight・Mass : 2.4kg or less
※ PCB Material/thickness : FR-4 / 1.6mm
※ Chassis material : Aluminium
※ Dimension in mm
※ Mounting torque : 1.2N・m (12.8kgf・cm) max
※ Screw tighting torque M4 : 1.6N・m (16.9kgf・cm) max
M3 : 0.8N・m (8.5kgf・cm) max

ACE900F external view





Pin connection and function of CN1

Pin No.	Function
1	G : Auxiliary power ground
2	PR : PR alarm
3	AUX : Auxiliary power (only remote ON/OFF)

Mating connector and terminal of CN1

Connector		Mating connector	Terminal	Mfr.
CN1	S3B-XH-A	XHP-3	Reel : SXH-001T-P0.6 Bulk : BXH-001T-P0.6	J.S.T.

※ Tolerance : ±1
※ Weight・Mass : 3kg or less
※ PCB Material/thickness : FR-4 / 1.6mm
※ Chassis material : Aluminium
※ Dimension in mm
※ Mounting torque : 1.2N・m (12.8kgf・cm) max
※ Screw tighting torque M4 : 1.6N・m (16.9kgf・cm) max
M3 : 0.8N・m (8.5kgf・cm) max

1 Ordering information

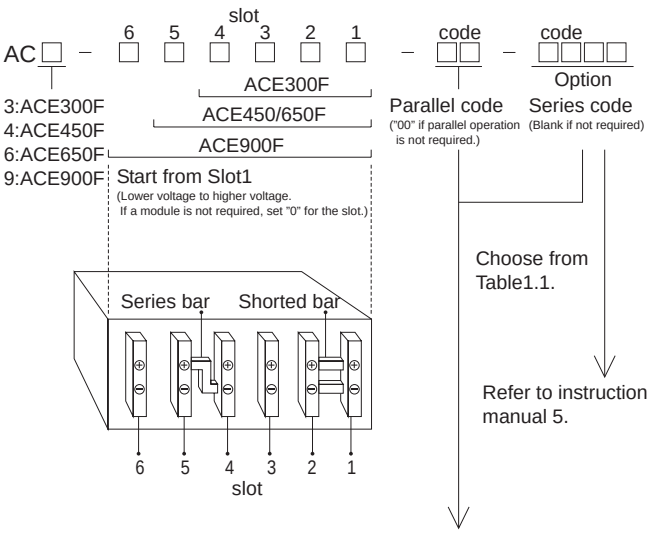
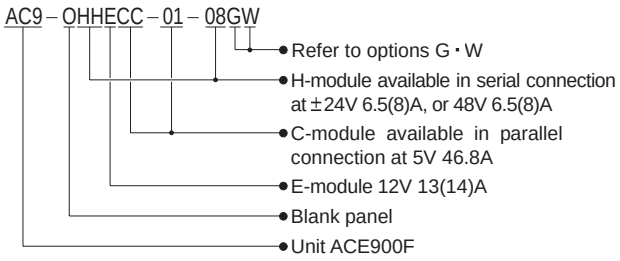


Table 1.1 Parallel / Series code

	code	slot6	slot5	slot4	slot3	slot2	slot1
ACE300F	00						
	01					●	●
	02				●	●	
	03				●	●	●
	04			●	●		
	05			●	●	●	●
	06			●	●	●	
	07			●	●	●	●
ACE450/650F	08		●	●			
	09		●	●		●	●
	0A		●	●	●	●	
	0B		●	●	●	●	●
	0C		●	●	●		
	0D		●	●	●	●	●
	0E		●	●	●	●	
	0F		●	●	●	●	●
ACE900F	10	●	●				
	11	●	●			●	●
	12	●	●		●	●	
	13	●	●		●	●	●
	14	●	●	●	●		
	15	●	●	●	●	●	●
	16	●	●	●	●	●	
	17	●	●	●	●	●	●
	18	●	●	●			
	19	●	●	●		●	●
	1A	●	●	●	●	●	
	1B	●	●	●	●	●	●
	1C	●	●	●	●		
	1D	●	●	●	●	●	●
	1E	●	●	●	●	●	
	1F	●	●	●	●	●	●

● : Output terminal
— : Connection

●EXAMPLE OF NAMING(1)



●EXAMPLE OF NAMING(2)

When the parallel operating module CC(5V46.8A) of example(1) is changed to module 2C(5V60A), the type name becomes the following.

Ex.: AC9-0HHE2C-00-08GW

●EXAMPLE OF NAMING(3)

The parallel and series connecting in 2A-2K follows Table 1.1. For example, when the output power is made 24V25(34)A by connecting two modules 2E[12V25(34)A] in series, the type name becomes the following.

Ex.: AC9-002E2E-00-02

●Configuration rules

(1) After the output voltage and the output current are confirmed, the code of the output module installed in the slots1-6 is selected from ACE Top page. Put the blank panel(code 0) in when modules are not installed in the slots.

(2) When output module is operated in parallel and series, the parallel code can be selected from Table 1.1 depending on whether or not the bus bar between the output modules exists.

※ Refer to 2, Series operation and Parallel operation for set notes.
Series operation might be able to draw maximum power by using some modules.

(3) Install more than two slots.

(4) List of correspondence module of series and parallel setting.

Parallel setting	possible	A-K, 2A-2K
	impossible	L, M, N, P, R, S, T, U, Y, W, Z, 9, Q, V
Series setting	possible	A-K, 2A-2K, L, M, N, P, R
	impossible	S, T, U, Y, W, Z, 9, Q, V

■Series operation is superior to parallel operation in dynamic load response. Therefore we recommend series operation in increasing power.

ACE

2 Series operation and Parallel operation in Modular power supply

2.1 Series operation

■Series operation is possible with the same output modules. The series bar is installed at shipping if there is a series setting in the type name. At module S, T, U, Y, W, Z, 9, Q and V series operation is possible, but series bar cannot be set by series code.

■Output current in series connection is the same as the specification of the connected module.

■Please notice and set the following items.

①Choosing same modules in series setting in principle.

②The rating voltage of the total in series setting can set less than 48V.

③It is impossible to use series setting with pallalel setting.

Please consult us excluding the above-mentined.

2.2 Parallel operation

(applying module : A-K, 2A-2K)

■Parallel operation is possible with same output voltage modules in the same power supply. The shorted bar is installed after adjusting internal if there is a parallel setting.

Parallel operation is impossible after shipping.

■The total output current in parallel.

Rated current of module that parallel operation is possible is adjusted to 90%.

Refer to next example.

Ex.: AC4-HHECB-08

- Parallel code 08 means slot4 and slot5 are connected with the bus bar.
- Output module code is "H", consequently total output current in parallel operation is shown as below ;

The total output current in parallel=(6.5+6.5) × 0.9=11.7A

■Notes of parallel operation are shown as follows.

①Please consult us using of remote sensing.

②Peak load is impossible.

③Adjusting output voltage is possible with each potentiometer in all modules that are connected in parallel.

In case of precision adjustment output voltage, remove bus bar, adjust voltage and install the bus bar again. The deferent voltage between each module makes load reguration big. Adjust to reduce difference voltage as possible ,or load regulation might become small.

■In series and parallel operation, output voltage increases like stairs due to a delay of the rise time output voltage at turn on.

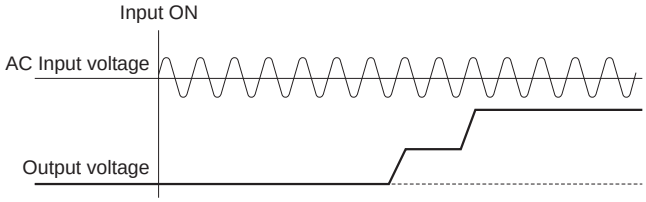


Fig.2.1 Start-up waveform in series and/or parallel operation

3 Function

3.1 Input voltage range

■The range is from AC85V to AC264V or from DC120V to DC350V. Only AC input is available to comply with agency approval.

■If the wrong input is applied, the unit will not operate properly and/or may be damaged. Avoid the followings to cause failure of the unit to apply square wave form input voltage, which is commonly used in UPS and inverters.

3.2 Inrush current limiting

■Inrush current limiting is built-in.

■If a switch on the input side is installed, it has to be the one handling the input inrush current.

■The thyristor technique is used for protection from inrush current. If power is turned ON/OFF repeatedly within a short period of time, that may cause failure. It is necessary to have enough time between power ON and OFF.

3.3 Overcurrent protection

■Overcurrent protection is built-in and activated at 105% of the rated current or 101% of the peak current. Overcurrent protection protects the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is removed.

■If the output voltage drops more than 50% of the rated voltage in an overcurrent protection mode, the average current will also be reduced by the intermittent operation.

■Auxiliary power(AUX)

Auxiliary power(AUX) is only possible for remote ON/OFF.

■Peakcurrent protection(applying module : 2E-2K)

Peakcurrent protection is built-in(refer to Output module specification ※1. for Peak loading).

If this function comes into effect, the output is shut down(the other modules are not shut down).

The minimum interval of AC recycling for recovery is 2 to 3 minutes(✱).

✱ The recovery time varies depending on input voltage and load condition.

3.4 Thermal protection

■Thermal protection circuit is built-in and shut down under following condition.

①When the current and the temperature which exceed from the derating curve.

②The case FAN stops or air flow is interrupted and the amount of the wind decreases.

After cut off input voltage and cooling down inside of power supply, turns on the input of the power supply again.

3.5 Overvoltage protection

■Overvoltage protection circuit is built-in for each output module and works independently.

The AC input should be shut down if overvoltage protection is activated.

The minimum interval of AC recycling for recovery is more than 1 minutes.

The recovery time varies depending on input voltage.

・Please note that internal components may be damaged if excessive voltage(over rated voltage) is applied to output terminal of power supply. This could happen when customer tests the overvoltage performance of the unit.

3.6 Output voltage adjustment

■Adjustment of output voltage is possible by using potentiometer.

■Refer to specifications of output module in detail.

※At module Y, W, Z, 9, Q and V the potentiometer is turn right and then, +voltage changes into the direction of + and -voltage changes into the direction of - at the same time.

3.7 Remote sensing (applying module : A-K, 2A-2K)

■Remote sensing circuit is built-in at each output module.

■Wiring method without using remote sensing is shown in Fig.3.1.

When you do not use the remote sensing, connect between +S and +M and between -S and -M with CN2 of each output module. When the power supply is shipped from a factory, a special harness is mounted on CN2.

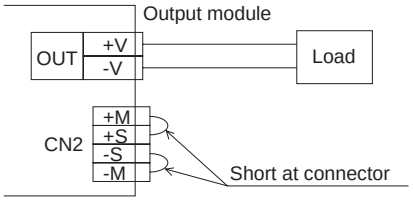


Fig.3.1 When not using remote sensing function

■Wiring method with remote sensing is shown in Fig.3.2.

■When you use the remote sensing, follow instruction as below.

①Note connecting wires enough because the load current flows to sensing line and an internal circuit of power supply is damaged occasionally, when defective contact of the screw such as loosening happens in the load line.

②Confirm line drop should be at 0.3V or less using a thick wire from the power supply to the load.

③When remote sensing function is used, output voltage might become unstable because of a impedance of wiring and load condition. And the power supply should be evaluated enough.

Following are examples to improve it.

・-S sensing wire is removed and terminals between -M and -S are shorted.

・C_0, C_1 and R1 are connected as below figure.

Please ask details to us.

■Do not draw the output current from ±M at CN2.

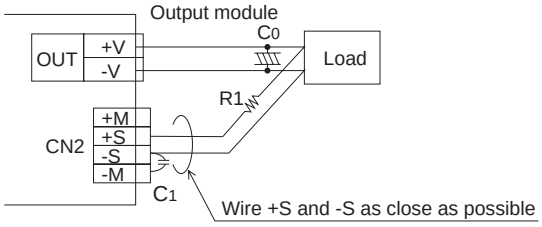


Fig.3.2 When using remote sensing function

3.8 Remote ON/OFF

■Each output module has remote ON/OFF. Remote ON/OFF control becomes available by applying voltage in CN2.

■Auxiliary power(AUX) for remote ON/OFF control.

Auxiliary power(AUX) is built-in for remote ON/OFF control.

Auxiliary power(AUX) is isolated from input,output and FG.

Fig.3.3 shows the way to connect remote control with AUX.

■Remote ON/OFF control logic.

①The output stops when the voltage(4.5 - 12.5V) is applied in RC+.

※Please use the option(-R) when reverse logic in remote ON/OFF operation is necessary. Refer to 5. Option

②Built-in fan does not stop even if the output is turned off with remote ON/OFF circuit.

③The LV alarm outputs when the output voltage is turned off with remote ON/OFF (except module S, T, U).

④This function works in each output module.

■Remote ON/OFF control is indepedent from each output module, therefore any output module is possible to control remote ON/OFF.

Note remote ON/OFF control is not all output module shut down in a lump. Recommend to use series and parallel remote ON/OFF circuit to make output module shut down in a lump.

■Remote ON/OFF circuit(RC+, RC-) is isolated from input,output and FG.

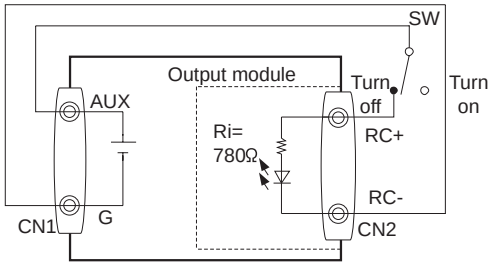


Fig.3.3 Example of connecting remote ON/OFF

Table 3.1 Specification of remote ON/OFF

Connection method		Fig 3.3 Remote SW
SW Logic	Turn on	SW open (0-0.5V between RC+ and RC-)
	Turn off	SW close (12V between RC+ and RC-)
Bases terminal		CN2 RC-

3.9 Isolation

■For a receiving inspection. such as Hi-Pot test, gradually increase (decrease) the voltage for start(shut down). Avoid using Hi-Pot tester with timer because it may generate voltage a few times higher than applied voltage at ON/OFF of a timer.

3.10 Alarm

■Table 3.2 shows the alarm function built-in.

①PR alarm:Detecting line voltage and fan condition.

②LV alarm:Detecting output voltage (except module S, T, U).

Table 3.2 Explanation of alarms

	Alarm	Output of alarm
PR	When line voltage is abnormal (low input voltage out of range) or fan stops, the alarm outputs from CN1.	Open collector method Good : Low (0-0.8V, 1-20mA) Fail :35V max
LV	When the output voltage becomes low or stops, the alarm outputs from CN2. Notice : ① When the output is over current(intermittent current), the alarm is unsettled status. ② LV alarm is not isolated from output. Please notice the connection when using series operating or power supply as negative voltage.(Refer to fig.3.5)	Open collector method Good : Low (0-0.8V, 1-20mA) Fail :35V max

Please consult us details.

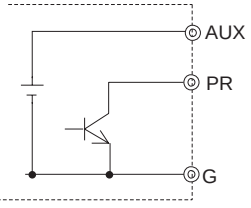
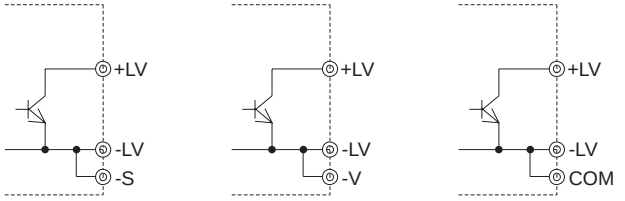


Fig.3.4 Internal circuit of PR

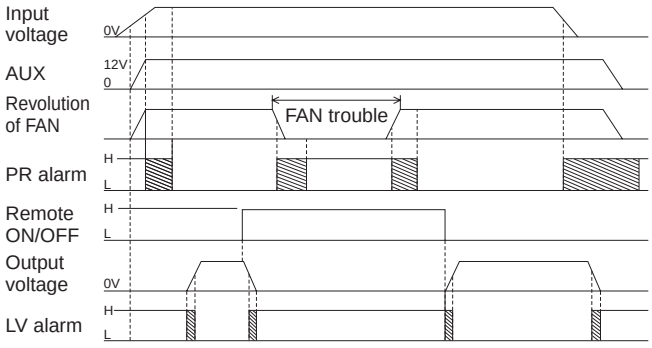


Applying module : A-K, 2A-2K

Applying module : L, M, N, P, R

Applying module : Y, W, Z, 9, Q, V

Fig.3.5 Internal circuit of LV



✱ ▨ : unsetteled area

✱ H : 2V ≦ H ≦ 35V or Open, L:L ≦ 0.8V

Fig.3.6 Sequence time chart

ACE

4 Assembling and installation method

4.1 Installation method

■Fan for forced cooling is built-in.

Do not block ventilation at inlet side and its opposite side(output terminal side).

※Please use the option (-F) when reverse exhaust is necessary.

Fig.4.1 Air flow

■Install air filter so that the effect of cooling does not decrease when the power supply is used in a dusty place.

Pay attention ventilation design when air filter is installed.

■When fan stops, thermal protection comes into effect and output modules are shut down. Regular maintenance is required for the fan, because the life expectancy of the fan depending on the use condition.

Fan unit for maintenance can be ordered.Refer to optional parts.

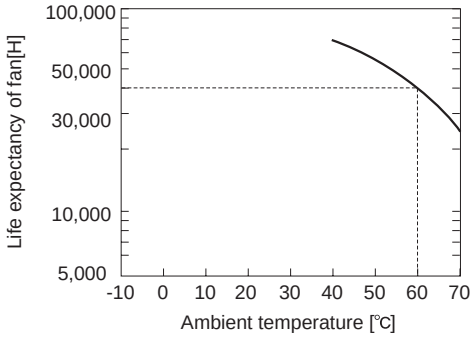


Fig.4.2 Life expectancy of fan(R(t)=90%)

■Fix firmly, considering weight, though it can be used by the installation method shown in Fig.4.3.

ACE

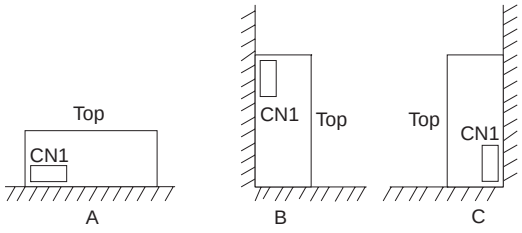


Fig.4.3 Installation method 1

■Avoid installation method 2 Fig.4.4 from mechanical stress.

■The screw should be inserted up to 6mm max from outside of the power supply to keep a distance between inside parts and an isolation(Fig.4.5).

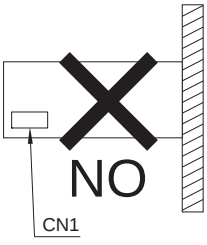


Fig.4.4 Installation method 2

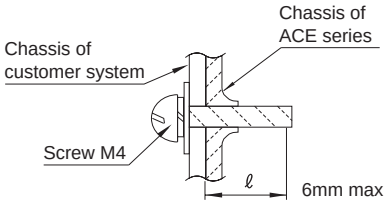


Fig.4.5 Mounting screw

4.2 Derating

■ACE series consists of output module combination. Make sure each output module are used within specifications and total output power is less than rated total output power.

■Derating curve of output module depending on ambient temperature(at suction side) shown in Fig.4.6.

■In the hatching area specification of Ripple,Ripple Noise is different from other area.

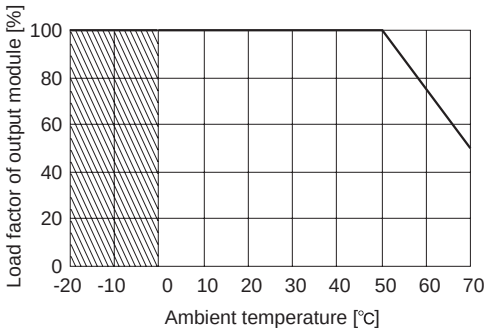


Fig.4.6 Derating curve of output module on ambient temperature

■Derating curve depending on input voltage is shown in Fig.4.7, Fig.4.8, Fig.4.9 and Fig.4.10.

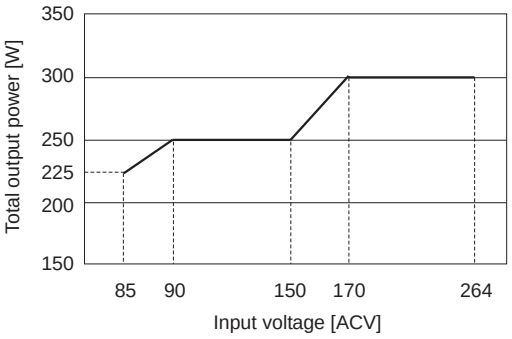


Fig.4.7 Derating curve depending on input voltage(ACE300F)

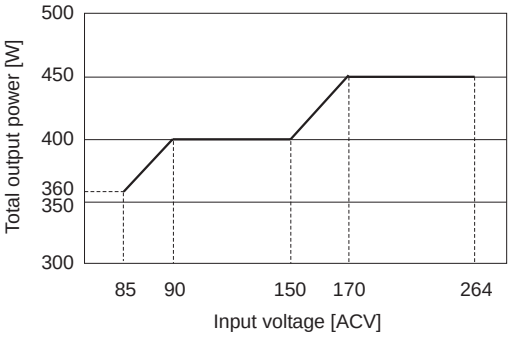


Fig.4.8 Derating curve depending on input voltage(ACE450F)

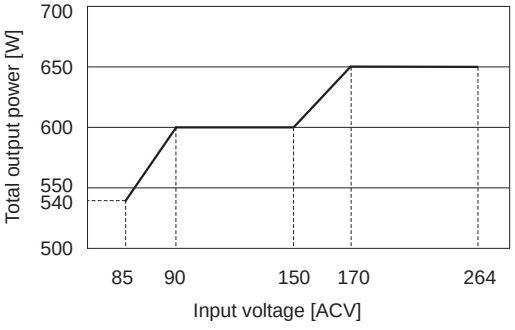


Fig.4.9 Derating curve depending on input voltage(ACE650F)

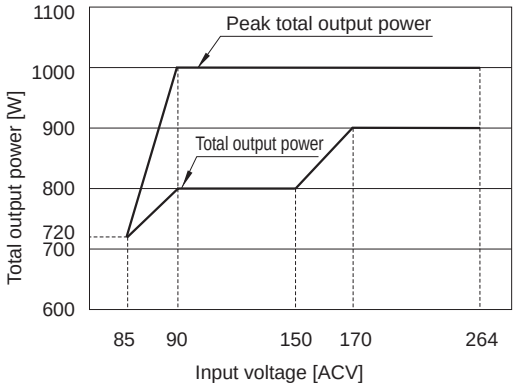
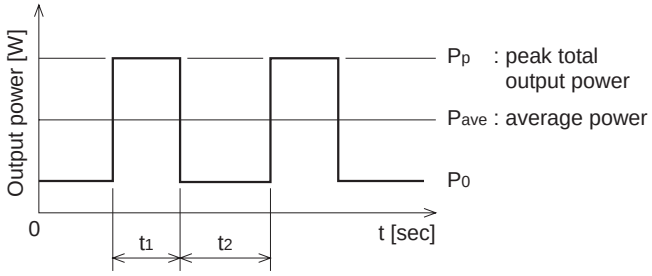


Fig.4.10 Derating curve depending on input voltage(ACE900F)

■ACE900F can output the peak power by the following conditions.



$t_1 \leqq 1$ [sec], $P_{ave} = \frac{P_p t_1 + P_0 t_2}{t_1 + t_2} \leqq$ total output power, $\frac{t_1}{t_1 + t_2} \leqq 0.3$

Fig.4.11 Peak output power(only ACE900F)

■Definition of load factor

$$A_0 = \frac{\text{(Sum of each module power)}}{\text{(Total output power)}} \times 100$$

$$= \frac{\sum_{k=1}^{6} (I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{\text{(Total output power)}} \times 100$$

Notice : Only the number with a small occupation slot number is calculated in 2A-2K.

$A_{11}, A_{21}, A_{31}, A_{41}, A_{51}, A_{61}$: $A_{k1} = I_{k1} / I_{0k1} \times 100$

$A_{12}, A_{22}, A_{32}, A_{42}, A_{52}, A_{62}$: $A_{k2} = I_{k2} / I_{0k2} \times 100$

Where ; I_{k1}, V_{k1}, I_{0k1} : output current (※1), voltage, rated current (※2) other than V_2 of module S, T, U.

I_{k2}, V_{k2}, I_{0k2} : output current, voltage, rated current in V2 of module S, T, U.

Total output power : Depending input voltage (Refer to Fig.4.7-4.10)

※1 The output current in module Y, W, Z, 9, Q and V is sum of +current and -current.

※2 Module rated current is shown below following ;

・except module Y, W, Z, 9, Q and V : refer to output module specification

・module Y, W, Z, 9, Q and V : 10A(Y), 6.4A(W) , 5A(Z), 3.2A(9) 12.8A(Q), 11A(V)

(Sum of +current and -current)

Load factor [%]=maximum value of A_0 to A_{62}

■About load regulation in module Y, W, Z, 9, Q and V

The sum of +power and -power must be less than output power that module Y is 50W, W is 76.8W, Z is 75W, 9 is 76.8W, Q is 153.6W, V is 165W.

The relation between the current and the load regulation is shown in the following example(Fig.4.12)

<Example of module W>

(1) Rated current 1 : 3.2A --- When drawing current within +3.2A, -3.2A(total 6.4A), the specification of load regulation is "load regulation 1".

(2) Rated current 2 : 4.2A --- When drawing current within +4.2A, -2.2A or +2.2A, -4.2A, the specification of load regulation is "load regulation 2".

(3) Peak current : 5A ------ It is possible to draw +5A, -1.4A or +1.4A, -5A in total 6.4A. Refer to Output Module Specification ※1 when drawing 4.2-5A.

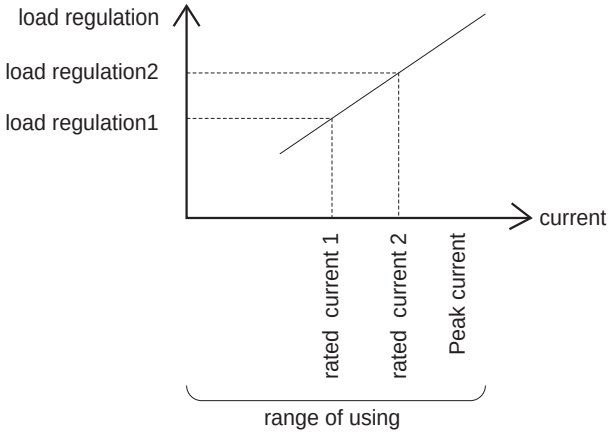


Fig.4.12 The relation between the current and the load regulation

■Minimum output current of module S, T, U.

The allowable load factor of V2 changes depending on the output current of V1 as follows.

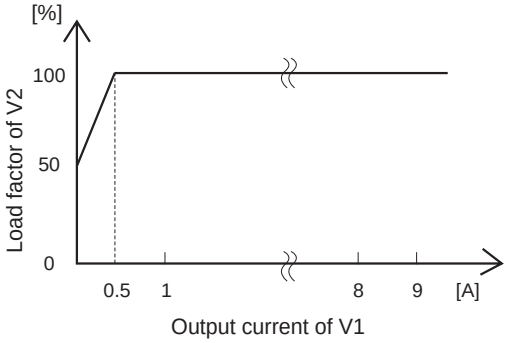


Fig. 4.13 Minimum output current of V1

■Example of usage

[Example1] The method to make sure if AC4-LWHEC-00 is possible to operate in as following condition.

Input voltage : AC100V
Ambient temperature : 50℃
Ouput module : slot1 : 5V 15A
slot2 : 12V 7A
slot3 : 24V 6A
slot4 : +12V 4A, -12V 1A
slot5 : 3.3V 10A

Calculating A_{11}-A_{51}

$$A_0 = \frac{\text{(Sum of each module power)}}{\text{(Total output power)}} \times 100$$

$$= \frac{\sum_{k=1}^{6}(I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{\text{(Total output power)}} \times 100$$

=396/400×100=99%
$A_{11}=I_{11}/I_{011}\times100=15/26\times100=58\%$
$A_{21}=I_{21}/I_{021}\times100=7/13\times100=54\%$
$A_{31}=I_{31}/I_{031}\times100=6/6.5\times100=92\%$
$A_{41}=I_{41}/I_{041}\times100=5/6.4\times100=78\%$
$A_{51}=I_{51}/I_{051}\times100=10/10\times100=100\%$

Consequently, the maximum value in A_{11}-A_{51} is 100%, while according to derating curve(Fig.4.6), the output modules are possible to operate at ambient temperature 50℃ in load factor 100%. As a result AC4-LWHEC-00 is OK to use for this condition.

[Example2] The method to make sure if AC9-2HCSWP-00 is possible to operate in as following condition.

Input voltage : AC100V
Ambient temperature : 50℃
Ouput module : slot1 : 15V 3A
slot2 : +12V 3.2A, -12V 2.3A
slot3 : 5V 8A, 5V 4A
slot4 : 5V 25A
slot5 : 24V 13A

Calculating A_{11}-A_{51}

$$A_0 = \frac{\text{(Sum of each module power)}}{\text{(Total output power)}} \times 100$$

$$= \frac{\sum_{k=1}^{6}(I_{k1} \times V_{k1} + I_{k2} \times V_{k2})}{\text{(Total output power)}} \times 100$$

=608/800×100=76%
$A_{11}=I_{11}/I_{011}\times100=3/4\times100=75\%$
$A_{21}=I_{21}/I_{021}\times100=5.5/6.4\times100=86\%$
$A_{31}=I_{31}/I_{031}\times100=8/10\times100=80\%$
$A_{32}=I_{32}/I_{032}\times100=4/5\times100=80\%$
$A_{41}=I_{41}/I_{041}\times100=25/26\times100=96\%$
$A_{51}=I_{51}/I_{051}\times100=13/14\times100=93\%$

Consequently, the maximum value in A_{11}-A_{51} is 96%, while according to derating curve(Fig.4.6), the output modules are possible to operate at ambient temperature 50℃ in load factor 100%. As a result AC9-2HCSWP-00 is OK to use for this condition.

5 Option

5.1 Option outline

■Consult us detailed option and delivery before hand.
■Please refer to 1. Ordering information for order method.
■It is possible a combination of the option, and consult us that it is not possible to do according to the option for the combination occasionally.

●-E, -G

・Low leakage current type.
・The difference from standard is shown Table 5.1.

Table 5.1 Low leakage type

	-E	-G
Leakage current (AC230V)	0.5mA max	0.15mA max
Conducted Noise	Class A	Not available
Ripple Noise	1.5 times standard	2.0 times standard

●-F

・Reverse air exhaust type.
・The difference from standard is shown Fig.5.1 and Fig.5.2.

Fig.5.1 Air flow(-F)

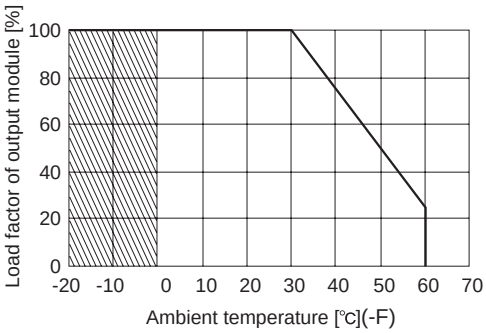


Fig.5.2 Derating curve of output module on ambient temperature(-F)

※Derating curve of output module on input voltage is also defferent for ACE900F.

●-N(External size is changed and consult us about details)

- Cooling by user's fan, without built-in fan.(Refer to Fig.5.3)
- When the safety standard is applied, it is necessary to measure the temperature of the transformer.
- Please consult us cooling method.

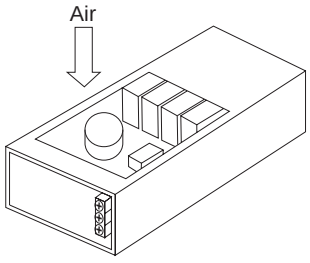


Fig.5.3 Image chart(-N)

●-K

- Low speed fan for reducing sound.
- The difference from standard is shown Fig.5.4.

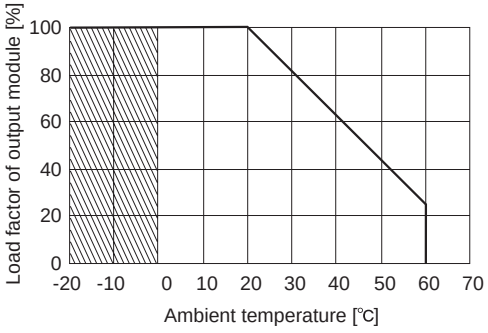


Fig.5.4 Derating curve depending on ambient temperature(-K)

●-R

- Reverse logic in remote ON/OFF operation.
- The module does not work as long as the voltage is not applied to RC terminal even if input voltage is applied.

  Turn on : 12[V] between RC+ and RC-
  Turn off : 0-0.5[V] between RC+ and RC-
- At option -R setting, all installed output modules become object that is a reverse logic.
- The harness for the CN2 connection is needed for this specification.
- Please use option harness H-SN-16 through H-SN-18.
- Please note the remote sensing treatment when you design the harness. Refer to 3.7 Remote sensing.
- Please consult us when you use standard logic and reverse logic by coexistence.

●-T(External size is changed and consult us about details)

- It is a model by which the filter the foreign body mixing measures is added.
- The difference from standard is shown Fig 5.5.
- Option(-T) cannot be used together with option(-F, -K).
- Use in the environment without dust or a regular mentenance is necessary, because the cooling ability cannot be kept when stopped up with dust.

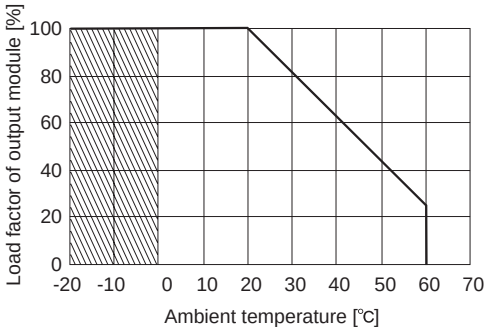


Fig.5.5 Derating curve depending on ambient temperature(-T)

●-U

- Operation stop voltage is set at a lower value than standard version.

Use condition

Input	AC70V(DC100V)	
	Duty 1s/30s	
Output	ACE300F	200W
	ACE450F	360W
	ACE650F	540W
	ACE900F	720W

※Avoid continuously operating about 1[sec] and more so that the power supply is broken.

●-W(External size is changed and consult us about details)

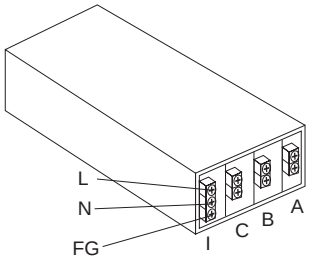
- Covers are installed on the terminal block of the output modules.
- All the terminal covers are installed in all mounted the output modules if option-W is specified.

6 Input module

In ACE300F, ACE450F and ACE650F, input terminal block and output terminal block are opposite.But Input module (code:I) can be used instead of the most left module.External size is changed and consult us about details.

ex : AC3－I CBA－00

Output module
Input module



※Conducted noise is class A when module I is specified.

7 Medical electrical equipment

・It is a specification which corresponds to medical electrical equipment. The type name and the specification, etc. are as follows. Please consult us for details.

7.1 Type

AC□ － □ □ □ □ □ － □□ － H

When medical electrical equipment and other options are combined, the type name end is as follows.

AC□ － □ □ □ □ □ － □□ － H○△

※ ○ , △ :other options

Refer to instruction manual 5. for Option.

i.e:type name when option K by which cooling fan is made low-speed is combined.

AC□ － □ □ □ □ □ － □□ － HK

✱The option not combined is as follows.

C : coating

G,E : low leakage current

※ Option H is a low leakage current specification.

7.2 Specification

・Safety : UL2601-1 (CSA601.1), EN60601-1

・Isolation : AC4,000V input-output, RC, AUX 1min.
cutoff current 10mA

・leakage current : 0.3mA max (AC100V), 0.5mA max (AC230V)
✱It is optionally available for 0.1mA max.

・conducted noise : complies with FCC-A, VCCI-A, CISPR22-A, EN55022-A

・Module which can correspond

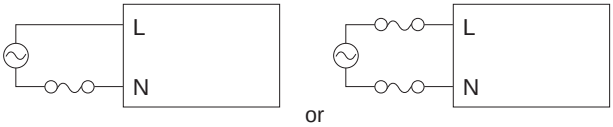
They are all modules except module S, T, and U of "Output module specification". Note that it is not possible to correspond in module S, T, and U.

・Ripple noise

Ripple noise increases to 1.5 times that of a equipment model.

7.3 Others

・Safety approved fuse or circuit breaker must be connected to the input terminal when applying to medical electrical equipment.



FUSE ACE300F AC250V8A ACE450F AC250V10A
ACE650F AC250V15A ACE900F AC250V20A

Fig.7.1 Connecting FUSE

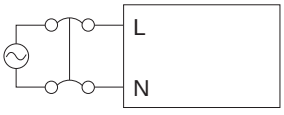


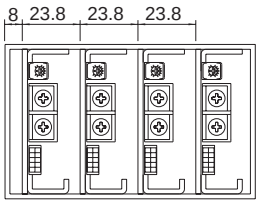
Fig.7.2 Connecting circuit breaker

Output module and connector pin assign

1.Output side view

ACE300F Output side view

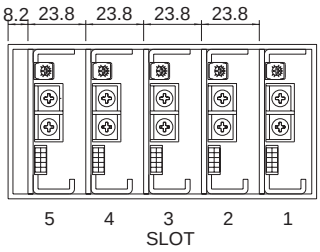
(Top)



※Tolerance : ±1

ACE450F/650F Output side view

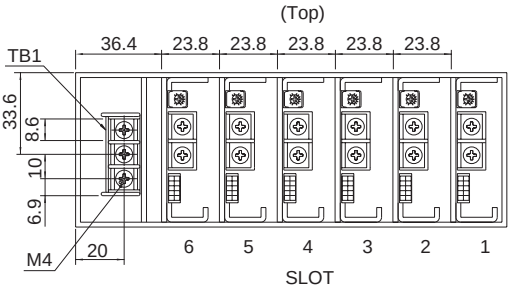
(Top)



※Tolerance : ±1

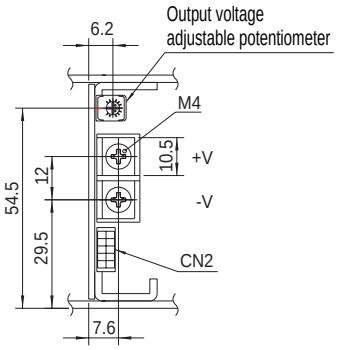
ACE900F Output side view

(Top)

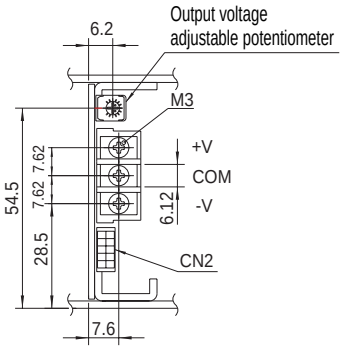


※Tolerance : ±1

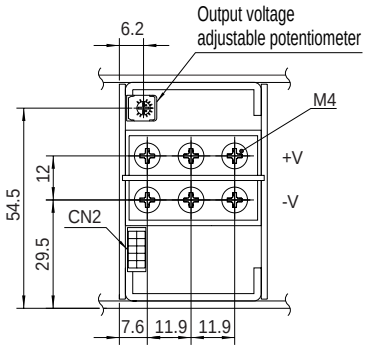
2.Output module side view and connector pin assign



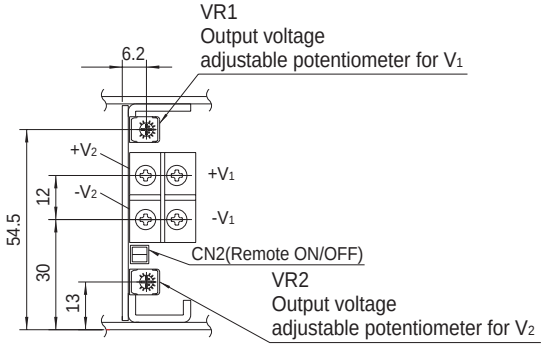
Module : A-K,L,M,N,P,R



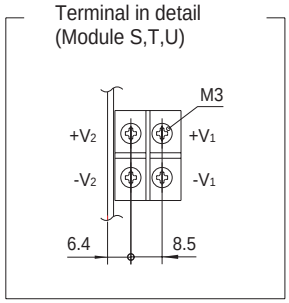
Module : Y,W,Z,9,Q,V



Module : 2A-2K



Module : S,T,U



Output module and connector pin assign

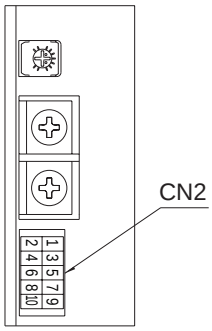
●CN2 connector pin assign except module S,T,U

Mating connector and terminal of CN2 in Output Module

Connector		Mating connector	Terminal	Mfr.
CN2	S10B-PHDSS	PHDR-10VS	Chain : SPHD-002T-P0.5 Loose : BPHD-001T-P0.5 BPHD-002T-P0.5 *1	J.S.T.

※ The housing for the remote sensing unused is mounted on CN2 of each output module(applying module : A - K,2A - 2K).

*1 Retchet Hand is nothing



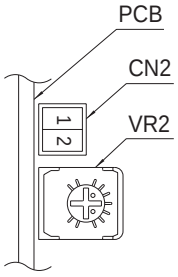
Pin connection and function of CN2 in Output Module

Pin No.	Function	
	Applying module : A - K,2A - 2K	Applying module : L,M,N,P,R,Y,W,Z,9,Q,V
1	RC+ : Remote ON/OFF +	RC+ : Remote ON/OFF +
2	RC− : Remote ON/OFF −	RC− : Remote ON/OFF −
3	N/C : N.C.	N/C : N.C.
4	N/C : N.C.	N/C : N.C.
5	LV+ : LV alarm	LV+ : LV alarm
6	LV− : LV alarm ground	LV− : LV alarm ground
7	+M : + Output voltage monitoring	N/C : N.C.
8	+S : + Remote sensing	N/C : N.C.
9	−M : − Output voltage monitoring	N/C : N.C.
10	−S : − Remote sensing	N/C : N.C.

●CN2 connector pin assign of module S,T,U

Mating connector and terminal of CN2 in Output Module

Connector		Mating connector	Terminal	Mfr.
CN2	S2B-PH-K-S	PHR-2	Chain:SPH-002T-P0.5S Loose:BPH-002T-P0.5S	J.S.T.



Pin connection and function of CN2 in Output Module

Pin No.	Function
1	Remote ON/OFF +
2	Remote ON/OFF −