

BEFORE USING THE POWER SUPPLY UNIT

Be sure to read this instruction manual thoroughly before using this product.
Pay attention to all cautions and warnings before using this product.
Incorrect usage could lead to an electrical shock, damage to the unit or a fire hazard.

⚠ DANGER

Never use this product in locations where flammable gas or ignitable substances are present.
There are risks of igniting these substances and exploding by an arcing.

⚠ INSTALLATION WARNING

- When installing, ensure that work is done in accordance with the instruction manual.
When installation is improper, there is risk of electric shock and fire.
- Installation shall be done by Service personnel with necessary and appropriate technical training and experience.
There is a risk of electric shock and fire.
- Do not cover the product with cloth or paper etc. Do not place anything flammable around. This might cause damage, electric shock or fire.

⚠ WARNING on USE

- Do not touch this product or its internal components while circuit is live, or shortly after shutdown.
There may be high voltage or high temperature present and you may receive an electric shock or burn.
- While this product is operating, keep your hands and face away from it as you may be injured by an unexpected situation.
- For products with no cover, do not touch them as there are high voltage and high temperature parts inside.
Touching them might cause injury such as electric shock or burn.
- There are cases where high voltage charge remains inside the product. Therefore, do not touch even if they are not in operation as you might get injured due to high voltage and high temperature. You might also get electric shock or burn.
- Do not make unauthorized changes to this product nor remove the cover as you might get an electric shock or might damage the product. We will not be held responsible after the product has been modified, changed or dis-assembled.
- Do not use this product under unusual condition such as emission of smoke or abnormal smell and sound etc.
Please stop using it immediately and shut off the product. It might lead to fire and electric shock. In such cases, please contact us.
Do not attempt repair by yourself, as it is dangerous for the user.
- Do not operate and store these products in environments where condensation occurs due to moisture and humidity. It might lead fire and electric shock.
- Do not drop or apply shock to this product. It might cause failure. Do not operate these products mechanical stress is applied.

⚠ CAUTION on MOUNTING

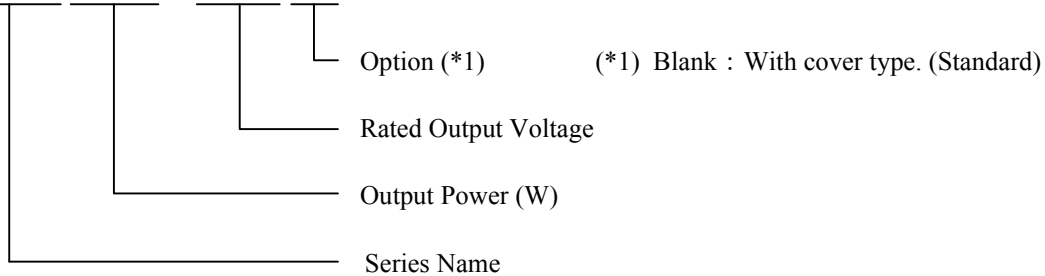
- Confirm connections to input/output terminals are correct as indicated in the instruction manual before switching on.
- Input voltage, Output current, Output power, ambient temperature and ambient humidity should be kept within specifications, otherwise the product will be damaged.
- Input line, please use the wires as short and thick as possible.
- Do not use this product in special environment with strong electromagnetic field, corrosive gas or conductive substances and direct sunlight, or places where product is exposed to water or rain.
- Mount this product properly in accordance with the instruction manual, mounting direction and shall be properly be ventilated.
- Please shut down the input when connecting input and output of the product.

⚠ CAUTION on USE

- Product individual notes are shown in the instruction manual.
If there is any difference with common notes individual notes shall have priority.
- Before using this product, be sure to read the catalog and instruction manual.
There is risk of electric shock or damage to the product or fire due to improper use.
- Input voltage, Output current, Output power, ambient temperature and ambient humidity should be kept within specifications, otherwise the product will be damaged, or cause electric shock or fire.
- If the built-in fuse is blown, do not use the product even after replacing the fuse as there is risk of abnormality inside.
Be sure to request repair to our company.
- For products without built-in protection circuit (element, fuse, etc.), insert fuse at the input to prevent smoke, fire during abnormal operation. As for products with built-in protection circuit, depending on usage conditions, built-in protection circuit might not work. It is recommended to provide separate proper protection circuit.
- For externally mounted fuse do not use other fuses aside from our specified and recommended fuse.
- When used in environments with strong electromagnetic field, there is possibility of product damage due to malfunction.
- When used in environment with corrosive gas (hydrogen sulfide, sulfur dioxide, etc.) , there is possibility that they might penetrate the product and lead to failure.
- When used in environments where there is conductive foreign matter or dust, there is possibility of product failure or malfunction.
- Provide countermeasure for prevention of lightning surge voltage as there is risk of damage due to abnormal voltage.
- Connect together the frame ground terminal of the product and the ground terminal of the equipment for safety and noise reduction.
If the ground is not connected together, there is risk of electric shock.
- Parts with lifetime specifications (built-in fan electrolytic capacitor) are required to be replaced periodically.
Set the overhaul period depending on the environment of usage and perform maintenance.
- Take care not to apply external abnormal voltage to the output. Especially, applying reverse voltage or overvoltage more than the rated voltage to the out-put might cause failure, electric shock or fire.

1. Model name identification method

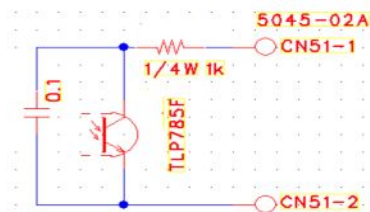
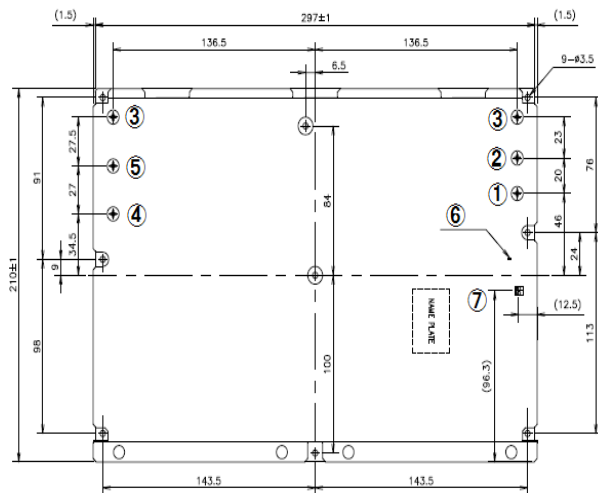
TEP 200 - 280 / □



2. Terminal Explanation

TEP200-280

- ① +V : + Output terminal (+280V)
- ② -V : - Output terminal(0V)
- ③ Safety Earth Terminal: \perp
(Provided both Input side and Output side)
- ④ +Vin : Input terminal :Connect to PV+
- ⑤ -Vin : Input terminal: Connect to PV-
- ⑥ Power On SMD Green LED
When output is normal, Green LED is 'ON'
When output is shut Down, LED is 'OFF'
- ⑦ Power Fail signal (Open collector when power Fail)
(5045-02A: Molex)



The signal 'L' level is depends on circuit external. The maximum sink current is 2mA. 20Vmax.

*Screw Terminals: F4121C S-9602 (FUJICON) sized M4

* Connector (MOLEX) for Power Fail Signal

Vertical Header(CN51)	Housing Crimp	Terminal
5045-02A	51191-0200	50802

Hand Crimping Tool: 63811-5200(MOLEX) ,11-26-0023(MOLEX) or equivalent.

Use recommended crimping tool and wire.

Matching housing and terminal pin --- Not included with the product.

(①, ②)(③)(④, ⑤) (⑦) are basic isolated each other.

3. Connecting method

Pay attention to the input wiring. If it is connected to wrong terminal, the power supply will be damaged.

- Input must be NOT Live when making connections.
- Connect \oplus terminal (2 terminals) to Safety Earth (frame ground of the equipment etc.) by thick wire for safety and improvement of noise reduction.
- Intend to be used Factory wiring only.
- Use isolated Ring Terminal for wiring. For safety purpose.



- Do NOT stress on PCB when wiring. The surface mounted device might be damaged.
- Recommended torque : 1.2N·m(12.2kgf·cm) Max

4. Explanation of Functions and Precautions

4-1. Input Voltage Range

Input voltage range is 300-1000VDC. Input voltage, which is out of specification, might lead unit damage.
TEP allow temporary overvoltage up to 1060V duration 1 second.
Between Input+ and Input -, leaded MOV (B72225S4751K1 EPCOS) fitted after input Fuse.
TEP is surge tested with external SPD (STP1000YPVM Mersen) on input terminal.

4-2. Output Voltage

Output voltage is set to the rated value at shipment. No output voltage adjustment available.

4-3. Inrush Current

TEP equipped Power thermistor to limit the inrush current. So that higher current will flow at higher ambient temperature or re-input condition. Please select input switch and fuse carefully with the high temperature and re-input the power condition. Please consider protection coordination as well.

The inrush current value in the specification is under cold start at 25°C.

4-4. Over Voltage Protection (OVP)

The OVP function (Inverter shut down method, manual reset type) is provided. OVP function operates within 295-350V. When OVP triggers, the output will be shut down. To reset OVP, remove the input of power source for a few minutes, and then re-input. In addition, the setting value of OVP is fixed and not adjustable. Pay attention not to apply higher voltage externally to the output terminal to avoid unit failure.

In addition, between Vout+ and Vout-, leaded MOV(B72210P2321K1 EPCOS) fitted.

4-5. Over Current Protection (OCP)

TEP provide over current protection. OCP type is constant current with delay shut down.

OCP function operates when the output current exceeds 101% of maximum DC output current of specification.

The outputs will be shut off after 250ms of continued OCP condition.

To reset shut off, remove the input of power source for a few minutes, and then re-input. (Same as OVP reset).

OCP setting is fixed and not to be adjusted externally.

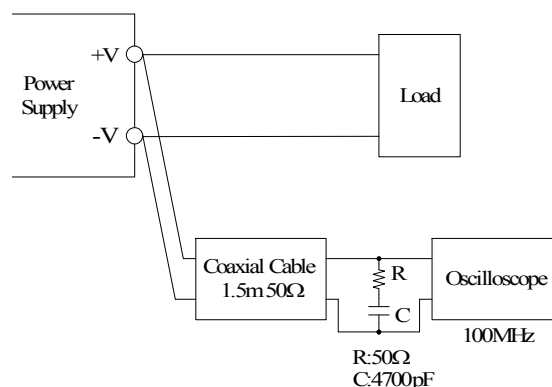
This function effective at turn on time as well. So that when capacitive load, unit might have start up failure. When output rise, TEP is in over current mode and might shut the output off before output voltage rise.

For pure capacitive load, TEP will bear over 800uF. When start up failure, please check the load condition. The recommended load condition are startup with no-load with extra capacitor only, wait a few second for reset over current mode then take load by switch control or start up in control off mode on downstream converters. In addition, when the down-converter have PFC, the charging current leads TEP to over current mode.

4-6. Output Ripple & Noise

The standard specification for maximum ripple value is measured according to measurement circuit specified by JEITA RC-9131B. When load lines are longer, ripple will becomes larger. In this case, electrolytic capacitor, film capacitor, etc. might be necessary to use across the load terminal.

The output ripple cannot be measure accurately if the probe ground lead of oscilloscope is too long.



4-7. Series Operation

TEP designed as NOT intend to use in series operation.

4-8. Parallel Operation

TEP output voltage is designed to decline when load is higher.

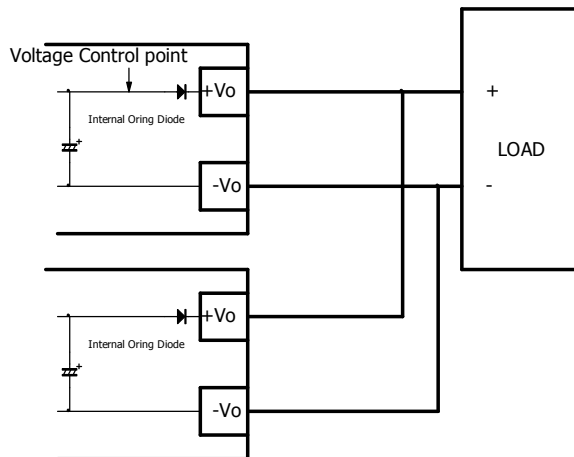
This enables parallel operation for power up by droop method.

Use a pair of nearest output voltage units for better power balancing. The balancing is affected by output voltage differences.

Also, internal Oring Diode offers protection against external over voltage applied to control point.

Parallel use intend to up to 2 units only.

Note the total output power should be less than 360W to avoid units shut down.



4-9. Isolation Test

Isolation test is NOT performed on each unit.

The isolation is verified by withstand Voltage test.

4-10. Withstand Voltage

TEP is designed to withstand 3.0kVAC between input and output, 3.0kVAC between input and Safety Earth. Output to Safety Earth withstands 2kV. Also input/output to signal 2kVAC.

When testing withstand voltage, set current limit of withstand voltage test equipment at 20mA. The applied voltage must be gradually increased from zero to testing value and then gradually decreased for shut down.

When timer is used, the power supply may be damaged by high impulse voltage at timer switch on and off.

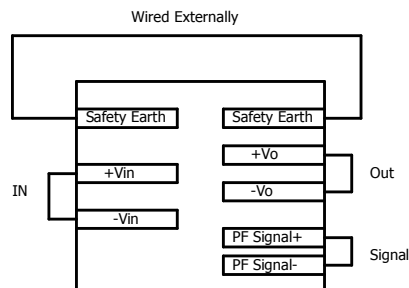
Connect input and output as follows.

IN-OUT 3kVAC 1min (20mA)

IN-Safety Earth 3kVAC 1min (20mA)

Out-Safety Earth 2kVAC 1min (20mA)

Signal-(IN/OUT) 2kVAC 1min (20mA)



Note1: This product has discrete ceramic capacitor in secondary circuit to Safety Earth. Some of the withstand voltage tester may generate high voltage at the matching with ceramic capacitor and may cause the unit damage. So, please check the waveform of test voltage.

Note2: In case of testing Earth Continuity test, The Input/Output Earth Terminal must be externally wired. The wire size should satisfy safety requirement.

5. Mounting Method

5-1. Mounting Procedure

TEP employ safety cover made of polycarbonate.

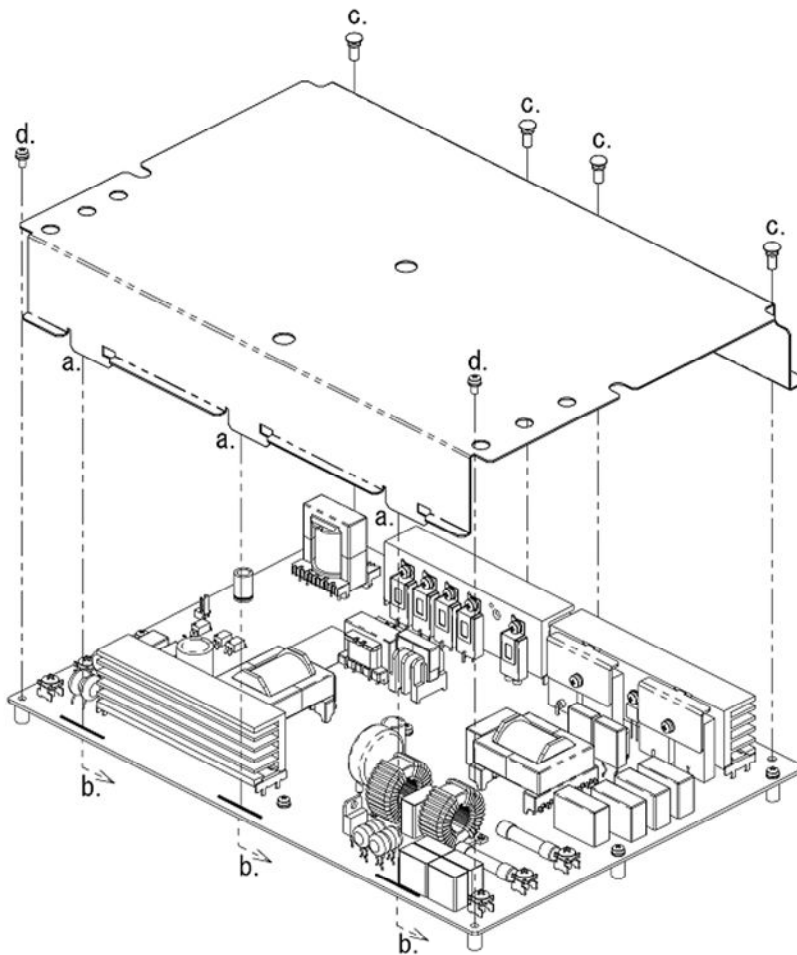
To mount TEP PCB, screw the 7 holes first on customer provided isolation stud.

The isolation stud should be suitable for required creepage /clearance.

After screw the TEP PCB, fit on the safety cover for safe operation.

Cover fitting procedure: (The output upwards)

- a. Insert cover edge into the slit left side.
- b. Slide down the cover until fully hook.
- c. Insert rivet right side (4 points)
- d. Screw the 2 of mount hole (left side)
- e. Confirm the cover is fully fitted on TEP PCB.



Note; For detail, refer to the leaf which attached with Cover and Rivet in the carton box.

5-2. Mounting Method

- (1) TEP is convection cooling type power supply. In the consideration for the heat dissipation and safety, please take a distance more than 50mm for air intake/out go.
- (2) Please take into consideration for insulation distance (space) more than 16mm from dead metal of enclosure as PCB type power supply(Pollution degree 3). The insulated stud must be height minimum 10mm. The screw head for stud is 6.4mm away from circuit inside. Then kept 16mm creepage. The screw head/washer size should be less than 6.4mm.
- (3) The required spacing surround the PCB is 2mm min. Since the PCB edge to circuit kept 6.4mm, air gap 2mm will satisfy safety spacing/creepage.
- (4) When utilize insulator, please consider 16mm creepage. When mounting, DO NOT stress on PCB.
- (5) Recommended torque for mounting screw TEP200-280 (M3 screw): 0.49 N·m (5.0 kgf·cm)
- (6) Protection Cover is in packaged on factory shipment. (See the item of "Protection Cover" in this section.)

5-3. Output De-rating according to the Mounting Directions

The Mounting Directions refer to the figures below. Recommend standard mounting is direction (B).

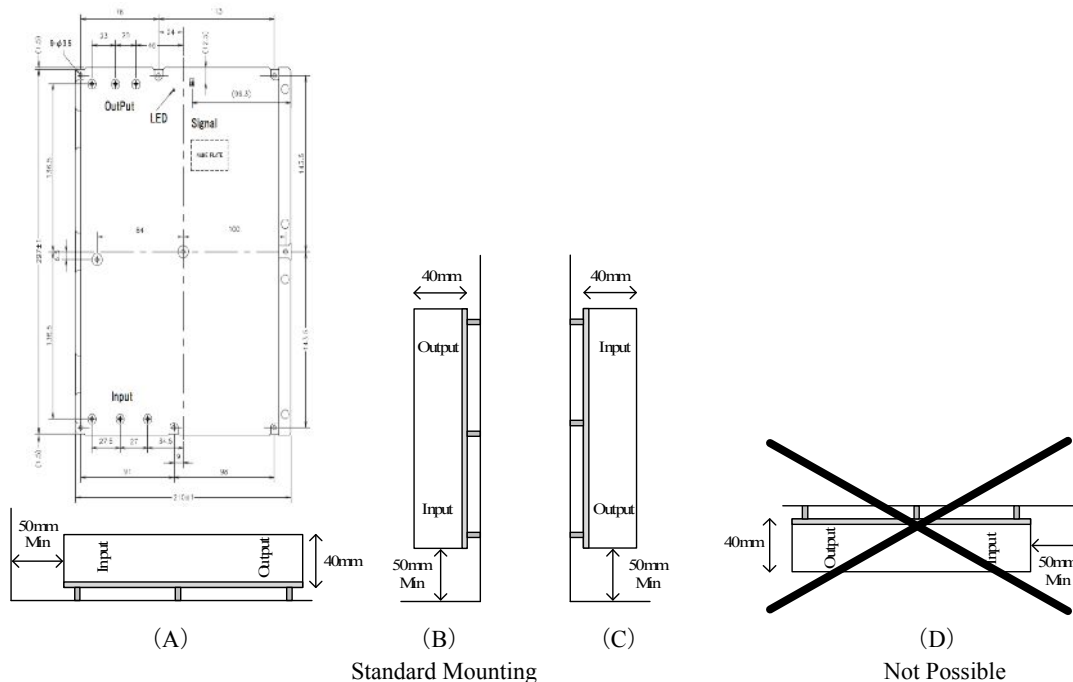
Mounting direction (A), (B) and (C) are allowed. Mounting direction (D) is NOT allowed.

When the mounting direction is (A), ambient temperature should be 50degC or less.

When removing the cover, direction (A), (B) and (C) does NOT required de-ratings.

However, 80% de-rating required for direction (A) with Cover.

•Mounting Direction



Note:

The Cover height is 41mm max on component side.

Component height in component side: 39mm Max

PCB thickness 1.6mm. Lead height 2.5mm Max. Cover fixing 10mm.

Total height including component lead less than 45mm.(Without cover.)

Mount with 9 xφ3.5holes.

Use stud with necessary spacing required by Safety instruction.(5.5mm Spacing/16mm creepage for 1000V)

Recommended insulated type stud to keep spacing.

https://us.schurter.com/bundles/snecscurter/epim/_ProdPool/_newDS/en/typ_Transipillars.pdf

<http://www.hirosugi.co.jp/products/POM/AS-B.html>

https://www.electronicfasteners.com/wp-content/uploads/2014/09/linecard_richco.pdf#search=%27Richco+standoff%27



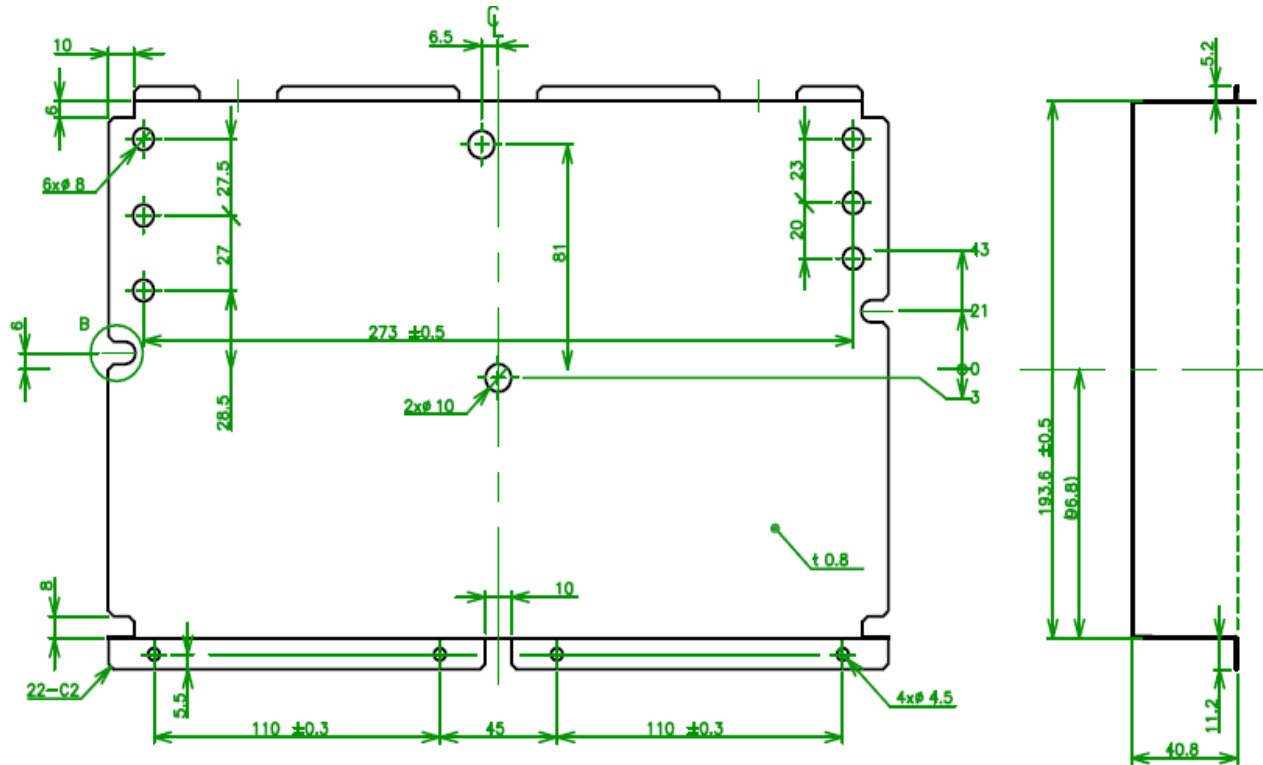
•Protection Cover (In packaged on shipment as standard)

To avoid electric shock /burning hazard, protection cover is provided.

The cover is in packaged on factory shipment.

Use cover as standard for safety purpose. The cover height will be 41mm from PCB.

The cover is made of flame retardant polycarbonate material $t=0.8\text{mm}$.



•Coating

To avoid electric shock /burning hazard, Coating is provided.

The coating protects PCB solder side only by spray coating.

The coating material is 1-2577 Dow coming.

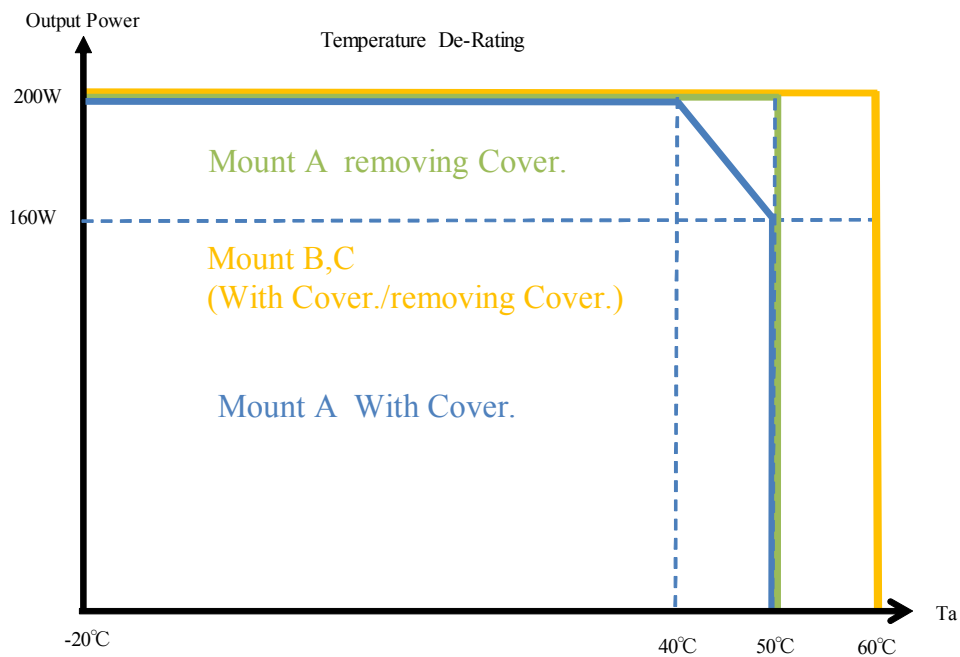
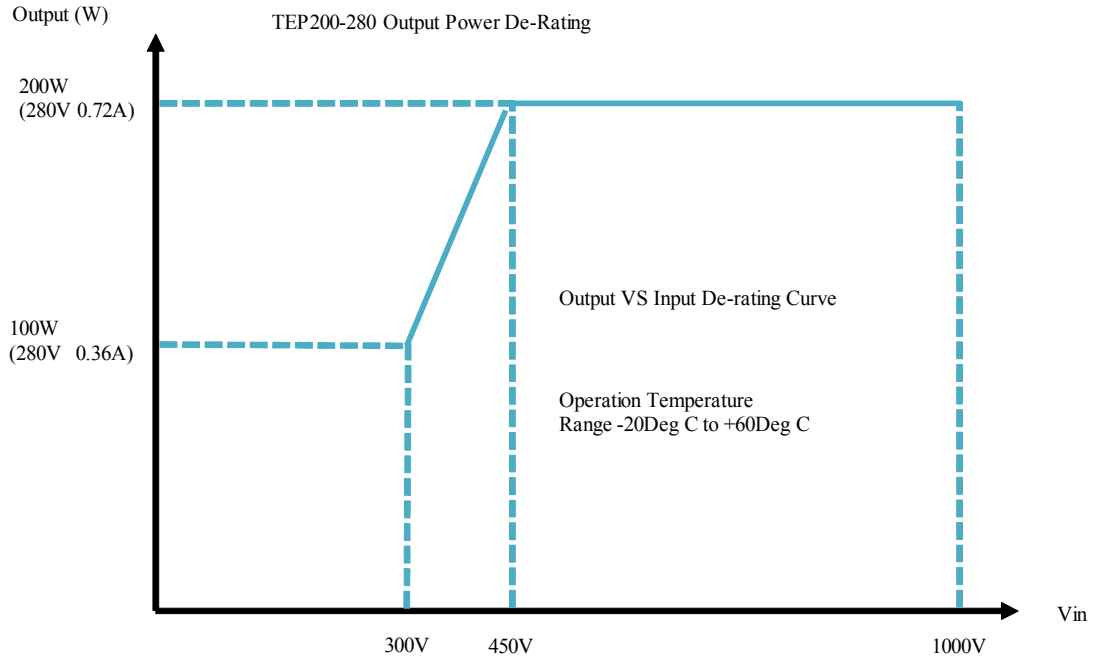
This does NOT mean Any Warranty for Humidity or Dust proof.

• Output De-rating according to the input Voltage

TEP require output power de-rating according to input voltage.

Refer to figures below.

When employ protection cover, the 80% power de-rating is required at mounting A only.



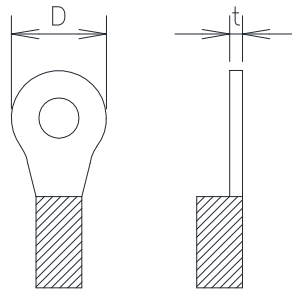
6. Wiring Method

- (1) TEP designed as Factory wiring only. No field wiring allowed.
- (2) The output load line and input line shall be separated, and use all lines as thick and short as possible to make lower impedance. The output load line(+/-) and input line(+/-) shall be twisted or use shielded wire to improve noise sensitivity. Also, please pay attention for Voltage/Temperature rating of wire.
- (3) Noise can be eliminated by attaching a capacitor to the load terminals.
- (4) The recommended wire type, torque and crimp-type terminal :

	Recommended Wire	Recommended torque	Recommended crimp-type terminal		
			D (MAX)	t (MAX)	Mounting pieces (MAX)
TEP200-280	AWG14-22	Terminal M4 Screws 1.0N·m (10.2kgf·cm) - 1.2N·m (12.2kgf·cm)	6.8mm	0.8mm	2 piece

Note 1: When using separate loads, use of two pcs. of 0.8mm thick crimp-type terminal is recommended.

Note 2: For recommended diameter, refer to wire maker recommended allowable current and voltage drop.



7. The life expectancy

The life expectancy of the power supply is 5years.

The life of the power supply depends on the life of the built-in aluminum electrolytic capacitor.

The life expectancy is not a guaranteed value, please consider as a reference.

Please do not use the product which passed over the life expectancy.

There is a risk of unexpected output shutdown and specifications may not be satisfied.

Please contact us for maintenance or exchange the product which passed over the life expectancy.

8. External Fuse Rating

Surge current flows when input turn on. Use slow-blow fuse or time-lag fuse. Fast-blow fuse cannot be used.
Fuse rating is specified by inrush current value at input turn on.
Do not select the fuse according to actual input current (rms.) values.

TEP employs internal fuse as 0508001MXEP (Little Fuse) 1000V1A rated Fast blow/High braking type.
Select the fuses which have more surge current capability.
Please consider protection coordination for selecting fuses.

9. Before concluding that the unit is at fault...

Before concluding that the unit is at fault, make the following checks.

- (1) Check if the rated input voltage is connected.
- (2) Check if the wiring of input and output is correct.
- (3) Check if the wire size is not too thin.
- (4) Check if the output current and output power does not over specification.
- (5) Audible noise can be heard when input voltage waveform is not DC.
- (6) Audible noise can be heard during Dynamic-Load operation.
- (7) Ensure that a large capacitor is not connected on the output side.

When large capacitor fitted, due to charging current, OCP might operate.
And the OCP duration exceeds 250ms, TEP will shut the output off.

10. Warranty Period

Warranty Period applies 5years.

Condition: Ambient Temperature 40degC, average load is 80 %(160W)

Do NOT use over warranty period. Regular maintenance recommended.

Following cases are not covered by warranty

- (1) Improper usage like dropping products, applying shock and defects from operation exceeding specification of the unit.
- (2) Defects resulting from natural disaster (fire, flood etc.)
- (3) Unauthorized modifications or repair.

11. Safety instruction (Reference Only)

TEP is NOT approved by safety. Also, NOT designed to meet full Safety requirement.

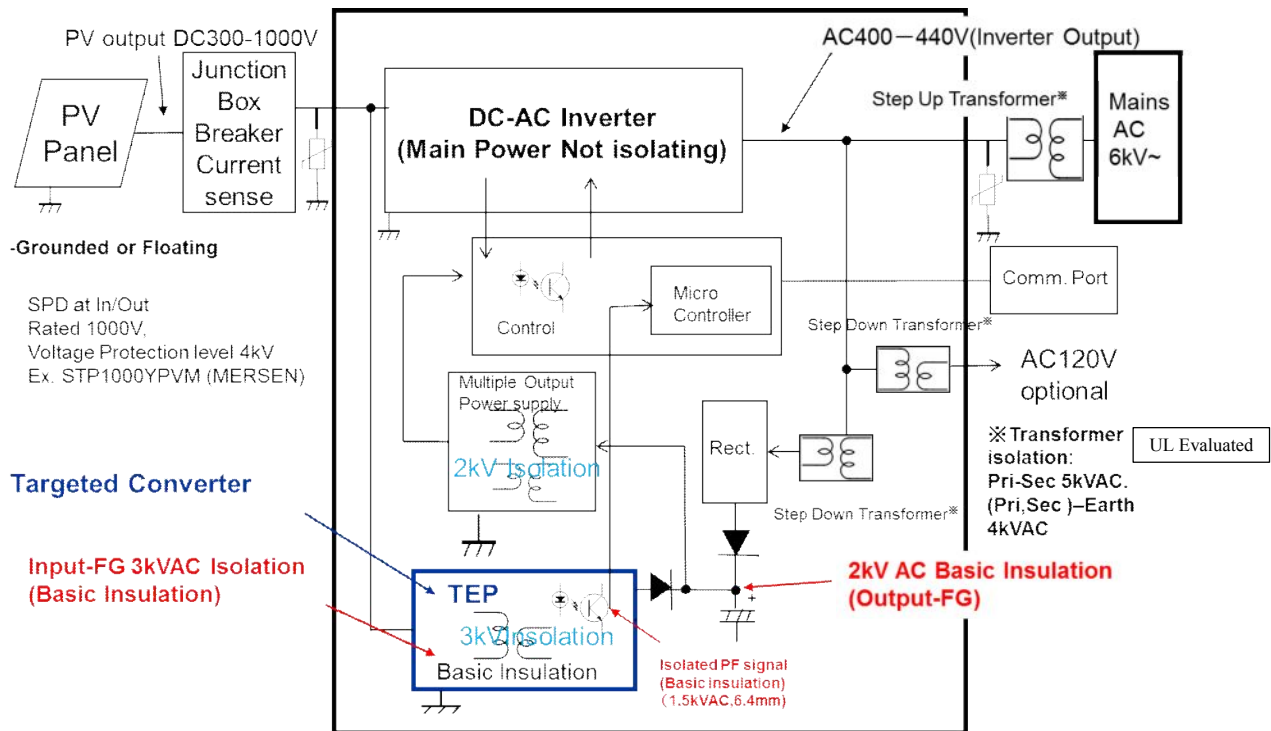
TEP is a DC-DC converter intend to be used with an end product utility interactive inverter intend for photo-voltic input from PV arrays which have maximum Array Short circuit current 3092A .

The end product is an isolated type and provides a 440V three phase output with maximum voltage of 254V (L-N).

TEP have the following characteristics.

- Open type intend for use in end product enclosure
- Intend to be used in end product inverter
- Intend to be used with UL evaluated Galvanic Isolation via Transformer at AC mains
- Intend to be used with UL evaluated Surge Suppressor on DC input (Rated1000V)
- Factory wiring only
- No User Accessible circuits(Basic insulation present only between input and output circuits and line circuit to Earth GND)
- To be evaluated as Recognized Component—QIKH2-US Only

Typical Application



Impulse Surge Capability:

PV side: TEP employ leaded MOV (B72225S4751K1 EPCOS) inside.

When required surge capability, please consider at application NOT apply over voltage in TEP PV side.

TEP require External SPD(STP1000YPVM Mersen) in PV side.

Output side: TEP employ leaded MOV(B72210P2321K1EPCOS). This absorber aim to provide to clamp the surge voltage less than 600V. However, the absorber can NOT clamp the surge voltage when surge current is higher than a tens ampere's. So, when require higher capability of surge, please consider in application NOT exceeding 500V in TEP output.

TEP should be tested with condition in customer end products.

So, the surge capability should be tested in END products. And NOT TEP alone.

END of Instruction Manual.