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Power Supply Device (KLTE-430D) Installation & Operation Manual



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Precautions for Installation and Operation

1. In case surge protector of this product runs out in lifecycle, and warning occurs, ask for repair service, and upon repair service, be sure to take protective action regarding lightning and surge protection/insulation.
2. The AC input ports of this product use ACL (Hot Line), ACN (Neutral Line), and PE (Power Earth Line). Ensure that the input cables connect to the properly marked terminals of the product by checking the phase of applicable site when connecting AC input cable. Otherwise, product functional features may fail.
3. In this product, surge protector is wired ahead of the KLTE-430D AC breaker. Application of an excessive surge beyond rated capacity may trip the circuit breaker within the distribution box. To prevent distribution box breaker from tripping, install distribution box breaker beyond the rated capacity.
4. Excessive vibration or shock applied during transport of this product may lead to product damage and possibly secondary damage. Take caution to keep the product away from excessive vibration and shock.

5. Connect the AC input cabling only after installing all other cables and wiring to this product (including any external battery banks).

When an external battery is used, exercise extreme caution connecting to the battery terminals as they are live voltages and can cause damage to the system and are hazardous to the operator.

NOTE: Manufacturer does not take any responsibility for any secondary problem occurring from damage of battery connector area.

An example of a secondary problem includes damage of battery output connector area due to short-circuit from connection of battery output connector area with reverse polarity of +/-.

6. If an external battery is used upon initial installation, the output of rectifier should be checked, and the battery NFB linked with rectifier be turned ON. If battery NFB is kept ON when rectifier does not put out data normally, battery lifecycle may decrease or be damaged due to battery discharge.

7. For this product, be sure to connect rectifier AC input PE(power earth line) and closure ground wire frame ground(FG) with external ground area.

NOTE: Our company does not take any responsibility for any secondary problem occurring from failure to connect with connector area.

An example of a secondary problem includes failure of surge protection element to operate upon application of external surge.

Other necessary precautions are explained in applicable installation and product description.

1. Specifications

1.1 Input characteristics

- 1.1.1 AC Input voltage scope: 1Ø 220VAC ± 10%
- 1.1.2 Input frequency range: 57Hz ~ 63Hz
- 1.1.3 Power factor: 0.97 or greater (50~100% load)
- 1.1.4 Efficiency: 89% (at 65~100% load)
- 1.1.5 Line Regulation: ± 1% (0.53V)

Table 1. Distribution of AC

No	Port	Class	Capacity	Rated voltage	Remark
1	AC INPUT	NFB*	20A	220VAC	Main breaker
2	AC OUTLET		4A	220Vac	Isolated from AC INPUT 1KW Availability,maximum

1.2 Output characteristics

- 1.2.1 Rated DC output voltage:-53.3V ± 1% (50% load)
- 1.2.2 DC Output Current: 30A, max
- 1.2.3 Load Regulation : ±1% (0.53V)
- 1.2.4 Distribution circuit: DC -53.3V (3 Ports), battery EXT (1 port)

Table 2. Direct current distribution area

No	Port	Class	Capacity	Number of linked terminals per NFB	Remark
1	DC OUTPUT L1	NFB*	15A	1	Breaker for RU
2	DC OUTPUT L2	NFB*	15A	1	Breaker for RU
3	DC OUTPUT L3	NFB*	15A	1	Breaker for RU
4	BATTERY EXT	NFB*	35A	1	Breaker for external storage battery

*NFB ('No-Fuse Breaker'), medium-acting type Circuit Breaker(s) should be applied.

1.3 Environment characteristics

- 1.3.1 Operating temperature scope: -30 degrees ~ +50 degrees
- 1.3.2 Operating humidity scope: 5% ~ 95%
- 1.3.3 High temperature storage temperature scope: +50 degrees
- 1.3.4 High temperature storage humidity scope: 5% ~ 95%

1.4 Safety rule

- 1.4.1 Lightning surge: Voltage 6KV(1.2 x 50us), current 3KA(8 x 20us)
- 1.4.2 Leakage current: 3.5mA or less(Measured at rated input/output condition)
- 1.4.3 Insulation internal voltage
 - Input - Case: 1,414 kVdc 10mA Cutoff
 - Input - Output: 2,121 kVdc 10mA Cutoff
- 1.4.5 High frequency electromagnetic interference (EMI): CISPR22 Class - A
- 1.4.6 Static electricity: KN 61000-4-2 model +/-2kV +/-4kV +/-8kV,
Contact model +/-2kV +/-4kV

1.5 Warning and protection function

- 1.5.1 Output high voltage protection function: Send out warning at -57.5V($\pm 0.2V$) scope
- 1.5.2 Output overcurrent protection function: Operates within 101% to 120% of maximum output current
- 1.5.3 Output short-circuit protection function: If output is short-circuited, all the functions of rectifier should be protected, and once the cause of short-circuit is removed, rectifier works back to normal.
- 1.5.4 Storage battery overdischarge protection function: Warning is sent out when storage battery voltage falls within the scope of $-44.0V \pm 0.2V$.

2. Packed condition and installation

2.1 Packed condition

This power equipment is shipped out in packed condition in rectifier system unit.

2.2 Transport

This power equipment may suffer from damage if severe shock or vibration occurs during transport. Take caution to keep the equipment away from shock or vibration. Also if the equipment is transported in a truck or other transporting vehicle, take action for rain.

2.3 Unpacking

Unpack the equipment at a place nearest the installed place. Take caution not to let any impurity enter the equipment.

2.4 Installation

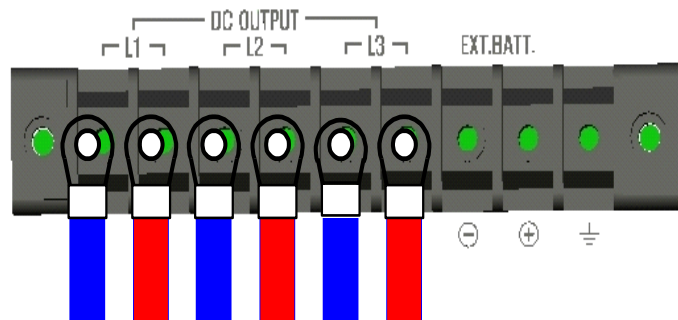
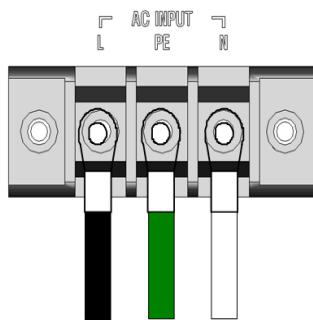
As for the connection of each part input, output, battery, alarm and ground, install the equipment in compliance with the instructions presented for each work. Take caution to keep away from short-circuit and reverse polarity etc when installing.

2.4.1 AC input wiring

1) Recommended wiring for single phase wiring

- a. Terminal block standard: 1Hole, M4, 10mm
- b. For N, PE, use of 3.5SQ or higher wires is recommended.
- c. Tightening torque should be 7.8 ~ 11.8Kgf rated scope. Tightening of a terminal with force beyond rated level may lead to terminal damage.

CAUTION - To guarantee surge protection and other product functions, be sure to connect N (Neutral) and PE (Power Earth) when wiring AC input section.



2.4.2 DC OUTPUT WIRING

1) Recommended wiring for DC OUTPUT wiring

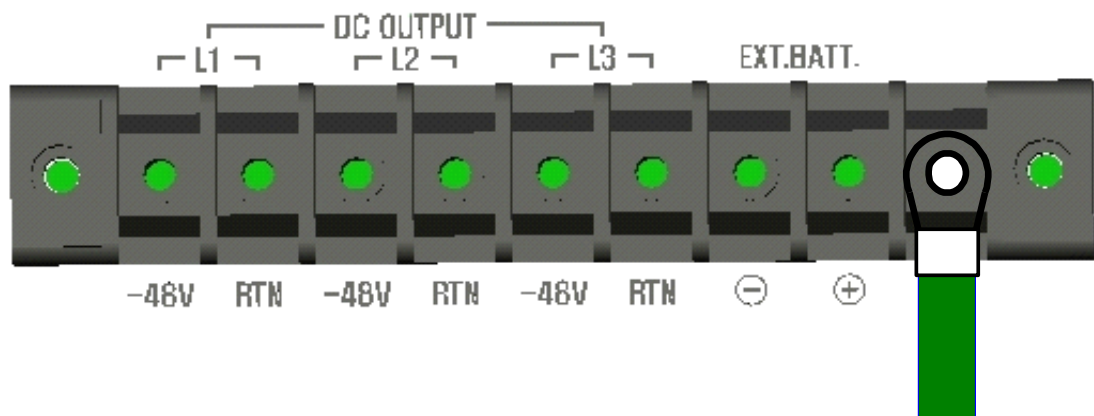
- a. Terminal block standard: 1Hole, M4, 10mm
- b. For -48V, RTN, use of wires 6SQ or above is recommended.
- c. Tightening torque should be 7.8 ~ 11.8Kgf rated scope. Tightening of a terminal with force beyond rated level may lead to terminal damage.

2.4.3 Ground wiring



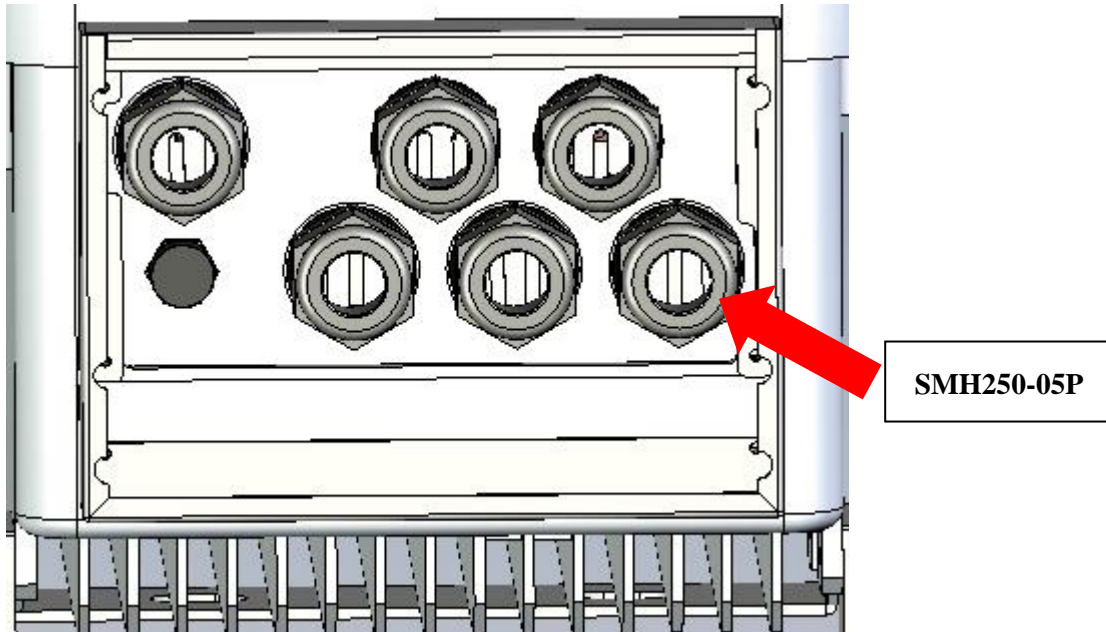
- 1) Recommended wiring for rack ground
 - a. Lug terminal standard: 14SQ 2Hole, M5, 22mm (Hole interval)
 - b. Wiring of 14SQ or above is recommended.
 - c. Tightening torque should be 10 ~ 13.5 Kgf rated scope. Tightening of a terminal with force beyond rated level may lead to terminal damage.

2.4.4 Communication ground wiring



- 1) Recommended wiring for communication ground wiring
 - a. Terminal block standard: 1Hole, M4, 10mm
 - b. As for communication ground wiring, use of 6SQ or above wires is recommended.
 - c. Tightening torque should be 7.8 ~ 11.8 Kgf rated scope. Tightening of a terminal with force beyond rated level may lead to terminal damage.

2.4.5 Connecting alarm cable

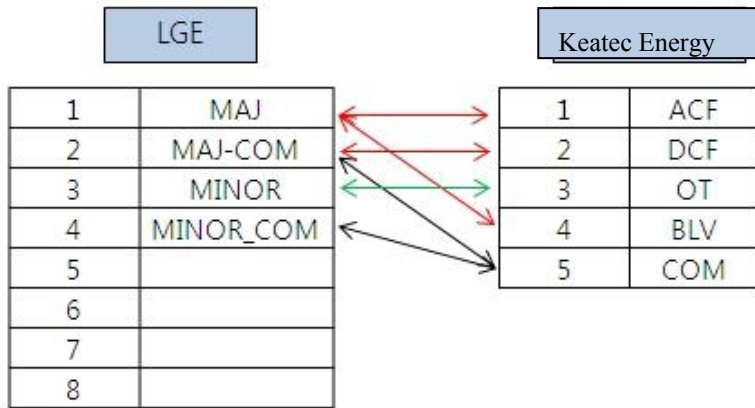


1) Connecting cable

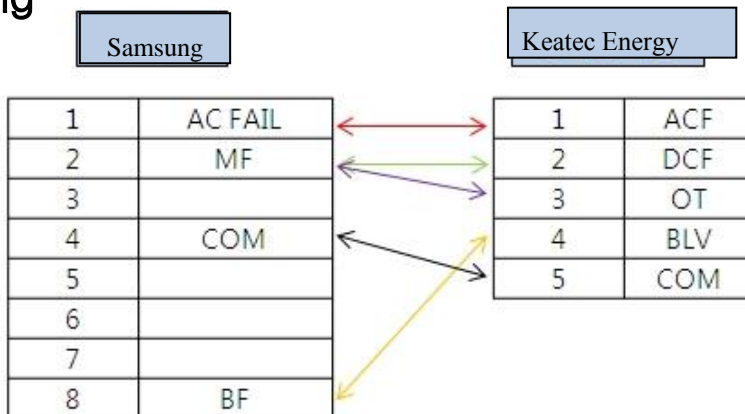
Pin number	Connection contents	Connector standard
1	ACF	SMH250-05P
2	DCF	
3	OT	
4	BLV	
5	COM	

Assignment of alarm pins by companies

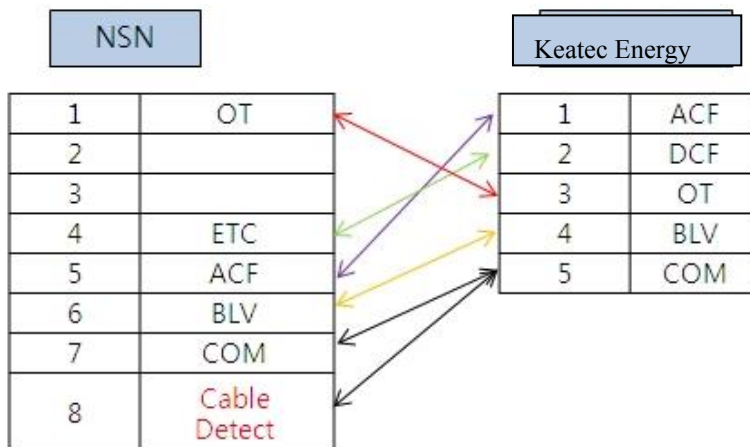
LG



Samsung



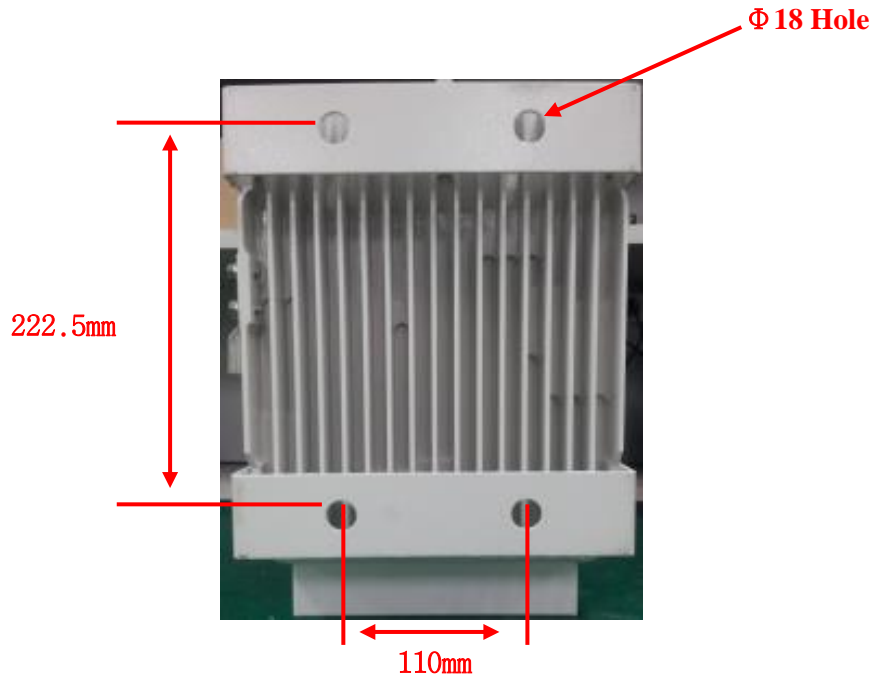
NSN



2.4.6 Installing Rectifier

Install the product in the procedure shown in the figure below.
Tightening with excessive torque and bolt longer than the material installed on original product may lead to problems such as product damage and waterproof function failure by fracture of insert hole. Take caution not to tighten with excessive torque or use long bolt.

Total weight of rectifier: 13kg



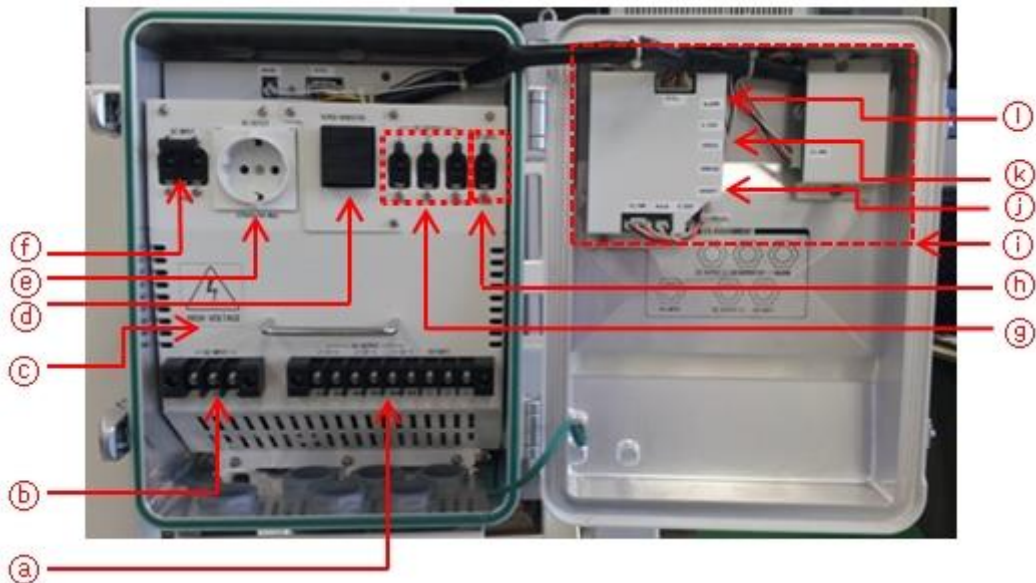
Mount rectifier on the fixing hole at the back of rack with M14 or above bolt.

3. Rack and module major parts, operation method and maintenance

3.1. Rectifier



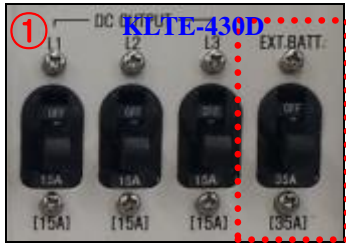
Status abnormality display etc
Green: Normal
Red: Fail



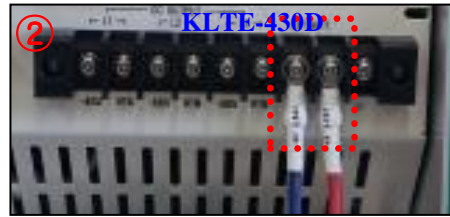
- Ⓐ DC output terminal consists of DC output 3-port (L1,2,3) battery and external connector. Rectifier also comes with one terminal for communication ground.
- Ⓑ AC input terminal is the terminal block to connect the 220V AC, and includes Power Earth ground (PE) terminal.
- Ⓒ Rectifying module delivers DC -53.3V/30A by receiving single phase 220 VAC input. The module is independently operated and is embedded with control module functionalities.
- Ⓓ Surge protector protects the rectifier from either direct or indirect lightning strikes.
- Ⓔ AC outlet is a 220VAC outlet port, and can be used for up to 1kW total capacity.
- Ⓕ AC NFB (circuit breaker) that decouples the AC via overcurrent; designed for 20A capacity.
- Ⓖ DC OUTPUT NFB is a circuit breaker that can decouple the DC output. A rectifier includes 3 DC output NFBs of 15A capacity.
- Ⓗ Battery NFB is a circuit breaker with 35A capacity that can decouple external battery power.
- Ⓘ Control module control board consists of control board and DC-DC converter power.
- Ⓙ Rack temperature sensor is a cable with a temperature sensor that measures the temperature of the Rectifier module portion
- Ⓚ DEBUG connector is port used for Rectifier System configuration and local status. The DEBUG port is not used during normal operation.
- Ⓛ Alarm transmission connector consists of alarm connector(SMH250-05P) that transmits data outside.

3.2 Connecting external battery

(CAUTION: When an external battery is used, the battery is connected with the use of the battery already installed on the rack of KLTE-430. Install the battery in the connecting procedure below. Take caution on the polarity of the terminals in particular when connecting.



1) Turn OFF external battery breaker



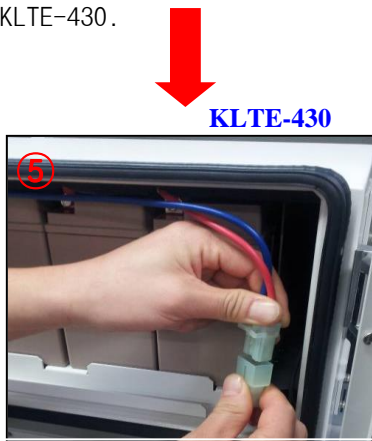
2) Connect external battery to terminal.



4) Turn OFF the external battery breaker of KLTE-430.



3) Connect the battery cable that came out of the external battery terminal of 2) KLTE-430D in the above figure to the external battery terminal of KLTE-430. (When connecting, match to the same polarity)

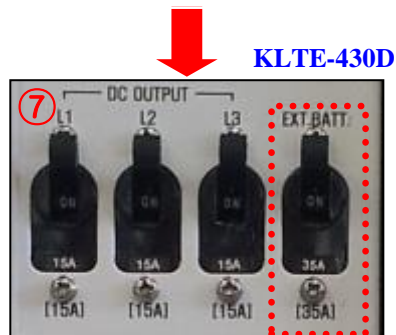


5) Plug the connector located at the right side of KLTE-430 storage battery.



6) KLTE-430 EXT BATT ON

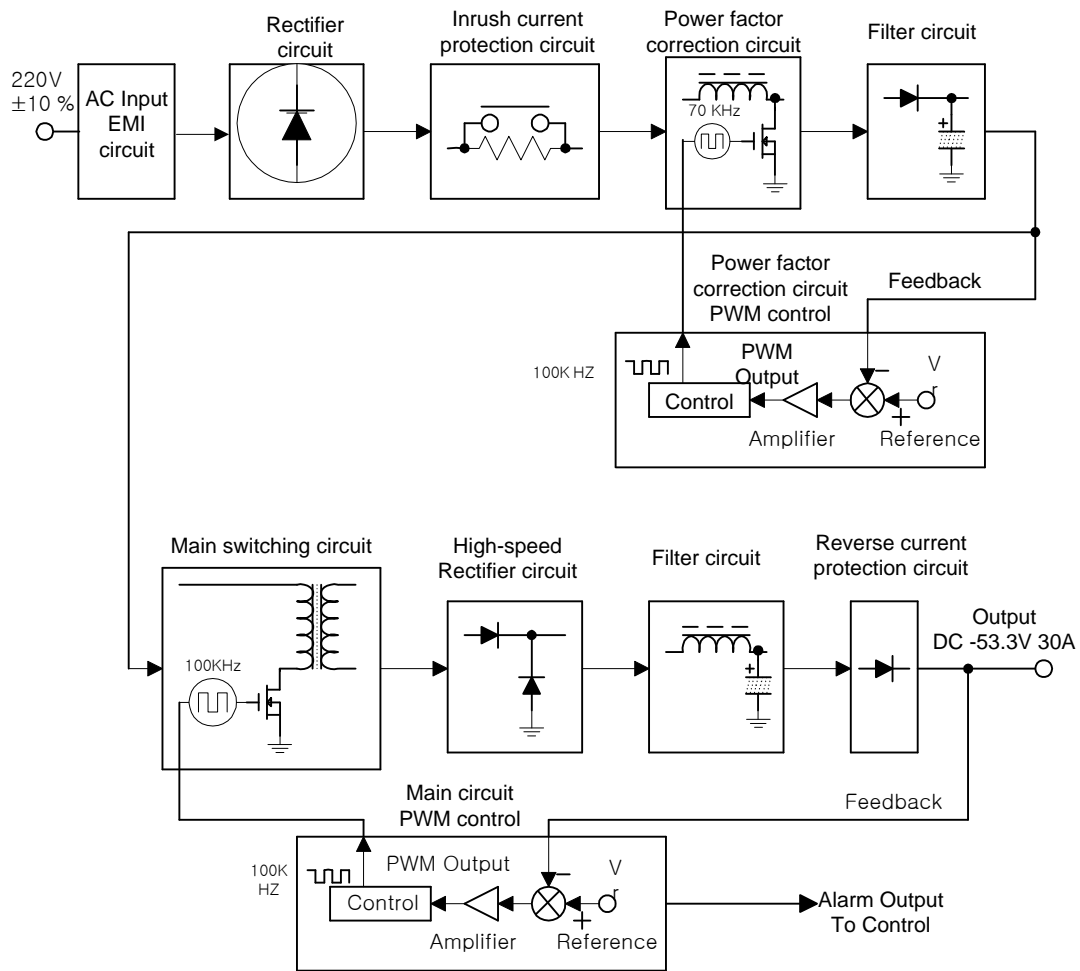
7) Turn ON the external battery terminal of KLTE-430D.



4. Rectifying module (KLTE-430D)

4.1 Mechanism of rectifying module operation

The rectifying module receives as input power compensation circuit that drives pulsating current rectified through bridge diode after being supplied with AC input single phase 220V power, and the DC output voltage(DC400V) of power compensating circuit receives high frequency as input and converts it as AC current of high frequency(80MHz). Each part operates as follows:



The schematics of rectifying module

4.2 Rectifying module circuit

4.2.1 Input circuit

The Input circuit consists of circuit breaker-protected 220V AC delivered through a filter then a rectifying circuit that converts the 50Hz~60Hz sinusoidal AC to pulsating (100Hz~120HZ) DC. The DC is then fed into a Power Factor Correction (PFC) circuit.

4.2.2 Rush current protection circuit

Rush current protection circuit is a circuit that restricts high capacity peak current that flows through input capacitor the moment input switch is turned ON.

4.2.3 Power factor improvement circuit

The rectifying circuit of condenser input style drops power factor by flowing condenser charged current, and power improvement circuit is a circuit that converts such dropped power factor to sine wave current. Power improvement circuit consists of voltage elevating choke, switching element(FET), rectifying diode, output capacitor and control circuit. Each circuit operates as follows:

1) Voltage elevating choke

This choke serves to accumulate and discharge energy. Specifically the choke accumulates energy when main switching element (FET) is turned ON, and puts out the accumulated energy through diode when main switch(FET) is turned OFF.

2) Switching element(FET)

Switching element is a semiconductor element that chops pulsating current voltage to high frequency(100 kHz), and converts AC current peak to PWM pulsating current, voltage- reducing by the turns ratio of the main transformer..

3) Output diode

This diode is an element that delivers to output port the energy accumulated in the ourput inductor/choke when main switching element (FET) is turned OFF.

4) Control circuit

Control circuit is a closed-loop circuit that turns main switch(FET) ON/OFF at 100 kHz. This circuit puts out square wave pulse by comparing pulsating current voltage, and output voltage, and chopping wave.

4.2.4 Filter circuit

Filter circuit is a circuit that filters high frequency pulsating current to direct current.

4.2.5 Main switching circuit

Main switching circuit consists of the following:

1) High frequency wave switching part

This part is a circuit that turns ON/OFF(PWM) output voltage(DC400V) of power factor correction (PFC) circuit through primary coil of transformer. To reduce voltage stress, direct current element (FET) is used.

2) Main Transformer

Transformer is an element that induces primary power to the secondary, and is configured in ON-ON method that delivers power to across the secondary when the main switching element (FET) is turned ON.

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4.2.6 High speed rectifier and filter element is composed of a diode that rectifies high frequency counter-electromotive force delivered from the transformer secondary (as a square wave voltage) then filtered for a cleaner DC voltage.

4.2.7 Counter-current protection circuit

This circuit is organized to ensure that the rest of rectifying modules can put out data normally in case abnormality occurred to one rectifying module during operation of multiple rectifying modules in parallel. To that end, this circuit utilizes diode at the final output terminal of rectifying module.

4.2.8 PWM control and protection circuit (Power factor improvement part)

The PWM control of power factor improvement part consists of PWM control circuit and PWM protection circuit. PWM control circuit controls the ON duty of switch(FET) so that input current may flow at 100 kHz(within 120 Hz) and be converted to sine wave current. To that end, the control circuit compares the output voltage(DC400V) and input pulsating current voltage and current waves, changes pulse ON duty of control part output to 10% to 90% PWM, and chops pulsating current voltage to 100 kHz within 120 Hz. PWM protection circuit protects rectifier output by shutting it down when the output flows at low voltage (below 300V) due to abnormal feedback loop and element.

4.2.9 PWM control circuit (Main circuit part)

This circuit is composed of feedback circuit that controls output voltage, driving circuit that drives main switch, and soft start circuit that removes transient phenomenon upon start-up. As for operating mechanism, this circuit compares reference voltage, output feedback voltage, and sinusoidal wave, puts out 100 kHz pulse, amplifies it in driving circuit, and controls the duty ratio of main switch.

4.2.10 Protection circuit

Protection circuit is composed of current limiting circuit that limits current when output current is elevated, over voltage shutdown circuit that stops output when output reaches high voltage due to failure of feedback, and circuit that transmits warning when no output is produced.

4.2.11 Warning transmission circuit

This circuit is a circuit that transmits the abnormal status occurring in rectifying module to the control unit. The circuit transmits warning in case rectifying module experiences abnormality like output overvoltage, short-circuit status, storage battery overdischarge, abnormal alternating current input(static electricity beyond tolerant scope)

5. Control PCB module (KLTE430D-CTL)

Control PCB module is mounted within rectifying module.

See Attachment: KLTE-430D control & operation MANUALpdf