DIGITAL BATTERY CHARGER CONTROLLER

FDCH-series

Manual

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1. Introduction

FDCH series, developed by HANMI TECHWIN, are the digital battery chargers used for charging the storage batteries for emergency power source.

Recently, the miniaturization with high performance and switch-over to cordless ones of electronic devices are in progress actively, and storage batteries are getting popular their driving power source.

In this case, the main requirements to the storage batteries are the stability, high energy density per unit volume or unit weight, long life and the feasibleness of discharge against current.

FDCH series have been designed in order to meet the characteristics of the above storage batteries and various economical requirements by digital control.

2. Characteristics

① Full Digital Battery Charging System

This battery charging system has been designed as programmable software using full digital system which has enabled us to minimize the size of control board.

Thus, the reliability and stability have been much improved, and the whole system has been minimized and lighter. And also, maintenance becomes easy.

② Simple Operation

The surrounding circuits are designed to meet the capacity, voltage and kind of a storage battery and all functions are operated automatically. And therefore, the operation is done by only turning on the main switch.

③ Operation status display function

It is easy to identify the operation status by displaying operation status information and fault status by LED. So it is easy to handle and improve the water conservancy.

④ Static Current, Static Voltage Charging Method

At the initial stage, the storage battery is charged with static current and at the close, the charging method is changed automatically to the static voltage charging

⑤ Perfect Protection

This system has the perfect protection capable of handling over current, over charge, over discharge and power failure.

Also, since the electronic thermal function is inside the system, there is no need for an outside thermal relay.

⑥ Improved Reliability

Input and output control parts are electrically divided by a photo coupler to avoid being influenced by noise. Therefore, the reliability is improved.

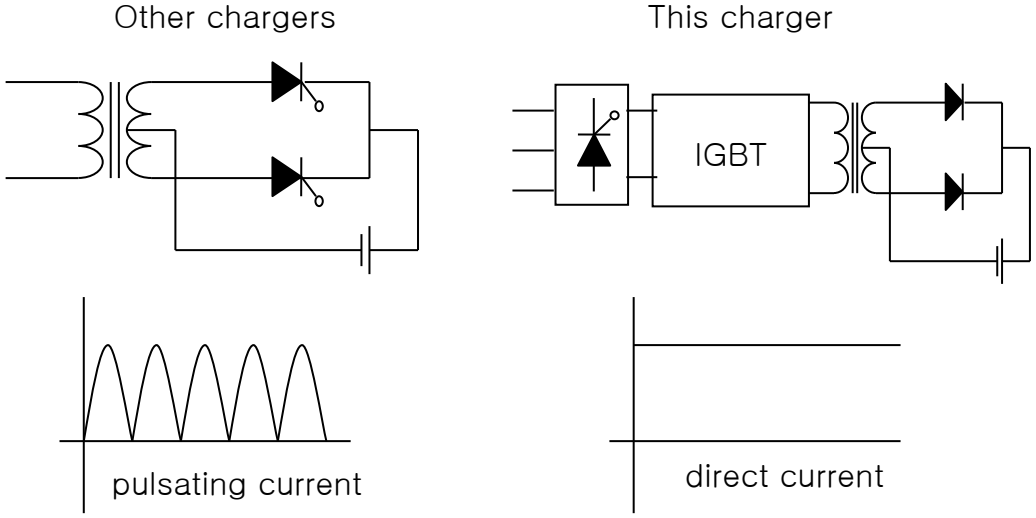
⑦ Use microprocessor unit

Using the programmed MPU (Micro Processor Unit), Intelligent Battery Charger using self-diagnosis function and protection function was realized.

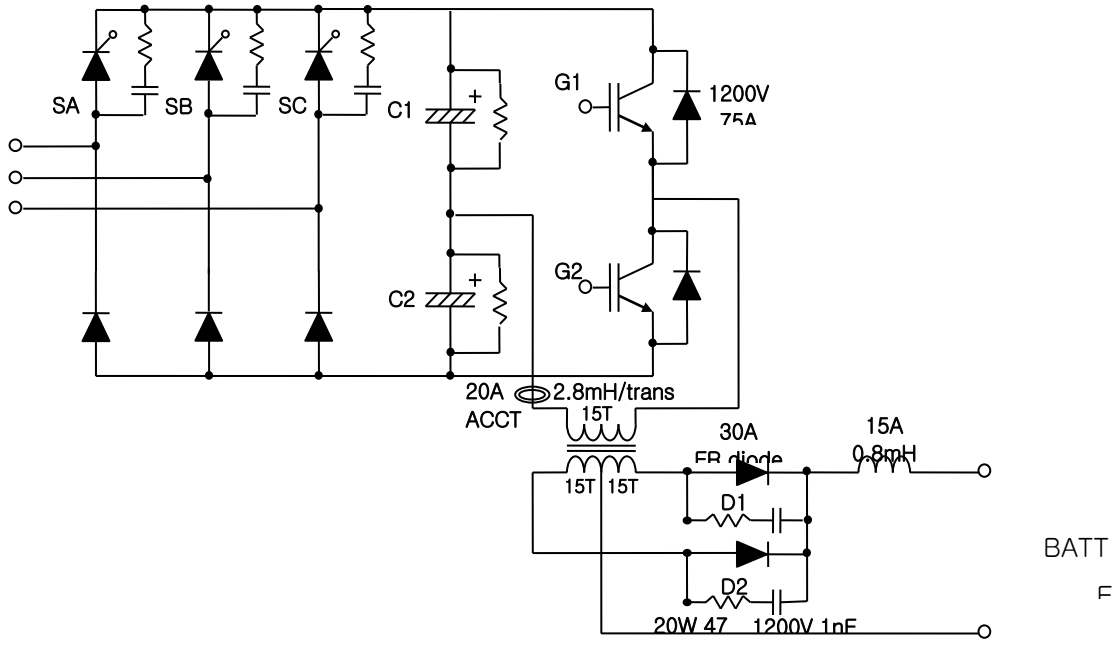
⑧ Using switching charging method

Switching type charging method using IGBT was used to make it smaller and lighter than a copper charging device using other methods. Generally, it is more advanced charging type than SCR type charger using pulse waveform. The input three-phase AC power is rectified, and the rectified DC is switched at high speed (about 18 kHz / sec) and digitized. It is a battery charging method designed to regulate voltage and current.

The figure below compares the charging circuit with the power circuit of this charger using an IGBT with another charger using SCR.



3. Power circuit



① Three Phase Semi-Converter

The power device Semi-SCR rectifies the input AC power in the steady state to supply power, and serves to cut off the input voltage in the event of anomaly detection.

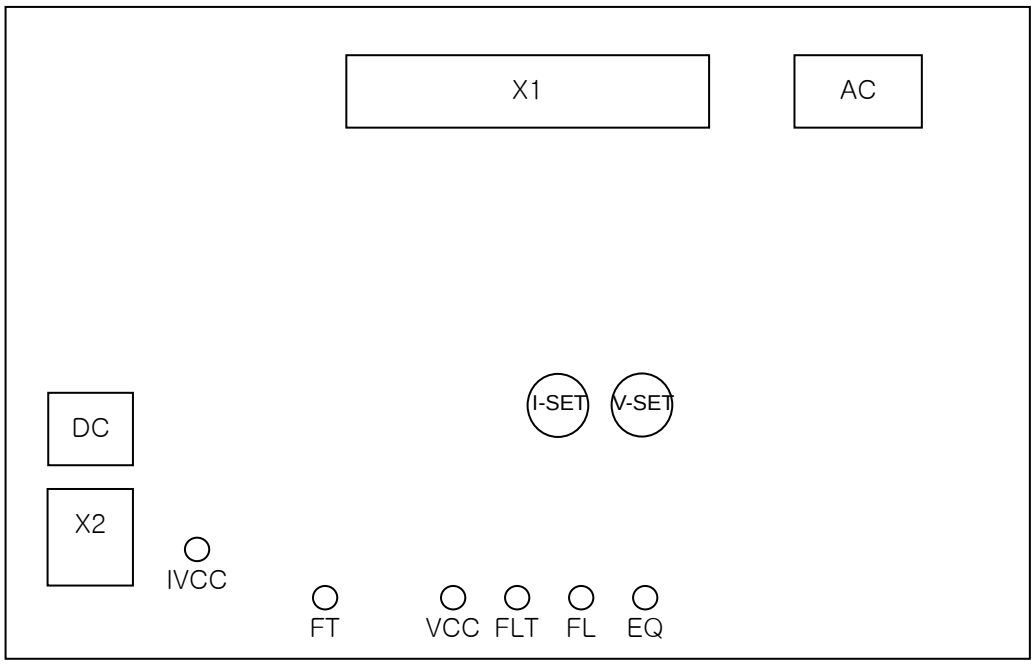
② High-speed switching using IGBT

The DC power rectified by the Semi-SCR is charged into the electrolytic capacitor, and the charged DC power is switched at high speed using IGBT G1 and G2 to regulate the current charged in the battery. In the IGBT operation, a voltage and a current waveform are formed in the primary side of the transistor on the G1 side in the forward direction and on the G2 side in the reverse direction.

③ Rectification by DIODE

The forward and reverse voltage and current waveforms of the primary side of the trans- former are rectified in the positive direction by the DIODE D1 and D2 of the secondary side of the trans- former. The positive voltage and current correspond to the charging voltage and charging current of the secondary battery.

4. Control board configuration diagram



4.1 X1 terminal : Control Power

X1-1 : IGND , X1-2 : OH , X1-3 : VC , X1-4 : VB , X1-5 : VA
X1-6 : KC . X1-7 : GC , X1-8 : KB , X1-9 : GB , X1-10 : KA
X1-11 : GA , X1-12 : IO , X1-13 : IO , X1-14 : S2 , X1-15 : G2
X1-16 : S1 , X1-17 : G1 , X1-18 : PC , X1-19 : NC

4.1.1 Heat sink overheat detection

If the temperature of the heat sink installed on the heat sink is above 85 ℃, it will be shorted between OH and IGND terminals. During operation, the fault signal 'overheat' is output and the output continues to be output.

4.1.2 Phase detection

SCR is determined by phase detection and frequency detection from the voltage between R and S and the voltage between S and T among the input R, S and T phases. When the order of the input R, S, and T changes, there is a function of controlling the order of change in accordance with the order.

If input power is not supplied or R, S, T phases are disconnected and AC input power between terminals X1-3, X1-4 and X1-4, X1-5 is not applied, it sends a fault signal ‘blackout’ and waits for AC input signal. A fault signal ‘blackout’ is sent during operation and the output stops.

4.1.3 SCR GATE GROUP

The terminals X1-6 to X1-11 are the gate driving part of the power device Semi-SCR and apply the gate-trigger signal in a predetermined order between the gate (G) and the cathode (K) of the SCR.

When the line voltage between the VA, AB and AC terminals of the input power sources R, S and T is inputted, the DC power rectified through the semi-converter is softcharged by the electrolytic capacitor by the driving operation of the power device Semi-SCR. The power device Semi-SCR rectifies the input AC power in the steady state to supply power, and serves to cut off the input voltage in the event of anomaly detection.

4.1.4 Current detection

The ACT (AC Current Transformer) installed on the primary side of the high frequency transformer detects the input current proportional to the battery charge current. The input current flowing to the primary side of the high frequency transformer is detected between IO terminals to control the battery charging current.

If an overcurrent is detected between terminals X1-12 and X1-13 during operation, the fault signal 'overcurrent' is output and the output stops.

4.1.5 IGBT GATE GROUP

The X1-14 to X1-17 terminals are gate drive parts of the power device IGBT, and apply a gate switching signal in a predetermined order between the gate (G) and the emitter (S) of the IGBT.

The three-phase AC power source input by the power device Semi-SCR is rectified, and the DC current rectified by the IGBT is switched at high speed to control the current charged in the battery.

4.1.6 Battery voltage detection

Battery output PC detects voltage at both ends of NC and controls battery charge voltage.

During operation, overcharge signal is output when overcharge detection occurs between X1-18 and X1-19 terminals, overdischarge signal is output when overdischarge is detected, and output is stopped.

4.2 X2 terminal: I / O terminal block

X2-1 : IGND , X2-2 : EQ , X2-3 : RESET , X2-4 : FT1 , X2-5 : FT2
X2-6 : C1 , X2-7 : C2 , X2-8 : FM1 , X2-9 : FM2

4.2.1 EQ input

The EQ command performs an equal-charge operation by short-circuiting the EQ input terminal. In order to select equal charge here, IGND and EQ terminals should be short-circuited, and this short-circuit time should be maintained for more than 2 seconds.

4.2.2 RESET input

External reset function, external reset and PCB internal reset. In order to perform a RESET, the IGND and RESERT terminals must be short-circuited.

4.2.3 FT(Fault relay) output

Short-circuit the fault relay when a fault occurs. This activates the Buzzer when a fault occurs and displays the fault status to the driver.

Here, the external wiring of the charger uses the control source DC220V or DC110V between the terminals FT1 and FT2.

4.2.4 FT(Fault relay) output

The terminals C1 and C2 are terminals for erasing the charging potential of the electrolytic capacitors C1 and C2.

In order to prevent malfunction due to uneven charging of the electrolytic capacitor after the rechargeable battery is operated or in the event of a malfunction, the battery is turned off when the input AC power of the charger is applied, and turned on when the AC power is off, thereby preventing uneven charging of the electrolytic capacitor.

Make sure that the MC (CM) on the charger input side is connected to the b contact. If connecting a contact, metal resistance for electrolytic capacitor erase may be damaged after input power supply.

4.2.5 FAN input power

The FM1 and FM2 terminals are the input power terminals of the FAN. Use the AC220V or AC110V power source that corresponds to the input power indicated on the FAN.

5. LED display and adjustment

Status	IVCC	FT	VCC	FLT	FL	EQ
	D40 LED	D19 LED RY1 RELAY	D17 LED	D6 LED	D35 LED	D4 LED
Blackout	○	○	○	X	X	X
Floating charge	○	X	○	X	☼	X
Equalizing charge	○	X	○	X	X	☼
Full charge	○	X	○	X	☼	☼
Overheat	○	X	○	☼	X	X
Overcurrent	○	○	○	☼	X	☼
Overdischarge	○	○	○	☼	☼	X
Overcharge	○	○	○	☼	☼	☼

※ LED Status (○ : ON , X : OFF , ☼ : FLASHING)

5.1 Status display

The current status is indicated by LED, which improves water retention and is easy to handle.

5.1.1 Blackout

When MAIN power is off or when there is a power failure, it indicates that the battery is in charge standby state and that it is 'power failure'.

5.1.2 Floating charge

MAIN When the power is turned on, the battery is floated, and the LED indicates that the charge status of the battery is 'floating charge'. The floating charge voltage is adjusted by the volume resistance V-SET, and the floating charge current is regulated by the volume resistance I-SET.

5.1.3 Equalizing charge

Equal charge is applied when EQ external input signal is applied and LED indicates that the charge status of the battery is 'Equal charge'. The equal charge voltage and the equal charge current are automatically set by the floating charge set value, and are automatically switched to the floating charge state after 6 hours of equal charge time.

5.1.4 Full charge

When the charge current of the battery becomes less than 10% of the set current, the LED indicates that the charge status of the battery is 'full charge'.

5.1.5 Overheat

When the heat sink temperature exceeds 85 ° C in the temperature sensor installed on the charger heat sink, the LED emits a fault signal 'overheat' and outputs the output continuously.

5.1.6 Overcurrent

When the charge current of the battery is more than 150% of the set current, the LED displays the fault 'overcurrent' status and stops charging.

Here, the set current refers to the current value set by the current setting I-SET at the time of constant current charging at the initial stage of the floating charge.

5.1.7 Overdischarge

When the output voltage of the battery and the charging voltage become less than 75% of the set voltage of the floating charge, the LED displays the fault signal 'over discharge' and stops charging. Here, the set voltage refers to the voltage value set by the voltage setting V-SET during the constant voltage charging at the end of the floating charge.

5.1.8 Overcharge

When the output voltage of the battery and the charging voltage become 105% or more of the equal charging voltage, the LED displays the fault signal 'overcharge' and stops charging.

5.2 Adjustment

The battery can be charged only by adjusting the charging voltage and the charging current, so it is easy to use and easy to handle.

5.2.1 Voltage adjustment (V-SET)

Charge voltage adjustment during battery charge can be adjusted by variable resistor V-SET.

The voltage adjustment can be done by adjusting the charge voltage during floating charge. Since the charging characteristics of the charger are soft charging, it takes some time to operate the charging voltage with the set voltage. Therefore, it is necessary to watch whether the charge voltage operates at the set voltage. Adjust the variable resistor so that the charge voltage does not exceed the set voltage. Turning the potentiometer clockwise increases the set voltage, and turning it counterclockwise decreases the set voltage.

If the charging voltage is higher than the set voltage, the operation will not cause an abnormality. However, continuous charging of the rechargeable battery may occur.

Generally, the charging voltage curve of a battery gradually increases to a set voltage at a charging voltage at the initial stage of charging. At the end of charging, constant voltage charging is performed with the set voltage.

5.2.2 Current adjustment (I-SET)

When charging the battery, the charge current adjustment can be adjusted by the variable resistor I-SET.

The current adjustment can be done by adjusting the charge current during floating charge. Since the charging characteristics of the charger are soft charging, it takes some time to operate the charging current with the set current. Therefore, it should be watched whether the charge current operates with the set current. Adjust the variable resistor so that the charging current does not exceed 10A. When the variable resistor is turned clockwise, the set current becomes large. When the variable resistor is turned counterclockwise, the set current becomes small.

When the charging current is operated above the set current, there is no abnormality in the operation, but continuous charging of the rechargeable battery may occur.

Generally, the charge current curve of the battery gradually increases to the set current at the beginning of charging, reaches the set current, and charges constant current. At the end of charging, the charging current gradually decreases and a current lower than the set current flows, and a current of about 1A or less flows to the full charge state.

6. Characteristics of Storage Battery and Charging Method

6.1 Characteristics of Lead Storage Battery

The general operation of a battery is divided into discharge and charge. The discharge capacity (AH), the discharge current (A), the discharge time (Hr), and the time rate (HR)

Charging voltage, charging current, charging time, temperature, etc. should be considered when charging.

The following describes the general characteristics of the battery. For more information, please refer to the battery manufacturer's catalog.

6.1.1 Capacity (AH)

The capacity of a battery (AH) refers to the total amount of electricity that can be drawn out when the battery is continuously discharged at a constant current. Is represented by a value obtained by multiplying the discharge time (Hr) by the magnitude of the discharge current (A).

① As the discharge current ratio increases, the total amount of electricity available is reduced. That is, the capacity (total electricity quantity) changes when the discharge current increases even in the same type of battery, which is the capacity characteristic of the battery. For example, it is not possible to discharge a battery capable of discharging for 20 hours (H) at 5A to 20A for 5 hours.

② The notation for capacity may also be expressed as a time rate (HR). For example, 100AH / 20HR and 80AH / 5HR for a 100AH product.

③ The change of the capacity according to the temperature is due to the difference in the reaction speed depending on the temperature of the battery, so the lower the temperature, the smaller the capacity. For example, a 100% battery at 25 ° C is reduced to 76% at −5 ° C, as it is typically reduced by 0.8% per 1 ° C

6.1.2 Autonomous discharge

Refers to a voltage characteristic until the voltage reaches 1.75 (V / cell) by continuously discharging at a relatively small current. The change of the voltage is small at the initial stage of the discharge, but rapidly decreases at the end of the discharge.

6.1.3 Relationship between capacity, discharge current, and discharge time

For the capacity, discharge current and discharge time, please refer to the discharge characteristic chart in the catalog of the battery manufacturer.

6.1.4 Typical charging characteristics

If the battery is continuously charged with the charging current and the charging voltage while the battery is discharged, the charging current is rapidly charged up to 80 ~ 90% of the capacity of the battery, and the charging current is gradually lowered when charging the remaining 10 ~ 20%. Therefore, it takes a considerable time to fully charge.

① Even if the battery charge voltage reaches the set voltage, the battery may not be fully charged. That is, it is in a state where no full charge has been transferred.

② If the battery charge voltage is higher than the set voltage, even if the battery is fully charged, the charge current is continuously supplied, which affects the life of the battery and shortens the service life. Therefore, charging over the set voltage is very dangerous because the battery is overcharged.

③ It is difficult to know the charging time because the time required for the capacitor to reach the set voltage or full charge differs depending on the discharged amount.

④ For the relationship between the capacity of the battery and the charging current, charging time, temperature, etc., please refer to the charging characteristic chart in the catalog of the battery manufacturer.

6.1.5 Storage battery management

Proper maintenance and regular inspections of the batteries can affect the life of the batteries.

① Check the tightening condition of the connecting wire bolt and the terminal contact condition of the battery.

② Check the charge status of the battery and check whether or not the equal charge is set.

Closed-cell batteries should not be equally charged.

③ Check that the voltage deviation between the cells of the battery or between the batteries is not large.

④ Make sure that the charge current and charge voltage of the battery are not higher than those of the battery.

⑤ The upper limit of the temperature of the battery being charged is 45 ° C. If the liquid temperature exceeds 45 ° C during charging, the charge current and charge voltage should be lowered or the charge must be temporarily stopped to lower the liquid temperature.

⑥ If the electrolyte of the battery is frequently dry and heat is generated, the charge current, charge voltage, or electrolyte is insufficient. If everything is normal and this happens frequently, the battery has reached its end of life and should be replaced with a new one.

⑦ Please refer to the catalog of the battery manufacturer for details on how to manage the battery.

6.2 How to charge the battery

The charging method of the battery is divided into floating charge and equal charge.

6.2.1 FL : Floating Charging

① The Battery charger is applied by connecting parallel to the load and the storage battery, and the discharge voltage of the storage battery due to self-discharging or the variation of the load is compensated. The battery charger voltage is adjusted equally to load voltage.

② The floating position of the selector switch (Floating/Equalizing) on the front panel should be selected.

③ During charging, don't do VR adjustment because voltage doesn't vary even though VR is adjusted. If VR is adjusted, the state of over charge or over discharge can appear and thus be careful about this.

④ Floating charge voltage = Storage Battery Voltage X 1.075

6.2.2 EQ : Equalizing charging

① In case of using several storage batteries in series for a long time, due to the difference in the self-discharging of each storage battery and so on, the voltage share of each cell becomes different and thus the storage battery can not show its performance fully and therefore, lead storage batteries need equalizing charging every 3 months.

② In general, the charge current is 1/10~1/20 [%] of the capacity of the storage battery but the large charge current shortens the life of the storage battery and thus, in case of our battery chargers, the charge current is adjusted to 3~5 [%] of the capacity of the storage battery in the factory.

③ The equalizing charge voltage is set 10 [%] higher than the floating charge voltage and the equalizing charge time is set to 4 hours.

7. Installation conditions and wiring

7.1 Installation conditions

① Places less than 1000 [m] above sea level

② Place where the ambient temperature is within -10 [℃] ~ +50 [℃]

③ Where there is no corrosive liquid or gas

④ Place without iron powder

7.2 Wiring

① Wire according to drawing.

② The wiring on the power supply main circuit is R-S-T order.

③ Disconnect the main circuit wiring and the control circuit wiring.

④ The ground terminal must be connected to the ground wire.

8. Commissioning and general checks

The commissioning and general check items should be checked in order of power supply, DC power, AC power, operation status check, and the following steps should be taken after solving the root problem in case of abnormality. If the problem can not be solved, please contact us and arrange for it to be resolved.

8.1 Before power supply

8.1.1 Battery check

① Ensure that the battery capacity and power supply are good.

② Check that the battery connection is correct.

8.1.2 Check input DC power

① Check that the input DC power supply is in good condition and the connection is correct.

8.1.3 Check input AC power

① The input AC power source should be used as a power source to charge the battery through the power device.

② Check that the input power is good and that the R-S-T connection is correct.

8.1.4 Check unit status

① Make sure that the input DC power supply is properly connected to PC-NC.

② Make sure that the input AC power source is properly connected to R-S-T.

8.1.5 Check PCB status

① Make sure that the input DC power is set correctly.

- J27, J28 JUMP PIN is shorted to DC 220V in the lower right part of the PCB, and JUMP is applied to DC110V.

② Make sure that the input AC power is set correctly.

- At the top left of the PCB, JUMP PIN is jumped to AC440V for AC 440V and to AC 220V for AC 220V.

③ Check SCR status as power-driven device.

- It is normal if the resistance value of KA-GA, KB-GB and KC-GC stages of the X1 terminal block on the left side of the PCB is several tens of Ω (depending on the capacity of the SCR). The measured value

should be within a certain value range at the same capacity. If the resistance value is 0 Ω or more, check whether it is defective or the connection is correct.

④ Check the status of IGBT which is a power driving device
- It is normal if the resistance value of G1-S1 and G2-S2 of the X1 terminal block on the left side of the PCB is more than several MΩ (depending on the capacity of the IGBT). The measured value should be within the specified range at the same capacity. If the resistance value is not 0Ω or more than MΩ, check if it is defective or the connection is correct.

8.2 After power on DC

8.2.1 Check battery DC power

① Make sure that the battery power is set correctly.

8.2.2 Check PCB status

① Check that the LEDs D17 (VCC), D19 (FT) and D40 (IVCC) are ON. Only the DC power is supplied to the unit. When the unit is in the normal state, the status of the LED is indicated as 'power failure'.
- If LED D17 (VCC) is OFF, check that DC voltage between D15 (-) and GND is + 7.5V.
- If the LED D19 (FT) and D40 (IVCC) are OFF, check that the DC voltage between D30 (-) and GND is + 7.5V.

② Check the power status
- VCC check: Check that DC voltage between D15 (-) and GND is + 7.5V.
- -VCC check: Make sure that DC voltage between D25 (+) and GND is -7.5V.
- IVCC check: Make sure DC voltage between D30 (-) and IGND is + 9V.

③ Check SCR status as power-driven device
- It is normal if the DC power of the KA-GA, KB-GB, and KC-GC stages of the X1 terminal block on the left side of the PCB is 0V.

④ Check the status of IGBT which is a power driving device
- It is normal if DC-4.5V of G1-S1, G2-S2 of the left X1 terminal block of the PCB.
- Check IGBT TURN ON voltage: Check that the DC voltage between D2 (-), S1 and D14 (-), S2 is + 14V.
- IGBT TURN OFF Check voltage: Check if DC voltage between D23 (+), S1 and D24 (+), S2 is -4.5V.

8.3 After applying AC power

8.3.1 Check input AC power

① Check that the R-S-T phase and power supply of the input AC power supply are correctly set.

② Check the permissible fluctuation range of the power supply voltage and the unbalance of the control power supply.

8.3.2 Check PCB status

① Check that the LED D35 (FL) is lit and D17 (VCC) and D40 (IVCC) are ON.

8.4 Check operation status

8.4.1 FL (floating charge) operation confirmation

① Check LED status indication: Check that LED D35 (FL) is lit and D17 (VCC) and D40 (IVCC) are ON.

② Confirm charging voltage: Make sure that the voltage across PC-NC is 1.075 times the battery voltage.
- The battery charge voltage is set to DC235V when DC220V.
- When the battery charge voltage is 110V DC, set it to 120V DC.

③ Check charge current
- The battery charge current should be set so that it does not flow more than 10A.
- Make sure the charge fits the normal charging characteristics.

④ The operation status is not correct or the DC output power is unstable.
- Check R, S, T phase and connection status of input AC power.

⑤ If a Fault Occurs During Operation
- If the fault status is displayed during operation, refer to chapter 8.5 Trouble Shooting Guide.

8.4.2 EQ (Equalizing charge) operation confirmation

① If the battery is sealed, do not charge it equally.

② EQ Apply external input signal.
- After confirming the state of charge of the battery, apply an EQ input signal in the unequal state.
- When the battery is of a closed type, it is preferable not to perform EQ (equal charging).

③ Check LED status indication: Check that LED D4 (EQ) is lit and D17 (VCC) and D40 (IVCC) are ON.

④ Checking the charging voltage: Make sure that the voltage across the PC-NC is 1.15 times the battery voltage.
- The battery charge voltage is set to DC250V when DC220V.
- When the battery charging voltage is 110V DC, set it to 130V DC.

⑤ Check charge current
- The battery charge current should be set so that it does not flow more than 10A.
- Make sure the charge fits the normal charging characteristics.

⑥ The operation status is not correct or the DC output power is unstable.
- Check R, S, T phase and connection status of input AC power.

⑦ If a Fault Occurs During Operation
- If the fault status is displayed during operation, refer to chapter 8.5 Trouble Shooting Guide.

8.5 Trouble Shooting Guide

The FDCH unit displays the operating status and fault status as LED status.

If a fault condition occurs, the FDCH unit displays a fault condition and remains on standby until the user confirms it.

Below is a description of the various fault conditions, their possible causes, and how to respond accordingly.

If the Fault condition persists despite the actions described above, please contact our company and get proper guidance.

8.5.1 Overheat

Possible causes :

① The temperature of the heat sink of the charger is over 85 ℃.

Action :

① Check for ambient temperature and air circulation.

② Check the temperature of the heat sink and the condition of the dust, and check the wiring of the temperature sensor attached to the heat sink.

③ Check if the fan is working properly.

④ Check that the battery has been overcharged for a long time, that the battery is in good condition, that the charging voltage and charging current are working properly.

8.5.2 Overcurrent

Possible causes :

① This fault signal is to protect the power device and the battery against instantaneous overcurrent.

② When the charge current of the battery becomes more than 150% of the set current, it displays fault condition and stops charging.

Action :

① Check if the set current is set correctly.

② Check the status of the battery and the connection of peripheral circuits, and check the charge status.

8.5.3 Overdischarge

Possible causes :

① This fault signal is to protect the battery against overdischarge.

② When the output voltage of the battery and the charging voltage become less than 75% of the set voltage of the floating charge, the fault is displayed and the charging is stopped.

Action :

① Check the status of the battery and the connection of peripheral circuits, and check the charge status..

② If the battery is over-discharged, turn the voltage setting V-SET counterclockwise to reset the voltage, and check if the battery is operating normally. If it still does not work, it should be operated in accordance with Section 8.6, "Caution and Precautions for Battery Discharge".

8.5.4 Overcharge

When the output voltage and charge voltage of the battery reaches more than 105% of the equal charge voltage, the LED displays the fault signal 'overcharge' and stops charging.

Possible causes :

① This fault signal is to protect the battery against overcharging.

② When the output voltage of the battery and the charging voltage become 105% or more of the equal charging voltage, the fault is indicated and the charging is stopped.

Action :

① Check the status of the battery and the connection of peripheral circuits, and check the charge status.

② Check that the setting voltage is set correctly. If the battery is overcharged, turn off the charger so that the voltage of the battery is set to the floating charge setting voltage, and then check the voltage of the battery and check the battery.

8.6 Precautions and precautions in case of overdischarge

8.6.1 Precautions and precautions in case of overdischarge

If the battery can not be charged by the charger due to over discharge of the battery, it can be charged by using DIODE MODULE. If you proceed in the following procedure, please proceed to the next step after troubleshooting each problem.

① Check if the AC power and DC power applied to the unit are OFF.

② Separate connection cable of X1-18 (PC), X1-19 (NC) terminal of PCB on a small flat-blade drive.
- Insulate the separated connecting cables with insulation tape so that they do not touch each other.

③ DIODE Configure the rectifier (REC1).
- If the DIODE rectifier is configured as an electric circuit of the magnet system, use it as it is, otherwise, use a DIODE rectifier to configure it.
- The DIODE rectifier is used for the power supply of the PCB, so the small capacity is irrelevant.
- Use single-phase AC 220V as the input power of the rectifier.
- Check whether the output power of the rectifier is DC 200V.

④ Connect the output power PP and N100 of the DIODE rectifier (REC1) to the X1-18 (PC) and X1-19 (NC) terminals of the PCB, respectively, using the connection cable.
- Be sure to check the polarity before connecting.
- PP should be connected to PC and N100 to NC. Otherwise, the PCB may be damaged.

⑤ DIODE Turn on the rectifier (REC1) and then operate in the same way as in Chapter 8, '8.2 DC power on'.

⑥ DC power is applied to the unit and AC power is applied.
- Work the same as in '8.3 After AC Power' in Chapter 8.
- Work the same as the '8.4 Checking the operation status' in Chapter 8.
- Be sure to check the charge voltage and charge current of the battery.

⑦ Charging continues until the battery output voltage reaches a voltage that can float (FL).
- Check the output voltage of the battery after turning off the AC power applied to the unit.
- Generally, the battery output voltage is more than DC175V when DC 220V, and DC 90V or more when DC 110V.

⑧ Turn off AC power, DC power, DIODE rectifier applied to UNIT.
- It must be OFF according to the order.

⑨ Disconnect the connection cable between output power PP, N100 of DIODE rectifier (REC1) and X1-18 (PC), X1-19 (NC) terminal of PCB.

⑩ Connect the connection cables of the X1-18 (PC), X1-19 (NC) terminals of the PCB.
- Be sure to check the polarity before connecting.

⑪ DC power is applied to the unit and AC power is applied.
- Work the same as in "Commissioning and General Check-Up" in Chapter 8.

9. Maintenance and Inspection

Regular maintenance and repair work can extend the life of the all-digital battery charger, reduce the frequency of faults in operation, and prevent faults.

9.1 Periodic inspection

9.1.1 Battery check

① Check if the battery is charged and the wiring is correct. We check once a month.

9.1.2 Charger unit cleaning

① Cleaning inside of PCB and UNIT
- Clean PCB and UNIT heat sinks once every 3 to 6 months.

② Air filter cleaning
- If there is a lot of dust on the air filter, the ventilation amount will decrease and the cooling effect will decrease. Clean once every 3 to 6 months.

9.2 Parts replacement tips

9.2.1 UNIT Replacement

① Prepare the same standard product as the existing product, check the wiring order, and remove.
② Assembled according to the wiring order, and grounding is required.
③ After replacing, firmly fix it so that the contact failure does not occur..

9.2.2 Replace PCB

① When replacing the PCB, check the mark on the PCB connector and remove it.
② Attention should be paid to the contact failure phenomenon when impurities adhere to the connector.

9.2.3 Power device replacement

① Prepare the same standard products as existing products, check the order of gate lines and remove.
② Separate the power device from the heat sink and take care not to damage the gate wire.
③ When using coping products, compare the circuit with the existing product, and then make wiring according to the circuit.
④ After replacing, firmly fix it so that the contact failure does not occur.

10. Standard Specifications

This specification can be changed by our working conditions.

	FDCH-22115	FDCH-22225	FDCH-38115	FDCH-38225	FDCH-44115	FDCH-44225	FDCH-22116	FDCH-22226	FDCH-38116	FDCH-38226	FDCH-44116	FDCH-44226
Rated Supply Voltage (Vac)	220		380		440		220		380		440	
Battery Voltage (Vdc)	110	220	110	220	110	220	110	220	110	220	110	220
Rated Frequency (Hz)	50						60					
Battery Capacity (AH)	35, 45, 60, 100, 150, 200, 250											
High frequency TEANS.	8/8T	8/15T	15/8T	15/15T	15/8T	15/15T	8/8T	8/15T	15/8T	15/15T	15/8T	15/15T
HEAT SINK	252 × 60 ×440											
COOLING FAN	120 x 120 x 38 (AC 110,220V) , 2EA											
THERMOSTART	85℃ NORMALLY CLOSE											

10.1 How to select a battery charger

10.1.1 Check basic specifications

① Input power AC voltage: Vac
Ex) The input voltage is AC 440V.

② Battery output DC voltage: Vdc
Ex) The output DC voltage of the battery is 110V DC.

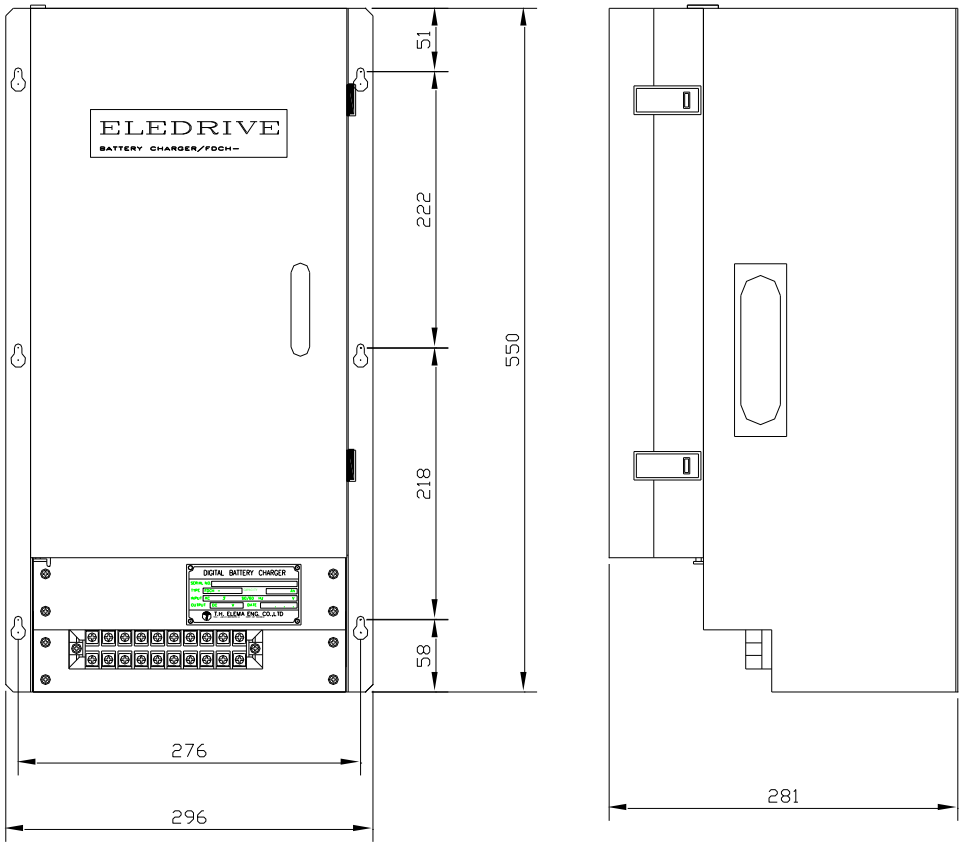
③ Input AC power frequency: Hz
Ex) Input AC power frequency is 60Hz.

④ Capacity of used battery: AH
Ex) The capacity of the battery to be used is 100AH.

⑤ Select the battery charger according to the above conditions.
Ex) Select the battery charger as FDCH-44116 (100AH).

11. Dimensions

This dimensions can be changed by our working conditions.



12. MAGNET SYSTEM electric circuit diagram

The MAGNET SYSTEM is a basic electric circuit diagram of the FDR-series and FDCH-series developed by Hanmi Techwin.

This circuit diagram can be changed by our working conditions.