DIGITAL LIFTING MAGNET CONTROLLER

TDR-Series

User Manual

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Contents

1. Product Overview

TDR-series, as an all-digital type lifting magnet controller developed by **HANMI TECHWIN**. CO. LTD., is a device which imposes 3 phase AC voltage by converting into DC voltage using a power driving component SCR(thyristor) and controlling the size of the output voltage and the output current.

It is essentially utilized in iron and steel manufacture related fields, iron and steel products of various industrial fields and logistics, transportation and cargo handling of material fields, and it is an essential system for automation and rationalization of industrial facilities.

TDR-series is a product which has improved the lifting and dropping performance by using 3 phase AC power to the lift/drop operations and maximized reliability by enhancing the phase detection performance and possessing SMPS. Additionally, it is greatly utilized as it enables to be used for permanent electromagnet control simply by setting the software option.

2. Product Features

① System realization by all software

As a miniaturization and all digital method of the control board, the magnet control system has been processed with software. The reliability and repairability was drastically improved due to drastic reduction of the control circuit as the magnet control logic and the peripheral circuits have been absorbed. The whole control system has been miniaturized and light-weightened.

② Simple control selection

TDR-series enables simple selection and control at the field by selecting the desired control method with an input key, and enables to select between permanent magnet or electromagnet modes by parameter setting.

③ Improvement of working efficiency

A power driving component, SCR, was used in the lifting and dropping operations of the magnet and the working efficiency has been improved by quick elimination of the remanent flux when dropping. The precision has been increased controlling by detecting the operation output voltage and current at the controller.

④ Perfect Protection Function

TDR-series possesses a protection function as to over current, over load, blackout and over heat, and prevents from a product fall with output voltage maintenance by the battery when a fault occurs.
It enables easy detection of the fault by observing the fault status through the LCD window when a fault occurs.
It requires no additional external temperature relay as it possesses an integrated electronic temperature sensor function.

⑤ Current Control

It enables rather precise current control by connecting Hall CT at the output DC terminal.

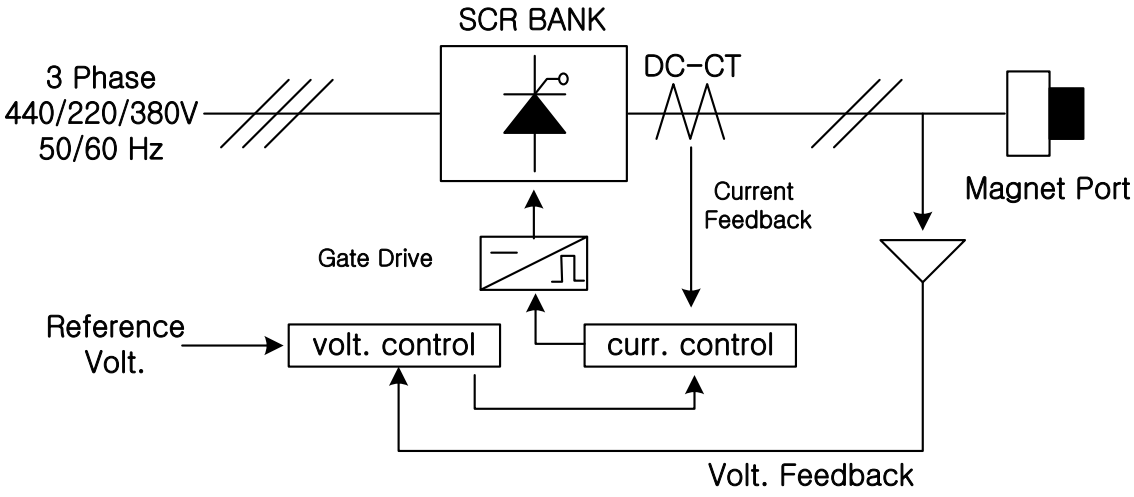
⑥ 3 Phase LIFT / DROP Operation

By realizing 3 phase LIFT/DROP using 5 SCR components, it has secured operation stability by enabling more stable drop operation than the drop operation using a single phase

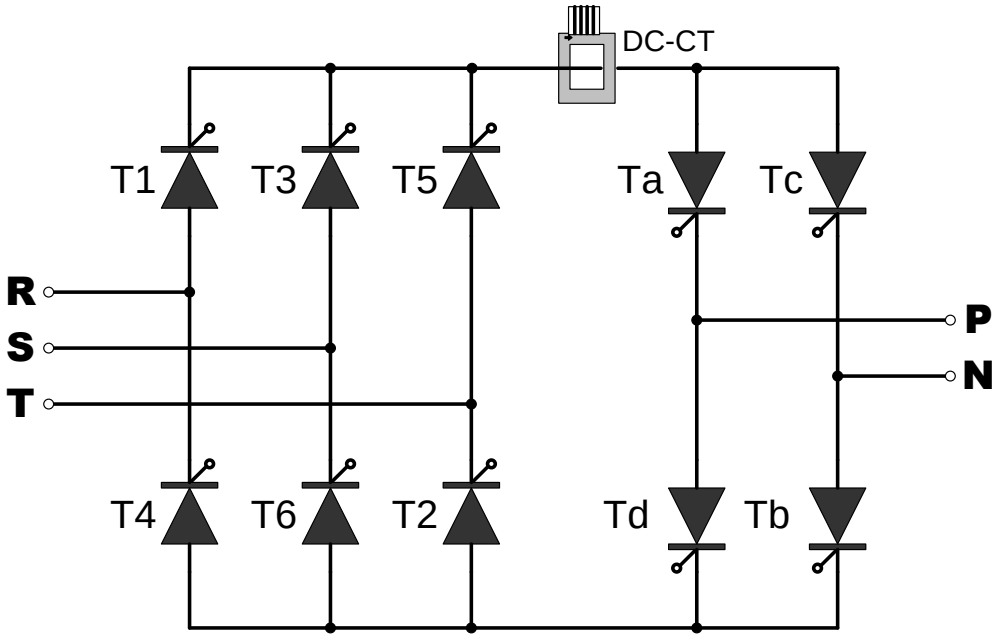
⑦ Improvement of reliability

The I/O control is separated using a photo-coupler to prevent from external noises and influences, and its internal SMPS fundamentally blocks risks from voltage drop occurring during SCR control.

3. Control Circuit Schematics



4. Power Circuit



① 3 phase conversion operation for LIFT

At lifting operation, positive DC voltage is generated at both P-N terminals by the 6 firing angles, T1, T2, T3, T4, T5 and T6 at the 3 phase input power (R, S and T phases) and Ta and Tb.

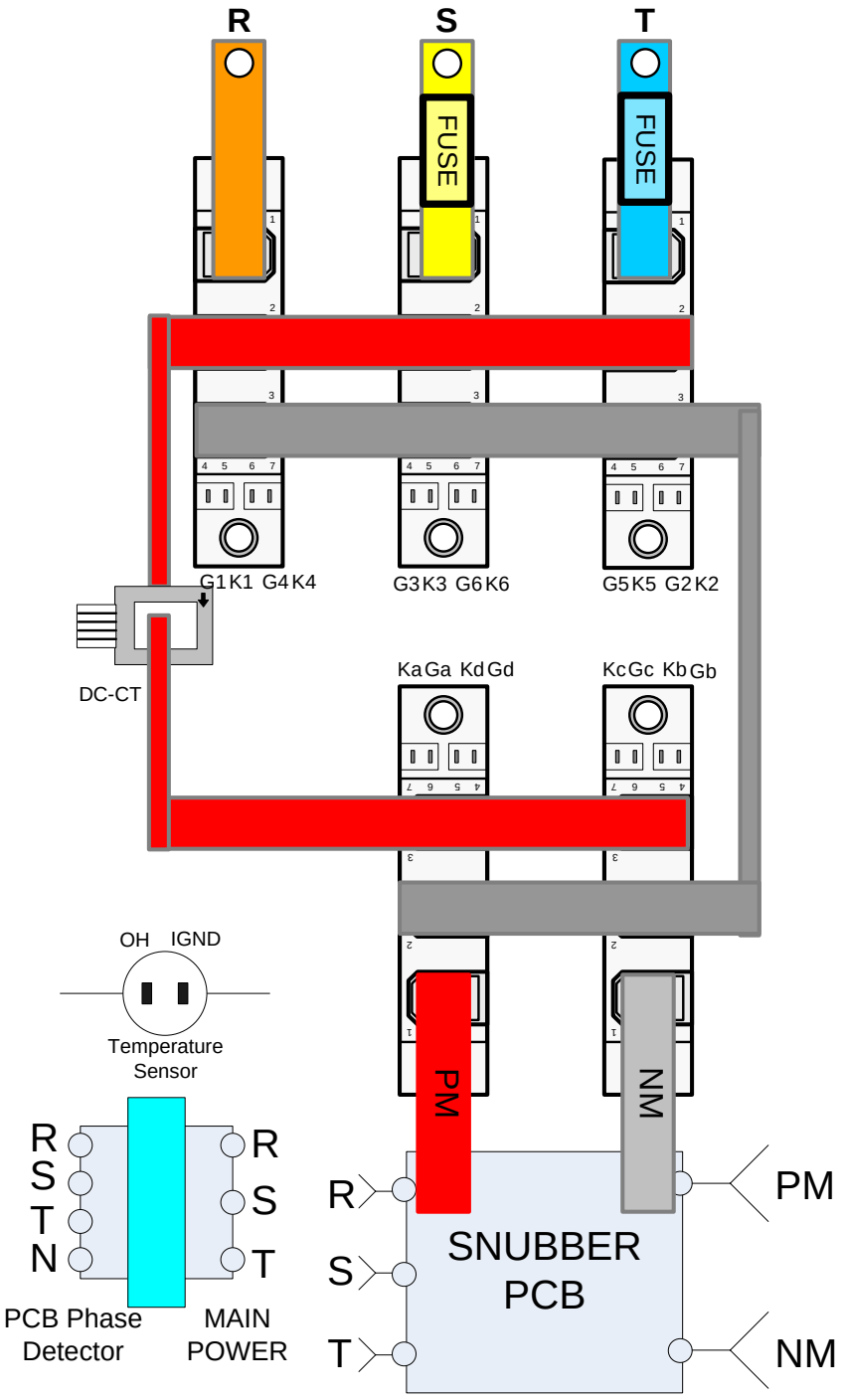
During operation, the firing angle is indicated on the LCD screen to check the firing angle in operation. The closer to 0 the firing angle is, the greater the output voltage becomes.

② 3 phase conversion operation for DROP

At dropping operation, negative DC voltage is generated at both P-N terminals by the 6 firing angles, T4, T5, T6, T1, T2 and T3 at the 3 phase input power (R, S and T phases) and Td and Tc.

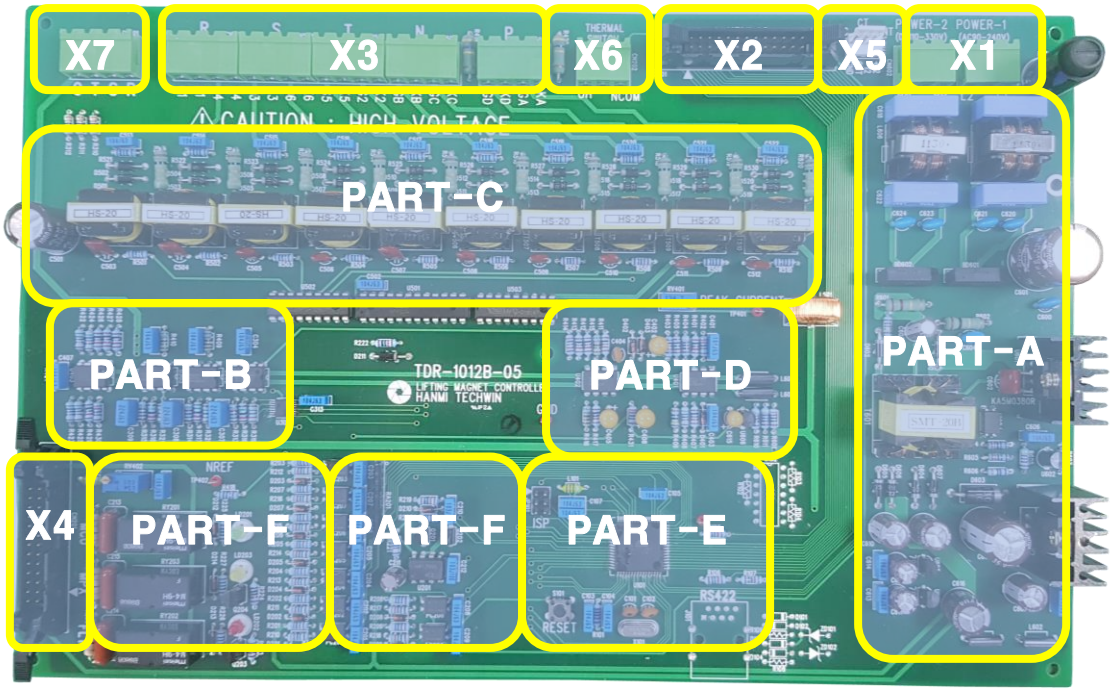
During operation, the firing angle is indicated on the LCD screen to check the firing angle in operation.

5. Power Conversion Part Installation Diagram



CAUTION : SEMIKRON standard is for order of gate.
It connects K1 G1 G4 K4 order for IXYS.

6. Control Board Structure



6.1 X1 terminal: POWER

- POWER1: AC 90 ~ 240 V
- POWER2: DC 110 ~ 330 V, it connects to the back-up battery for power supply at blackout.

6.2 X2 terminal: Key Board Interface Connector

- X2 terminal is a terminal that controls the LCD screen and transmits output signal to control the key input signal to the keypad, and connects with the keypad module, FDK6040A, with a cable connector.

6.3 X3 terminal: Gate Control

- X3 terminal, as a gate driving part of the power component SCR, imposes the gate trigger signal at constant order between the gate(G) and cathode(K) of SCR.
- It is an input terminal of R,S and T phase power for AC voltage measurement and phase detection.
- It is used as an input terminal to receive the feedback of DC output voltage.
- It determines the roll call time and roll call order of the driving component SCR by detecting the phase from the input R, S and T phases voltage zero crossing spots. In case the input power is not supplied or R, S and T phases are short,

Before operation it sends the fault signal [Fault] – 000A POWER LINE FAULT,

and during operation is sends the fault signal [Fault] – 000A BAD OR NO PHASE and stops sending the output.

6.4 X4 terminal: Terminal Interface

- It is connected with the TDR-1012-TB I/O terminal by a cable connector.
- It receives the notch input from Stick mode and the reference input from Analog mode.
- It generates signals for control at faults through a relay.

6.5 X5 terminal: CT interface

- Being connected to DC-CT by a cable connector, it detects the current generated through SCR.

When it detects over current during operation, it sends the fault signal [Fault] – 000A OVER-CURRENT.

If no current is detected during operation, it sends the fault signal [Fault] – 000A UNDER-CURRENT and stops the operation.

6.6 X6 terminal: Thermal Sensor Interface

The temperature sensor installed on the heatproof plate is connected in serial with the fuse, detects fuse damage and the heatproof plate overheating. If the fuse of the input S and T phases get burned or the connection is inappropriate, or the heatproof plate temperature is over 85℃ at the temperature sensor, between OH and IGND terminals get short, sends the fault signal

[Fault] – 000A FUSE OR OVERHEAT

and stops generating the output.

6.7 TDR-1012B-TB: I/O terminal

1	3	5	7	9	11	13	15	17	19	21	
RGND	RVCC	LIFT	CN2	CN4	SOP	NCOM	RCOM	XA	XB	FCOM	
	2	4	6	8	10	12	14	16	18	20	22
	REF	NCOM	DROP	CN3	CN5	RESET	RA	RB	XCOM	FA	FB

6.7.1 LIFT input

LIFT command enables the lifting operating that sticks the load to the magnet due tolift input terminal short.

6.7.2 DROP input

DROP command enables the dropping operating that separates the load from the magnet by the short of the drop input terminal.
The previous status is maintained if there is no LIFT command nor DROP command(No operation is executed in case LIFT command and DROP command come in simultaneously).

6.7.3 Reference input

The input voltage between TB1-1 and TB1-2 terminals as a reference of the potential type operates as a random reference according to the analog value. The values between TB1-3 and TB1-1 are put into the TB1-2 terminal by distributing as a resistance of desired value.

6.7.4 Stick input

2N, 3N, 4N and 5N terminals notch signals of the Switch mode. When this signal is put in, Notch-2 Ref, Notch-3 Ref, Notch-4 Ref, Notch-5 Ref, the references as to the regarding notch, is imposed to the magnet at lift operation. If all 2N, 3N, 4N and 5N terminals are open, 1N notch signal is imposed to the magnet as the reference value Notch-1 Ref.

6.7.5 RESET input

As an external reset function, the reset function of magnet includes external reset, PCB internal reset and system reset by program.

6.7.6 FA, FB, FCOM(Fault relay) output

When a fault occurs, LED(LD203(Red)) is turned on and shorts the fault relay. This indicates the fault status to the driver by operating the buzzer at fault occurrence.

6.7.7 SOP(Safe Operation) input

This function, as a load fall prevention function by shaking when moving a crane, when SOP short signal comes in, the output becomes 100% rated voltage(at voltage control) or rated current(at current control).

6.7.8 XA, XB and XCOM outputs

It is a safety device to prevent fall of the load by operating MPX relay and using the backup battery power, when current cannot be supplied to the magnet through the positive converter of SCR due to a fault occurrence at life operation status.

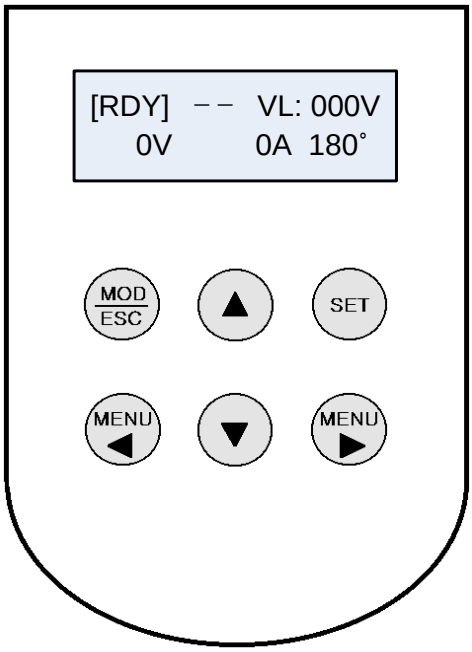
Here, fall of the load due to battery discharge should be prevented by placing the load down in a safe status, opening the brake and opening MPX relay by reset command.

Fault status is displayed on LCD when blackout or fault occurs, and at this status, the lift operation cannot be executed until reset input comes in.

6.7.9 RA, RB and RCOM outputs

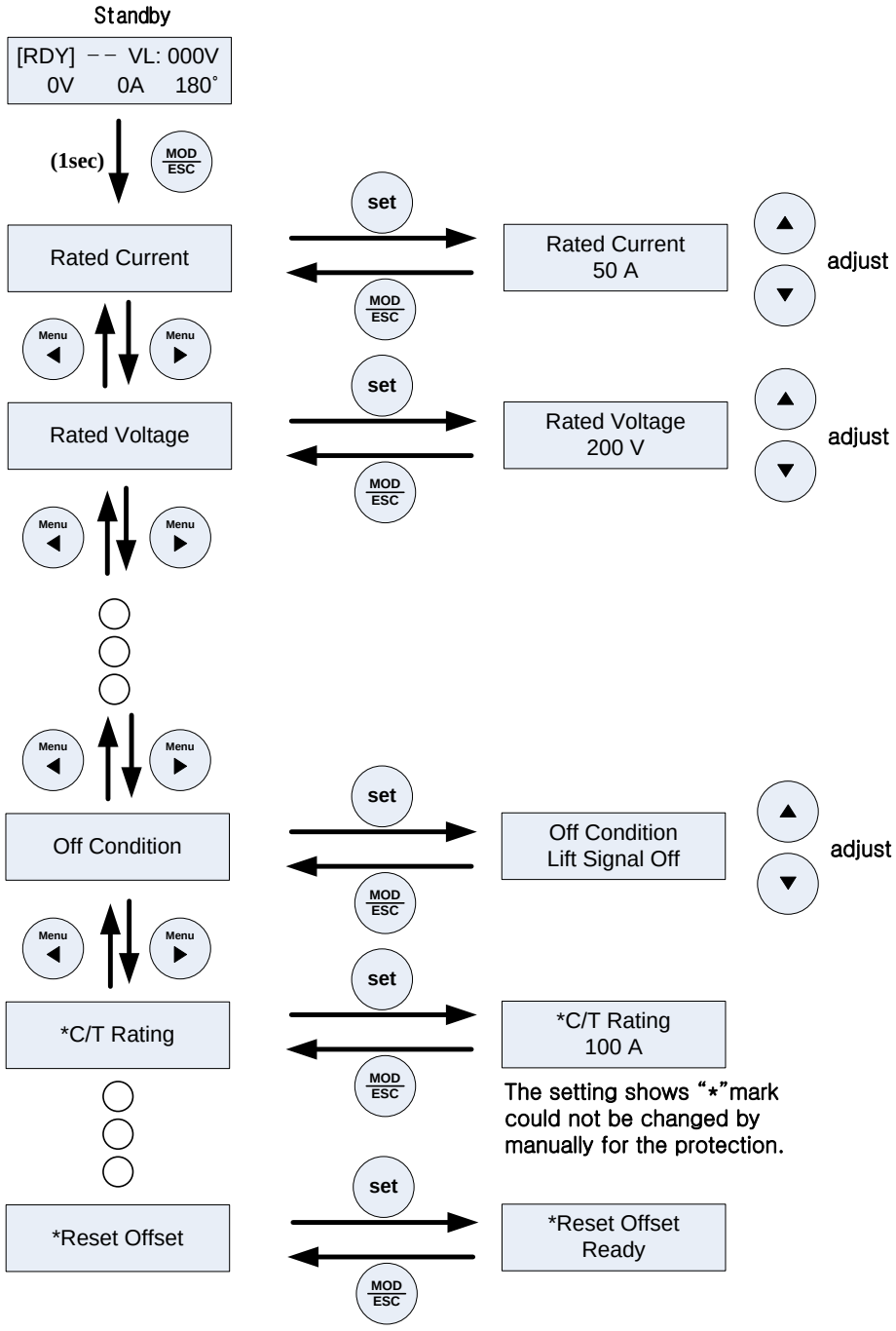
It generates the controller operation status. At normal operation, RA and RCOM get short and the controller does not operate, or in case of an unexpected operation, RB and RCOM get short. Mal-operation by controller abnormal operation can be prevented by using with OR connection of FA-FCOM and RB-RCOM.

7. Name & Function of KEYPAD Parts



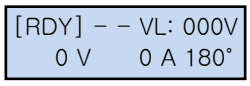
Key	Description
MOD/ESC	Pressing this key for 1 second enables to enter the setting mode. Pressing ESC key enables to escape from each mode.
SET	Pressing SET key enables to select or set the mode or parameter.
▲	The selected parameter value increases by pressing this key.
▼	The selected parameter value decreases by pressing this key.
MENU ◀	If MENU key is pressed, the items on the menu are changed in the proper direction and indicated.
MENU ▶	If MENU key is pressed, the items on the menu are changed in the reverse direction and indicated.

8. Parameter Setting with the KEYPAD



① Driving preparation Mode

In case it is not operated with the rectifier input power fed only (at normal status),



is displayed on the LCD screen.

② Select Mode

Enter Select Mode to set a mode or parameter value in the driving preparation mode. Select Mode can be entered by pressing MOD/ESC key for more than 1 second.

③ Shift parameter

It enters the Control mode which enables to control the selected parameters by SET key.

It enables the parameters to escape from Control mode to Select mode by MOD/ESC key.

It shifts to parameters by MENU◀ and MENU▶ keys.

④ Change parameter

In Control mode,

the parameter value of the digit selected by ▲ key increases.

the parameter value of the digit selected by ▼ key decreases.

⑤ Save parameter

'Save parameter' automatically saves the numbers when escaping from 'Parameter select' mode, when there is a changed parameter.

9. Parameter

	Menu	Range	Default
Parameter	Rated Current	2 ~ 400 A	50 A
	Rated Voltage	10 ~ 450 V	220 V
	Limit Current	3 ~ 450 A	75 A
	Limit Voltage	15 ~ 600 V	300 V
	Control Type	Voltage / Current	Voltage
	Control Input	Switch / Analog / Mixed	Switch
	Starting Level**(Note 1)**	0 ~ 250 %	100%
	Starting Time **(Note 1)**	0.0 ~ 10.0 sec	0.0 sec
	Ascend Time**(Note 1)**	0.0 ~ 30.0 sec	0.0 sec
	Descend Time**(Note 1)**	0.0 ~ 30.0 sec	0.0 sec
	Notch-1 Ref.	0 ~ 200 %	20%
	Notch-2 Ref.	0 ~ 200 %	40%
	Notch-3 Ref.	0 ~ 200 %	60%
	Notch-4 Ref.	0 ~ 200 %	80%
	Notch-5 Ref.	0 ~ 200 %	100%
	Ref_level1**(Note 2)**	0 ~ 130 %	20%
	Ref_level2**(Note 2)**	0 ~ 130 %	40%
	Ref_level3**(Note 2)**	0 ~ 130 %	60%
	Ref_level4**(Note 2)**	0 ~ 130 %	80%
	Ref_level5**(Note 2)**	0 ~ 130 %	100%
	Drop Level**(Note 1)**	0 ~ 200 %	50%
	Drop Time**(Note 1)**	0.0 ~ 10.0 sec	0.5 sec
	Off Condition	Lift Signal Off / Drop Signal On	Lift Signal Off
	SOP Condition	Change by Lift / change by SOP	Change by SOP
	LIFT Hold on SOP	Hold on SOP / No Hold	No Hold
	*C/T Rating	5 ~ 600 A	100 A
	*Minimum Alpha**(Note 3)**	Auto setting ~ 80 °	Auto setting
	*Off wait-time	2.0 ~ 10.0 sec	5.0 sec
	*Drop wait-time	0.10 ~ 2.00 sec	0.10 sec
	*Zero cur level	1 ~ 100	5
	*Zero Volt Level	30~300%	50%
	*Keep zero-time	0.10 ~ 3.00 sec	1 sec
	*Phase wait	100 ~ 2000ms	200ms
	*MaxSyncFailCnt	10 ~ 100	30
	*VDSens Flt Lev	10 ~ 100 V	30 V
	*PI Gain kp	0 ~ 20	10
	*PI Gain ki	0 ~ 20	10

	Menu	Range	Default
Parameter	*Magnet Select	Permanent / Electro	Electro
	PM Oper. Time**(Note 4)**	0.5 ~ 10.0 sec	1.0 sec
	PM Slope Time**(Note 4)**	2.0 ~ 10.0 sec	5.0 sec
	Analog Ref	Variable according to Potential Meter resistance value	-
	*Under C Fault	Enable/Disable	Disable
	*Reset Offset	Initializes AD Converter offset.	
	*Alpha Test	Verifies the output voltage by αangle by controlling the firing angle with the keypad.	
	Phase Balance	Checks the input power balance.	
	Fault Scan	Saves the status information of the 10 faults previously occurred.	
	Fault Init	Erases the past fault status data of the fault scan.	

The setting with" * "mark is protected from artificial modification.

Note 1) The setting is only available when Electro is selected at the Magnet Select.

Note 2) Only selectable if Mixed is selected in the Control Input.

Note 3) The control range for the Minimum Alpha value can be changed depending on circuit delay.

Note 4) The setting is only available when Permanent is selected at the Magnet Select.

Values of the above parameters can be set by the keypad and check via LCD window after the magnet stops the operation. If power(auxiliary power) is fed to the rectifier and initialized by being saved to RAM from EEPROM memory, it is saved to EEPROM by reading the default values from ROM.

9.1 Rated Current

It is the parameter to set the rated current of the electromagnet. It becomes the standard for setting the target value or the limit value in terms of current control.

Setting range: 2 ~ 400
Default: 50 A

9.2 Rated Voltage

It is a parameter to set the rated voltage of the electromagnet. It becomes the standard for setting the target value or the limit value in terms of voltage control.

Setting range: 10 ~ 450
Default: 220 V

9.3 Limit Current

If it is greater than the setting current, it recognizes as over current and makes the current into below the setting value by adjusting the firing angle as it recognizes as over current.

Setting range: 3 ~ 450
Default: 75 A

9.4 Limit Voltage

In case the output is greater than the setting value to protect the power module SCR and the magnet from instantaneous over voltage, it disables the voltage from giving the setting by adjusting the firing angle.

Setting range: 15 ~ 600
Default: 300 V

9.5 Control Type

The control method is setting the standard value command voltage or current.
Voltage control, Current control

Setting range: Voltage / Current
Default: Voltage

9.6 Control Input

Magnet voltage and current command can be set to Switch type which is multi step driving, Analog type which is no step driving or Mixed type which operates in the same way as the Switch type while receiving the analog input.
The Switch type only operates with the preset reference value, and Analog type operates with random reference value according to the proportion of the analog input value. The Mixed type operates with the preset reference value according to the analog input like the below table.

Setting range: Switch / Analog / Mixed
Default: Switch

[Input and output at Mixed method]

Ratio of voltage value fed as to the voltage value set in Analog Ref	Output reference value
At the setting value of Ref_level-1	Notch-1 Ref
At the setting value of Ref_level-2	Notch-2 Ref
At the setting value of Ref_level-3	Notch-3 Ref
At the setting value of Ref_level-4	Notch-4 Ref
At the setting value of Ref_level-5	Notch-5 Ref

9.7 Starting Level

For magnets, the current is stabilized slowly at the initial stage due to the influence of the inductance component. In order to overcome such a nature, there are cases of improving the magnet operation by flowing sufficient current quickly at the initial stage of lifting. It is a parameter to set voltage size imposed at the initial stage for such a case.

Voltage suitable for the notch is generated after generating the voltage as much as the staring level during the starting time by setting like the starting time of the next item.

It is shown as the ratio on rated voltage, the standard voltage is generated as it is when it is 100%, and voltage belongs to twice the standard voltage is generated for 200%. However it cannot exceed the input power voltage.

Setting range: 0 ~ 250 %

Default: 100 %

9.8 Starting Time

It implies the time which the voltage of the starting level is generated, and the voltage by the notch input after this time passes is generated.

Setting range: 0.0 ~ 10.0 sec

Default: 0.0 sec

9.9 Ascend Time

It is the parameter to set the time consumed until ascending the output as much as the input notch changed during lift operation.

Setting range: 0.0 ~ 30.0 sec

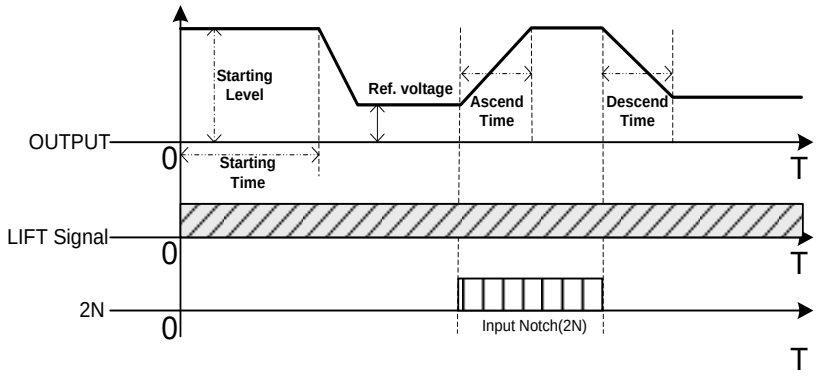
Default: 0.0 sec

9.10 Descend Time

It is the parameter to set the time consumed until descending to the reference voltage of the changed input notch.

Setting range: 0.0 ~ 10.0 sec

Default: 0.0 sec



9.11 Notch-1 Ref

If step-1 signal is put in to the rectifier at Switch/Mixed control mode, it imposes as a reference on step 1 to the magnet at LIFT operation.

Setting range: 0 ~ 200 %
Default: 20 %

9.12 Notch-2 Ref

If step-2 signal is put in to the rectifier at Switch/Mixed control mode, it imposes as a reference on step 2 to the magnet at LIFT operation.

Setting range: 0 ~ 200 %
Default: 40 %

9.13 Notch-3 Ref

If step-3 signal is put in to the rectifier at Switch/Mixed control mode, it imposes as a reference on step 3 to the magnet at LIFT operation.

Setting range: 0 ~ 200 %
Default: 60 %

9.14 Notch-4 Ref

If step 4 signal is put in to the rectifier at Switch/Mixed control mode, it imposes as a reference on step 4 to the magnet at LIFT operation.

Setting range: 0 ~ 200 %
Default: 80 %

9.15 Notch-5 Ref.

If step-5 signal is put in to the rectifier at Switch/Mixed control mode, it imposes as a reference on step 5 to the magnet at LIFT operation.

Setting range: 0 ~ 200 %
Default: 100 %

9.16 Drop Level

When DROP signal is fed, the operation of imposing reverse voltage of drop level to the magnet is performed for the drop time in order to remove the magnetized remnant flux of the magnet. It is the parameter to set the size of the reverse voltage here.

Setting range: 0 ~ 200 %
Default: 50 %

9.17 Drop Time

When DROP signal is fed, after checking the zero current, the operation of imposing reverse voltage of drop level is performed for drop time in order to remove the magnetized remnant flux of the magnet. It implies the time that imposes the reverse voltage here.

Setting range: 0.0 ~ 10.0 sec
Default: 0.5 sec

9.18 Off Condition

In case of setting the condition for 0V voltage of the magnet port, that is, the LIFT signal being OFF, the PN-MN value becomes 0V when LIFT signal is OFF, and in case DROP signal is ON, it maintains the output voltage(PN-NM) at LIFT before the DROP signal is ON, and the output(PN-NM) becomes 0V when the DROP signal becomes ON.

Setting range: Lift Signal Off / Drop Signal On
Default: Lift Signal Off

9.19 *SOP Condition

It sets the conditions of using SOP(Safety Mode). In case of Change by Lift, if SOP signal is imposed even once during LIFT operation, 100% output value is maintained before DROP operation, and for Change by SOP, 100% output value is maintained only when SOP signal is imposed during LIFT operation.

Setting range: Change by Lift / Change by SOP
Default: Change by SOP

9.20 *LIFT Hold on SOP

It sets the conditions on Lift Off at SOP(Safe Mode) operation. When it is set to Hold On SOP, the output is maintained by 100% even at Lift Off during SOP operation, and for No Hold, it performs Lift Off operation is performed by Lift off even during SOP operation.

Setting range: Hold on SOP / No Hold
Default: No Hold

9.21 *C/T Rating

It checks the capacity of DC-CT(current transformer) used at the rectifier and sets to the value.

Setting range: 5 ~ 600 A
Default: 100 A

9.22 *Minimum Alpha

It sets the minimum value of the firing angle at lift or drop operation. It is initialized to the minimum value accepted by the circuit if not set. The setting value is maintained if the value set by the user is greater than the initial value and is set to the initial value if the value set by the user is less than the initial value.

Setting range: Automatic setting ~ 80˚
Default: Automatic setting˚

9.23 *Off Wait-time

If DROP signal is fed to the rectifier during LIFT operation, it enters into DROP operation by removing(regenerating) the voltage and current that controls the SCR's firing angle as quickly as possible, and it is the maximum time the regeneration is performed here. Thus, once this time is passed, it moves on to the next stage even if remnant voltage and current exists. Therefore, if this time is too shortly set, it may cause a damage of SCR, as reverse voltage is fed without the remnant flux being completely removed.

Setting range: 2.0 ~ 10.0 sec
Default: 5.0 sec

9.24 * Drop Wait-time

If DROP signal is fed, it checks the zero current after Off-wait-time and enters DROP operation after waiting for drop-wait-time by stopping the gate operation in order to remove the magnetized remnant flux of the magnet.

Setting range: 0.10 ~ 2.0 sec
Default: 0.10 sec

9.25 Zero Current Level

After LIFT operation, it detects the current flowing in the magnet being 0 and moves on to DROP operation, and it is considered as 0 if the current is under the value set in this parameter. If the current is detected to be 0, it checks if the status is maintained during Keep zero time and enters DROP WAIT operation.

Setting range: 1 ~100
Default: 5

9.26 Zero Volt Level

When voltage at the magnet is less than the setting value after LIFT operation, it checks if the status is maintained for Keep zero time and enters DROP operation.

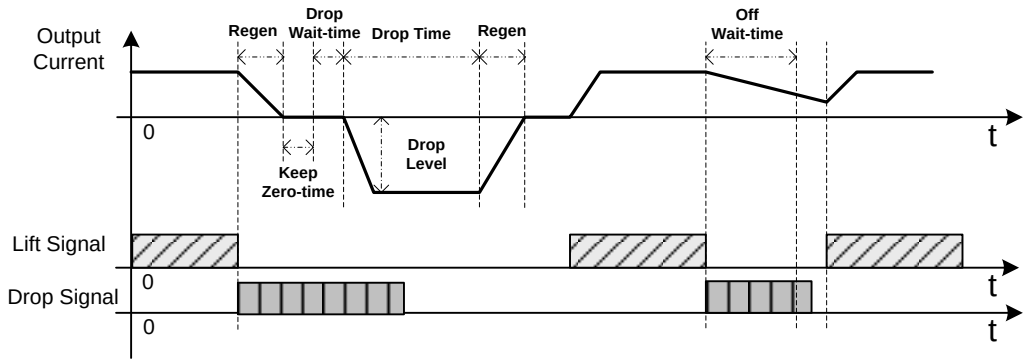
It shows in % value and the reference is the last voltage value of the LIFT status.

Setting range: 30~300%
Default: 50

9.27 Keep Zero Time

It uses the feedback current to check if the positive voltage at LIFT operation or the negative voltage at DROP is completely eliminated while going through the regeneration process. If, the current is less than **Zero Current Level** during the time set in this item, it goes onto the next operation by considering it is completely eliminated.

Setting range: 100 ~ 3000[ms]
Default : 1000[ms]



9.28 Phase Wait

It is the item to set the sensitivity on Bad or No Phase. After detecting no phase, it compares the number of phase detection failure after the set time with the value set at **MaxSyncFailCnt** and generates Fault signal if the value is greater.

Setting range: 100 ~ 2000[ms]
Default: 200[ms]

9.29 MaxSyncFailCnt

It shows the sensitivity of the fault occurrence when a certain phase power is unstable or missing among the input powers. The sensitivity increases as the setting value is low. It counts the number of phase detection failure during the time set at **Phase wait** and generates fault if it is more than the value set in **MaxSyncFailCnt.**

Setting range: 10 ~ 100
Default: 30

9.30 *VDSens Flt Lev

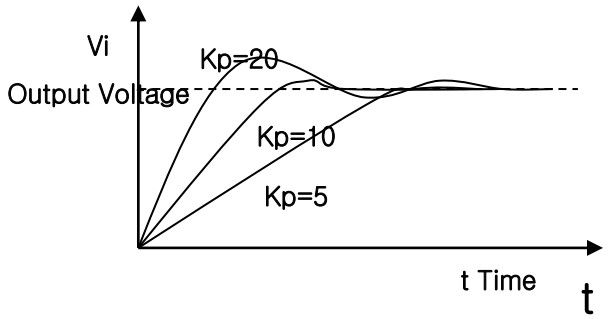
It is the reference value to generate VDSensor fault. It measures the voltage value of the P-N terminal (port output) at READY status and generates a fault if this measurement value is greater than the set value.

Setting range: 10 ~ 100V
Default: 30V

9.31 *PI Gain kp

As the output signal response gain on the deviation of Reference, the voltage reference value, and voltage feedback signal, the actual magnet voltage at voltage control, increasing this value increases the output voltage proportional gain (Kp), i.e. the gradient, like below picture.

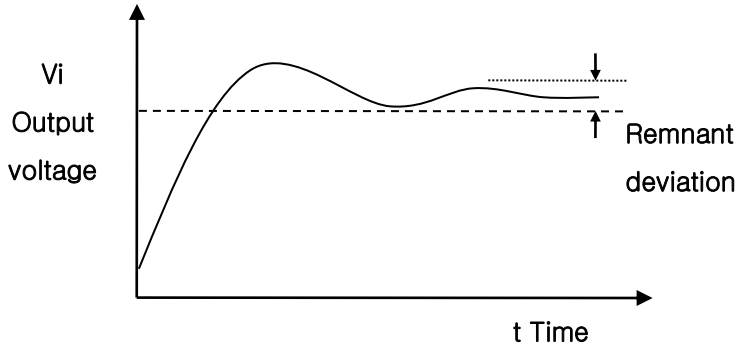
Setting range: 0 ~ 20
Default: 10



9.32 *PI Gain ki

It is the response gain of the integral circuit implying the output signal to remove the remaining deviation on the difference of Reference, the voltage reference value, and voltage feedback signal, the actual magnet voltage at voltage control.

Setting range: 0 ~ 20
Default: 10



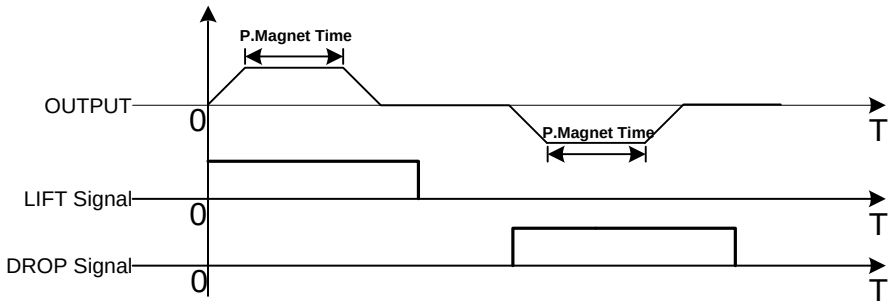
9.33 *Magnet Select

It enables to select between Permanent magnet mode or Electromagnet mode.

Setting range: Permanent / Electro
Default: Electro

9.34 PM Oper. Time(Permanent Magnet Operating Time)

It enables to set the output time at Lift/Drop in Permanent mode.



Setting range: 0.5 ~ 10.0 sec
Default: 1.0 sec

9.35 PM Slope Time(Permanent Magnet Slope Time)

It executes DROP operation if SOP input is fed in Permanent Magnet Mode. Here, it enters OFF Mode by the reverse voltage increasing slowly during the set time rather than increasing instantaneously. If enters OFF Mode immediately once SOP input disappears.

Setting range: 2.0 ~ 10.0 sec
Default: 5.0 sec

9.36 Analog Ref

It indicates the voltage value put into the controller through the terminal board input ref. The maximum output can be set to 100% by setting the value of this item to 4.0[V] by setting the terminal board input value to maximum and adjusting the variable resistance RV402.

9.37 Under C Fault

It sets if the 'Under current fault' function would be used. It sets if it would recognize the status which the current going through the port at LIFT or DROP operation is undetected as a fault or not. For instance, a fault occurs by executing LIFT operation at the port unconnected status.

9.38 Reset Offset

For effective control of the control, it should accurately read the feedback voltage and current and reference values through ADC. In order for the controller to read the ADC values accurately, the controller initializes the offset generated by component deviations etc., and this parameter is used when the values displayed on the LCD window are not accurate, and should be performed by making all the inputs and outputs to '0'.

9.39 Phase Balance

It is a parameter that displays the degree of 3 phase input deviation. It is the value which has expressed the time between the zero crossing times of each phase. It can be determined as a good status if the values of each phase are shown similarly. As the value which has simply measured the time only, it can be used for reference only.

9.40 Fault Init(Fault memory initialization)

It deletes all of the 10 types of fault memories occurred in the past and makes into Ready status.

9.41 Fault Scan (Fault memory check mode)

It enables to check 10 faults of the past, and recent faults are saved in the order of numbers 0 ~ 9.

0 line power off : Recent fault status
1
.
.
8
9 over current

※ Parameter Setting Tip

Ex.) Example of parameter setting on **TDR-110(22kW)**

(1) Set the parameter menu.

① *Set Reset Offset.

☞ Set offset after the 3 phase input power cutoff

② Set rated voltage and rated current.

☞ Rated Current = 22kW / Rated Voltage

- Rated Voltage = 220 [V] (Default)
- Rated Current = 100 [A]

③ Set limit voltage and limit current.

☞ Set ~ 1.5 times of the rated output

- Limit Voltage = 300 [V] (Default)
- Limit Current = 150 [A] (Rated Current * 1.5)

④ *Set C/T rating.

☞ Set to the internal DC-CT of the unit

- *C/T Rating = 200

(2) Set the variable resistor of the control board. (RV401, RV402)

① RV401: It is a variable resistor to set the over current.

☞ Over Current = Rated Current * 1.5 [A]

☞ *C/T Rating: 4 [V] = Over Current: RV401 [V]

- RV401 = (Over Current * 4) / (C/T Rating) = 3 [V]

If 1.5 times the current of the rated current flows when set like above, the pot protection by over current is easy as over current fault is generated.

② RV402: It is the variable term for mutual response by converting the voltage fed from the reference terminal into the voltage level which can be discriminated by the controller.

☞ Set the parameter menu to Analog Ref.

☞ Set the location of the control handle in the control room to max.

☞ Change the Analog Ref value indicated on LCD to become 4.0V while controlling RV402.

☞ Then, it generates rated voltage in case the control handle is located at MAX. There may be slight voltage change by the error of the reference input resistance value. Please refer to this to adjust.

10. Magnet operation form

General operation of the lifting magnet is divided into lifting operation that adheres the load to the magnet and dropping operation that separates the load and lift from the magnet. The operation form of the TDR-Series magnet controller is separated like the following.

10.1 LIFT (adhesion) operation

Lift operation is classified into Potential mode that gives a random reference value and Switch mode that only gives a preset reference value by dividing into many stages.

10.2 DROP (separation) operation

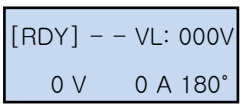
If DROP signal is fed into the unit during LIFT operation, DROP operation performs the operation of eliminating the magnet current as soon as possible by conducting regeneration, and performs the operation of imposing reverse voltage of drop level for drop time to eliminate the remnant flux of the magnet. DROP action improves work efficiency by shortening the drop time as it remove the magnet current as soon as possible. It is adjusted by the values set in the parameters <Drop Level> and <Drop Time>.

11. Status Indication

TDR-series displays the current status when an abnormality occurs before or during operation and enables to check current status easily.

11.1 Status indication before operation

In case only input power if fed to the rectifier and it is not operated (At normal status)

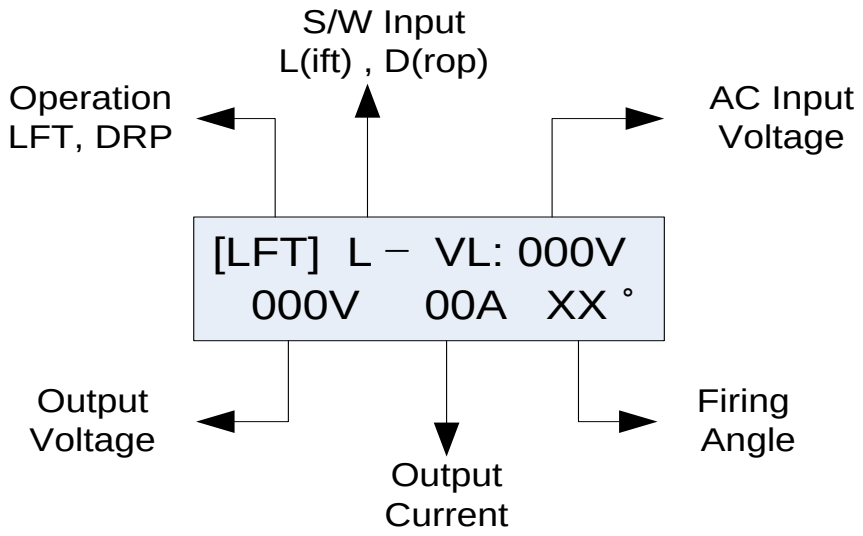
Driving preparation mode 

status is indicated on the LCD screen.

After this status indication, parameter modification or magnet operation is available.

11.2 Status indication during operation

During magnet operation, operation status, driving selection, input voltage/output voltage, output current and firing angle are indicated on the LCD screen.



11.3 Monitoring at abnormality occurrence

It indicates the fault content at abnormality occurrence before or during operation. At fault occurrence, it takes necessary actions and converts to Driving Preparation Mode by resetting. If a fault occurs before operation, it generates a fault signal without entering the operation, and if a fault occurs during operation, it generates a fault signal and stops the operation.

12. Installation Condition & Wiring

12.1 Installation condition

- A place with altitude less than 1000 [m]
- A place with the ambient temperature of –20 ~ +85[℃]
- A place with no corrosive liquid or gas
- A place with no iron dust

12.2 Wiring

- Wiring shall be connected according to the drawing.
- The wiring of the main circuit of the input power is in the order of R-S-T.
- The wiring of the main circuit and the control circuit shall be separated.
- The ground terminal must be connected to the ground wiring.

13. Test Driving & General Check Points

For test driving and general check points, the checking should be done in the sequence, before imposing power, after imposing DC power, after imposing AC power and operation status check, and when an abnormality occurs during the checking, the problem should be solved before moving on to the next stage. Contact Taehwa for necessary countermeasures if the problem cannot be solved.

13.1 Before imposing power

13.1.1 Check magnet port

① Check capacity and P-N connection status of the magnet port.

13.1.2 Battery check

① Battery power is used for blackout compensation power or electricity sequence power.
② Check for back power condition status and connection status.

13.1.3 Check input AC power

① Input AC power is used for imposing DC power to the magnet port through a power component or the battery charging power.
② Check the input power status and the R-S-T connection status.

13.1.4 Check rectifier status

① Check the R-S-T connection status for the input AC power.
② Check the connection status of output P-N.
③ Check if DC-CT has appropriate capacity.

13.1.5 Check PCB status

① Check input (AC or DC) power setting status.
② Check the connection status of SCR Gate wiring.
③ Check the connection status with DC-CT.
④ Check the connection status with Thermal Sensor.
⑤ Check SCR, the power driving component, status
- It is normal if the resistance of K1-G1, K4-G4, … , KA-GA~ KD-GD terminals of the X3 terminal board at the left side of PCB is scores of Ω(varies according to the SCR capacity). The measurement value at same capacity should come in a certain range, and if the resistance value is 0Ω or over kΩ, it is faulty or the connection status should be checked.

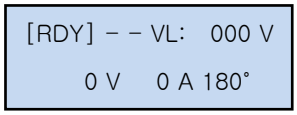
13.2 After imposing DC power

13.2.1 Check battery DC power

① Check if the battery power is properly set.

13.2.2 Check rectifier indication status

① When only DC power is fed to the rectifier and at normal status, the LCD screen displays



.

13.2.3 Check PCB status

① Check if LD201(Green) LED is lit only.

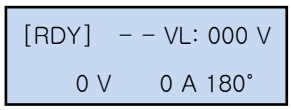
13.3 After imposing AC power

13.3.1 Check input AC power

① Check if R-S-T phases of input AC power and power are properly set.

② Check accepted variable range and unbalance status of power voltage.

13.3.2 Check rectifier indication status

① 

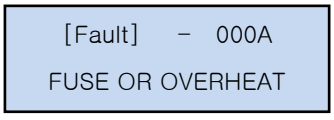
is indicated on the LCD screen when AC power is fed to the rectifier and is at normal status.

② In case Fault status is displayed on the LCD window rather than Driving Preparation Mode(READY), take necessary actions by referring to Chapter 15 of Trouble Shooting Guide.

13.3.3 Check PCB status

① Check for On status of LED LD201(Green). If LD201(Green) is Off, check power supply status at X1 terminal.

② Check is the resistance of X6 terminal is 0Ω. If the resistance is not 0Ω,



is displayed on the LCD screen.

13.4 Check operation status

13.4.1 Check mode and parameter by keypad

Check if the operation type, control type, indication unit, control mode and parameters are appropriately set to the driving form.

13.4.2 Check LIFT operation

① Check if it is being operated according to each control mode and according to the set parameter value.
② Operation status is indicated on the LCD screen.
③ When it does not operate
- Check if LIFT signal is fed, and check if TB1-4 and TB1-5 terminals are DC0V. In case power is not generated, check the connection status of LIFT signal.

④ In case the operation status is inaccurate or DC output power is unstable,
- Check R, S and T phases and the connection status of input AC power.

⑤ In case a fault occurs during operation,
- In case Fault status is displayed, take necessary actions by referring to Chapter 15 of Trouble Shooting Guide.

13.4.3 Check DROP operation

① Set the parameter values by checking the attachment/detachment status of the load to see if DROP operation is being operated with the set parameter values.
② When it does not operate,
- Check if DROP signal is fed, and check if TB1-4 and TB1-5 terminals are DC0V. In case power is not generated, check the connection status of DROP signal.

③ When the power is DC0V and DROP is displayed on the LCD screen,
- 'Drop Time' of the parameters should be reset, as it is a case which 0 current is not detected.

④ When it does not move on to READY Mode after DROP operation,
- 'Drop Time' and 'Drop Level' of the parameters should be reset, as it is a case which 0 current is not detected.

13.5 Cautions and countermeasure actions at blackout test and fault occurrence

13.5.1 Cautions and countermeasure actions at blackout test and fault occurrence

If blackout (Or turn off Main M/C at blackout test) or fault(BAD OR NO PHASE) occurs while driving at the status of the product mounted on the magnet port during working on the magnet,

① MPX is turned on at the rectifier, and thus the power supplied to the magnet port is converter into battery power from rectifier power.
② Place the product on the ground by opening the hoisting motor brake.

③ The fault [Fault] – 000A / BAD OR NO PHASE is displayed on the rectifier LCD screen.

④ Wait for power supply (Or turn on Main M/C ON at blackout test)

⑥ Operate the reset switch of the rectifier.

⑦ All processes are available if [RDY] – – VL: 000V / 0 V 0 A 180° is displayed on the LCD window.

** Caution **

- All works of the rectifier is impossible without numbers ⑤ and ⑥ processes.

13.5.2 Driving precautions when transporting a product

① When placing the magnet port on the product:

- Place the product at the inside of the magnet port to prevent the product isolating from the magnet port.

② Move the product after 4~5 seconds from the lift.

- For reference, the circuit is composed to inhibit the crane work for 4~5 seconds of lifting.

* Note: It is prohibited to adhere the product at the status which voltage is imposed to the magnet port.

14. Repair Inspection

Regular inspection and repair work enables to extend life span of the all digital type lifting magnet controller, and reduce the fault occurrence frequency or prevent fault at work.

14.1 Regular inspection

14.1.1 Check magnet port

① Check magnet port capacity an P-N connection status.

14.1.2 Rectifier cleaning

① PCB and inside rectifier cleaning

- Clean dust of the PCB or the rectifier heatproof plate once every 3~6 months.

② Air filter cleaning

- Dust in the air filter causes fall of cooling effect due to reduction of amount of ventilation. Clean once every 3~6 months.

14.2 Component Replacement

14.2.1 Rectifier replacement

① Remove after preparing the same standard product with the existing one and checking the wiring sequence.

② Assemble according to the wiring sequence and ensure to assemble the ground.

③ Fix securely to avoid contact failure after replacement.

14.2.2 PCB replacement

① Replace the PCB after checking the PCB connector code.

② Caution is required to avoid contact failure if there are impurities on the connector.

14.2.3 SCR replacement

① Remove after preparing the same standard product with the existing one and checking the gate wiring sequence.

② Separate SCR from the heatproof plate and be careful the gate wiring from being damaged.

③ Connect the wiring according to the circuit by comparing with the existing product when replacing.
Securely fix to avoid contact failure after replacement.

15. Trouble Shooting Guide

TDR-series rectifier includes the monitoring function on fault operation and situation. If a fault condition occurs, TDR-series rectifier shows a message and goes to standby mode until the user confirms this. Below explains about various fault messages, possible causes and the following brief countermeasure actions. If the fault status is continued despite the actions explained above, contact Taehwa Co. Ltd. and provide appropriate guidelines.

15.1 Fault types

① **CT: BAD OFFSET**
② **UNDER-CURRENT**
③ **OVER-CURRENT**
④ **STACK OVERHEAT**
⑤ **OUT OF CONTROL**
⑥ **BAD OR NO PHASE**
⑦ **POWER LINE FAULT**
⑧ **UNSTABLE POWER**
⑨ **ABNORMAL RESET**
⑩ **SYSTEM HALT**
⑪ **VD SENSOR FAULT**
⑫ **RESET FAULT**

15.2 Fault description

① **Fault message: CT: BAD OFFSET**

Description:

■ A case which the current greater than 1[A] is detected occurs despite the operation has not begun. It is the case of current flow by wrong connection related to CT or by component damage.

Possible cause:

■ CT or CT Line connection failure, SCR damage

Countermeasure:

■ Check the connection status of CT. Check SCR damage.

② **Fault message: UNDER-CURRENT**

Description:

■ It is the case which the magnet output level is under the reference value for 12 seconds despite it is at LIFT/DROP operation.

Possible cause:

■ It occurs at wrong connection between the rectifier and the port.

■ It occurs at CT damage or wrong wiring.
■ It occurs when it is not able to generate the output current due to a component damage.

Countermeasure:
■ Check the connection of the magnet with PM and NM terminals.
■ Check the abnormality status of SCR component.
■ Check the connection abnormality status with DC-CT.

③ Fault message: OVER-CURRENT

Description: It occurs at instantaneous over flow at the port.
The reference value can be adjusted with a variable resistor, and the current which has exceeded the reference value makes a fault and stops the operation by generating a controller interrupt. This fault protects SCR and the magnet as to instantaneous overcurrent.

Possible cause:
■ It occurs when the rectifier terminal is short.
■ It is due to the driving status and inappropriate parameter values. Rapid load change may also be the cause.

Countermeasure:
■ Check for the magnet status and any short circuit at the peripheral circuit.
■ Sufficiently set the setting value by adjusting the variable resistor and take a look at the driving status.

④ Fault message: FUSE OR OVERHEAT

Description:
■ It occurs when OH of the terminal board is open.

Possible cause:
■ It is the case which the temperature of the heatproof plate of the rectifier is over 85℃.
■ It is the case which the AC input terminal fuse of the rectifier has been damaged.

Countermeasure:
■ Check the ambient temperature and the air circulation.
■ Check temperature status and debris status of the heatproof plate and check the connection status of the temperature sensor mounted on the heatproof plate.
■ Check the AC input voltage at the spot which has passed the fuse.
■ Inspect for overload driving status for a long period of time.

⑤ Fault message: OUT OF CONTROL

Description:

■ It occurs when the output voltage cannot reach the target value even by adjusting the firing angle to generate the target output.

Possible cause:

■ It occurs when the output voltage is not controlled due to component damage.

Countermeasure:

■ Check for damage status of the stack internal component.

⑥ Fault message: BAD OR NO PHASE

Description:

■ It occurs when a frequency or phase cannot be determined from the input AC power.

Possible cause:

■ This fault is a problem related to phase voltage detection. Check the power status (R, S, T).

■ Check if the MaxSyncCnts(Maximum Sync Counter) value from the parameters is set too low.

Countermeasure:

■ Check if the 3 phase power is fed in properly.

■ Check if there is too much noise at the 3 phase power.

■ Adjust the MaxSyncCnt value.

⑦ Fault message: POWER LINE FAULT

Description:

■ It detects the input power status or the frequency when feeding the power and shows on the LCD screen in case of a problem.

■ It displays on the LCD screen if the AC power of the level not being able to generate the set operation voltage.

Possible cause:

■ It is the case which input power is not impose.

■ It is the case which noise is severe at the input power.

Countermeasure:

■ Look at the connection status of R, S and T phases of the input power.

■ Measure the AC voltage between R, S and T phases of the input power.

■ Check again for secure connection of the terminal.

⑧ Fault message: UNSTABLE POWER

Description:

■ It occurs when the controller cannot operate properly due to unstable power voltage.

Possible cause:

■ It is the case which the power supplied to the controller is unstable.

Countermeasure:

■ Check for any abnormality at the PCB SMPS part.
■ Check if the AC power input of the power part is normal.
■ Reset the controller.
■ Replace the PCB if the fault is repeated even after the reset.

⑨ Fault message: ABNORMAL RESET

Description:

■ It occurs when the controller cannot operate properly due to unstable power voltage.

Possible cause:

■ It is case which the controller cannot operate normally.

Countermeasure:

■ Check the power supplied to the controller.
■ Check the controller peripheral circuit.
■ Reset the controller.
■ Replace the PCB if the fault is repeated even after the reset.

⑩ Fault message: SYSTEM HALT

Description:

■ It occurs when the controller cannot operate properly due to unstable power voltage.

Possible cause:

■ It occurs when the PCB controller(ATMega128) enters at abnormal operation status.

Countermeasure:

■ Reset the controller.
■ Replace the PCB if the fault is repeated even after the reset.

⑪ VD SENSOR FAULT

Description:

■ It occurs when a voltage greater than that set in the parameter "VDSens Flt Lev" at the P-N terminal(POT output) is detected at READY status.

Possible cause:

■ It occurs if the port output voltage is not completely eliminated even at READY status.

■ It occurs when the voltage set in "VDSens Flt Lev" parameter is too low.

■ It occurs when there is an abnormality at the PCB VD sensor part.

Countermeasure:

■ Measure the P-N terminal voltage after selecting the multi-meter at DC Voltage at READY status. If voltage is remained in actual, check the port status or the wire connection status.

■ If a fault occurs despite no actual voltage has been measured, perform the following actions.

■ Check if the value set in "VDSens Flt Lev" parameter is too low.

■ Check if the fault continues to occur even after performing "Reset Offset" parameter.

■ Check if the fault continues after the PCB replacement.

⑫ Fault message: RESET FAULT

Description:

■ It occurs when reset signal is fed into the drive at LIFT status.

Possible cause:

■ It is the case which reset button is pressed due to manipulation mistake during LIFT

■ It is the case which noise has intruded in the drive reset line during LIFT

Countermeasure:

■ Check if LIFT is at OFF.

■ Check noise occurrence status at the drive reset line.

16. Standard Specification

Below is the standard specification of TDR-series. This specification may change according to the working conditions of HANMI TECHWIN Co. Ltd.

TDR-35	TDR-50	TDR-70		TDR-110		TDR-150		TDR-180		TDR-250	
6KW	9KW	12KW	15KW	19KW	22KW	26KW	29KW	31KW	38KW	42KW	52KW
28 A	42 A	55 A	68 A	87 A	100 A	120 A	131 A	141 A	173 A	205 A	237 A
HEAT SINK	252 × 60 ×440										
R-C SNUBBER	RCS-02(10W 68Ω , 0.1 μF2000V)										
COOLING FAN	120 x 120 x 38 (AC 110, 220V)							120x120x38 (AC110,220V)			
	2EA							4EA			
THERMO START	85°C NORMALLY CLOSE										

16.1 Magnet controller selection

① Magnet capacity to be used: KW

Ex.) The magnet capacity is 13KW.

② DC voltage to be imposed to magnet: V_{dc}

Ex.) DC voltage imposing to the magnet is DC110V.

③ DC current flowing in the magnet: I_{dc}

- Calculate with I_{dc} = KW / V_{dc}.

Ex.) Current flowing in the magnet = 13KW / 110V = 118.2A.

④ Select rated current of the basic specification with the calculated $I_{dc.}$

- RATED CURRENT >= Select according to I_{dc}.

Ex.) For rated current, select 120A which is greater than 118.2A, the current flowing in the magnet. And, select 26KW for the output(KW) and TDR-150 for the type.

⑤ Select the magnet controller according to the above conditions.

Ex.) Select the magnet controller to TDR-150 (26kW).

17. Dimension

Below picture shows the standard dimension of TDR-series. The dimensions may change according to the working conditions of HANMI TECHWIN. CO., LTD.