

DIGITAL LIFTING MAGNET CONTROLLER

FDR-series



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1.

2.

3.

4.

5.

6.

7. KEYPAD

8. KEYPAD

9.

10.

11.

12.

13.

14.

15. Trouble Shooting Guide

16.

17.

1.

FDR - series

SCR(thyristor)

3

converter

가

FDR - series
module

. Module

, THYRISTOR

가

2.

logic

가

software

가

가

key

10

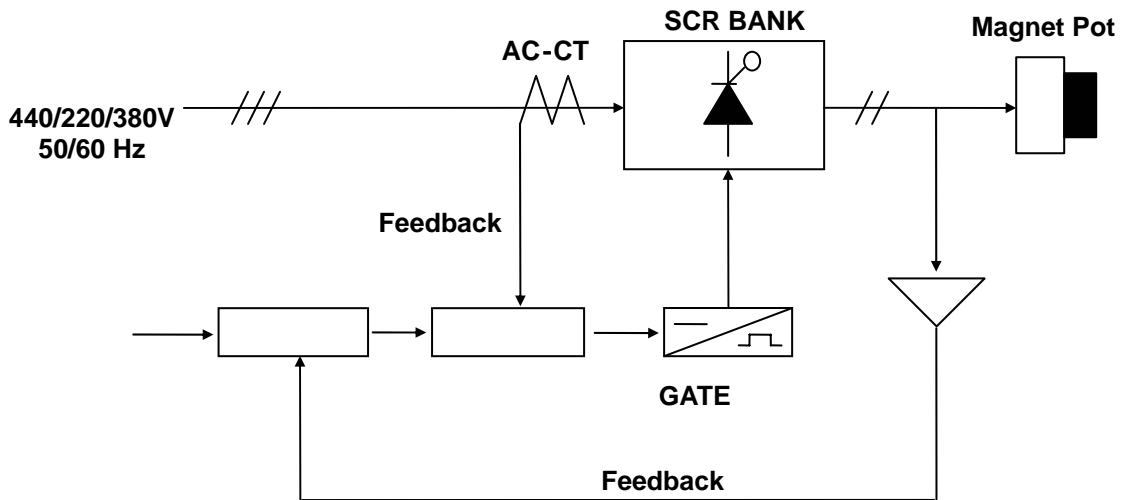
key

, key NR(Notch Reference) / CR(Constant Reference) /
OE(Over Excitation) / OS(Over Shoot)

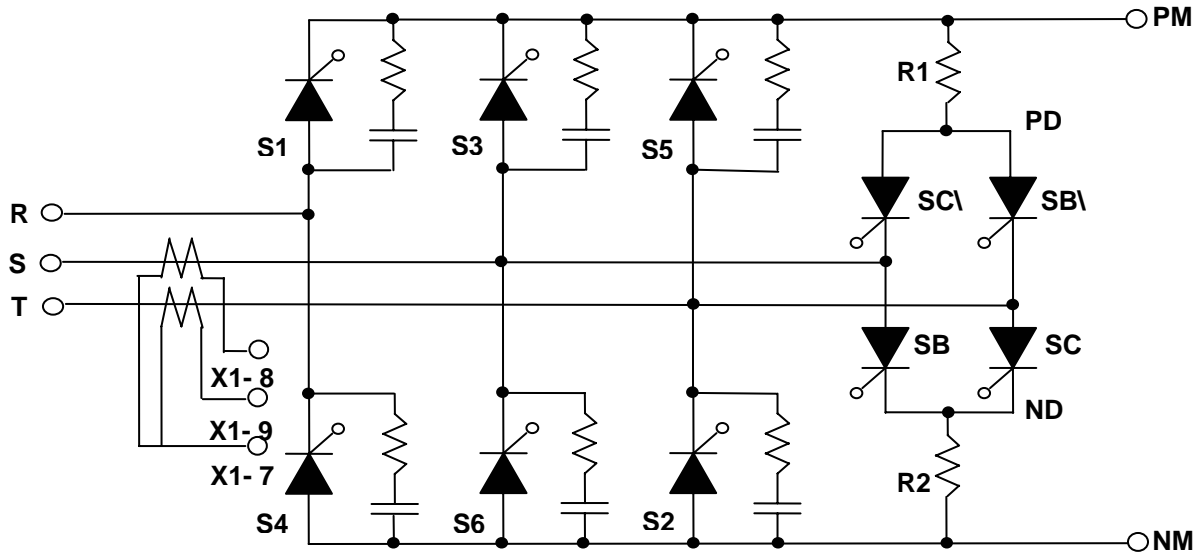
SCR

, Fault
가
nv-RAM
back up
, EMI

3.



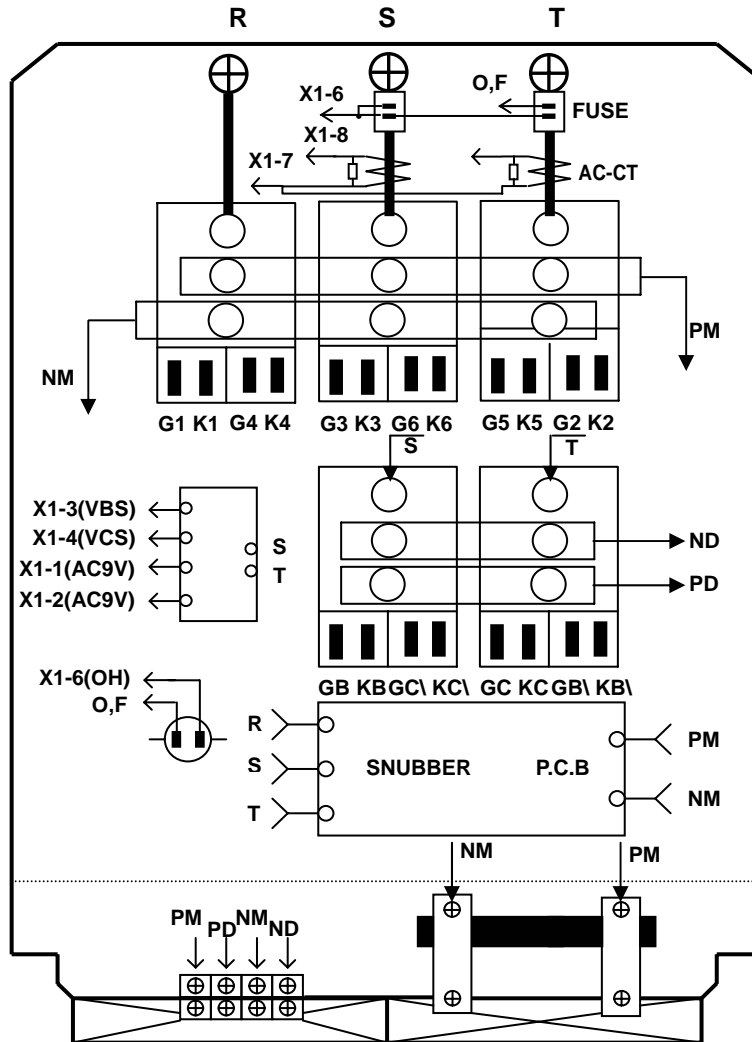
4.



LIFT	Converter			
(LIFT)		(R,S,T)	SCR	S1, S2, S3, S4, S5, S6
6	PM-NM		positive DC	.
LCD		(Firing angle)	display	
positive DC	()	0 ~90	PM-NM	
.	, 90~180	PM-NM	negative DC	
.	90	0	0	가
.	.	.	30 ~160	.

DROP	Converter			
(DROP)		(S,T)	SCR	SB, SB' , SC, SC' 4
	PM-NM		negative DC	.
LCD		(Firing angle)	display	
negative DC	()	0 ~90	PM-NM	
.	, 90~180	PM-NM	positive DC	
.	90	0	0	가
.	.	.	30 ~160	.

5.



6.1.2 Fuse

R, S, T Fuse 가
 가 85
 OH, IGND , * Fault *
 Fuse or Overheat

6.1.3

R, S, T S, T 2 ACCT(AC Current Transformer)
 converter X1-7, X1-8 S lb
 feedback , X1-7, X1-9 T lc
 100% 1V
 X1-7, X1-8 X1-7, X1-9
 lb * Fault *
 b-CT Fault
 lc * Fault *
 c-CT Fault
 * Fault *
 Over current
 * Fault *
 Over load

6.2 X2 : KEY, DISPLAY GROUP

X2 Keypad key LCD display
 cable connecter

6.3 X3 : SCR GATE GROUP

X3 SCR SCR gate(G)
 cathode(K) converter SCR 가
 LIFT converter SCR DROP converter
 SCR

6.3.1 Magnet

PM	PM, NM	SCR	cathode	NM	LIFT	SCR	cathode
	, DROP	SCR	100%		1V 가		feedback
	PM, NM						

* Fault *
Vd sensor fault

6.4 X4, X5 :

X4, X5 FDR-TB-9805 cable connecter

6.5 FDR-TB-9805 :

TB1-1 : +8V , TB1-2 : +5V , TB1-3 : NREF , TB1-4 : GND
 TB1-5 : +24V , TB1-6 : IGND , TB1-7 : LIFT , TB1-8 : DROP
 TB1-9 : SO , TB1-10 : 2N , TB1-11 : 3N , TB1-12 : 4N
 TB1-13 : 5N , TB1-14 : RESET , TB1-15 : FT , TB1-16 : MX

6.5.1 DC 8V

+8V, GND DC8V battery
PCB

6.5.2 Reference

NREF, GND potential type reference
 4V . 0 ~ 4V
 4V 가 100% ,
 100%가 .

6.5.3 DC 24V

+24V, IGND DC24V ON, OFF

6.5.4 LIFT

LIFT LIFT

6.5.5 DROP

DROP DROP

LIFT , DROP

6.5.6 SO(Safe Operation)

Operation) 가 Stick type NR mode SO(safe
 Potential type 100% () ()
)가 .
 , SO ' SO return low' ON/OFF
 . ON 가 가 , OFF
 DROP 가 가

6.5.7 Stick

2N, 3N, 4N, 5N Stick type (control mode) NR mode
 Unit 가 LIFT
 (reference) NR_ref2, NR_ref3, NR_ref4, NR_ref5 magnet 가
 . 1N 2N, 3N, 4N, 5N 가
 NR_ref1 magnet 가

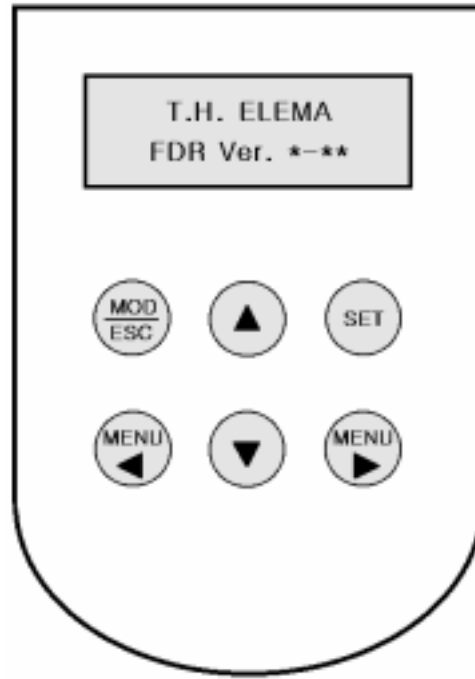
6.5.8 RESET

Reset , Magnet reset Reset, PCB Reset
 System reset

6.5.9 FT(Fault relay)

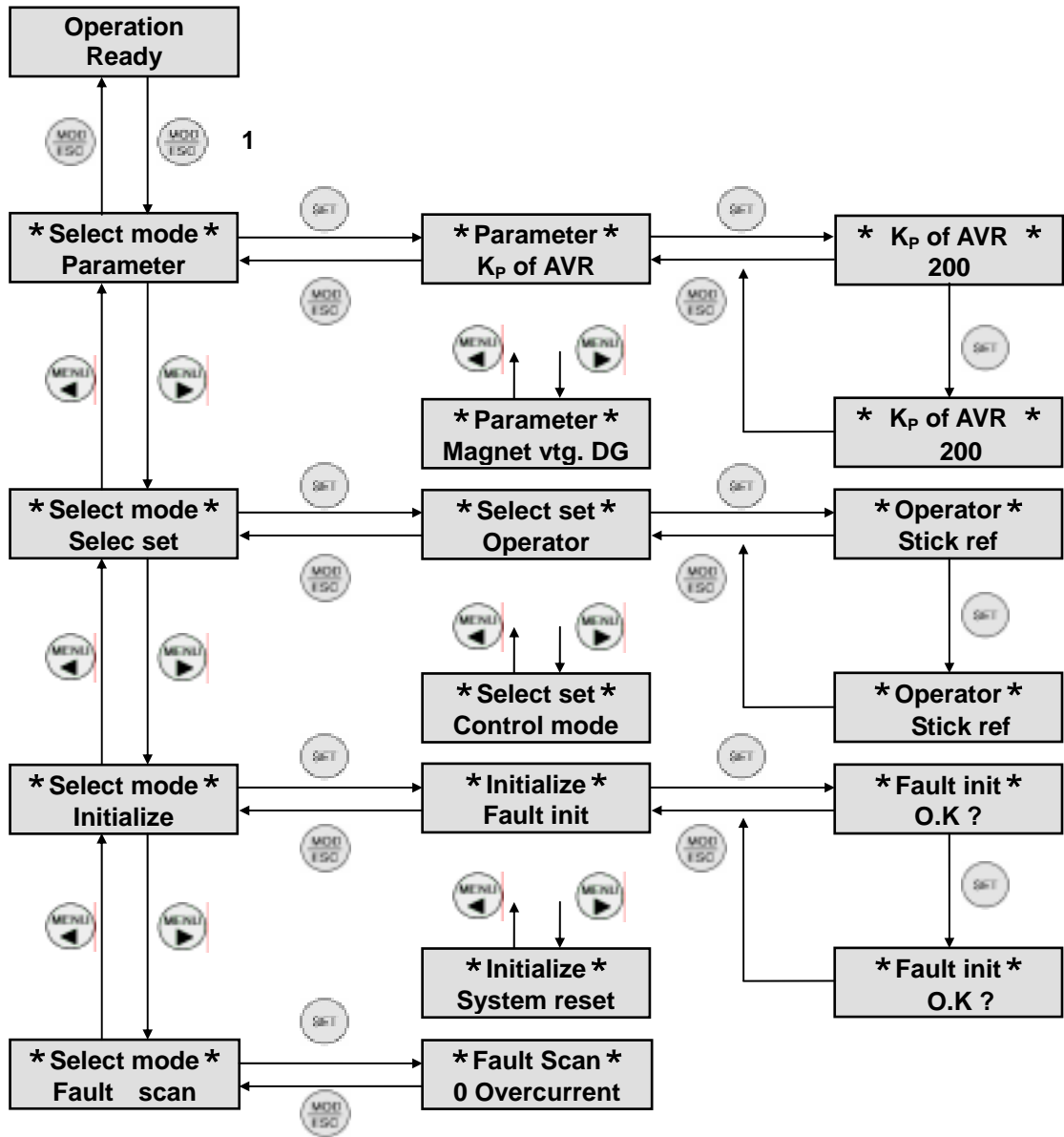
Fault Fault relay Fault Buzzer
 Fault

7. KEYPAD



KEY	EXPLANATION
	1 ESC
	SET
	가
	MENU
	MENU

8. KEYPAD



Unit . ()

LCD



가 display .



1

, touch off
가

가
가 LCD



가 1 가 .

가 1 .



3

가 .

9.

	Menu - Level 1	Menu - Level 2	Range	Default
Select mode	Parameter	K _P of AVR	1 999	200
		K _I of AVR	0 999	200
		K _{PC} of ACR	1 999	50
		K _{IC} of ACR	0 999	50
		Ref 1	65 120	100[%]
		Ref 2	100 185	165[%]
		Ref 3	140 200	200[%]
		NR_ref 1	10 30	20[%]
		NR_ref 2	30 50	40[%]
		NR_ref 3	50 70	60[%]
		NR_ref 4	70 90	80[%]
		NR_ref 5	90 100	100[%]
		t 1	2000 7000	5000[ms]
		t 2	2000 7000	5000[ms]
		Negative time	0 3000	400[ms]
		Holding time	0 5000	500[ms]
		Drop voltage	0 150	50[%]
		Overload	120 200	150[%]
		Overcurrent	150 300	200[%]
		DC vtg. gain	80 110	100[%]
		ACCT cur. gain	80 110	100[%]
		Magnet cur.DG	10 999	100[A/100%]
		Magnet vtg.DG	50 999	220[V/100%]
	LIFT of Max.Vtg.	130 200	140[%]	
	Select set	Operator	Stick / Potential	Stick
		Control object	Voltage/Current control	Voltage control
		Unit(%/real)	Percent / real unit	Percent unit
		Control mode	NR/CR/OE/OS mode	NR mode
		SO return low	On/Off	On
		Normal operate	On/Off	Off
	Initialize	Fault init	Fault scan	Fault
		Parameter init		default
		System reset		System
Fault Scan		10 가	Fault	

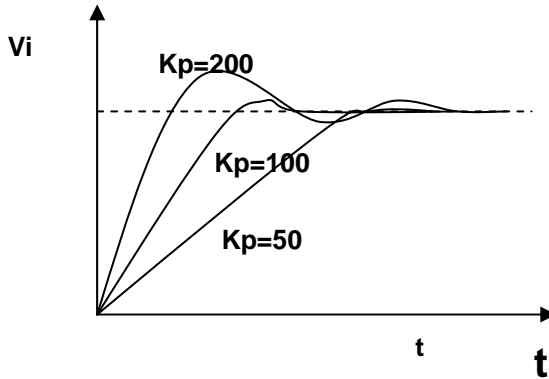
9.1 (Parameter)

Parameter	Magnet LCD	Unit	Initialize	() EPROM	Keypad
nv_RAM				EPROM	Default
nv_RAM					

9.1.1 Kp of AVR

(voltage control)
Feedback

Reference magnet 가
(Kp) , 가 가 .



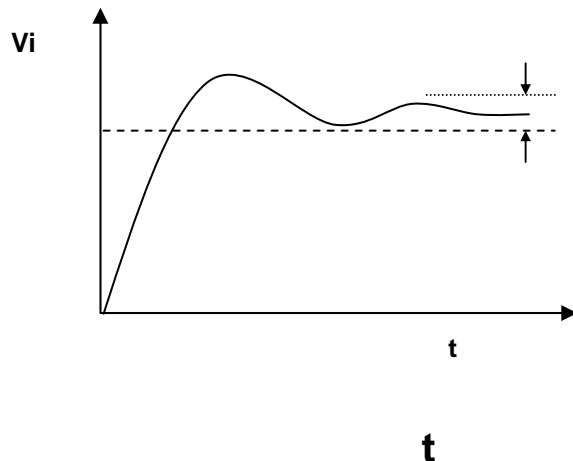
: 1 999
Default : 200

9.1.2 Ki of AVR

(voltage control)
Feedback

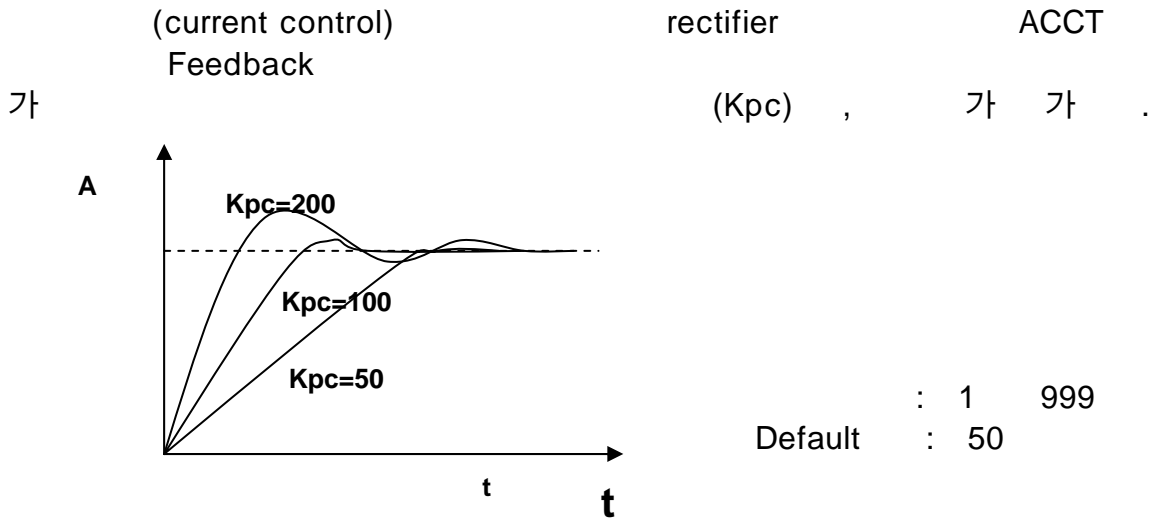
Reference magnet

Gain .

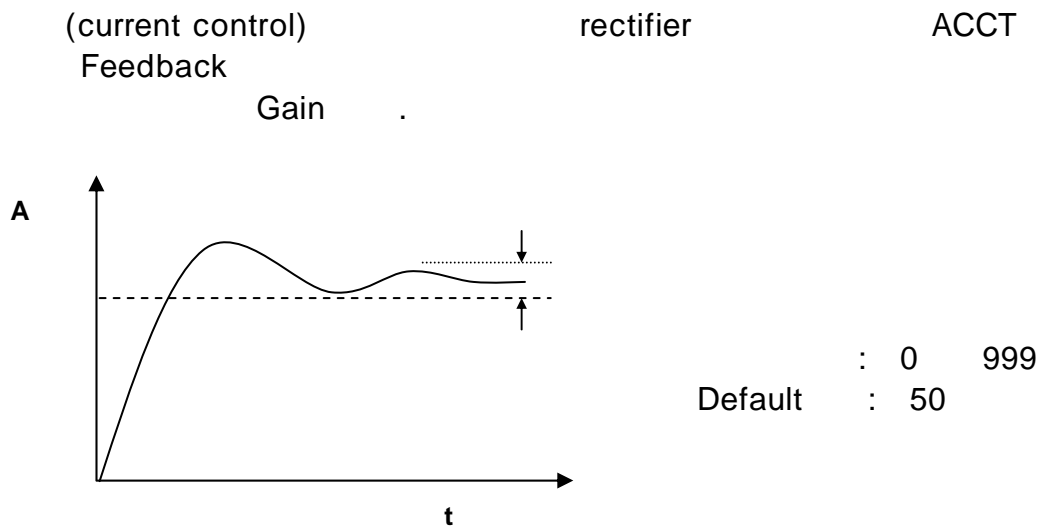


: 0 999
Default : 200

9.1.3 Kpc of ACR



9.1.4 Kic of ACR



9.1.5 Ref1

Stick type DROP (control mode) magnet CR, OE, OS mode (Ref1) 가 LIFT .

: 65 120[%]
Default : 100[%]

9.1.6 Ref2

Stick type	(control mode)	OE, OS mode	LIFT
magnet	(Ref2)	가	. OE mode
t1 , OS mode	t2	가 .	
			: 100 185[%]
			Default : 165[%]

9.1.7 Ref3

Stick type	(control mode)	OS mode	LIFT
t1 magnet	(Ref3)	가	.
			: 140 200[%]
			Default : 200[%]

9.1.8 NR_ref1

Stick type	(control mode)	NR mode	Unit 1	가
LIFT	1	(reference)	magnet	가 .
				: 10 30[%]
				Default : 20[%]

9.1.9 NR_ref2

Stick type	(control mode)	NR mode	Unit 2	가
LIFT	2	(reference)	magnet	가 .
				: 30 50[%]
				Default : 40[%]

9.1.10 NR_ref3

Stick type	(control mode)	NR mode	Unit 3	가
LIFT	3	(reference)	magnet	가 .

: 50 70[%]
 Default : 60[%]

9.1.11 NR_ref4

Stick type (control mode) NR mode Unit 4 가
 LIFT 4 (reference) magnet 가 .

: 70 90[%]
 Default : 80[%]

9.1.12 NR_ref5

Stick type (control mode) NR mode Unit 5 가
 LIFT 5 (reference) magnet 가 .

: 90 100[%]
 Default : 100[%]

9.1.13 t1

Stick type (control mode) OE, OS mode LIFT magnet
 Ref1 , OS mode (t1) 가 . OE mode
 Ref3 가 가 .

: 2000 7000[ms]
 Default : 5000[ms]

9.1.14 t2

Stick type (control mode) OS mode LIFT magnet
 Ref2 (t2) 가 .

: 2000 7000[ms]
 Default : 5000[ms]

9.1.15 negative time

LIFT Unit DROP 가 positive converter
(negative time) 가 magnet
.
: 0 3000[ms]
Default : 400[ms]

9.1.16 Holding time

DROP 가 negative time magnet
negative converter (Drop
voltage) (Holding time) 가 .
: 0 5000[ms]
Default : 500[ms]

9.1.17 Drop voltage

DROP 가 negative time magnet
negative converter (Drop
voltage) (Holding time) 가 .
: 0 150[%]
Default : 50[%]

9.1.18 Over load

SCR magnet UNIT
1

*** Fault ***
Over load

.
: 120 200[%]
Default : 150[%]

9.1.19 Over current

SCR magnet

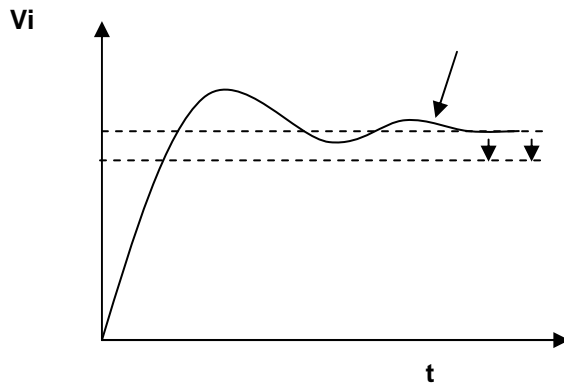
UNIT

* Fault *
Overcurrent

: 150 300[%]
Default : 200[%]

9.1.20 DC vtg. gain

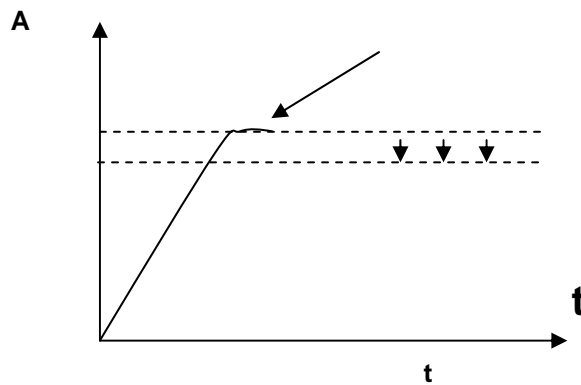
Feedback Gain , Reference magnet



: 80 110[%]
Default : 100[%]

9.1.21 ACCT cur. gain

Feedback Gain , rectifier ACCT



: 80 110[%]
 Default : 100[%]

9.1.22 Magnet cur. DG

display magnet	100%	LCD %	.
			: 10 999[A]
		Default	: 100[A/100%]

9.1.23 Magnet vtg. DG

display magnet	가	100%	LCD %	.
				: 50 999[V]
			Default	: 220[V/100%]

9.1.24 LIFT of Max. Vtg.

display magnet	가	100%	LCD %	.
				: 130 200[%]
			Default	: 140[%]

9.2.3 Unit(%/real) ()

Magnet LCD , ,
 , , percent .
 : Percent / Real unit
 Default : Percent unit

9.2.4 Control mode ()

stick ,
 NR, CR, OE, OS mode .
 : NR/CR/OE/OS mode
 Default : NR mode

9.2.5 SO return low (SO)

SO(Safe Operation)
 SO 가 Stick type NR mode
 Potential type 100% () ()
)가 . 'SO return low' SO ON/OFF
 . ON 가 가 , OFF
 DROP 가 가 .
 : On / Off
 Default : On

9.2.6 Normal operate ()

LIFT, DROP, . ON
 LIFT DROP DROP
 . OFF LIFT OFF (LIFT, DROP 가)
 LIFT DROP .
 : On / Off
 Default : Off

9.3 Initialize ()

nv_RAM default
Fault Initialize Parameter Initialize 가 .

9.3.1 Fault init ()

10 가 Ready

9.3.2 Parameter init ()

default .

9.3.3 System reset ()

System .

9.4 Fault Scan ()

10 , 0 ~ 9

0 line power off :

1

.

.

.

8

9 over current

10.

Lifting magnet
LIFT

DROP

FDR - series

10.1 LIFT ()

LIFT

Potential type
Stick type

10.1.1 Stick type

4 가 mode 가

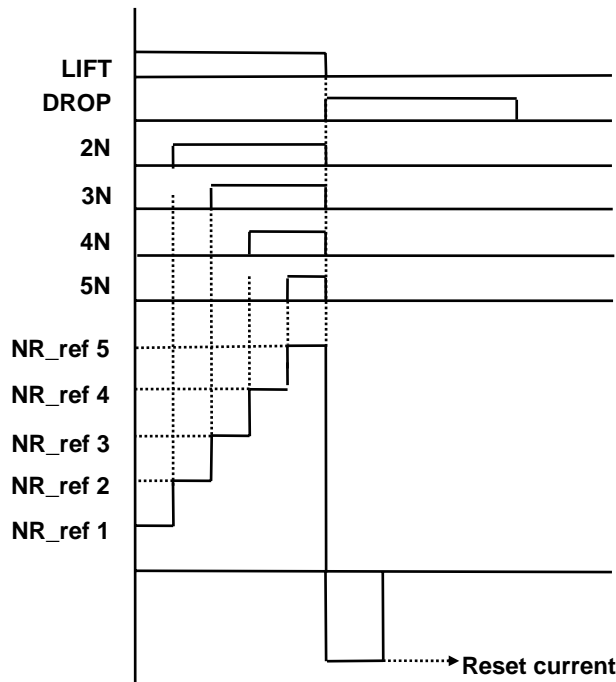
NR (Notch Reference) mode

1N , 2N, 3N, 4N, 5N

Notch

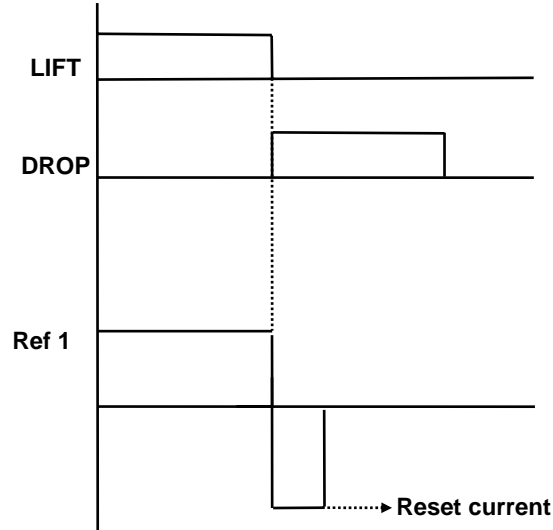
가 mode

NR_ref1, NR_ref2, NR_ref3, NR_ref4, NR_ref5



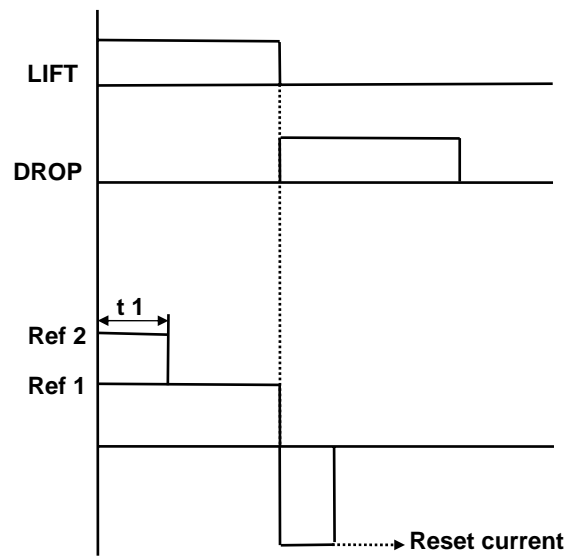
CR (Constant Reference) mode

LIFT (Ref 1) 가 Mode Ref1



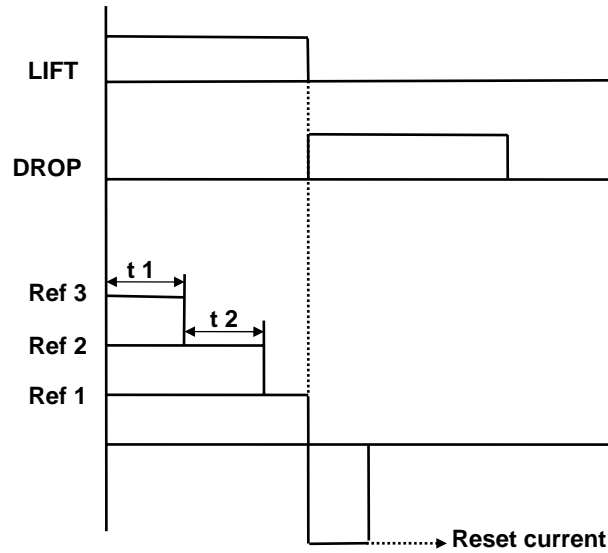
OE (Over-Excitation) mode

LIFT (Ref 1) 가 Mode (Ref2) (t1) Ref1, Ref2, t1



OS (Over-Shoot) mode

LIFT (Ref 1) (Ref3, Ref2) (t1, t2),
 가 Mode Ref1, Ref2, Ref3, t1, t2



10.1.2 Potential type

0 ~ 4V

I/O

TB1-3 : NREF , TB1-4 : GND

10.2 DROP ()

DROP LIFT Unit DROP 가 positive converter
 (negative time) 가 magnet
 , magnet
 negative converter (Drop
 voltage) Magnet 가
 (Holding time) 가

negative time, Drop voltage, holding time

11.

FDR - series

11.1

Unit ()

LCD



가
가

11.2

LCD 1
2 (Vd),
(Ref), (id), (id_ref), ()
Unit(%/real) Percent Unit Real Unit



11.2.1

- : Vd = 100% / DC
- : Ref = 100% / 가 DC
- : id = 100% / DC
- : id_ref = 100% / DC
- : = 66° / SCR (Firing angle)

11.2.2



11.3

fault 가 Fault 가 , RESET Fault Display . Fault .

12.

FDR - series

12.1

1000 [m]
- 10[] ~ +50[]
가 가

12.2

R-S-T

13.

가 , DC 가 , AC 가 ,

13.1 가

13.1.1 magent pot

P-N 가

13.1.2 Battery

Battery 가 , 가

13.1.3 AC

AC magnet pot DC 가
Battery 가 , R-S-T 가

13.1.4 Unit

AC R-S-T
P-N 가

13.1.5 PCB

AC
- PCB R21 JUMP PIN AC 440V
AC440V AC 220V AC220V JUMP
DC
- PCB R30,R28 DC220V 10k ,
DC110V 20k

SCR
 - PCB X3 K1-G1, K4-G4, ... , KC-GC, KC' -GC'
 (SCR)
 k 가 0

13.2 DC 가

13.2.1 Battery DC

Battery

13.2.2 Unit display

Unit DC

LCD

* Fault *
phase loss

가 display

13.2.3 PCB

LED D32(+VCC) , D2(+5V) , D33(+24V) , D25(FT) 가 on

- LED D32(+VCC) , D2(+5V) 가 off , TB1-1,TB1-4
DC9V SMPS
- LED D33(+24V) 가 off , TB1-5,TB1-6 DC24V

SMPS
SCR

- PCB X3 K1-G1, K4-G4, ... , KC-GC, KC' -GC'
DC 0V

13.3 AC 가

13.3.1 AC

AC R-S-T

13.3.2 Unit display

Unit AC LCD **Operation Ready**
 가 display
 - 가 Fault 가 display 15 Trouble
 Shooting Guide

13.3.3 PCB

LED D32(+VCC) , D2(+5V) , D27(-VCC) , D33(+24V) 가 on

- LED D27(-VCC) 가 off , X1-1,X1-2 AC9V
 Unit trans.

X1-3,X1-4 AC9V

- Unit trans.

LCD

*** Fault *
Phase loss**

가 display

X1-5,X1-6 DC0V
 Unit

AC

R-S-T

Fuse display

LCD

*** Fault *
Fuse or Overheat**

가

X1-7,X1-8 DC0V
 AC

S

ACCT

CT

LCD

*** Fault *
b-CT Fault**

가 display

X1-7,X1-9 DC0V
 AC

T

ACCT

CT

LCD

*** Fault *
c-CT Fault**

가 display

PCB TP1,GND DC0V
 PCB X3-11, X3-7 DC0V
 PM-NM

LCD

*** Fault *
Vd sensor Fault**

가 display

13.4

13.4.1 KEYPAD

default

13.4.2 LIFT

가 LCD

display

- LIFT 가

TB1-7, TB1-6

DC0V

가

LIFT

- AC

R,S,T

Fault 가

DC

- Fault

가 display

15

Trouble Shooting Guide

13.4.3 DROP

DROP

- DROP 가

TB1-8, TB1-6

DC0V

DC0V

, LCD

DROP

DROP

display

- 가

‘ Negative time’

DROP

가

- 가

‘ holding time’ , ‘ Drop

voltage’

13.5 test , Fault

13.5.1 test, fault

TEST Main M/C OFF) Fault(Over Current, Over Load, Over Heat, Phase Loss)가

Rectifier MX ON, MX3 OFF , Rectifier battery

Hoist Brake

Drop , Rectifier MX OFF, MX3 ON ,

battery Rectifier

* : (5)

Rectifier LCD "Line Power off" fault 가 display . (TEST Main M/C ON)

Rectifier Reset Switch

Rectifier LCD "Operation Ready"가 display 가

**

**

-

-

-

Rectifier

Rectifier fuse SCR

13.5.2

-

4 5

-

4 5

*

:

가

14.

, fault fault .

14.1

14.1.1 magent pot

P-N 가

14.1.2 magent unit

- PCB UNIT
- PCB UNIT 3~6 1 .
- Air filter 가 Thyristor 가
- . 3 ~ 6 1 .

14.2

14.2.1 UNIT

14.2.2 PCB

PCB PCB

14.2.3 SCR

SCR

15. Trouble Shooting Guide

FDR unit	Fault	FDR unit	Fault message
가	Fault message	가	Fault

Fault List

- 1 phase loss
- 2 b-CT Fault
- 3 c-CT Fault
- 4 Vd sensor Fault
- 5 Line power off
- 6 Fuse or Overheat
- 7 Over current
- 8 Over load

- Group** - check fault **before** operation : 1, 2, 3, 4
 - check fault **during** operation : 5, 6, 7, 8

Fault message : Phase loss

:
가 : , LCD
가
:
R,S,T
R,S,T

Fault message : b-CT fault

가 :
S CT
:
S CT
S CT 2

Fault message : c-CT fault

가 :
T CT
:
T CT
T CT 2

Fault message : Vd sensor Fault

가 :
Magnet sensor , PM-NM
:
PM-NM
PM-NM 0V
PCB TP1 0V

Fault message : **Line power off**

가 :
Fault (Vbs, Vcs)
: X1 (VBS, VCS) 9V

Fault message : **Fuse or Overheat**

가 :
FDR unit Fuse 가
FDR unit 가 85
: Fuse
Fan

Fault message : **Over current**

가 :
Fault SCR Magnet
: Magnet 가
Overcurrent

Fault message : **Overload**

가 :
Magnet 가
: Overload

16.

FDR - series

		FDR-35H	FDR-50H	FDR-70H		FDR-110H		FDR-150H		FDR-180H		FDR-250H		
OUT PUT (kW)		6KW	9KW	12KW	15KW	19KW	22KW	26KW	29KW	31KW	38KW	42KW	52KW	
RATED CURRENT(A)		28 A	42 A	55 A	68 A	87 A	100 A	120 A	131 A	141 A	173 A	205 A	237 A	
FUSE (A)	1	40 A	65 A	90 A	110 A	130 A	160 A	190 A	210 A	220 A	270 A	320 A	340 A	
	2	60 A	80 A	100 A	140 A	160 A	200 A	240 A	260 A	280 A	340 A	400 A	460 A	
SCR SPEC.	SEMI.	SKKT27/16	SKKT42/16	SKKT72/16		SKKT92/16	SKKT105/16	SKKT132/16			SKKT162/16		SKKT170/16	
	EUPEC.	TT25N16	TT46N16	TT92N16		TT93N16	TT105N16	TT142N16			TT162N16		TT170N16	
HEAT SINK		252 × 60 × 440												
CT RATIO (pri./sec.)		500/5(KJ-04, 15A, 1%)					800/5(KJ-04, 15A, 1%)							
CT PRIMARY TURNS		2		1										
RO(10W)		0.8	0.6	0.8	1	1.3	0.9	1	0.9	0.8	0.7	0.6	0.5	
R-C SNUBBER		RCS-02(10W 68 , 0.1 μF 2000V)												
COOLING FAN		120 x 120 x 38 (AC 110, 220V) 2EA									120x120x38 (AC110,220V) 4EA			
THERMOSTART		85 NORMALLY CLOSE												
TRANSFORMER		CAP. : 35VA Freq. : 50/60 Hz Primary volt. : AC 220V, 380V, 440V, 460V Secondly : AC 9V, 9V												

16.1

16.1.1

) : kW
13kW .

) 가 DC : Vdc
가 DC DC110V .

DC : I_{dc}
- I_{dc} = kW / V_{dc}
) = 13kW / 110V = 118.2A

I_{dc} RATED CURRENT
- RATED CURRENT >= I_{dc}
) RATED CURRENT 118.2A
120A

, OUTPUT(kW) 26kW , FDR-150

- AC 440V – H , AC 380V – M , AC 220V – L
) AC AC440V

) FDR-150H (26kW)

17.

FDR - series

