Digital Motor Protection Relay

<DSP-3SD : 3CT based>

Samwha DSP Ltd.

Order

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1. Abstraction

Installation	Model	Protection	Auxiliary
Panel Mounting Type	DSP-3SD	▸ Over/Under current ▸ Phase Loss ▸ Reverse Phase ▸ Locked Rotor ▸ Current Unbalance	▸ Password ▸ Self-diagnostics

2. Main Features

◯ Access restricted to authorized operator: Password

◯ MCU based digital control : optimized protection

◯ Compact size,Practical simple applicationn

* Protection : Over/Under current, Phase loss, Reverse Phase,Locked rotor,Current Unbalance

* Indication : 3 phase current

◯ 3 phase load protection through 3 CT

◯ To cover wide and precise current range for the protection

*10 Type

- Definite T-I: 0.5A～10A , 0.5A~6A with external CT
- Inverse T-I: 0.5A~6A/800% to “oc”

*60 Type

- Definite T-I: 5A～60A
- Inverse T-I: 5A~15A/800% to “oc”

*Wide protection current range with external CT : 1A～600A

◯ Trip cause indication by number and/or characters : 4 digit window

◯ Rotated indication for 3 phase current with 3 sec interval

*1P(single phase) :L1-L3 current

*3P(three phase) :L1-L2-L3

◯ Convenient selection for 1P/3P in preset mode

◯ Manual/Electrical/Auto Reset : easy selection in preset mode → flexible application to meet various system

◯ Stable operation under frequency variation from Inverter : 30Hz ~ 400Hz

◯ Self-diagnostic test by one touch of "SET" key

◯ History, latest 8 trip events including self-diagnostic function

3. Function

Protection	Operation Time	Description
Over current	*d-time:1～300sec, *o-time ▸ definite T-I:1~60sec ▸ Inverse :1~30Class	To protect over current based on L1,L2,L3
Under current	*U-time:1~30sec/definite	To protect under current based on L1,L2,L3
Phase loss	1～5sec	To protect phase loss based on load current
Reverse phase	Within 0.5sec	Based on initial phase state of load current
Locked rotor	dt +0.1sec	Operated if actual is greater than 200% preset "OC" value
Current unbalance	"Ubt" mode:1~10sec	30%~90%:[(max-min)/max]*100[%]
Indication	**Description**	
Rotated during the operation	*Indication in every 3 sec :3 phase current *Possible to fix one of rotated factor or to release :repeated one touch with "CLR" key	
to check and/or to change preset value of each mode during the operation	*Possible to check a value and a mode as pressing "SET" key once during the operation ▸ preset value and mode are appeared alternatively ▸ next mode as pressing "CLR" Key or previous mode as pressing "SET" key *Possible to change preset value after entering into working state if the preset value of "OPSET" mode("CAB" mode group) is "ON"→ factory default value is "OFF" *Return to operating mode as pressing both "SET" and "CLR" key in the same time or waiting for 15sec as storing adjusted value	

4. Technical Specification

Division		Description
Current range	10 Type	0.5A～10A : Definite T-I 0.5A~6A :Inverse T-I/800%, with external CT
	60 Type	5A～60A: Definite T-I 5A~15A: Inverse T-I/800%
	External CT	1A~600A
Time Preset	Starting trip delay time(dt)	1～ 300 Sec

	Over current trip delay time(ot)	1～ 60 Sec	
	Phase loss trip delay time (PLc)	1~5 Sec	
	Current unbalance trip delay Time(Ubt)	1~10sec	
Allowable tollerance	Current	C<=2A:0.2A,C>2A:±5%	
	Time	t<=2sec:± 0.2초, t>2sec:±10%	
Control power		*220VAC : Standard Type *110VAC : Optional Type *24VDC : Optional Type	
Trip output	Main:95-96,97-98	1a-1b(1-SPDT),250VAC/2A,30VDC/1A, Resistive	
Application environment	Temperature	Operation	-25^{O}C~+70^{O}C
		Storage	-40^{O}C~+80^{O}C
	Humidity	30～85%,non-condensing	
Current tollerance against changeable frequency from inverter		Average ± 5%, 30Hz~400Hz	
Max Main Conductor Size		25SQ	
Screw Torque		Max0.6N.m	
Insulation Resistence/IEC-60255-5		100Mohm or more/500VDC, circuit-case	
High Voltage Withstand Test/IEC-60255-5		*circuit-case:AC2000V,60Hz, 1 min *contact-contact:AC1000V,60Hz,1min	
Lightning Impulse Voltage Withstand Test/ IEC-60255-5		*Circuit-Ground,Circuit-Circuit:1.2/50 uS,5KV *Contact-Contact:1.2/50uS, 5KV	
1 MHz Burst Immunity Test:IEC 61000-4-18		2.5KV,Positive/Negative under 2sec	
Electrostatic Discharge :IEC-61000-4-2		*Air :Level 3, 8KV *Contact:Level 3, 6KV	
Radiated Electromagnetic Field Disturbance: IEC-61000-4-3		Level 3, 10V/m	
Electric Fast Transient Burst:IEC-61000-4-4		Power, Realy output:Level 4, 4KV	
Surge Immunity test:IEC-61000-4-5		Relay output:1.2X50uS,2KV(0^{O},90^{O},180^{O},270^{O})	
Conducted Disturbence Test :IEC-61000-4-6		10V,Level 3	
Power Consumption		2W Max	

5.Preset Mode

▶ Main Mode

Press "SET" key to enter into setting mode ,then input password. The more detail is described in "Operation of Control key "

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Mode	Function/ range	Description	Factory Setting value
P***	Password	*need to input a number of digit ,"000" to enter into setting mode *need to move a cursor from first digit(100unit) to last unit(1unit) to pass over next mode as pressing CLR key(Enter function) 3 times. *possible to change password in "PEdI" mode in CAB mode group	000
PhASE/ 1P/3P	to select phase of power line	*1P:Single phase ‣ "PLc","rPc","Uc" and "Ub" mode are disable naturally ‣ under current protection is executed based on higher value between L1 and L3 *3P:Three phase	3P
ct/setting value	to preset a ratio of external CT	*This mode is available for 10 Type *to preset CT ratio of external CT with 5A secondary rating *CT ratio :1~120[preset value = primary value of CT/5] *1:to sense a current through its own CT or external CT with 5/5 ratio *2t:two times winding through CT hole,0.3~3A *4t:four times winding through CT hole,0.2~2A	1
oc/setting value	to preset a range to protect over current	*Preset range ‣ 10 Type : 0.5A~10A, 0.5A~6A with external CT ‣ 60 Type : 5A~60A *current range is naturally change to 0.5A ~6A in case external CT is matched	10:10 60:60
dt/OFF/ setting value	to preset starting delay time	*Trip delay time to prevent unwanted trip caused by starting current *OFF:dt is zero *1~300sec *available in case current over 0.4A is sensed/preset value is not used in case current under 0.4A is sensed	5

Otc/deF/Inv	to select time-current chracteristics for over current protection	*to decide T-I characteristics : deF/Inv *deF(definite):trip based on preset value for “OC” and “ot” *inverse ▸dt=0 : trip based on cold curve ▸dt>0 :trip based on hot curve after dt is elapsed (actually dt+calculated time in inverse curve) ▸10 type:0.5~6A/800% ▸ 60 type:5A~15A/800%	deF
Ot/setting value	to preset trip delay time	*to preset time to make a trip when a current exceeds preset value *definite:1sec~60sec	5
Lc/oFF /on	to protect locked rotor	*OFF:disable for this mode in starting state *ON:Lc is shown in trip after dt+0.1sec if starting current exceeds 200% to oc	OFF
PLc /oFF/ Setting Value	to protect phase loss by load current	*OFF:disable *1~5 sec/adjustable:to make a trip to protect phase loss based on load current	OFF
RPc /oFF/ Setting value	to protect reverse phase by load current	*OFF:disable *ON:to make a trip to protect initial reverse phase based on load current within 0.5sec	OFF
Uc/oFF/ setting value	to preset a range to protect under current	*preset range:0.6A～under "OC" preset value *In case preset "OC" value is under 0.7A, "UC" function is not available *”UC” mode is naturally “OFF” if 2t ,4t is preset, so it is necessary to try to preset “UC” mode again	OFF
Ut/setting value	to preset trip delay time for under current	*trip in preset time after dt is elapsed *1～30sec	"--"
Ub/oFF/ setting value	to define current unbalance rate	*to protect current unbalance among each phase *calculation : [(max-min)/max]*100[%] *preset range : 30%～90%	OFF
Ubt/oFF/ setting value	to preset trip delay time for current unbalance	*oFF: this mode is disable naturally if “Ub” preset “oFF” *1~10sec	OFF
rESt/ Hr/Er/ A-rE	to decide how to reset trip state	*Hr:manual reset/Password input *Er:electrical reset : "CLR" Key : Control power-off *A-rE : automatic reset by time of “AUt” mode only for over current trip	Er

AUt/setting value	to preset auto reset time	*time range : 0(instant), 0.1sec,1~300sec *If Hr is preset in " rESt" mode, this mode becomes disable	"--"
out/a/b	to decide initial state of main trip output	In case the control power is powered, ‣ a:initial state of 1a(main trip) output is changed to oposite state(95-96→open,97-98→close) ‣ b:initial state of 1a is not changed (95-96→close, 97-98→open) *Not possible to change the preset value of this mode in any case during operation even if "OPSE" mode("CAB" mode group) is "ON"	b
trIP /8~1/ trip cause/ trip value	to show latest number of 8 trip cause	*to show the number of 8 trip cause in the order *press "UP" or "DN" in the "trip" mode state, then trip cause and value are shown alternatively *press "CLR" or ""SET" to check next event or previous event *self-test trip is also stored *In order to enter setup state on the way of trip condition check, press "DN" under pressing "UP" firstly and release "DN" firstly under pressing "UP", finally release "UP"	--
Test	*to check if this relay is ready to work normally or not. *"tESt" is appeared in case the operator press "CLR" key for 3 sec or more, then release pressed "CLR" key *main trip output(95-96,97-98) will be trip after counting down preset o-time *press "CLR" key to reset		

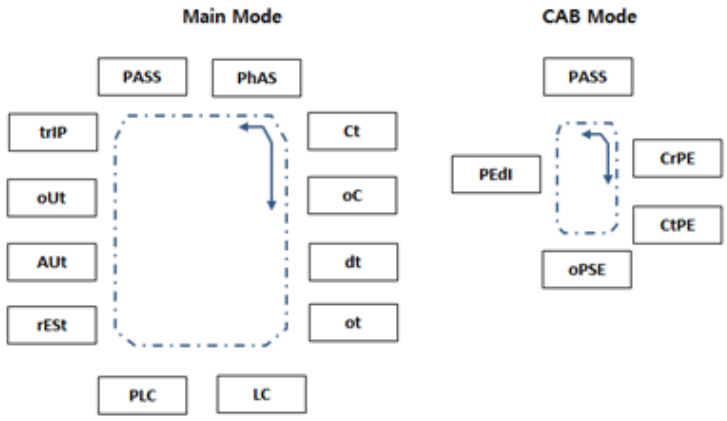
▶ Cab(calibration Mode

This mode is appeared as pressing "SET" key for 10 sec or more , and is disappeared as "SET'key once more

Mode	Function/ range	Description	Factory Setting value
P***	Password Input	*need to input password to adjust this mode group so that authorized person may be able to adjust. *how to input is same as a case of main mode	000
CrPE	to have a calibration for phase "R"current	*Possible to adjust within +,- 0.1A~9.9A by using "UP"."DN" key.	0

CSPE	to have a calibration for phase "S"current		
CtPE	to have a calibration for phase "T"current		0
OPSE /ON/ OFF	to decide if a preset value can be changed or not during normal operation	*ON:possible to change a preset value during normal operation *OFF:not possible to change a preset value during normal operation *This mode can not interfere “out” mode in any case	OFF
PEdI	to change Password	*Possible to input new digit by using "UP" or "DN" key after positioning a cursor on the required digit as using “SET" & "CLR" key with directional job *How to complete password change:firstly press "CLR" key to come out "setting mode" ,then press both "SET" & "CLR" key	000

6. The order of Rotated Mode



7. Input-Output terminal

DIV		Terminal	Description
Input	Control Power	A1(+) , A2(-)	*220VAC : Standard Type *110VAC : Optional Type
Output	Main Trip	*1a-Ib:95-96, 97-98	*Over Current *Locked Rotor *Phase Loss

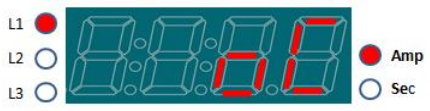
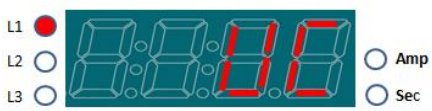
8. Operation of Control Key

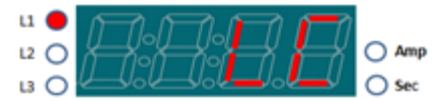
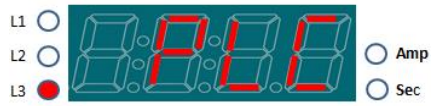
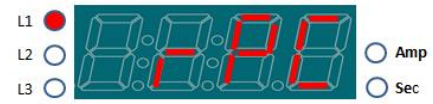
1."SET" key	*Press "SET" Key to enter into setting mode, then "P000"(factory default password) is shown *Move cursor from first digit to right end digit by pressing "CLR" key, finally press once more, if password is not changed from factory default value, but if password is changed, then make required digit by using "UP","DN" key untill operator meets changed password. *If there is no input for 15sec or pressing both "SET" and "CLR"key, it can be entered into operating condition.
2.Changed feature of Setting Key	*After entering into posible state for preset , each key acts its job as followed :SET→ backward direction ,CLR → foward direction, UP.DN → able to select number or character in preset mode. *The previous mode based on setting mode is come out as pressing "SET" key during doing a prest job

3."SET" Key & "CLR" Key/to select MODE	*Possible to select Mode by using "SET" or "CLR" key
4."UP" key & "DN" Key/Adjust	*Possible to preset required value as selection a character or number by using UP/DOWN.
5."SET" & "CLR"Key/Store	*The storage for preset data is completed by pressing both SET and CLR key in the same time or after 15sec is elapsed
6.“CLR" key	*While each factor is rotated, one of rotated factor is fixed by pressing "CLR" key *After fixing a operating factor, the operator is able to rotate manually one by one as pressing "UP"(forwardly), "DN"(reversely)
to check and/or to change preset value of each mode during the operation	* Possible to check a value and a mode as pressing "SET" key once during the operation ‣ preset value and mode are appeared alternatively ‣ next mode as pressing “CLR” Key or previous mode as pressing “SET” key * Possible to change a preset value after entering into checking state if the preset value of “OPSE” mode(“CAB” mode group) is “ON”/factory default value is “OFF” * Return to operating mode as pressing both “SET” and "CLR" key in the same time or waiting for 15sec as storing adjusted value
Test/Reset : "CLR" Key	*to check if this relay is ready to work normally or not. *"tESt" is appeared in case the operator presses test sw on the converter or "CLR" key for 3 sec or more, then release pressed test sw or "CLR" key *main trip output (95-96,97-98) will be trip after counting down preset o-time *After making trip, press "CLR" key for the reset action

9. Trip Indication

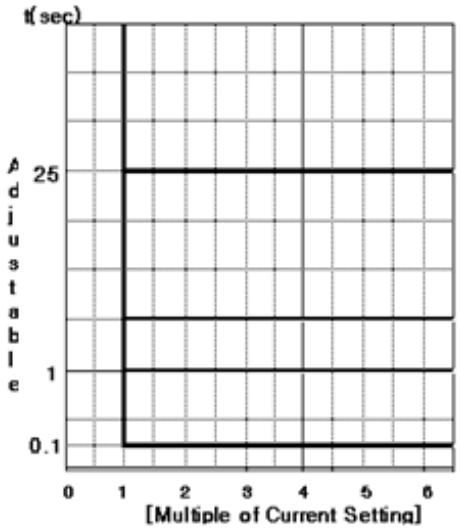
Trip cause and caused value are appeared alternatively

Trip	Display	Cause
Over Current		*trip caused by over current based on phase L1
Under Current		*trip caused by under current in phase L1

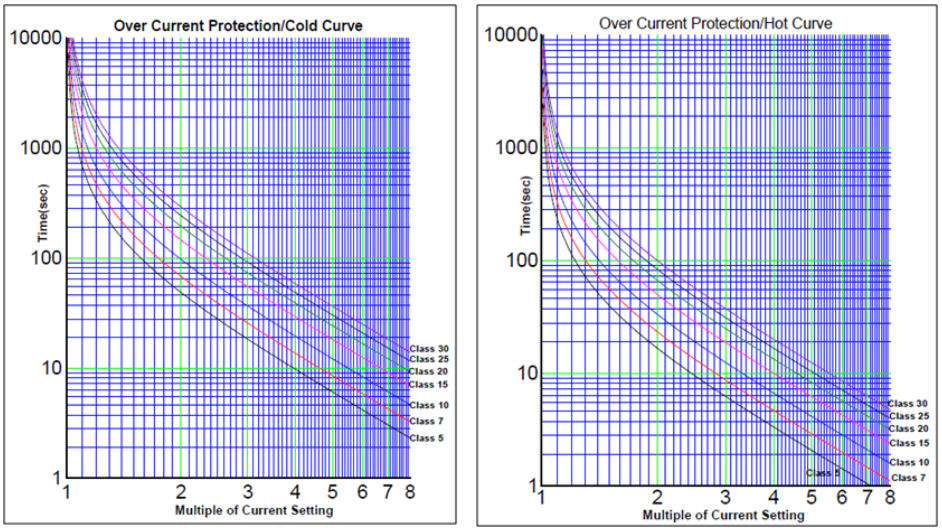
Locked Rotor		*trip caused by locked rotor current in phase L1 during motor start
Phase Loss		*trip caused by phase loss of phase L3 in load part
Reverse Phase		*trip caused by initial reverse phase of phase L1 in load part
Current Unbalance		*trip caused by current unbalance of phase L1

10. Time-Current Characteristics

- **Definite Time**

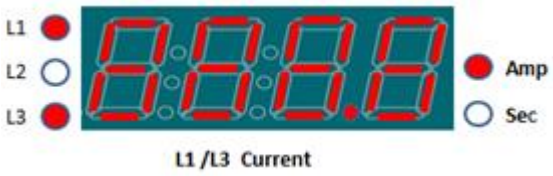


- **Inverse Time**

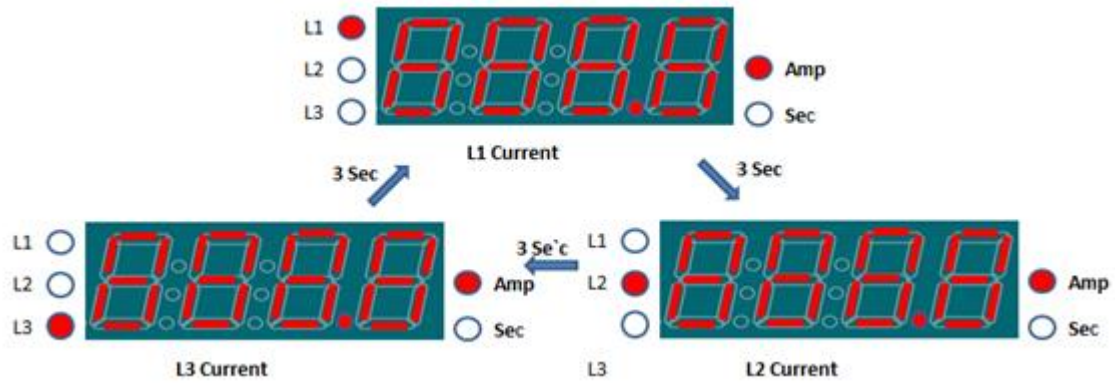


11. Rotated Indication

- **1P(Single Phase) Load Current : Phase L1-L3**



- **Three Phase Load Current : Phase L1-L2-L3**



12.Preset Mode Window

Division	Mode	Preset value

	“SET”,“CLR” Key	“UP”,“DN” Key
Current		
Over current trip delay time(ot)		
Starting trip delay time(dt)		

13.Operational Indication

- Indication during d-time for mortor starting

  ⟶ “d & Current value” is indicated if “d-time” is executed for mortor starting, but “d” is flickering in every 1sec

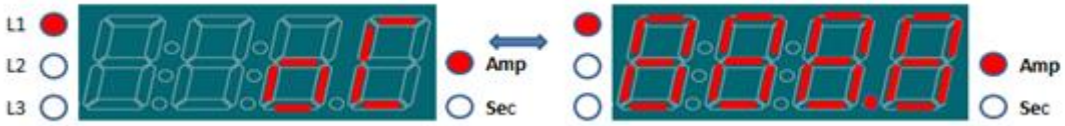
- Indication during preset operating time before trip in followed each case

  - “OC” trip

    ⟶ “o & Current value” is indicated if “o-time” is executed for over current protection , but “o” is flickering in every 1 sec

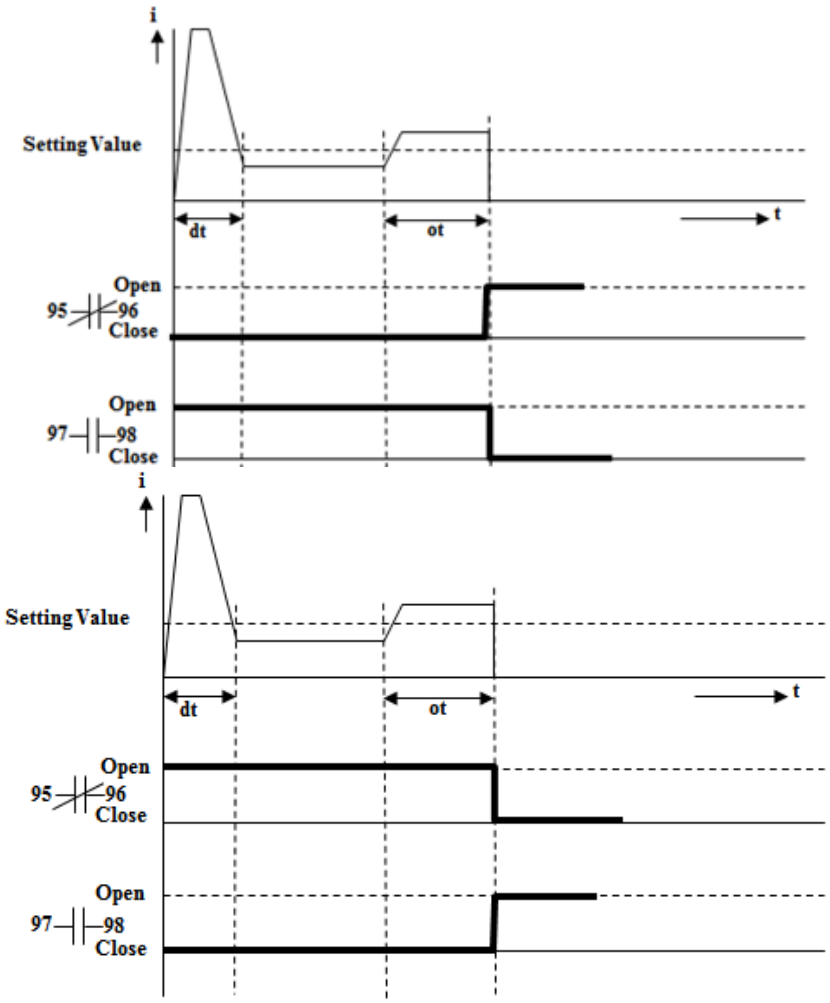
- Trip Indication

Indication after trip in every each case is that “trip cause” and “trip value” are shown alternatively



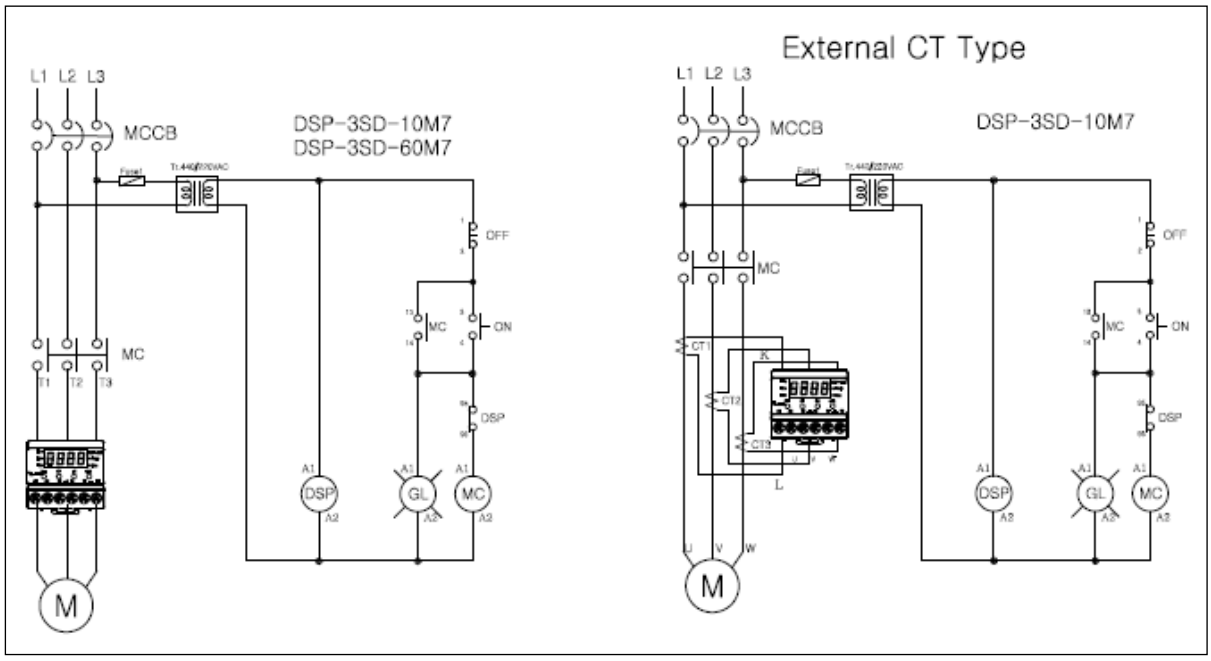
14. Time Based Trip Relay Output

- Over current protection/ “out” mode:b



- Over current protection/ “out” mode:a

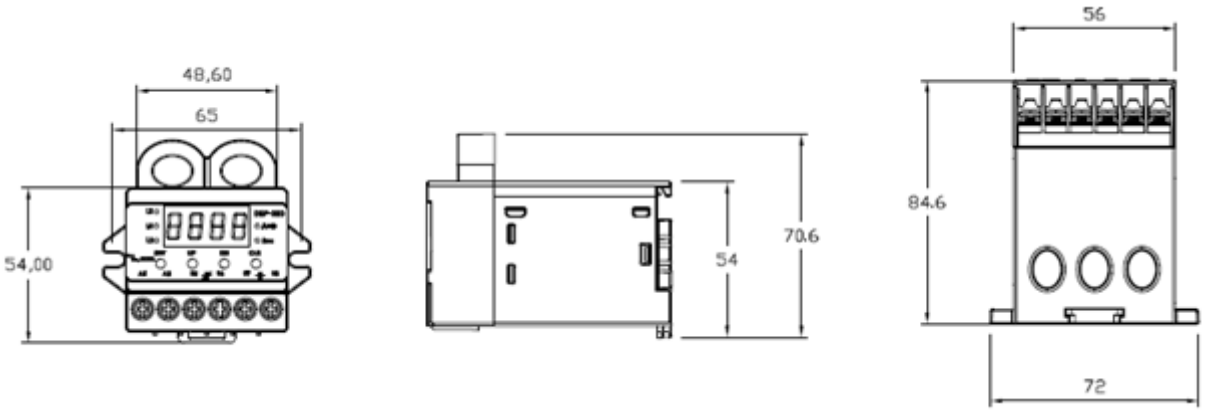
15. Application Sequence Diagram



*Note

It is required that external auxiliary power relay shall be matched with trip output of DSP in order to meet large capacity of contactor

16. Dimension



17. Order Form

Item	Reference Code	Description
DSP-3SD	DSP-3SD-10-B	Panel Mounting Type, 0.5~10A/0.5A~6A with external CT,24VDC,Optional Type
	DSP-3SD-10-F7	Panel Mounting Type, 0.5~10A/0.5A~6A with external CT,110VAC,50/60Hz,Optional Type
	DSP-3SD-10-M7	Panel Mounting Type, 0.5~10A/0.5A~6A with external CT,220VAC,50/60Hz,Standard type
	DSP-3SD-60-B	Panel Mounting Type, 5~60A,24VDC ,Optional Type
	DSP-3SD-60-F7	Panel Mounting Type, 5~60A, 110VAC, 50/60Hz , Optional Type
	DSP-3SD-60-M7	Panel Mounting Type, 5~60A,220VAC,50/60Hz , Standard type
3CT combined	Basic code + C1	With 100/5 CT
	Basic code + CC	With 150/5 CT
	Basic code + C2	With 200/5 CT
	Basic code + C3	With 300/5 CT
	Basic code + C4	With 400/5 CT