Digital Motor Protection Relay

<DSP-AOM-N : New Control Function Meter>

SamWha DSP Ltd.


DSP-AOM-N
RUN
STOP
RCS
MCC
L1
L2
L3
A
GR
LF
UP
Logic
DN
STOP
RUN
RESET

Contents

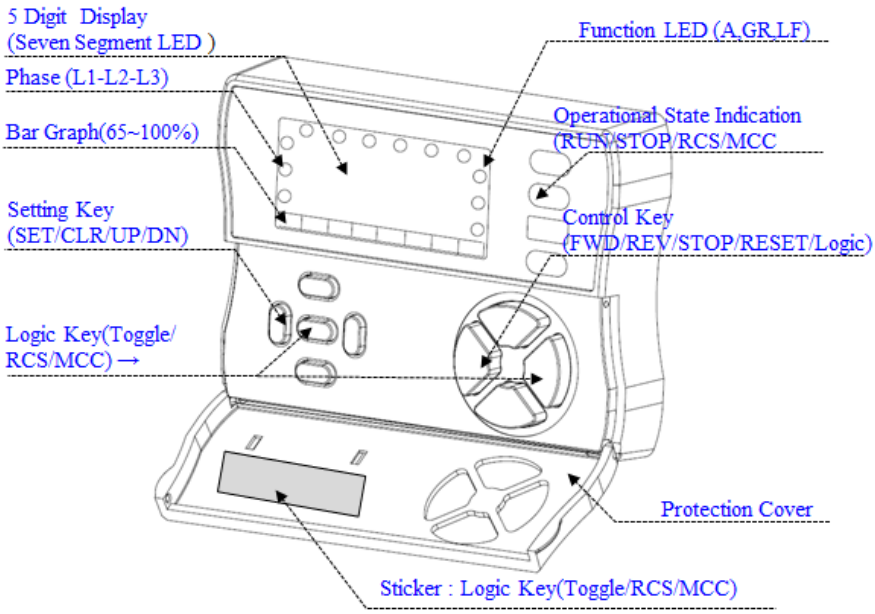
Digital Motor Protection Relay

<DSP-AOM-N:4E Class>

1.Abstraction

Installation	Model	Protection	Description
Panel Flush Mounting Type	DSP-AOM-N	Over/Under Current,Phase Loss,Reverse Phase,Locked Rotor,Current Unbalance, Ground Fault	Password,self-diagnostics,Run(ON)-STOP(OFF) control in Meter

Panel Flush Mounting Type



2. Main Feature

◯ Access restricted to authorized operator : Password
◯ MCU based digital control : precised motor protection
◯ Compact size, Multi-function
  *Protection : Over current/Under current/Phase loss/Reverse phase/Locked rotor/Current unbalance,Ground fault
  *Indication : Current/L1, L2, L3 , earth current, load factor
  *Control : Run-Stop/Display meter
◯ To cover wide and precised current range for the protection
  *10 Type : 0.5A～10A or 0.5A~6A exclusively for external CT
  *70 Type : 5A～70A
  *Extended current range with external CT : 1A～1200A
◯ To be able to control motor and to indicate operation state through multi-function meter
  *Convenient selection for control position/press 1sec : Logic key/RCS↔MCC(Meter)
    -MCC : motor start/stop is executed by RUN-STOP key
    -RCS : motor start/stop is executed by external auto device
    -control position change during an operation : press “logic key” for 3 sec or more
  *Operating state indication : Run-Stop,Load factor,Trip,Test
  *Convenient reset for trip event : “RESET” key
  *Load factor indication by actual value
◯ To show a trip cause and operational information in a character and/or a number : 5 Digit Window
◯ To indicate a necessasary information in every 3 sec: current(L1,L2,L3),earth current, load factor
◯ Possible to use various rated ZCT to sense a zero phase current for GF protection
  *Standard type : to use external ZCT

Type	External ZCT
DSP-AOM-N-V	200mA/100mV
DSP-AOM-N-A	200mA/1.5mA

  *Optional type : to use embedded ZCT**(not available for external CT application)**
◯ Highly sensitive level and wide range for ground fault protection : 50mA～2A /Zero-phase sequence current
◯ Alarm for disconnection with ZCT:in case ZCT is not connected with Z1,Z2 and the value in “Ec” mode is preset in motor stopping state after the control power is on, then "Ec-ct" is flickered 3 times and enter into “Auto"(normal ready state)state /need to preset "Off" in "Ec" mode to clear alarm
◯ Various way to reset after trip: Manual,Electrical or Automatic /to response flexibly for applied sequence system
◯ To keep a stable operation under frequency variation from Inverter : 30Hz～300Hz
◯ Self-diagonostic test by one touch for "CLR" key
◯ Latest 8 trip events
◯ To have stable state under the noise environment :connection cable with line noise filter between display meter and converter/panel flush mounting type
◯ Convenient installation into existed meter hole:65Φ hole or rectangular hole/display meter of panel flush mounting type

3. Function

Protection	Operating time	Description
Over current	·d-time :1～300sec/def. ·o-time :Definite/1～60sec :Inverse/0.2~30 Class	to protect over current of each phase /L1, L2, L3
Under current	·U-time :1～30 sec/def.	to protect under current of each phase/L1,L2,L3
Current unbalance	8 sec	·adjustable:30%～90%: ·% rate=[(max-min)/max]*100[%]
Phase loss	1~5sec/def	to protect phase loss of each phase,L1,L2,L3, based on load current
Reverse phase	within 0.5 sec	to ptotect reverse phase based on load current
Locked rotor	dt + 0.1 sec	to protect locked rotor in starting state
Ground fault	Edt:1～25sec/def Eot:1～30sec/def	to protect GF by zero phase sequence current sensed through ZCT
Indication	**Description**	
Rotated indication during the operation	*Indication in every 3 sec : 3 phase current >> Earth current >> Load factor *Load factor : [actual running current / preset value of "oc"] *Possible to fix one of rotated factor or to release : repeated one touch with "CLR" key	
To check 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 * possible to check next mode as pressing “CLR” Key * Return to operating mode as pressing both “SET” and "CLR" key in the same time or waiting for 15sec	

4. Technical Specification

DIV		Description
Load Current range	10 Type	*0.5A～10A *external CT : 0.5~6A , inverse 800%
Load Current range	70 Type	*5A～70A *5A~40A: inverse 800%
Load Current range	With External CT	1A～1200A
Ground fault current	Zero phase sequence current	*50mA～2A *sensed through external ZCT or embeded ZCT *External CT type is not possible to use embeded ZCT *External ZCT ▷V Type : 200mA/100mV ▷A Type : 200mA/1.5mA
Time preset	Starting delay time(dt)	1～300 sec/def.
	Over current trip delay time(ot)	*1～60 sec/def. *5～30 Class/inverse
	Under current trip delay time(ut)	1～30sec/def.

	Ground fault starting delay time(Edt)		OFF,1～25 sec/def.
	Ground fault trip delay time(Eot)		1～30 sec/def.
	Phase loss trip delay time(PLc)		1~5sec/def
Allowable tollerance	Current		C<=2A:0.2A,C>2A:±5%
	Time		t<=2sec:± 0.2ec, t>2sec:±10%
Control power			*AC 85V ～ AC260V,50/60Hz (DC90V ～ DC370V)
			*DC24V(Optional)
Trip output relay	Main:95-96-98		1c(1-SPDT),250VAC/3A, 30VDC/1A,Resistive
	Logic:C-R-M	C-R	1a(1-SPST),250VAC/3A,30VDC/1A,Resistive
		C-M	1a(1-SPST),250VAC/3A,30VDC/1A,Resistive
Application environment	Temperature	Operation	-25^{O}C～+70^{O}C
		Storage	-40^{O}C～+80^{O}C
	Relative humidity		30～85%/Relative,non-condensing
Current tollerance against changeable frequency from inverter			Average +,- 5%,30Hz～300Hz
Max Main Conductor Size			25SQ
Screw Torque			Max 0.6 N.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:1.2/50uS,5KV *Control Circuits: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°,90°,180°,270°)
Conducted Disturbence Test: IEC-61000-4-6			10V,Level 3
Power consumption			4W Max

5.Preset Description

▶ Main Mode

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

Mode	Function/ range	Description	Factory Setting value
P****	Password	*need to input a number of digit ,"0000" to enter setting mode *need to move a cursor from first digit(1000unit) to last unit(1unit) to pass over next mode as pushing CLR key(Enter function) 4 times. *possible to change password in "PEdIt" mode in CAB mode group	0000
ctrol/oFF/chEc	to confirm for"RUN" operation	*OFF: "RUN" or "STOP" for a motor is executed right after pressing "RUN" key or "STOP" key *chEc: "Start" is shown right after pressing "RUN" key to make run a motor,then a motor is actually run after pressing once again within 5 sec *"Run" process is not valid if 5 sec is exceeded from the first pressing *"Stop" key takes same function manner as a case of "OFF" *This mode becomes disable if RCS is selected by Logic key *This mode is not cooperated with "OPSET" Mode of "CAB" mode group	OFF
ct/setting value	to preset a ratio of external CT	*This mode is available for 10 Type *To preset CT ratio[primary value/5] *CT ratio:1~240 *2t:twice winding through CT hole *4t:four times winding through CT hole *1:to sense a current through its own CT or external CT with 5/5 ratio	1
oc/ setting value	to preset a range to protect over current	*current range for over current protection *10 Type : 0.5A～10A or 0.5A～6A for external CT *70 Type: 5A～70A	*10:10A *70:70A
dt/OFF/ setting value	to preset starting delay time	*Trip delay time to prevent unwanted trip caused by starting current *1～300sec *available for sensing current over 0.2A , otherwise preset dt is not adopted internally	5sec
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	deF

		▸dt>0 :trip based on hot curve after dt is elapsed(actually dt+calculated time in inverse curve) ▸Available multiple value in each type: -10Type:1~(30/“OC” prset value) -70Type:1~(210/“OC” prset value)	
Ot/ setting value	to preset trip delay time	*to preset time to make a trip when a current exceeds preset value *definite:1sec～60sec *inverse:0.2～30 Class	5sec
Lc/oFF /on	to protect locked rotor	*OFF:disable for this mode *ON:to make a trip in 0.1sec after eleapsed dt ("Otc"=def,inv) if starting current exceeds 300% to “oc” preset value during dt	OFF
Shoc/ oFF/setting value	Shock protection during working	*OFF:disable for this function *preset to "OC":followed calculation /max 700% -10Type:180% [30/"OC"preset value] % -70Type:180% [200/"OC" preset value] %	oFF
st/setting value	to preset a time for shock protection	*0.5 3sec/def. *this mode is shown as "st--" if shock mode is Disable	"--"
PLc /oFF/ setting value	to protect phase loss by load current	*OFF:disable *1～5sec/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 reverse phase based on load current within 0.5sec	OFF
Ec/oFF/ setting value	to preset zero phase current	*to protect for ground fault protection *OFF:disable *sensitive range:50mA～2A *Possible to select one of both rating for ZCT :AOL/M-V type:200mA/100mV :AOL/M-A type:200mA/1.5mA *Possible to make alarm for ZCT disconnection in motor stop state in case the value is preset in this mode : “Ec-ct" is flickering 3 times and enter into “Auto” mode(normal ready state)	OFF
Edt/oFF/ setting value	to preset starting trip delay time	*definite T-I *preset range :1～25sec *this mode is shown alternatively as "Edt" & "--" if “Ec” mode is disable”	"--"
Eot /setting value	to preset operating trip delay time for GF protection	*1～30sec/def. *this mode is shown alternatively as "Eot" & "--" if "Ec" mode is disable”	"--"

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	OFF
ut/setting value	to preset trip delay time for under current	*trip in preset time after dt is elapsed *1～30sec	"--"
ub/oFF/ value	to define current unbalance rate	*to protect current unbalance among each phase *calculation : [(max-min)/max]*100[%] *preset range : 30%～90%	50%
rESEt/ Hr/Er/ A-rE	to decide how to reset trip state	*Hr:manual reset/Password input *Er:electrical reset :"Reset" key :Control power-off *A-rE:auto reset :only available for “OC” trip :possible to reset “RESET” key in meter even before auto reset time does not reach preset time	Er
Aut/ setting value	to preset auto reset time	*time range :0(instant),1～300sec *If Hr is preset in "rESEt" mode, this mode becomes disable	"--"
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 is shown alternatively *press "CLR" or ""SET" to check next event or previous event *In order to enter setup state on the way of trip condition, 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 presses test sw on the converter or "CLR" key for 3 sec or more, then release pressed test sw or "CLR" key *main(95-96-98) trip output will be trip after counting down preset o-time *”reset” key in converter and “CLR” key is available to reset test trip state, but not available for “RESET” key in control block		

▶ Cab(calibration) Mode

This mode is appeared as pressing "SET" key for 5 sec or moe , 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 it of main mode	0000
CrPEr	to have a calibration for phase	*Possible to adjust within +,- 0.1A~10A by using "UP"."DN" key.	0

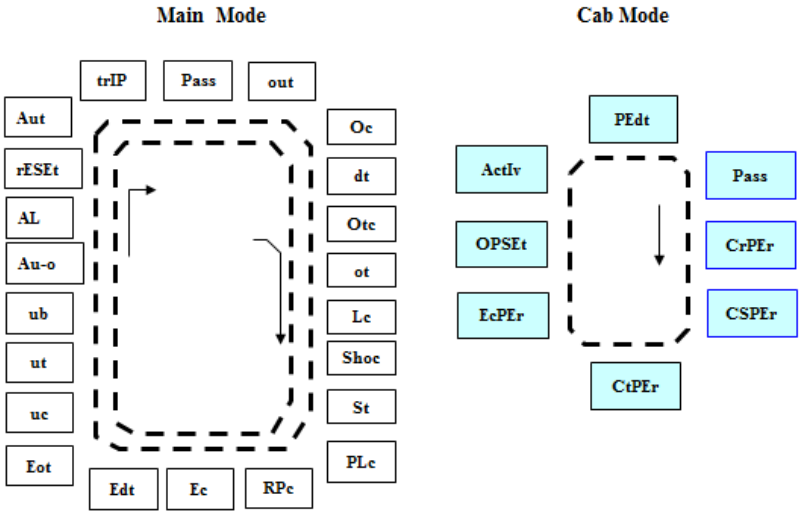
	"R"current		
CSPEr	to have a calibration for phase "S" current		0
CtPEr	to have a calibration for phase "T" current		0
EcPEr	to have a calibration for GF current	*Possible to adjust within +,- 50% by using "UP"."DN" key.	100
oPSEt/ON /OFF	to decide if it is possible to preset during the operation	*ON : it is possible for operator to change a preset value during motor normal operation except “out” mode * OFF : it is not possible for operator to change a preset value during motor normal operation	OFF
ActIv/50/60	to select frequency of power system	*to eliminate the input noise from Z1-Z2 *50 : 50Hz power system *60 : 60Hz power system	60
PedIt	to change Password	*Possible to enter 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	

Note

1.The operator will has to give an attention in order to apply for the function of preset “OPSET” mode which the operator is possible to change preset value of each mode while the operation is executed normally because the unwanted trip may be happend

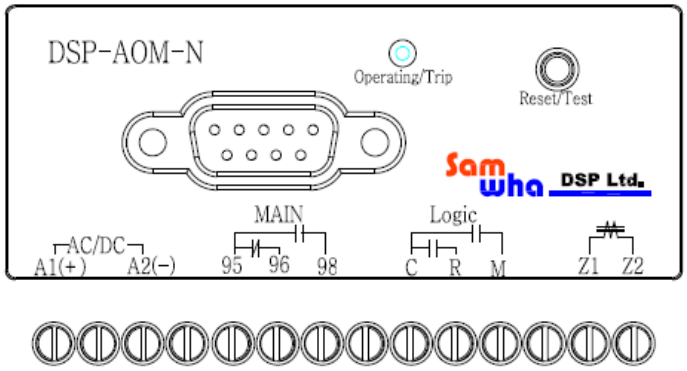
2.The operator can not preset “out” mode in any case concerned with “OPSET” mode

6. The order of Rotated Mode

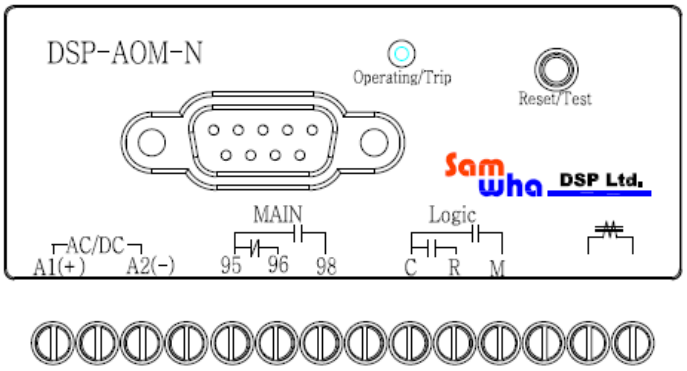


7.Input-Output terminal

‣DSP-AOM-N : Standard type/with external ZCT



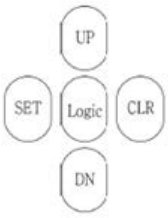
‣DSP-AOM-N : Optional type/with Embeded ZCT

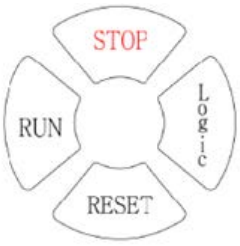


DIV	Feature	Terminal	Description	
Input	Control power	A1(+),A2(-)	*85～260VAC,50/60Hz *90～370VDC	
Input	Z1,Z2	ZCT	*External ZCT ▹V Type : 200mA/100mV ▹A Type : 200mA/1.5mA *with Embeded ZCT :Optional Type	
State Indication	RED		Operating	Available for converter with display meter type
	Green		Power/Stop	
	Yellow		Trip	
Output	Main Trip	*1c:95-96-98	*Over Current *Under Current *Locked Rotor *Phase Loss *Reverse Phase *Ground Fault *Current Unbalance	
	Logic	*1a X 2: :C-R :C-M	*MCC is slected by Logic key : Motor start/stop is executed by RUN/STOP key in control block of meter *RCS is slected by Logic key : Motor start/stop is executed by external device	

			*Logic key is activated if trip is occurred under RCS operation→possible to make reset a trip state *Motor stop under RCS operation : C-R is opened as pressing Logic key for 3sec or more during the operation state → return to a condition under MCC operation state.

8. Operation of Control key





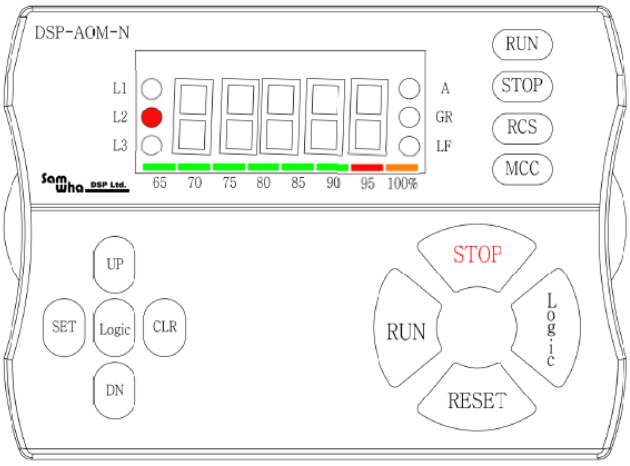
▸Logic key is located inside and outside cover
▸Both "logic" key works same job

1."SET" key	*Press "SET" Key to enter into setting mode, then "P0000" (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 follows :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 "OPSET" mode

<table>
<tr><td></td><td colspan="2">belonged to “CAB” mode group is “ON”/factory default value is “ON”
* Return to operating mode as pressing both “SET” and "CLR" key in the same time or waiting for 10sec as storing adjusted value</td></tr>
<tr><td>Test/Reset:"CLR" Key</td><td colspan="2">*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
*only main(95-96-98) trip output will be trip after counting down preset o-time
*LED on the converter is turned on after a trip
*After making trip, press "CLR" key ,not RESET key in control block of meter, for the reset action</td></tr>
<tr><td rowspan="3">RUN-STOP-RESET</td><td>  </td><td>*Motor run : to make “C-M” be closed
*“ctRol” mode
-OFF:possible for motor to run right after pressing this key
-chEc:”Start” is shown as prssing,then motor is possible to run as pressing this key once again within 5 sec</td></tr>
<tr><td>  </td><td>*Motor stop : to make “C-M” be opened</td></tr>
<tr><td>  </td><td>*Make a reset only after trip which is executed during the operation</td></tr>
<tr><td>MCC-RCS/Toggle key</td><td> 
Inside

 
Outside</td><td>*Both “Logic” key works same job
*MCC-RCS is selected as toggling this key with turning LED
-MCC : RUN-STOP of motor is executed by “RUN” and “STOP” key in meter/ C-M is closed to start motor as pressing “RUN” key,but C-R is not responsed all the time
-RCS : RUN-STOP of motor is executed by external switch ,not “RUN” and “STOP” key in meter/ C-M is not responsed all the time
*Logic key should be pressed 3sec to toggle MCC to RCS,but motor is stopped in the toggling instant
*The trip of C-M or C-R each comes out with main trip together if trip is happened
*The control position returnes to same condition as previous position after power is recovered , if control power is off while motor is normally working.</td></tr>
</table>

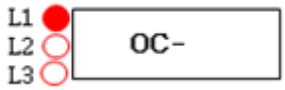
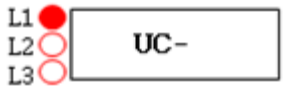
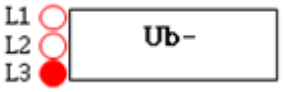
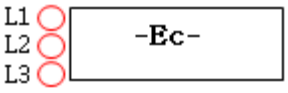
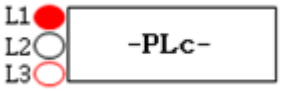
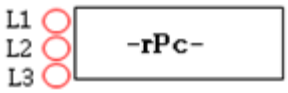
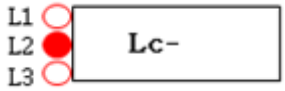
9. Operational state indication



DIV	Indication	Description	Remark
Control Block	RUN	Motor start/operation : “RUN” LED is turned on/RED	
	STOP	Motor stop : “STOP”is turned on/GREEN	
	Logic	*Toggle switch to select MCC/RCS *Under motor stop : press 1sec *Under motor operation : press 3sec *Motor is stopped in toggling instant	Applied for both “logic” key
	RESET	Make reset after trip	
Indication	RCS	Motor is operated by remote controlled device/LED is turned on,green	
	MCC	Motor is operated by “RUN”,”STOP” key/LED is turned on,green	
	TRIP	Yellow LED(100%) on the bar graph is flickered	
	A	Load current	
	GR	Earth current	
	LF	Load factor=[running current/preset “OC” value]	
	L1/L2/L3	3 phase,each	
	Window	7 segment LED	
	Bar Graph	65~100%, Load factor	

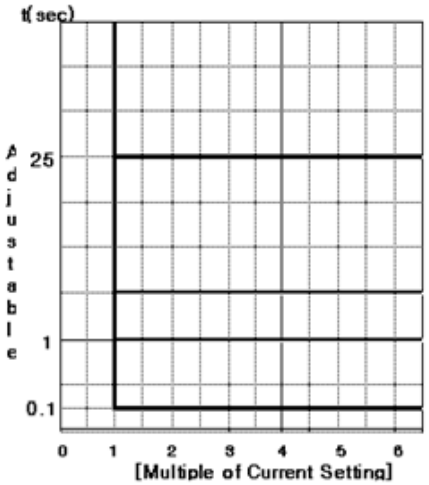
10. Trip Indication

Trip cause and caused value is appeared alternatively

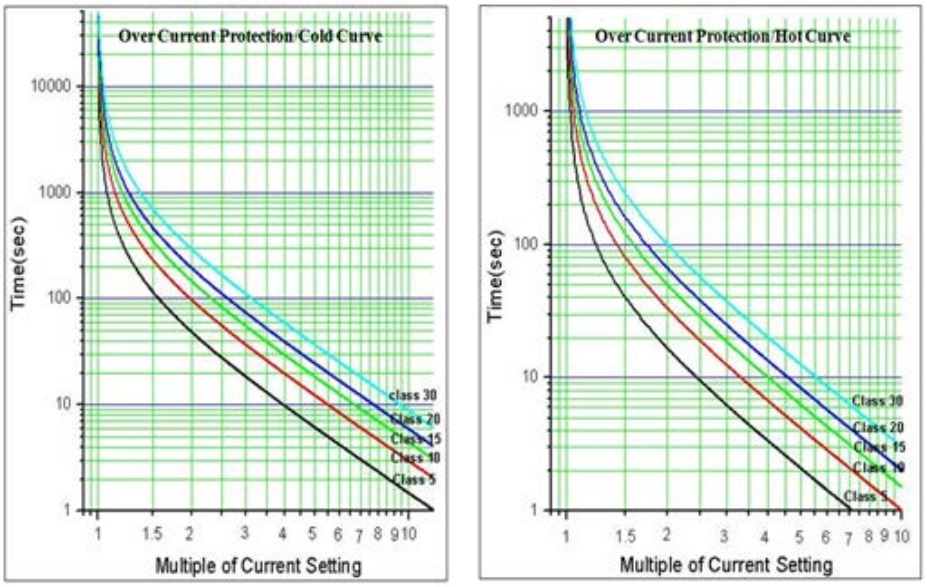
Trip	Display	Cause
Over current(oc)		*trip caused by over current in phase L1
Under current(Uc)		*trip caused by under current in phase L1
Current unbalance		*trip caused by unbalanced current in phase L1
GF		*trip caused by ground fault current
Phase loss		*trip caused by phase loss of phase L2 in load part
Reverse phase		*trip caused by reverse phase in load part
Locked Rotor		*trip caused by locked rotor current in phase L2 during motor starts

11.T-I Characteristcs

▸Definite

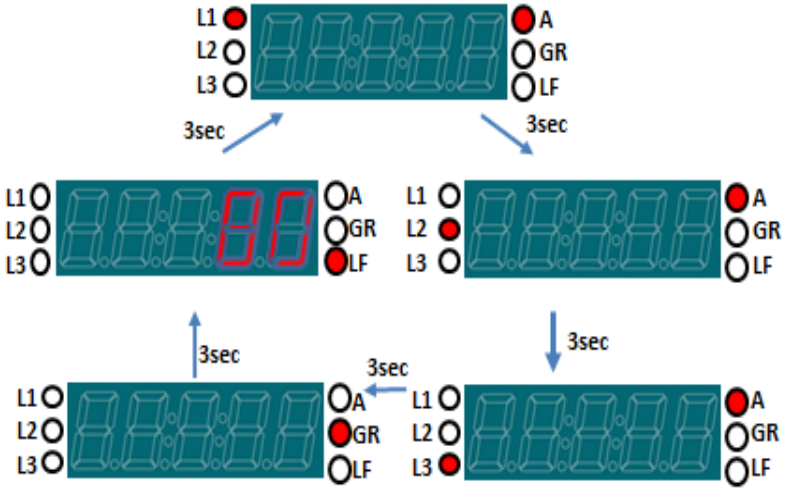


▸Inverse



12. Rotated indication

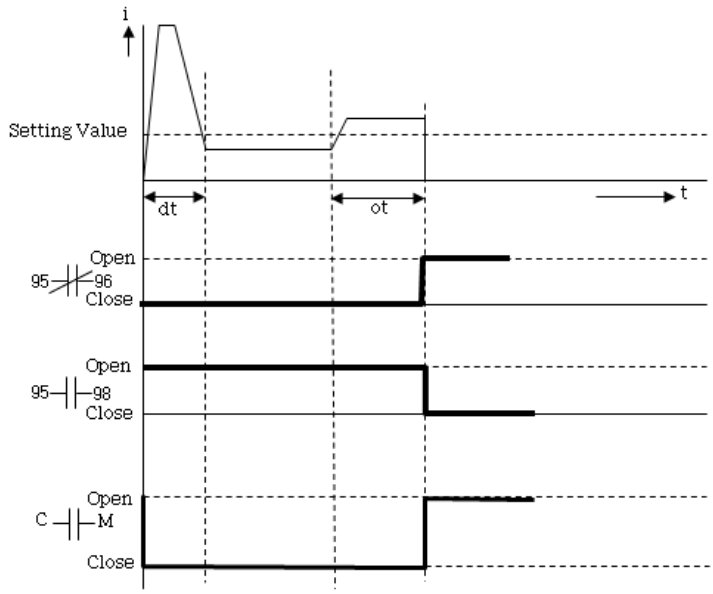
- 3 phase current(L1,L2,L3),Earth current,Load factor



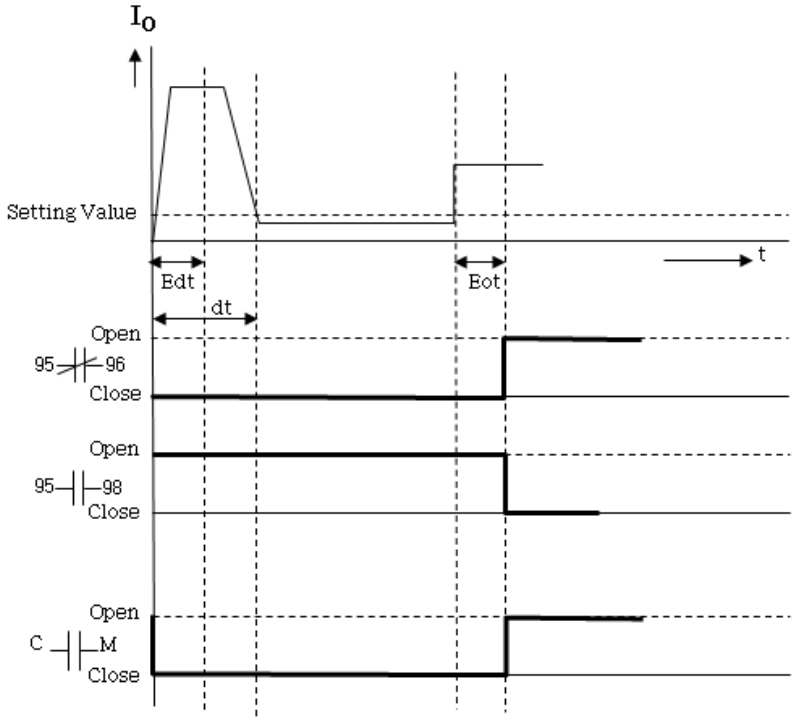
☞ "Ec-ct" is flickering if ZCT is not connected with a terminal of Z1-Z2 in motor stop state while the condition of "Ec" is available and the preset is not ahead anymore

13. Time Based Trip relay Output

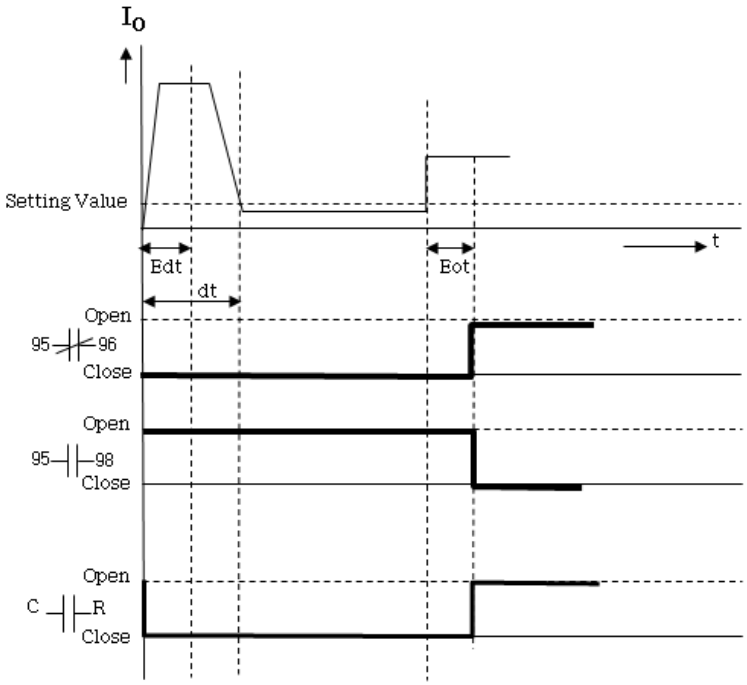
- Over current protection /MCC is selected by Logic key:Run/Stop is done by C-M, , but opened in trip



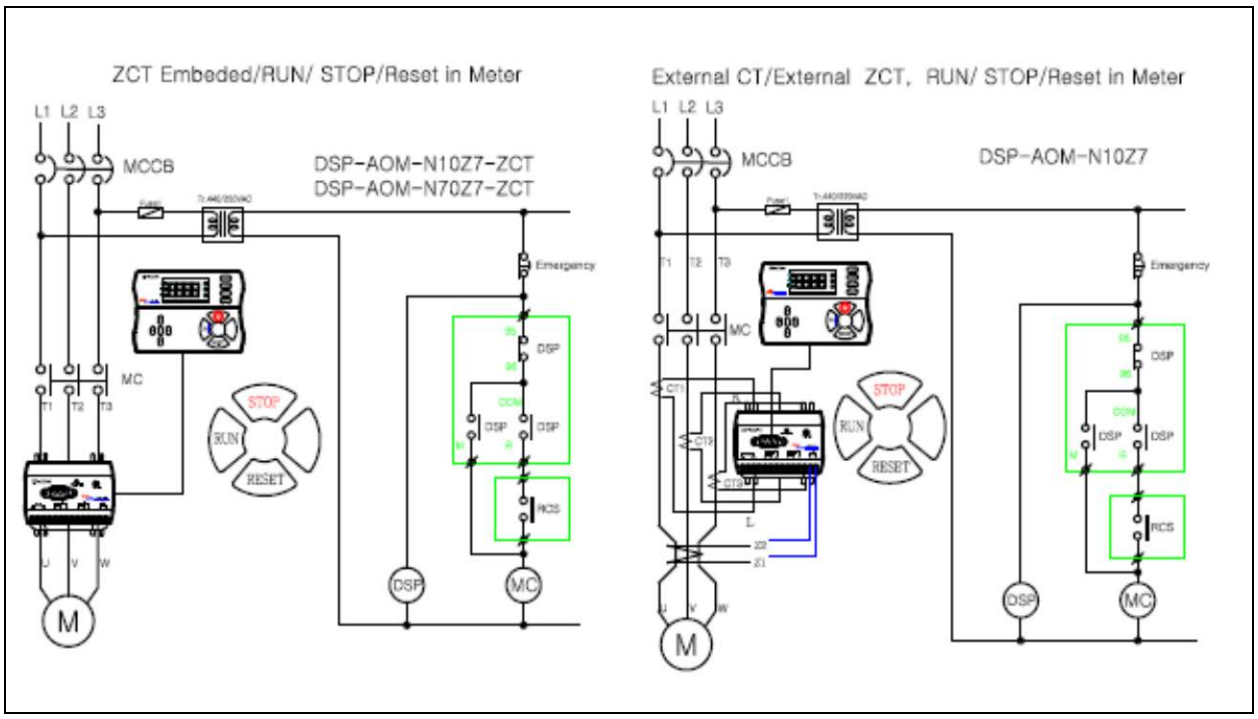
- Ground fault protection /MCC is selected by Logic key:Run/Stop is done by C-M, ,but opened in trip

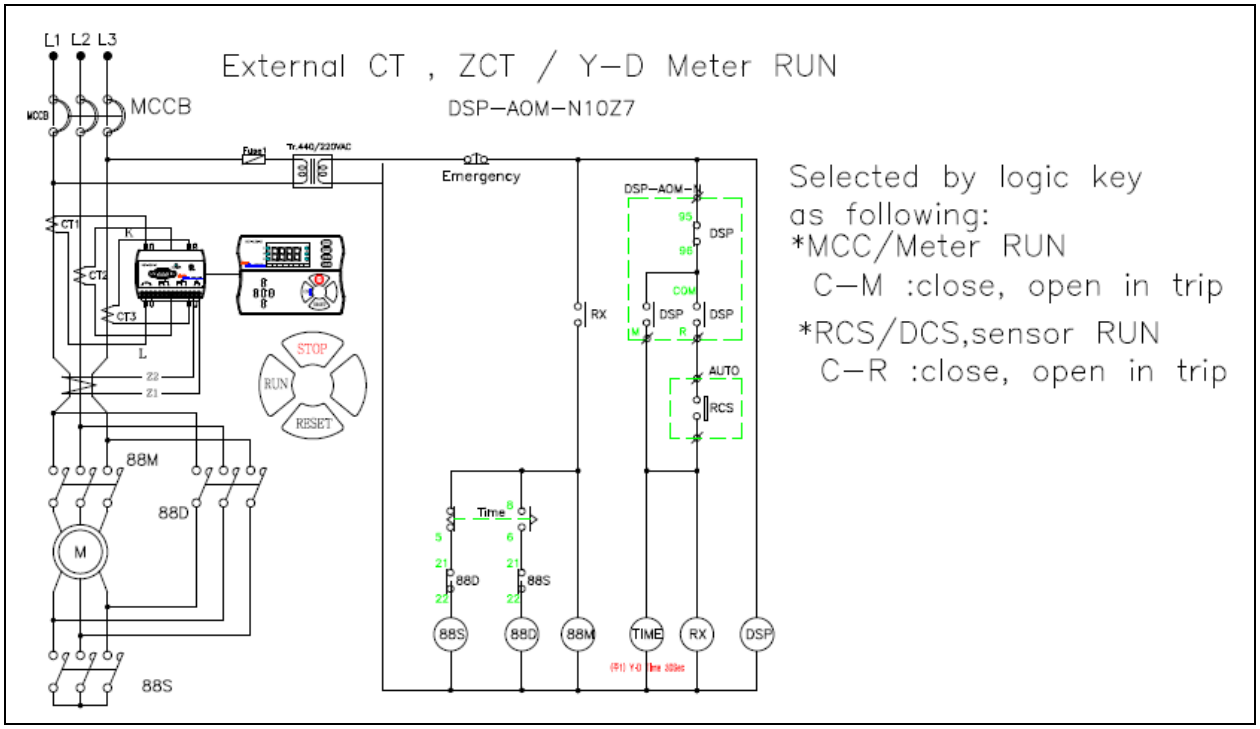


- Over current protection /RCS is selected by Logic key:Run/Stop is done by external device :C-R is naturally closed ,but opened in trip/ C-M is not concerned



14. Application Sequence Diagram



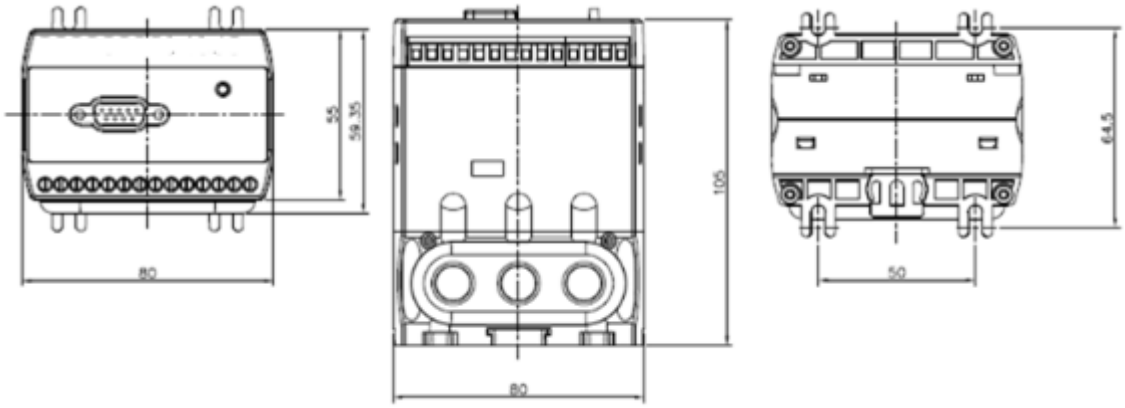


***Note**

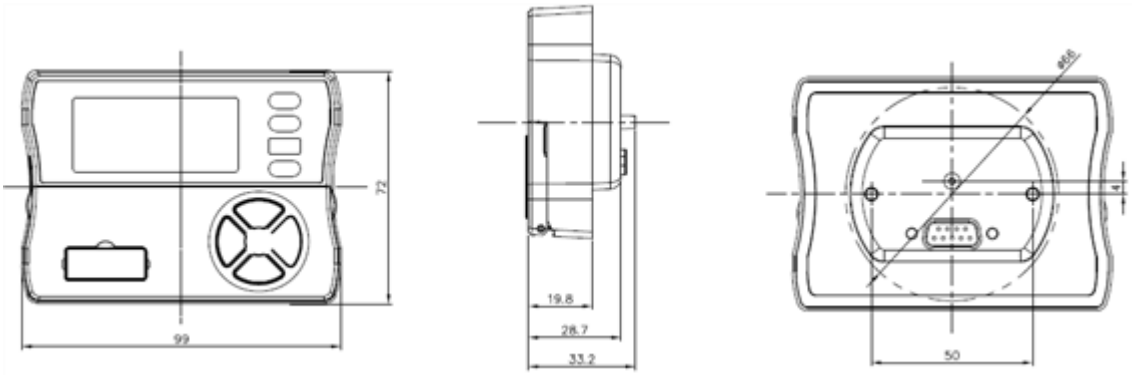
Output trip relay(95-96-98/1c,C-R-M(2a) of DSP is rated 3A/resistive,so it is required that aux relay with sufficient rating to operate a large capacity of contactor will be matched with DSP output.

15. Dimension

- Converter



- Display Meter



16. Order form

DSP-1(Type)-2(Rating current)-3(Control power)-4(ZCT rating)- 5(ZCT Embeded)
-6(Optional condition)

Item	Reference Code	Description
DSP-AOM-N	DSP-AOM-N-10Z7-V	Panel Flush Mounting Type,0.5A～10A, External CT/0.5A～6A , 85～260VAC ,50/60Hz(90～370VDC) , available for external ZCT/200mA :100mV
	DSP-AOM-N-70Z7-V	Panel Flush Mounting Type,5A～70A, 85～260VAC , 50/60Hz(90～370VDC),available for external ZCT/ 200mA :100mV
	DSP-AOM-N-10Z7-A	Panel Flush Mounting Type,0.5A～10A,External CT/0.5A～6A, 85～260VAC ,50/60Hz(90～370 VDC),available for external ZCT/200mA :1.5mA
	DSP-AOM-N-70Z7-A	Panel Flush Mounting Type,5A～70A,85～260VAC , 50/60Hz(90～370 VDC),available for external ZCT/200mA :1.5mA
	DSP-AOM-N-10Z7-ZCT	Panel Flush Mounting Type, 0.5A～10A,85～260VAC, 50/60Hz(90～370 VDC),ZCT embedded/not posible to use external CT
	DSP-AOM-N-70Z7-ZCT	Panel Flush Mounting Type, 5A～70A,85～260VAC, 50/60Hz(90～370 VDC),ZCT embedded/not posible to use external CT

Terminal Type	Basic code+T	3 Terminal through each CT Hole	
Combined with 3CT	Basic code + C1	with 100/5 CT	Not use for ZCT embeded
	Basic code + CC	with150/5 CT	Not use for ZCT embeded
	Basic code + C2	with200/5 CT	Not use for ZCT embeded
	Basic code + C3	with300/5 CT	Not use for ZCT embeded
	Basic code + C4	with400/5 CT	Not use for ZCT embeded

*Accessory

Item	Refeence	Description	Remarks
Cable	DSP -CABLE-12	1.2m	
	DSP -CABLE-18	1.8m	
	DSP -CABLE-30	3m	
	DSP -CABLE-50	5m	
ZCT	DSP -ZCT-A-XX	100mA/1.5mA	XX:Inner diameter of ZCT
Display Meter	DSP -ID-AOM-N	Input device/Display Meter	