POWER COM

SOFT START
USER MANUAL

MODEL : BD-SS30-BP1-255A/500A

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Contents

MOTOR DIGITAL SOFT STARTER (POWER COM)

1. Overview of SOFT START UNITS

An induction motor at start draws 400% starting torque and 600%~700% starting current.
400% starting torque causes wear and breakage of gear, belt, and bearings attached to the motor and increases the maintenance cost.
700% and higher starting current incurs arc at the primary contact point of magnetic contactor and a phase loss by damaging the contact point and causes the voltage dip to increase the capacity of facilities.
Therefore, the contactless soft starter is used to gradually and analogically increase from the low voltage suitable for the starting torque to the full voltage for the rated torque so as to start the motor with the low current.

The whole system of SOFT START UNITS is controlled
by the built-in microprocessor.

The three-phase voltages applied to the motor are connected in reverse-parallel with Thyristor and control the voltage phase angle.
By digitally setting up according to the characteristics of the load phase angle, it carries out functions of Soft Start, Soft Stop, Pump Start, Pump Stop, Kick Start, Hunting Jump and Energy Saving.
In addition, the trip functions at the time of overload, phase loss and SCR overheating are built in so as to completely protect the motor and soft starter.

The motor torque is proportional to the square of the voltage and the motor current is proportional to the applied voltage.
Thus, the accelerated torque and starting current of motor can be adjusted by properly controlling the applied voltage.

The RMS of applied voltage at the start can be changed by adjusting a conduction phase angle with a thyristor.
Therefore, this product is a voltage controller to regulate the applied voltage by adjusting the voltage phase angle.

It is different from an inverter which can change the frequency and voltage applied to the motor at the same time. It cannot change the frequency of power supply while it can change the voltage only.
After start the motor, it automatically supplies the full power supply voltage without adjusting the phase angle.

There is a by-pass start type which, once completed the start of motor, applies the power supply voltage directly to the motor with a magnetic contractor, not through a thyristor.

When the motor is switched off, all thyristor triggers stop and the current is off at the next zero crossing point and then, the switching arc or voltage spike does not occur.

2. The Intended use of SOFT START(POWER COM) UNITS

☞ Starting 3-phase induction motor and preventing excessive current input when the operation stops

☞ Protecting 3-phase induction motor from overheating

☞ Protecting the peripheral system from the electric shock caused by sudden excessive current input during initial startup of 3-phase induction motor

☞ Protecting the gear or decelerator around mechanical system against mechanical impact occurred during the use of 3-phase induction motor

3. Applications of SOFT START(POWER COM) UNITS

☞ All fields where 3-phase induction motors are used

☞ Any facilities that the induction motor starting current is excessive

☞ Any machineries concerned about potential damages caused by sudden boost of acceleration or emergency stop

☞ Induction motor with a potential risk of overheating

☞ Where the soft start or stop is required

☞ Where start or stop of operation frequently takes place

☞ Pump, fan, conveyor belt, air-compressor, escalator, press, etc. where induction motor is used

☞ Cranes and hoists during driving or moving side and winding motor's start unit (monorail crane, Gantry crane, overhead crane, tower crane, etc.)

4. Characteristics of SOFT START(POWER COM) UNITS

☞ removes high peak value current at the startup to make the motor to smoothly operate and stop and reduce the starting current

☞ makes optimum starting and operation torque with the minimum current and then reduces the unnecessary current so as to save the maintenance cost

☞ semi-permanent product life, minimal installation space, easy to install and replace and maintenance cost saving by using semiconductor chips

☞ extends facility load and life by removing high starting current at startup

☞ precise start and stop is possible by CPU operation and easy to check the cause of malfunction with a digital display

☞ When and if any short circuit among three phases occurs during operation or in stop, 3-phase operation monitoring and control systems immediately

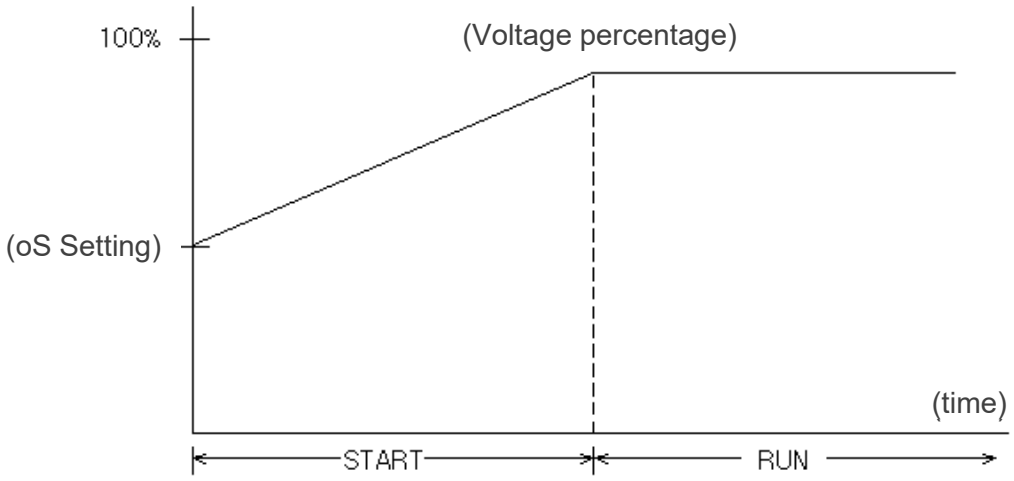
☞ Soft Start, Soft Stop, Kick start, Hunting jump and By-pass function can be used as it has the control capability of operation-time and deceleration-time.

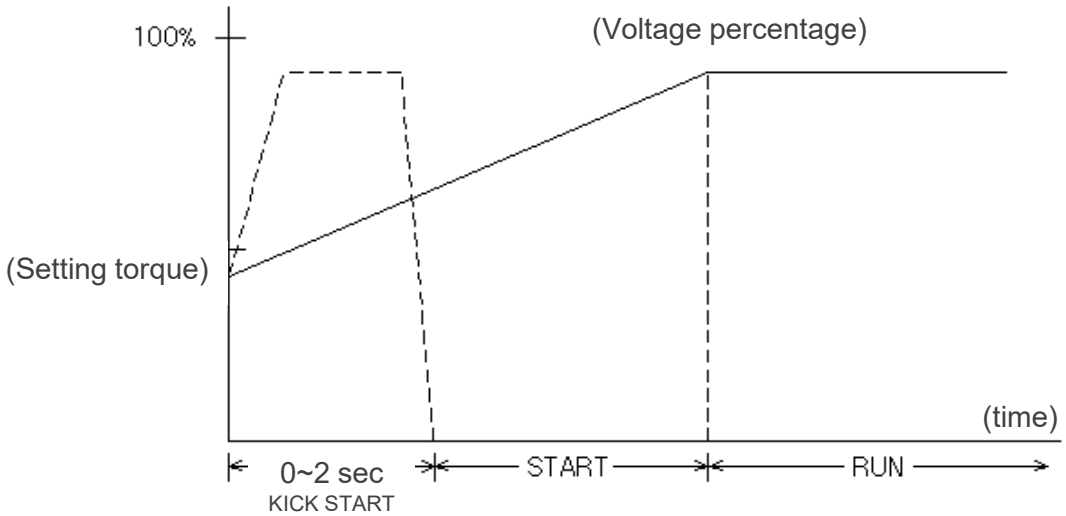
- Operation-time controllable from 0.1 second to 249.9 seconds at maximum
- Deceleration-time controllable from 0.1 second to 249.9 seconds at maximum

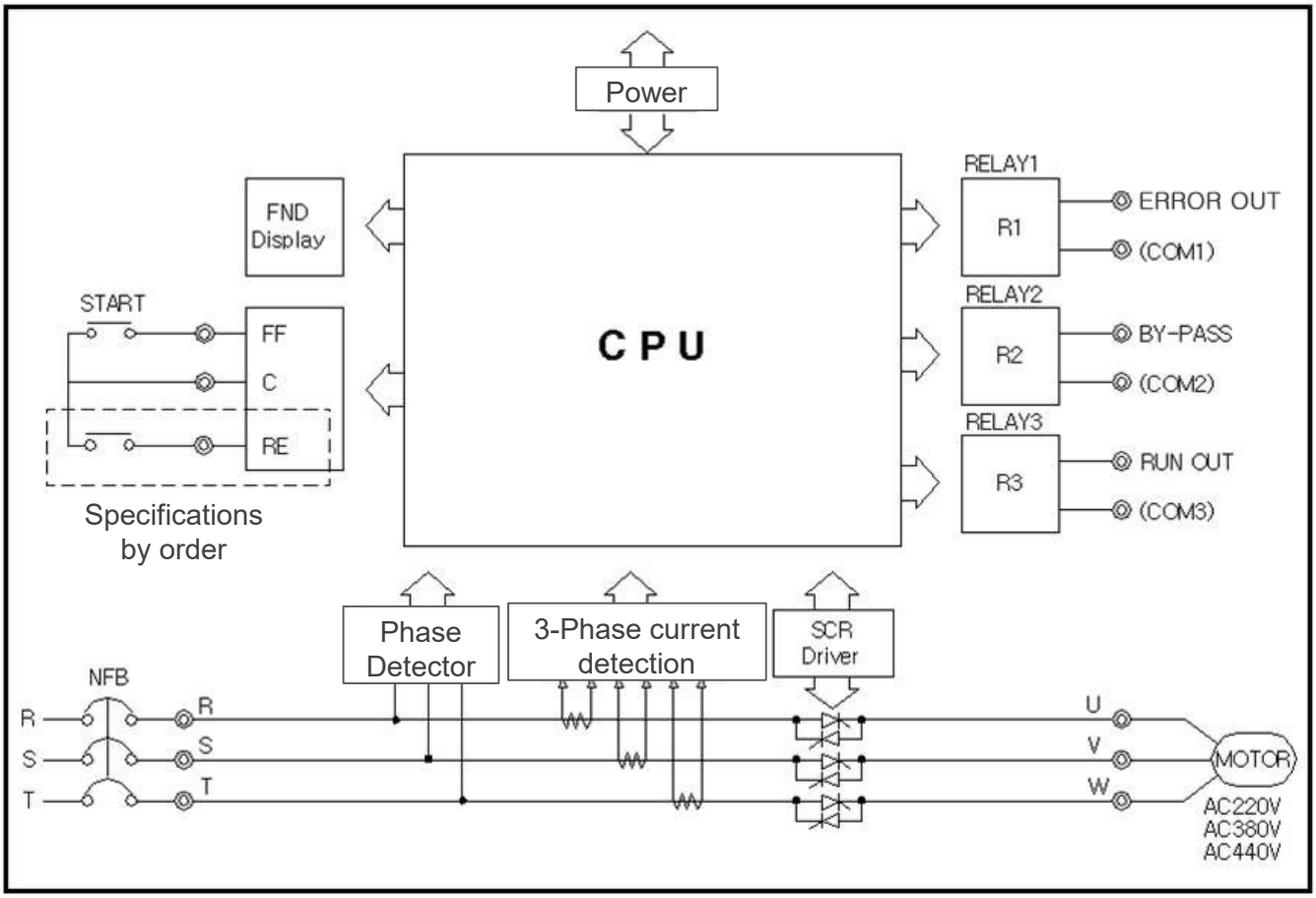
☞ When the abnormal current and phase loss occurs during operation or in stop, the product output relay 3 will operate to apply it to the outside control signal, alarm and PLC, etc. and so is convenient.

☞ At the initial activation of pump load, the motor begins the hunting start just before the maximum load start as the characteristics of sudden load start. At this time, it can protect the motor against the hunting impact by setting the hunting-jump time as same as the starting time at hunting and maximizing the SCR phase angle just before the hunting start begins.

(The figure below is the SOFT START starting curve and KICK START starting curve.)







<Figure 3. SOFT START BD-SS30-BP1 Units Block Diagram>

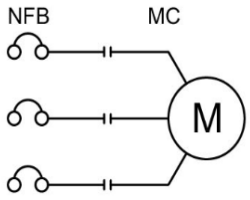
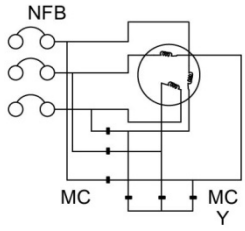
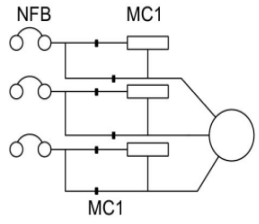
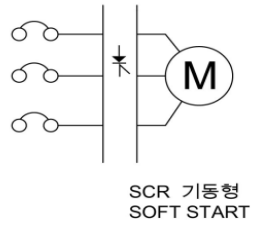
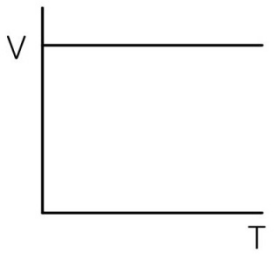
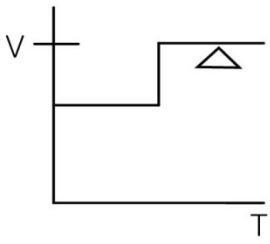
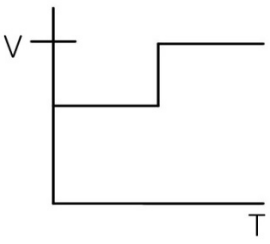
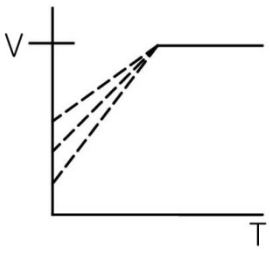
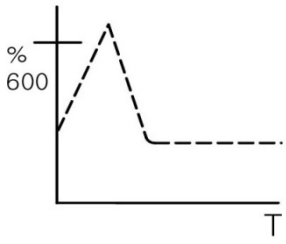
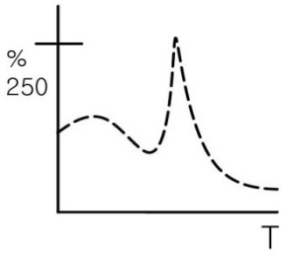
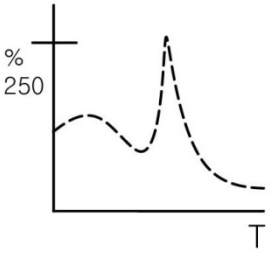
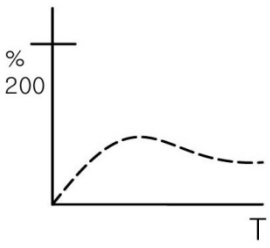
(Relay Operation Function)

1. Relay 1 : Open when the motor in erroneous operation, Cross when returning to operation
2. Relay 2 : Open when reaches By-Pass set time, Cross when motor stops
3. Relay 3 : Open when motor starts, Cross when motor stops

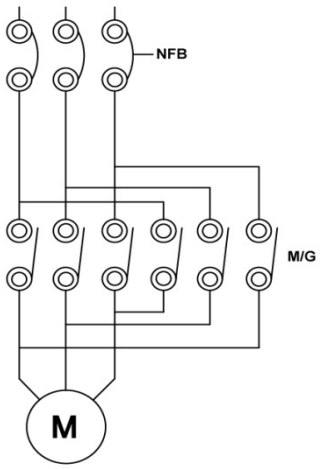
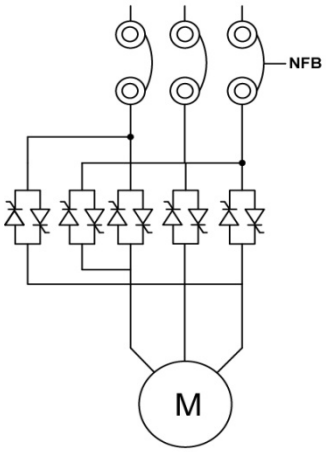
(Motor Operation Input Description)

1. Forward input : Forward rotation when the contact signal input at terminal C and terminal FF
2. Reverse input : Reverse rotation when the contact signal input at terminal C and terminal RE ! (Option)

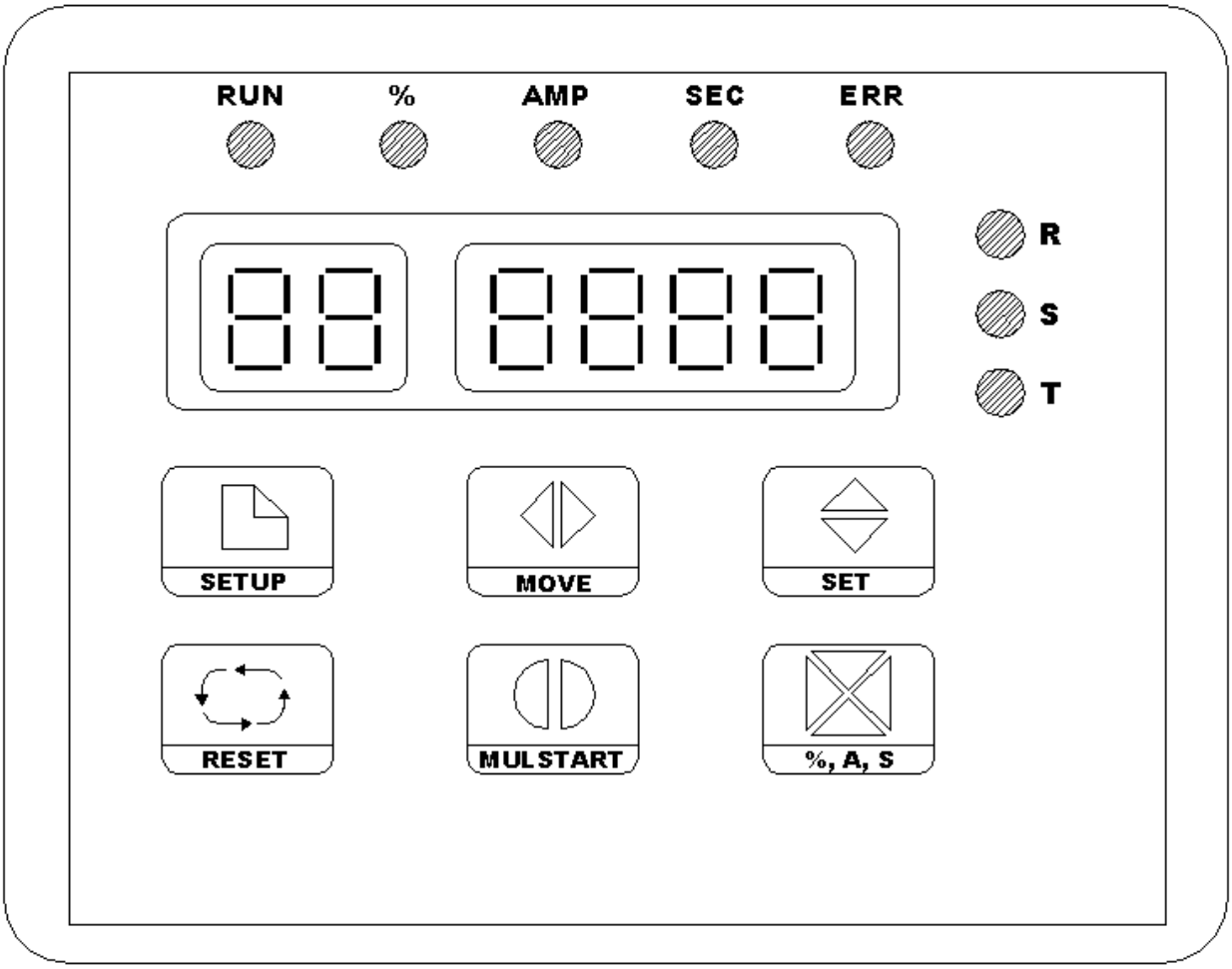
5. Comparisons of SOFT START(Power Com) UNITS with various startup methods

MOTOR Startup	MOTOR Startup Method			
	MAGNETIC	Y-△	REACTOR	SOFT STARTER
Motion Overview	When starting the motor, full voltage is applied from the beginning	Start with Y connection only when starting the motor being operated by wiring. Starting load current is 300% maximum load current value.	When starting with a reactor to the primary side of motor, start the motor with the starting voltage lowered as much as the lowered value of reactor voltage.	Start the motor moving smoothly from the startup until normal rotation by the digitally setup method of non-contact semiconductor
Operating Circuit Diagram				
Features and Advantages and Dis-advantages	- The startup time is short with the motor's high original acceleration torque and high instantaneous acceleration torque. - High starting current, which causes the voltage dip .(No soft start)	- Can reduce the voltage dip - Most inexpensive and easy to use - The minimum starting load is too low to apply a direct start. - Mechanical shock can occur as the power supply is open in operation after the startup.	- Even though the minimum starting load can be adjusted by switchover of the reactor tabs, the acceleration load fluctuates severely as the motor rotation increases. - Expensive manufacturing costs. - The reduction of minimum starting current is large compared to that of maximum starting current	- The startup time is adjustable according to the load type from low to regular speed, and the smooth operation is possible. - It can softly stop the motor and perfectly protect the motor by using the digital three-phase monitor.
Starting Voltage Curve				
Starting Current Curve				

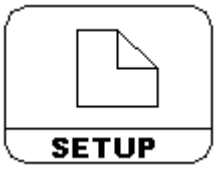
6. Motion comparisons of MAGNET and SOFT START(POWER COM) UNITS

Motion Type	MAGNET SYSTEM Forward/Reverse Motion	POWER COM SOFT START Forward/Reverse Motion
Motion Configuration		
How to operate	The magnet, activated by user's switch operation, starts and stops the motor.	The non-contact forward/reverse unit starts the motor by user's switch operation. (Forward, Reverse – Option)
Contact protection	The arc, severely incurred at forward/reverse motion of magnet, wears the contact point and then, causes the phase loss.	No arc occurs because all motions are non-contact and there is no contact wear. As such, it is semi-permanent.
Product operating character-istics	During startup, 400% or more load by full starting voltage gives severe stress on the motor and attached devices to seriously wear the gears and belts. Then, causes significant losses due to high maintenance costs.	When the motor starts and stops, its soft start and stop don't produce instantaneous traumatic stress on gears, belts, reduction gears, etc. Then, the maintenance costs are low. In addition, it is also energy cost effective as it does not incur the peak current.
Product noise	During operation, there is much mechanical and electrical noise.	Non-contact operation, there is no noise.
Maintenance and repair	The more forward or reverse motions, the higher maintenance costs.	More efficient for the motor with more frequency of forward or reverse motion. Maintenance free after installation.
Vibration during operation	Much vibration when starts and stops.	Non-contact, so there is no vibration.
Compatibility	Complexity in installation and large size.	Easy to install and simple. Easy to install in combination with existing magnet panel.
Product size	Complicated to install and large size.	Small size and easy to handle.

7. SOFT START(POWER COM) Front Panel Control and Display



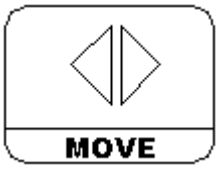
(1) DATA input KEY



Buttons to enter the initial data.

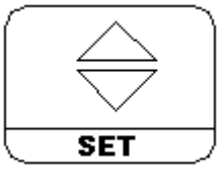
It moves to the next data when you push this button.

(2) FND numeric value shift KEY



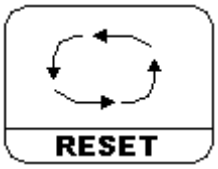
In each of the MODE, it moves to FND position when you push the shift button to FND of the numerical value you would like to enter.

(3) Numerical value input KEY



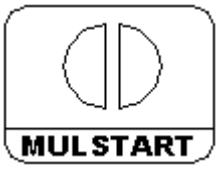
As a button to set the DATA value which you would like to set in each mode, it sets the number illuminating in FND.

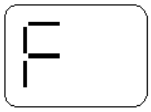
(4) Manual RESET KEY

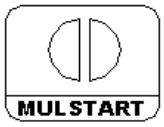


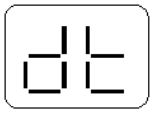
It is a button to return the internal system when the motor is in erroneous operation due to phase loss, phase balance, SCR short circuit, over-current, etc.
(Manual RESET shall not be used at the motor startup. RESET button can work only during erroneous or SETUP operation.)

(5) Manual TEST(START) operation KEY
: Display when one-way operation mode <BD-SS30-BP1>

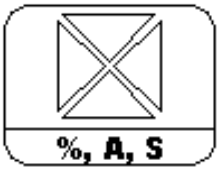


Manual START – When the button is once pressed,  is directed to appear and the motor gradually starts for the set time.

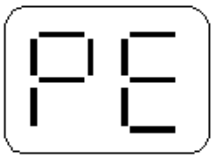
With another press of 

button at this time, the motor stops after gradually decelerated for the set time  .

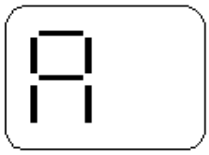
(6) Digital display KEY to confirm each function during operation



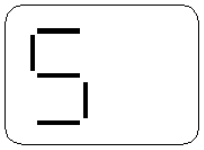
By pressing the button to confirm each function during operation, the following three kinds of indication appear in the FND display.

① 

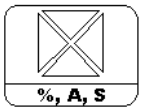
display the set value, expressed in %, of starting torque during operation

② 

the current value of motor during operation for each of phase R, phase S and phase T is directed to appear in the display.

③ 

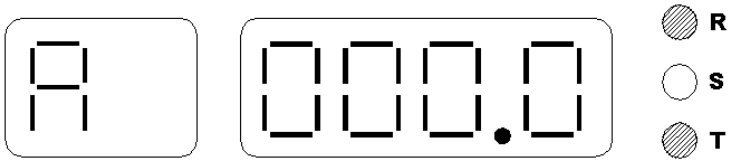
display the set START time, expressed in second, during the startup of motor.
(Time setting range : 1sec ~ Max 99.9 sec)

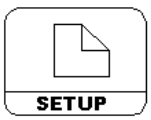
Each time you press each one of the 

buttons above,
the FND display will show in order of Amount of starting torque (%)
→ Current value of motor's two phases R and T (A) (R, M, S)
→ the set starting time (sec).

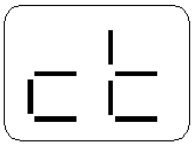
(7) How to enter the product DATA value

After connecting the initial control voltage of product (AC85V ~ 260V), the values in the display are directed to display the initial operation-ready state as shown below. (shown when setting the current among the setting values of motor)

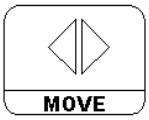


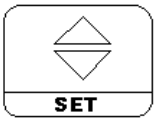
① When the value is digitally displayed in the display below after you press 

button among six buttons in the front display panel, enter each of values in order in accordance with the characteristics of motor.

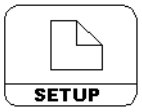


: It is a section to input the rated current value of motor to be used.
Enter each of C/T values when C/T is installed inside the product.
Note! (BD-SS30BP1-100 type automatically sets it inside.)

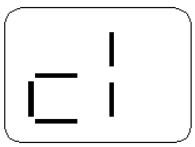
Enter the internal C/T ratio value in line with C/T ratio by using 

button and 

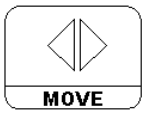
button. (Maximum C/T settings – 5000A)
(Note: The maximum current indication is divided into 2250A and 5000A.)

② When the directed values each are shown in the display window as shown in the figure below after pressing the 

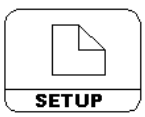
button once again, confirm each of two phase values of the motor by using the button.



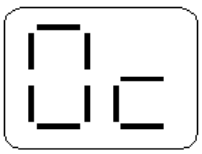
: It is a section to show each of phase values during operation for confirmation.
(C1 – displays the phase R value, C2 – displays the phase T value)

Each time 

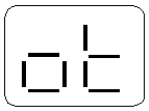
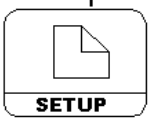
button is once pressed, each of the values of phase R and phase T will be displayed in order and then, each of actual phase loads can be confirmed.

③ When the directed value in the display window is displayed as shown in the figure below after 

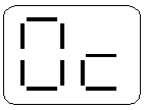
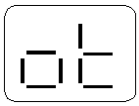
button is pressed once more, set the rated value of the motor to be used.



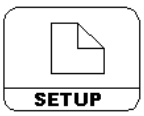
: It is a section to input the over-current value of motor.
Input the value according to the rated current value of motor.
(Setting range: 5A ~ Max 2250A) SS30BP-255A TYPE
(Setting range: 10A ~ Max 5000A) SS30BP-500A TYPE

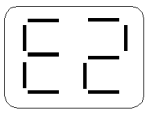
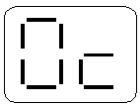
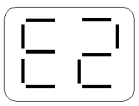
④ It is a section to set the delay time until  current value of the motor continuously maintains above the rated current value and trips when the directed value is displayed as shown in the figure below after 

button has been once pressed.

When the current at  set current value or more is sustained above the  set value, the internal circuit judges it over-current, displays an ERROR sign then, Error Relay 1 is printed.

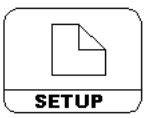
(At this time, the over-current value and set value is sequentially directed in the display window.)

⑤ When the value in the display window is shown as in the figure below after the 

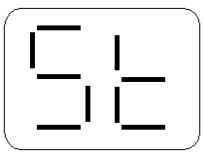
button is pressed once again, the flickering  is displayed and Error Relay 1 is printed in two seconds if the current flows over the set % of the set  rated current value at the startup of  motor.

(E2 setting range is Min 300% ~ Max 700% - delivered at 400% ex factory)

(※ The operation state of E2 is OFF when the value is set at zero.)

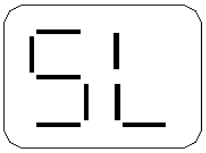
⑥ When the 

button is pressed once again,

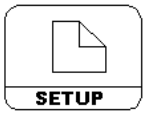
 : It is a setting section for the initial starting time.

It starts the motor gradually up to the maximum voltage in proportion to the set time and operates the amount of voltage in proportion to time.

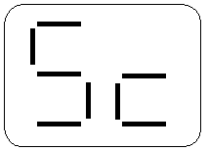
Starting time setting range: 1 SEC ~ Max 99.9 SEC)

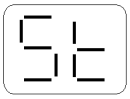


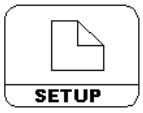
: SLOW START operation setting time. (1 SEC – 99.9 SEC)
At the startup of the motor, o.S setting value maintains SLOW START operation for S.L setting time and then, reaches the maximum voltage by S.T time. (※ If S.L setting time is zero, the operation is off.)

⑦ When the 

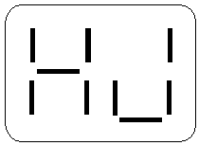
button is pressed once again,

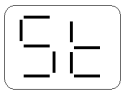
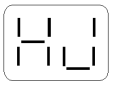
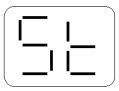


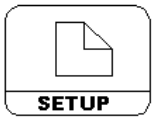
: It is a section to set Kick Start. At the startup of the motor, 70% of motor voltage, the load voltage is applied for the set time period and then, starts gradually for the  setting time period.
(Setting range: 0.1 SEC ~ Max 3.0 SEC)
(※ When the setting value is zero, it cannot work.)

⑧ When the 

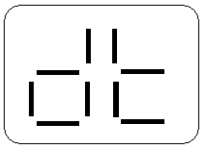
button is pressed once again,



: it is a section to set the hunting jump time. At the initial startup of motor, full voltage is automatically applied to the internal control sign.
※ However, in case of  setting value change,  setting value will automatically be set with  setting value.
(※ When set to zero, it cannot work.)

⑨ When the 

button is pressed once again,

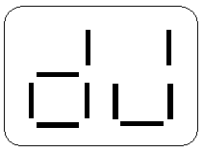


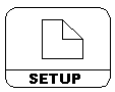
: a section to set the deceleration delay time when the motor stops the voltage decreases gradually from the maximum voltage for the deceleration delay setting time period when the motor stands still.

This time period is used to the extent that the standstill time is required to be extended. The voltage decreases until the load torque becomes larger than the motor torque and then stops. Setting range (1 SEC ~ 99.9 SEC)

※ Reference : used for the pump motor stop

(※ When it is set to zero value, the operation function is OFF.)

⑩ 
: It is a section to set the DECEL JUMP.

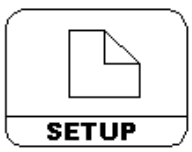
When the 

button is pressed once again, During 

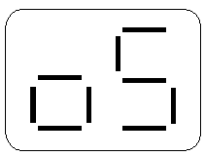
the operating time, the motor slowly decelerates and stops from the below  setting value.

(Setting range-10% to 100%-percentage of rated voltage)

(※ Does not work when set to zero)

⑪ When the 

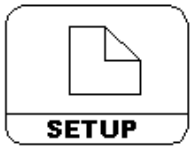
utton is pressed once again,



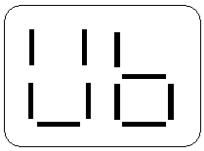
- Section for setting the amount of motor starting torque.

The voltage gradually increases to the maximum voltage from above the set value at initial startup.

(Setting range 10% ~ 99% - percentage setting for motor voltage)

⑫ When the 

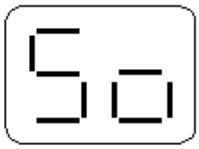
button is pressed once again,

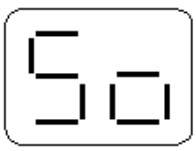
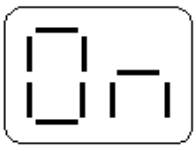

: Unbalance setting section between phases during operation.

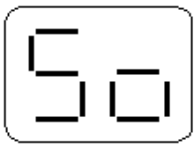
When the two-phase C / T current value in the product deviates above the  setting value, the blinking display and Error Relay 1 operate

And the motor stops operating.

At this time, the display window directs each of phase deviation values sequentially. (Setting range 5% ~ Max 50%)
※ If UB value is set to zero, this function cannot work.


: a function to set ON/OFF of SOFT START output signal during normal operation. When using BY-PASS M/G after installation, use it after having set the S.o to ON function.
If and when using OFF function, the internal control components will heat up as time passes, shorten the lifespan of components and cause malfunction.
<u>However, it is recommended to use the OFF function only when the motor frequently repeats to start and stop.</u>


- - -

== Function used
(apply when using BY-PASS M/G)


- - -

== Function stopped
(use when frequent repetition of Start and Stop)

(8) 
: Frequency setting – 50hz/60hz setting button.

(Use the setting button to set the frequency according to the site conditions.)

(9)  : the auto hunting jump operation setting button.
ON – Function OFF – Function disabled.

At the initial start of the motor after ON-setting, it finds the hunting point of the motor and automatically detects the current value and increases the voltage to 80% of the maximum voltage.

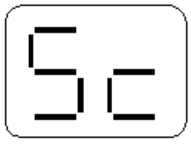
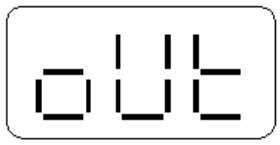
Used to remove the hunting load of the motor.
(Function does not work when set to OFF)

(10)  : Auto Current Limit Function Button.
Set maximum current value of starting current.

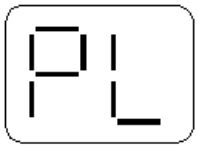
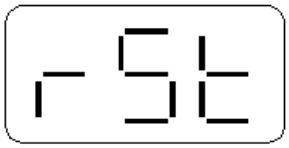
It applies to the load of the motor that needs to be started by limiting the starting current.

※Caution – If the current limit setting value is set too low, the motor will not start.
Therefore, set the minimum limit current value more than 250%.
(When shipped from the factory – set to 300% motor rating)

9) Error signal function automatically set inside (Settings cannot be changed.)

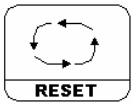
A.   : When being flickered (SCR short circuit)

When the current flows through the motor due to a SCR short circuit or a burned damage during the preparation of startup, the flickering and ERROR RELAY 1 are activated. (This section displays when the motor stands still.) When the minimum detection current is 10A or more, it operates in two seconds.

B.   : When being flickered (damaged phase and cut phase of the input units)

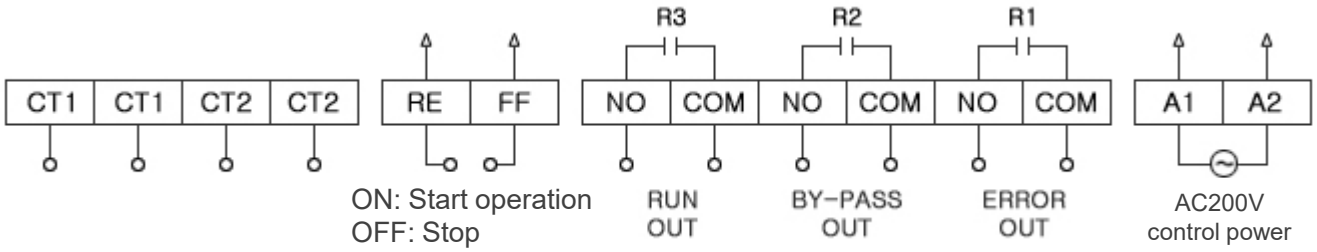
When and if detects any damaged or cut phase in the input units of R, S, T phases from the time of startup of motor, ERROR RELAY 1 and any damaged or cut phase among three phases of R, S, T will start to flicker. (It starts to flicker in two seconds after the time of damage and cut in phases.)

(12) How to return to the initial stage when the product in erroneous operation

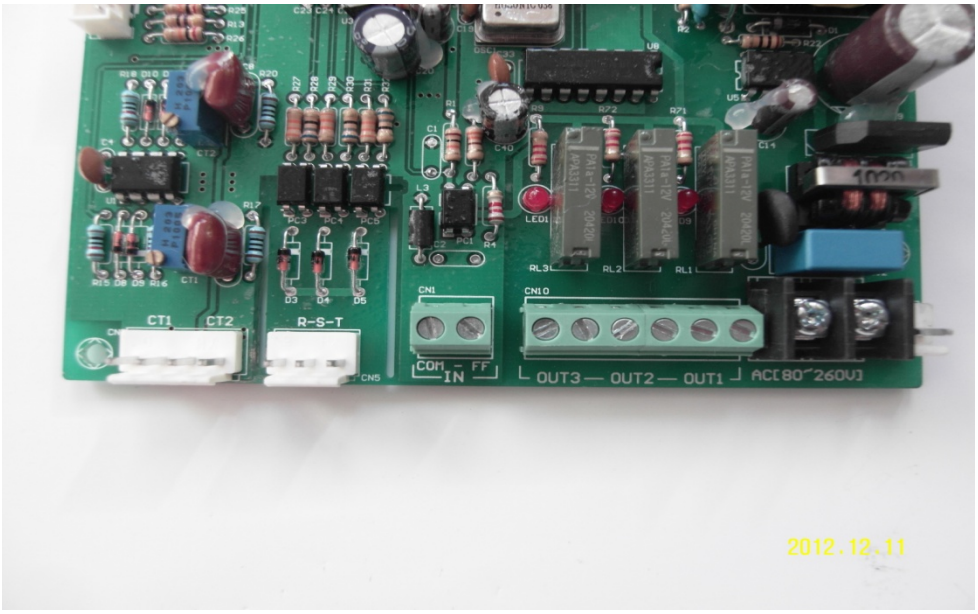
When the product is in the erroneous operation or in standstill due to the abnormal current, press 

button among input buttons to return to the initial stage.
Then, remove the cause and start it again.

8. Basic Connection Diagram by Product Function

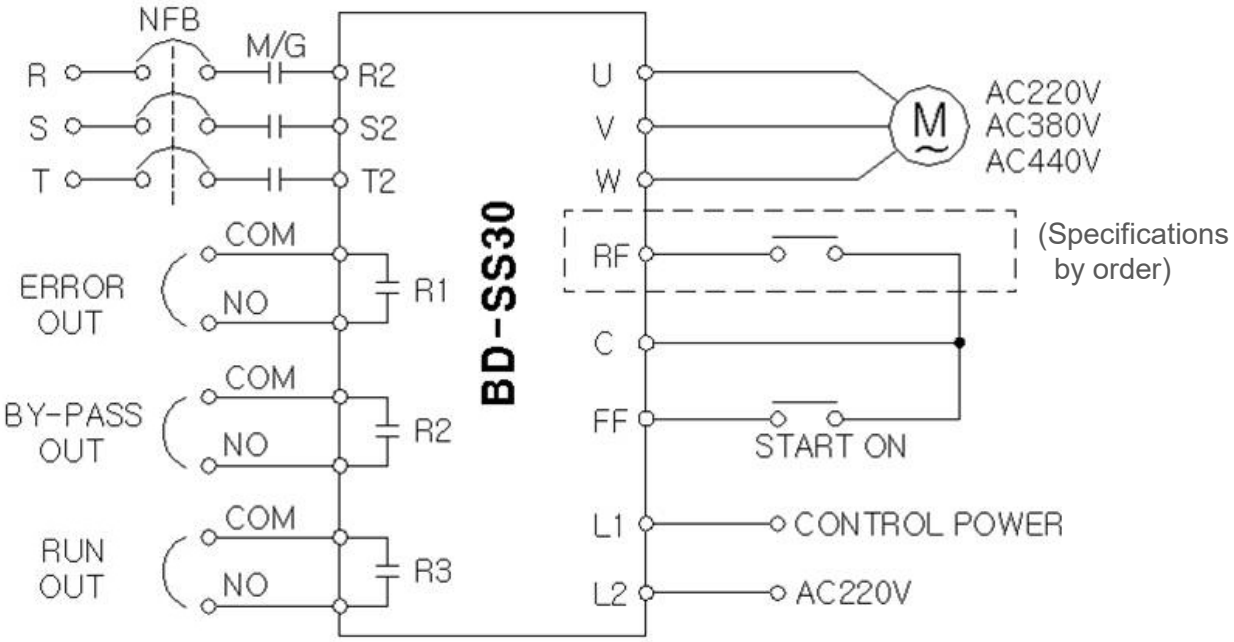


9. PCB terminal layout

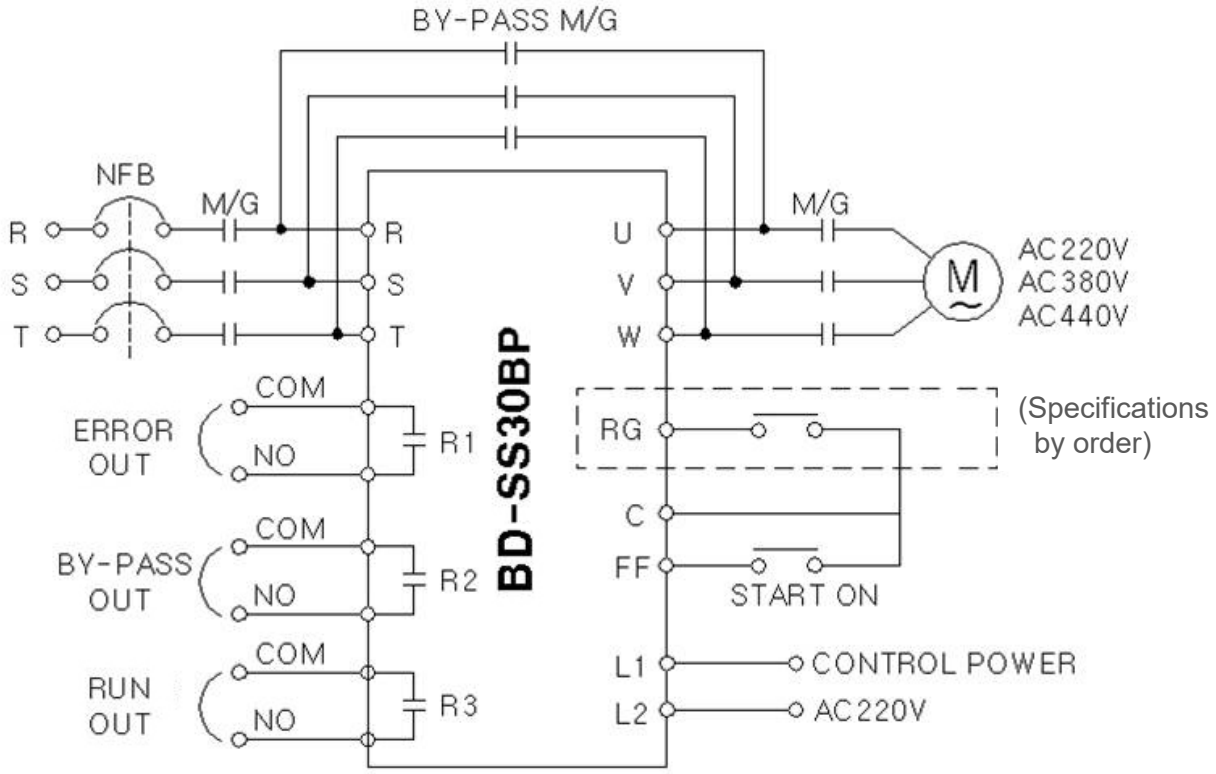


10. Product basic wiring diagram

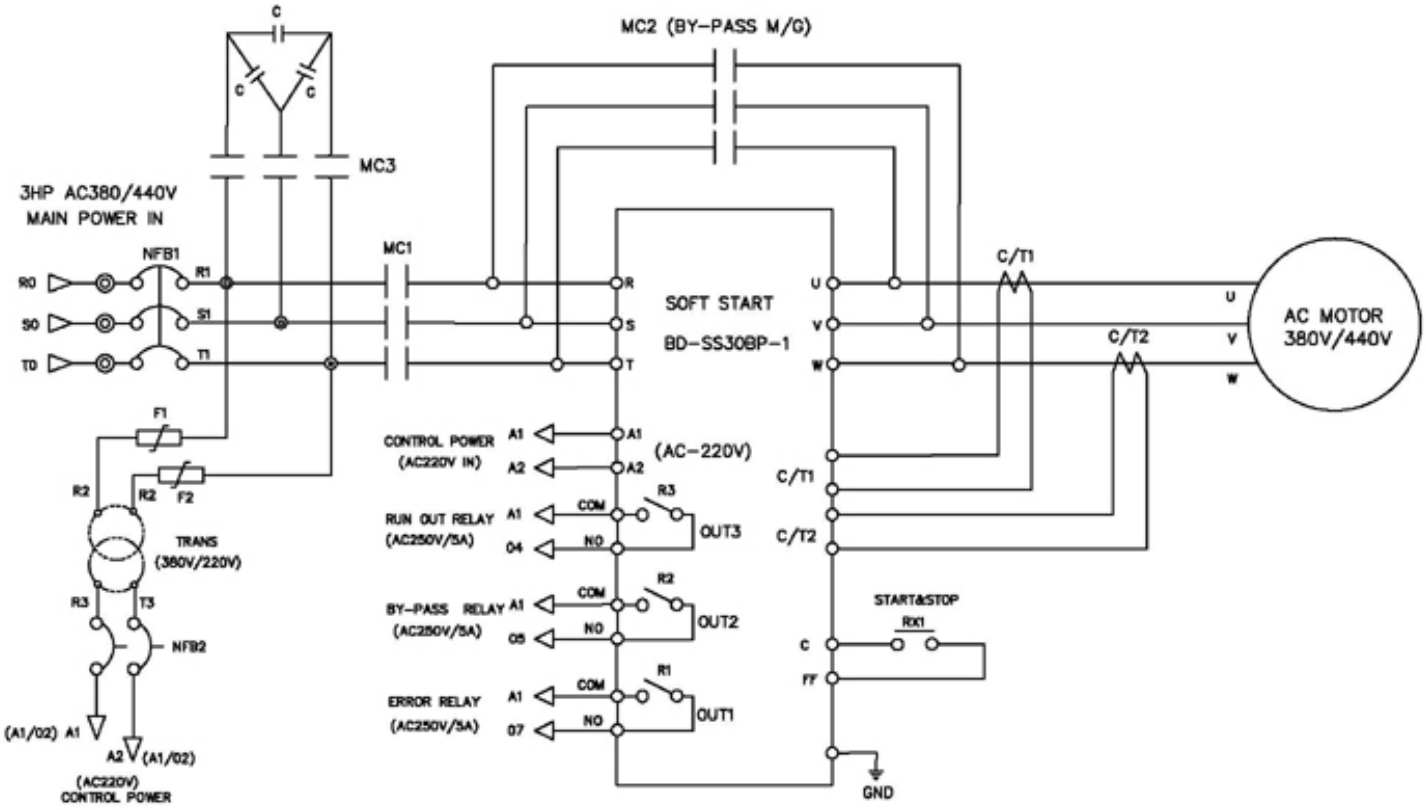
(1) BY-PASS contact output type wiring



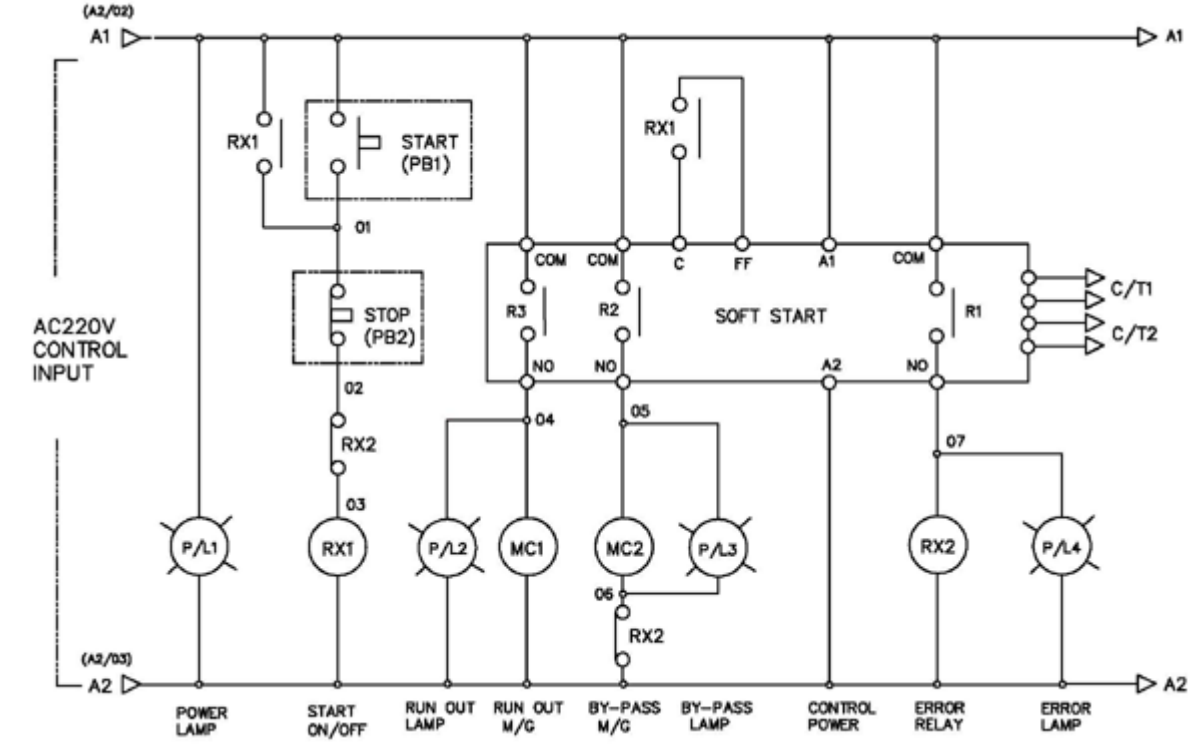
(2) Built-in BY-PASS M/G type wiring



(3) BY-PASS CT External operation wiring



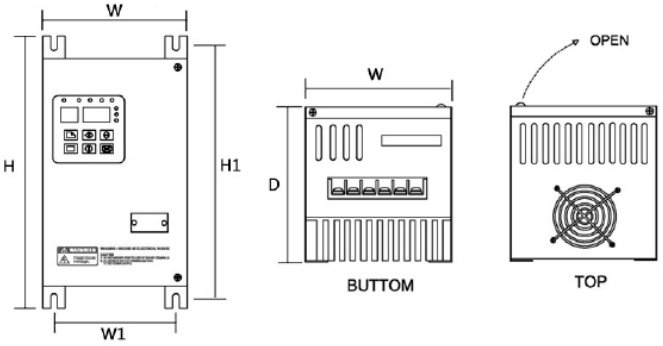
(4) BY-PASS CT External operation wiring



11. Specifications by product model

BD-SS30-BP (Terminal fastening method) SOFT START Dimensions

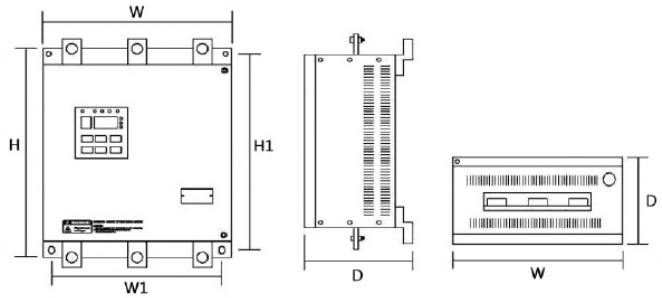
(BY-PASS Operation - M/G External Attachment)



220V	440V	W	W1	H	H1	D	Terminal / Method		Weight
7KW	15KW	130	108	230	220	132	M5	6P/30A	≒3.0kg
11KW	22KW	210	183	230	215	143	M6	6P/60A	≒4.5kg
15KW	30KW	210	183	230	215	143	M6	6P/60A	≒4.5kg
18KW	37KW	210	183	230	215	143	M6	6P/60A	≒4.5kg
22KW	45KW	255	235	275	245	195	M8	6P/60A	≒5.0kg
30KW	60KW	255	235	275	245	195	M8	6P/100A	≒9.0kg
37KW	75KW	255	235	275	245	195	M8	6P/100A	≒9.0kg
45KW	90KW	255	235	275	245	195	M10	6P/150A	≒10.0kg
55KW	110KW	255	235	275	245	195	M10	6P/150A	≒10.0kg

BD-SS30-BP (Input and output busbar fastening method) SOFT START Dimensions

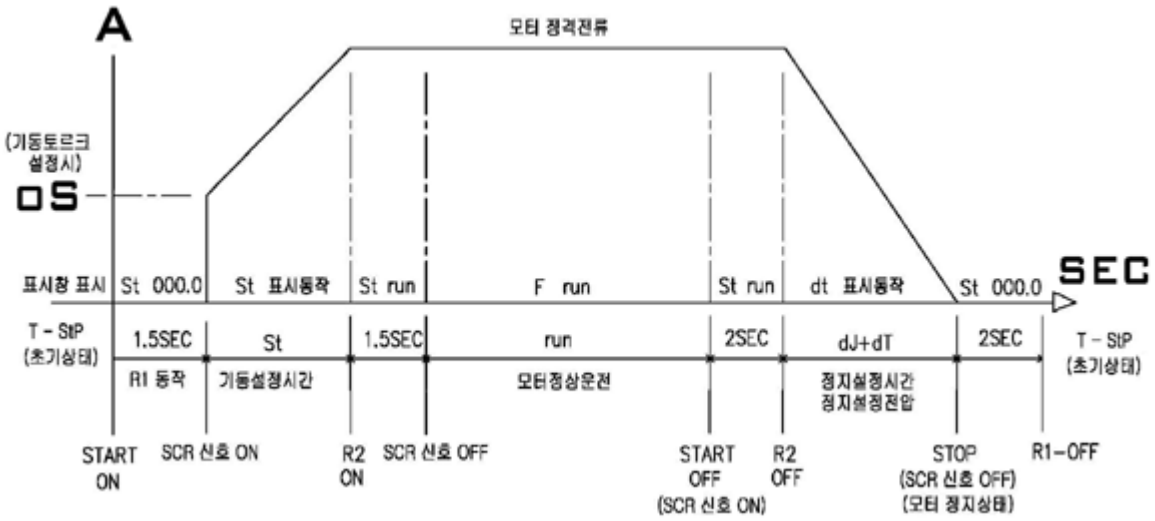
(BY-PASS Operation - M/G External Attachment)



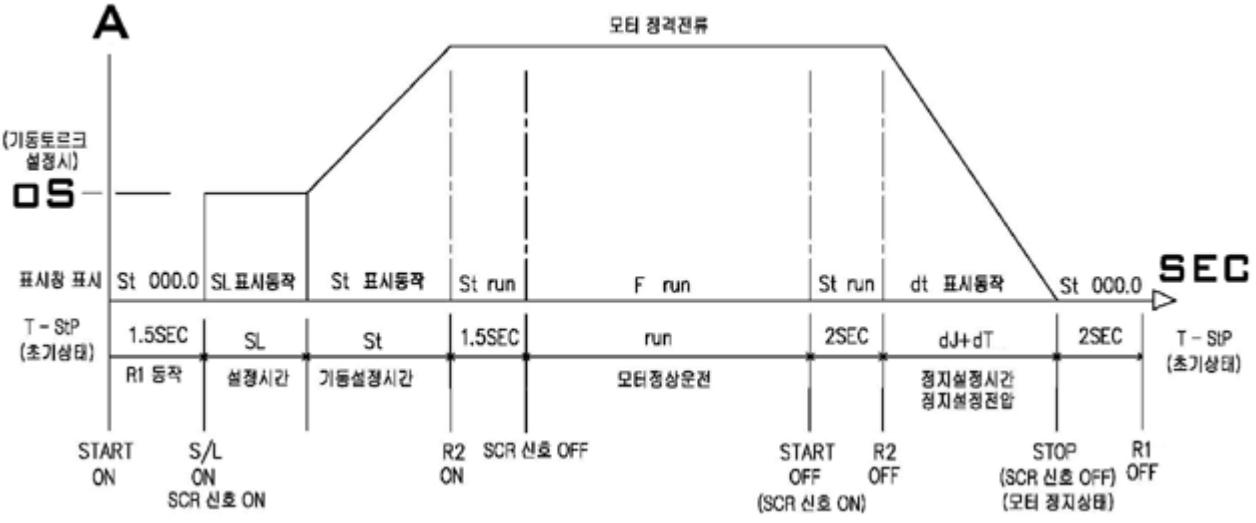
220V	440V	W	W1	H	H1	D	Terminal	Busbar Size	Weight
75KW	150KW	300	200	380	360	300	12mm	30*5t	≒28.0kg
90KW	180KW	300	200	380	360	300	12mm	40*6t	≒30.0kg
110KW	200KW	300	200	380	360	300	16mm	40*6t	≒30.0kg
130KW	250KW	300	200	380	360	300	16mm	40*6t	≒30.0kg
150KW	300KW	300	200	430	410	300	16mm	40*6t	≒33.0kg

12. Characteristic function curve of SOFT START UNITS

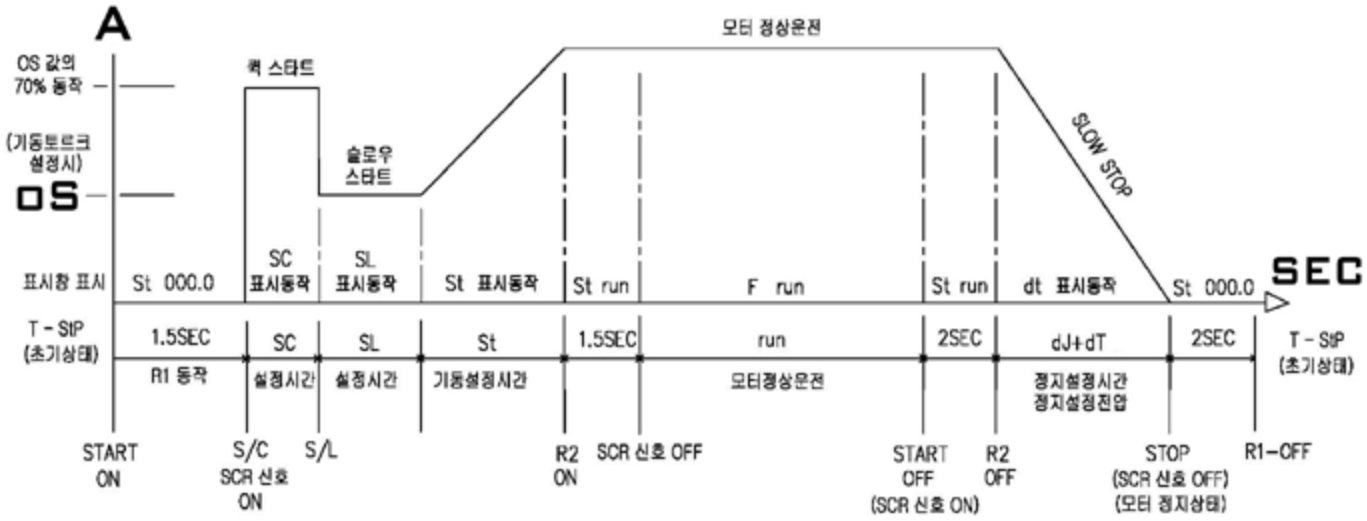
(1) Basic type operating curve
: Control characteristic curve from motor starting to stopping



(2) Operation curve when setting S / L
: Control characteristic curve when setting slow start



(3) Operation curve when setting SC and SL
: Control characteristic curve when setting SC+S/L (Quick / Slow)



※ In case of ERROR operation, R1, R2 RELAY-OFF is automatically operated, and a circuit that blocks M1 and BY-PASS M/G is used.

① R1 Operation Function
: Using M1 magnet in front of SOFT START,
It can be used for the purpose of gradually starting the motor after R1 relay operates by operating the M1 magnet for 2 seconds.

② R2(ON-OFF) Operation Function
: When using SOFT START BY-PASS M.G with R2 RELAY during normal operation after the initial start of the motor, BY-PASS M / G operates to operate the motor continuously.
At this time, SOFT START will be in the SCR OFF state and only the monitoring function of the motor will be shared.
It can be used permanently without temperature rise.