

STR-UNIT Operating Manual

Seroun Thyristor Regulator

CV-type(Constant Voltage)

CC-type(Constant Current)

CP-type(Constant Power)



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1. Introduction

Seroun's Thyristor Regulator(STR Unit) is designed and assembled to the highest standards and technologies in the industry for single phase and three phase load application. Since STR Unit features compactness and lightweight, high density of mounting in an instrumentation panel is possible. As an integrated manufacturer, with about two decades of experiences in power control development and its application, we have been providing an unique thyristor regulator to customers. The Unit based on the phase control system is available with constant voltage type(CV-type), Constant Current type(CC-type) and constant power type(CP-type) as well as a conventional voltage control type, so with its excellent operating performance and reliability, an ideal type can be selected in accordance with the characteristics of heating elements of the electric furnace heater. Before install and operate the Unit, you are recommended to go over this manual carefully so that the functions can be exerted effectively to your full satisfaction.

2. Confirmation of the Unit

Before installing inside the panel, please inspect the Unit as below ;

- 2-1. Check if the Unit is in conformity with your order specifications.
- 2-2. Check if the Unit is damaged by a trouble during transportation
- 3-3. Bolts/nuts may be loosened during its transportation, please tighten the loosened bolts/nuts.

3. How to install

- 3-1. Attach the Unit lengthwise and vertically so that the key board operation and the parameter display of the Unit can be done exactly.
- 3-2. Install the Unit in a place of good ventilation, and without dust and vibration and corrosive gas.
- 3-3. Operating ambient temperature of the Unit is 50°C max. Please refrain from operating the Unit wherever the temperature goes up higher.
- 3-4. Provide a space for heat radiation all around the Unit(lengthwise 200 mm and widthwise 50mm)
- 3-5. Operating ambient humidity of the Unit must be lower than 90% RH, please refrain from operation of the Unit in any place of higher humidity.

4. Operating instruction

4-1. Before starting the Unit.

- 4-1-1. Check if there is any incorrect connection or damage in the heater and tighten bolts/nuts loosened inside the Unit.
- 4-1-2. Check if there is any insufficient or damaged isolation between phases inside the Unit and in the heater.
- 4-1-3. Check if there is any insufficient or damaged isolation between the input, or output and case of the Unit.
- 4-1-4. Check if the power input and output of the Unit are properly connected and tightened.

4-2. Connection of the terminals.

- 4-2-1. "VR" terminal ;

If customer wants to restrict the load of the heater in range of 0~100 % outside the Unit, please install a B10K Ω volume on the instrument panel of the heater and connect it to the "VR" terminal correctly. And in case customer wants to use the volume of the Unit at 'Local' or wants to move the LCD display panel and operation key board of the Unit to the instrument panel of the heater, leave this "VR" contact opened.

4-2-2. "RUN" terminal ;

If customer wants to turn the Unit on or off by the power switch on the instrument panel, please connect this power switch to this "Run" terminal.

As explained in "4-2-1" above, in case customer wants to use the power ON/OFF switch of the Unit at the 'Local', or want to move the LCD display panel and operation key board of the Unit to the instrument panel of the heater, leave this "Run" contact opened.

Whenever customer wants to use this external power switch, the "POWER" key on the Operation key board must be turned "OFF" because both power switches are in parallel each other.

4-2-3. "4~20mA" terminal ;

Connect the DC 4~20mA signal from temperature controller to this terminal for automatic Operation.

4-2-4. "Alarm" terminal ;

If customer wants to move the alarm of the Unit to the alarm system on the instrument panel, please connect to this terminal.

4-3. Arrangement of the key board of the Unit :

4-3-1. First of all, turn on the NFB of the instrument panel.

4-3-2. Turn off the power by pushing the power "OFF" key..

4-3-3. Set the MANU/AUTO selection key at "MANU", because the setting change of value of all the operation parameters must be done at "MENU" position.

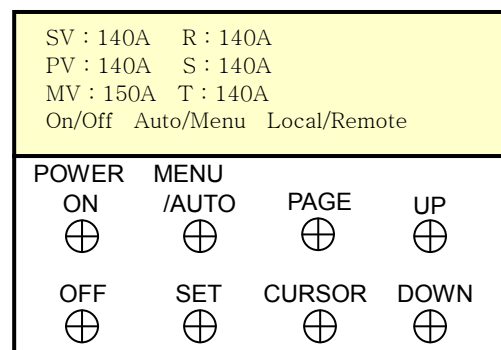
4-4. Setting of operation parameters.

When customer need to do the setting and changes of all the operation parameters, which are set at initial delivery

The change or resetting of these parameters is done by the key of "ENTER" "PAGE", CURSOR and UP/DOWN at the LCD panel.

Ex) **To change the over-current alarm setting value from 60A to 70A(or 110~120 % of the rating) ;**

- A. Push "PAGE" key to open the page of LCD panel.
- B. Push "CURSOR" key and place it at "OC"
- C. Push "UP" or "DOWN" key to input 70A.
- D. After resetting all the parameters, push the "ENTER" Key for memory so it is not necessary to repeat the setting of the parameters again when the Unit restarts.



4-4-1. **Setting Value(SV)** at the "Manual" operation :

This is used to input the **SV** for "Local" or "Remote" at "Manual" operation.(The Unit is set and delivered at the "rating").

4-4-2. **Over-Current(OC) alarm resetting :**

This is used to change the OC alarm point and the value must be changed in range of 110~130 % of rating (The Unit is set and delivered at "110 %").

4-4-3. **Soft Time(ST) resetting :**

This is used to change the **soft start time** in range of “0~330 seconds (The Unit is delivered at 10 seconds normally).

4-4-4. **Frequency(Hz) resetting :**

This is used to select “50” Hz or “60” Hz(The Unit is set and delivered at the inquired frequency).

4-4-5. **Maximum Load(MV) setting :**

This is used to set the maximum operating load (The Unit is set and delivered at the “rating”).

4-4-6. **Selection of the signal from temperature controller :**

This is used to select DC “4~20mA” or DC “0~10V” as a control signal.(The Unit is set and delivered at DC “4~20mA” which is a major control signal).

4-4-7. **Present Value(PV) :** All the actual values of all the parameters are displayed on the display panel of the Unit.

4-4-8. **Capacity(CP) :** The rating capacity can be displayed on the display panel of the Unit, but customer should not touch it.

4-5. **Selection of operation mode :**

4-5-1. **Selection of “Local” or ‘Remote” :**

The mode at the time of delivery is set at “Local”. Customer may select “Remote” instead “Local” when necessary.

@ “Remote” is selected when the external volume(B10KΩ) the instrument panel is installed under connection with “VR” terminal of the Unit.

4-5-2. **Selection of type CV, CC and CP :** The type at the time of delivery is set at the inquired type. Please confirm if the inquired type is set correctly or not.

4-5-3. **Selection of “AUTO” or “MANUAL” :** See “4-6 Normal Operation” below.

4-6. **Normal operation ;**

After completing the input or change of all the parameters and pushing the “ENTER” key for memory in accordance with procedure mentioned in clauses of 4-3, 4-4 and 4-5 above, please follow the instruction of individual operation mode as below.

4-6-1. **“Manual” operation modes ;**

A. **“Local” operation ;**

- a . Turn on either the power switch on the operation panel of the Unit or the power switch on the instrument panel of the heater.
- b. Increase the load at “SV” on LCD panel with “UP” and “DOWN” key, and control the temperature of the heater manually.

B. **“Remote” operation ;**

- a. Turn on either the power switch on the operation panel of the Unit or the power switch on the instrument panel of the heater.
- b. Watching the value at on LCD panel, increase the external Volume(B10kΩ) on the instrument panel of the heater gradually and control the temperature of the heater manually.

4-6-2. "Auto" operation modes ;

A. "Local" operation ;

- a. At the "Manual-Local" operation mode in clause 4-6-1. A., select "Auto" instead "Manual" by pushing the "AUTO/MENU" key on the operation panel of the Unit.
- b. The Unit is automatically operated by DC "4~20mA" control signal (or DC "0~10V") coming from the temperature controller of the heater.

B. "Remote" operation ;

- a. At the "Manual-Remote" operation mode in clause 4-6-1. B., select "Auto" instead "Manual" by pushing the "AUTO/MENU" key on the operation panel of the Unit.
- b. The Unit is automatically operated by DC "4~20mA" control signal (or DC "0~10V") coming from the temperature controller of the heater.

● Ex) Display on LCD panel by type of the Unit and operation mode(in case 380V,50A, 50Hz.

○ "Manual" operation

Type	Page & Symbol			Manual					
	Page	Left	Right	Local			Remote		
CV Constant Voltage	Page 1	SV	R						
		PV	S						
		MV	T						
		ON/OFF	Menu/ Auto	Local/ Remote					
	Page 2	OC	Local/Remote						
		ST	HZ						
		IN	4~20mA/0~10V						
		ION/OFF	Menu/ Auto	Local/ Remote					
CC Constant Current	Page 1	SV	R	50 A	50 A	50 A	50 A	50 A	
		PV	S	50 A	50 A	50 A	50 A	50 A	
		MV	T	55 A	55 A	55 A	55 A	55 A	
		ON/ OFF	Menu/ Auto	Local/ Remote	On	Menu	Local	On	Menu
	Page 2	OC	Local/Remote		50 A	Local	50 A	Remote	
		ST	HZ		10 sec	50 HZ	10 sec	50 HZ	
		IN	4~20mA/0~10V		20mA	16 mA	20mA	16 mA	
		ON/OFF	Menu/ Auto	Local/ Remote	On	Menu	Local	On	Menu
CP Constant Power	Page 1	SV	R						
		PV	S						
		MV	T						
		ON/OFF	Menu/ Auto	Local/ Remote					
	Page 2	CP	Local/Remote						
		ST	HZ						
		OC	4~20mA/0~10V						
		ON/OFF	Menu/ Auto	Local/ Remote					

○ “Auto” operation

Type	Page 및 Symbol			Auto					
	Page	Left	Right	Local			Remote		
CV Constant Voltage	Page 1	SV	R						
		PV	S						
		MV	T						
		ON/OFF	Menu/ Auto	Local/ Remote					
	Page 2	OC	Local/Remote						
		ST	HZ						
		IN	4~20mA/0~10V						
		ON/OFF	Menu/ Auto	Local/ Remote					
CC Constant Current	Page 1	SV	R	50 A	50 A	50 A	50 A	50 A	
		PV	S	50 A	50 A	50 A	50 A	50 A	
		MV	T	55 A	55 A	55 A	55 A	55 A	
		ON/OFF	Menu/ Auto	Local/ Remote	On	Auto	Local	On	Auto
	Page 2	OC	Local/Remote		50 A	Local	50 A	Remote	
		ST	HZ		10 sec	50 HZ	10 sec	50 HZ	
		IN	4~20mA/0~10V		20mA	16 mA	20mA	16 mA	
		ON/OFF	Menu/ Auto	Local/ Remote	On	Auto	Local	On	Auto
CP Constant Power	Page 1	SV	R						
		PV	S						
		MV	T						
		ON/OFF	Menu/ Auto	Local/ Remote					
	Page 2	CP	Local/Remote						
		ST	HZ						
		OC	4~20mA/0~10V						
		ON/OFF	Menu/ Auto	Local/ Remote					

Note : Whenever the Unit is turn On and Off with the external Power On/Off switch, please turn Off the Power On/Off switch on the operation panel of the Unit.

5. Other instruction

5-1. Cautionary instruction for operation of the Unit.

- A. For wiring the main circuit, use the wires with sufficient margin to the rated current of the Unit
- B. Please refrain the bundle of control circuit wires from the main circuit wires
- C. Do not apply higher than DC 10V and DC 20mA from the temperature controller.
If applied, some internal parts of the Unit may be damaged.
- D. When the Unit is installed inside a instrument panel, please pay attention the heat generated
Inside the Unit and take a ventilation into consideration.
- E. Note that normal operation is failed unless polarity PT(Voltage Transformer) and CT(Current Transformer) is matched when the power display is used.
- G. Install the Unit so that its front door can be easily opened and closed for maintenance or
Inspection.
- H. The finger guard of the cooling fan is not provided, please install it if necessary.
- I. For measurement of output voltage and current during operation, please use an effective value
meter such as a moving iron type or thermocouple type.

5-2. Maintenance and inspection.

- A. Note that a dust, a humid air, an overheat and a vibration can cause the Unit a
degraded performance or other troubles.

- B. For maintenance and inspection, please be sure that the main input power to the Unit turned off.
- C. When the alarm circuit activates, relay makes the specific LED flickering on LCD panel.
Turn off the power after making sure what kind of alarm is flickering..
- D. “OT” flickering on LCD panel means that the heat sink temperature is so high by trouble of the cooling fan or other reasons. Replace the cooling fan or take other measures to improve cooling effect, Then start normal operation again.
- E. “OC” flickering on LCD panel warns that the input current to the load is higher than the “OC” alarm setting value or a parts of the heating element is shorted, please check the heater for short or a electrical leakage in the Unit, then put the Unit into operation again.

5-3. Troubleshooting.

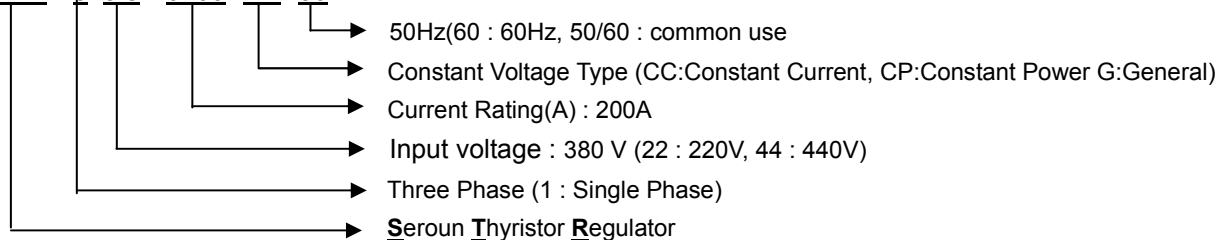
Should any default is detected, please read this instruction manual carefully and check the following points.

Condition	Cause	Failure relay	Result		Indication on LCD	Action to be taken
			3 phase	1 phase		
Output is not given	1. Over-current	OC	Output stop	Output stop	flicker	A. Power off. B. Remove the causes. C. Start the Unit again.
	2. Over heat of heat sink	OT	Output continue	Output continue	flicker	
	3. H.S. fuse intercepted	SP	Output continue	Output stop	flicker	
	4. Load short	SL	Output continue	Output stop	flicker	
Output is abnormal	1. Load open	SL	Output continue	Output stop	flicker	
	2. Polarity problem in CP type between PT&CT	-	Output continue	Output stop	flicker	

6. References

6-1. Model identification

S T R--3 . 3 8--0200--CV--50



6-2. General specification

Application	Heater Power Control
Number of Phase	Single Phase and Three Phase
Control system	Phase Control
Applicable load	<ul style="list-style-type: none"> • Resistance load • Inductive load • Transformer primary load • Rectifier primary load
Control input	<ul style="list-style-type: none"> • On/Off signal : Contact turned on when lower than setting temperature • Signal current : DC 4~20 mA(unit input resistance 250 Ω) • Signal voltage : DC 0~10 V

Cooling method		<ul style="list-style-type: none"> • 25/35/40/ for Three Phase and 25/35/40/50/60/70A for Single Phase : self-cooling • 50A or higher for Three Phase and 90A or higher for Single Phase : fan cooling
Ambient Condition	Temperature	• Operating Temperature : -10~50 °C , storage temperature : -20~70 °C
	R. humidity	• 30~90 % (without dew)
	Site Condition	• To keep it away from the corrosive gas, dust and vibration
Insulation	Voltage	<ul style="list-style-type: none"> • AC2000V/minute for 220 V series. • AC2500V/minute for 380/440V series.
	Resistance	• 20MΩ or higher (DC500 V Mega)
Input	Voltage	<ul style="list-style-type: none"> • 220V±10%. • 380/440V±10%. • Control Power : AC13V • Power for fan : AC220~230V
	Frequency	• Three phase : 50 and 60Hz • Single phase : common use
Output ratings		<ul style="list-style-type: none"> • 25/35/40/50/60/70/90/110/130/150/200/250/300/350/400/450/500A. • 600A or higher can be complied with customer's specification
Output voltage regulation range		• 0 to 98 %(of effective value)
Circuit protection		• High speed fuse installed
Load setting range		• 0 to 100 % (of ratings)
Soft start system		<ul style="list-style-type: none"> • "0 to 300" seconds setting can be selectively done by operation key. The value is displayed on display panel
Display		<ul style="list-style-type: none"> • the outputs of voltage and current (in case installation of circuit of Constant Voltage and Constant Current), • the output of power(in case installation of Constant Power circuit) • all of PV and SV. • Display on LCD panel (4 lines x16 Characters)
Current limit		• Setting up to 100 % of rating
Type	Constant Voltage (CV)	<ul style="list-style-type: none"> • Input voltage change : ±10 % within ±1 % • Temperature change : -10~50 °C within ±2 %
	Constant Current(CC)	<ul style="list-style-type: none"> • Input voltage change : ±10 % within ±1 % • Temperature change : -10~50 °C within ±3 %
	Constant Power(CP)	<ul style="list-style-type: none"> • Input voltage change : ±10 % within ±1 % • Load change : 4 times within ±5 %
Operation key board		• On/Off, Manual/Auto., setting of all the Parameters and Frequency etc
Communication(RS-485)		• Output setting and monitoring by interface for communication

6-3. Protecting function

Function	Description	Failure relay	Result	Action to restart	Alarm on LCD	Three phase	Single phase
Over-current protection	• Detect at higher than 110~130 % of rated current	OC	Output stop	Eliminate the cause	Flicker	○	○
Circuit protection	• Detect the interception of high speed fuse	SP	Output continue	Eliminate the cause	Flicker	○	
Detection of load open	• Detect heater short and open	SL	Output continue	Eliminate the cause	Flicker	○	○
Overheat protection of heat sink	• When the heat sink temperature rises to 85 °C, the thermal switch activate Please check whether the cooling fan is running well or not.	OT	Output Continue	Eliminate the cause	Flicker	@50A or higher	@90A or higher

6-4. Characteristic of control and operation

• Wave Pattern Control : Phase Control

• Input/Output characteristics :

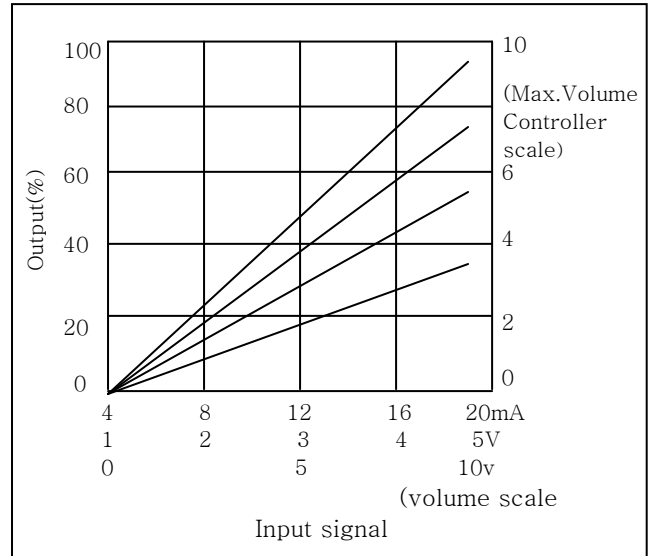
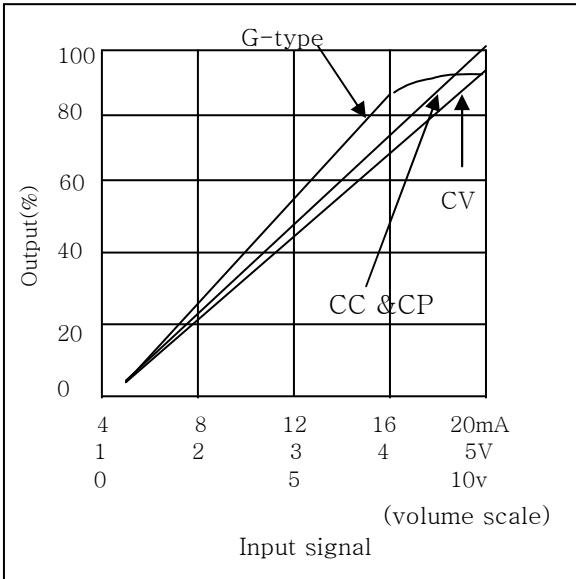
This function for phase control and cycle Control is shown in drawing as below. It shows that input/output of CV, CC and

• Function for Maximum Output setting :

This gradient setting can be done intentionally by connecting a setting unit(10 kΩ volume). This function is useful for an electric furnace with 3 zone controls,

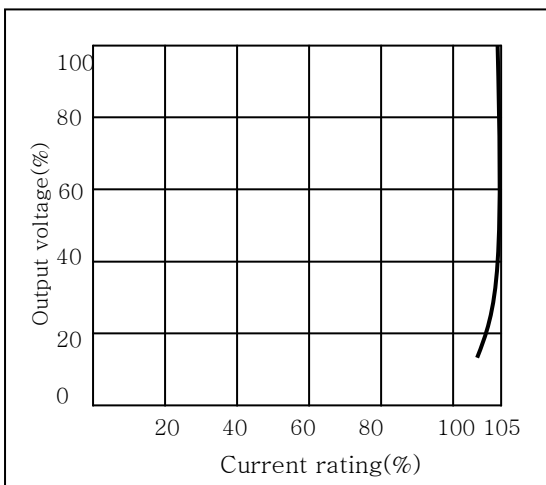
CP type are stable and improved.

in which three STR Unit is operated by one TIC



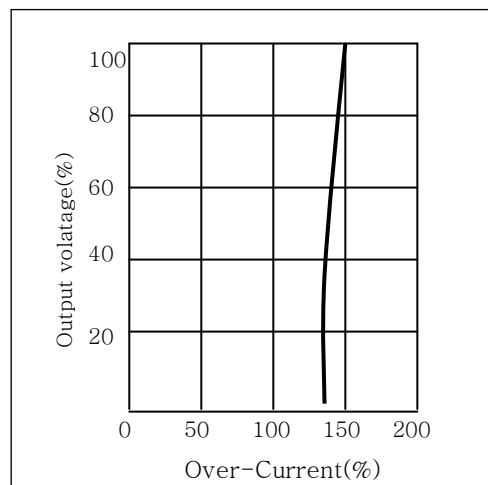
● **Function for Restriction of output Current :**

This function is to restrict the current to protect the Unit from Over-Current when something happens such as an increase of the load change



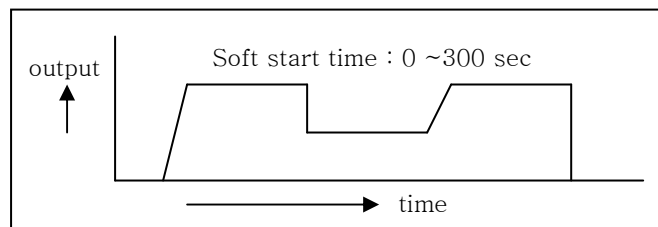
● **Function for Protection from Over-Current :**

Even Over-Current flows to the heater, the Gate of thyristor is not turned off and then the Unit is operated continuously.



● **Function for Soft Start :**

Because this function can minimize the peak current, the capacity of transformer for load can be minimized. Soft Start time can be adjustable in range of 0~330 seconds.



● **Function for protecting the heat sink from overheating :**

This function is to warn the operator on a cooling fan trouble and to protect the thyristor when the heat sink temperature is abnormally high due to the cooling fan trouble or other.

● **Alarming function :**

The “a-contact” at zero volt and one circuit (AC250V, 1A) .

This function warns an over-current and over-temperature of the heat sink.

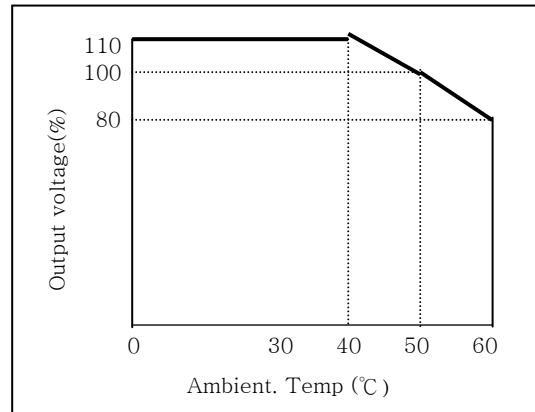
The interception of the rapid fuse and the failure of the heater can be perceived by reading the power output on the display panel of the Unit.

● **Output v/s ambient temperature :**

The current rating of the Unit is allowable at a maximum ambient temperature 50°C .

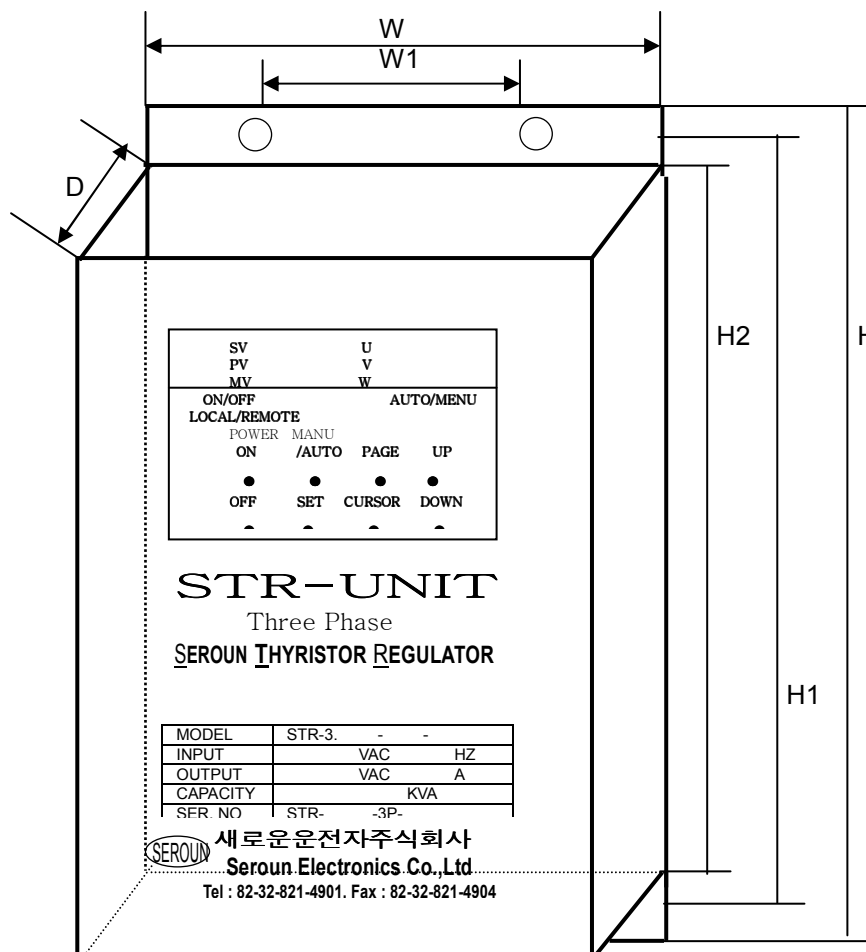
At an ambient temperature higher than 50°C allowable current decreases.

So it is recommendable to change the load according to an ambient temperature



6-5. Outline dimensions

● **Single Phase Unit and Three Phase Unit**



Size table

Model	cooling	H	H1	H2	W	W1	D	w't (kg)	terminal	
Single Phase	25 & 35A	By self								
	40 & 50A	By self								
	60 & 70A	By self								
	90,110,130 & 150A	By fan								
	200,250 & 300A	By fan								
	350,400 & 450A	By fan								
	500A~	By fan	It may comply with customer's specification							
Three Phase	25,35 & 40A	By self	350	325	300	180	120	235	8.5	13P
	50, 60 & 70A	By fan	350	325	300	180	120	235	9.0	13P
	90 & 110A	By fan	350	325	300	180	120	235	9.5	13P
	130 & 150A	By fan								
	200,250A	By fan								
	300,350, 400, 450 & 500A	By fan								
	600A~	By fan	It may comply with customer's specification							

6-6. Operation and display

• **LCD Display Panel :**

- Display formats : 16 characters X 4 lines.
- This panel displays all of parameters, values and operating conditions

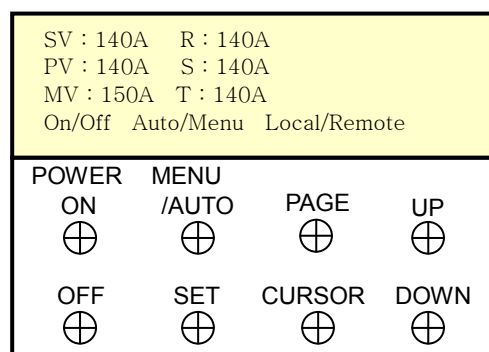
• **Operation Panel :**

- Keys for power On/Off
- Key for selection of Manual or Auto .
- Selection and setting of Local or Remote
- Selection and setting for 50Hz or 60Hz
- Setting and input of parameters and values.

• **Alarming system :** see “ 6-3. Protection Function”

• **Function of operation Keys :**

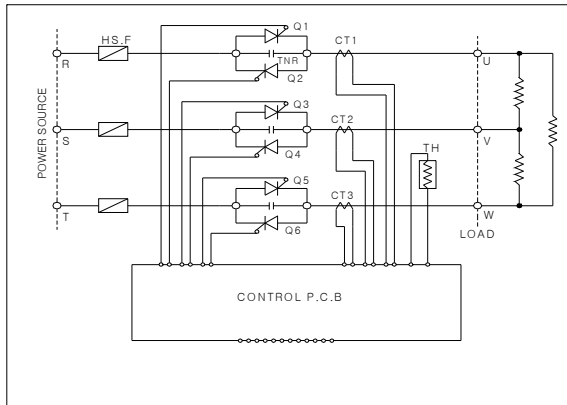
- **POWER ON :** To turn the Unit on.
- **POWER OFF :** To turn the Unit off.
- **MANU/AUTO :** To select Auto or Manual.
- **ENTER :** To set the operation parameters for memory.
- **PAGE :** To select the displaying page.
- **CURSOR :** To input or revise the parameters.
- **UP :** To increase the value of parameters.
- **Down :** To decrease the value of parameters.



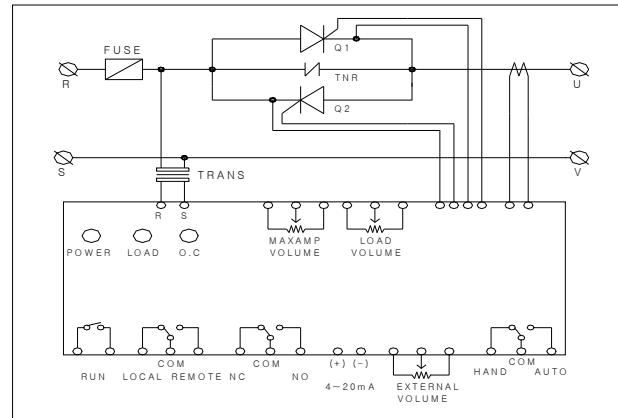
6-7. Internal connection circuit

6-7-1. Constant Voltage type and Constant Current type

Three Phase



Single Phase



6-7-2. Constant Power type

6-8. Standard connection circuit

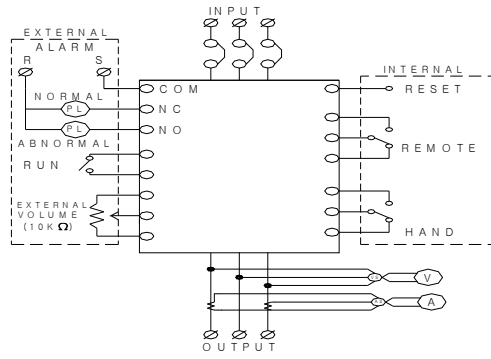
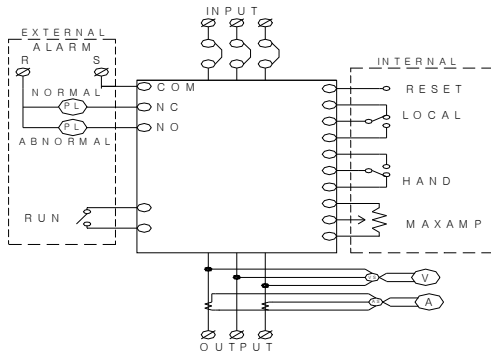
6-8-1. Constant Voltage type and Constant Current type

Three Phase

A. Manual operation

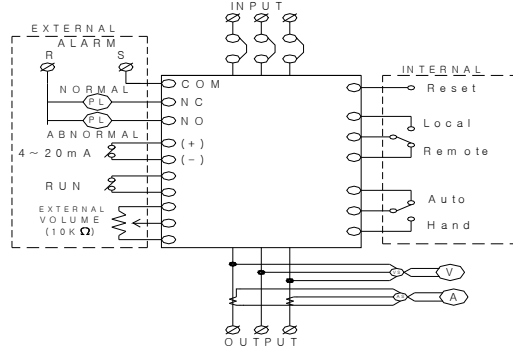
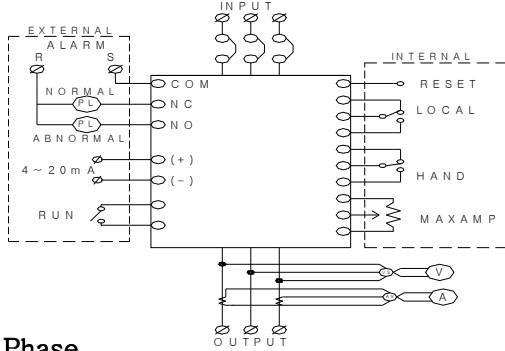
(With Internal Volume-up/down in LCD panel)

(With External Volume)



B. Automatic operation by 4~20mA
(With Internal Volume-up/down in LCD panel)

(With External Volume)

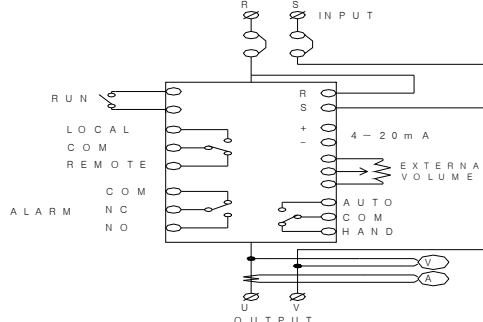
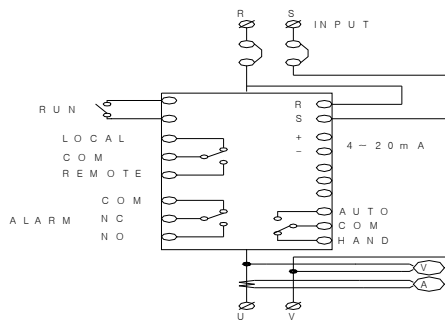


Single Phase

A. Manual operation

(With Internal Volume-up/down in LCD panel)

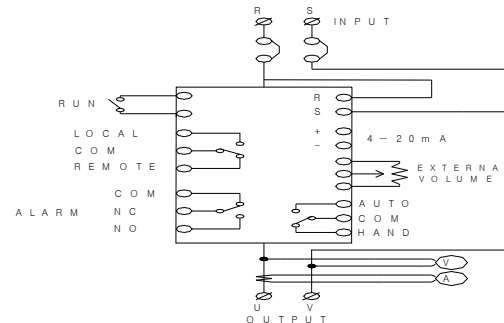
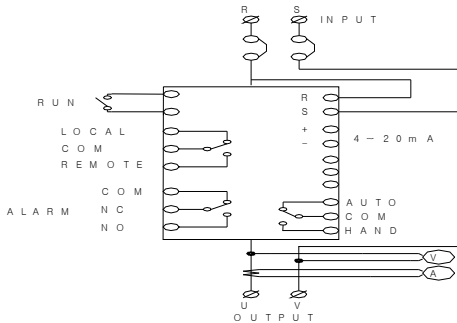
(With External Volume)



B. Automatic operation by 4~20mA

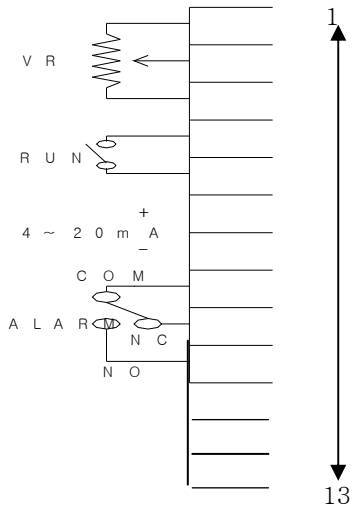
(With Internal Volume-up/down in LCD panel)

(With External Volume)



6-8-2. Constant Power type

6-9. Terminal diagram

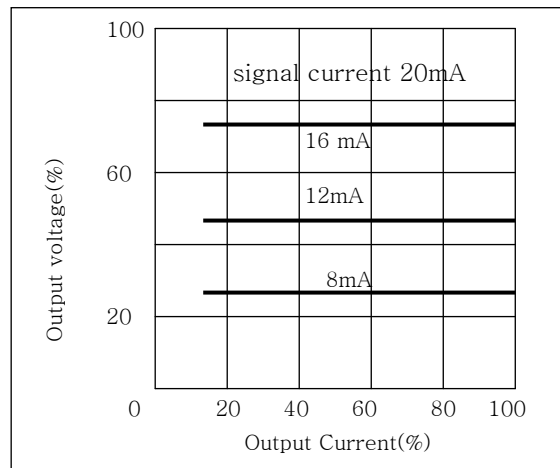
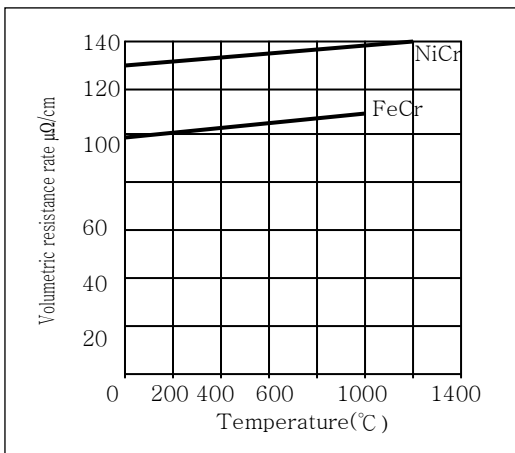


6-10. Application by type of the Unit

A. Constant Voltage type :

Regardless the change of input voltage of the Unit and the change of load, **Output Voltage** is **constant**.

This type Unit is usually applied in case an electric furnace heater element is FeCr wire, NiCr wire or any other heating element which has a very small temperature coefficient vs its electrical resistance, and also can obtain a linear and stable output of the heater.

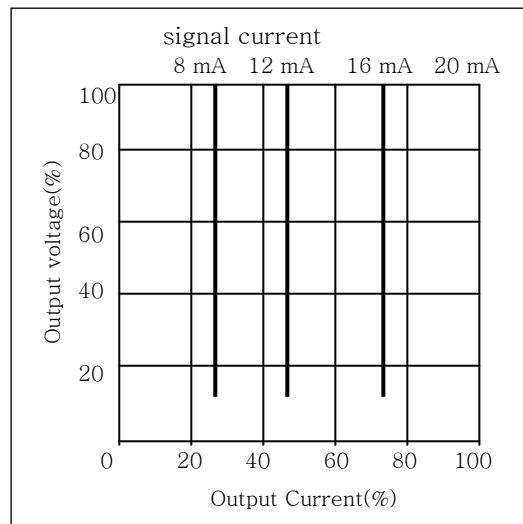
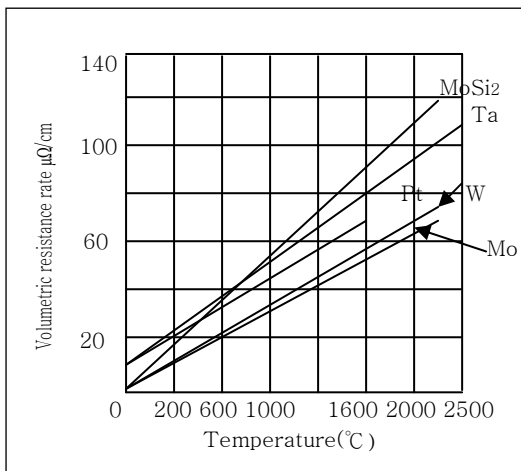


B. Constant Current type :

Regardless the change of input voltage of the Unit and the change of load, **Output Current** is **constant**.

In case an electric heater element is a platinum wire, a molybdenum wire, or any other heating element of which electrical resistance is very low at low temperature and its value increases from 6 to 12 times at high temperature, the output current change rapidly along with temperature, even if output voltage is constant. Especially large current flows in heater at low temperature.

- Ex) • Molybdenum silicide(MoSi₂ is called ‘Superkanthal’),
- Direct heating furnace e.g. salt bath furnace and Glass melting furnace
 - Direct electrified heater e.g. wire or steel plate heater
 - A source power for ion nitriding

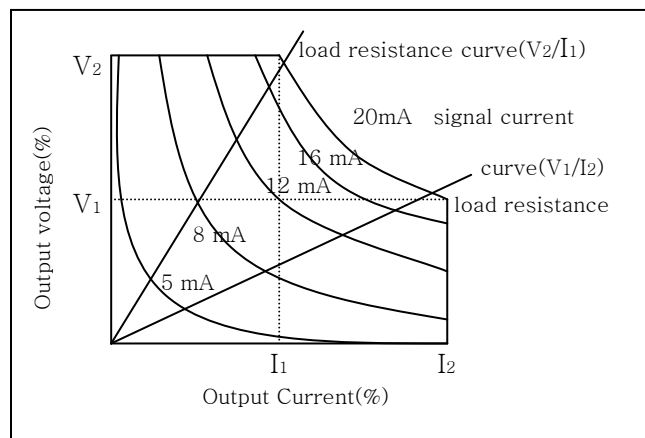
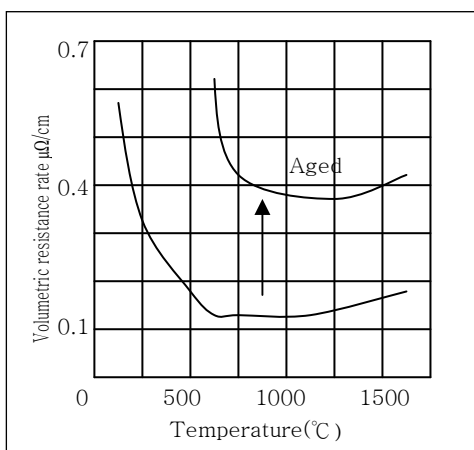


C. Constant Power type :

Regardless the change of input voltage of the Unit and the change of load, **Output Power** is **constant**.

This type is mainly used in which an electric furnace heater is a silicone based ceramic element or any other heating element of which electrical resistance changes along with its heating temperature and deteriorates to about 4 times of the initial value due to aging, the heater power changes with temperature and its aging, even if input voltage of heater is kept constant.

- Ex: • Silicon Carbide(SiC) heater
- Carbon heater
 - Heater which temperature monitoring is impossible



6-11. Interface for communication(Optional)

- A. As an optional function, the Unit has the Communication Interface which can access maximum fifteen(15) Units to each cable
- B. And adopting the Communication Control Unit(CTR), it is possible to access maximum 120 Units to each personal computer
- C. It is possible to monitor the output voltage, output current and output power, and the setting of signal by the personal computer is also possible as well.

