

SC-225/SC-250 SC-325/SC350 STATIC CONTACTOR (Thyristor Switch) USER MANUAL



Safety Provisions

Do not open the device enclosure. There are no user-servicable parts inside the device enclosure. Ensure that the earth connection of the device is done.

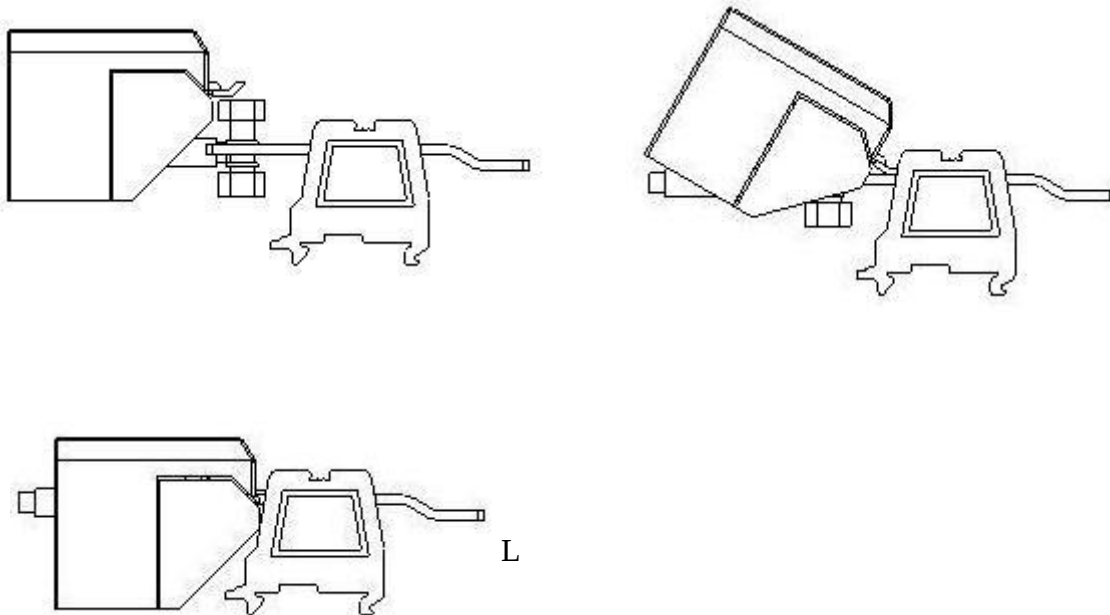


Warning: Consider that there may be voltages at life-threatening levels on the device's power terminals even though capacitors of the power factor correction system are switched off, and take the necessary precautions.



Warning: Charges on the capacitors may be at life-threatening levels after the system's energy has been completely cut. Therefore, do not handle the device until all the capacitors have been discharged completely!

- When establishing the auxiliary supply and power connections of the device, use fast type fuses.
- Attach the terminal covers that came with the device to the power terminals of the device as shown below.



- After you've put the terminal cover into place, push it in the direction of the device so it is properly attached.

Warnings

- Read this manual carefully before installation and operation of the Static Contactors.
- Commissioning, maintenance and operation of the device should be done by authorized personnel.
- Do not operate the device at low voltage.
- Do not use this device for any other reason than its intended purpose.
- Clean your device only with a dry cloth. Water and solvents may damage the device.
- Before commissioning your device, make sure that all the terminal connections are done correctly.
- Current limiter reactors must be installed at power lines for usage on standard power factor correction systems without harmonic filter reactors.

Guaranty Conditions

Your device is guaranteed for 1 year against production errors.

Contact your reseller for any kind of maintenance services concerning your device.

The manufacturing company cannot be held responsible from any unwanted circumstances if the instructions in this entire user manual haven't been followed.

Index

Security Conditions.....	Hata! Yer işareti tanımlanmamış.
Warnings.....	Hata! Yer işareti tanımlanmamış.
Guaranty Conditions.....	Hata! Yer işareti tanımlanmamış.
Index.....	Hata! Yer işareti tanımlanmamış.
1 Introduction	4
1.1 Utilization Areas.....	4
1.2 General Features.....	4
1.3 Technical Features	4
1.4 Applied Standards.....	5
1.5 Front/Side/Back Panel.....	6
1.6 Hardware Structure and Features	11
2 Device Utilization	12
2.1 Contents of Package.....	12
2.2 Operation of Device.....	12
2.4 Installation.....	13
2.5 Electrical Connection.....	16
2.6 Inputs and Outputs	18
3 Configuration	18
3.1 Utilization and Settings	18
5 Troubleshooting	22
6 Help	23

1 Introduction

1.1 Utilization Areas

Static contactors are used with special power factor control relays for more efficient power factor control on systems with quick-changing power factors by providing the necessary capacitive power during the quick changes of the system. By using static contactors, power factor correction capacitors can be switched on and then off in a 1 period time (20 milliseconds), thus providing the necessary capacitive power for the quick switching loads.

Note: 1 period is 20 milliseconds for 50 Hz networks.

1.2 General Features

- Reaction time shorter than 20 ms
- Triggering via RS-485
- Reactor thermic input
- Thermal protection
- Warning LEDs
- Long operational life
- Easy installation
- Silent operation

1.3 Technical Features

Auxiliary Supply (Un)	: Look at the label.
Operating Voltage (max) P-P	: 480V (SC-250/SC-225), 690V (SC-350/SC-325)
Maximum Power	: 25KVA _r (SC-225/SC-325), 50KVA _r (SC-250/SC-350)
Frequency	: 45-65Hz
Triggering	: 5-30VDC
Operating Temperature	: -10...+55
Storage Temperature	: -10...+75
Humidity	: 95%

Communication	: RS-485 MODBUS RTU
Baud rate	: 9600
Parity	: NO
Data Bit	: 8
Stop Bit	: 1
Address	: Set between 1-247 with DIP switches
Cable diameter (max)	: 25mm ² with connector (main terminals) 2,5mm ² (triggering, auxiliary supply, sensor) CAT5 (RS-485)
Enclosure Protection Class	: IP-00
Standards	: EN 60947-1
Dimensions (H X W X D)	: 275,7mm X 140mm X 212,1mm
Weight	: 5,350kg (SC-225) 5,550kg (SC-325) 6,250kg (SC-250) 6,450kg (SC-350)

1.4 Applied Standards

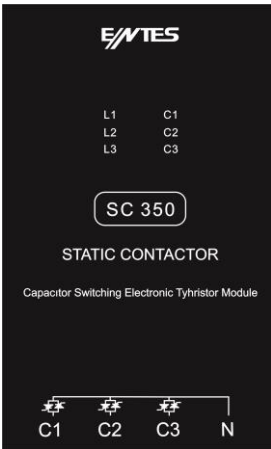
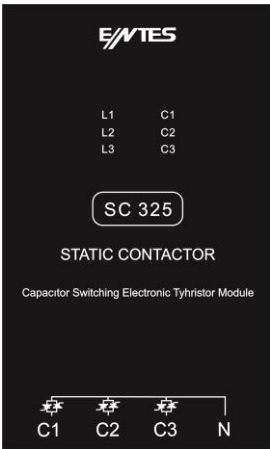
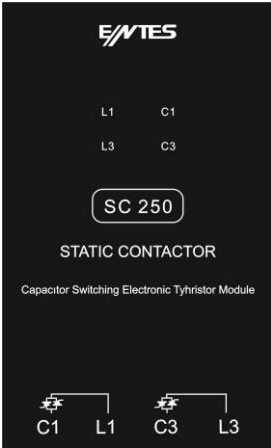
The device complies with the TS-EN 60947 standard.

Standards which are referenced under the chapter reference 60947-4-3:

- IEC 60050(161)
- IEC 60085
- IEC 60269-1
- IEC 60410
- IEC 60439-1
- IEC 60664
- IEC 60947-4-2
- IEC 61000-2-1, IEC 61000-3-2, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-11
- IEC 61131-2
- CISPR 11, CISPR 14

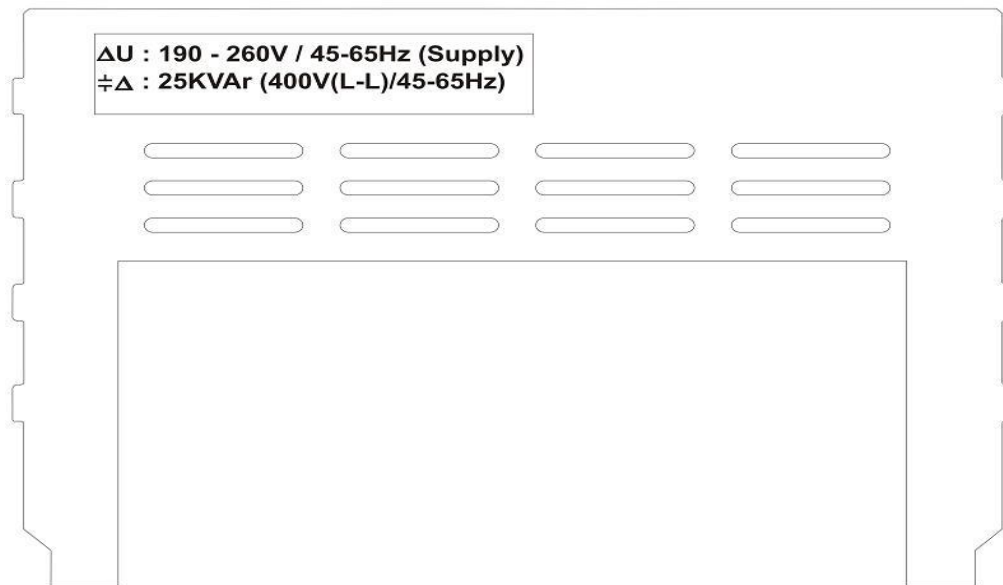
SC-225/SC-250/SC-325/SC-350 STATIC CONTACTOR

1.5 Front/Side/Back Panel

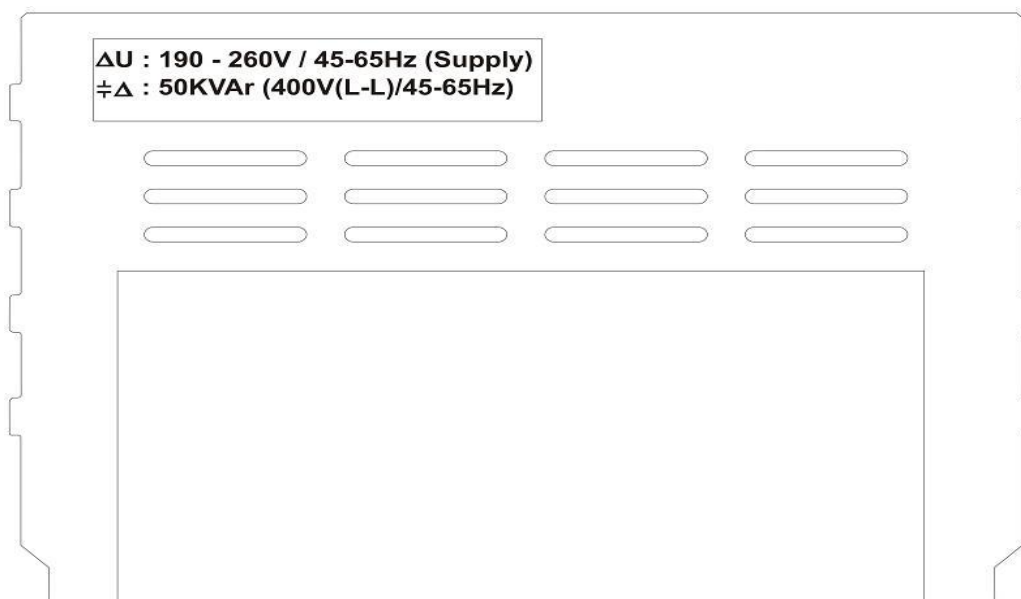


SC-225/SC-250/SC-325/SC-350 STATIC CONTACTOR

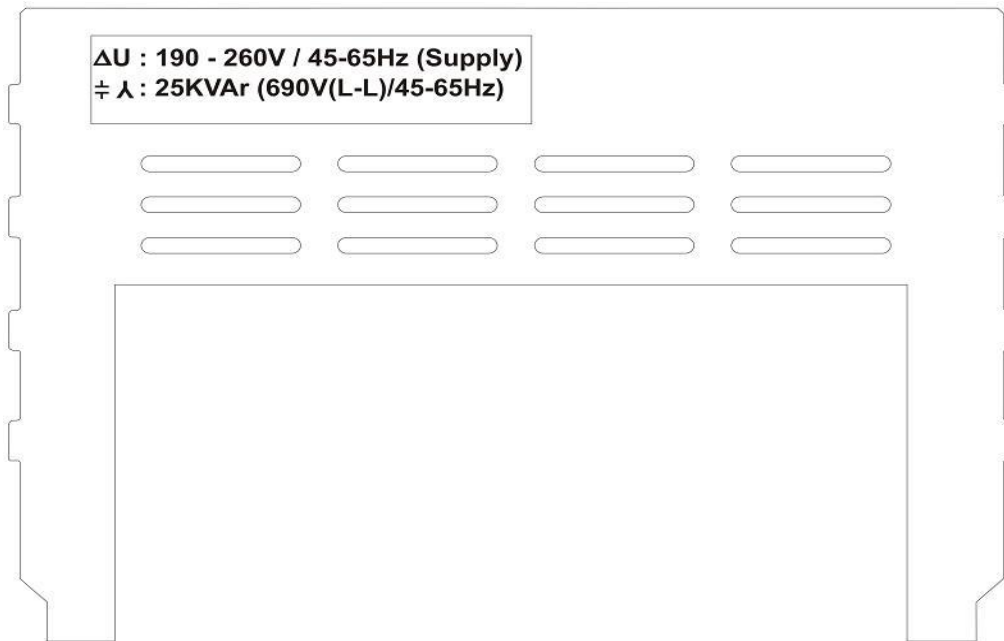
SC-225 Module Plate View



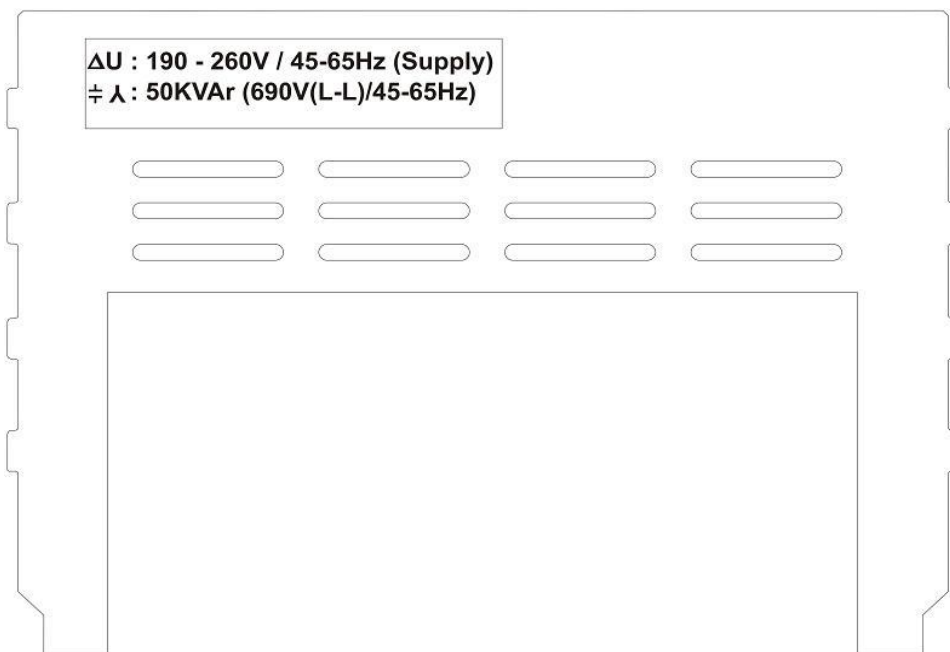
SC-250 Module Plate View



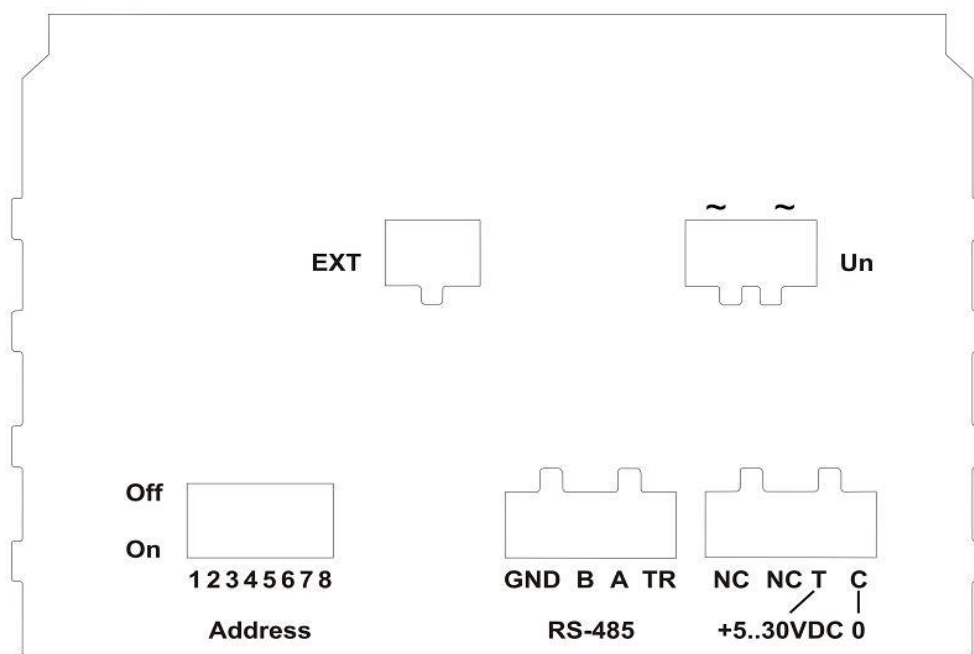
SC-325 Module Plate View



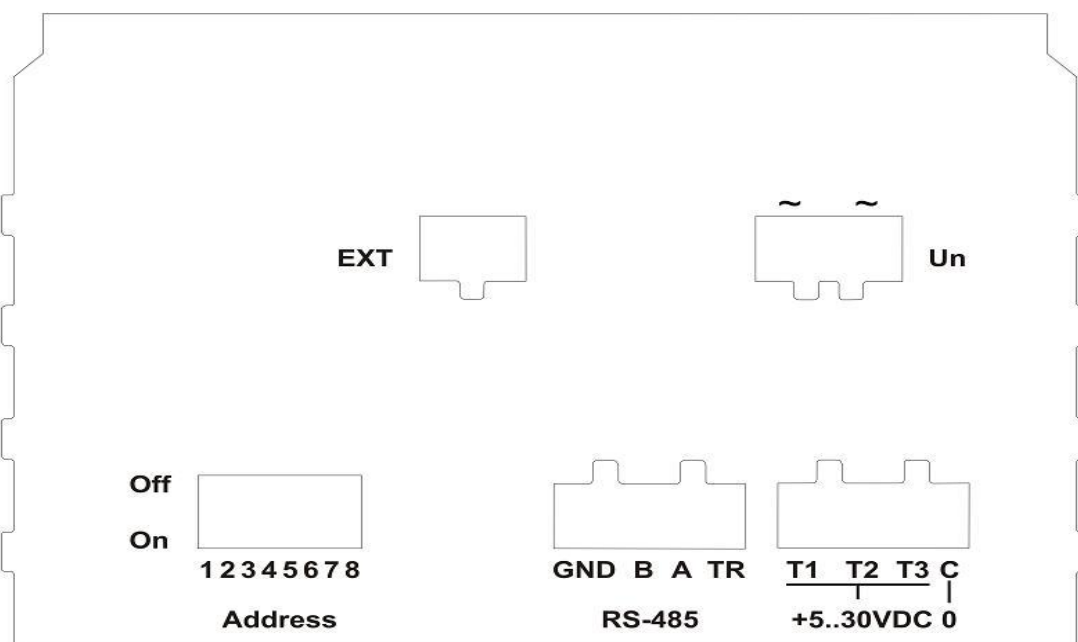
SC-350 Module Plate View

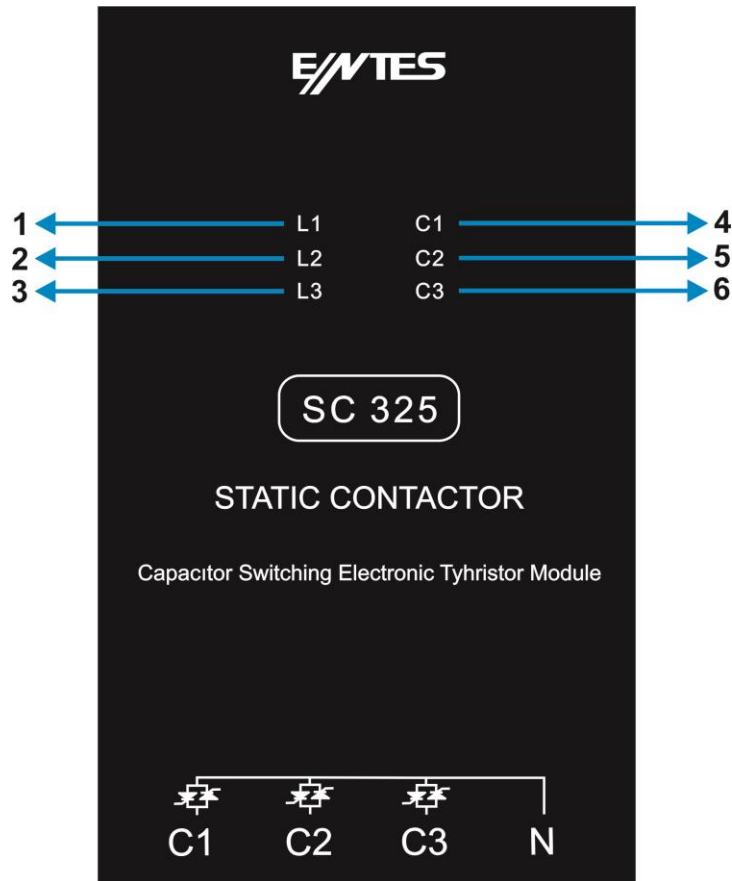


SC-225/325 Terminal Plate View



SC-250/350 Terminal Plate View

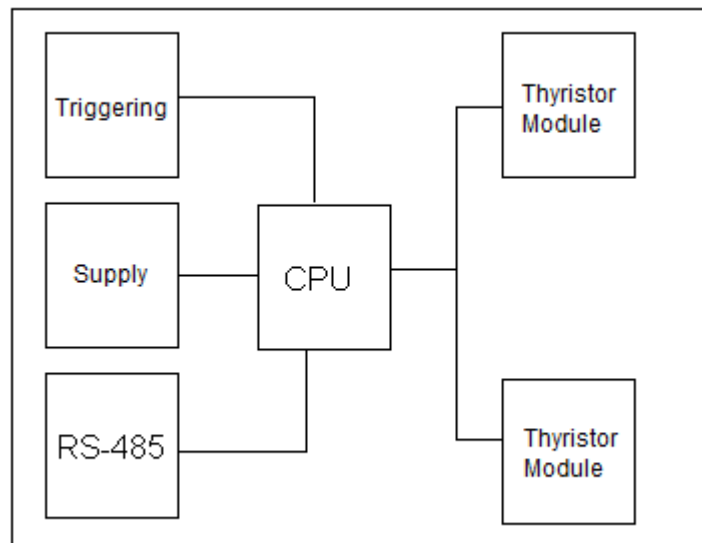




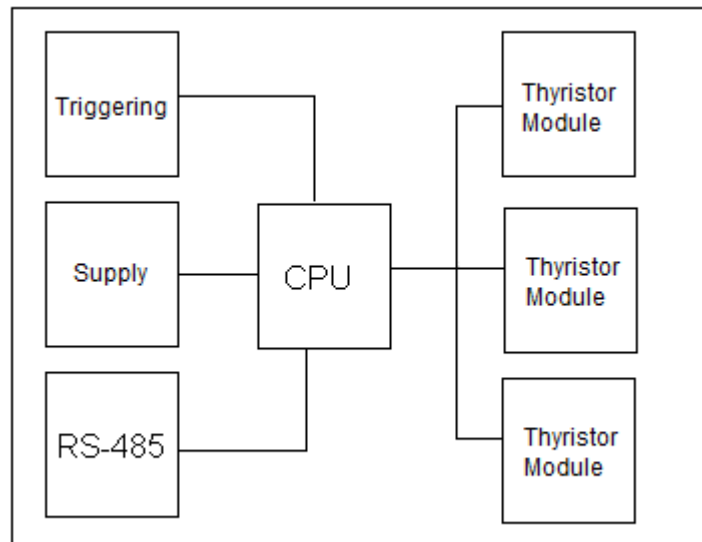
- 1- Shows that L1 phase voltage is at an acceptable level.
- 2- Shows that L2 phase voltage is at an acceptable level.
- 3- Shows that L3 phase voltage is at an acceptable level.
- 4- Shows that C1 capacitor is switched on.
- 5- Shows that C1 capacitor is switched on.
- 6- Shows that C1 capacitor is switched on.

1.6 Hardware Structure and Features

SC-225/250 Block Diagramm



SC-325/350 Block Diagramm



2 Device Utilization

2.1 Contents of Package

1 pc. SC-225/SC-250/SC-325/SC-350,
4 pcs. Panel mounting screw-nut set
4 pcs. Power terminal covers
1 pc. Installation template
1 pc. Metal handle
2 pcs. Handle installation screws
User Manual

2.2 Operation of Device

There are 4 models as below:

SC-225: 25 KVAR with 2 Thyristors,
SC-250: 50 KVAR with 2 Thyristors,
SC-325: 25 KVAR with 3 Thyristors,
SC-350: 50 KVAR with 3 Thyristors.

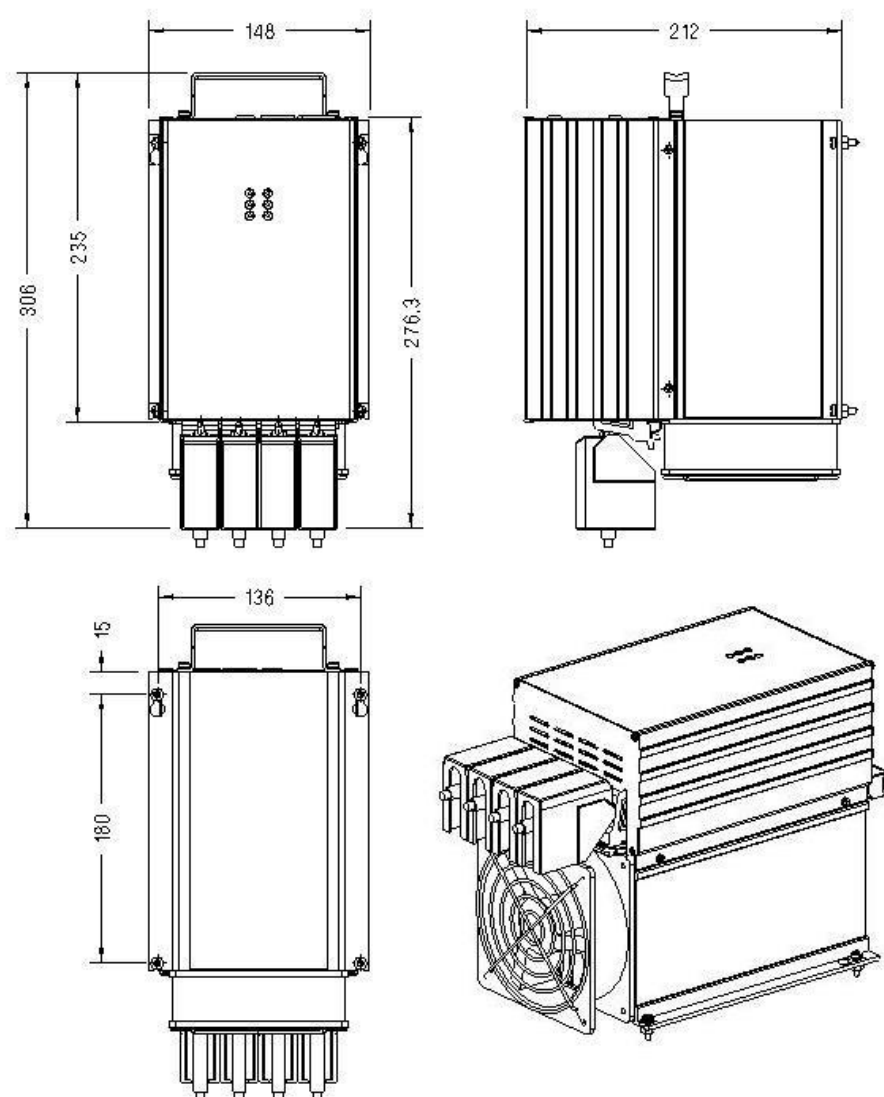
SC-225/SC-250 models can be used only for the capacitors with triangle connection.
SC-325/SC-350 models can be used only for the capacitors with star connection.

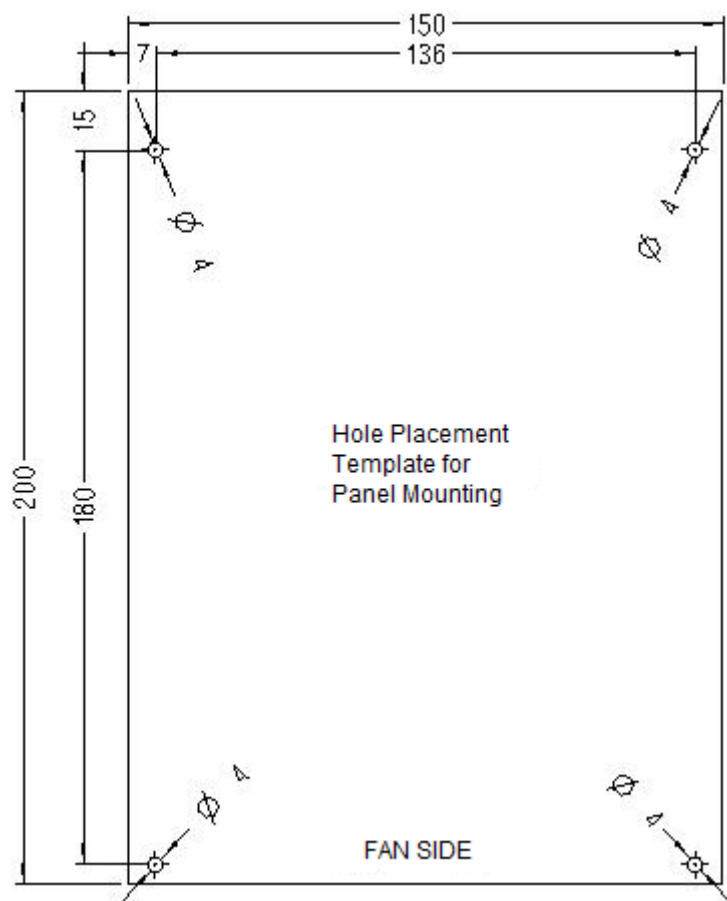
Static contactor switches the thyristors modules on or off according to the command it receives from the Power Factor Controller via Modbus or DC triggering. By adjusting the switch on time when the voltage on the capacitor and the voltage of the phase/phases that the capacitor connected to are equal, the static contactor limits the current value to a minimum during switching the capacitor on. Thus, capacitors can be switched on or off in a very short time period. The capacitor can be switched on in under a period (20 milliseconds) after the command is received from the relay. When the capacitors are not connected to the system, they are kept at a charged state at the peak value of the phase/phases that they are connected to. This ensures that the zero transfer occurs at the point on the sinus wave with the lowest gradient. If capacitor voltage remains at a higher value than the peak value for any reason (reactors may cause this), triggering is done at the peak value since there will be no equal values between peak value and capacitor voltage.

Device contains a thermic protection. With this thermic protection, the capacitors are switched off when the temperature value exceeds a set value. Additionally, an external thermic can be connected. With this thermic, the capacitors can be switched off by setting the device to an alarm status. For example, you can connect the reactor thermic to this input. This input is isolated.

2.4 Installation

SC-225/SC-250/SC-325/SC-350 STATIC CONTACTOR

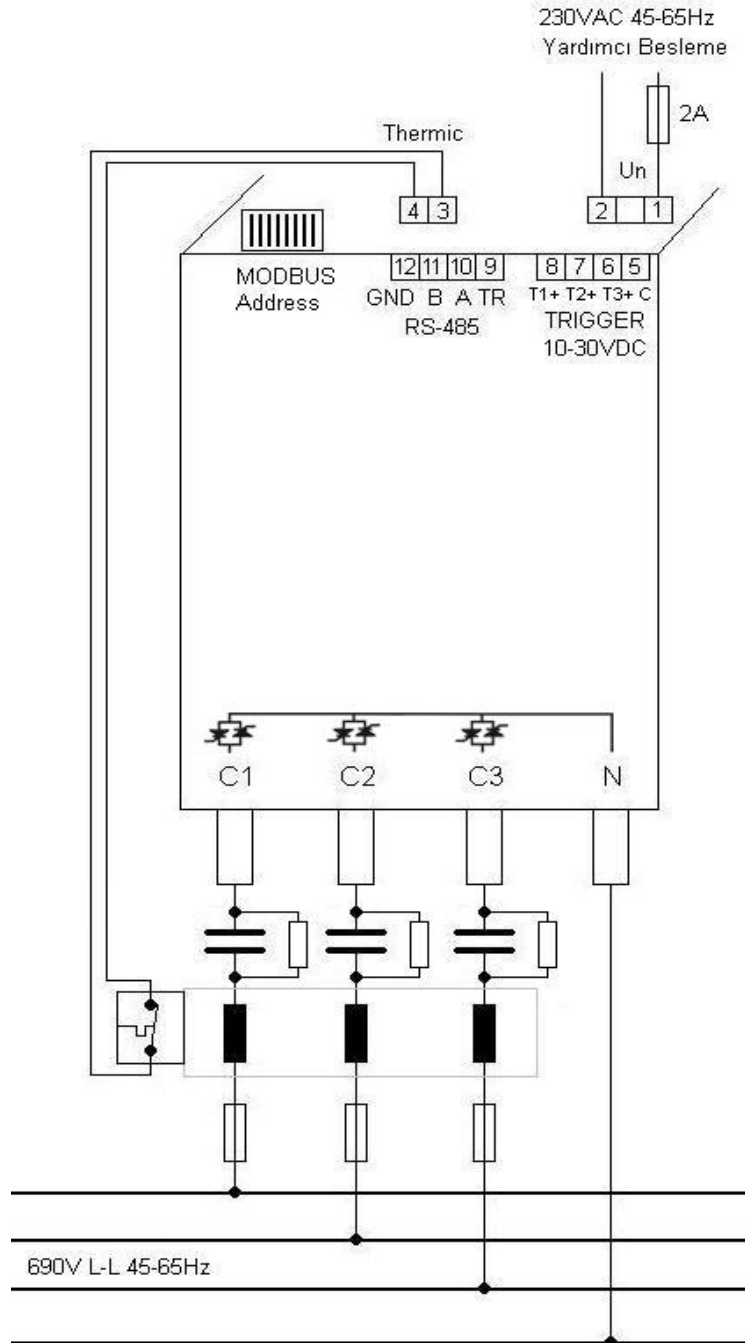




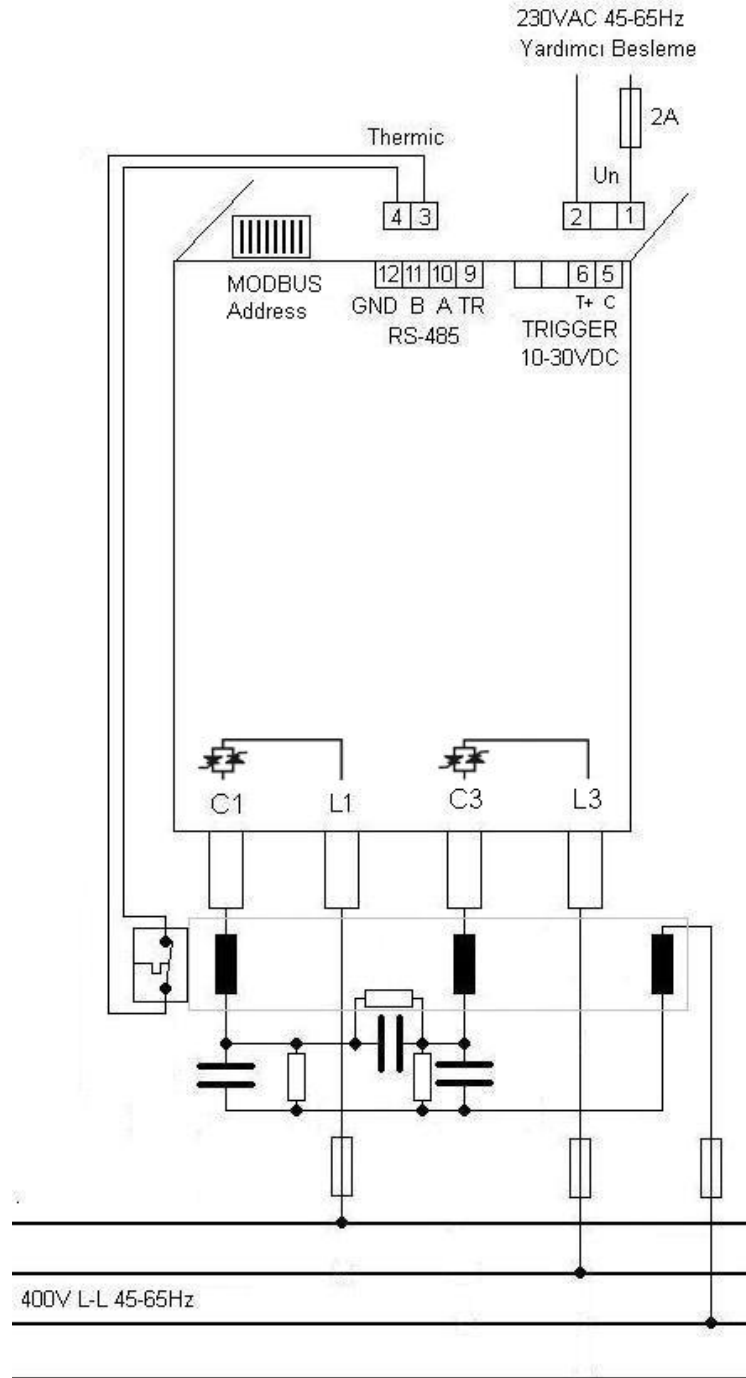
1. Earthing cable must be connected to the screw marked with Earth symbol.
2. Use 4 pieces of Metric-5 bolts for panel mounting.
3. Use panel mount template for panel holes.
4. Put the terminal covers in place.
5. Power cables must absolutely be connected with ferrules.
6. Make sure to leave at least 10 cm at the bottom and top for adequate cooling.

2.5 Electrical Connection

SC-325/SC-350 CONNECTION DIAGRAM



SC-225/SC-250 CONNECTION DIAGRAM



2.6 Inputs and Outputs

EXT: For connecting an external thermic.

Triggering Inputs: It is used to switch the capacitors on with 5-30 VDC voltage.

RS-485: It is used to switch the capacitors on through MODBUS-RTU protocol.

Auxiliary supply: Supply voltage is connected to the device.

Power Terminals:

C1, C2, C3: Capacitors are connected.

L1, L3: Phases are connected.

N: For neutral connection.

3 Configuration

3.1 Utilization and Settings

Device address can be set between 1 and 247 by using the 8 DIP switches located on the device.

	1.Switch	2.Switch	3.Switch	4.Switch	5.Switch	6.Switch	7.Switch	8.Switch
ON	1	2	4	8	16	32	64	128
OFF	0	0	0	0	0	0	0	0

Each one of the 8 switches has a value as given on the table above. Address is the summation of the numbers of DIP switches that are at ON position. If a wrong address is set (such as 0, ..., 248, ..., 255), device switches itself to alarm status and green LEDs blink while the red LEDs are switched off. On the table below, the switch positions for some example address values are given.

	1.Switch	2.Switch	3.Switch	4.Switch	5.Switch	6.Switch	7.Switch	8.Switch
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
23	ON	ON	ON	OFF	ON	OFF	OFF	OFF
247	ON	ON	ON	OFF	ON	ON	ON	ON

As seen from the table above, addresses like 3, 23 and 247 can be created like the examples below by adding the switch values together:

$$3 = 1+2$$

$$23 = 1+2+4+16$$

247 = 1+2+4+16+32+64+128

Coil Table

SC-325/SC-350 için;

ADDRESS(HEX)	COIL	R/W	
0000-03DA	TRIGGERING	R/W	
0400	1. CHANNEL TRIGGER	R	
0401	2. CHANNEL TRIGGER	R	
0402	3. CHANNEL TRIGGER	R	
0403	1. CHANNEL ON/OFF	R	
0404	2. CHANNEL ON/OFF	R	
0405	3. CHANNEL ON/OFF	R	
0406	L1 VAR	R	
0407	L2 VAR	R	
0408	L3 VAR	R	
0409	THERMIC1	R	
040A	THERMIC2	R	
040B	THERMIC3	R	
040C	EXTERNAL THERMIC	R	
040D	1. EXTERNAL TRIGGER	R	
040E	2. EXTERNAL TRIGGER	R	
040F	3. EXTERNAL TRIGGER	R	

Functions of the device are used with the help of coils, which have been given their addresses on the table above. Triggering coils have been spread out to 0000-03DA address range so that it can cover all channels of 247 devices with 3 channels. 4 coils have been reserved for each device. The first 3 are for the 3 channels. 4th one is left empty. On models with 2 channels, coil of the 2nd coil is also non-functional. This allows the triggering or the deactivating of the channels of all devices separately from each other with a single broadcast message. So in a single message, some capacitors can be switched on and some can be switched off. Other coils can't be reached this way.

Triggering addresses; is calculated as (Device address - 1) * 4 + phase number - 1. For example; (4 - 1) * 4 + 2 - 1 = 12 is used to switch on the L2 phase of device number 4.

(1 - 1) * 4 + 1 - 1 = 0 is used to switch on the L1 phase of device number 1.

SC-225/SC-250/SC-325/SC-350 STATIC CONTACTOR

For the L3 phase of device number 247, the coil at the $(247 - 1) * 4 + 3 - 1 = 986$ (0x03DA) address must be set to 1.

Which coil addresses correspond to which channels of devices from 1 to 247 can be seen on the table below. First column shows the first 12 bits (000X-03DX) of the address. On the following columns, last 4 bits (XXX0-XXXF) of the address is shown.

	XXX0	XXX1	XXX2	XXX3	XXX4	XXX5	XXX6	XXX7	XXX8	XXX9	XXXA	XXXB	XXXC	XXXD	XXXE	XXXF
	L1	L2	L3		L1	L2	L3		L1	L2	L3		L1	L2	L3	
000X	1			EMPTY	2			EMPTY	3			EMPTY	4			EMPTY
001X	5			EMPTY	6			EMPTY	7			EMPTY	8			EMPTY
002X	9			EMPTY	10			EMPTY	11			EMPTY	12			EMPTY
003X	13			EMPTY	14			EMPTY	15			EMPTY	16			EMPTY
004X	17			EMPTY	18			EMPTY	19			EMPTY	20			EMPTY
005X	21			EMPTY	22			EMPTY	23			EMPTY	24			EMPTY
006X	25			EMPTY	26			EMPTY	27			EMPTY	28			EMPTY
007X	29			EMPTY	30			EMPTY	31			EMPTY	32			EMPTY
008X	33			EMPTY	34			EMPTY	35			EMPTY	36			EMPTY
009X	37			EMPTY	38			EMPTY	39			EMPTY	40			EMPTY
00AX	41			EMPTY	42			EMPTY	43			EMPTY	44			EMPTY
00BX	45			EMPTY	46			EMPTY	47			EMPTY	48			EMPTY
00CX	49			EMPTY	50			EMPTY	51			EMPTY	52			EMPTY
00DX	53			EMPTY	54			EMPTY	55			EMPTY	56			EMPTY
00EX	57			EMPTY	58			EMPTY	59			EMPTY	60			EMPTY
00FX	61			EMPTY	62			EMPTY	63			EMPTY	64			EMPTY
010X	65			EMPTY	66			EMPTY	67			EMPTY	68			EMPTY
011X	69			EMPTY	70			EMPTY	71			EMPTY	72			EMPTY
012X	73			EMPTY	74			EMPTY	75			EMPTY	76			EMPTY
013X	77			EMPTY	78			EMPTY	79			EMPTY	80			EMPTY
014X	81			EMPTY	82			EMPTY	83			EMPTY	84			EMPTY
015X	85			EMPTY	86			EMPTY	87			EMPTY	88			EMPTY
016X	89			EMPTY	90			EMPTY	91			EMPTY	92			EMPTY
017X	93			EMPTY	94			EMPTY	95			EMPTY	96			EMPTY
018X	97			EMPTY	98			EMPTY	99			EMPTY	100			EMPTY
019X	101			EMPTY	102			EMPTY	103			EMPTY	104			EMPTY
01AX	105			EMPTY	106			EMPTY	107			EMPTY	108			EMPTY
01BX	109			EMPTY	110			EMPTY	111			EMPTY	112			EMPTY
01CX	113			EMPTY	114			EMPTY	115			EMPTY	116			EMPTY
01DX	117			EMPTY	118			EMPTY	119			EMPTY	120			EMPTY
01EX	121			EMPTY	122			EMPTY	123			EMPTY	124			EMPTY
01FX	125			EMPTY	126			EMPTY	127			EMPTY	128			EMPTY

SC-225/SC-250/SC-325/SC-350 STATIC CONTACTOR

020X	129	EMPTY	130	EMPTY	131	EMPTY	132	EMPTY
021X	133	EMPTY	134	EMPTY	135	EMPTY	136	EMPTY
022X	137	EMPTY	138	EMPTY	139	EMPTY	140	EMPTY
023X	141	EMPTY	142	EMPTY	143	EMPTY	144	EMPTY
024X	145	EMPTY	146	EMPTY	147	EMPTY	148	EMPTY
025X	149	EMPTY	150	EMPTY	151	EMPTY	152	EMPTY
026X	153	EMPTY	154	EMPTY	155	EMPTY	156	EMPTY
027X	157	EMPTY	158	EMPTY	159	EMPTY	160	EMPTY
028X	161	EMPTY	162	EMPTY	163	EMPTY	164	EMPTY
029X	165	EMPTY	166	EMPTY	167	EMPTY	168	EMPTY
02AX	169	EMPTY	170	EMPTY	171	EMPTY	172	EMPTY
02BX	173	EMPTY	174	EMPTY	175	EMPTY	176	EMPTY
02CX	177	EMPTY	178	EMPTY	179	EMPTY	180	EMPTY
02DX	181	EMPTY	182	EMPTY	183	EMPTY	184	EMPTY
02EX	185	EMPTY	186	EMPTY	187	EMPTY	188	EMPTY
02FX	189	EMPTY	190	EMPTY	191	EMPTY	192	EMPTY
030X	193	EMPTY	194	EMPTY	195	EMPTY	196	EMPTY
031X	197	EMPTY	198	EMPTY	199	EMPTY	200	EMPTY
032X	201	EMPTY	202	EMPTY	203	EMPTY	204	EMPTY
033X	205	EMPTY	206	EMPTY	207	EMPTY	208	EMPTY
034X	209	EMPTY	210	EMPTY	211	EMPTY	212	EMPTY
035X	213	EMPTY	214	EMPTY	215	EMPTY	216	EMPTY
036X	217	EMPTY	218	EMPTY	219	EMPTY	220	EMPTY
037X	221	EMPTY	222	EMPTY	223	EMPTY	224	EMPTY
038X	225	EMPTY	226	EMPTY	227	EMPTY	228	EMPTY
039X	229	EMPTY	230	EMPTY	231	EMPTY	232	EMPTY
03AX	233	EMPTY	234	EMPTY	235	EMPTY	236	EMPTY
03BX	237	EMPTY	238	EMPTY	239	EMPTY	240	EMPTY
03CX	241	EMPTY	242	EMPTY	243	EMPTY	244	EMPTY
03DX	245	EMPTY	246	EMPTY	247	EMPTY	BOŞ	EMPTY

For SC-225/SC-250;

ADDRESS(HEX)	COIL	R/W	
0000-03DA	TRIGGERING	R/W	
0400	TRIGGER	R	
0401	1. CHANNEL ON/OFF	R	
0402	3. CHANNEL ON/OFF	R	
0403	L1 VAR	R	
0404	L3 VAR	R	
0405	THERMIC1	R	
0406	THERMIC3	R	
0407	EXTERNAL THERMIC	R	
0408	EXTERNAL TRIGGER	R	

Triggering address is $(\text{device address} - 1) * 4$. So, the coil at address 0 must be set to 1 to trigger the device at 1. address. On models with 2 channels, channels can't be triggered separately.

5 Troubleshooting

When the red LEDs on the front panel of the device blink, it indicates that the triggering command has arrived from the relay but switching on couldn't be done for some reason.

LEDs inform the user about these reasons as below:

- Green LEDs are switched on: External thermic error
- Green LEDs are switched off: Voltage error on the phase with its LED off
- Green LEDs blink: Device internal temperature error
- If red LEDs are switched on but green LEDs blink, it means that triggering signal is being created but thyristors can't switch. If this occurs, device must be immediately turned off and necessary controls must be done.

6 Help

- **Headquarters:**
 - Yukarı Dudullu OSB 3. Cadde AND Sitesi No:6 34775 Ümraniye, İstanbul / TR.
 - Telephone: +90 (216) 313 0110
 - Fax: +90 (216) 314 1615
 - Fax (sales): +90 (216) 314 1615
- **E-mail:**
 - International sales: impex@entes.com.tr
 - Domestic sales: satis@entes.com.tr

Sister Companies Abroad

ENTES B.V. / Hollanda

Industrie Park Oost 3A, 5348 GM OSS THE NETHERLANDS

Tel: +31 412 644 319

Fax: +31 412 651 872

e-mail: info@entes.eu