SEMIKRON

innovation+service

Modules for thyristor-control

THYRISTOR TRIGGER MODULES

RT380M B2C

PHASE ANGLE THYRISTOR REGULATOR

- 220/380V bitension supply
- Perfect operation with inductive loads
- Control voltage selectable 0-5/0-10 V.
- Auxiliary 5V supply for the control voltage
- 4.000 V galvanic insulation
- Triggers the whole range of SEMIKRON thyristors
- Encapsulation compatible with Semipack raster
- No external components required.
- Works with 50 Hz and 60 Hz

The model RT380MU B2C is designed to trigger 4 thyristors in B2C configuration, and can also be used with only 2 thyristors, with a variable retard over the zero crossing of the mains alternating voltage.
In this way, the power allowed through to the load by the thyristors is regulated.

The load may be supplied with a variable alternating voltage if both thyristors are connected in anti-parallel, or with a variable voltage if both are connected in a semi-controlled rectifier assembly.

This regulator is suitable for a wide range of possible applications, among which are:
Illumination control, electric furnace temperature control, d.c. motor speed control, starting and control of induction motor speeds, galvanising bath control, electrolytic process control.

The module will be supplied standard for 50 Hz. To work with 60 Hz, a 3.2MΩ resistor (1%) has to be soldered between the two external pins marked R.

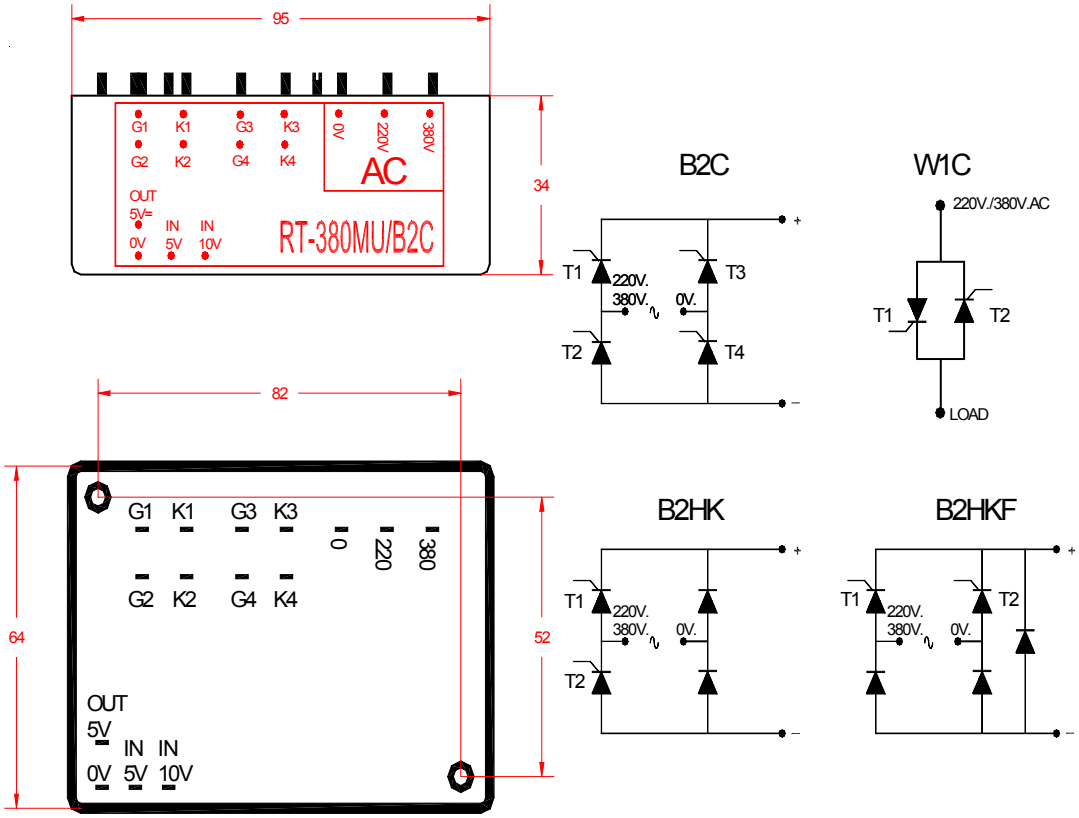
ELECTRICAL SPECIFICATIONS:

Supply voltage	220/380 V_{AC}, +10% / -15%
Maximum power drain	3W
Triggering current	300 mA @ Vgk=5V
Control voltages	0-5V Rin=5kΩ
	0-10V Rin=10kΩ
Auxiliary output voltage	5V Imax=100 mA
Insulation	4.000 Vca inlet/outlet
Supply frequency	47-63Hz
Operating temperature range	0-50ºC
Terminals	faston 2.8 x 0.8mm
Mounting holes	for M4 screws
Weight	0.5 kg

Conforms to VDE standards.

WIRING DIAGRAMS:

IMPORTANT: If the module does not work, invert the gate connections.



B2C

W1C

B2HK

B2HKF

RT120MS

Single phase thyristor control module with current or voltage feed-back

- Power supply 110/220/380V (optional 110/220/440V), 50-60 Hz selectable
- Works with inductive loads up to cos φ = 0,2
- Control signals 0-5V, 0-20mA o 4-20mA external
- Adjustable ramp for softstart and/or softstop
- Current limit or voltage stabilisation with input for current transformer, Hall effect transformer or voltage transformer
- 4.000 V galvanic insulation
- Posibility of external gradient adjusting

CARACTERÍSTICAS TÉCNICAS

Power supply		110/220/380 Vac ±10% (optional 110/220/440 Vac ±10% 50 or 60 Hz selectable
Power drain		
Input signals	control signal	0 - 5 Vcc (15 Vcc max., 100kΩ) 0-20mA o 4-20mA (250Ω)
	current limit	0 - 4 Vrms (10 Vrms max.)
Adjustable gradient range		25-100%
Adjustable ramp range		0.5-6 seconds
Triggering current		300 mA @ V_{GT} = 5V
Working temperature		5 - 60ºC
Humidity		10 - 95% without condensation
Weight		350 gr

This module has been designed to regulate two thyristors in a W1C, B2HK or B2HKF connection to control the power flow the thyristors let through to the load.

The module can be controlled by means of an external continuous voltage of 0 to 5 V or by means of a 0-20 mA or 4-20 mA current loop. Default value 0-5V (see “Jumpers settings”).

The module has also a feedback signal input which can be fed from a current probe (current transformer or Hall probe) the purpose of which is to limit the current to a determined value, which can be adjusted by means of a potentiometer located on the board for this purpose.

It can also be used to limit a voltage, for which a reference is taken from the output voltage by means of the voltage transformer, the low voltage secondary side of which is connected to the module as a feedback signal. If the voltage increases, the trigger angle will be reduced. This transformer's secondary voltage can be for example 6V. In this case, since the input standard voltage is 4V, a voltage divider should be mounted between the transformer secondary side and the input (6.8kΩ in series and 10kΩ in parallel connection).

Obviously, both in the current feedback and the voltage feedback schemes, the condition for the limit module is that it is not totally conductive, in such a way that a certain clearance remains both to increase the angle and to reduce it. For example if the current input is to be limited to 100A, but a maximum conduction of only 80A is available, this limiting function will never operate. Thus, if an a.c. output voltage (in the W1C circuit) is to be limited at 220 V and the input voltage is already higher than 220V, the module will reduce the phase angle and will limit it if this voltage increases.

Potentiometer settings

To adjust the potentiometers, an oscilloscope connected to terminal K1 and G1, or K2 and G2 is required. This instrument can also be replaced with a tester connected to the load terminals (when the thyristors are switched on). Also, the voltages between 4 (+) and 8 (-) and between 7 (+) and 8 (-) should be measured with a tester (approximately 5V DC in both cases). If the control signal is from a current loop, a milliamperemeter should be connected in series to measure the current (20mA).

First adjust the potentiometers to the following settings:

P1: to 0% (clockwise)
P2: to 100% (counterclockwise)
P3: to 0% (counterclockwise)
P4: to 0% (clockwise)
P5: to 100% (clockwise)
P6: to the minimum (clockwise)

The functions of these potentiometers are as follows:

P1: It enables adjusting the control signal operation start point. This is required when a 4-20 mA control signal is used. The module should start operating at 4 mA and from 0 to 4 mA it should not output any trigger pulses. The potentiometer should be adjusted by injecting 4mA to the input (or e.g. 1V in a voltage control scheme) in such a way that the trigger pulses just become apparent. The voltage from which the module starts generating pulses is the one existing between this potentiometer's cursor and ground (it can be measured with the tester).
If a threshold is not desired, it should be adjusted in such a way that a control signal voltage of 0V prevents any trigger pulses from being generated (set it to 0% clockwise).

P2: It sets the control signal *span*, that is the operation range. Inject the maximum signal value (20mA or 5V) to the control input and set this potentiometer until the voltage reading between terminal **4** (+) and **1** (-) is 5V.

P3: It internally sets the *gradient*, that is, a maximum point to be reached. Therefore, 5V or 20mA should be injected into the control input and to the potentiometer adjusted to the maximum desired output value.

P4: It sets the minimum desired output power for a 0V input signal. For example, if this potentiometer is set to 50%, at an 0V input signal it would conduct 90° (15%), but when a band shift is performed, at an input signal of 2.5V it will conduct to 100%.

P5: It sets the point from which the current is to be limited or the voltage to be stabilized. To adjust it, 5V or 20mA should be injected to the control signal and its setting varied until the yellow LED goes on.

P6: It sets the rise ramp time (*soft start*), and fall ramp time (*soft stop)*. The load times are determined by R54, C26 and the potentiometer setting. The ramp with the potentiometer at the minimum is 0.5 seconds.

Jumper settings

The jumper settings are as follows:

- **J2**

  ON: 4 to 20mA or 0 to 20mA current loop control signal
  OFF: 0 to 5V voltage control signal

- **J15**

  ON: it performs the minimum soft stop possible of 0.3 seconds defined by R54 and C26.
  OFF: It allows a soft stop with a stop time approximately equal to the *soft start* time.

- **J16**

  It is a 3-pin jumper.
  Setting near terminals: It allows a current or voltage limiting.
  Setting near J15: It disables the limiting functions.

• J17

ON: prepared for working at 60Hz.
OFF: prepared for working at 50Hz.

Input signals and external gradient potentiometer

• 7 and 8

These are the control signal inputs of 0 to 5V, 0 to 20 mA or 4 to 20 mA. Terminal 7 is the positive (+) and terminal 8 is the ground or negative (-).

• 5 and 6

These are the current or voltage feedback inputs. In the case where a conventional current transformer is mounted, connect on the module the resistor in parallel (**R10**) indicated by the manufacturer of the transformer in order to convert the current into a voltage drop.
The standard signal value without the parallel resistor **R10** is 4Vrms. To adjust it to other values, change the resistors **R9** and **R10** as follows:
a) If the feedback is by current, **R9=0Ω** (shortcircuit) and **R10 (Ω)=4/Irms (A)** (to give the 4Vrms input), being Irms the **secondary current** of the current transformer.
b) If the feedback is by voltage and the value > 4Vrms, **R10=10kΩ** and **R9=(10 x Vin - 40)/4** , being Vin the maximal feed-back voltage and the result given in **kΩ**.

• 4, 3, 2 and 1

If an external *gradient* is desired, connect the two ends of a 10 kΩ potentiometer to terminals 3 and 1 and its centre cursor to terminal 2. With this external potentiometer, an additional *gradient* to the one set with **P3** can be regulated or adjusted.
For example, if an internal gradient of 80% has been set using **P3**, it means a control signal of 0 to 5V allows and adjustment from 0% to 80% of the output voltage. Also, if the external potentiometer is set to 50% (at a approximately half the potentiometer range), the final adjustment can range from 0% to 50% of the 80%, that is, from 0% to 40%. This external potentiometer is not supplied with the module and should be of linear type.
If the external gradient potentiometer is not used, it is necessary to make a bridge between terminals 2 and 3.

The 4 input is used as a test point (see P2 setting).

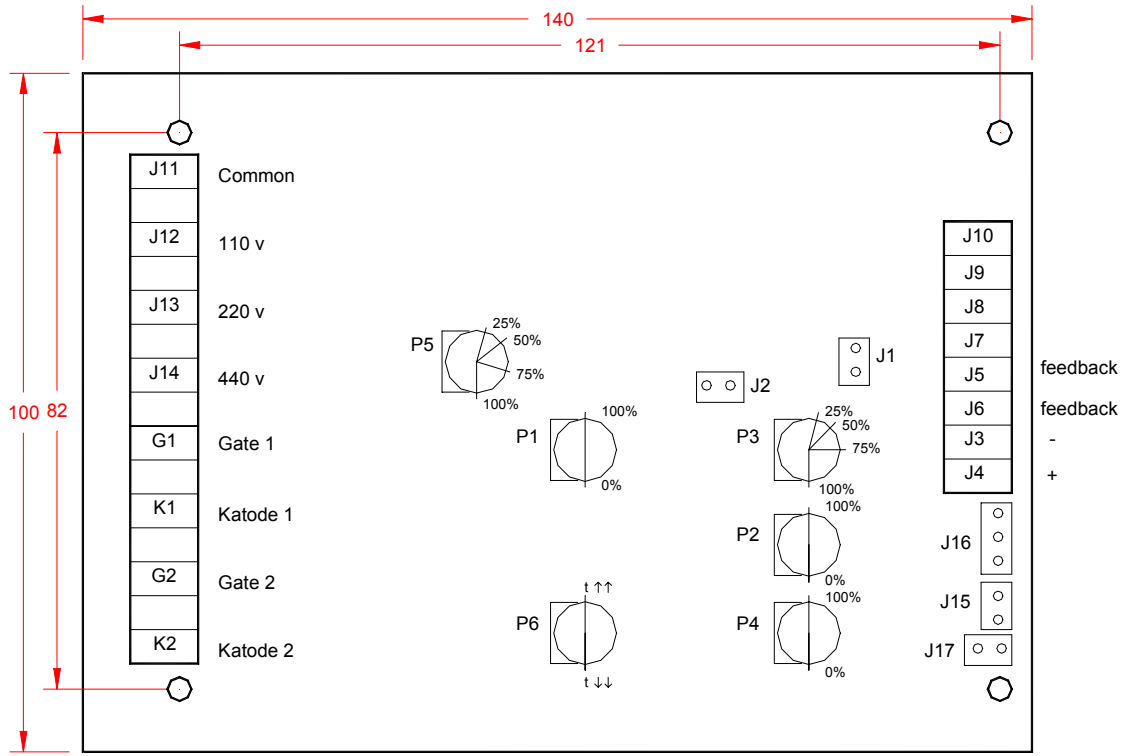
LED indications

• DL1 (yellow)

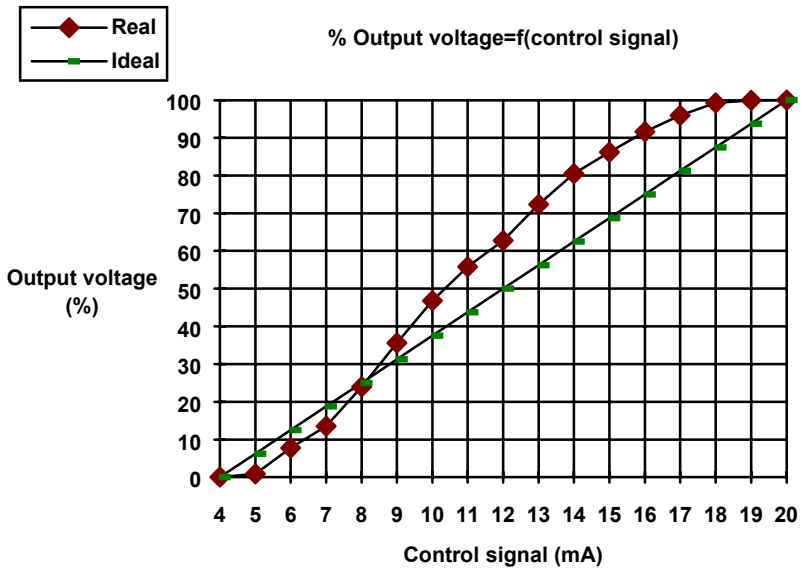
When it is on, it indicates that the current or voltage limiting function is operating. This LED will go on even if jumper J16 is set to disable the limiting functions (setting B).

• DL2 (green)

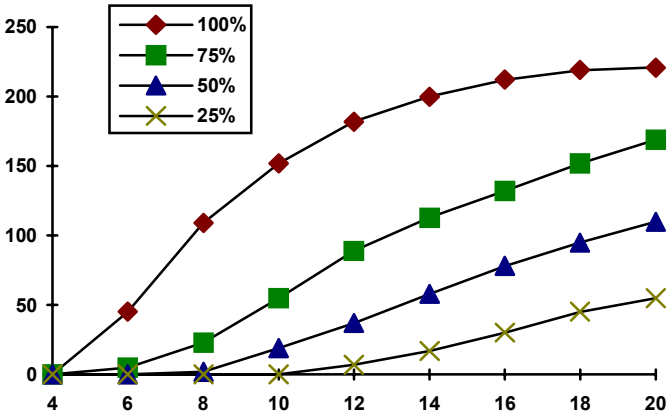
Power indicator light.


140
121
100
82
J11
Common
J12
110 v
J13
220 v
J14
440 v
G1
Gate 1
K1
Katode 1
G2
Gate 2
K2
Katode 2
P5
25%
50%
75%
100%
P1
100%
0%
P6
t ↑↑
t ↓↓
J2
J1
P3
25%
50%
75%
100%
P2
100%
0%
P4
100%
0%
J10
J9
J8
J7
J5
J6
J3
J4
feedback
feedback
-
+
J16
J15
J17

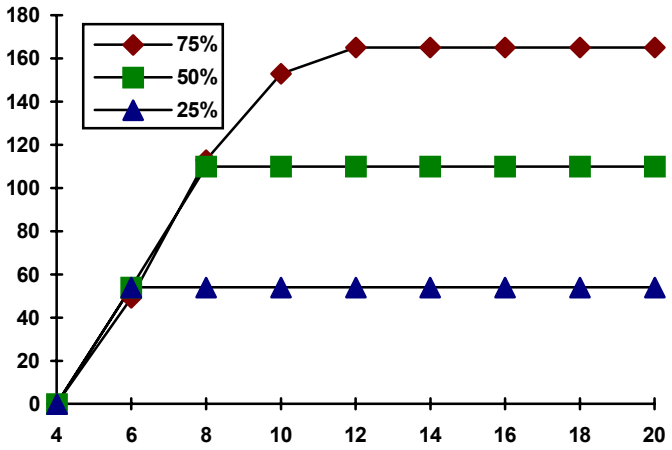
Output voltage=f(control signal)



Output voltage = f (control signal, gradient)



Output voltage = f (control signal, limitation)



MP380T

Microprocessor controlled three-phase control module for thyristors

- 220/380V, 45-65 Hz self-adjusting supply
- Supply through external transformer up to 690Vac
- Perfect operation with inductive loads up to cos φ = 0,2
- Digital phase regulation through keyboard or by 0-5V, 0-10V, 0-20mA or 4-20mA externals
- Programmable start and stop ramps with optional pedestal
- End-of-ramp output for controlling a contactor by-pass
- Current limitation function with current transformer o Hall probe input
- 4.000V galvanic insulation
- Phase failure detection with switch-off and correct phase sequence detection with warning
- Overheating protection with switch-off using thermal trip and thermal resistor (0 to 99ºC) with temperature display
- External inhibition input
- Remote control through PC available through RS485 (up to 99 units)
- Display may be mounted on cabinet front panel

SPECIFICATIONS

Supply voltage		220/380 Vac ±20% 45 to 65 Hz
Power drain		15 VA max.
Input voltages	INHIBIT-IN, THERMAL TRIP	10 - 24 Vcc
	0-5 V IN	0 - 5 Vdc (15 Vdcmax.)
	0-10 V IN	0 - 10 Vdc (15 Vdc max.)
	CURRENT LIMITATION	0 - 10 Vdc (15 Vdc max.)
Output signals	+5V OUT	5 Vdc 10 mA max.
	+15V	15 Vdc 10 mA max.
	-15V	-15 Vdc 10 mA max.
	LINT, FRAMP, INH-OUT	Open colector 30 Vdc max., 50 mA max.
Trigger current		300 mA @ V_{GT} = 5V
Working temperature		5 - 60ºC
Humidity		10 - 95% without condensation
Power-on		1 second
Weight		1 kg

SUPPLY VOLTAGE

The supply voltage is selected by way of the bridges **J5**, **J6**, **J7**, **J8** y **J9**.

	J5	**J6**	**J7**	**J8**	**J9**
220 Vac	yes	yes	yes	no	yes
380 Vac	no	no	no	yes	no

The **MP380T** is provided with a supply voltage failure detector. If the supply voltage is more than 20% below the rated supply voltage, it will stop the operation, will activate the **INH-OUT** and "**LU**" will be displayed.

SEMICONDUCTOR PROTECTION

The use of **RC** snubber circuits is recommended for protecting the thyristors and facilitating their triggering under highly inductive loads.

CONTROL MODE

Remote control through RS-485; a single PC can control all the parameters of up to 99 different modules. There is special software available for this application, to be acquired separately.

Local keyboard control.

TYPE OF START-UP

Manual start-up: the module will be activated when the **UP** and **PROG** keys are depressed simultaneously.

Automatic start-up: the module will be activated one second after current switch on.

In either of the start-up modes, the module will be de-activated when the **DOWN** and **PROG** keys are depressed simultaneously.

TRIGGER LAG (PHASE LAG)

The module has two preset phase lags, according to whether the thyristors are connected in **W3C** o **B6C**. There is a further user-variable adjustment in which the phase lag is expressed as a % of 90º, i.e., a displayed value of 50 will represent a 50% lag of 90º, i.e. 45º. In this way the user can compensate the phase lag introduced with big transformers, when the module is fed directly and has to trigger the thyristors on the secondary of this transformer.

TRIGGER SETPOINT MODES

These will be selected by the configuration program according to whether local or remote control is desired.

To vary the trigger point when working in local mode, it will be necessary to hold the **PROG** key depressed for 3.5 seconds and **4xx** will be displayed, where **xx** is the trigger point currently in operation.

When a change is desired, use the **UP** key to increment and the **DOWN** key to decrement.

When working in remote mode, the control signal may be 0-5V, when connected across terminals 11(+) and 13(-), or 0-10V, when connected across terminals 12(+) and 13(-).

Where it is desired to effect control by a current loop with a 0-20mA signal, wire up as for 0-5V and connect a 249Ω resistor (1%) in parallel with the connexion terminals, with bridge **J12** installed.

Where it is desired to work with a 4-20mA signal, remove the bridge **J12** and connect a 316Ω resistor (1%).
In the case that the input signal is lower than 4mA, display will blink quickly. When it goes from 3,9 to 4mA, display will show "**LU**" and inhibit alarm output will be instantaneously activated.

Where it is desired to work with other values of current, resistor **R57** (normally 6k65Ω) has to be changed to meet (with the bridge **J12** removed):

$$R57 = \frac{19.6 \times Vst}{15 - Vst}$$ R57 in kΩ, where Vst is the start voltage

Example: it is desired to control the load between 6 and 18 mA, where 6 mA is 0% and 18 mA is 100%

The control span is: Span = 18 - 6 = 12 mA
The resistor to connect in parallel with the input 0-5V is: 5V/0.012A = 416Ω
The start voltage for 6 mA is: Vst = 0.006A x 416Ω = 2.496V ≈ 2.5V

Therefore R57 has to be: $$R57 = \frac{19.6 \times 2.5}{15 - 2.5} = 3.92k\Omega$$

CURRENT LIMITATION

This can be activated (1) or de-activated (0) by way of the program parameters.

The module calculates the current rms value analogically by way of a specific device. There is no need to rectify the input signal.

It may operate with current transformers or Hall probes. Where a current transformer is used, a resistor conforming to the manufacturer's specifications should be connected in parallel with it.
The bridge **J10** must be installed when working with transformers or Hall probes.

If the rms value of the scale bottom end voltage supplied by the transformer or probe is less than or equal to 4Vrms, then the resistors R66 and R82 must be selected to fulfil the following:

$$R66 = R82 = \frac{236}{Vin} \qquad \text{in k}\Omega \ (1\%)$$

In this case, the resistor R85 must be 0Ω (bridge) and R84 must not be installed.

Where the input voltage is above 4Vrms, R66 and R82 shall be 59kΩ (1%). The divider R85-R84 must be calculated to meet:

$$R84 = \frac{23.6}{Vin} \qquad\qquad R85 = 5.9 - R84$$

all values in kΩ and 1% resistors. The module is standardly equipped for an input of 4V.

With the **MP380T** activated and current limitation selected, if the current in the probe is the same as or greater than the selected value, the trigger point of the thyristors will be brought down until the desired current value is achieved and "**LI**" will be displayed.

The maximum actuation time of the current limit is 0,4 seconds, and the precision of the current measure is ±2%.

RAMP START OR "PEDESTAL" VALUE

This is the value from which the ramp will rise and at which, in the case of a stop ramp (soft-stop), the thyristor triggering will cease. This value is given as a % of the final set point.

RAMP TIME

This is the time taken, during start-up, to go from the ramp start value to the locally chosen final trigger point. Where remote control is used, the final point will be the value existing at the input at the time of start up.

Start ramp only or start and stop ramp may be selected. The stop ramp time will be the same as the time programmed for the start ramp.

On start up and during the reamp, the **FRAMP** output will be deactivated and will be activated at the end thereof. With this, a "by-pass" contactor short-circuiting the thyristors at the ramp end may be controlled in the case of a soft starter.

TEMPERATURE CONTROL

There is always an external thermal trip alarm independently of the configuration of the **MP380T** thermal trip.
In the absence of voltage at the **TERMO** (open contact), the thyristors will be stopped and "**Ot**" will be displayed. If the stop ramp is activated, it will do it.
The system will be reinitialised when the **TERMO** terminal will be reactivated.
Where it is desired not to use the external thermal trip, the **TERMO** terminal must be activated (install a bridge across **TERMO** and +15), or it may be used as reverse external inhibition (no voltage live).

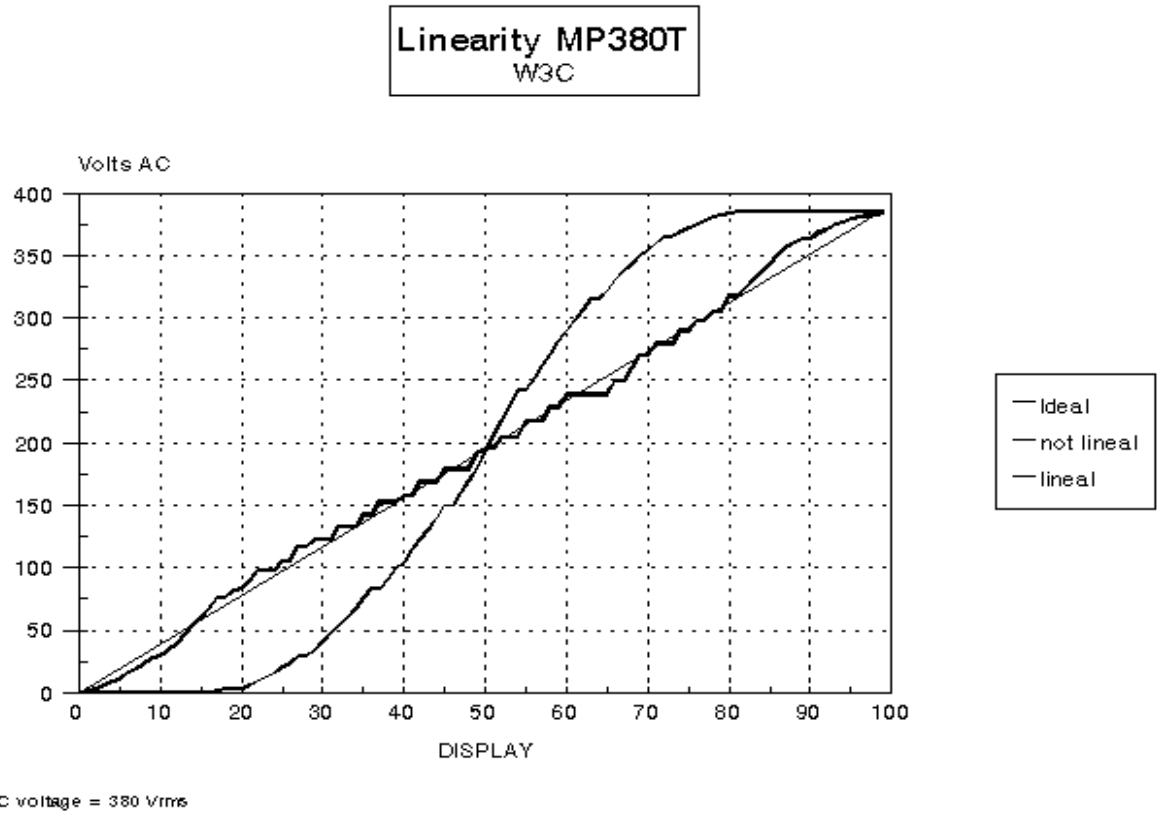
If local temperature control is selected by way of the thermal resistor included in the kit, the alarm point will be selected through the configuration menus. The display reading is in degrees Celsius.
If the temperature is the same as or higher than the selected temperature, the thyristors will be stopped and "**Ot**" will be displayed. It will also do the stop ramp, if it is programmed.
Operation will be reinitialised when the temperature has dropped to 10ºC below the programmed set point.
Both alarm systems may coexist.

The thermal resistor, or otherwise a 1kΩ resistor, has to be installed always across the **IN-TEMPE** terminals. The terminals cannot be left open.

CONTROL VOLTAGE/OUTPUT VOLTAGE **RATIO**

In a normal rectifier or regulator, the *control voltage/output voltage* ratio is not linear but cosinusoidal. This is due to the fact that the control voltage increases the thyristor firing angle linearly, i.e., from 0 to 120º in the case of a three-phase voltage. Nevertheless, since the wave form that the thyristor is to control is not square, but sinusoidal (mains), at the beginning of the sine curve, the output voltage increase is very small, because the sine curve value is also small. The rate increases up to 50% of the sine curve and then gradually reduces to the end.

We have introduced a parameter where it may be programmed whether it is wanted that this ratio be approximately linear or normal (cosinusoidal), as shown in the following figure:



We have to point out that the linearity is not perfect, since the module accuracy is always ±1% relative to the 120º conduction, whereby output voltage jumps will be observed as the control voltage (or the display value) is varied. Nevertheless, there are cases where it may be of interest to programme this parameter linearly.

PARAMETER PROGRAMMING

With the **MP380T** in the off-state, hold the **PROG** key depressed for 3,5 seconds. After this time, the selection menu of the different parameters to be programmed by the user will be displayed.

Use the **UP** key to pass to the following parameter of the variable displayed at this time or to increment the variable value. Use the **DOWN** key to pass to the previous parameter of the variable or to decrement the value of the variable.
Use the **PROG** key to validate the selected variable or selected value of the variable.
Every time a parameter is validated, the value or state of the following one to be displayed will be the previously programmed value.

With the **MP380T** in the on-state and outside the ramp area, the trigger set point and the current limitation value may be varied if the equipment has been configured with an internal set point and current limitation. To this end, proceed in the same way as for configuration, i.e. holding the **PROG** key depressed for 3.5 seconds and then, if it is configured with internal set point, **4xx** will be displayed. Use the **UP** and **DOWN** keys to change the value. When the **PROG** key is depressed again, **5xx** will be displayed if current limitation has been programmed and proceed in the same way. If **PROG** is depressed again, the temperature as measured by the thermal resistor will be displayed, if this measurement has been activated. The temperature will be displayed with three digits, from 0º to 125ºC (±3ºC).

The different program parameters will be displayed sequentially as shown below:

1 00	Local control by means of keyboard
1 xx	Remote control by means of RS485, where xx is the unit address
2 SL	Local start-up
2 SA	Automatic start-up on switch-on
3 3	Phase lag for W3C configuration
3 6	Phase lag for B6C or M6 configuration
3 L	User selected phase lag
3 xx	Phase lag value in % of 90º
4 00	External voltage or current trigger set point
4 xx	Internal trigger set point, where xx is the internal set point value
5 00	Current limitation suppressed
5 xx	Current limitation activated, where xx is the current value as % of transducer span
6 xx	Ramp start or pedestal value
7 0	Start ramp only
7 1	Start and stop ramp
7 xx	Ramp time in seconds
8 00	Temperature probe stop suppressed
8 xx	Temperature probe stop activated, where xx is the stop temperature value (from 0º to 99ºC)
9 0	Ratio *control voltage/output voltage* non linear
9 L	Ratio *control voltage/output voltage* linear

START UP AND DISPLAY OF ALARMS AND STATES

When the equipment is first switched on, the thyristors will not be activated for 1 second, although it is configured for automatic start-up (**Power-On**). At the end of this time, the letter "**L**" will be displayed, indicating that the equipment is in the local control mode. When in remote mode, the letter "**r**" will be displayed.

If the **UP** and **PROG** keys are depressed simultaneously, the equipment will start up, executing the start-up ramp, if the pedestal value is lower than the set point and the ramp time is other than **0**.

To stop operation at any time, it is sufficient to depress the **DOWN** and **PROG** keys simultaneously.

Whenever an alarm occurs, the **INHI-OUT** output will be activated and the thyristors will be stopped.

With any alarm having caused a stoppage disappears, the equipment will start up as though it were running through a start-up process, with the previously programmed values.

If no alarm occurs, the display reading will be the value, at that time, of the trigger point as a %.

If the temperature is surpassed or the external thermal trip opens, "**Ot**" will be displayed. The alarm state will disappear when the temperature has gone down by 10ºC.

If the **INHI-IN** contact is closed, "**Ir**" will be displayed and the **INHI-OUT** output will be activated without stop ramp, although if it is programmed.
If the current limiter cuts in, "**Li**" will be displayed and the **LINT** output will be activated.

If the "**T**" phase fails, "**FF**" will be displayed and the **INHI-OUT** output will be activated without stop ramp although it is programmed.

If the supply voltage to the **R** and **S** phases drops more than 20% below the nominal voltage, "**LU**" will be displayed and the **INHI-OUT** output will be activated. If the **R** or **S** phase fails, the equipment will switch off.

The yellow **LED** will be illuminated in case of inversion of the module supply phases. This is only a warning signal and will not switch the equipment off, since the important point for correct operation is that the synchronization between the module, thyristors and mains is correct, conforming to the wiring diagram.

When the equipment is switched on and the ramp is being performed, the **FRAMP** output will be de-activated. At the end of the ramp, it will be activated.

WIRING

R	Phase R	
S	Phase S	
T	Phase T	
G	Ground	
1	FRAMP	End of ramp output
2	INHI-OUT	Inhibit output
3	TERMO	Thermal trip input (the other at +15V)
4	INHI-IN	Inhibit input (the other at +15V)
5	RS485	
6	RS485	
7	IN-TEMPE	Thermal resistor
8	IN-TEMPE	Thermal resistor
9	+5Vcc	Potentiometer auxiliary supply
10	LINT	Current limitation output
11	IN 0-5Vcc	External 5V set-point input
12	IN 0-10Vcc	External 10V set-point input
13	GND	Ground
14	-IN-INT	Current probe
15	+IN-INT	Current probe
16	+15Vcc	Supply output
17	-15Vcc	Supply output

FAILURE TABLE OF DISPLAY

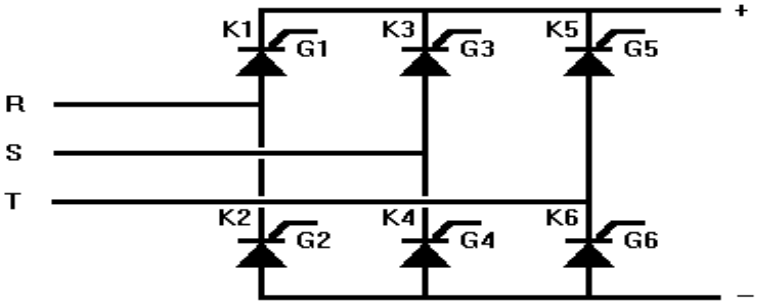
DISPLAY	Cause
FF	Phase failure: no voltage in phaseT
LU	Voltage between phases R-S too low(<80%)
LI	Current limiting
Ir	External inhibit activated (INHI-IN)
Ot	Overtemperature in external thermal trip or in termoresistance

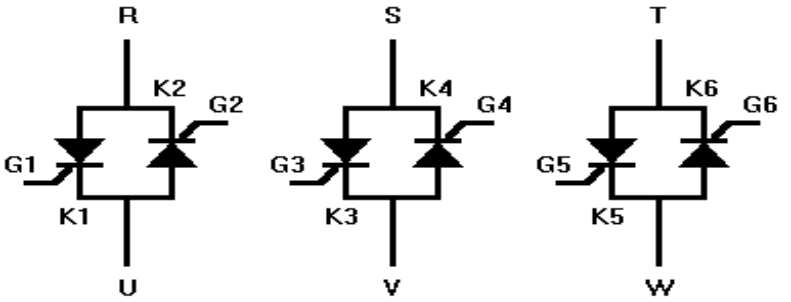
2	K5
3	G5
5	K6
6	G6
8	K3
9	G3
11	K4
12	G4
14	K1
15	G1
17	K2
18	G2

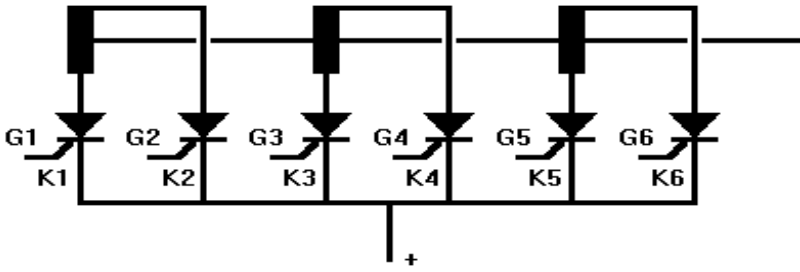
The module can be delivered in two different versions:

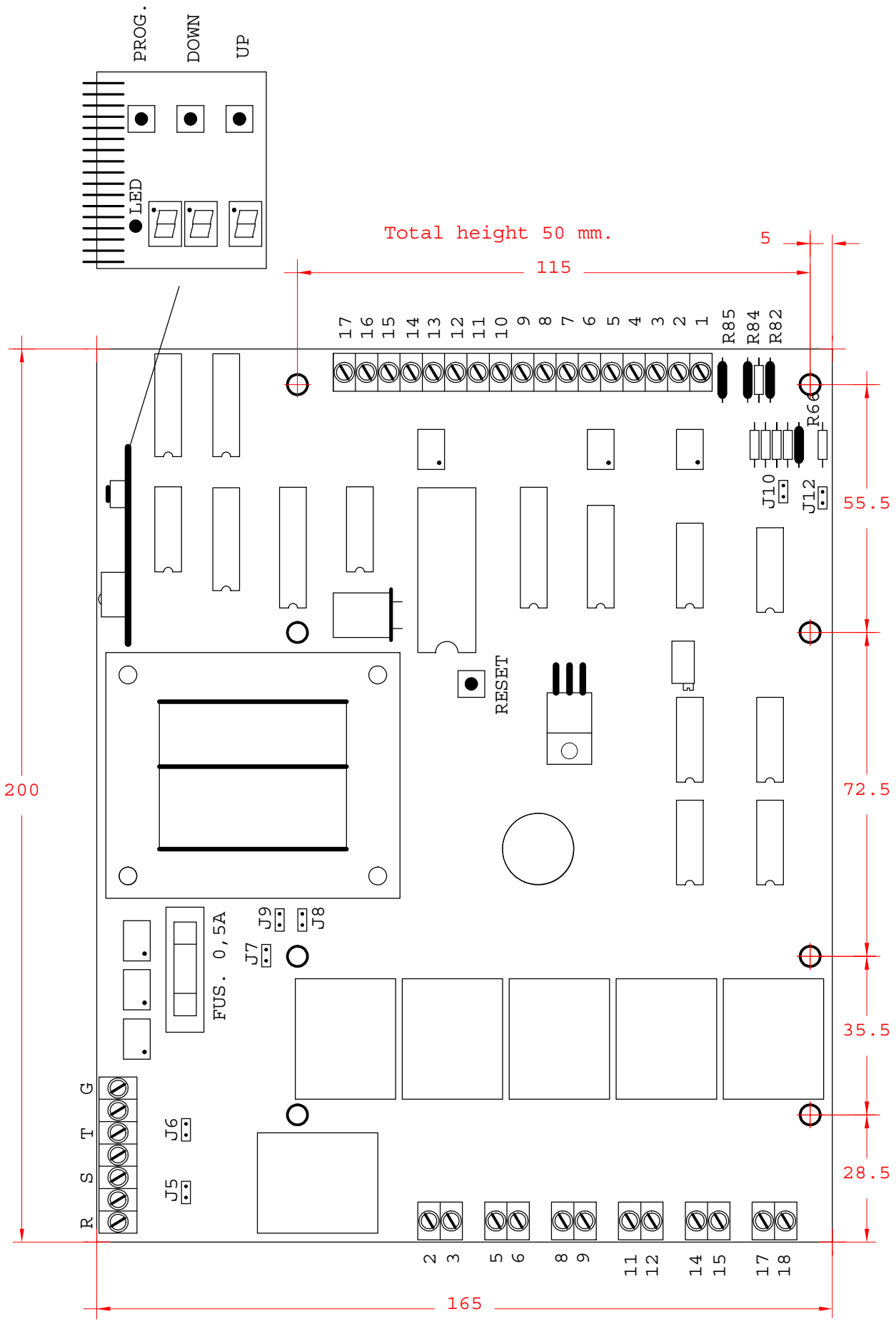
- **MP380TEV** basic configuration
- **MP380TSV** with current limitation

14/4/00







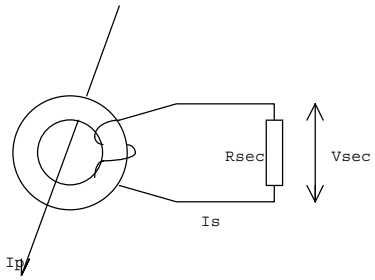

PROG.
DOWN
UP
LED
Total height 50 mm.
5
115
17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
R85
R84
R82
R66
J10
J12
55.5
RESET
200
72.5
FUS. 0,5A
J9
J8
J7
J6
J5
R S T G
35.5
28.5
2 3
5 6
8 9
11 12
14 15
17 18
165

TRANSFORMADORES DE CORRIENTE

Estos transformadores se utilizan para medidas de corriente alterna a 50/60 Hz, desde 25A hasta 400A (corriente nominal de primario).

La particularidad de estos transformadores es el importante número de espiras del secundario. Esto permite tener una corriente en el secundario muy débil, y por tanto adaptable a un circuito electrónico.

La corriente del secundario puede obtenerse como una tensión al hacerla circular en bornes de una resistencia conectada al secundario. Esta resistencia, de baja potencia debido a la baja corriente, puede estar montada directamente sobre un circuito impreso.



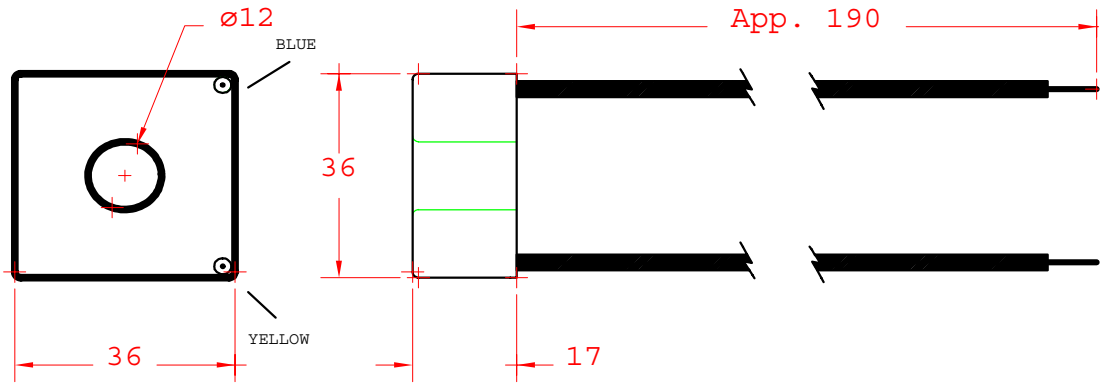
Un transformador de corriente es un transformador en el cual la corriente del secundario es prácticamente proporcional a la corriente del primario y desfasada respecto a ella un ángulo aproximadamente cero, para un sentido determinado de las conexiones.

Las diferentes normas existentes (CEI 185, VDE 0414, etc.) imponen las tolerancias sobre el error de relación y sobre el desfase, en base a la potencia deseada.

Modelo	I primario máx.	relación ns/np	Potencia máxima f=50-60Hz	Precisión
TI 350/0.35	350A	1000/1	2VA	0.5%

La resistencia de carga (imprescindible) y la tensión en bornes de la misma deben ser calculadas sin exceder en ningún caso la potencia e intensidad máxima del transformador.

Ejemplo: deseamos medir con este transformador una intensidad de primario de 150A, y debe tener una tensión de salida de 4V con la que atacaremos a una tarjeta que aprovechará esta tensión para realizar una realimentación que limitará la corriente. La resistencia **<u>mínima</u>** de carga que podemos conectar será R=8Ω.
Las resistencias de carga hay que calcularlas para que influya lo menos posible en las tensiones de entrada del circuito electrónico, pero también teniendo en cuenta que la tensión generada en sus bornes no sea excesivamente alta.



RT380T

Analog three-phase thyristor trigger module

- 220/380V bitension supply
- Supply with external trafo up to 550 Vac
- Perfect operation with inductive loads up to cos φ = 0,2
- Control voltage selectable 0-5/0-10V
- External inhibit input
- 4.000 V galvanic insulation
- Triggers the whole range SEMIKRON
- No external components needed

TECHNICAL SPECIFICATIONS

Supply voltage		220/380 V_{AC} +10% / -15%
Power drain		8 VA max.
Input voltages	INHIBIT-IN	7-16 Vcc
	0-5 V IN	0 - 5 Vcc (15 Vcc max.)
	0-10 V IN	0 - 10 Vcc (15 Vcc max.)
Output signals	+5V OUT	5 Vcc 100 mA max.
Trigger current		600 mA @ V_{GT} = 5V
Isolation		4000Vca inlet/outlet
Working frequency		45-65Hz (automatic adaptation)
Working temperature		5 - 50ºC
Humidity		10 - 95% without condensation
Power-on		1 second
Weight		1 kg

This encapsulated module has been designed for triggering 6 thyristors with phase regulation in order to control the power on the load. It is recommended the use of external RC-snubbers to protect the thyristors and to facilitate its triggering.

The load may be supplied with a variable alternating voltage if the 6 thyristors are connected in antiparallel W3C, or with a variable direct voltage if they are connected in B6C, B6HK or B6HKF.

The external thermal trip has to be normally close. If it opens, the module stops, the green LED stops lighting and the red LED lights.

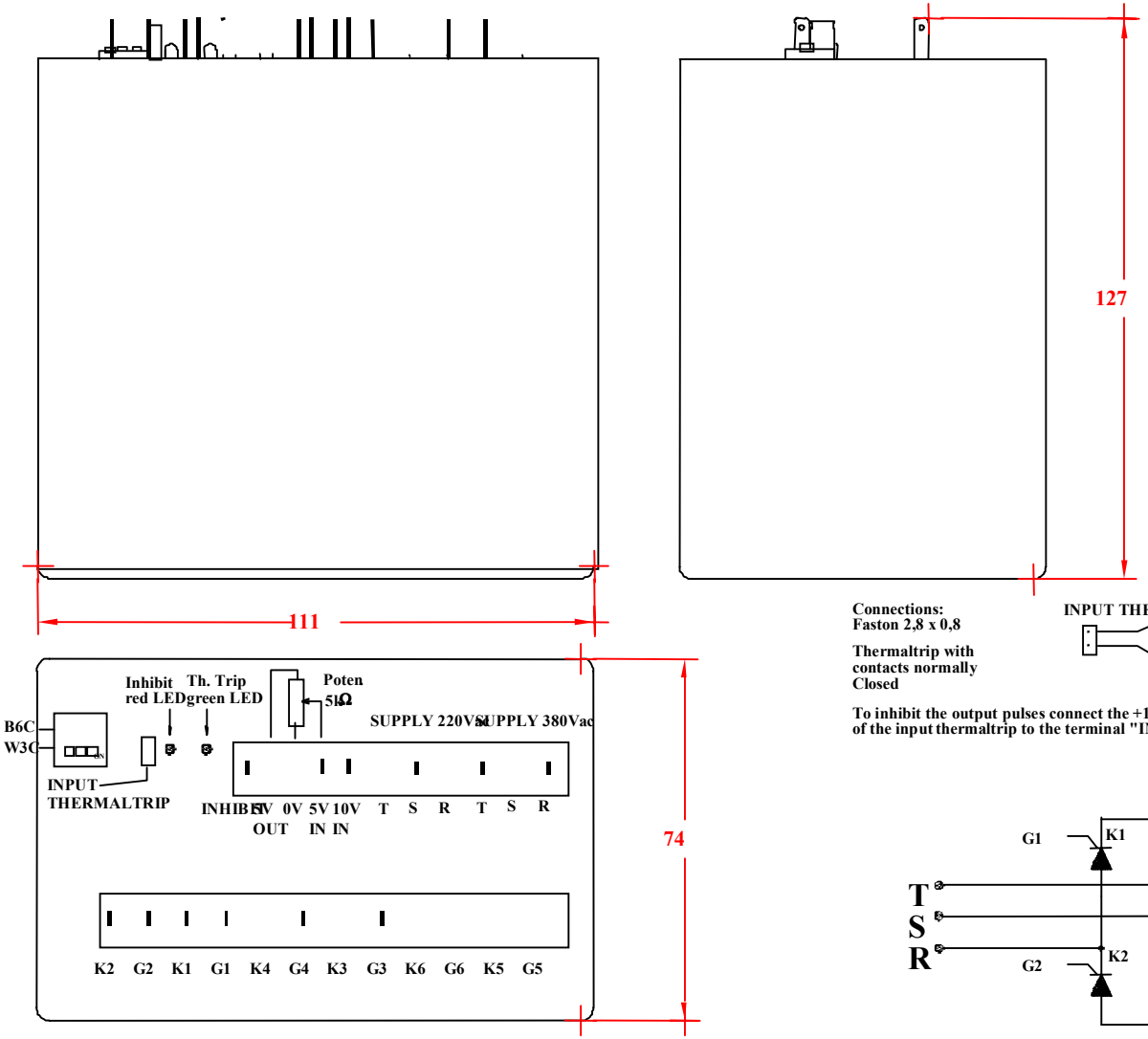
The module has an automatic Power-on delay of approx. 1 second. That means that during the first second the output is inhibited (no pulse output).

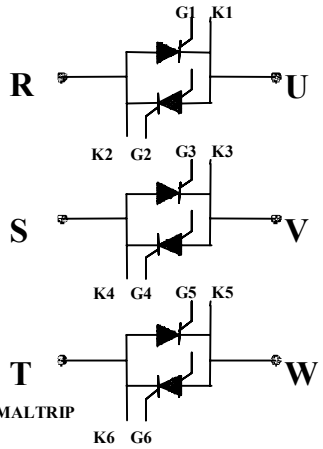
It is important to connect the three phases and the outputs of gates and cathodes exactly as shown in the label. Done this, the input phases ***of the whole equipment*** (module + power) can be connected in the sequence you want.

To select the thyristors connection W3C, the three minidips have to be in ON position. For a B6C connection, they have to be in OFF position.

An input of +12V (7 to 16V) in the input INHIBIT stops the output of gate pulses and red LED starts lighting. This +12V can be external or using the internal auxiliary $12V_{DC}$ present at the thermal trip jumper (see drawing). If the jumper of the thermal trip is connected, the module will be inhibited.

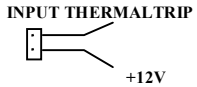
SEMIKRON RT380T



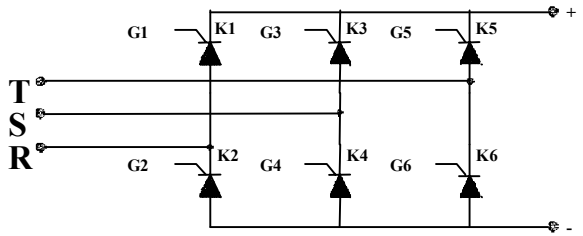


Connections:
Faston 2,8 x 0,8

Thermaltrip with contacts normally Closed



To inhibit the output pulses connect the +12V of the input thermaltrip to the terminal "INHIBIT"



Current Transformer
TI 300/0,3
300 A / 0,3 A

Absolute Maximum Ratings		
Symbol	**Term**	**Values**
I_1	Max. primary current	300 A
I_2	Max. secondary current	0,3 A
	Precision class sec. current	0,5 %
$\frac{n_s}{n_p}$	Transformer current ratio	1000 : 1
P_{out}	Max. Power output (50/60 Hz)	2 VA
f_{op}	Operating frequency	50 / 60 Hz
R_2	Load resistance [1)]	> 22,2 Ω

TI 300 / 0,3

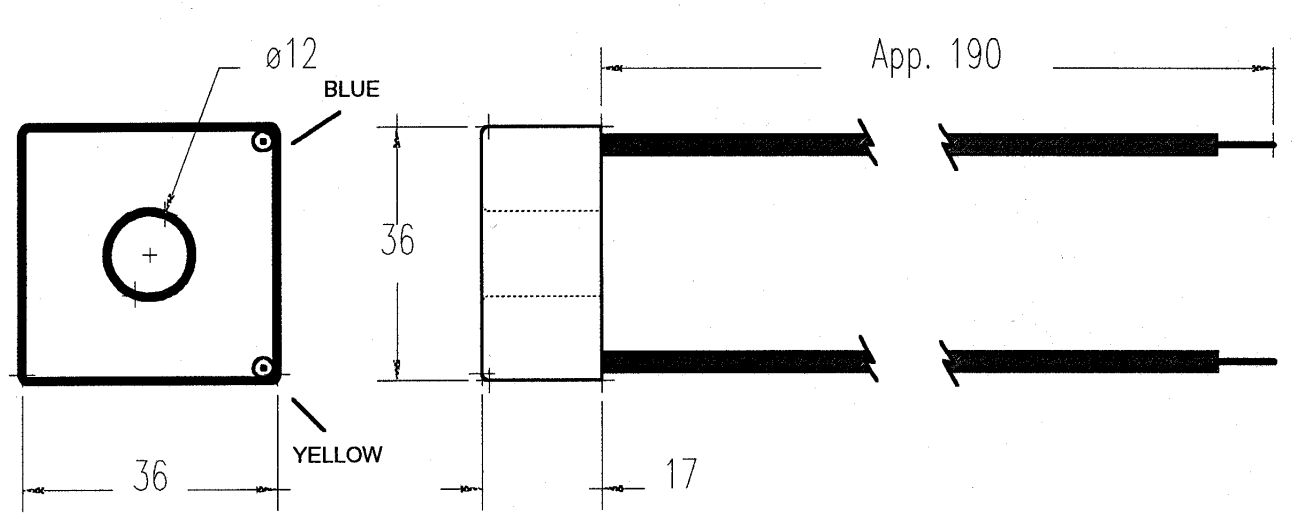


Fig. 1 Outline

Dimensions in mm

TRIGGERING UNIT SKW3 ZC FOR SIX THYRISTORS

3-PHASE STATIC CONTACTOR WITH ZERO CROSSING TRIGGERING

- Power supply voltage 230/400 Vac
- Line voltage for the thyristors, max. 690Vac
- Auxiliary control voltage 12Vcc built-in
- Galvanic isolation 4.000V through pulse transformers
- Triggering of the whole range of SEMIKRON thyristors
- Indicator LEDs, power (green) and trigger (yellow)
- Built-in fuse
- Trigger control on zero crossing

TECHNICAL DATA

Power supply voltage		AC 230/400 V +10% -20% 50/60 Hz
Power consumption		9VA
Control signal	voltage:	DC 8 - 30 V
	consumption:	2mA at DC 12V
Triggering current		500 mA @ V_{GT} = 5V
Operation temperature		-10 at 60ºC
Humidity		10 - 95% w/o dew
Weight		420 gr

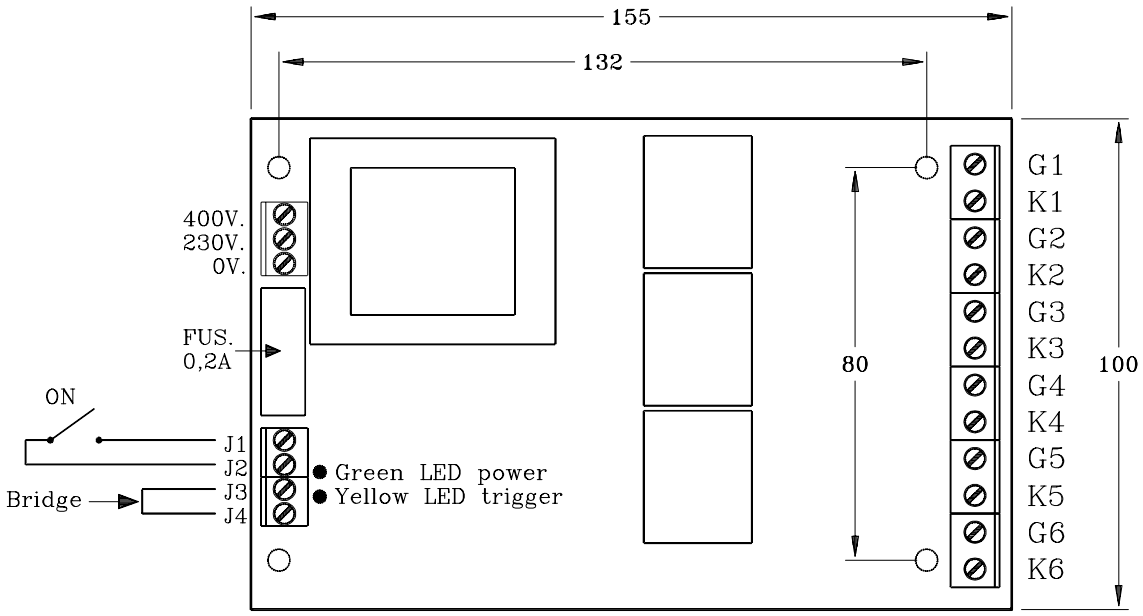
The module is equipped with pulse transformers, and has been designed to trigger 6 thyristors in W3C anti-parallel connection. It is useful that the thyristors are equipped with RC circuits.

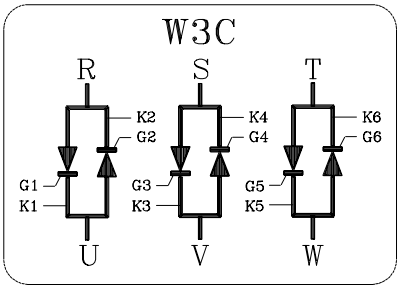
The module is most appropriate for applications as a three-phase static relay for load switching in AC operation. Switching on is performed after the control voltage is applied, waiting when the thyristor current crosses zero.

The thyristors are triggered by connecting the J1(+12V) and J2(+trigger), on the one hand, and J3 (-trigger) and J4(ground) terminals, on the other. This can also be accomplished by using an external voltage of 6 to 30 VDC connected between J2(+) and J3(-).

To supply other devices (max. 50 mA) the internal auxiliary voltage of 12 VDC(J1: +12V, J4:0V) can be used.

By providing a step-down transformer at the power input terminals, the thyristors can be triggered from a line voltage up to 690 VAC, since the pulse transformers whithstand this voltage. In this case, some little changes on the module have to be done (change of the resistors R43, R44, R45). for 330kΩ (or two of 150kΩ) 3W minimum).Those rsistors are calculated to for a W3C connection in series with the phases. In case to connect the antiparallel thyristors in series with the load, and both (thyristors + load) in triangle, resistors have to been changed or they can be damaged.


155
132
400V.
230V.
0V.
FUS.
0,2A
ON
J1
J2
J3
J4
Bridge
Green LED power
Yellow LED trigger
80
100
G1
K1
G2
K2
G3
K3
G4
K4
G5
K5
G6
K6


W3C
R
S
T
K2
G2
K4
G4
K6
G6
G1
K1
G3
K3
G5
K5
U
V
W

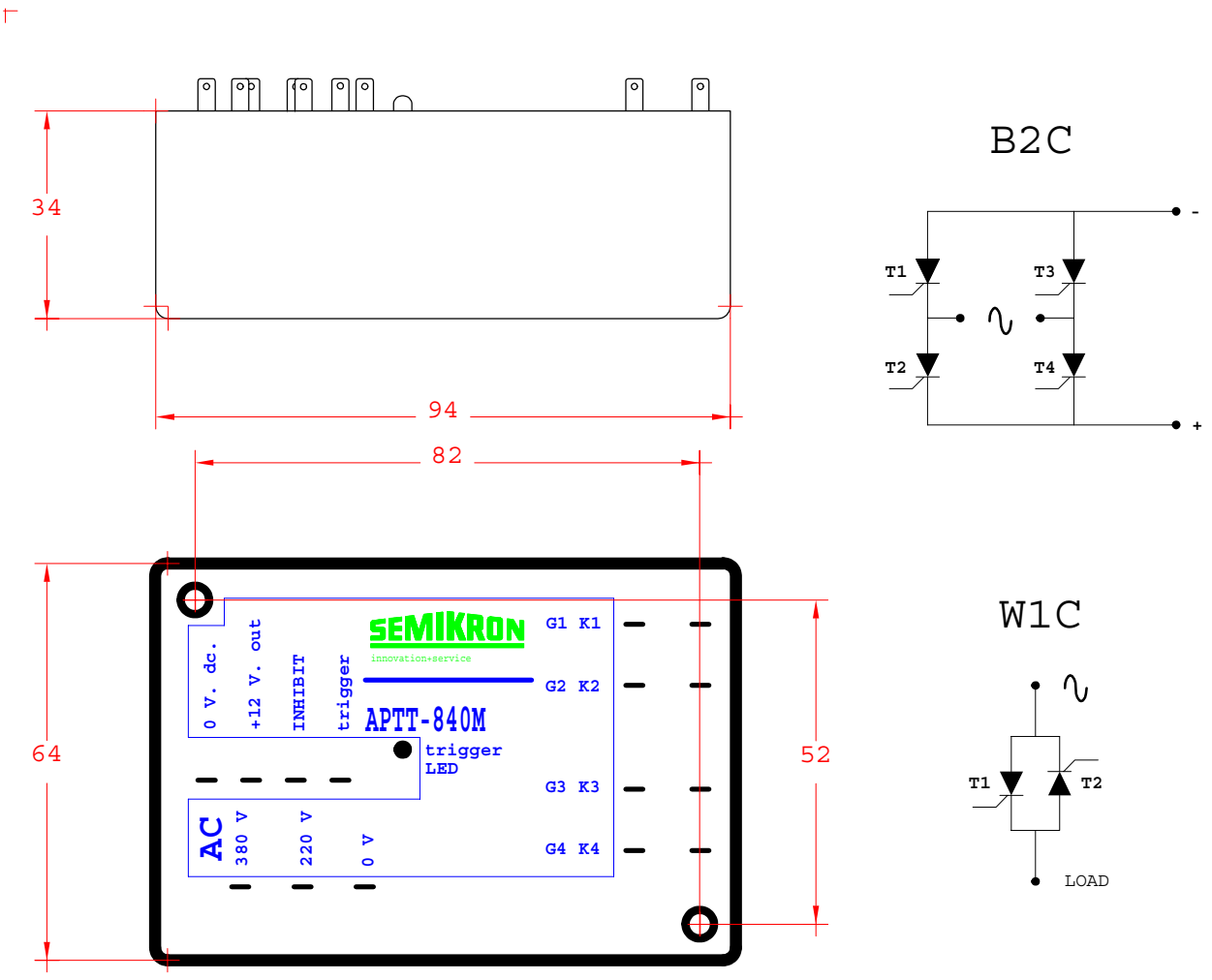
SINGLE-PHASE TRIGGER APTT 840S

- Mains voltage up to 660Vac (minimum 3Vac)
- Control voltage 12Vcc -10mA (minimum for triggering 8V, maximum for not triggering 4V)
- Module power supply 220/380Vac
- Galvanic insulation 4000V
- Operating temperature 0/+50ºC
- Triggers the full range of SEMIKRON thyristors
- Control signal indicator LED

This module has the same features as the APTT 840M. The only difference is that while the 840M can trigger 4 thyristors and takes the zero-crossing sync signal from a secondary on the supply transformer, the 840S only triggers 2 thyristors and the sync is taken directly from the cathodes of the two antiparallel-connected thyristors.

This requires connecting 10kΩ/5W resistors from R1 to R1K and from R2 to R2K. The terminals R1K and R2K are connected internally to K1 and K2. This has the advantage that the zero-crossing does not have to be synchronised with the mains supply but with the load current.

An example of this application could be the connection of capacitor banks using thyristors in W1C, for correcting the mains power factor (cos φ). If sync is required at other points, the appropriate resistors can be connected between R1, R2 and whatever other points may be wished.



DUTY CYCLE REGULATOR DCR
(Duty Cycle Regulator)

- Supply 230/380 Vac
- Working temperature 0/+50ºC
- Control warning LED
- Freely adjustable 4-20 mA input

This module has been designed for controlling loads where interference problems require the regulation to be made by a number complete cycles, by varying the ratio of conducting cycles to nonconducting cicles..

The module has an internal oscillator of approximately 1 Hz frequency. The field of regulation may be adjusted from 4 to 20 mA by way of two potentiometers, these two limits being freely variable, i.e., the customer may change to 0-20, 10-25, 15-20, etc.

At the lower limit, (when 4 mA are flowing, for example) the Led will glow at 100% and as the current increases the ratio of illuminated time to extinguished time will gradually reduce until the upper limit (20mA) is reached, when the LED will not glow al all.

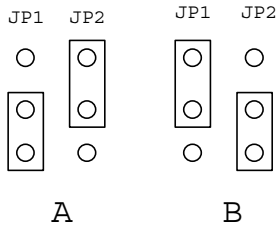
A typical application for this module is the control of resistive loads in an oven, by way of a 4-20 mA input loop.

This module controls a zero-crossing trigger module, like the APTT 840S.

Adjustment is as follows:

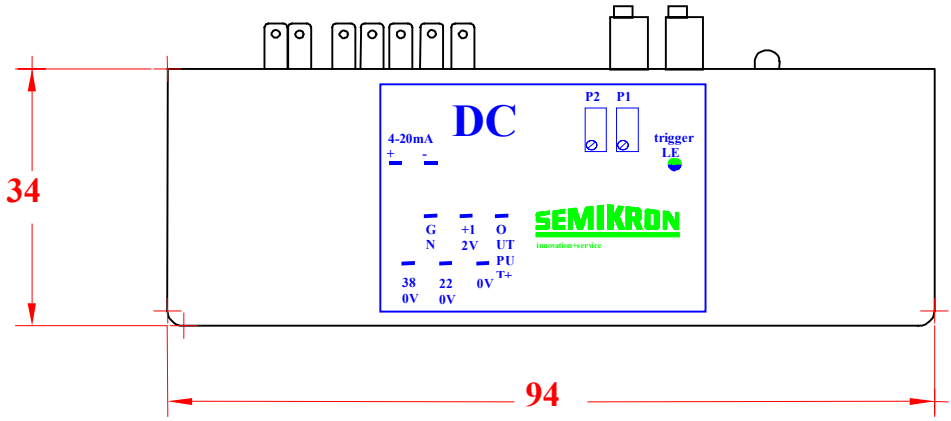
1. Enter 20 mA and adjust P1 (10k) so that the Led is virtually extinguished.
2. Turn I down until the LED is fully illuminated.
3. If I is above the desired value (4 mA), reduce the resistance of P2 (100k); if it is bellow, increase the resistance.
4. Repeat the process from 1) until complete adjustment is achieved.

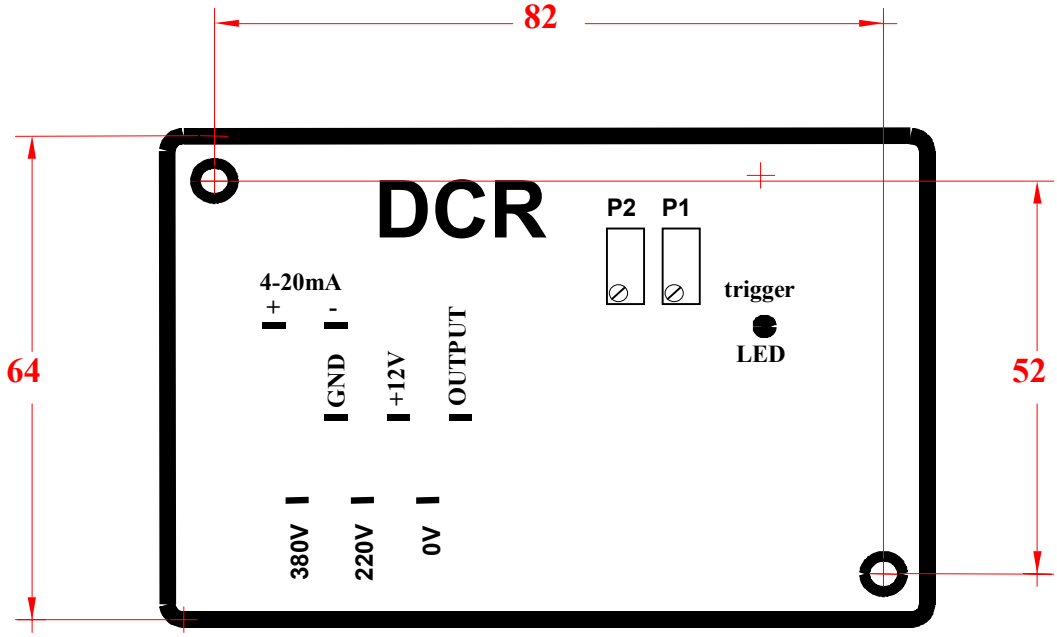
In some cases, it is necessary to invert the output from the input current. For this cases the module has two jumpers (JP1 y JP2) that can be adjusted as follows:



A: 4mA = LED off, no output
20mA = LED on, output activated

B: 4mA = LED on, output activated
20mA = LED off, no output

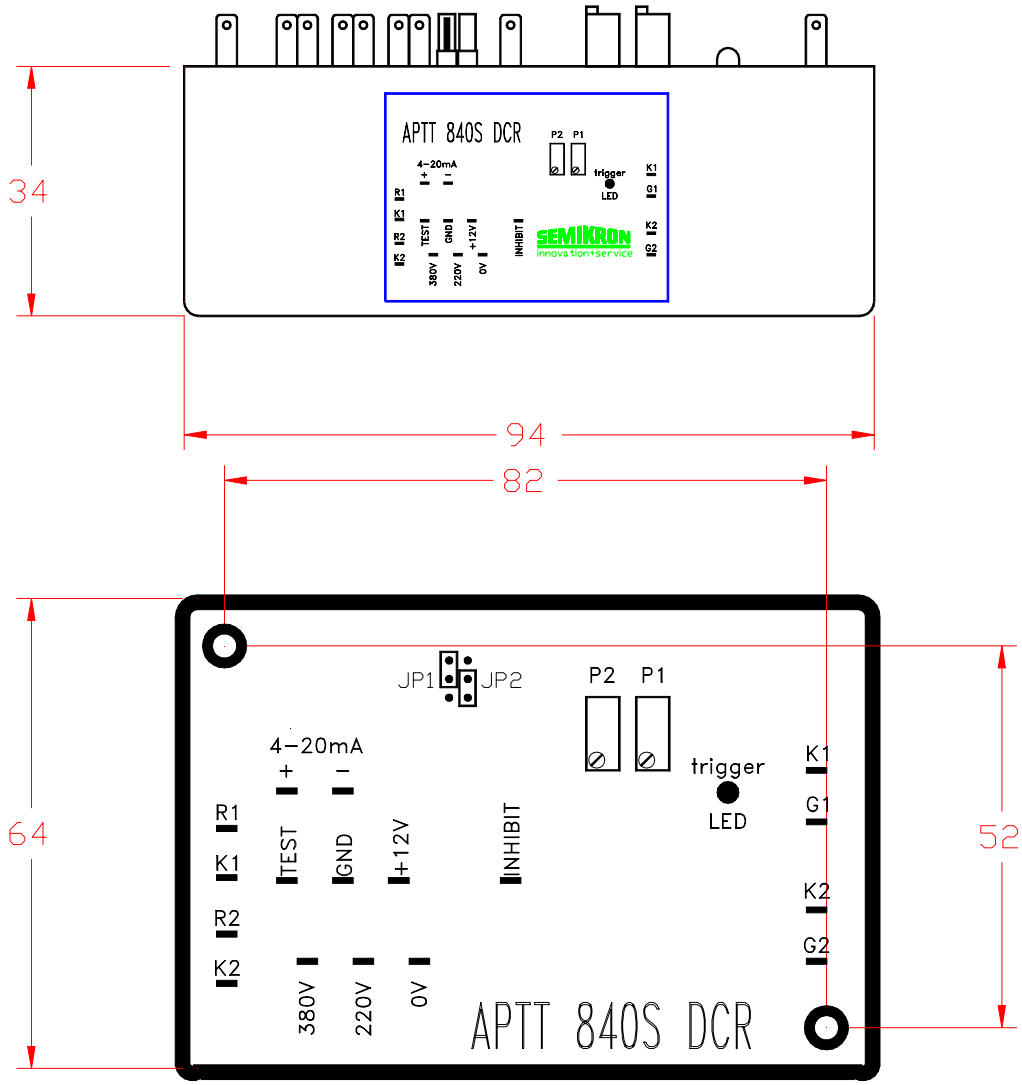

DC
4-20mA
+
-
P2
P1
trigger
LE
G
N
+1
2V
O
UT
PU
T+
SEMIKRON
innovation+service
38
0V
22
0V
0V
34
94


82
DCR
P2
P1
4-20mA
+
-
trigger
LED
GND
+12V
OUTPUT
380V
220V
0V
64
52

SINGLE-PHASE TRIGGER WITH PULSE TRAIN REGULATOR APTT840S DCR

- Mains voltage up to 660Vac (minimum 3Vac)
- Control voltage 12Vcc (10mA)
- Module power supply 220/380Vac
- Galvanic insulation 4000V
- Operating temperature 0/+50ºC
- Triggers the full range of SEMIKRON thyristors
- Control signal indicator LED
- 4-20mA input, freely adjustable

This module is obtained by combining the APTT 840S modules and the DCR, obtaining the features of both.



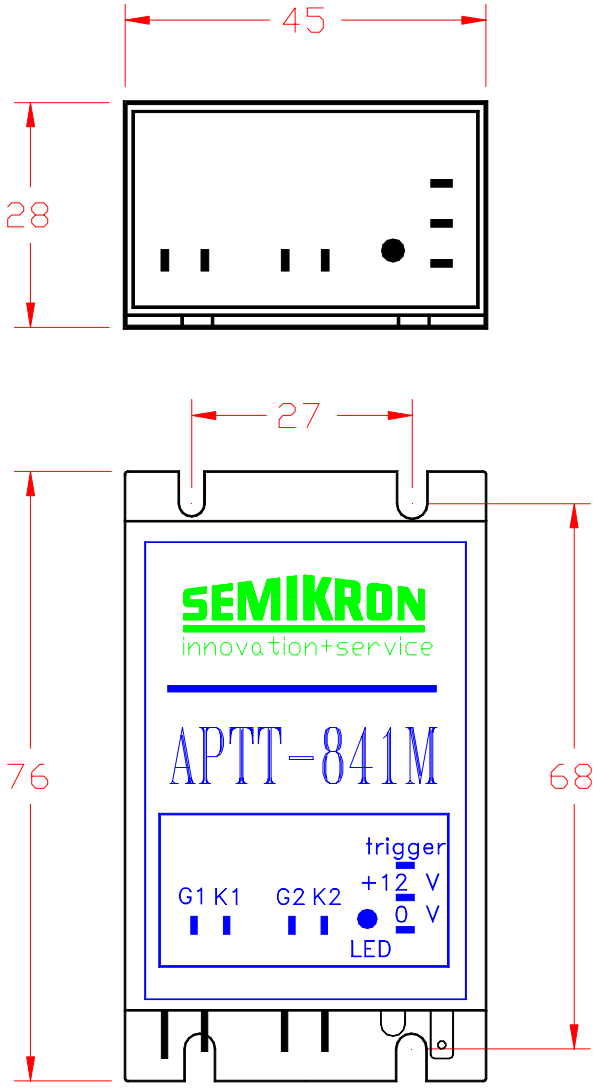
NON-ZERO-CROSSING THYRISTOR TRIGGERS

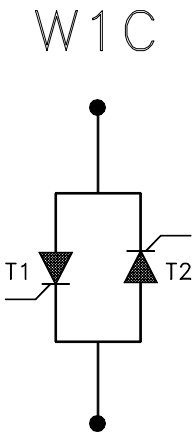
TWO-THYRISTOR TRIGGER APTT 841M

- Mains voltage up to 660Vac (minimum 3Vac)
- Control voltage 12Vcc (10mA)
- Module power supply 12 Vcc (250mA)
- Galvanic insulation 4000V
- Operating temperature -20/+50ºC
- Triggers the full range of SEMIKRON thyristors
- Control signal indicator LED

This module has been developed to trigger 2 W1C antiparallel-connected or rectifying (B2HK or B2HKF) thyristors. It is advisable to use a RC network in the thyristors.

Designed as a single-phase static relay in load connects and disconnects in c.c. and a.c. applications. The load connects when the control voltage is output and disconnects when the thyristors' current crosses the zero.
This module requires an external +12Vcc - 250mA power supply. The thyristors can be triggered by joining two terminals (+12V and "trigger") or using an outside 12 Vcc voltage supply connected between 0V and "trigger".





TRIGGERING UNIT SKTT6 FOR SIX THYRISTORS

3-PHASE INSTANTANEOUS STATIC CONTACTOR

- Power supply voltage 230/400 Vac
- Line voltage for the thyristors, max. 660Vac
- Auxiliary control voltage 12Vcc built-in
- Galvanic isolation 4.000V through pulse transformers
- Triggering of the whole range of SEMIKRON thyristors
- Indicator LEDs, power (green) and trigger (yellow)
- Built-in fuse

TECHNICAL DATA

Power supply voltage		AC 230/400 V ±10% 50/60 Hz
Power consumption		9VA
Control signal	voltage:	DC 6 - 30 V
	consumption:	2mA at DC 12V
Triggering current		500 mA @ V_{GT} = 5V
Operation temperature		-10 at 60ºC
Humidity		10 - 95% w/o dew
Weight		420 gr

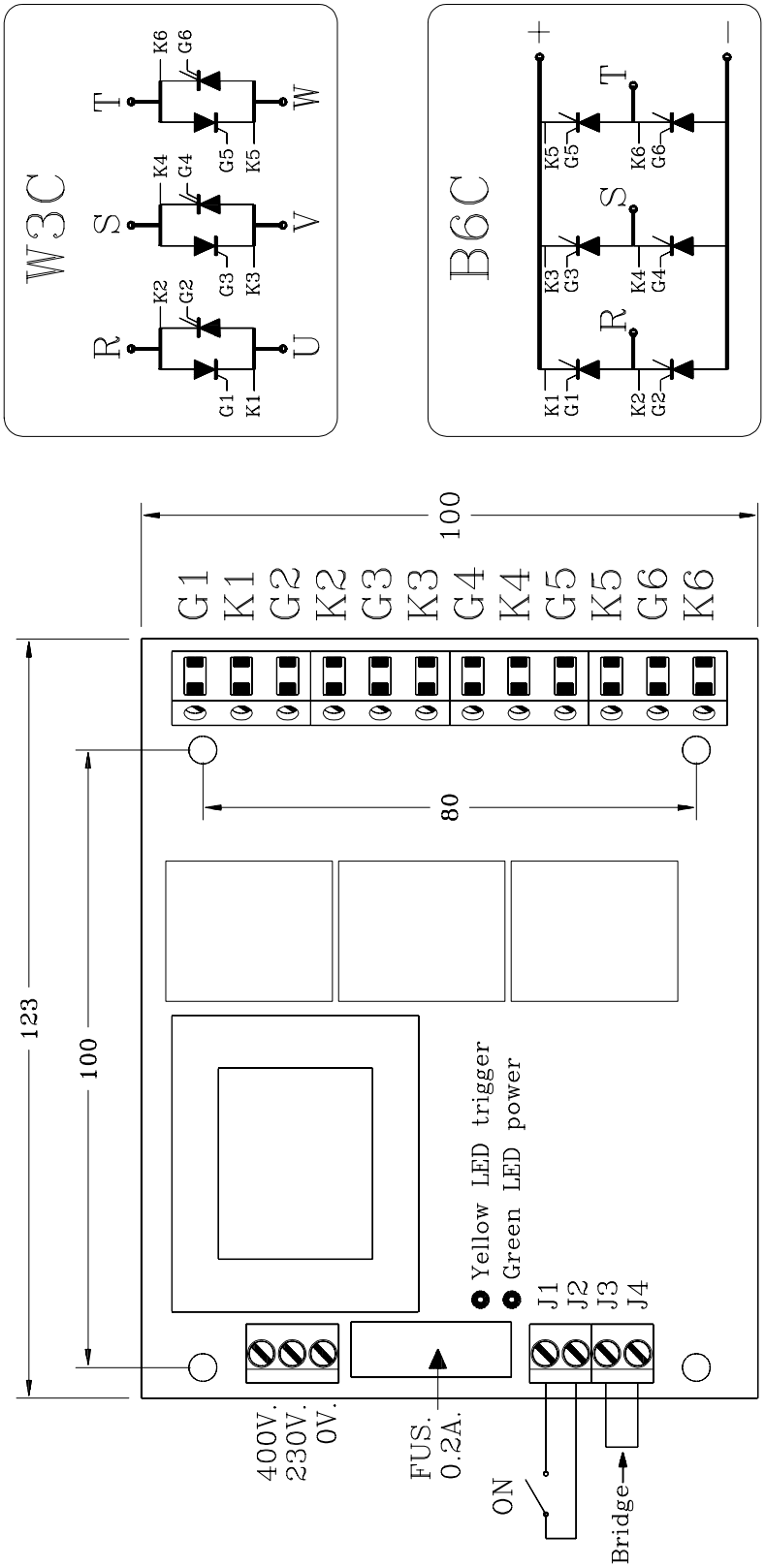
The module is equipped with pulse transformers, and has been designed to trigger 6 thyristors in W3C anti-parallel or rectifying (B6C, B6HK or B6HKF) connection. It is useful that the thyristors are equipped with RC circuits.

The module is most appropriate for applications as a three-phase static relay for load switching in AC or DC operation. Switching on is performed instantaneously when the control voltage is applied (it does not wait for zero crossing) and switching off occurs when the thyristor current crosses zero.

The thyristors are triggered by connecting the J1(+12V) and J2(+trigger), on the one hand, and J3 (-trigger) and J4(ground) terminals, on the other. This can also be accomplished by using an external voltage of 6 to 30 VDC connected between J2(+) and J3(-).

To supply other devices (max. 50 mA) the internal auxiliary voltage of 12 VDC(J1: +12V, J4:0V) can be used.

By providing a step-down transformer at the power input terminals, the thyristors can be triggered from a line voltage up to 660 VAC, since the pulse transformers whithstand this voltage.


W3C
R
S
T
U
V
W
G1
K1
G2
K2
G3
K3
G4
K5
G6
K6
B6C
+
−
R
S
T
K1
G1
K2
G2
K3
G3
K4
G4
K5
G5
K6
G6
100
80
123
100
Yellow LED trigger
Green LED power
J1
J2
J3
J4
400V.
230V.
0V.
FUS.
0.2A.
ON
Bridge

CONVERTERS

4-20mA/0-10V CONVERTER

- Module power supply 220Vac
- Operating temperature 0/+50ºC

This module converts the 4-20mA used in the industry to the 0-10V required for controlling the RT380 and MP380 modules (M and T).

Once the module has been turned on and 4mA is being input in "IN 4-20mA", set the output 0-10V to 0V with the "0V" potentiometer. Then send 20mA to the same input and adjust the output to 10V with the "SPAN" potentiometer.

The "OUT 4-20mA" output is a reproduction of the "IN 4-20mA" input but amplified with an internal buffer. The output values are adjusted with the "4mA" and "20mA" potentiometers.