# 598P/599P Application Manual

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# Contents

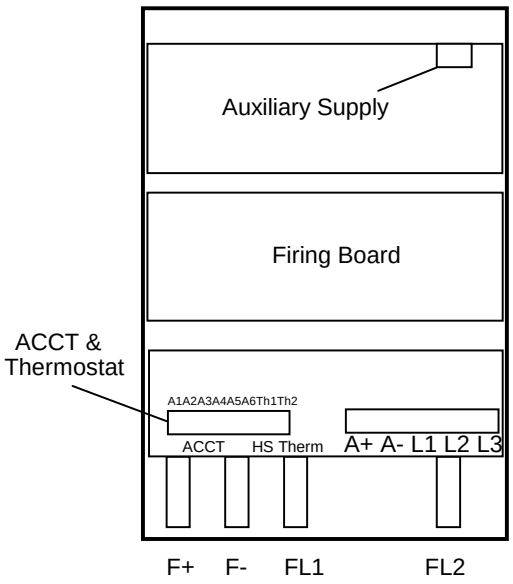
# Overview

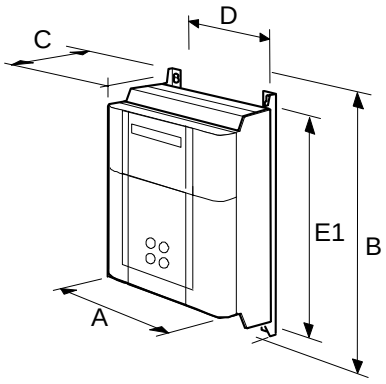
The 598/9P External Stack Assembly provides the Hardware necessary to interface the 590Plus Control Door to an existing 3 Phase Stack assembly. The Design assumes that a Fully Controlled 3 Phase Six Pulse Converter exists which is complete with Thyristor Suppression, Current Feedback, Temperature Monitoring and Suitable Fusing.

The External Stack Module provides: -

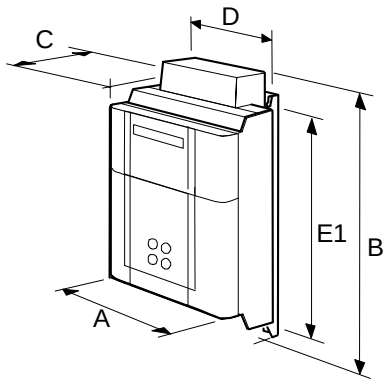
- Thyristor Firing Signals;
- Thyristor Firing Pulse Transformers;
- ACCT Feedback Rectification and Scaling;
- Armature Voltage Feedback Interface;
- Coding and Phase Rotation Interface;
- Mains Present Monitoring
- Heatsink Over-temperature Input;
- Field Power Modules and Input / Output Terminations;
- Field Current Monitoring and Scaling;
- All Standard 590Plus I/O Terminations.

# Outline Drawing




60A




120A

| Current Rating (A) | Weight in Kg (lbs.) | Overall Dimensions | | | Fixing Centres | |
|---|---|---|---|---|---|---|
| | | A | B | C | D | E1 |
| 60 | 10-14 (22-30) | 250 (9.8) | 415 (16.3) | 180 (7.1) | 200 (7.9) | 400 (15.7) |
| 120 | 15 (33.2) | 250 (9.8) | 445 (17.5) | 180 (7.1) | 200 (7.9) | 400 (15.7) |
| *Dimensions are in millimetres (inches)* | | | | | | |

# Electrical Installation

## 3-PHASE CONTACTOR

An AC Line Contactor should be connected in series with the 3 Phase Power AC Supply to the Power Stack. The Contactor does not switch current and should be driven via the Pilot Relay provided on the Power Board. The Pilot Relay has a limited drive capability of 3 Amps and it is likely that the Inrush Current of the Contactor used in this application will exceed this level and thus an intermediate Slave Relay should be fitted which is controlled directly by the Drive with Contacts of this Slave Relay used to Close the Main Contactor. If the use of a DC Contactor is preferred the coil should be controlled by a Slave Relay as previously described however it is important to connect an Auxiliary Contact from this DC Contactor into the Enable Input of the Drive Module on Control Board Terminal C5 to guarantee the correct sequencing of the Control Circuits.

## AUXILIARY SUPPLY

The Controller needs an Auxiliary Supply to provide the Power for the Control Electronics Power Supplies and the Slave Relay Coil. This should be a Single Phase AC Supply in the range 110Vac to 240 Vac 50/60 Hz. The Electronic Power Supply Circuitry will function over this range without difficulty however the Pilot Relay uses this supply to drive the Slave Contactor; hence the Auxiliary Supply Voltage should be tailored to suit the desired coil voltage of the Slave Relay.

When the 598/9P External Stack Controller is required to power a Motor Field with a current greater than 60 amps an Auxiliary Fan will be fitted to the module, this Fan will be either 100/120 Vac or 220/240 Vac depending upon the Customer Order requirements.

## SEMICONDUCTOR FUSES

Semiconductor Fuses should always be provided to protect the Power Thyristors under fault conditions. Where Line Fuses are used the Coding and Mains Present should be connected to the Stack side of the Fuse to enable the Mains Present to detect Fuse Failure and inhibit the Control Circuits. Where Limb Fuses are used Micro-switches should be added to the Indicator Fuses to detect fuse failure and the resultant combined signal used to disable the Controller via the Enable Input.

Semiconductor fuses must also be provided for the Field AC Supply to protect the Field Power Devices. These fuses should be selected to limit the Fault $I^2t$ through the Device to within the Device Rating.

## CURRENT TRANSFORMERS

The Drive Module relies upon Current Transformers to provide a measurement of the outgoing Armature Current. The unit is designed to operate with Current Transformers with a ratio of 2000:1 and the Calibration calculations and scaling will operate normally. Any other ratio of the Current Transformer will result in a Calibration error in the Software, i.e. a 1000:1 CT will actually result in half the expected output current.

The Current Transformer, if not purchased from Eurotherm Drives, should have a core with a low magnetising current to reduce the measurement error, and maximum output voltage of approximately 6 volts. Under normal operation the output from the three Current Transformers is fed via a 3 phase rectifier to a fixed burden, thus the output voltage under normal conditions is 1.1Vdc plus two diode volt drops. The Current Transformer should cater for a worst case overload of 3 times Full Load Current or a maximum output of 3.3Vdc plus two diode drops.

## HEATSINK THERMOSTATS

Since most High Current Stack assemblies are force cooled, a Digital Input is provided on the External Stack Module to shutdown the controller in the event of Cooling Failure or Heatsink over-temperature. The Input Circuitry is operating at Control Signal voltage levels hence SELV and has no Safety Isolation. If Thermostats are being used which are fitted to a “Live” Heatsink then the contacts of the Thermostats should be “anded” together via relay logic and the Volt Free Contact of the Output Relay used to drive the Heatsink Over-temperature Input. It is important to ensure that each individual Thermostat is capable of providing Basic Isolation at the Stack Supply Voltage since the contacts will be connected to drive via the Output Relay which itself provides the second level of Basic Isolation giving Double Isolation of the SELV circuitry.

## FIRING AMPLIFIERS

There are two options available for the Firing of the Power Thyristors: -

a) Direct driven Pulse Transformers locally mounted on the 590P External Stack Module. These Pulse Transformers provide a Maximum of 1 Amp of Thyristor Drive Current at 10 Volt. They cannot be used where the Supply Voltage is greater than 500 Vac.

b) Separate Firing Amplifiers, which can be, fitted close to the Thyristor thus minimising safety issues. These amplifiers require a separate 24 V DC Supply but provide an output Current Source at 1 amp for better Thyristor Firing and improved Voltage isolation. They must be used on 600 - 690 Vac Supplies.

## POWER THYRISTOR COMPATIBILITY

It is important to verify that the Thyristors of the External Power Assembly can be consistently fired by the Firing Amplifier Outputs. Each Semiconductor Manufacturer provides a Thyristor Gate Characteristic to enable a judgement to be made.

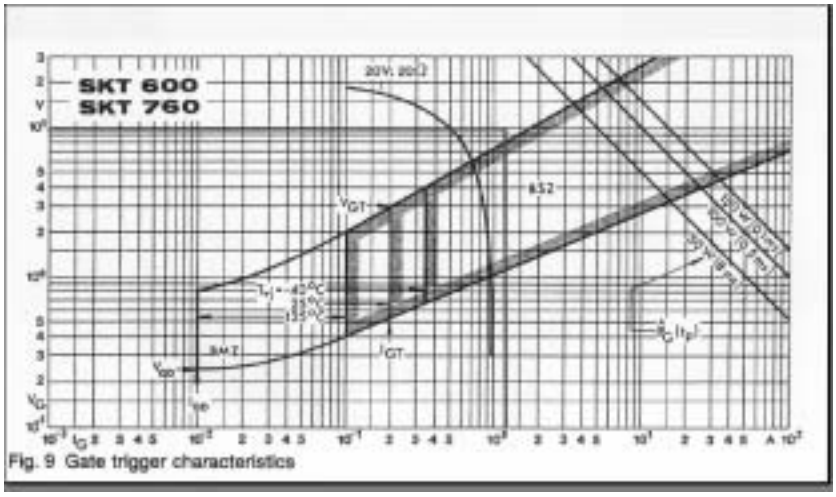


Fig. 9 Gate trigger characteristics

A load line should be plotted on the characteristic and provided this line passes through the Area of Certain Triggering marked BSZ, the two items are compatible.

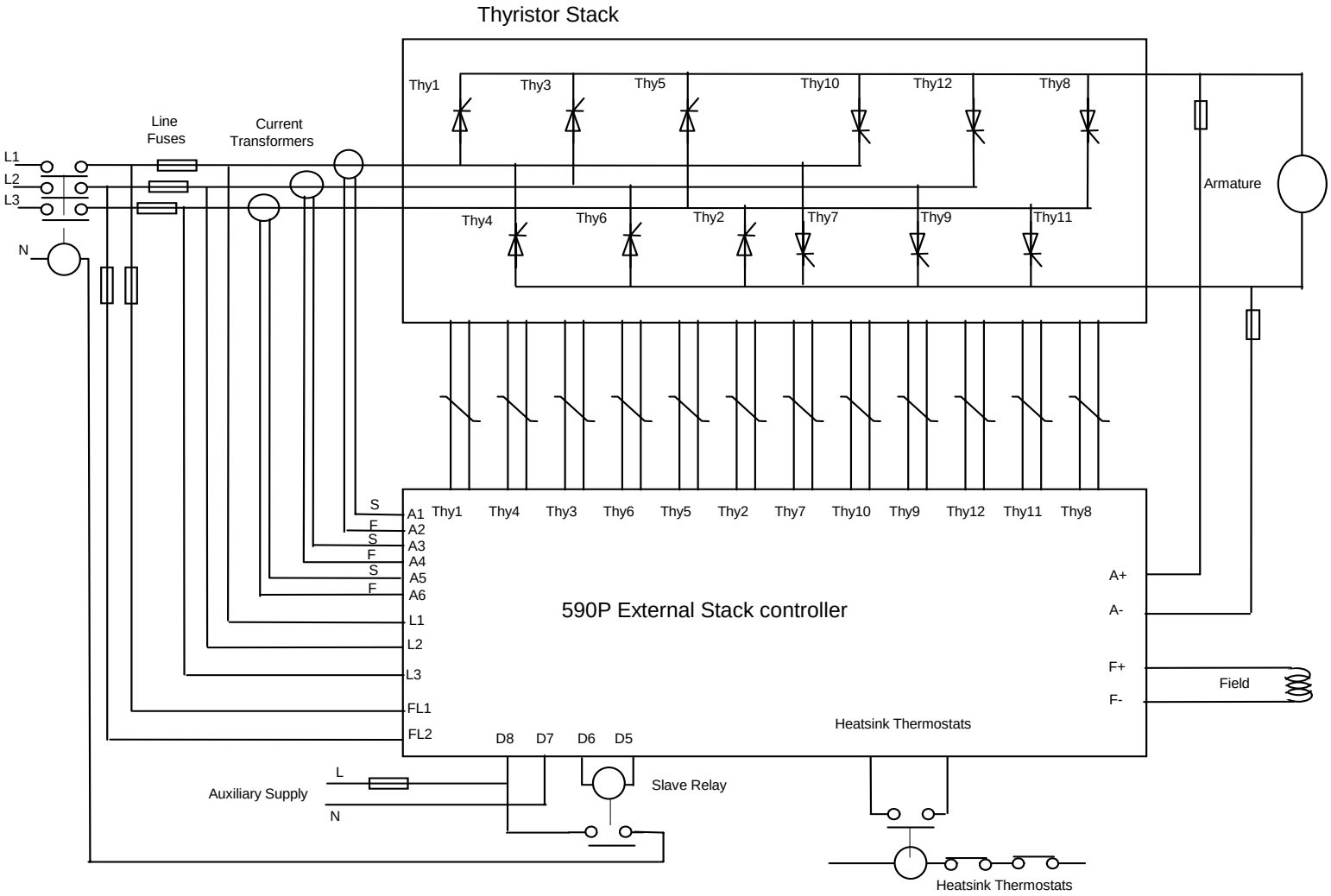
The Output Characteristic of the Pulse Amplifier is marked on the Gate Characteristic shown above at approximately 1 amp and 10 V; it can be seen that the line passes directly through the line of certain triggering.

If the Trigger Board is used it will provide a characteristic similar to the sample shown a 20 V 20 ohms. Data for the Load Line is given in the Table below.

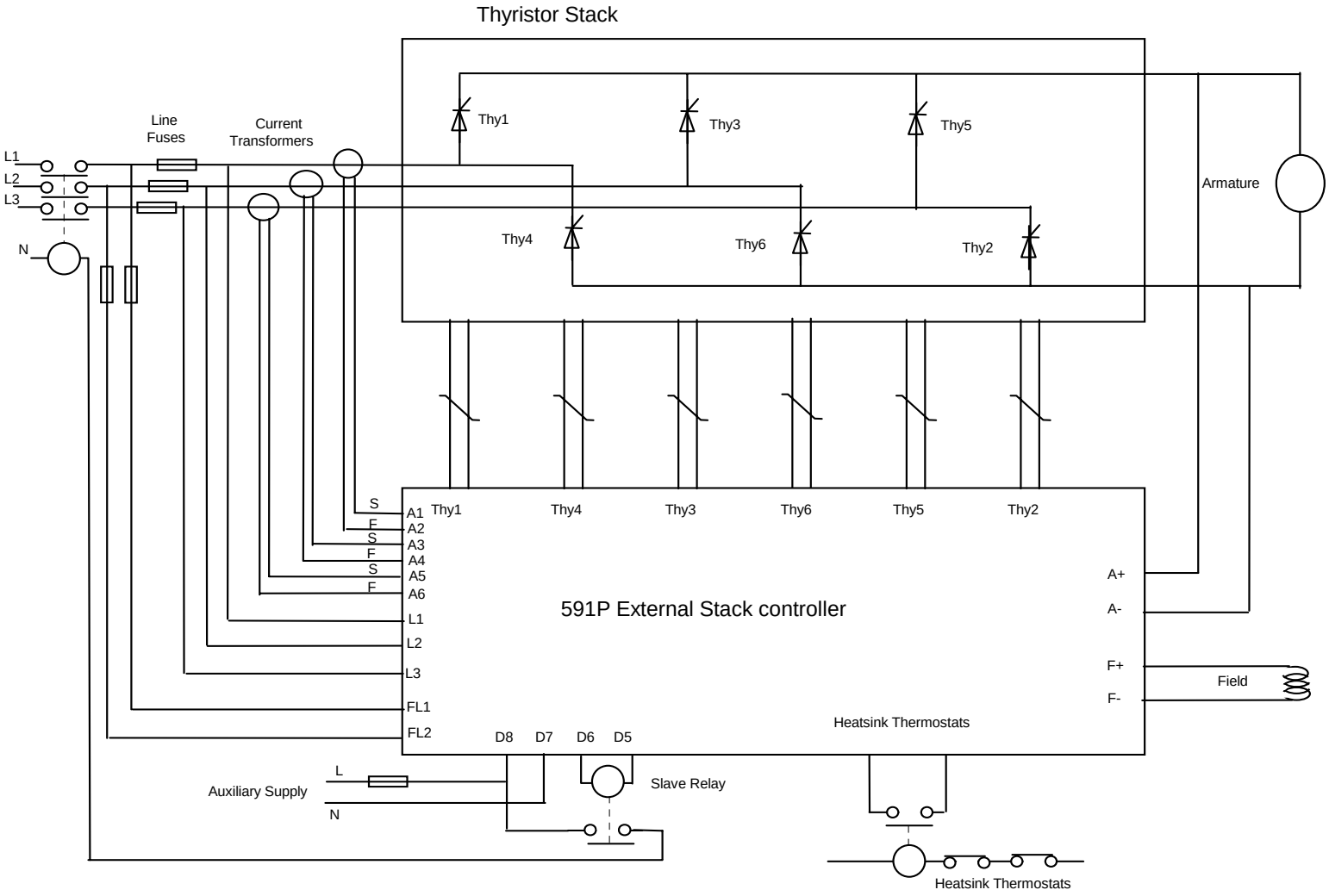
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I gate | 1.35 | 1.14 | 0.98 | 0.87 | 0.77 | 0.70 | 0.56 | 0.47 | 0.36 | 0.29 | 0.16 | 0.11 | 0.04 |
| V gate | 0.00 | 1.14 | 1.97 | 2.60 | 3.09 | 3.49 | 4.22 | 4.72 | 5.34 | 5.71 | 6.39 | 6.65 | 7.06 |

# Power Connections

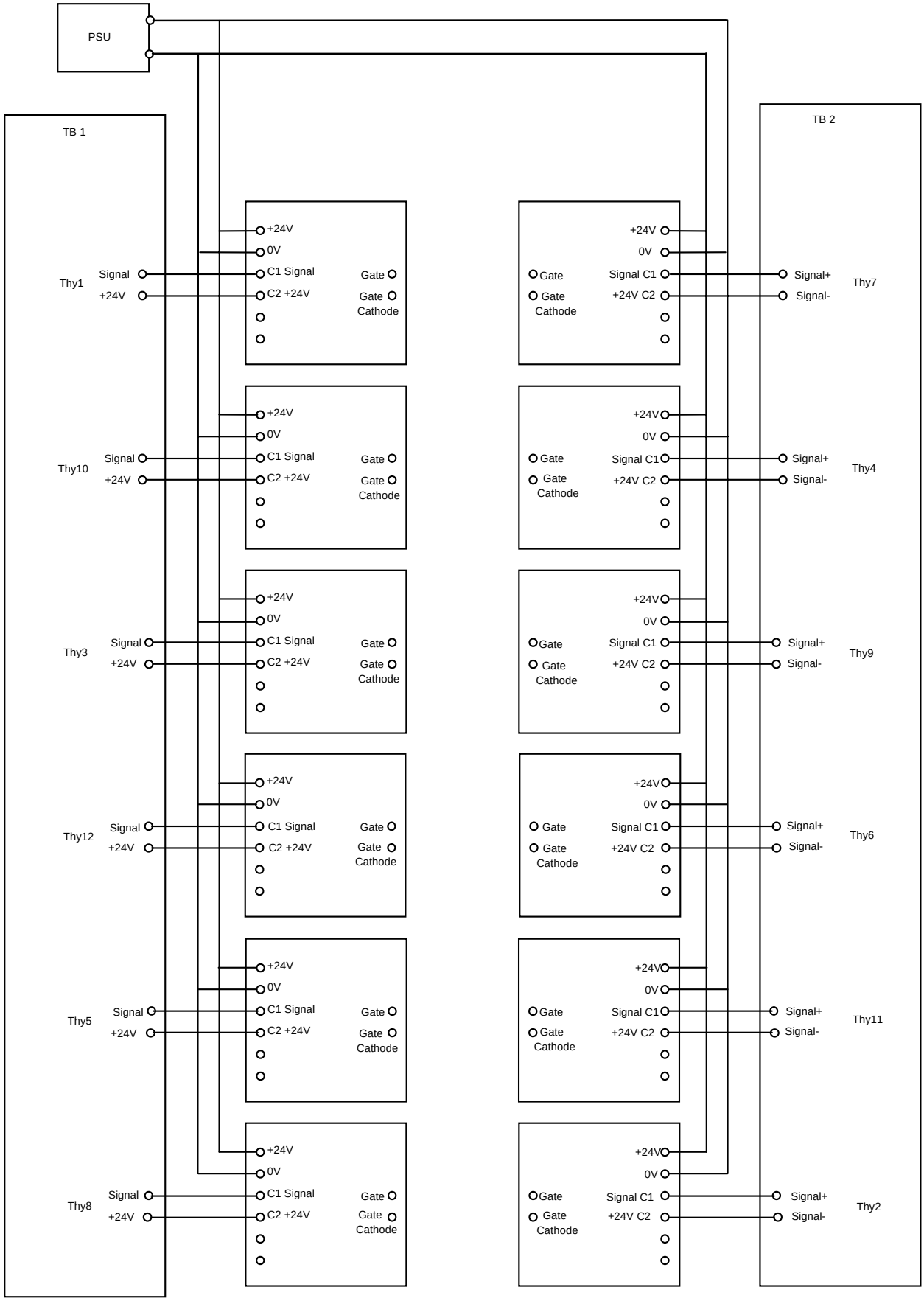
## Minimum Connection 4Q Stack Trigger Board Option



## Minimum Connection 2Q Stack Trigger Board Option

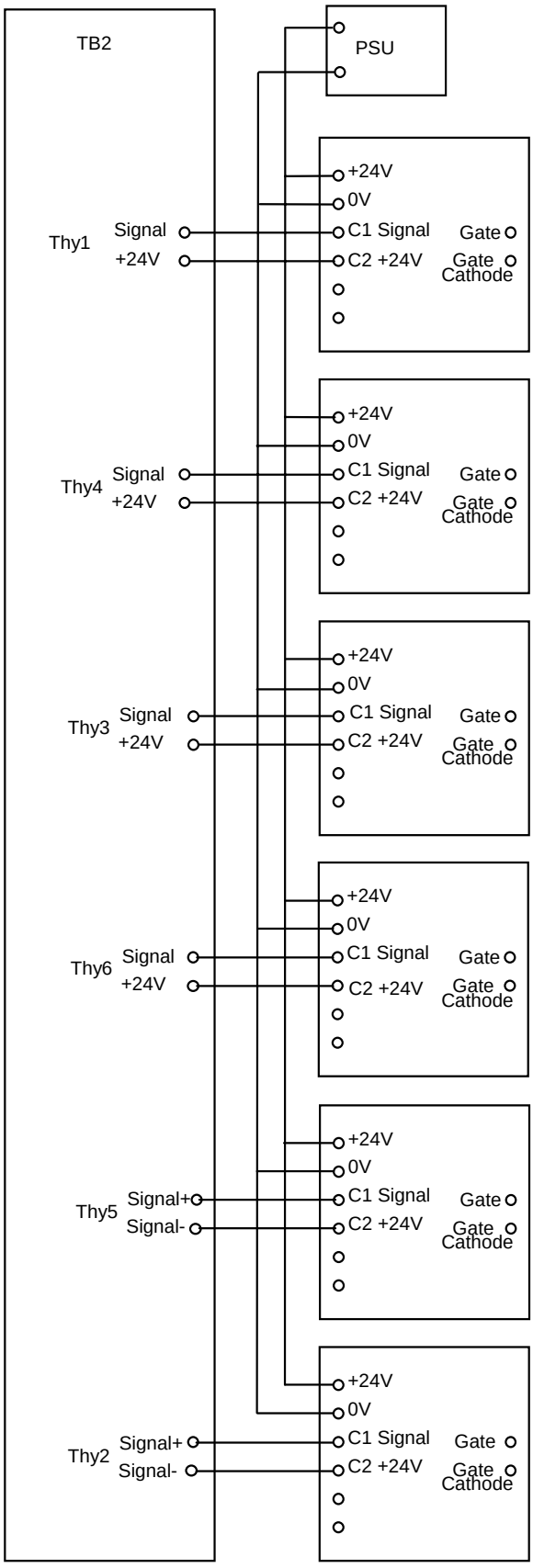


## Pulse Amplifier Connections 4Q Stack




4Q Power Amplifier Connections.

## Power Amplifier Connections 2Q Stack

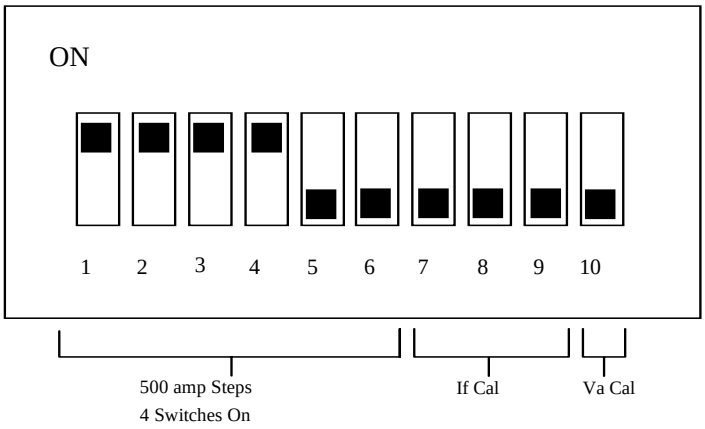



2Q Power Amplifier Connections.

# 598/9P Set-up Procedure

At the moment the software identifies the 590P External Stack Module as a 590PH Module and therefore the External Stack must be set for a similar current range to an equivalent 590PH.

### CALIBRATION SWITCH




### ARMATURE CURRENT CALIBRATION

4 switches must be "On" to give 2000 amps of Current Burden on the Power Interface Board which, when added to the 1024 Amps of Current Burden on the 590P Door, gives a total of 3024 amps Current Burden for the Module. The software uses this figure to calibrate the Controller to the desired current setting range.

### FIELD CURRENT CALIBRATION

| SW7 | SW8 | SW9 | Field Calibration |
|---|---|---|---|
| 0 | 0 | 0 | 20 |
| 0 | 0 | 1 | 40 |
| 0 | 1 | 0 | 60 |
| 0 | 1 | 1 | 80 |
| 1 | 0 | 0 | 100 |
| 1 | 0 | 1 | 120 |

### ARMATURE VOLTAGE CALIBRATION

| SW10 | Attenuation | Calibration |
|---|---|---|
| 0 | Va/100 | Normal |
| 1 | Va/200 | Va/2 |

## Example

Set the Product Code of the Module to a 590H of the same Current Range as the Stack and with the associated maximum field current calibration. i.e. for a 2Q Stack with a 2000 Amps Armature and a 35 Amps Field set the Product Code to DC 2Q 2200A 40 D

Set the Field Calibration switches to the appropriate range i.e. with SW7 OFF, SW8 OFF & SW9 ON.

Adjust the Armature Current and other parameters as normal provided the external CT is 2000:1.

For a different CT Ratio "R" set the Armature Current using an appropriate multiplier where the multiplier M = 2000/R and the Armature Current Setting is M * Normal. i.e. if the CT Ratio is 1000:1 you will need to set 2 * the required current. Note this may mean that you may have to select a Higher Current Range on the Initial Product.

# Technical Specification

## ENVIRONMENTAL DATA

| | |
|---|---|
| Operating Temperature | 0 to +45°C |
| Storage Temperature | -25 to +55°C |
| Shipping Temperature | -25 to +70°C |
| Enclosure Rating | IP20 |
| Altitude Rating | Maximum Altitude 500 metres.<br>De-rate the Output at 1% per 200 metres. |
| Humidity | Maximum 85% relative Humidity at 45°C non-condensing. |
| Atmosphere | Non flammable, non-corrosive and dust free. |
| Climatic | Class 3k3 as defined by EN60721-3-3 (1995). |
| Safety<br>Europe<br>North America / Canada<br>Conditions | Designed to : -<br>EN50178 when enclosure mounted.<br>UL508C<br><br>Overvoltage Category III<br>Pollution Degree 2 |

## ELECTRICAL RATINGS

| | |
|---|---|
| Supply Voltage | 110 – 240 Vac ±10% 3ph Coding or 1ph Power - Low Voltage Build<br>220 – 500 Vac ±10% 3ph Coding or 1ph Power – Medium Voltage Build<br>380 – 690 Vac ±10% 3ph Coding or 1ph Power – High Voltage Build |
| Supply Frequency | 50/60 Hz ±10% |
| | |
| Output Current | 60 Amps dc naturally cooled - 120 amps dc Force Cooled.<br>De-rate linearly at 1% per °C above rated temperature. |
| Supply Current<br>Field<br>Coding | <br>(1 times Field Current dc value) Amps 1ph ac.<br>Nominal 3ph ac. |
| Field Output Voltage | (0.9 times 1ph Supply Voltage) V dc |
| Total Losses | (3 times Idc out) Watts. |
| | |
| Auxiliary Supply | 110 – 240 Vac ±10% 1ph – Naturally Cooled.<br>110 – 120 Vac ±10% 1ph – Force Cooled 115 Vac Fan configuration.<br>220 – 240 Vac ±10% 1ph – Force Cooled 230 Vac Fan configuration. |
| Auxiliary Supply Current | SMPS Quiescent Current – 500mA 115 Vac or 250mA 230 Vac i.e. 50 VA.<br>Fan Current - 270mA @ 115 Vac or 135mA @ 230 Vac. |
| Auxiliary Supply Fuse | 3 Amps. |

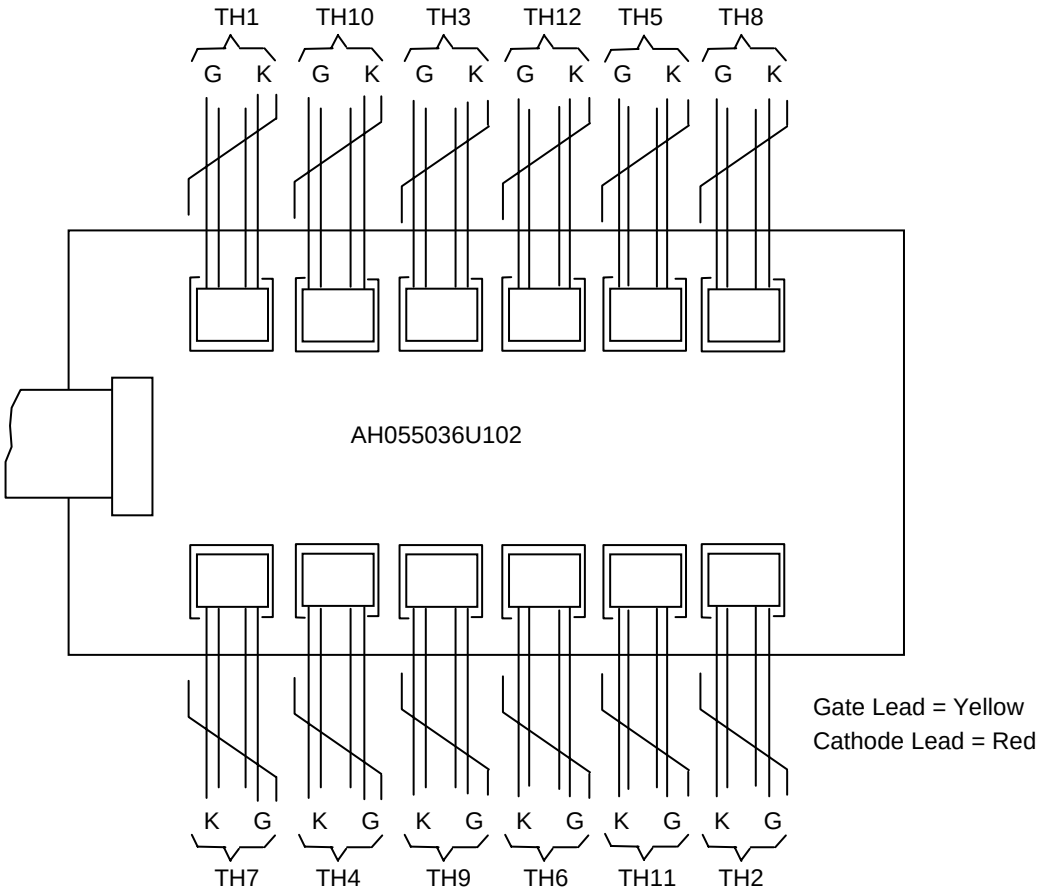
## FIELD FUSING

| DC Output | Supply Voltage | Semiconductor $I^2t$ | Fuse Rating | Fuse $I^2t$ | ED Part No. |
|---|---|---|---|---|---|
| 60 Amps | 500 Vac | 19100 $A^2s$ | 80 amps | 2550 $A^2s$ | CH570084 |
| 120 Amps | 500 Vac | 19100 $A^2s$ | 125 amps | 8500 $A^2s$ | CH571253 |
| 60 Amps | 690 Vac | 8830 $A^2s$ | 80 amps | 2550 $A^2s$ | CH570084 |
| 120 Amps | 690 Vac | 8830 $A^2s$ | 125 amps | 8500 $A^2s$ | CH571253 |

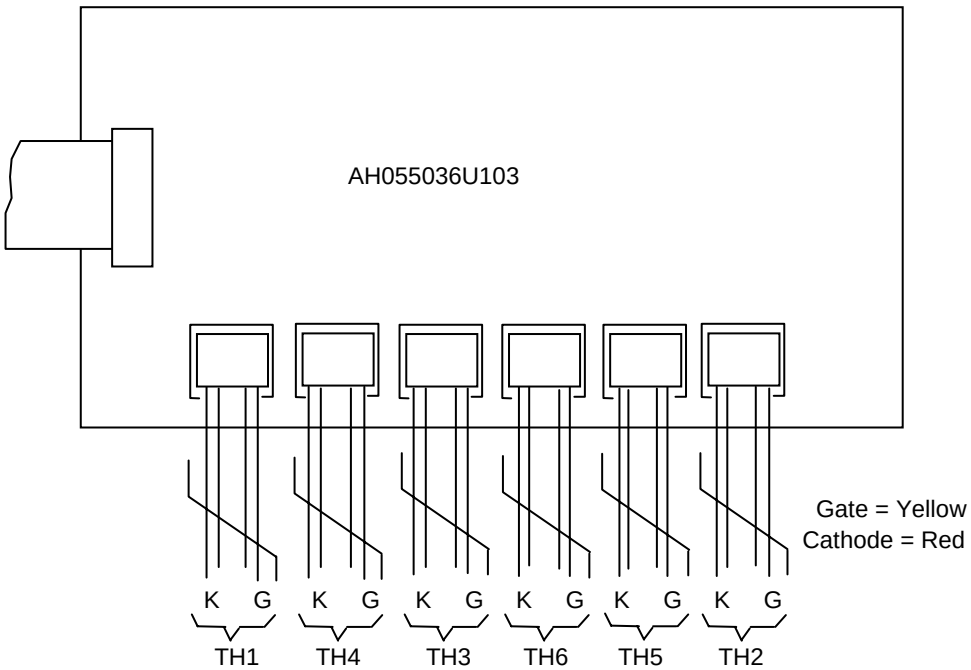
# Thyristor Wiring

### STANDARD TRIGGER BOARD TERMINAL ASSIGNMENT

### 4 Quad

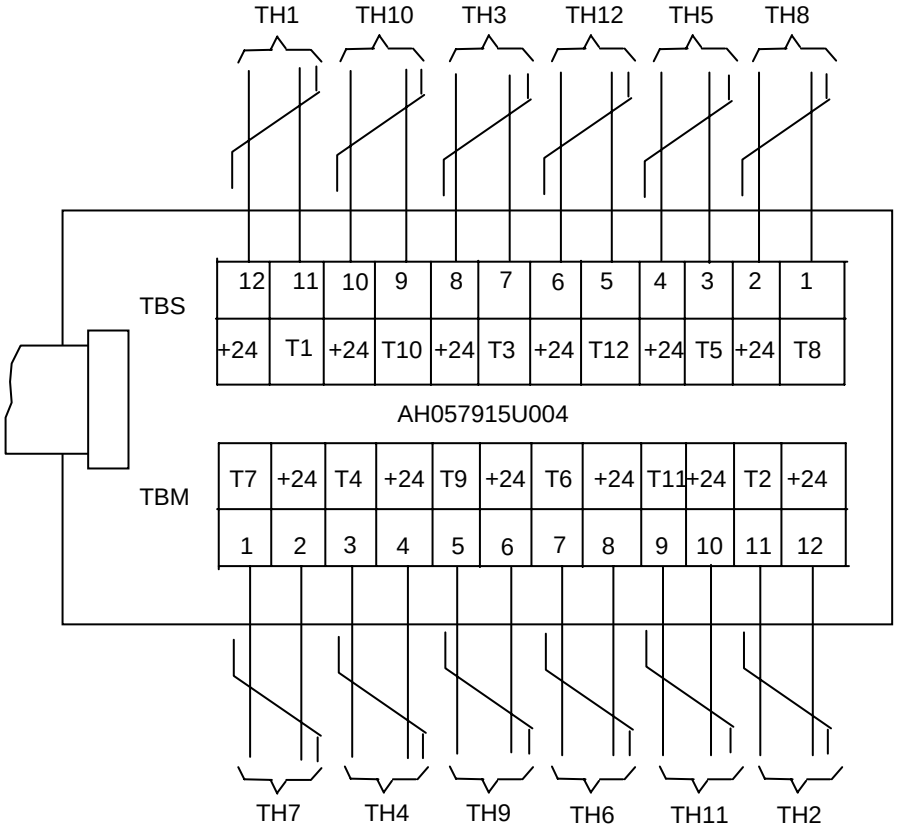



### 2 Quad

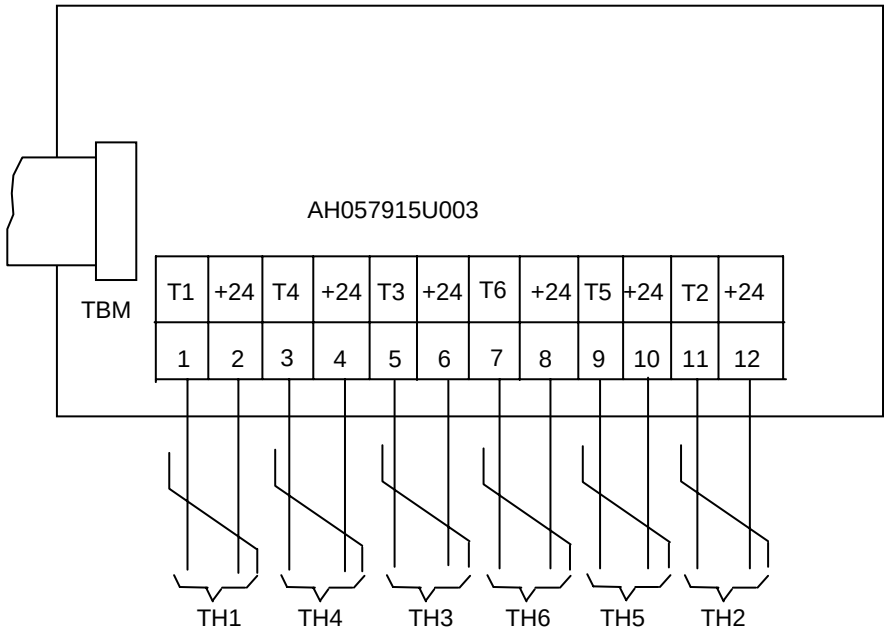


## OPTOISOLATOR TRIGGER BOARD TERMINAL ASSIGNMENT

### 4 Quad

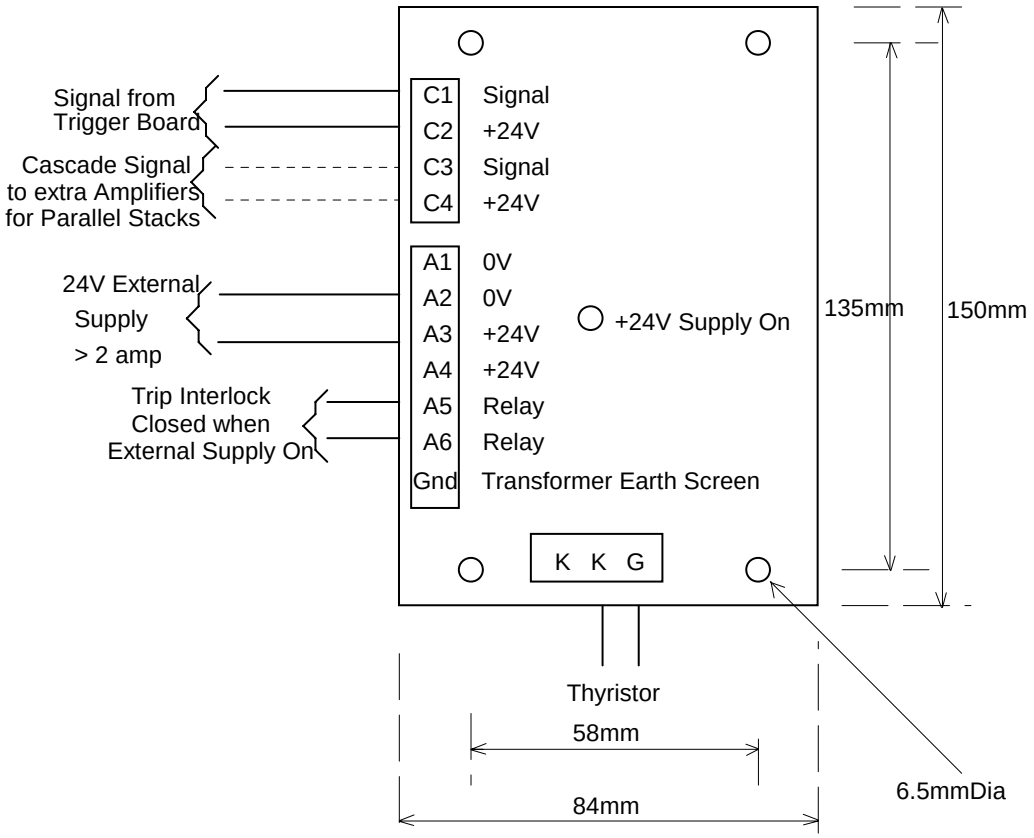



### 2 Quad



## OPTOISOLATOR FIRING BOARD TERMINAL LAYOUT AND DIMENSIONS

### VERSION 1

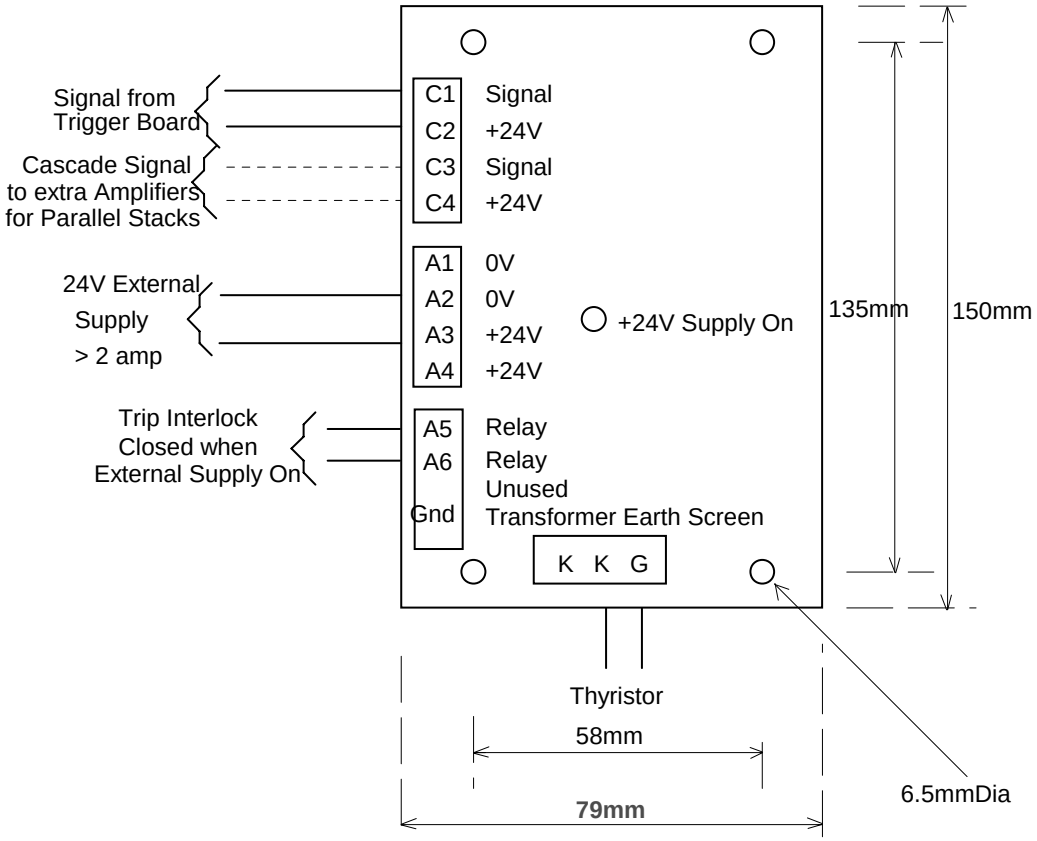


## VERSION 2

In version 2 the PCB has been re-tracked on a different software package and the components updated to Standard Parts. This gives the following differences.

1) The PCB is slightly narrower (79mm) but fits on the same fixing centres;
2) Terminal Block A is split into two parts A1 to A4 and A5, A6 & Earth. This is to enable the use of the Relay on AC Supplies up to 240 Vac where previously clearances were inadequate;
3) There is now an extra terminal between A6 7 Earth which is unused;
4) Radial Electrolytic Capacitors are used instead of Axial;
5) The add-on modification has been incorporated into the Circuit.

The functionality of the PCB is the same as before.



# Product Code

| Block | Variable | Description |
|---|---|---|
| 1 | XXXX | Product<br>598P : 590+ External Stack 4Q DC Drive<br>599P : 591+ External Stack 2Q DC Drive |
| 2 | XXXX | Four Digits describing the Maximum Field DC Current Output.<br>0060 = 60 Amps<br>0120 = 120 Amps |
| 3 | XXX | Three Digits describing the Nominal 3 Phase Supply Voltage.<br>240 = 110 to 240 Vac ±10% 50/60Hz. – Low Voltage Build.<br>500 = 220 to 500 Vac ±10% 50/60Hz. – Medium Voltage Build.<br>690 = 380 to 690 Vac ±10% 50/60Hz. – High Voltage Build. |
| 4 | XXXX | Four Digits describing the Mechanical Package Style.<br>*First Two Digits* — *Livery*<br>00 — Standard<br>05 — Distributor<br>*Third Digit* — *Firing Amplifier*<br>T — Trigger<br>A — Power Amplifier<br>*Fourth Digit* — *Operator Station*<br>0 — No Opstation<br>1 — 6901 Opstation |
| 5 through 7 | | As 590+. |
| 8 | XXX | Three Digits defining the required Auxiliary Supply Voltage.<br>0 = Universal Supply. 110 to 240 Vac ±10% 50/60Hz. — 60 Amp Product only.<br>115 = 110 to 120 Vac ±10% 50/60Hz. — 120 Amp Product requirement.<br>230 = 220 to 240 Vac ±10% 50/60Hz. — 120 Amp Product requirement. |
| 9 | XXX | Special Options. |