invensys
Eurotherm

Thyristor

Catalogue

Power
Switches

Power
Control

imagine making the impossible possible

Excellence in control and data management

Our formidable range of power products cover all types of load and voltage but **imagine** having the power to save energy. With many features like high performance alarm strategy and advanced diagnostic load fault detection, Eurotherm is the only choice for your power control applications. Add to this, an absolute commitment to technological innovation, constant reinvestment in research and development, and a team of dedicated experts who understand your problems and processes; we can and do **imagine** making the impossible possible for our customers.

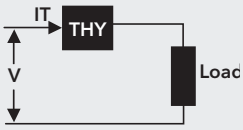
Complete product range
For the control of electrical heating or other switching applications, Eurotherm has a range of thyristor units to suit every need. Whether the load is constant or variable resistance, inductive or transformer coupled, single or three phase, we have thyristors to meet your exact requirements. Our standard range will cater for currents up to 630 amps but by using separate driver and power units, this range can be extended up to 4000 amps.

Choice of optimum firing mode
Thyristors can deliver power in long or short bursts - even down to half a cycle of the supply voltage - in order to match the load and heater requirements exactly. Alternatively, phase angle firing can be used for inductive or transformer coupled loads or applications where current limitation is required. This tight control of delivered power gives better temperature control which results in improved product quality. Additionally, the thyristor's ability to switch rapidly reduces the thermo-mechanical stresses on the heater elements, resulting in less downtime and lower maintenance costs.

Digital communications
Adding digital communications to thyristor units introduces further sophistication into process management. This enables digital accuracy in downloading setpoints and is ideal for large, multi-zone installations. The need for calibration of analogue signals is eliminated and wiring is reduced since only a single digital link is needed to connect all zones to a central programmer. Digital communications also provides logging of process parameters, energy consumption, abnormal conditions, faults and alarms.

Thyristor current calculations
The formulae opposite provide a simple way to calculate the thyristor current (IT) for various resistive loads. The calculated value of IT should then be multiplied by 1.2 to allow for variations in supply voltage and manufacturing tolerances of the load.

Single Phase

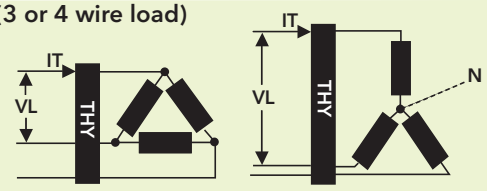


Thyristor current IT = p (watts) / V (volts)

Example: A 3kW load across 230 volts
$IT = \frac{3000}{230} = 13\ A$

Applying safety factor, current = 13 x 1.2 = 16A
A 16A, 230 volt thyristor unit can be used.

Three Phase (3 or 4 wire load)



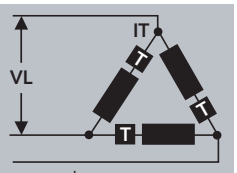
Thyristor current IT = p (watts) / 1.732 x VL (volts)

Example: A 60 kW load across 415V, 3 phase supply
$IT = \frac{60{,}000}{1.732 \times 415} = 83A$

Applying safety factor, current = 83 x 1.2 = 100A
A 100A, 415 volt three phase thyristor can be used.

HINT: If voltage = 415 volts, just multiply the number of kW by 1.4 to get IT.
E.g. In above example IT = 60 x 1.4 = 84A or multiply by 1.7 to include a 20% safety factor.

Three Phase (6 wire open delta)



IT = p (watts) / 3 x VL (volts)

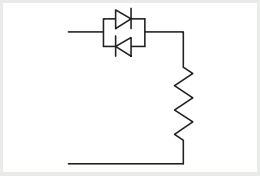
Example: A 100kW load with 415V, 3 phase supply
$IT = \frac{100{,}000}{3 \times 415} = 80A$

Applying safety factor, current = 80 x 1.2 = 96A
A 100A, 415 volt three phase thyristor can be used.

imagine having the power to save energy

invensys Eurotherm

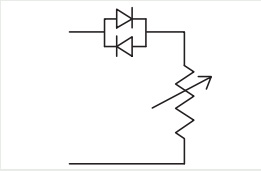
Load types



Resistive elements whose ohmic value does not change greatly over their temperature range

(Low temperature coefficient of resistance) e.g. Austentic alloys (NiCr, NiCrFe). Example trade name Nikrothal. Typical resistance change 7%

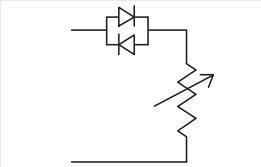
Constant Resistive Loads



Resistive whose ohmic value changes with temperature

(Especially elements with large positive temperature coefficient of Resistance) e.g. Tungsten (W), Molybdenum (Mo) or Molybdenum disilicide (MoSi2).
Trade name for latter is Kanthal Super. Resistance change 20:1

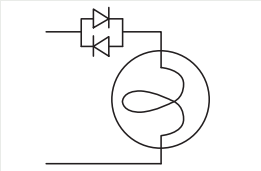
Variable Resistive Loads



Resistive elements whose ohmic value changes with time

(They may also have a temperature change of resistance) e.g. Silicon Carbide. Example trade name is Hot Rod. Typical resistance increase of 2 to 4 times with time (and temperature).

Variable Resistive Loads



Infrared Heaters

This will be dependent on the wave length of the headers

Long Wave

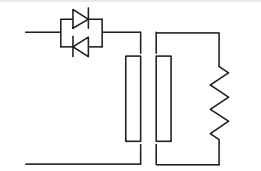
(>1.5μm) (and most Medium)

Constant Resistive Loads

Short Wave

(>1.5μm) (and some Medium)

Variable Resistive Loads



Resistive elements which are connected via a transformer

Variable Resistive Loads

?

Load characteristics unknown

Consult Eurotherm

How to use this catalogue

This catalogue enables the correct thyristor unit to be chosen to match your requirements:

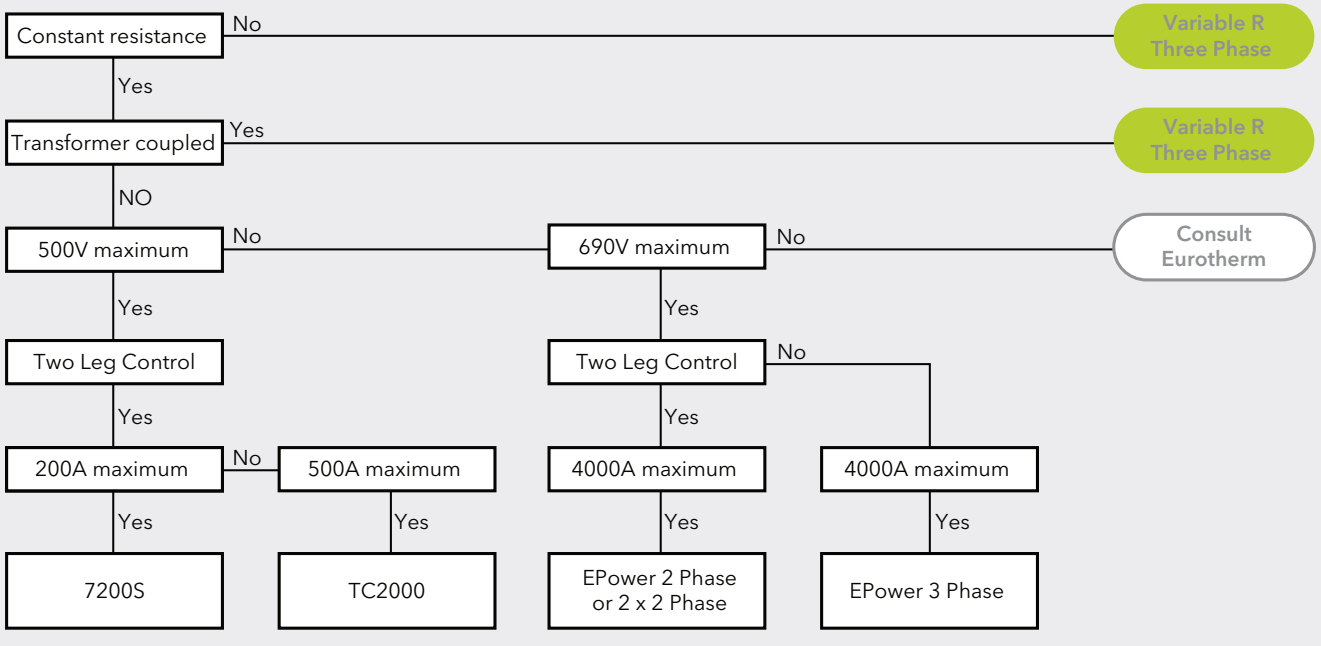
1. If you know what type of load you are using, then section headed "Load types" will provide a route to selecting a thyristor to suit that load.
2. If you know the features that you require of a thyristor, the "Thyristor features guide" section will allow you to select the thyristor with the appropriate characteristics.
3. The intermediate pages give additional information about the thyristors in relation to the specific load types.
4. On the page opposite you will find the formulae required to calculate the thyristor currents for resistive loads.

Thyristor selection charts

Constant resistive loads

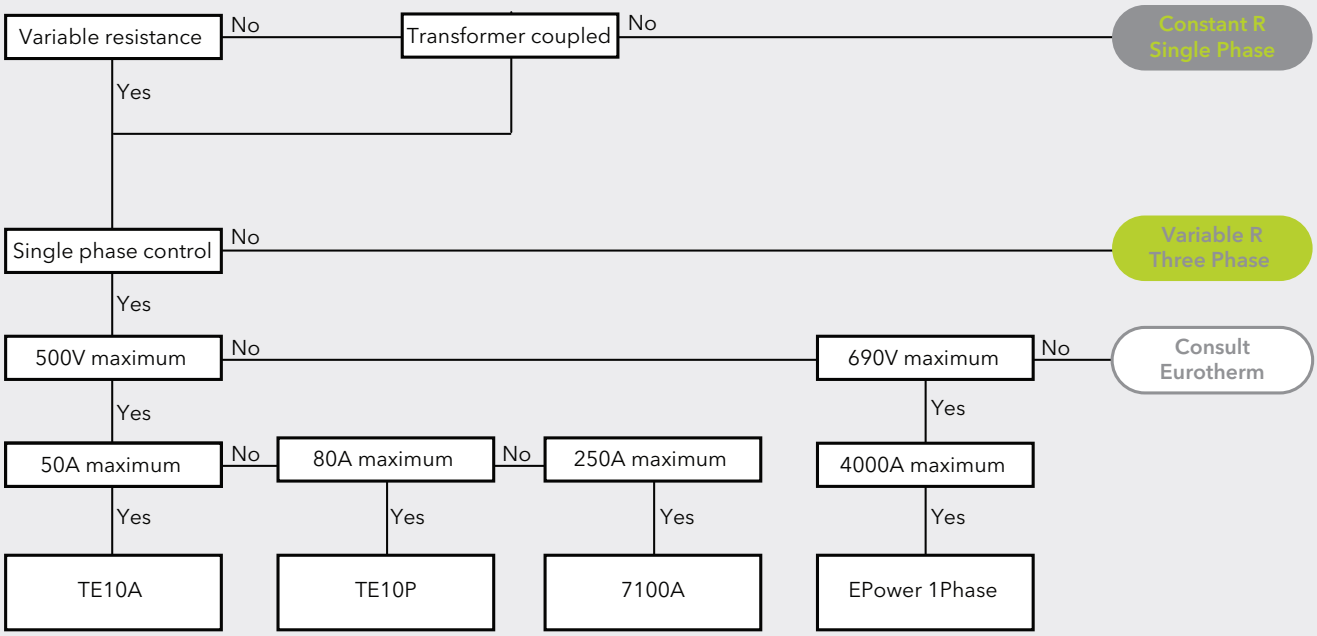
Single Phase Constant Resistive Loads Controlled by Power Switches

Three Phase Constant Resistive Loads Controlled by Power Switches

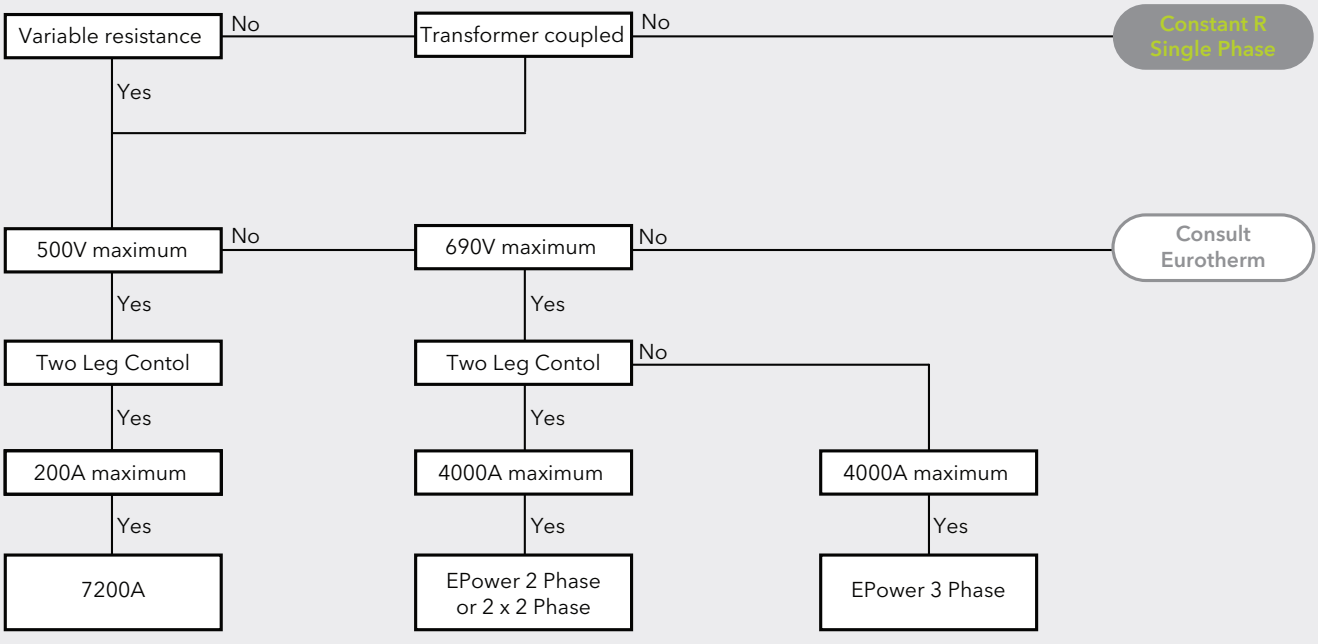


Variable resistive loads

Single Phase Variable Resistive Loads



Three Phase Variable Resistive Loads



Power Switches

Our Range of Power Switches extends up to 250A, for example, in the 7100S. In single phase, two leg control of 3 wire 3 phase systems, or true three phase models, they provide an ideal alternative for electromechanical contactors or mercury switches. With no moving parts to wear they offer high reliability, and long life.

With zero crossing burst firing, there is reduced electromagnetic interference (EMI) and no harmonic disturbance to the supply. Fast cycle switching is considerably faster than any electromechanical device and can dramatically extend the life expectancy of resistive heaters by reducing thermal stresses.

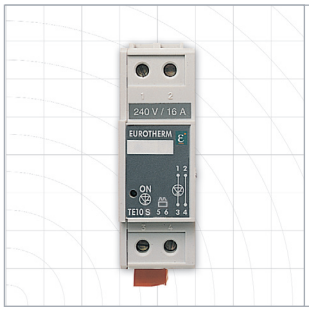
Single phase power switch – 7100L

- Current up to 100A
- Voltage up to 500V
- Simple installation and maintenance
- Small size
- Protected against transients
- Fast cycle times
- High reliability
- Zero volts switching

Constant Resistive Loads

Benefits/Ideal for
- Trace heating
- Refrigeration
- Environmental chambers
- Plastics extrusion
- Resistive loads

Single phase power switch – TE10S

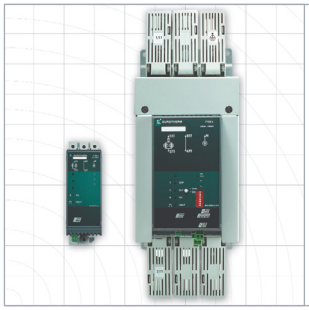


- Current up to 50A
- Voltages up to 500V
- Input Polarity insensitive,
- DC and AC Logic Input
- Partial Load Failure Detection
- Simple installation and maintenance

Constant Resistive Loads

Benefits/Ideal for
- Medium size ovens
- Refrigeration
- Plastic extrusion
- Paint drying
- Resistive and SWIR loads

Single phase power switch – 7100S



- Current up to 250A
- Voltage up to 500V
- Inputs: Logic (AC or DC)
- Analogue 4-20mA for Time Proportional Output
- Intelligent half cycle firing available
- Diagnostic Load Fault detection
- Thyristor short circuit alarm
- Overtemperature alarm
- Digital communications

Constant Resistive Loads

Benefits/Ideal for
- Trace heating
- Thermo-forming
- Multi-zone heating
- Autoclaves
- Ovens
- Paint drying
- Resistive and SWIR Loads

invensys
Eurotherm

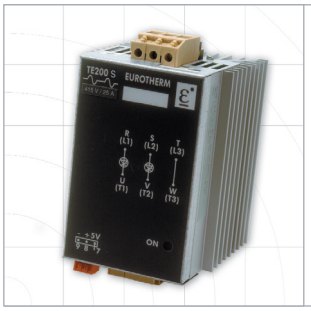
Two phase power switch – 7200S

- Current up to 200A
- Voltage up to 500V
- Logic Inputs (AC or DC)
- Analogue 4-20mA for Time Proportional Output
- Thyristor short circuit alarm
- Overtemperature alarm
- Diagnostic Load Fault detection
- Digital comms

Constant Resistive Loads

Benefits/Ideal for
- Injection moulding
- Thermo-forming
- Multi-zone heating
- Autoclaves
- Resistive loads

Two phase power switch – TE200S

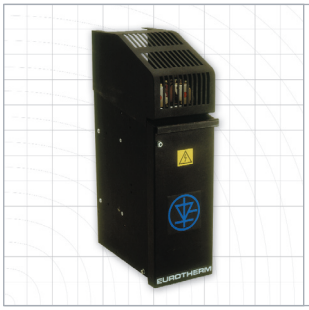


- Current up to 63A
- Voltage up to 500V
- Ergonomic design
- DC or AC logic input signal
- Firing mode: Logic ON/OFF, zero crossing firing with LED indication
- Nominal current per phase - 16-63A
- Supply voltage 200V ac to 500V ac

Constant Resistive Loads

Benefits/Ideal for
- Heat treatment
- Metallurgy
- Plastics
- Foods processing
- Environmental temperature control

Two phase power switch – TC2000

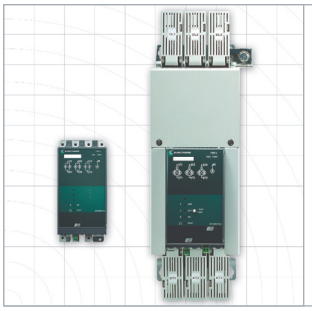


- Current up to 500A
- Voltage up to 500V
- Two leg control of three phase, three wire star or delta
- Phase rotation insensitive
- Diagnostic socket to aid commissioning
- Compact size

Constant Resistive Loads

Benefits/Ideal for
- Multi-zone heating
- Furnaces
- Ovens
- Resistive loads

Three phase power switch – 7300S



- Current up to 160A
- Voltage up to 500V
- Inputs: Logic (AC or DC)
- Analogue 4-20mA for Time Proportional Output
- Overtemperature alarm and shutdown
- Thyristor short circuit alarm
- Diagnostic Load Fault detection
- Digital comms

Constant Resistive Loads

Benefits/Ideal for
- Injection moulding
- Thermo-forming
- Multi-zone heating
- Autoclaves
- Resistive and SWIR loads

Power Control

Our range of power controllers can drive complex and transformer coupled loads. These products can take inputs from discrete controllers and plcs and have a wide range of full wave, half wave and phase angle firing modes to suit all load types.

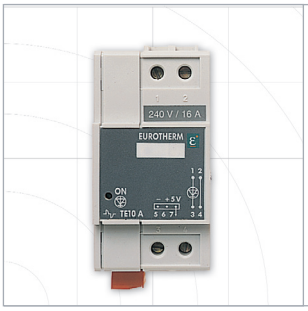
EPower™ controller

- 50 to 630A in compact version (integrated thyristors)
  800 to 4000A in decentralised version (external stack)
- Voltage up to 690V
- Modular Design
- Software Configurable
- QuickStart Easy Setup
- Advanced Configuration using Graphical Wiring Editor
- Predictive Load Management
- Flexible Communications

Variable Resistive Loads

Benefits/Ideal for
- Glass furnaces
- Melt heat treatment
- Food processing
- Multi-channel heaters
- High temperature furnaces
- Induction heating
- Vacuum furnace
- Large extruders

Single phase power controller – TE10A



- Current range 16 to 50A
- Voltage range 100 to 500V
- Compact : reduction in cabinet size
- Phase Angle Firing
- Advanced Single Cycle Operation
- Operating mode for short-wave infrared
- Internal EMC filter
- Compensation for supply fluctuations

Variable Resistive Loads

Benefits/Ideal for
- Paint drying
- Air conditioning
- Heat treatment
- Plastics extrusion
- Resistive, Inductive and SWIR loads

Single phase true power controller – TE10P

- Current range 16 to 80A
- Voltage range up to 500V
- True power control
- High precision control
- Modbus + Profibus comms
- Drives all load types

Variable Resistive Loads

Benefits/Ideal for
- Heat treatment
- Plastics
- Loads requiring high stability and accuracy
- Moving loads where the temperature is difficult to monitor
- Loads with characteristics that change with time or temperature

Single phase power controller – 7100A

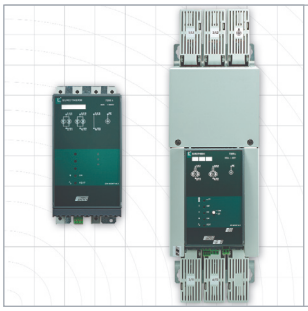
- Current range 16 to 250A
- Voltage range 100 to 500V
- Firing modes to suit all loads
- Current limit
- Alarm options
- Power control

Variable Resistive Loads

Benefits/Ideal for
- Glass lehrs
- Metal furnaces
- Semi-conductor manufacture
- Induction heating
- Complete loads

invensys
Eurotherm

Two phase power controller– 7200A

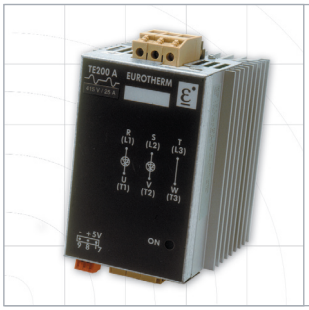


- Current range 16 to 220A
- Voltage range 200 to 500V
- Two Independent Channels
- Inputs 0-20mA or 4-20mA, 0-5V or 0-10V
- Firing modes: Burst, Single cycle
- Thyristor Overtemperature alarm
- Current limit option
- Partial load failure detection
- Thyristor short circuit
- Load open circuit

Variable Resistive Loads

Benefits/Ideal for
- Glass lehrs
- Metal furnaces
- Ceramic furnaces
- Semi-conductor manufacture
- Induction heating
- Transformer coupled loads
- Complex loads

Two leg three phase burst firing power controller – TE200A



- Current range 16 to 63A
- Voltage range 200 to 500V
- Input voltage 0-5Vdc, 0-10V dc
- Input current 4-20mA
- Analog input configured as voltage, current or potentiometer
- Burst firing or single cycle firing modes
- Ergonomic design
- Nominal current per phase 16-63A

Variable Resistive Loads

Benefits/Ideal for
- Heat treatment
- Metallurgy
- Food processing
- Plastics
- Environmental temperature control

Three phase power Controller – 7300A

- Current range from 16-160A
- Voltage 200 to 500V
- Input current: 0-20mA or 4-20mA
- Input voltage: 0-5V or 0-10V
- Multiple firing modes
- Suitable for virtually all load types
- Digital communications
- Current limit option

Variable Resistive Loads

Benefits/Ideal for
- Injection moulding
- Thermo-forming
- Multi-zone heating
- Autoclaves
- Resistive loads

Three phase burst firing power controller – TE300

- Nominal current per phase 16 to 63A
- Voltage up to 500V
- Ergonomic design
- Burst firing, single cycle and advanced single cycle firing modes

Variable Resistive Loads

Benefits/Ideal for
- Paint drying (car industry)
- Metallurgy
- Plastics
- Food sector
- Environmental temperature control

Related power control products

EPower™ MC Controller is the Eurotherm series of power management and control units for high current values. Combining the advantages of the latest technologies and innovations to produce a truly impressive performance for your process.

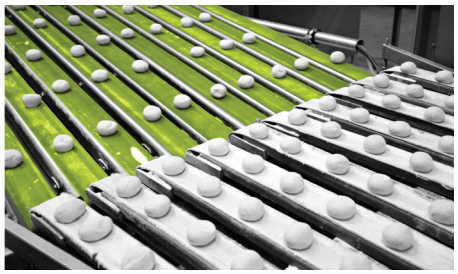
Thyristor selection guides

Power Switches		Single Phase			Multi Phase			
Features		**7100L**	**TE10S**	**7100S**	**7200S**	**TE200S**	**TC2000**	**7300S**
Heater Type	**Constant Resistance**	●	●	●	●	●	●	●
	SWIR (Short wave infrared)	none	●	●	●	●	●	●
Maximum Voltage (Volts)		500V	500V	500V	500V	500V	500V	500V
Maximum Current (Amps)		100A	50A	250A	200A	63A	500A	160A
Controlled Phases		1	1	1	2	2	2	3
Input	**Analogue**	none	none	●	●	none	●	●
	Logic	●	●	●	●	●	●	●
Firing Mode	**Burst Firing**	●	●	●	●	●	●	●
PLF and/or PLU		none	●	●	●	none	●	●
Diagnostics		none	none	●	●	none	●	●
Alarms		none	●	●	●	none	●	●
Digital Communications		none	none	Modbus	Modbus	none	none	Modbus

invensys
Eurotherm





Power Control		EPower™ Controller	Single Phase			Multi Phase			
Features		EPower Controller	TE10A	TE10P	7100A	7200A	TE200A	7300A	TE300
Heater Type	Constant Resistance	●	●	●	●	●	●	●	●
	SWIR (Short wave infrared)	●	●	●	●	●	●	●	●
	Variable Resistance	●	●	●	●	none	none	●	none
	Inductive/Transformer Coupled	●	●	●	●	none	none	●	none
True Power Control		●	none	none	●	none	none	●	none
Maximum Voltage (Volts)		690V	500V	500V	500V	500V	500V	500V	500V
Maximum Current (Amps)		Compact 50-630A Decentralised 800-4000A (MC)	50A	80A	250A	200A	63A	160A	63A
Controlled Phases		1-4 x 1, 1-2 x 2 or 3	1	1	1	2	2	3	3
Input	Analogue	●	●	●	●	●	●	●	●
	Logic	●	●	●	●	●	●	●	●
Firing Mode	Phase Angle	●	●	●	●	none	none	●	none
	Burst Firing	●	●	●	●	●	●	●	●
PLF and/or PLU		●	none	●	●	●	none	●	none
Current Limit		●	●	●	●	none	none	●	none
Diagnostics		●	none	●	●	●	none	●	none
Alarms		●	none	none	●	●	none	●	none
Digital Communications		Profibus, EtherNet/IP, CC-Link, DeviceNet, Modbus, Modbus TCP, ProfiNet	none	Profibus, Modbus	none	none	none	Modbus	none

Eurotherm:
International sales and service

www.eurotherm.com

AUSTRALIA *Melbourne*
Invensys Process Systems
Australia Pty. Ltd.
T (+61 0) 8562 9800
F (+61 0) 8562 9801
E *info.eurotherm.au@invensys.com*

AUSTRIA *Vienna*
Eurotherm GmbH
T (+43 1) 7987601
F (+43 1) 7987605
E *info.eurotherm.at@invensys.com*

BELGIUM & LUXEMBOURG
Moha
Eurotherm S.A./N.V.
T (+32) 85 274080
F (+32) 85 274081
E *info.eurotherm.be@invensys.com*

BRAZIL *Campinas-SP*
Eurotherm Ltda.
T (+5519) 3707 5333
F (+5519) 3707 5345
E *info.eurotherm.br@invensys.com*

CHINA
Eurotherm China
T (+86 21) 61451188
F (+86 21) 61452602
E *info.eurotherm.cn@invensys.com*

Beijing Office
T (+86 10) 5909 5700
F (+86 10) 5909 5709/10
E *info.eurotherm.cn@invensys.com*

FRANCE *Lyon*
Eurotherm Automation SA
T (+33 478) 664500
F (+33 478) 352490
E *info.eurotherm.fr@invensys.com*

GERMANY *Limburg*
Invensys Systems GmbH
>EUROTHERM<
T (+49 6431) 2980
F (+49 6431) 298119
E *info.eurotherm.de@invensys.com*

INDIA *Mumbai*
Invensys India Pvt. Ltd.
T (+91 22) 67579800
F (+91 22) 67579999
E *info.eurotherm.in@invensys.com*

IRELAND *Dublin*
Eurotherm Ireland Limited
T (+353 1) 4691800
F (+353 1) 4691300
E *info.eurotherm.ie@invensys.com*

ITALY *Como*
Eurotherm S.r.l
T (+39 031) 975111
F (+39 031) 977512
E *info.eurotherm.it@invensys.com*

KOREA *Seoul*
Invensys Operations Management
Korea
T (+82 2) 2090 0900
F (+82 2) 2090 0800
E *info.eurotherm.kr@invensys.com*

NETHERLANDS *Alphen a/d Rijn*
Eurotherm B.V.
T (+31 172) 411752
F (+31 172) 417260
E *info.eurotherm.nl@invensys.com*

POLAND *Katowice*
Invensys Eurotherm Sp z o.o.
T (+48 32) 7839500
F (+48 32) 7843608/7843609
E *info.eurotherm.pl@invensys.com*

Warsaw
Invensys Systems Sp z o.o.
T *(+48 22) 8556010*
F *(+48 22) 8556011*
E *biuro@invensys-systems.pl*

SPAIN *Madrid*
Eurotherm España SA
T (+34 91) 6616001
F (+34 91) 6619093
E *info.eurotherm.es@invensys.com*

SWEDEN *Malmo*
Eurotherm AB
T (+46 40) 384500
F (+46 40) 384545
E *info.eurotherm.se@invensys.com*

SWITZERLAND *Wollerau*
Eurotherm Produkte (Schweiz) AG
T (+41 44) 7871040
F (+41 44) 7871044
E *info.eurotherm.ch@invensys.com*

UAE DUBAI
Invensys Middle East FZE
T (+971 4) 8074700
F (+971 4) 8074777
E *marketing.mena@invensys.com*

UNITED KINGDOM *Worthing*
Eurotherm Limited
T (+44 1903) 268500
F (+44 1903) 265982
E *info.eurotherm.uk@invensys.com*

U.S.A. *Ashburn VA*
Invensys Eurotherm
T (+1 703) 724 7300
F (+1 703) 724 7301
E *info.eurotherm.us@invensys.com*

ED68
Contact details correct at time of print.

Eurotherm is also represented in the following countries:

Afghanistan
Albania
Algeria
Angola
Argentina
Armenia
Azerbaijan
Bahrain
Bangladesh
Barbados
Belarus
Bermuda
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei Darussalam
Bulgaria
Cambodia
Cameroon
Canada
Central African Republic
Chad
Chile
Colombia
Congo
Costa Rica
Côte d'Ivoire
Croatia
Cyprus
Czech Republic
Denmark
Djibouti
Ecuador
Egypt
El Salvador
Eritrea
Estonia
Ethiopia
Fiji
Finland
Georgia
Ghana
Greece
Greenland
Guinea
Hungary
Iceland
Indonesia
Iraq
Israel
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kuwait
Kyrgyzstan
Laos
Latvia
Lesotho
Libya
Lithuania
Macedonia
Madagascar
Malaysia
Malta
Micronesia
Moldova
Morocco
Mozambique
Myanmar
Namibia
Nicaragua
Niger
Nigeria
Norway
Oman
Pakistan
Palestinian Territory
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Qatar
Romania
Russia
Rwanda
Saudi Arabia
Senegal
Serbia and Montenegro
Sierra Leone
Singapore
Slovakia
Slovenia
Somalia
South Africa
Sri Lanka
Sudan
Swaziland
Syria
Tajikistan
Tanzania
Thailand
The Gambia
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
United Arab Emirates
Uruguay
Uzbekistan
Venezuela
Vietnam
Yemen
Zambia
Zimbabwe

Represented by:

Eurotherm Part No. HA026173 Issue 7

Printed in England on recycled paper 05.10

invensys
Operations Management