OZtherm™

Digital Power Controller

F-311

SINGLE PHASE S.C.R. CONTROLLER

*

FEATURING
PHASE ANGLE SWITCHING
FOR CONTROL OF
AC OR DC
OUTPUT

*

DESIGNED
and
MANUFACTURED
by

Fastron
TECHNOLOGIES PTY. LTD.

OZtherm™ Range of Digital Power Controllers

Fastron first released their " X " Series of S.C.R. Power Controllers in 1980, progressively developing over 20 different models and selling over 1000 controllers worldwide.

These controllers were primarily designed as custom built, open frame, OEM assemblies sold directly to equipment manufacturers.

The **OZtherm**™ range of controllers capitalize on our experience in this field to provide a reliable and robust design housed in a series of standard assemblies and enclosures.

- **F100 SERIES** ..... Contactors utilizing CRYDOM solid state relays mounted on a Heat Sink Assembly with fuses and transient suppressors.
- **F200 SERIES** ..... Solid State Contactors utilizing S.C.R.`s and control card mounted in standard enclosures.
- **F300 SERIES** ..... Phase Angle Controllers utilizing S.C.R.`s and control card mounted in standard enclosure`s
- **F400 SERIES** ..... Burst Controllers, similar to F300 in construction, featuring fast cycle, zero cross switching.

BENEFITS OF THE OZtherm™ F311 PHASE ANGLE CONTROLLER

- Continuously variable control, 0 - 100%
- Digital Control eliminates the D.C offset into transformer loads which is commonly found on inferior controllers.
  This also provides more precise and stable control whilst minimizing nuisance tripping of circuit breakers and blowing of fuses due to transformer saturation.
- Wide range of standard options to suit many applications
- Proudly Australian Designed and Manufactured in our Melbourne factory enabling us to provide complete local support for customer applications, engineering and service.

PHASE ANGLE SWITCHING

Phase Angle Control provides continuously variable power to the load.

The firing of the thyristors is determined by the controller circuitry which causes the thyristors to conduct for part of the A.C supply cycle. **Fig.2** shows the voltage waveform at 75% and **Fig.3** 25% for A.C loads.

The more power that is required, the more the conduction angle is increased until 100% power when the full cycle is conducting. **Fig.1**

FULL OUTPUT

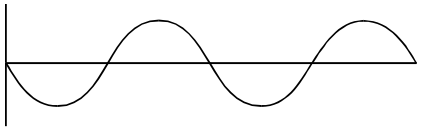

Fig.1

75% OUTPUT

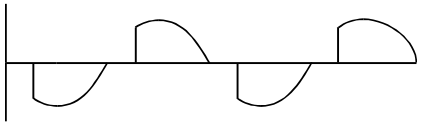

Fig.2

25% OUTPUT

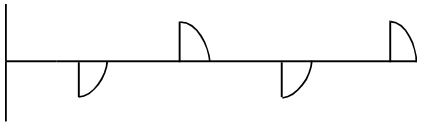

Fig.3

MODEL DESIGNATION / ORDER CODE

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F311 -		-		-	DESCRIPTION	Fuse Rating	Case Size	Weight KG	Cable Termination mm^2	Dissipation Watts	I^2t Thyristor Rating
Line Voltage	**1**				110 volt A.C line input						
	2				240 volt A.C line input						
	4				415 volt A.C line input						
Rated Current at 50 deg. Celcius.	**25**				25 amperes A.C line current	25	fig.4	5	2.5 - 6.	48	610
	40				40 amperes A.C line current	45	fig.4	5	10 - 16.	68	1,060
	50				50 amperes A.C line current	55	fig.4	5	10 - 16.	72	2,300
	65				65 amperes A.C line current	75	fig.4	5	10 - 25.	88	5,000
	75				75 amperes A.C line current	90	fig.4	5	10 - 25.	94	9,100
	100				100 amperes A.C line current	125	fig.4	5	10 - 25.	111	16,200
	110				110 amperes A.C line current	125	fig.4	5	M10 bolt	122	27,600
	125				125 amperes A.C line current	150	fig.4	5	M10 bolt	124	97,000
	150F				150 amperes A.C line current - fan	150	fig.5	6	M10 bolt	176	16,200
	180F				180 amperes A.C line current - fan	225	fig.5	6	M10 bolt	194	84,000
	200F				200 amperes A.C line current - fan	225	fig.5	6	M10 bolt	204	97,000
	250				250 amperes A.C line current	300	fig.6	26	M10 bolt	345	90,600
	300				300 amperes A.C line current	400	fig.6	26	M10 bolt	423	106,000
	350				350 amperes A.C line current	400	fig.6	26	M10 bolt	458	238,000
	400F				400 amperes A.C line current - fan	400	fig.6	26	M10 bolt	533	106,000
	500F				500 amperes A.C line current - fan	500	fig.6	26	M10 bolt	593	238,000
	650F				650 amperes A.C line current - fan	350x2	fig.6	26	M10 bolt	795	781,000
	750F				750 amperes A.C line current - fan	400x2	fig.6	26	M10 bolt	826	2x10^6
	900F				900 amperes A.C line current - fan	500x2	fig.7	40	M10 bolt	1174	781,000
	1100F				1100 amperes A.C line current - fan	600x2	fig.7	40	M10 bolt	1270	2x10^6

Options.	**A**	A.C. Voltage regulation.	
	C	Current limit and trip.	A.C. current measurement.
	CC	Voltage limit and current trip. Current source	A.C. current measurement.
	F	High speed fuses.	
	MD	Meter output of input control signal.	
	MI	Meter output of average current.	Requires C or CC option.
	MP	Meter output of average power.	Requires PW option.
	MV	Meter output of average voltage.	Requires A or D option.
	PW	Power limit.	Requires A and C options.
	T	Thermal cutout.	Standard on fan models.

APPLICATION LOAD / OPTION SELECTION (Table 1)

Series Name	Primary Control of Transformer	Number	Applicable Load	Option Selection
F311	**YES**	**1**	Load where resistance does not change (Class A)	Standard type
		2	Load where resistance changes with temp (Class B)	CC option
		3	Load where resistance changes over the elements lifetime. (Class C - Silicon Carbide, etc)	PW option
		4	Load which has peak in rush current	C option

DESCRIPTION OF OPTIONS (Table 2)

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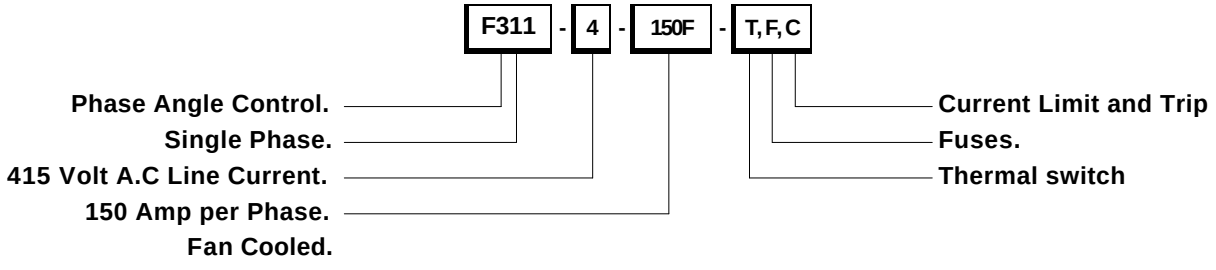
OPTION	DESCRIPTION	APPLICATION
A	Regulates output voltage when input voltage fluctuates.	Used where significant supply fluctuations can cause;- nuisance current limit / trip operation; excessive power to the load and erratic control.
C	Maintains current output to a predetermined level for A.C systems. Current limit can be set by internal or external potentiometer. LED indicates current limit operation. Current trip is adjustable " on board " and volt free output contact is provided for external indication. The trip function inhibits operation until manually reset. (A.C. Current transformer supplied loose.)	Typically used with constant resistance and transformer loads. Reduces output to match and protect lower rated loads. (Control input controls output voltage)
CC	Current source operation Voltage limit and current trip independently adjustable by internal potentiometer. Maintains constant current under variable resistance loads for A.C. systems (A.C. Current transformer supplied loose.)	Particularly suitable for plating rectifiers via primary A.C transformers. (Control input controls output current)
F	Supplied loose with isolated stand-offs for external mounting.	
MD	0 -1 milliamp retransmission of input control signal.	Suitable for 1 milliamp moving coil meter.
MI	Single 0 -1 milliamp D.C output signal proportional to the average output current.	Suitable for 1 milliamp moving coil meter.
MP	Similar to MI. option but indicating average output power.	Suitable for 1 milliamp moving coil meter.
MV	Similar to MI. option but indicating average output voltage.	Suitable for 1 milliamp moving coil meter.
PW	Output is monitored to maintain a preset average VA limit. (This function can be used on current source systems and a unity power factor is assumed.)	Designed for critical loads such as silicon carbide elements which require a watts density limit for maximizing element life.
T	Thermal switch is mounted on the heatsink to ensure the unit is shut off when an over temperature condition is reached within the unit. Reset is automatic when temperature falls below the trip level. This option is standard on fan cooled units.	



ORDERING EXAMPLE

DIMENSIONS / MOUNTING DETAILS

Shown mounted vertically in cabinet

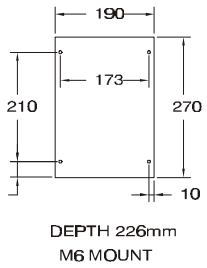


Fig.4

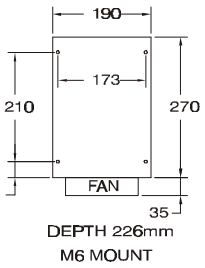


Fig.5

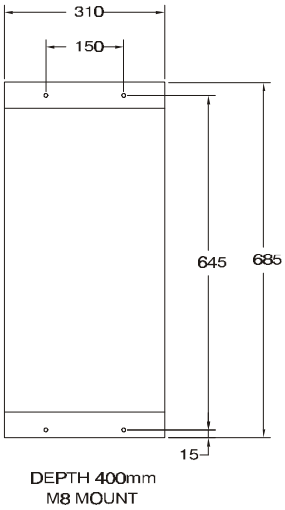


Fig.6

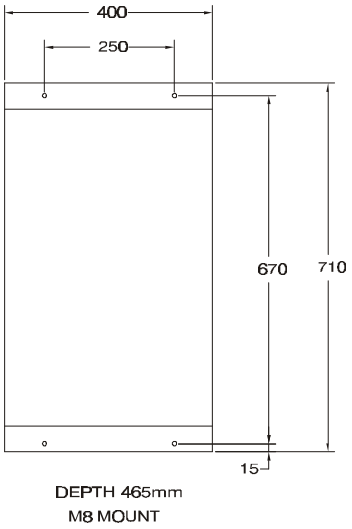
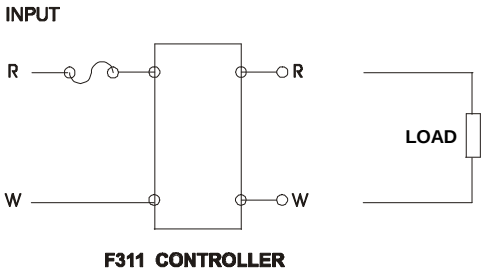


Fig.7



STANDARD SPECIFICATIONS (Table 3)

Control Mode	Phase angle. (soft start provided as standard)
Control Range	0 - 100%
Maximum Current	25 - 1100 amperes (higher currents available on request)
Power Supply	110 / 240 / 415 volts A.C . 50 HZ. +/- 10% (60Hz and other voltages on request)
Transient Protection	Internal R.C snubber
Control Input	4 - 20 milliamps (receiving impedance 100 ohms) 0 - 10 volts (receiving impedance 10K ohms) 10K ohms potentiometer
Adjustments	Ramp (soft start time) 1-20 seconds Zero (- 20% to +20%) ; span (0 - full scale)
Ambient Temperture	0 - 50 degrees Celsius (Maximum temperture of cooling air)
Ambient Humidity	0 - 85% relative humidity
Power Factor	Unity

PLEASE NOTE;- If your application requires the Power Controller to function differently to our standard specifications or you are uncertain about the choice of options please contact the factory.

OZTHERM POWER PRODUCTS

Thyristor based power controllers offer numerous benefits.
They are a reliable replacement for electromechanical contactors , being virtually maintenance free.
Thyristor based power controllers are ideal for controlling complex loads , such as heating elements that change resistance over time or temperature , transformer coupled loads , plating rectifiers and fast systems.

PRINCIPLE OF OPERATION

Oztherm power controllers consist of two main parts , the control electronics and the power switching electronics.
Thyristors , also known as SCRs , are used as the power switching devices.
A thyristor functions like a diode that can be “turned on” by a momentary pulse to its gate.When a thyristor has been turned on via its gate and its anode is positive relative to its cathode it will conduct.
The thyristor turns itself off when there is near zero current through it.
To control full wave AC over the positive and negative half cycle two thyristors arranged in inverse parallel are required.
The control electronics provide the firing impulses for the thyristor gates.The control input signal is measured and the timing of the gate firing impulses are varied in response to it.

Three types of firing mode are available on Oztherm power controllers.
Phase angle control works by varying the conduction angle of the AC sine wave.
Burst control modulates power by turning the thyristors on and off for AC cycles.The control electronics turn the thyristors on at a position determined by the control signal and off at zero current. The output is the ratio of OFF time to ON time.
On/ Off control is similar to burst control and is like an “electronic relay” in operation.
F100 and F200 series power controllers use the on/ off firing mode
F300 series power controllers use the phase angle firing mode.
F400 series power controllers use the burst firing mode.

SELECTING THE CORRECT CONTROLLER FOR HEATING ELEMENT TYPES

Heating elements can be broadly divided into three categories:-

CLASS A
These elements have negligible resistance variation with either temperature or time. Examples include: Nickel/Chromium or similar alloys.

CLASS B

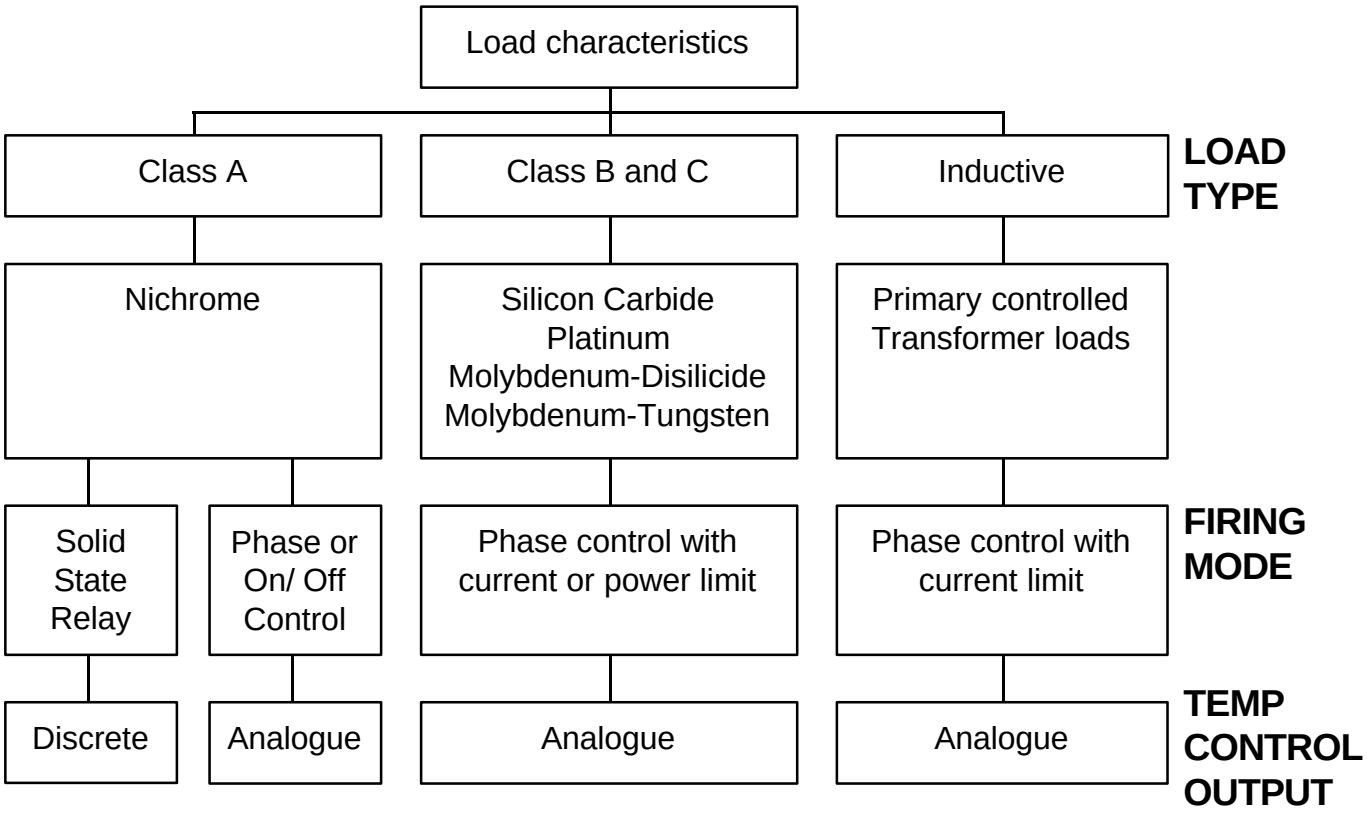
These elements have a low cold temperature resistance that increases greatly at operating temperature. Examples include: Molybdenum Disilicide, Platinum and Molybdenum Tungsten

Class B elements usually require current limit on start up, as their low cold resistance results in high currents at the operating supply voltage.These elements may also require a stepdown transformer to match the supply voltage to the rated element voltage.
Because current limit is required,and the element voltage ratings are less than line voltage,phase angle control (F300 series controllers) is the recommended firing mode.

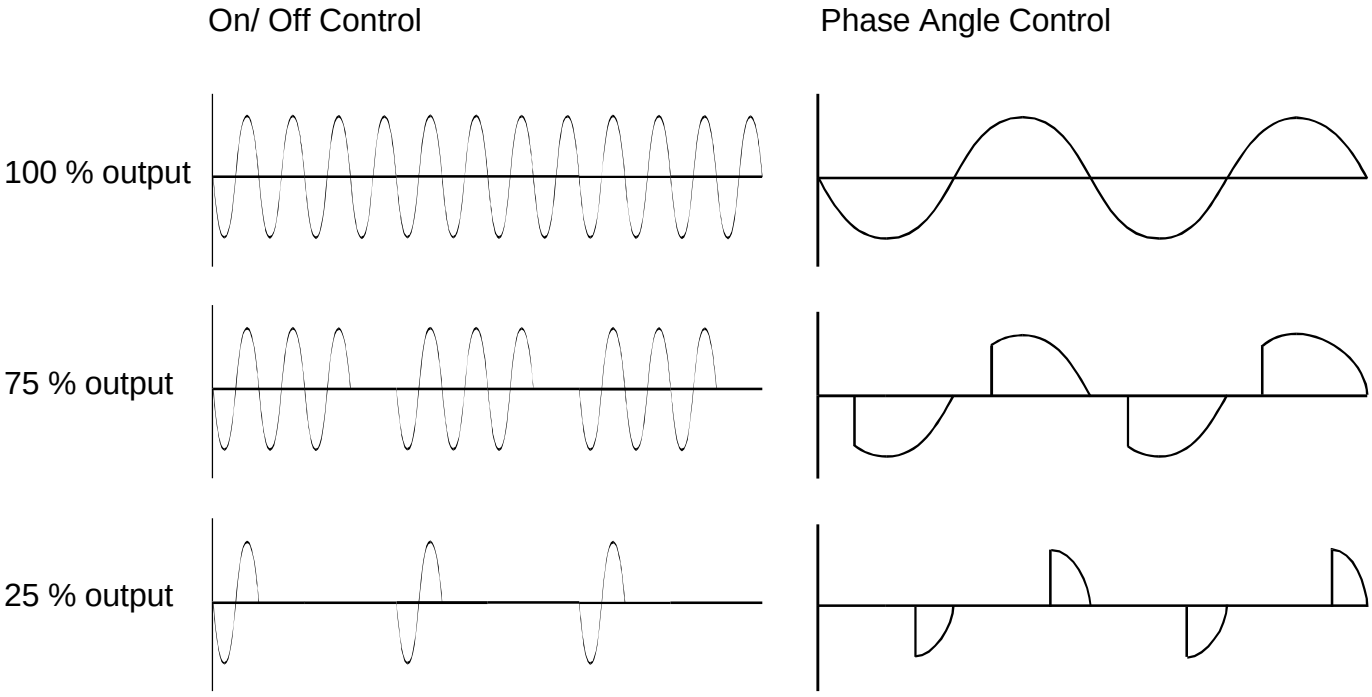
CLASS C

The resistance of these elements increases greatly with time in use (typically 2 to 4 times) and with temperature.Silicon carbide is a common example .The power controller must be sized so that it can deliver the higher currents required to maintain the desired power when the elements are new. If the elements are sized correctly the use of a stepdown transformer may be avoided.
The power limit (PW) option is recommended for this class of element as it compensates for element ageing and limits the maximum load power. Phase angle (F300 series controllers) is the recommended firing mode.

CONTROLLER SELECTION AND ELEMENT TYPE



VOLTAGE WAVEFORMS FOR ON/ OFF AND PHASE ANGLE CONTROL



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