OZtherm™

Digital Power Controller

F-431

3 PHASE S.C.R. CONTROLLER

*

FEATURING
FAST CYCLE BURST SWITCHING
FOR CONTROL OF 3 PHASE
AC 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™ F431 BURST CONTROLLER

- Continuously variable control, 0 - 100%
- Digital Control and zero cross switching eliminates line harmonics
- Wide range of standard options to suit many applications
- Unity power factor from zero cross switching
- Proudly Australian Designed and Manufactured in our Melbourne factory enabling us to provide complete local support for customer applications, engineering and service.

FAST CYCLE BURST SWITCHING

Fast Cycle Burst Control provides continuously variable power to the load by switching groups of 16 whole cycles in a minimum submultiple consistent with the required duty cycle.

The firing of the thyristors is determined by the controller circuitry which causes the thyristors to conduct for whole A.C cycles. **Fig.2** shows the voltage waveform at 75% (3 cycles on, 1 cycle off) and **Fig.3** 25% (1 cycle on, 3 cycles off) for A.C loads.

The more power that is required, the more the duty cycle is increased until 100% power when all cycles are conducting. **Fig.1**

FULL OUTPUT

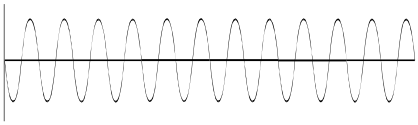


Fig.1

75% OUTPUT

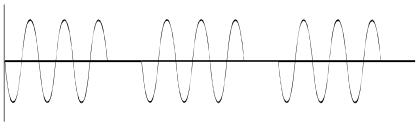


Fig.2

25% OUTPUT

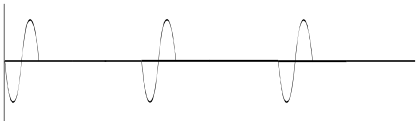
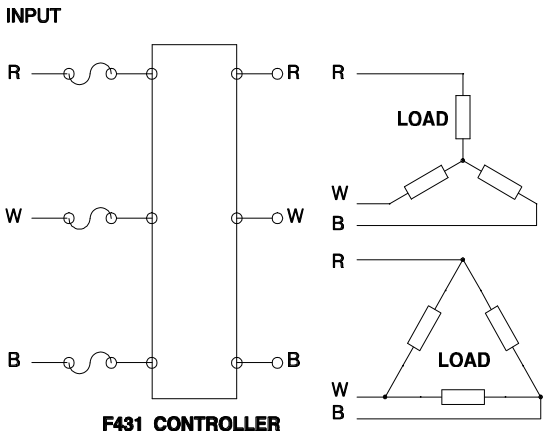
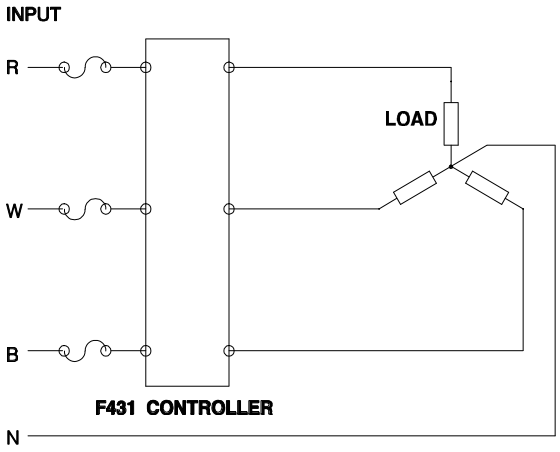


Fig.3

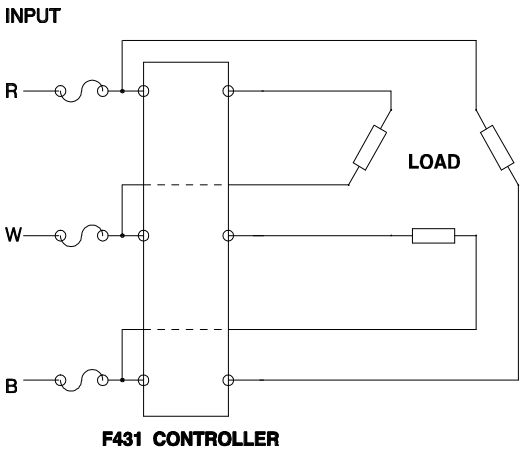
CIRCUIT CONFIGURATIONS



3 WIRE STAR OR DELTA



4 WIRE STAR



6 WIRE OPEN DELTA

APPLICATION LOAD / OPTION SELECTION (Table 3)

Series Name	Primary Control of Transformer	Number	Applicable Load	Option Selection
F430	NO	1	Load where resistance does not change. (Nichrome, Iron-chrome, Kanthal, etc.)	Standard type C option
		2	Load which has peak in rush current. (Tungsten Halogen Lamp, Far infrared lamp etc.)	C option

MODEL DESIGNATION / ORDER CODE

OZtherm™

F431 -		-		-	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.		**20**			20 amperes A.C line current	25	fig.5	10	2.5 - 6.	119	610
		30			30 amperes A.C line current	35	fig.5	10	2.5 - 6.	134	2,300
		40			40 amperes A.C line current	45	fig.5	10	10 - 16.	165	5,000
		50			50 amperes A.C line current	55	fig.5	10	10 - 16.	188	9,100
		70			70 amperes A.C line current	75	fig.5	10	10 - 25.	232	16,200
		80			80 amperes A.C line current	90	fig.5	10	10 - 25.	241	97,000
		100F			100 amperes A.C line current - fan	100	fig.6	12	M6 bolt	333	16,200
		120			120 amperes A.C line current	125	fig.7	26	M10 bolt	393	24,000
		130			130 amperes A.C line current	150	fig.7	26	M10 bolt	386	97,000
		150F			150 amperes A.C line current - fan	150	fig.7	28	M10 bolt	505	24,000
		150			150 amperes A.C line current	175	fig.7	26	M10 bolt	502	168,000
		175			175 amperes A.C line current	200	fig.7	26	M10 bolt	482	245,000
		200F			200 amperes A.C line current - fan	250	fig.7	28	M10 bolt	657	84,000
		240F			240 amperes A.C line current - fan	250	fig.7	28	M12 bolt	755	97,000
		280F			280 amperes A.C line current - fan	300	fig.7	28	M12 bolt	995	168,000
		340F			340 amperes A.C line current - fan	375	fig.7	28	M12 bolt	1016	245,000
		400F			400 amperes A.C line current - fan	400	fig.8	60	M10 bolt	1600	106,000
		500F			500 amperes A.C line current - fan	500	fig.8	60	M10 bolt	1780	238,000
		650F			650 amperes A.C line current - fan	350x2	fig.8	60	M10 bolt	2384	781,000
		750F			750 amperes A.C line current - fan	400x2	fig.8	60	M10 bolt	2479	2x10^6
		900F			900 amperes A.C line current - fan	500x2	fig.9	98	M10 bolt	3523	781,000
		1100F			1100 amperes A.C line current - fan	600x2	fig.9	98	M10 bolt	3810	2x10^6

Options.	**C**	Current limit and trip.	A.C. current measurement
	F	High speed fuses.	
	FW	4 wire load.	Three phase and neutral.
	MD	Meter output of input control signal.	
	MI	Meter output of average current.	Requires C option.
	MP	Meter output of average power.	Requires PW option.
	PH	Phase loss output.	
	PW	Power limit.	Requires C option.
	PLF	Partial load failure.	Requires C option.
	T	Thermal cutout.	Standard on fan models.

ORDERING EXAMPLE

F431 - 4 - 150F - P, F, C

- **Burst Control.**
- **Three Phase.**
- **415 Volt A.C Line Current.**
- **150 Amp per Phase.**
- **Fan Cooled.**
- **Current Limit and Trip**
- **Fuses.**
- **Partial Load Failure**

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.**

DESCRIPTION OF OPTIONS (Table 2)

OPTION	DESCRIPTION	APPLICATION
C	Maintains average 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 transformers supplied loose.)	Typically used with constant resistance and transformer loads. (Control input controls output voltage)
F	Supplied loose with isolated stand-offs for external mounting.	
FW	4 wire load.	Three phase and neutral.
MD	0 - 1 mA retransmission of input control signal	Suitable for 1 milliamp moving coil meter.
MI	Single 0 - 1 mA output D.C. output signal proportional to the average of the summation of the output current of each of the three phases.	Suitable for 1 millamp moving coil meter.
MP	Single 0 - 1 mA output D.C. output signal proportional to the average of the summation of the output power of each of the three phases.	Suitable for 1 millamp moving coil meter.
PH	For indication of loss of a phase including momentary loss. A latched volt free contact is provided which will stay latched until manually reset.	
PW	A quasi power limit similar to option C and averaged over all three phases. A balanced load and a unity power factor is assumed.	
PLF	A reduction in output current from normal levels is sensed and signalled by an LED and by a volt free output contact for external indication.	Designed for sensing open or faulty load elements
T	Thermal switch is mounted on the heatsink to ensure the controller is shut off, and automatically resets when an over temperature condition is reached within the unit. This option is standard on fan cooled units. It automatically resets when temperature falls below the trip level.	

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STANDARD SPECIFICATIONS (Table 1)

Control Mode	Fast Cycle Burst
Control Range	0 - 100%
Maximum Current	20 - 450 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 68 ohms / .1 micro-farad
Control Input	4 - 20 milliamps (receiving impedance 100 ohms) 0 - 10 volts (receiving impedance 10K ohms) 10K ohms potentiometer
Adjustments	Ramp 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

DIMENSIONS / MOUNTING DETAILS

Shown mounted vertically in cabinet

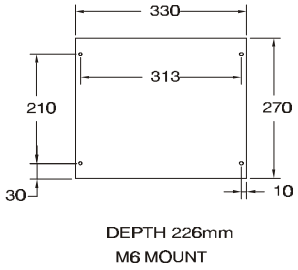

Fig.5

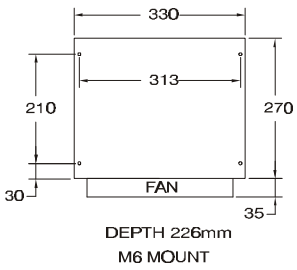

Fig.6

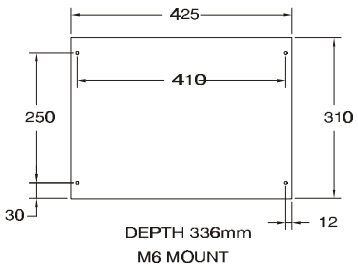

Fig.7

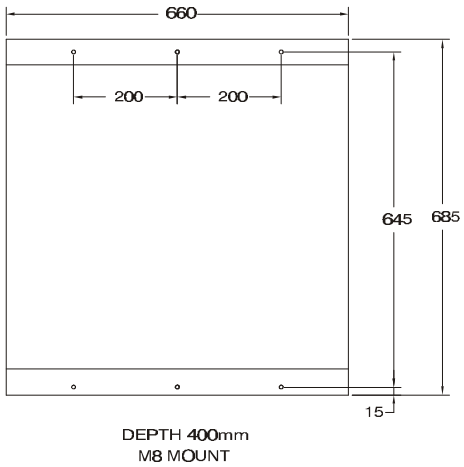

Fig.8

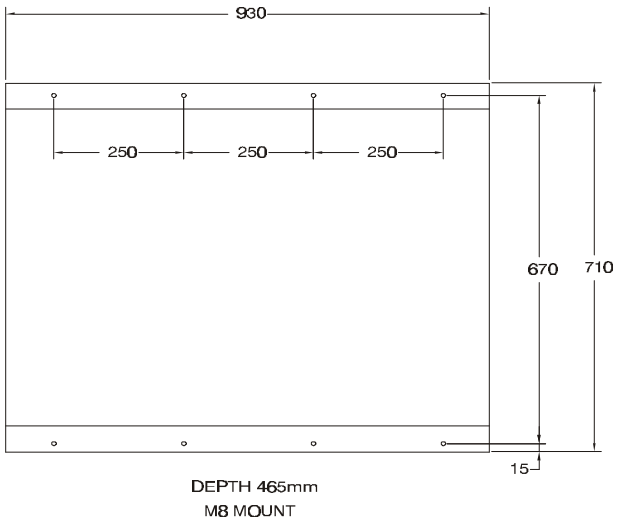

Fig.9

FASTRON TECHNOLOGIES PTY LTD reserve the right to modify the design without notice.

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.

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