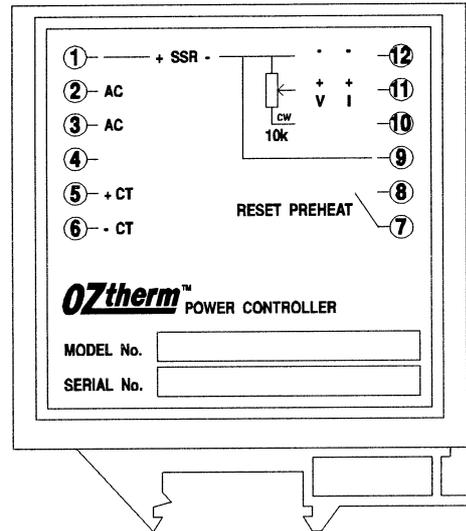
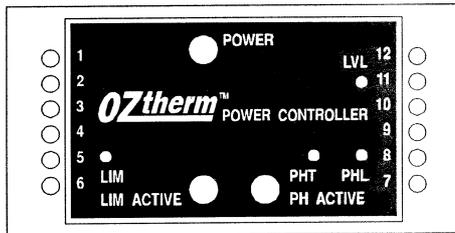


OZthermTM

Power controller



F-312

SINGLE PHASE CONTROL MODULE

INSTALLATION AND COMMISSIONING MANUAL

DESIGNED
and
MANUFACTURED
by

Fastron
Electronics



Page 1: Index

Page 2: 1.0 Description of optional functions

- 1.1 Current limit (C)
- 1.2 Potentiometer control (VP)
- 1.3 0 to 10 V control (V1)
- 1.4 0 to 5 V control (V5)
- 1.5 4 to 20 mA control (VA)
- 1.6 Preheat (P)

2.0 Installation and wiring

- 2.1 Location
- 2.2 Wiring
- 2.3 Transformer loads

Page 3: 2.4 Current transformers

3.0 Adjustment and calibration

- 3.1 HI-LVL adjustment (span)
- 3.2 Current limit
- 3.3 Preheat

Page 4: 4.0 Wiring

- 4.1 Solid state relay notes

5.0 Specifications

6.0 Dimensions

Page 5: 7.0 Trouble shooting guide

Appendix 1 Useful formulas

Appendix 2 Conversion formulas for fan flow rates

Page 6: Appendix 3 Part number breakdown

Appendix 4 Approximate thermal calculations for fan cooled enclosures

Page 7: Appendix 5 Solid State Relay assemblies for use with F312

Page 8: Appendix 6 Solid State Relay assembly mounting details

F312 INSTALLATION AND COMMISSIONING MANUAL
REVISION 1.0 NOV 1993

This manual represents your F312 as manufactured at the time of publication. Every effort has been made to ensure that the information in this manual is complete and accurate. Fastron Technologies P/L cannot be held responsible for errors and omissions. Fastron Technologies P/L reserve the right to make changes and improvements to the product without obligation to incorporate these changes and improvements into units previously shipped. Fastron Technologies P/L cannot be held responsible for any unsuitability or inability to use this product and cannot be held responsible for any damage consequential or not arising out of the use or inability to use this product .

1.0 DESCRIPTION OF OPTIONAL FUNCTIONS

1.1 CURRENT LIMIT (C)

Current limit is often used with class B heating elements. On cold start up, low element resistance causes excessive current. The current limit option restricts maximum current until the elements reach operating temperature. F311 and F330 controllers also have a current trip function which disables the controller if the trip current is exceeded. Current transformer and burden resistor are supplied loose with this option.

1.2 POTENTIOMETER CONTROL (VP)

Provides for the use of a 10 K ohm potentiometer as the main control input

1.3 0 to 10 V CONTROL (V1)

Provides for the use of a 0 to 10 V signal as the main control input

1.4 0 to 5 V CONTROL (V5)

Provides for the use of a 0 to 5 V signal as the main control input

1.5 4 to 20 mA CONTROL (VA)

Provides for the use of a 4 to 20 mA signal as the main control signal

1.6 PREHEAT (P)

Provides a reduced voltage "preheat" with a timer for reduced voltage initial startup of systems. Preheat is active from initial power up and the unit reverts to normal operation after the timer finishes. This option is suitable for some types of ceramic elements which ingress moisture and have to be dried out at a reduced power when starting from cold and for slow startup of systems if required.

2.0 INSTALLATION & WIRING

2.1 LOCATION

The controller must not be installed in excessively humid or corrosive atmospheres or in air of greater than 50 deg C ambient.

2.2 WIRING

All wiring to the controller should comply with AS3000 (or the relevant national standard). Power cable connections must be tight to minimise heating, electrical compound should be used to improve thermal and electrical conductivity. Refer to diagram for correct power wiring.

Control input signal wiring must be run separately from power wiring. Screened cable is recommended for this purpose. If screened cable is not available then a twisted pair should be used.

2.3 TRANSFORMER COUPLED LOADS

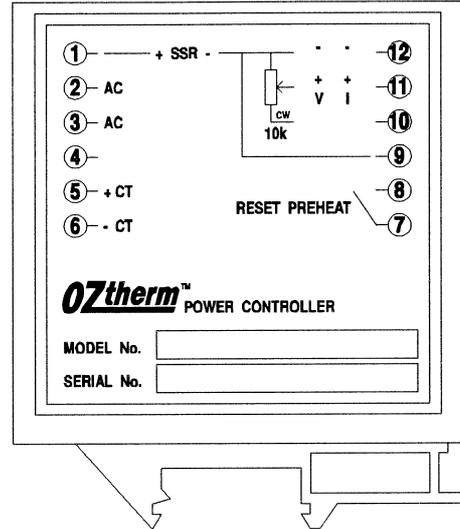
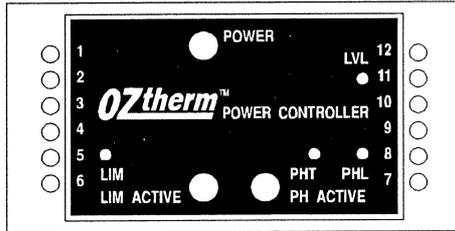
Fastron recommends that the F312 power control module not be used with primary control of transformer coupled loads, however depending upon the transformer flux level it is possible to control transformer primaries with the F312. Current limit (option C) is recommended for transformer loads due to the high fault currents that are possible.

The F312 control module can be run on the secondary of any transformer as long as the voltage on the F312 power control module is the same as the secondary voltage of the transformer.

2.4 CURRENT TRANSFORMERS

(Applicable to option C only)

CT must be installed as shown in the diagram. The burden resistor supplied should go across the CT secondary.



3.0 ADJUSTMENTS AND CALIBRATION

Note: LVL adjustment must always be done before current limit is adjusted.

3.1 LVL ADJUSTMENT (SPAN)

Using a portable calibrator or similar, input the maximum control input signal. Adjust the LVL potentiometer for full voltage across the controller output terminals.

Note: The F312 control module is preadjusted in the factory for minimum control signal gives zero output and for maximum control signal gives full output.

3.2 CURRENT LIMIT

(Applies only to option C only)

Set the LIM potentiometer fully anticlockwise. With the control input signal set to maximum gradually turn the LIM potentiometer clockwise until the required current limit level, measured through the load, has been reached. When the controller is limiting the current the LIM ACTIVE led will light.

3.3 PREHEAT

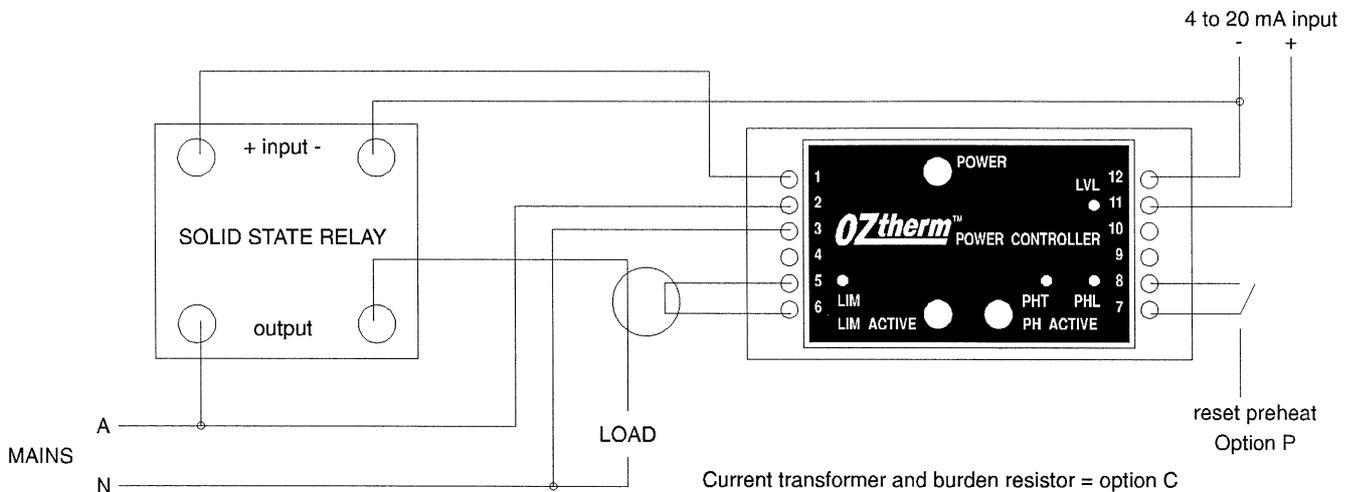
(Applies to option P only)

The PHL potentiometer adjusts the reduced starting "preheat" voltage level and the PHT potentiometer adjusts the "preheat" time.

Set the PHL potentiometer fully anticlockwise and the PHT potentiometer fully clockwise. Turn the power on to the F312 controller. The Preheat function will start automatically and the PREHEAT ACTIVE Led will light while the "preheat" function is active.

Adjust the PHL potentiometer clockwise until the desired reduced starting voltage is obtained measured at the output terminals. Adjust the PHT potentiometer anticlockwise until the desired "preheat" time is obtained.

4.0 WIRING



4.1 SOLID STATE RELAY NOTES

The solid state relay and heatsink assembly should be mounted with the heatsink fins vertical and with the airflow to the heatsink unobstructed.

THE SOLID STATE RELAY SHOULD BE A RANDOM CROSS TYPE.

Please contact Fastron Technologies if there are any queries.

5.0 SPECIFICATIONS

Control Mode	Phase angle. (soft start provided as standard - 1sec)
Control Range	2 - 98%
Power Supply	110/240/415 volts A.C . 50 HZ. +/- 10% (60 HZ. and other voltages available on request)
Control Input	4 - 20 milliamps (receiving impedance 220 ohms) 0 - 10 volts or 0 - 5 volts (receiving impedance 10K ohms) 10K ohms potentiometer
Adjustments	Span (0 - full scale) Current limit (0 - 100%) - Option C Preheat level (0 - 60 %) - Option P Preheat time (7 - 150 sec) - Option P
Indications	Power on LED Current limit active LED - Option C Preheat active LED - Option P
Ambient Temperature	0 - 50 degrees Celsius
Ambient Humidity	0 - 85% relative humidity
Power Factor	Unity

6.0 DIMENSIONS

H x W x D = 79 x 40 x 86 mm

7.0 TROUBLE SHOOTING GUIDE

FAULT	POSSIBLE CAUSE	REMEDY
No output from controller	No control input signal	Ensure input signal is present and polarity is correct
	Load circuit open	Check load circuit continuity and repair if necessary
Controller not modulating with respect to control input signal	HI-LVL potentiometer fully anticlockwise	Check and adjust if necessary
	Preheat active and PH-LVL anticlockwise	Check and adjust if necessary
	No control input signal	Ensure input signal is present and polarity is correct
	Current limit set too low	Check current limit LIMIT led and readjust current limit if necessary
	HI-LVL potentiometer fully anticlockwise	Check and adjust if necessary
	Preheat active and PH-LVL anticlockwise	Check and adjust if necessary
	Current transformer disconnected or damaged or incorrectly installed	Inspect current transformer and wiring and correct if necessary
	Load circuit open	Check load circuit continuity and repair if necessary

APPENDIX 1

USEFUL FORMULAS

Peak voltage $V_{peak} = 1.414 \times \text{Rms voltage } V_{rms}$

Total power delivered to the load $P_{tot} = V_L \times I_L = V_L \times I_L \times \cos(a)$

Ohms law : $V = I \times R$

$$P = V \times I = I \times I \times R = V \times V / R$$

Resistors in series: Total resistance $R_{tot} = \text{resistance one } R_1 + \text{resistance two } R_2 + \dots$

Resistors in parallel: Total resistance $R_{tot} = 1 / (1 / R_1 + 1 / R_2 + \dots)$

$\pi = 3.1416$

APPENDIX 2

CONVERSION FORMULAS FOR FAN FLOW RATES

FROM	TO	MULTIPLY BY
Cubic m / min	CFM (cubic feet / minute)	35.3
	L / sec (litres per second)	16.67
	m / sec (metres per second) 120 mm fan	1.577
	m / sec (metres per second) 92 mm fan	2.679
	m / sec (metres per second) 80 mm fan	3.579

APPENDIX 3

PART NUMBER BREAKDOWN

F312	-	-	-	DESCRIPTION	
1				110 volt A.C line input	
2				240 volt A.C line input	
4				415 volt A.C line input	
		C		Current limit	External CT and burden (loose) Reduced voltage start with built in timer
		P		Preheat	
		VP		Potentiometer control (10kohm)	
		V5		0 to 5V control	
		V10		0 to 10V control	
		VA		4 to 20 mA control	

APPENDIX 4

APPROXIMATE THERMAL CALCULATIONS FOR FAN COOLED ENCLOSURES

H = heat loss from solid state relay (kW)

T1 = inlet air temperature (deg C)

T2 = outlet air temperature (deg C)

V = volumetric flow through enclosure, fan flow required (cubic m/s)

Cp = a constant = 1.01 (kJ / kg x K)

P = density of air = 1.13 at 40 deg C and at sea level (kg / cubic m)

1: Calculate H, heat dissipated by solid state relay and fuses. As a rule of thumb the solid state relay will dissipate 1.2 Watts per amp. Fuse heating should be added .

For a 40 Amp solid state relay $H = 1.2 \text{ Watt} / \text{amp} \times 40 \text{ Amp} = 48 \text{ Watt}$

H is in kW so $48 \text{ Watt} = 0.048 \text{ kW}$

2: T1 is the maximum external ambient air temperature. 40 deg C is usually a good conservative number.

T2 should be the maximum operating temperature of the F312 module and of the solid state relay assembly. 50 deg C is standard for all OZTHERM power products.

3: For heat balance:

$$H = V \times P \times Cp \times (T2 - T1)$$

$$\text{or } V = H / (P \times Cp \times (T2 - T1))$$

for the above example:

$$P = 1.13$$

$$Cp = 1.01$$

$$T2 - T1 = 50 - 40 = 10 \text{ deg C}$$

$$H = 0.048 \text{ kW from step 1}$$

$$\text{so: } V = 0.048 / (1.13 \times 1.01 \times 10) = 0.0042 \text{ cubic m/s}$$

$$\text{multiply by 60 for cubic m/min} = 0.25 \text{ cubic m/s}$$

APPENDIX 5

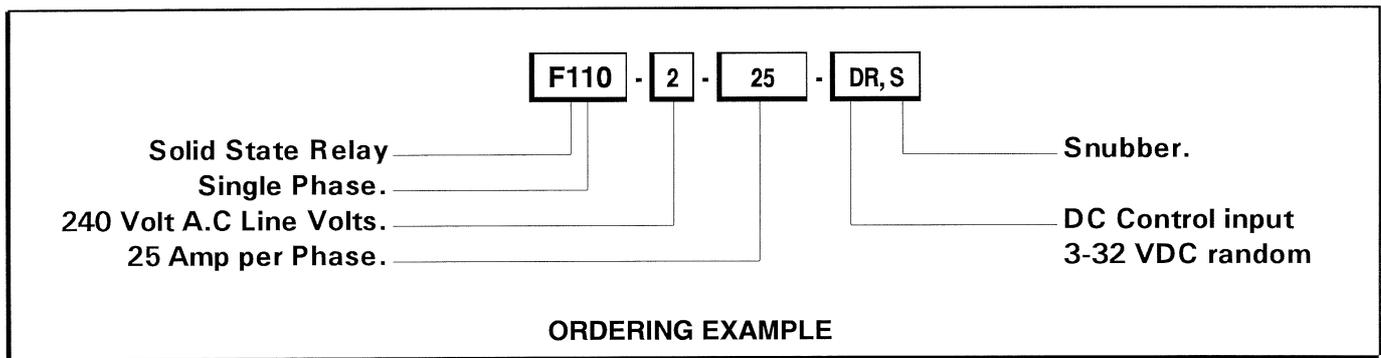
SOLID STATE RELAY ASSEMBLIES FOR USE WITH F312

F110 - [] - [] - [] -				DESCRIPTION	Fuse Rating	Case Size	Weight KG	Dissipation Watts	I ² t Thyristor Rating
Line Voltage	1			110 volt A.C line input (1 phase)					
	2			240 volt A.C line input (1 phase)					
	4			415 volt A.C line input (1 phase)					
Rated Current at 50 deg. Celcius.		25		25 amperes A.C line current	25AF	fig.4	0.689	29	260
		40		40 amperes A.C line current	45AF	fig.5	1.136	47	1,620
		50		50 amperes A.C line current	55AF	fig.6	2.447	60	1,620
		75		75 amperes A.C line current	80AF	fig.7	2.862	95	4,150
		90		90 amperes A.C line current	95AF	fig.8	2.779	120	4,150

Options.

A	AC Control input (90-280 VAC)	Zero cross
D	DC Control input (3-32 VDC)	Zero cross
DR	DC Control input (3.5 - 26 VDC)	Random
F	Semiconductor fuses	Includes mounting hardware
S	R-C Snubber	Instead of standard Varistor

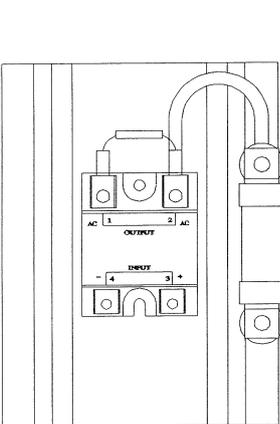
F110 SOLID STATE RELAY SHOULD HAVE OPTION "DR" AND "S" FOR USE WITH F312 MODULE



APPENDIX 6

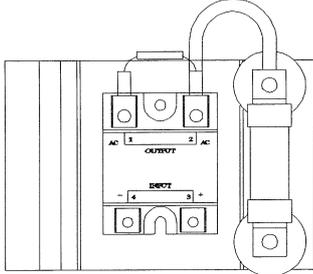
DIMENSIONS / MOUNTING DETAILS

Shown mounted vertically in cabinet. Mounting is via vertical bolt head slots in the heatsink.



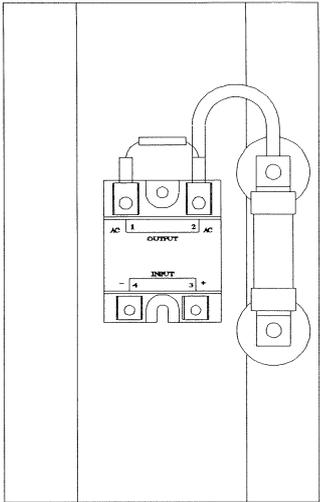
H x W x D = 145 x 106 x 84 mm
Slot = 93.6 mm for M5 bolt

Fig.4



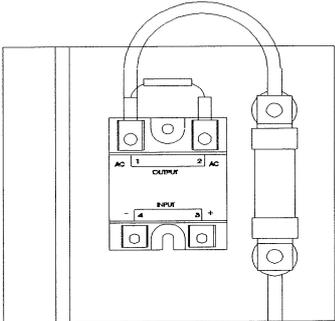
H x W x D = 85 x 120 x 166 mm
Slot = 85 mm for M8 bolt

Fig.5



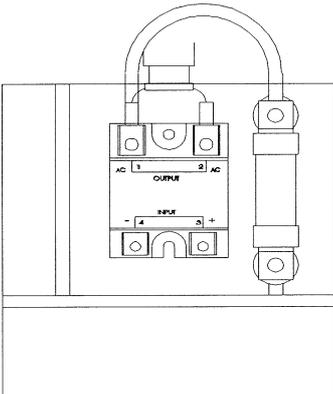
H x W x D = 200 x 120 x 166 mm
Slot = 85 mm for M8 bolt

Fig.6



H x W x D = 110 x 125 x 181 mm
Slot = 110 mm for M5 bolt

Fig.7



H x W x D = 135 x 125 x 181 mm
Slot = 110 mm for M5 bolt

Fig.8

PRODUCTS AND SERVICES

POWER ELECTRONIC COMPONENTS

BRIDGE RECTIFIERS	- Single and Three Phase	PULSE TRANSFORMERS	- PCB type, leaded and SMD
CHOKES	- Line, RFI, EMC	SCR / DIODE BRIDGES	- Single / Three Phase
DIODES	- Std., Fast. (Stud, Puk, Module)	SOLID STATE RELAYS	- Half / Full Control
FANS/ACCESSORIES	- AC/DC to 150mm dia.	THYRISTORS	- AC & DC Input / Output
FILTERS	- Line, RFI, EMC	SCR / DIODE MODULES	- PCB & Module Type
FUSES	- Semiconductor Protection	VARISTORS	- Std., Fast (Stud, Puk, Module)
HEAT SINK	- Extruded, Cast & Fabricated types machined to order		- Std., Fast
IGBT's	- 1, 2 & 6 pack modules		- High power module type, versions with thermal disconnect
POWER CAPACITORS	- Power, PFC, DC Link and Electrolytic types		

AUTOMATION / INSTRUMENTS / PROCESS CONTROLLERS

SMART RELAYS	- Millenium EVO 24 I/O Programable Relays	PROGRAMABLE LOGIC CONTROLLERS(PLC)	- Crouzet 26 I/O, Compact, Blind, Expanadable 3G, Bluetooth versions
PROCESS CONTROLLERS	- Pressure, R. Humidity, other.	HMI TOUCH SCREENS	- Ethernet, Modbus, 4,7,10 Inch
ELECTRICITY METERS	- I, V, kW, kWh, kvar, kvarh, PF, Freq, THD, Pulse, Comms, Load Shedding - Panel & Din Mount Type	TEMP. CONTROLLERS	- Shinko, Single / Multi-Point - Pattern Control

POWER SUPPLIES / SIGNAL CONDITIONERS / MONITORING RELAYS

CURRENT TRIP MODULES	- Measurement / Alarm	SENSOR POWER SUPPLY	- +/- 15v for Hall Effect Sensors
LOOP POWER SUPPLIES	- Process type, 24V/ 4 - 20mA	TEMPERATURE TRANSMTR	- Thermocouple / RTD
MONITORING RELAYS	- V, I, Watts, Temp, Level etc.	VOLTAGE TRIP MODULES	- Measurement / Alarm
		SIGNAL CONDITIONERS	- DC/AC, I/V, Trip/Reset and Alarms

SENSORS / PROBES / TRANSDUCERS

CURRENT AC / DC	- Hall Effect Sensors, CT types	RELATIVE HUMIDITY	- Room/Duct Sensors
DCCT's	- Hall Effect Sensors	TEMPERATURE	- Thermocouples, RTD's, Infra-Red
LEVEL	- Paddle Switch Type	VOLTAGE AC / DC	- Hall Effect Sensors, VT types
POWER (kW, kWh, kVa,kVarh)	- Process Level O/P and Pulse		- Oztherm (Fastron in-house design)

POWER SEMICONDUCTOR HEAT-SINK ASSEMBLIES AND ACCESSORIES

HEAT SINK ASSEMBLIES	- AC, Single/ 3 Phase & multi-phase - DC Bridge and DC switch - Convection, Fan forced, oil or water cooled	WATER COOLERS	- Non-isolated & Isolated water path
		SEMICONDUCTOR CLAMPS	- Single and Double sided
		SNUBBERS	- AC Single / 3 Phase / DC
		DC SUBSTATION DIODES	- Blocking Diode Cubicles

SOLID STATE SWITCHES AND POWER CONTROLLERS

SOLID STATE CONTACTORS	- AC/DC Input or Output - Single, 3 Phase - Solid State Relay & Thyristor Types.	THYRISTOR CONTROLLER (SCR)	- Single & 3 Phase - Phase Angle, Burst Control - OZtherm Brand (Fastron in-house design)
------------------------	--	----------------------------	--

SOFTWARE

ENERGY MONITORING	- Ergo Energy monitoring software - Cloud or local data collection options - Real-time monitoring and profiling - Wi-Lem Wireless Energy Moitoring - Crouzet Smartphone PLC app	DATA ACQUISITION	- Electrical and Process Parameters
POWER QUALITY	- RS485 MOBUS / Ethernet TCP/IP Comms - Power Quality Analysers, MiQEN and MiSMART software.	TEMPERATURE MONITORING & CONTROL	- Single and Multi-point - Pattern Control
		DATA LOGGING	- Historical Analysis - Trending & Reporting

SYSTEMS SOLUTIONS & ENGINEERING SERVICES

ENERGY MONITORING, POWER ELECTRONICS AND AUTOMATION

- # ENERGY MONITORING, POWER QUALITY, DATA AQUISITION, ELECTRICAL & PROCESS MEASUREMENT SOLUTIONS
- # PROGRAMABLE LOGIC CONTROLLERS, HMI TOUCH SCREENS, TEMPERATURE, HUMIDITY, AND LIGHT SENSORS
- # PRODUCT DESIGN AND DEVELOPMENT; CONTROL CUBICLE DESIGN, ASSEMBLY AND TESTING
- # APPLICATIONS ENGINEERING AND CONSULTANCY
- # POWER SEMICONDUCTOR REPLACEMENT; TESTING AND MATCHING TO CRITICAL PARAMETERS
- # REPAIR & REFURBISHMENT OF SEMICONDUCTOR ASSEMBLIES & POWER ELECTRONIC EQUIPMENT
- # REPAIR, TESTING, UPGRADE AND TRAINING ON ALL PRODUCTS

Fastron
Electronics

ABN: 38 622 808 137

9B Lakewood Blvd Braeside
Victoria, Australia 3195
Email: sales@fastron.com.au

Tel: +61-3-9763 5155
Fax: +61-3-9763 5206
Web: www.fastron.com.au

PROUDLY SUPPORTING



Digital Power Meters, Digital Panel Meters, Isolated Transmitters, Transducers, Converters, I/O Controllers, Current Shunts and Current Transformers.



Programmable Logic Controllers(PLC), Smart Relays, HMI Touch Screens, Encoders, Brushless DC Motors, Motor Controllers, Smartphone/Tablet PLC apps, Intuitive Crouzet Touch software.



Energy monitoring real time software including data recovery and graphic functions for single or multi site environments with live dashboard, costing, alarming, reporting and bill checking options, specialising in custom applications. **Designed and Manufactured by** 



Power Semiconductors including Thyristors and Diodes for applications in Rectifiers, Converters, Power Supplies for Industrial, Traction and test and instrumentation equipment.



Ring and Split core CT's, Shunts and Meters, DC kWh Meters



Discretes, IGBTs, Power Modules, Bridge Rectifiers & AC Controllers, Thyristor and Diode modules, Specialist Semiconductors including Silicone carbide



IGBTs, Power Modules, Bridge Rectifiers & AC Controllers, Thyristor and Diode modules, IGBT driver boards, Stacks and Assemblies. 



Monitoring, Control and Measurement of electrical parameters related to Energy Monitoring and Power Quality including Power Factor Correction products. Single and 3 phase Energy Meters, Measuring Centres and Network Analyzers with MiQEN and MiSMART software; Measuring Transducers. MV and LV, PFC capacitors and contactors. DC Link capacitors. Synchronisation Meters.



Electrolytic Capacitors for DC Link, Ripple, and AC Filter Application



Power Capacitors for critical applications and extreme environments including snubber energy absorbers



Voltage & Current Transducers for industrial drives, robots & cranes, cable cars & ski lifts, elevators & escalators, ventilation & conditioning, medical systems and power supplies for computer & mobile systems. Battery Monitoring system and Wi-Lem Energy Monitoring Solutions.



Rope CT's, Rogowski Coils with Integrators, Standalone Integrators, Teardrop Coils, Standard CT's



Electricity Measurement, including Voltage, Current, Power, Power Factor, Total Harmonic Distortion, with analogue outputs and MODBUS / Ethernet communications available for all of your energy measurement requirements. Current and Voltage Transducers, Clamp on Current Sensors.



SCR (thyristor) Power Controllers complete with Control Electronics and Power Semiconductor heat sink assembly, (Phase angle, burst firing, ON/OFF switching) Solid State Contactors, Signal Conditioners and custom products. **Designed and Manufactured in Australia**



Power Modules and Solid State Relays, 3 phase and single phase for ac/dc motor drives, welding, power supplies, and UPS, used in temperature, medical, traffic signals and home appliance applications.



High Power Thyristors, (phase control, fast and ultrafast), Diodes (rectifier, avalanche and welding types), IGBT's and heat sink and assemblies.



Custom Heatsink Extrusions, Bonded Heatsink, Water cooled Heatsink, Thermal Analysis Services



CT's, Shunts, Signal Conditioners, Electrical Energy Meters and Software Systems Solutions for Measurement, Test and Energy Management applications in the industrial, commercial and government sectors.



Surge Suppression, Chokes, EMC Filters, Power Input Filter, Pulse Transformers.



Solid State Relays, I/O Modules, Filters, Heat Sinks, Din Rail Mounting systems, for low power and high power electrical switching and control applications. SCR/Diode Bridges and Modules. 



Temperature, Process and Humidity Controllers, Sensors and Recorders for a wide range of applications including furnaces, boilers, ovens, kilns and extruders as well as a range of Signal Conditioners.



Silicone Carbide Mosfets & Schottky Diodes, Power Modules, Fast Diodes, Bridge Rectifiers, Controlled Rectifiers, SCR's, Power Supplies for Plasma heating, Metal Finishing, and Power Regulation



Semiconductor Fuses for power control applications. **Designed and Manufactured by**  Private label name brand replacement(NBR) Semiconductors and Solid Sate Relays

High energy Varistors and thermal disconnects for voltage transient suppression used in telecommunications, rectifier electronics, power electronics, measurement & control, process systems, computers, medical, automotive. test and instrumentation.



ABN: 38 622 808 137

9B Lakewood Blvd Braeside
Victoria, Australia 3195
Email: sales@fastron.com.au

Tel: +61-3-9763 5155
Fax: +61-3-9763 5206
Web: www.fastron.com.au