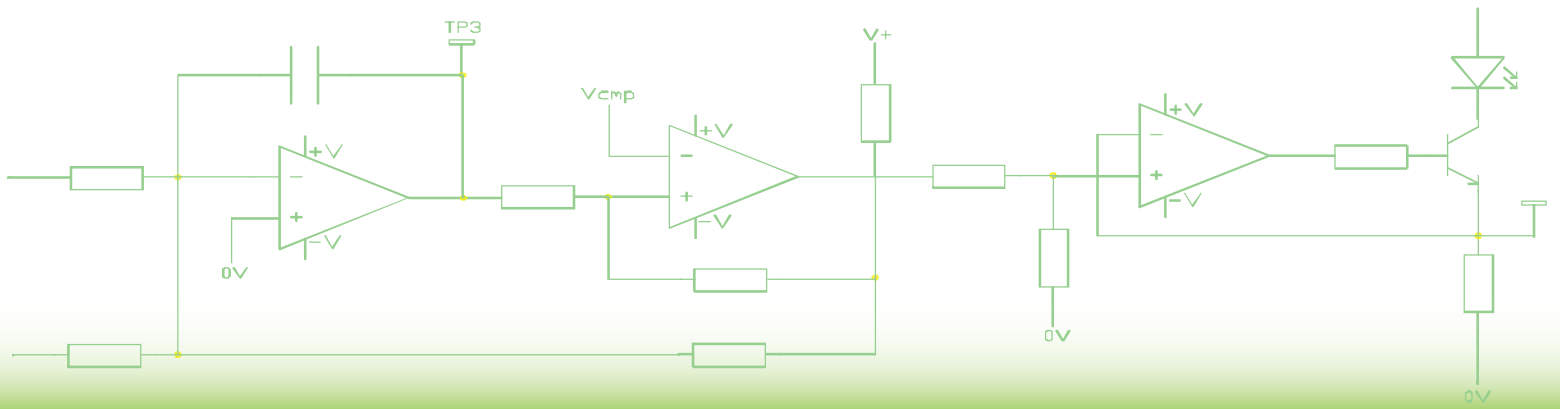
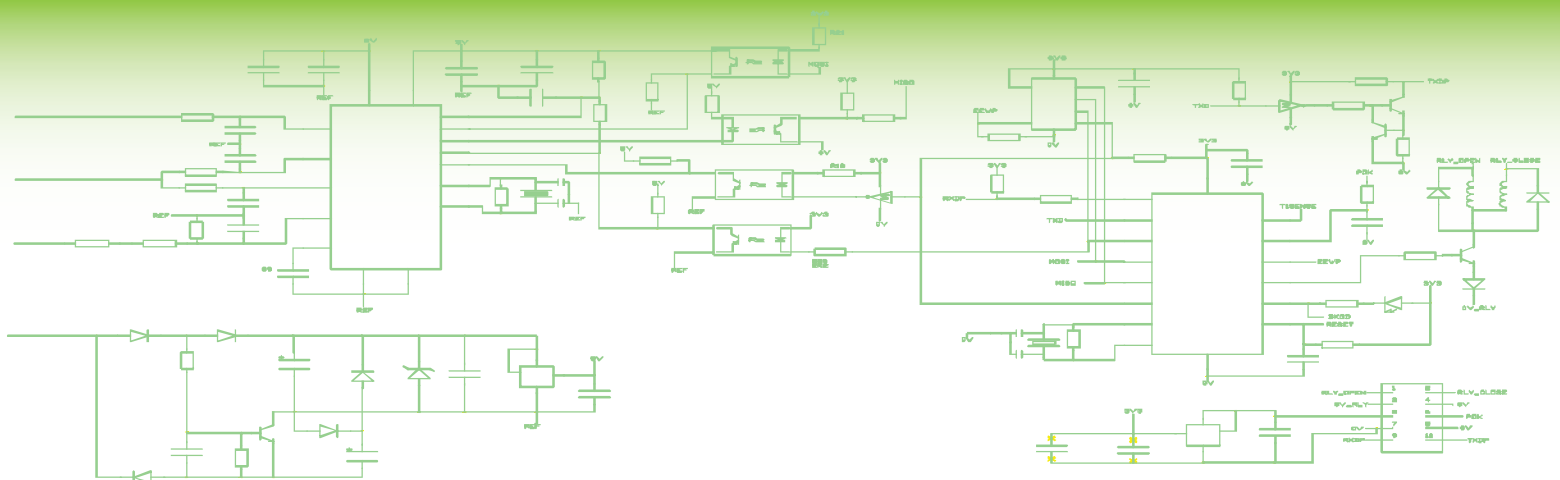




VB CONTROLS

PRODUCT CATALOG

www.vb-controls.com



General Information	1
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GENERAL INFORMATION

VB Controls Inc designs and manufactures solid state relays and solid state contactors. All our electronics and heatsinks are made in the USA and have RoHS Compliance. In addition to off-the-shelf products, VB Control has strong focus on custom products, especially under Private Label. Custom products include solid state relays and contactors, phase angle power control, real power and accumulated energy meters, lighting controls, motor drives and temperature controls. We have in-house automated assembly allowing flexibility, fast response and small lot builds.

VB Controls also provides consulting services including complete custom product design. These clients have full ownership of the completed design.

VB Controls Inc was incorporated February 2000 in the state of Virginia. Through automation, low overhead and a rural location, VB Controls provides quality "Made in the USA" products at superb value.

C2 SERIES - DUAL SOLID STATE CONTACTOR

FEATURES INCLUDE:

- 480V, 65 and 100A
- Two Independent SSC Channels
- Power Density, (2) 100A SSC in 3.2"
- MOV Protected Outputs
- (2) AC or (2) DC Logic + 0-10V Control
- 2000V/uSec Immunity
- 4000V Isolation
- 1400V Blocking Voltage
- Cool 1.1Watts/Amp
- Thermal Limit
- Diagnostics
- SCRs on DCB
- CE, RoHS
- Made In USA
- Repairable

SPECIFICATIONS

All specifications at 40C unless otherwise stated.

Models	C2-065-IDC2	C2-100-IDC2	C2-065-IAC2	C2-100-IAC2	
Output					
Output Amps per channel	0.25 to 65	0.25 to 100	0.25 to 65	0.25 to 100	Amps RMS
Output Volts, Switched	48 to 480	48 to 480	48 to 480	48 to 480	VAC, nominal
Itsm (Single Cycle Surge) 50Hz	1500	1500	1500	1500	Amps RMS
Fusing I ² T (Note 1)	22,500	22,500	22,500	22,500	Itsm ² x 10mSec
MOV Standoff Voltage	575	575	575	575	VAC, Maximum
MOV Energy	220	220	220	220	Joules, 8/20uS
Thermal Limit Threshold	105	105	105	105	Degrees C, typical
Thermal Limit Hysteresis	10	10	10	10	Degrees C, typical
Heatsink Cooling	Convection	24VDC Fan	Convection	120VAC Fan	
Power Dissipation	1.0	1.1	1.0	1.1	Watts per Amp, typ.
Control					
Independent Logic Inputs	2	2	2	2	
Control Voltage, each LGC Input	3 to 32VDC	3 to 32VDC	100-240VAC	100-240VAC	Nominal
Control Current, Minimum	2mA	2mA	1.5mA	1.5mA	
Guaranteed LGC Off Voltage	< 1VDC	< 1VDC	< 40VAC	< 40VAC	
0 to 10V Analog Input Z	48K	48K	N/A	N/A	Ohms, Typical
Control Supply Voltage	12 to 28VDC	24VDC	100-240VAC	120VAC	Nominal
Control Supply Current	0.04 Amp	0.15 Amp	0.03 Amp	0.12 Amp	Maximum
Fan Activation Temperature	N/A	65C	N/A	Constant On	Typical
Fan Hysteresis	N/A	10C	N/A	N/A	Typical
Fan Life	N/A	100K	N/A	60K	Hours, Est. L10 at 40C
Diagnostic Detection	H,V,C	H,V,C	H	H	Heat, Volts, Current
Diagnostic Output Current	-8mA	-8mA	N/A	N/A	Low = Diagnostic Alert
Control Peak Over-Voltage	125V	125V	1500V	1500V	50uSec Pulse Width
Isolation					
Control 1 to Control 2	1500V	1500V	1500V*	1500V*	*Shared Neutral
Control 1&2 to Control Supply	1500V	1500V	1500V*	1500V*	*Shared Neutral
Line 1 to Line 2	4000V	4000V	4000V	4000V	VRMS
All Control to Line 1&2	4000V	4000V	4000V	4000V	VRMS
All Electronics to Case	4000V	4000V	4000V	4000V	VRMS

MODEL CODES

* Contact Factory for Through Bulkhead Mount

C2-100-IDC2 = DC Control, 100A, 24V Fan	C2-100-IDC2-N	DC Control, No Heatsink *
C2-100-IAC2 = AC Control, 100A, 120V Fan	C2-100-IAC2-N	AC Control, No Heatsink *
C2-065-IDC2 = DC Control, 65A Convection	HS-03CW-D24	24VDC Fan Assisted Heatsink *
C2-065-IAC2 = AC Control, 65A Convection	HS-03CW-A120	120VAC Fan Assisted Heatsink *



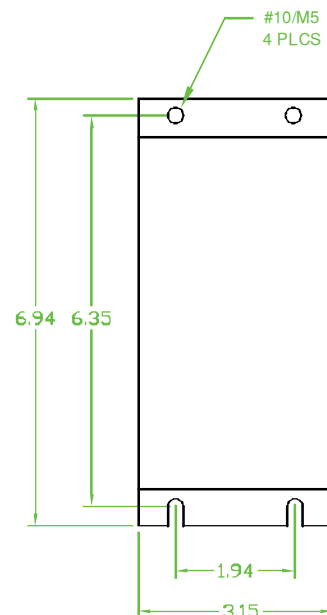
GENERAL, ALL MODELS

Output Terminals, Wire Gauge	2-8AWG
Output Terminals, Torque	40-50 in/lbs
Input Terminals, Torque	3-6 in/lbs
Mounting Screw Size	#10 or 5mm
Ambient, degrees C	-40 to 85
Plastic	UL V0 Noryl

Note 1: To protect SCR from most shorts, use fuse with an I²T clearing specification less than 25% of the SCR.

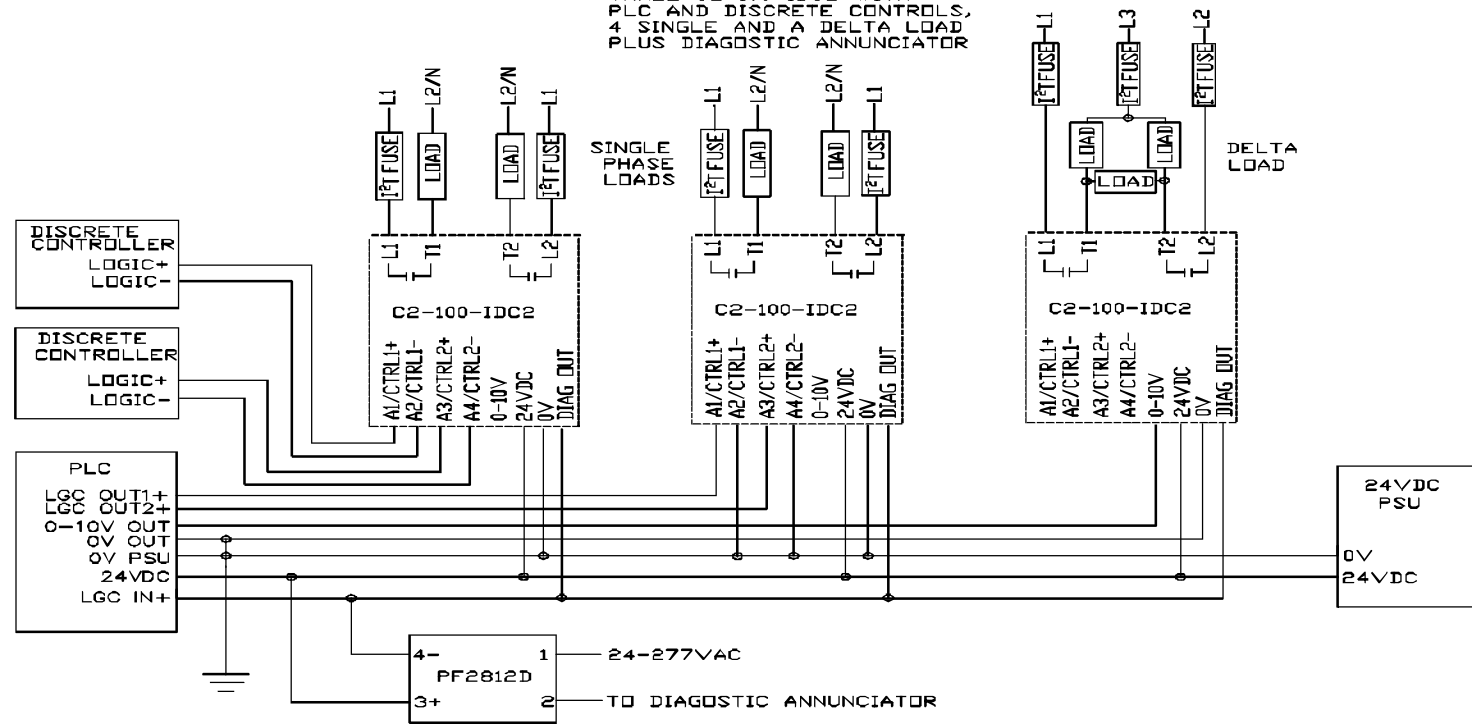
Dimensions: 3.15"W x 6.94"H x 6.3"Deep
Weight 6 lbs.

MOUNTING INFORMATION

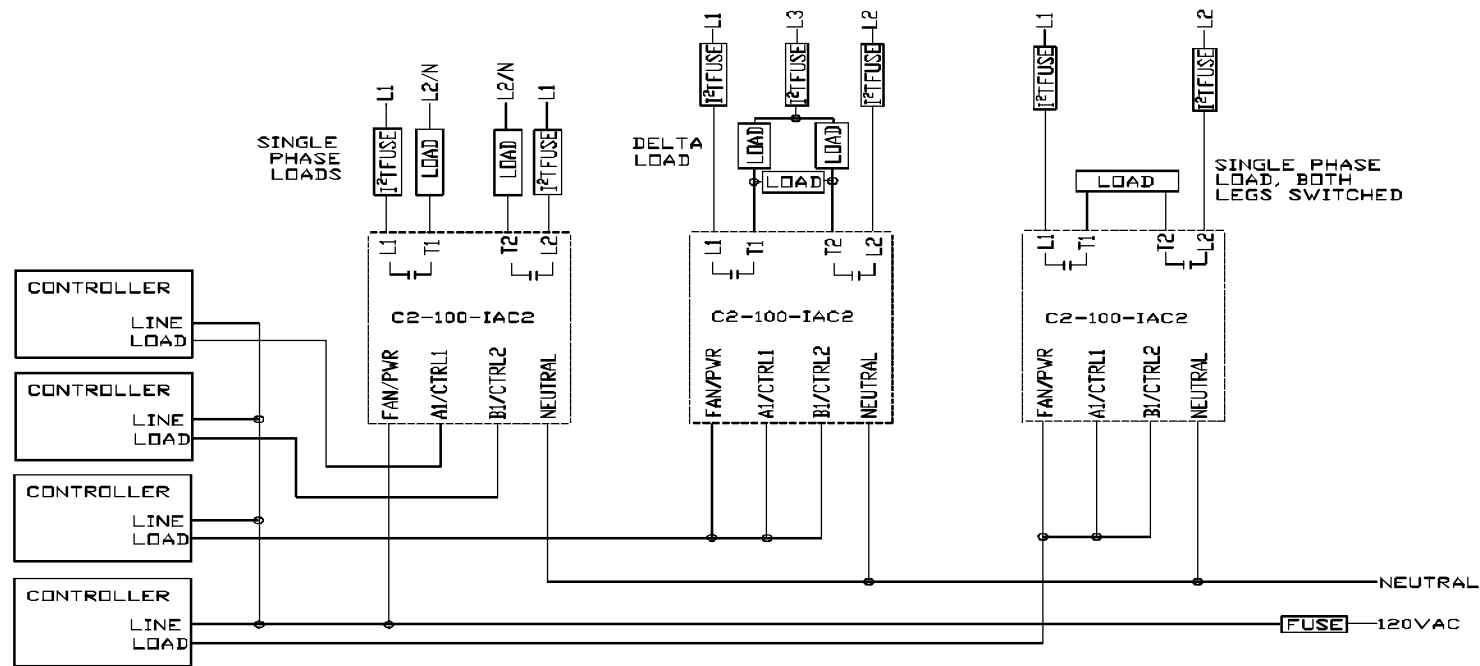


WIRING

EXAMPLE SYSTEM WIRING
THREE C2-100-IDC2 WITH
PLC AND DISCRETE CONTROLS,
4 SINGLE AND A DELTA LOAD
PLUS DIAGNOSTIC ANNUNCIATOR



EXAMPLE WIRING SHOWING
THREE C2-100-IAC2
AND VARIOUS LOADS



PF SERIES PANEL MOUNT AC SOLID STATE RELAY

FEATURES INCLUDE:

- 12 to 90 Amps AC
- 24 - 600VAC
- DC and AC Control
- Control Input LED
- SCR Blocking voltage 800 to 1600V
- MOV Protected Output (some models)
- Transient Immunity to 2000V/uSec
- Zero Cross Synchronized
- IP20 Output Cover
- 4000V Isolation
- CE, RoHS compliant
- Made in USA

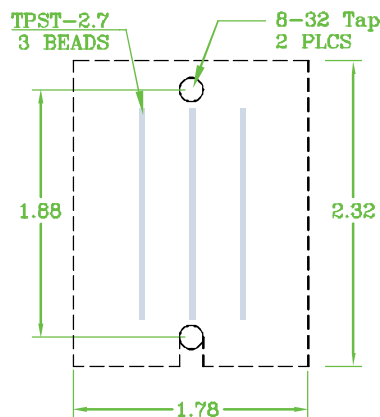
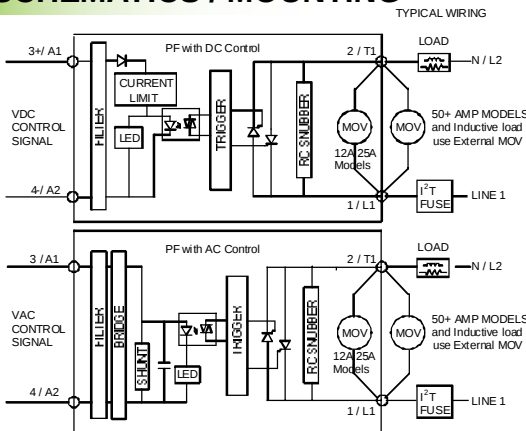
SPECIFICATIONS

All specifications at 40°C unless otherwise stated.

Model Codes	PF2812A	PF2825A	PF2850A	PF6050A	PF6090A	PF2812D	PF2825D	PF2850D	PF6050D	PF6090D	
OUTPUT											
Output Amps, with Heatsink	.15 to 12	.15 to 25	.25 to 50	.25 to 50	.25 to 90	.15 to 12	.15 to 25	.25 to 50	.25 to 50	.25 to 90	Amps RMS
Output Volts	24-277	24-277	24-277	48-600	48-600	24-277	24-277	24-277	48-600	48-600	VAC, nominal
Blocking Voltage	800	800	800	1600	1600	800	800	800	1600	1600	Max. Vpeak
OffState dV/dT Immunity	1000	1000	2000	2000	2000	1000	1000	2000	2000	2000	Volts/uSec
Full Current Baseplate Temp.	95C	90C	100C	100C	100C	95C	90C	100C	100C	100C	Maximum
I _{tsm} , Single Cycle Amps, 60Hz	128	260	560	560	1500	128	260	560	560	1500	Amps
I ² T for Fusing ***	136	560	2600	2600	18600	136	560	2600	2600	18600	I _{tsm} ² x 8.3mS
Internal Output MOV	YES	YES	NO	NO	NO	YES	YES	NO	NO	NO	
Power Dissipation	1.1	1.1	1.2	1.2	1.2	1.1	1.1	1.2	1.2	1.2	Watts/Amp
CONTROL											
DC Control Voltage, ON						3 to 32	3 to 32	3 to 32	4 to 32	4 to 32	LED on at 3.5
DC Control Current, ON						5.5mA	5.5mA	5.5mA	5.5mA	5.5mA	Minimum
DC Current Limit						8mA	8mA	8mA	8mA	8mA	Typical
DC Control Voltage, OFF						< 1.0	< 1.0	< 1.0	< 2.0	< 2.0	VDC
DC Control, peak over voltage						+/-250V	+/-250V	+/-250V	+/-250V	+/-250V	EN61000-4-5
AC Control Voltage, ON	90-264	90-264	90-264	90-264	90-264						VAC
AC Input Impedance	15K	15K	15K	15K	15K						Ohms, typ.
AC Control Voltage, OFF	< 30	< 30	< 30	< 30	< 30						VAC
AC Control, peak over voltage	+/-1KV	+/-1KV	+/-1KV	+/-1KV	+/-1KV						EN61000-4-5
HEATSINK Selection in 40C air											
10 sq in metal plate+TPST-2.7G	.15 - 6	.15 - 6	.25 - 6	.25 - 6	.25 - 6	.15 - 6	.15 - 6	.25 - 6	.25 - 6	.25 - 6	Amps
Model HS-1.3CW + TPST-2.7G	> 6	> 6	< 32	< 32	< 32	> 6	> 6	< 32	< 32	< 32	Amps
Model HS-08CW + TPST-2.7G			> 32	> 32	< 50			> 32	> 32	< 50	Amps
Model HS-05CW + TPST-2.7G					< 72					< 72	Amps
Model HS-03CW + TPST-2.7G					> 72					> 72	Amps ***



SCHEMATICS / MOUNTING



GENERAL, ALL MODELS

Case Material	UL V0 Lexan
Output Terminal Torque	20 in/lbs
Control Terminal Torque	6 in/lbs
Mounting Screw Torque	15 in/lbs
Ambient Temperature	-40 to 85C
Wire Gauge, Output	(2) 8 awg Max.
Wire Gauge, Control	(2) 12 awg Max.

- * To protect SCR from most shorts, use fuse with an I²T clearing specification less than 33% of the SCR.
- ** Heatsink on verticle surface with verticle fins, 40C free air 4" above and 1" below and TPST under SSR.
- *** See 80% rule in application section.

PR SERIES PANEL MOUNT AC SOLID STATE RELAY

FEATURES INCLUDE:

- 12 to 50 Amps AC
- 24 to 600VAC
- DC or AC Control
- OEM Version
- SCR Blocking voltage 800 to 1600V
- Transient Immunity to 1000V/uSec
- Zero Cross Synchronized
- 4000V Isolation
- CE, RoHS compliant
- Made in USA

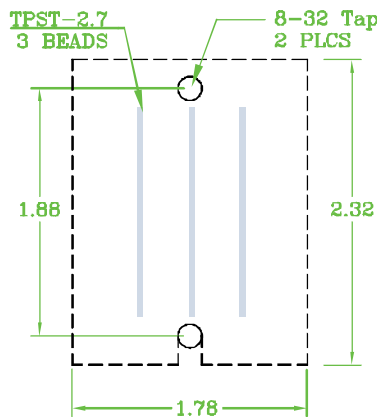
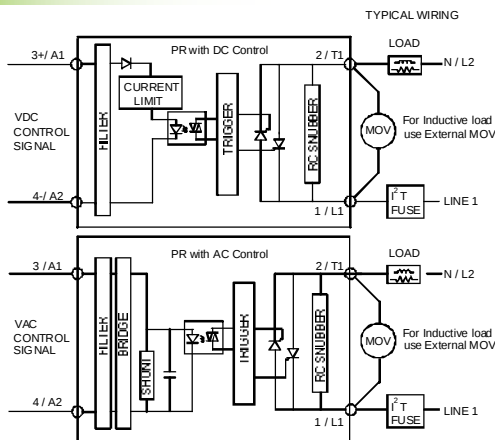
SPECIFICATIONS

All specifications at 40°C unless otherwise stated.

Model Codes	PR2812A	PR2825A	PR2850A	PR6050A		PR2812D	PR2825D	PR2850D	PR6050D	
OUTPUT										
Output Amps, with Heatsink	.15 to 12	.15 to 25	.25 to 50	.25 to 50		.15 to 12	.15 to 25	.25 to 50	.25 to 50	Amps RMS
Output Volts	24-277	24-277	24-277	48-600		24-277	24-277	24-277	48-600	VAC, nominal
Blocking Voltage	800	800	800	1600		800	800	800	1600	Max. Vpeak
OffState dV/dT Immunity	1000	1000	2000	2000		1000	1000	2000	2000	Volts/uSec
Full Current Baseplate Temp.	95C	90C	100C	100C		95C	90C	100C	100C	Maximum
Itsm, Single Cycle Amps, 60Hz	128	260	560	560		128	260	560	560	Amps
I ² T for Fusing *	136	560	2600	2600		136	560	2600	2600	Itsm ² x 8.3mS
Power Dissipation	1.1	1.1	1.2	1.2		1.1	1.1	1.2	1.2	Watts/Amp switched
CONTROL										
DC Control Voltage, ON						3 to 32	3 to 32	3 to 32	4 to 32	VDC
DC Control Current, ON						5.5mA	5.5mA	5.5mA	5.5mA	Minimum
DC Current Limit						8mA	8mA	8mA	8mA	Typical
DC Control Voltage, OFF						< 1.0	< 1.0	< 1.0	< 2.0	VDC
DC Control, peak over voltage						+/-250V	+/-250V	+/-250V	+/-250V	EN61000-4-5
AC Control Voltage, ON	90-264	90-264	90-264	90-264						VAC
AC Input Impedance	15K	15K	15K	15K						Ohms, typ.
AC Control Voltage, OFF	< 30	< 30	< 30	< 30						VAC
AC Control, peak over voltage	+/-1KV	+/-1KV	+/-1KV	+/-1KV						EN61000-4-5
HEATSINK Selection **										
10 sq in metal plate+TPST-2.7G	.15 - 6	.15 - 6	.25 - 6	.25 - 6		.15 - 6	.15 - 6	.25 - 6	.25 - 6	Load Amps
Model HS-1.3CW + TPST-2.7G	> 6	> 6	< 32	< 32		> 6	> 6	< 32	< 32	Load Amps
Model HS-08CW + TPST-2.7G			> 32	> 32				> 32	> 32	Load Amps



SCHEMATICS / MOUNTING



GENERAL, ALL MODELS

Case Material	UL V0 Lexan
Output Terminal Torque	20 in/lbs
Control Terminal Torque	6 in/lbs
Mounting Screw Torque	15 in/lbs
Ambient Temperature	-40 to 85C
Wire Gauge, Output	(2) 8 awg Max.
Wire Gauge, Control	(2) 12 awg Max.

* To protect SCR from most shorts, use fuse with an I²T clearing specification less than 33% of the SCR.

** Heatsink on verticle surface with verticle fins, 40C free air 4" above and 1" below and TPST under SSR.

PE SERIES PANEL MOUNT DC SOLID STATE RELAY

FEATURES INCLUDE:

- 12 to 75 Amps DC
- 60 to 900V
- 3-32VDC Control
- Power Efficient, Low R_{ds_ON}
- 15uSec Response Time
- TVS Protected Input
- Low Loss Clean Switching
- Input Indicator
- IP20 Output Cover
- CE, RoHS compliant
- 2100 VDC Isolation
- Made In USA

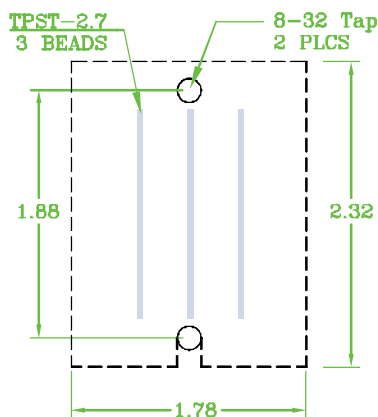
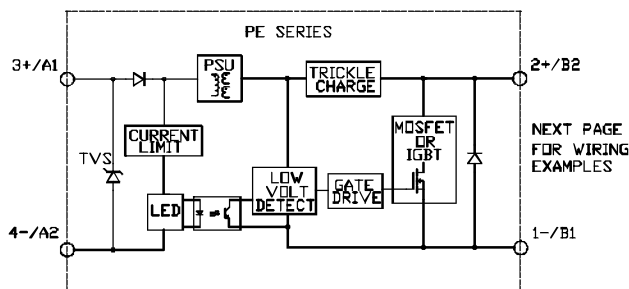
SPECIFICATIONS

All specifications at 40C unless otherwise stated.

Model Codes	PE0630	PE0675	PE1012	PE1025	PE1050	PE1075	PE2020	PE2040	PE6020	PE9030	
OUTPUT											
Output Amps, with Heatsink	0 to 30	0 to 75	0 to 12	0 to 25	0 to 50	0 to 75	0 to 20	0 to 40	0 to 20	0 to 30	Amps DC
Output Volts	0 to 60	0 to 60	0 to 100	0 to 100	0 to 100	0 to 100	0 to 200	0 to 200	0 to 600	0 to 900	Volts Peak
R_{ds_ON} (On-State Resistance) *	0.014	0.0028	0.030	0.020	0.010	0.0045	0.065	0.033	IGBT	IGBT	40C Baseplate
Voltage Drop @ Full Current	0.42	0.21	0.36	0.50	0.50	0.34	1.3	1.3	1.9	2.0	40C Baseplate
Surge Current, non-repetitive	320	1200	160	220	440	950	130	260	80	90	Amps, 10uSec
Leakage Current at Rated VDC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	mA Max.
Full Current Baseplate Temp.	100C	100C	100C	100C	100C	100C	95C	95C	90C	85C	Maximum
Reversing Diode Current	-30	-75	-12	-25	-50	-75	-20	-40	-20	-30	Amps Max.
CONTROL											
DC Control Voltage, ON	3 to 32	3 to 32	3 to 32	3 to 32	3 to 32	3 to 32	3 to 32	3 to 32	3 to 32	3 to 32	LED on at 3.5V
Control Current, Minimum	9	9	9	9	9	9	9	9	9	9	mA
Control Current at 32V, typ	18	18	18	18	18	18	18	18	18	18	mA
Control Voltage, OFF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	VDC
TVS Protection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	60V Standoff
Under-Drive Protection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
TIMING											
Response time, Ctrl to Output	15	20	15	15	15	25	15	15	15	25	uSec, Max.
Maximum Frequency (>8V Ctrl)	20K	12K	20K	20K	20K	7K	20K	20K	20K	10K	Hz, PSU Limit
HEATSINK Selection **											
10 sq in metal plate+TPST-2.7G	0 - 17	0 - 40	0 - 12	0 - 14	0 - 20	0 - 32	0 - 8	0 - 11	0 - 4	0 - 5	Load Amps
Model HS-1.3CW + TPST-2.7G	> 17	> 40		> 14	> 20	> 32	> 8	11 - 32	> 4	5 - 20	Load Amps
Model HS-08CW + TPST-2.7G								> 32		> 20	Load Amps



SCHEMATIC / MOUNTING



GENERAL, ALL MODELS

Case Material	UL V0 Lexan
Output Terminal Torque	20 in/lbs
Control Terminal Torque	6 in/lbs
Mounting Screw Torque	15 in/lbs
Ambient Temperature	-40 to 85C
Wire Gauge, Output	(2) 8 awg Max.
Wire Gauge, Control	(2) 12 awg Max.

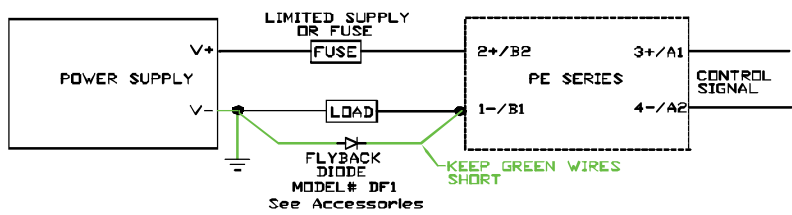
* R_{ds} Typically 50% higher at maximum temperature.

** Heatsink on verticle surface with verticle fins, 40C free air 4" above and 1" below and thermal paste between PE Series and heatsink.

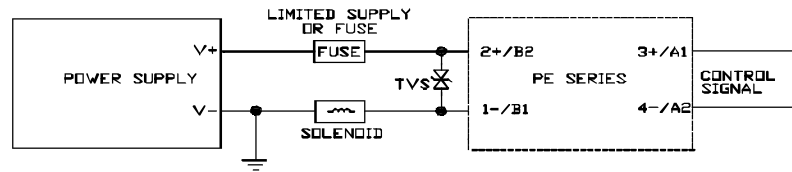
PE PANEL MOUNT DC SOLID STATE RELAY

WIRING

TYPICAL ON/OFF APPLICATION

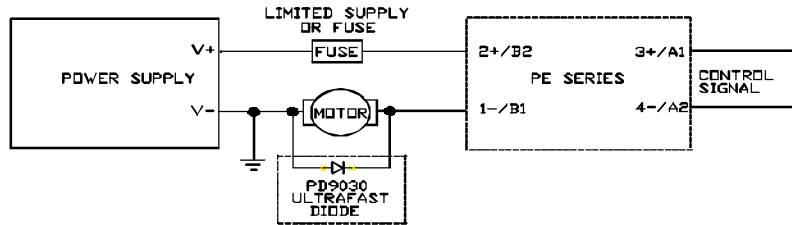


SOLENOID FAST OFF TIME

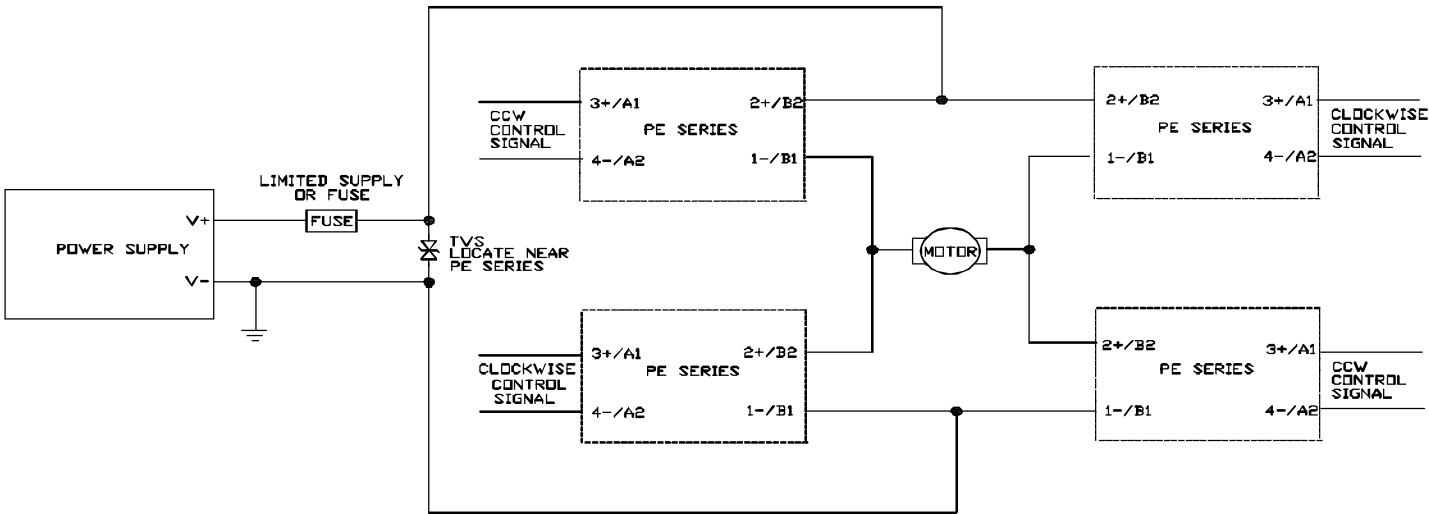


PSU Voltage	MODEL	TVS Model#
0 to 36VDC	PE06xx	TVS06
0 to 56VDC	PE10xx	TVS10
0 to 110VDC	PE20xx	TVS20
0 to 300VDC	PE60xx	MOV60
0 to 420VDC	PE90xx	MOV80

UNIDIRECTIONAL MOTOR PULSE WIDTH MODULATED



REVERSABLE MOTOR PULSE WIDTH MODULATED H BRIDGE



CAUTION: CW AND CCW SHOULD NEVER BE ON AT THE SAME TIME. ALLOW MOTOR TO STOP BEFORE REVERSING DIRECTION

PHASE ANGLE POWER CONTROL

FEATURES INCLUDE:

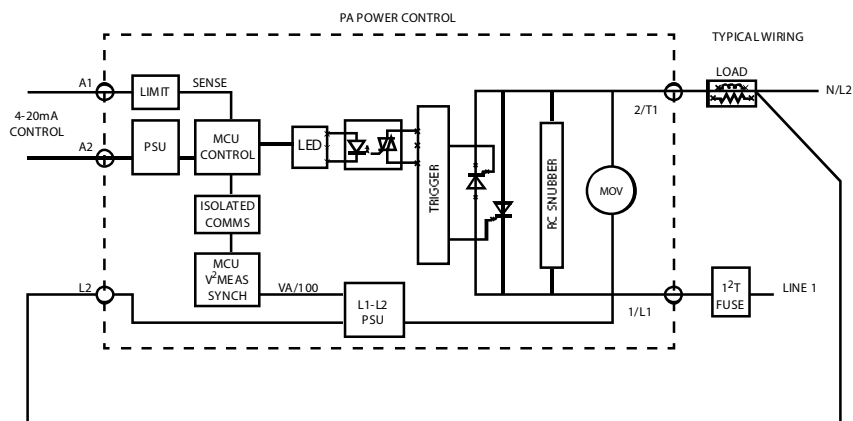
- V Squared Power Control
- Slow On and 1/2 Cycle Quench
- Resistive or Inductive load
- No External Transformer
- MOV Protected Output
- 4-20mA Input, with current limit
- Power Curve Linearization
- Input Indicator
- Safety Cover
- Hardware installed
- Rohs compliant
- UL pending
- Made In USA



SPECIFICATIONS

	PA2425M					
OUTPUT						
Output Amps	.15 to 25					
Output Volts	100-240					
Blocking Voltage, Impulse	800					
OffState dV/dT Immunity	1000	PRELIMINARY DATA				
Heatsink Temp for Full Current	90C					
I2T for Fusing, 10 mSec	340					
Single Cycle Current, 60Hz	260					
Internal MOV option, energy	70					
CONTROL						
4-20mA Drive Voltage, Max	6,5					
Equivalent Resistance, at 20mA	325					
DC Current Limit	25					
Zero Degree Conduction	4,1					
Full Conduction	19,9					
Slow On Time, 0 to 100%	2					
Power Equation Constants, Max						
V0	0,85					
Rt	0.016					

SCHEMATICS/DIMENSIONS



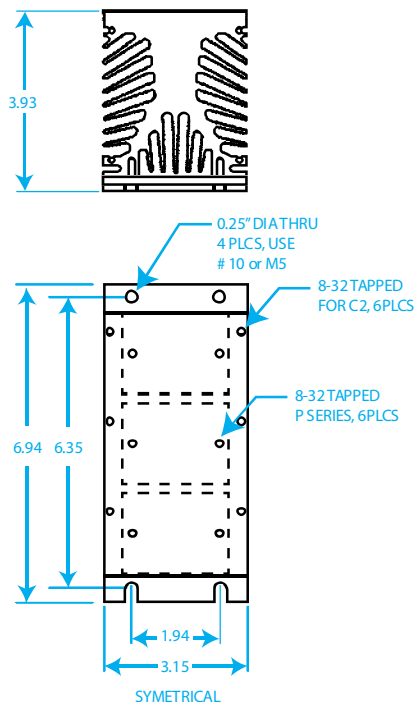
GENERAL, ALL MODELS

Torque Specifications	
Output Terminals	16-20 in/lbs
Control Terminals	4-6 in/lbs
Mounting Screws	10-15 in/lbs
Ambient, degrees C	-40 to 85

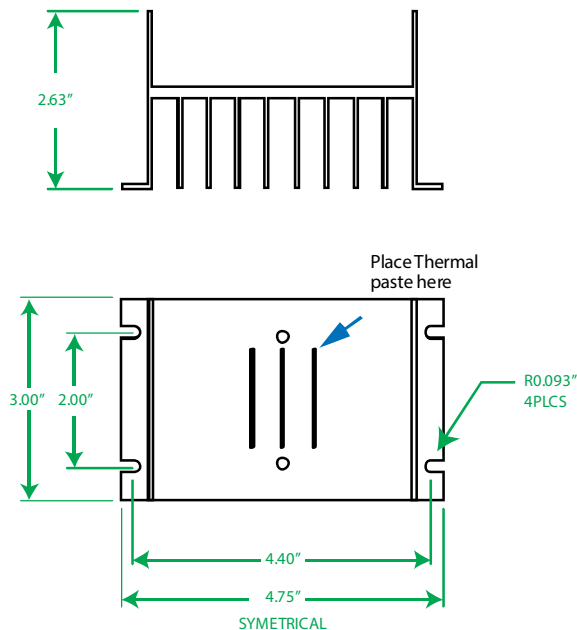
ACCESSORIES

GENERAL, FOR ALL MODELS

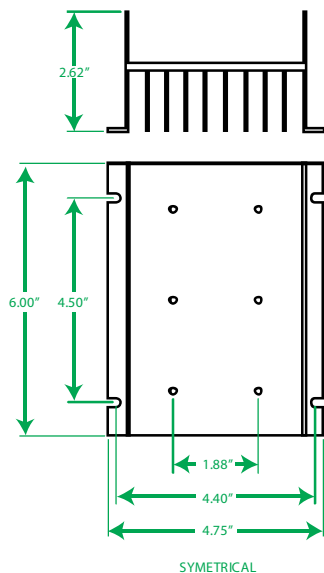
ORDER CODE	DESCRIPTION
HS-05CW	HEATSINK, 0.5C PER WATT



ORDER CODE	DESCRIPTION
HS-13CW	HEATSINK, 1.3C PER WATT (lower is better)



ORDER CODE	DESCRIPTION
HS-08CW	HEATSINK, 0.8C PER WATT



ORDER CODE	DESCRIPTION
HS-13CW	HEATSINK, 1.3 WATTS/DEGREE C
HS-08CW	HEATSINK, 0.8 WATTS/DEGREE C
HS-05CW	HEATSINK, 0.5 WATTS/DEGREE C
TPST-2.7G	THERMAL PASTE, 2.7 GRAM SYRINGE (Mounts about 10 P series)
TPST-25G	THERMAL PASTE, 25 GRAM SYRINGE (Mounts about 100 P series)
DF1	ULTRA FAST DIODE 900V, 4A AVERAGE, 150A PEAK
TVS06	TVS 60V PEAK, 36VDC MAX. PSU, 1.5KW PEAK
TVS10	TVS 100V PEAK, 55VDC MAX. PSU, 1.5KW PEAK
TVS20	TVS 200V PEAK, 110VDC MAX. PSU, 1.5KW PEAK
MOV60	MOV 600V PEAK, 300VDC/230VAC MAXIMUM
MOV80	MOV 800V PEAK, 420VDC/320VAC MAXIMUM
MOV160	MOV 1600V PEAK, 620VAC, MAXIMUM
PD9030	ULTRAFast DIODE, 900V, 30AMP

CUSTOM PRODUCTS AND SERVICES

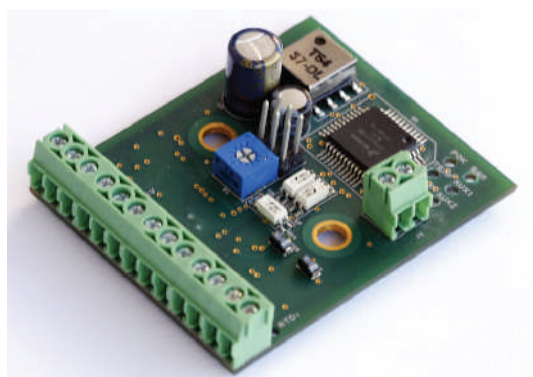
Providing an exclusive product with superb value

We will design electronics to meet your unique requirements, package the design and set up production.

We work with standard agencies per client requirements.

EXAMPLE DESIGNS

TEMPERATURE CONTROLLER WITH CT CURRENT INPUT & CUSTOM EIA485 COMMUNICATIONS PROTOCOL.
MOUNTS ON P SERIES SOLID STATE RELAY



5 AMP LUXEON LED VARIABLE INTENSITY DRIVE WITH 100 STEP INTENSITY / TIME SEQUENCER AND
CUSTOM EIA485 COMMUNICATIONS PROTOCOL. SYNCHRONIZES LED INTENSITY & TIME WITH DIGITAL CAMERA



Solid state relays (SSR) and solid state contactors, unlike their electromechanical cousins, do not wear out and typically provide many years of service. However, poor reliability will occur if specifications are exceeded. The common causes of solid state relay failure are over-current, over-temperature and over-voltage.

Over-current protection begins with choosing the correct SSR for the application. Determine the load current. For heaters with a KW rating, convert to Watts ($KW \times 1000$) and divide by the heater voltage. For example, a 2KW 240V heater would have a nominal load current of 8.3Amps ($2000W/240V$).

Use the Rule of 80%. All VB Controls products are designed for 100% current. However, power line voltage can be up to 10% high and a 10% tolerance is routine for resistive loads. Thus, the actual current may be 20% higher than the nominal values. The steady state load current should be no more than 80% of the nominal values. For example, a 25Amp SSR (PR2825D) is a good choice for load currents up to 20Amps nominal.

High in-rush loads require the SSR be chosen for its surge capability. Examples are motors, transformers, Incandescent tungsten lights, and short wave IR heaters. Motors have a "Locked Rotor Current" specification. Tungsten lighting typically draws ten times the steady state current (wattage / voltage) for the first cycle (.017 Sec.). For high in-rush loads, refer to the manufacturer's datasheet. All VB Controls SSR models will reliably handle surge currents up to 120% for 10 seconds, 140% for one second or 200% for one cycle. Examples: A motor with locked rotor current rating of 32A could be controlled by a 25A SSR such as the PF2825D. An Incandescent light rated 120V, 250Watts will have an in-rush of about 20A ($(250W/120V) \times 10$) and may use a PR2812D.

Semiconductor fuses are recommended to protect SCR based models (C, PF, and PR series). Semiconductor fuses have an I²T Clearing specification and SCRs have a maximum I²T specification. The fuse specification should be 1/4th the SCR I²T or lower. At 1/4th an SCR will fail for approximately every 5 fuses that blow. Equipment with chronic load short circuits will have reliability issues and need root cause determination and short circuit resolution. **Ensure the fuse's interrupt rating is greater than the prospective short circuit current of the supply voltage.** Supply lines should be fused per local electric codes. For the fuse to fulfill its function, the fuse must have the correct amperage, speed and interrupt ratings.

H Bridge applications require good timing. Turning on CW and CCW simultaneously creates a short through the PE model's Output.

Over-temperature protection primarily depends on heatsink selection and mounting. Heatsinks should be mounted on a vertical (up and down) surface with the fins also vertical. Thus, hot air can rise along the body and fins of the heatsink. There should be at least one inch free air below and four inches above the heatsink. "Free air" is air space without obstructions that might hinder convection. The ambient temperature referred to on all datasheets is one inch below the heatsink. If possible, mount heatsinks in the lower half of a cabinet.

P series models need to be mounted to a heatsink. **Use thermal paste.** Our thermal paste comes in a convenient syringe. Three unbroken beads placed as shown on the datasheet's mounting information drawing will provide excellent thermal transfer. Some excess paste may squeeze out the sides, but it will remain under the case's plastic lip. Removal of excess is normally not needed. **VB Controls does not recommend the use of thermal pads** under P series models. Thermal paste works better and is typically less expensive. All P series qualification tests were performed using thermal paste.

In most applications, the ambient temperature will be below 40 degrees Centigrade (104F). Each SSR datasheet has a recommended heatsink depending on load current. When possible, follow the recommendation. However, if heatsink calculations are needed follow these four steps.

1. **Determine allowed heatsink temperature rise.** Always provide a 10C reliability margin. For example a PF2850D has a maximum baseplate temperature of 100C. If the maximum ambient is 40C, then the heatsink can rise 50 degrees Centigrade $((100-40)-10)$.

2. **Determine load current.** Heaters normally have a Kilowatt rating. Load current equals $(KW \times 1000)/Volts$. For example, a 6KW 240V heater would have 25A load current. Never use a heater at a higher voltage than specified. Motors have a Full Load Amperage (FLA) that is normally on the motor's ID plate. Transformers have a VA rating. Divide the VA rating by Voltage to get current.

3. **Determine the power dissipation.** The PF, PR datasheet shows power dissipation in watts per amp switched. If mounting (2) PF2850D to a heatsink and if the load current through each is 25A, the power dissipation would be 60Watts $((1.2W \times 25) \times 2)$. Power dissipation on a PE with IGBT is Load Current x Voltage Drop. For a MOSFET use $1.5 \times Current^2 \times Rds_{on}$. MOSFETs have a positive temperature coefficient and the 1.5 multiplier compensates for hot resistance.

4. **Calculate the heatsink's thermal resistance to air** by dividing the allowed temperature rise by the power dissipation. In the above example, 0.83C/Watt (50C/60W) is required. Lower thermal resistance is better and the HS-08CW is a good choice. A heatsink rated at 1.0C/W would not be acceptable.

The C2 series has built in thermal limit and will protect itself from short term over-temperature. **Extended time operating at thermal limit will decrease reliability.** For ambient temperatures above 40C, derate the C2 current linearly to zero at 125C. Do not exceed the maximum specified ambient in any event.

For AC switching applications, external Over-Voltage protection is normally not needed. All C2 models and PF Series below 50A have built-in MOV output protection and are "Inductive Load and High Noise Ready" straight out of the box. Higher current PF and all PR models have the highest blocking voltage on the market plus internal RC noise suppression and normally do not need external protection with resistive loads. When using an inductive load, or if the power line is suspected of having transients in excess of the model's Blocking Voltage specification, use an external MOV across the output terminals. The MOV80 is used to protect PR28xxx models and the MOV160 is used for PR60xxx models.

The PE Series output needs external over-voltage protection. The type of PE output protection is application dependent. For most applications, a flyback suppression diode is sufficient. The DF1 flyback suppressor will work for all models. Refer to PE wiring (page 7). The DF1 wires are highlighted in green on the drawing. Keep these wires short and **observe DF1 polarity.** If the DF1 wires are longer than a couple meters, especially in PWM applications over 100Hz, a local Power Supply Capacitor or a TVS may be needed. Fast-Off applications, such as a limit switch driven solenoid, needs flyback for quickest solenoid Off-Time. Use a TVS across the PE output. Refer to the chart on PE wiring (page 7) for TVS selection. All TVS parts supplied by VB Controls are bidirectional (no polarity concerns).

CE Note: Unless otherwise specified, all models were tested to EN60947-4-3, load current ratings are AC51 qualified at 100% continuous and 120% for 10 seconds.

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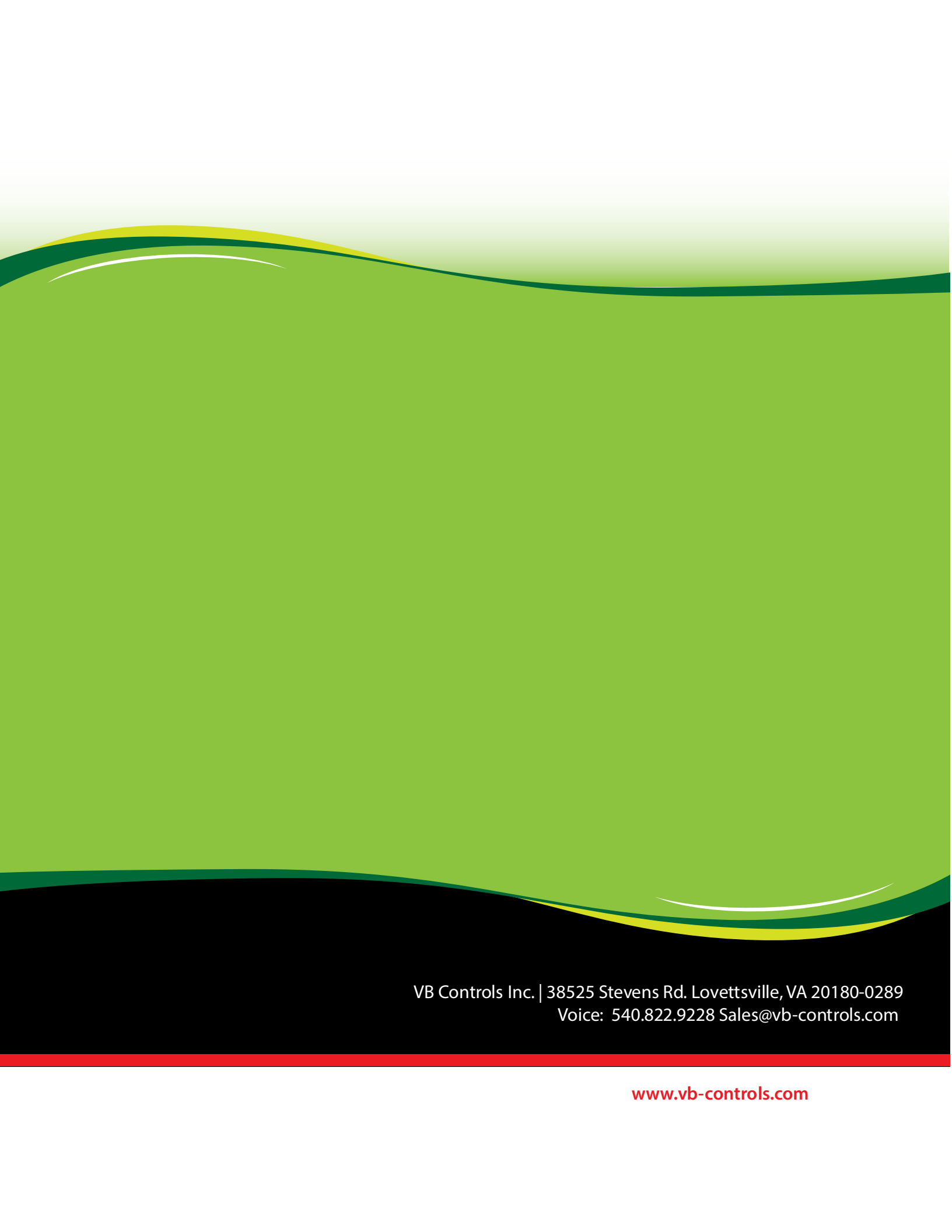
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Product must be installed as specified in VB Controls literature and according to local and national electric codes. Improper installation can cause fires, premature failure, loss, damage, injury or even death.

Solid State Relays do not provide galvanic isolation. A mechanical disconnect must be opened prior to touching terminals or electrical conductors. Access to lethal voltage should be limited to qualified personnel. Electric shock can cause injury or death.

Electronic products may fail at any time, without warning, in an open, closed, partially conducting or unstable state. Any application where a failure might cause harm or damage to people, animals or property must have redundant back up, shut down, disconnect or alarms as appropriate to protect against harm or damage. Failure to provide such protection is an improper application. Improper application of electronic products can cause fires, premature failure, loss, damage, injury or even death.

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