

MODEL 18D-SW/E-SW

- **Description:** Phase-Angle SCR Power Controls
- **Product Range:** 120-600 VAC, Single- or Three-Phase, 10-350 Amps
- **Application:** Transformer-Coupled/Inductive Loads

FEATURES

- All Solid State Construction
- **Exclusive** "2 Millisecond" Fuses for Short-Circuit Protection
- **Exclusive** "V_{bo} Clamping" Transient Voltage Protection
- **Exclusive** Full Rated Operation in 50°C (122°F) Ambients Through 450 Amps Without Fans
- **Exclusive** Proprietary Heatsinks
- Silent, Arcless Switching
- 1/2 Second Soft-Start
- Single- or Three-Phase Input
- Open-Chassis or Enclosed
- Full Range of Control Options and Accessories

TYPICAL APPLICATIONS

- Transformer-Coupled Loads
- Inductive Heating
- Silicon-Carbide Elements
- Foam Cutting
- Other Inductive Loads

Model 18D-SW/E-SW SCR controls utilize phase-angle firing to provide infinitely variable control of single-

phase (18D-SW) and three-phase (18E-SW) a.c. voltages to inductive loads. These units are solid state replacements for variable transformers, saturable core reactors, electromechanical contactors, and mercury relays. Power SCRs replace contacts and brushes to switch electric power without moving parts, and, when operated within stated ratings for current, voltage, and temperature, have no known MTBF or life expectancy rating.

INNOVATIVE ADVANCED TECHNOLOGY:

Three Pillars Of Protection

18D-SW/E-SW SCR controls incorporate **exclusive** design features to protect the power semiconductor components against damage:

1> Unique "V_{bo} Clamping" provides unmatched protection for power semiconductors against transient voltage spikes common on industrial power mains.

2> "2 millisecond" fuses protect semiconductors against short-circuit faults. Payne Engineering SCR controls are the only power controls in the industry that are equipped with factory tested and approved fuses that are coordinated with power semiconductors.

3> Proprietary heatsinks are engineered in-house, coordinating finite-element analysis (FEA) with on-site lab tests. Payne Engineering SCR controls operate at 50°C (122°F) ambient temperatures with no derating.

APPLICATION FLEXIBILITY

Standard configuration of all 18D-SW/E-SW SCR controls is manual control via a 270° turn potentiometer (included). A 1/2 second soft-start feature minimizes the current inrush to inductive loads when first energized. Standard options allow for automatic open- or closed-loop control in response to an analog control signal from a temperature

controller, PLC I/O module, or other external source. Other options allow controls to be configured for the specific requirements of each application.

SPECIFICATIONS

Power Circuit: inverse-parallel thyristors selected for V_{bo} Clamping transient protection, with parallel R-C circuit for dv/dt protection. Current-clamping 2-millisecond power fuses in series with the power semiconductors provide short-circuit protection.

Control Circuit: all solid state circuitry supplies synchronized gate firing pulses to each thyristor via isolating pulse transformers.

Mains Frequency: 50, 60 Hz standard. Other frequencies available as special order (consult factory).

Output Voltage: 0 to nominal input voltage, infinitely variable.

Overall Efficiency: 98.5 to 99.5%.

Power Loss: approximately 1-2 watts/ampere/switched pole.

Voltage Drop Across Power Circuit at 100% Output: 1-2 volts maximum per switched pole.

Proof Voltage: (isolation between power circuit, control circuit and ground) greater than 2 kV.

Control Input: manual control via 75K Ohm, 2 watt potentiometer with integral On/Off switch and indicating dial plate standard.

Control Power: 5 watts maximum, derived from 12 VA isolation control transformer on all units.

Fuse Protection: 2 millisecond I²t fuses are factory tested and coordinated with all power semiconductors, considering:

- a. fuse element melt time t_{melt} ;
- b. peak melt current I_{melt} ;
- c. arc quench time t_{arc} ;
- d. peak arc current I_{arc} .

Transient Voltage Protection: voltage breakover (V_{bo}) protection with R-C filters for dv/dt protection.

Ambient Temperature Range: -10 to + 50°C.

Terminal Connections: 10-30 amp use Bakelite or thermoplastic blocks; 50 amps and larger use screw lugs or stud bolts.

STANDARD OPTIONS

RMS Voltage Limit: circuit-board mounted variable-resistance trimmer in series with manual potentiometer. Allows user to limit output voltage to connected load at maximum potentiometer setting. Not applicable to units controlled by external analog signal.

Milliamp Control: circuitry integral to main board allows output voltage to load to be controlled by external analog signal (milliamps or d.c. voltage) in closed-loop system. Voltage output from power control is proportional to analog signal input. Multi-turn SPAN and GAIN trimmers provide for field calibration/adjustment of signal response range (18D-SW).

Output Current Limit: output voltage from control is varied to keep load current at or below adjustable limit. Includes current transformer.

RMS Output Voltage Regulation: output voltage variations are limited to $\pm 1\%$ for input variations up to $\pm 30\%$. Maximum regulated output voltage may not be greater than 75% of minimum input voltage.

Isolated Chassis Construction: electrically isolated chassis available through 30 amp size.

Optically Isolated ma. Control Card: circuit card for field retrofit of manually operated power controls for automatic control in response to external analog milliamp signal. Optically isolated circuit permits use in open or closed loop control schemes. Voltage output from power control is proportional to analog signal input. Multiturn SPAN and GAIN trimmers provide for field calibration/adjustment of signal response range (18D-SW).

Optically Isolated ma Control: optically isolated circuitry integral to main control board that allows output to the load to be controlled by an external analog signal in an open or closed-loop control scheme. Voltage output from power control is proportional to analog signal input. Multiturn SPAN and GAIN trimmers are provided for signal response calibration or field adjustments to the signal response range (18E-SW).

Heatsink Overtemperature Switch: temperature sensor mounted to heatsink chassis switches if heatsink temperature exceeds maximum allowable level. Available either to turn control off or to drive external indicating signal.

120 V Pilot: 120 VAC pilot voltage signal used to actuate control.

70-400 Hz: control configured for operation at frequencies ranging from 70-400 Hz or 16-2/3 and 25 Hz

277 VAC Input: 277 VAC input voltage rating.

550 VAC Input: 550 VAC input voltage rating (+10% max.).

600 VAC Input: 600 VAC input voltage rating (+10% max.).

ENCLOSURES

18D-SW/E-SW power controls can be supplied in a steel electrical enclosure with a hinged front cover. Enclosures are ventilated to facilitate proper cooling of the control. Ventilation openings are covered by expanded metal mesh, and are located in the bottom and at the top of the side panels. Enclosure fans are not required. For non-ventilation enclosure requirements, consult local sales office.

SIZING CONSIDERATIONS

Model 18D-SW and 18E-SW SCR power controls are designed for use on inductive loads. **Size units by actual load current, not kW**

- 1> Always use maximum possible load current for sizing purposes.
- 2> The amp rating on all 18D-SW/E-SW power controls is stated on the nameplate. Steady-state current draw must not exceed that rating at anytime.
- 3> Rated voltage of the connected load should match the input voltage to the power control.

SIZING EXAMPLE

Application: three-phase, 480 VAC, delta-connected transformer with a steady-state current draw of 20 amps/phase; 480 VAC, three-phase, 60 Hz input voltage.

Model Number Selection:

- a. Variable-voltage: 18
- b. Three-phase: E
- c. 480 VAC input: -4-
- d. Amp rating: 20, so control amp rating = 30
- e. Transformer Load: SW

Model Number: 18E-4-30SW

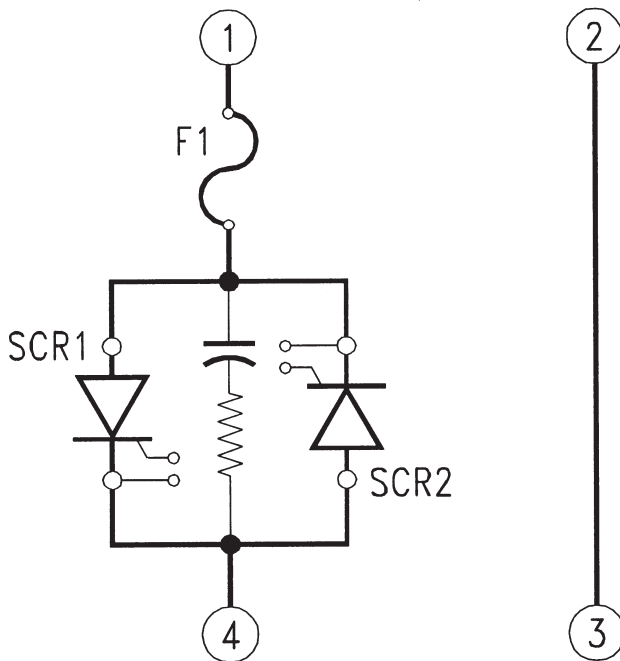
Options: as required.

WHEN ORDERING, SPECIFY:

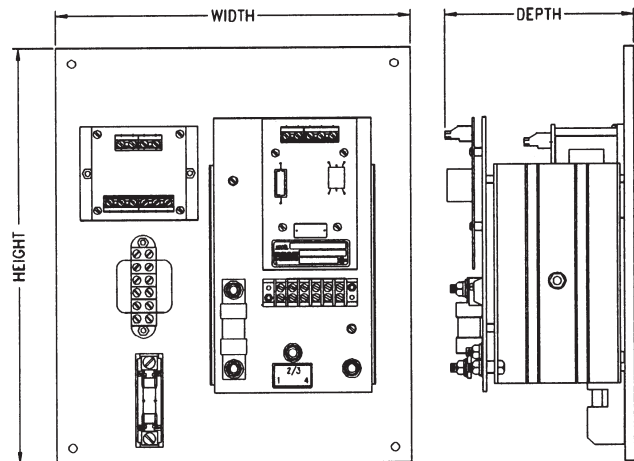
- Model Number
- Input Voltage
- Frequency
- Load Specifications
- Options
- Enclosure Requirements

APPLICATION NOTE: 18E-SW controls are also used for three-phase, 4-wire resistive loads and unbalanced three-phase resistive loads. Consult factory or local sales office for complete application and sizing information.

Model Number	KVA @		Fuse Number	Open Chassis Dimensions Inches (millimeters)			Enclosed Dimensions Inches (millimeters)		
	Max. Amps	Max. Rated Voltage		Height	Width	Depth	Height	Width	Depth
Single-Phase, 120 VAC, 50/60 Hz Input, 0-118 VAC Output									
18D-1-10SW	10	1.2	49B25-30	10 (254)	5.5 (140)	4.5 (115)	14 (356)	12 (305)	8 (203)
18D-1-30SW	30	3.6	49A50-80	10 (254)	5.5 (140)	5.5 (140)	14 (356)	12 (305)	8 (203)
18D-1-80SW	80	9.4	49A50-150	13.25 (337)	11.25 (286)	7 (178)	20 (508)	16 (407)	9 (229)
18D-1-150SW	150	17.6	49A50-250	15 (381)	9.5 (242)	8 (204)	20 (508)	16 (407)	9 (229)
18D-1-350SW	350	41.3	49A50-600	21 (534)	13 (331)	10.5 (267)	36 (915)	24 (610)	12 (305)
Single-Phase, 208/220/240 VAC, 50/60 Hz Input, 0-206/218/238 VAC Output									
18D-2-10SW	10	2.4	49B25-30	10 (254)	5.5 (140)	4.5 (115)	14 (356)	12 (305)	8 (203)
18D-2-30SW	30	7.2	49A50-80	10 (254)	5.5 (140)	5.5 (140)	14 (356)	12 (305)	8 (203)
18D-2-80SW	80	19.0	49A50-150	13.25 (337)	11.25 (286)	7 (178)	20 (508)	16 (407)	9 (229)
18D-2-150SW	150	35.7	49A50-250	15 (381)	9.5 (242)	8 (204)	20 (508)	16 (407)	9 (229)
18D-2-350SW	350	83.3	49A50-600	21 (534)	13 (331)	10.5 (267)	36 (915)	24 (610)	12 (305)
Single-Phase, 380/415/440/480 VAC, 50/60 Hz Input, 0-378/413/438/478 VAC Output									
18D-4-10SW	10	4.8	49B25-30	10 (254)	5.5 (140)	4.5 (115)	14 (356)	12 (305)	8 (203)
18D-4-30SW	30	14.4	49A50-80	10 (254)	5.5 (140)	5.5 (140)	14 (356)	12 (305)	8 (203)
18D-4-80SW	80	38.2	49A50-150	13.25 (337)	11.25 (286)	7 (178)	20 (508)	16 (407)	9 (229)
18D-4-150SW	150	71.7	49A50-250	15 (381)	9.5 (242)	8 (204)	20 (508)	16 (407)	9 (229)
18D-4-350SW	350	167.0	49A50-600	21 (534)	13 (331)	10.5 (267)	36 (915)	24 (610)	12 (305)

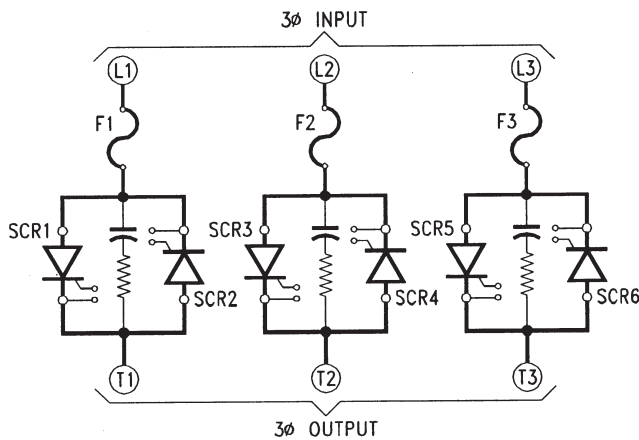


POWER CIRCUIT SCHEMATIC

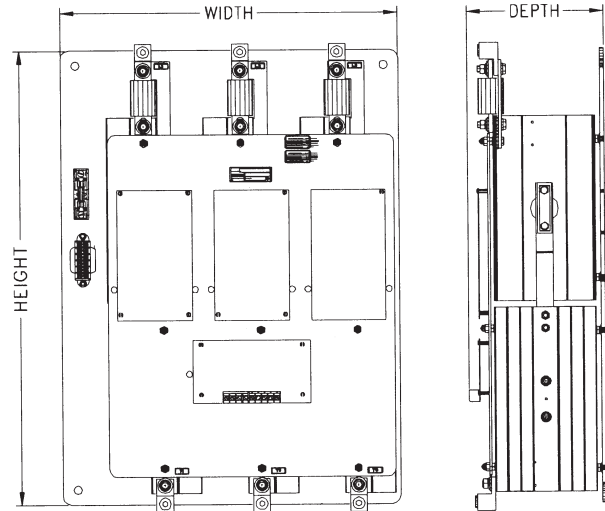


OPEN CHASSIS DIMENSIONS

Model Number	KVA @			Open Chassis Dimensions			Enclosed Dimensions		
	Max. Amps	Max. Rated Voltage	Fuse Number	Height Inches (millimeters)	Width Inches (millimeters)	Depth Inches (millimeters)	Height Inches (millimeters)	Width Inches (millimeters)	Depth Inches (millimeters)
Three-Phase, 208/220/240 VAC, 50/60 Hz Input, 0-206/218/238 VAC Output									
18E-2-10SW	10	4.1	49B25-30	10 (254)	10.25 (261)	5.12 (131)	14 (356)	12 (305)	8 (203)
18E-2-30SW	30	12.2	49A50-80	10 (254)	10.25 (261)	6.12 (156)	14 (356)	12 (305)	8 (203)
18E-2-80SW	80	32.7	49A50-150	24 (610)	11 (280)	6.5 (166)	30 (702)	20 (508)	9 (229)
18E-2-150SW	150	61.3	49A50-250	27 (686)	21 (534)	9 (229)	36 (915)	24 (610)	12 (305)
18E-2-350SW	350	143.0	49A50-600	27 (686)	27 (686)	11 (280)	42 (1067)	30 (702)	16 (407)
Three-Phase, 380/415/440/480 VAC, 50/60 Hz Input, 0-378/413/438/478 VAC Output									
18E-4-10SW	10	8.2	49B70-30	10 (254)	10.25 (261)	5.12 (131)	14 (356)	12 (305)	8 (203)
18E-4-30SW	30	24.7	49A50-80	10 (254)	10.25 (261)	6.12 (156)	14 (356)	12 (305)	8 (203)
18E-4-80SW	80	66.0	49A50-150	24 (610)	11 (280)	6.5 (166)	30 (702)	20 (508)	9 (229)
18E-4-150SW	150	124.0	49A50-250	27 (686)	21 (534)	9 (229)	36 (915)	24 (610)	12 (305)
18E-4-350SW	350	288.0	49A50-600	27 (686)	27 (686)	11 (280)	42 (1067)	30 (702)	16 (407)



POWER CIRCUIT SCHEMATIC



OPEN CHASSIS DIMENSIONS

All dimensions are approximate, and are not to be used for construction purposes. Payne Engineering Company Inc. reserves the right to make changes to product design, construction, and component parts in the interest of technical advancement without prior notification.