



**906-13AW Thermostat**

## System Description

The SCR/Sequencing Control System is designed to provide a combination of proportional (SCR) and/or sequencing steps for single or three phase load configurations. The combination of control/controller and their arrangement allow the designer to customize a system to meet specific application requirements.

The components may include an arrangement of:

- 906 Series – Electronic Thermostat(s) or Input Signal
- 901-D Series – Logic (proportional time base)
- 900 Series – Power Switch(es)
- 901-HR Series – Sequencer

Components may be used stand alone or in combination to accomplish various degrees of control function.

The electronic thermostat, logic, and sequencer are Class II low voltage controls. The power switch is a Class I line voltage power controller that is U.L. Recognized.

The 901-D Series multiple input logic accepts most all commercial electronic or electric input signals. An “on board” pressure transducer provides pneumatic input signals direct. Logics are factory calibrated to accept input signals for DP Series logics as listed in Tables 1 and 2.

The application of SCR and sequencer provide modulation and step control in combination, and functions as a Vernier System in this configuration.

Each power switch is a “zero firing” single phase master controller which may be arranged in any connection in the line, in the Delta, or in the Wye without any regard to phasing. Multiple parallel load circuits may be added to meet total current or KW load requirement.

## Thermostat Inputs

The 906 Series Electronic Thermostats provide two electronic thermostat ranges for wall or remote sensing/set point. Thermostats are available in a standard or miniature size. Optional visible or concealed set point adjustment/function switches are incorporated in the miniature thermostat only. The 906 Series is available with a 10K thermistor input of 65° – 85°F or a temperature sensing IC for 30° – 160°F range. For other thermostat input signals, refer to Table 2. See the 906 Series Electronic Thermostat Product Data literature for detailed thermostat information.

## Specifications, 906 Thermostats

**Table 1**

Model 906–	Type	Range °F	Size	Set Point	Sensor Probe
13W	Wall	65 – 85	Std.	Visible	Self-contained
13AW	Wall	65 – 85	Mini	Visible	Self-contained
13ADRW	Remote	65 – 85	Mini	Visible	Duct Probe
13DRW	Remote	65 – 85	Std.	Visible	Duct Probe
23AW	Wall	65 – 85	Mini	Conceal	Self-contained
23ADRW	Remote	65 – 85	Mini	Conceal	Duct Probe
19DDRW	Remote	30 – 160	Mini	Visible	Duct Probe

## Optional Thermostat Input Signals by Others

**Table 2**

Signal	Signal Range	Calibrated Factory*	Thermostat By
Ohms	0 – 135	10 – 130	Others
VDC	2 – 10 or 2 – 20	2 – 10	Others
mA	2 – 10 or 2 – 20	2 – 10	Others
psi	0 – 15	9 – 13	Others

\* Standard factory calibration unless otherwise requested when ordered.

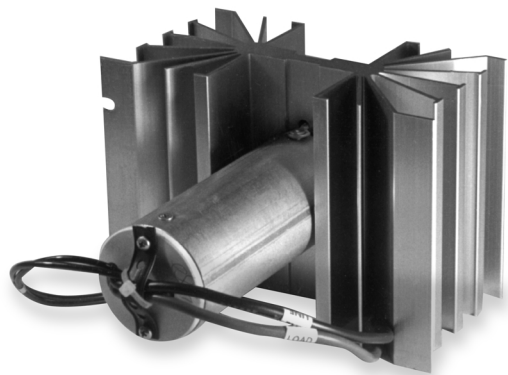
Sensor Resistance (65 – 85°) @25°C/77°F	10K
Sensor Output Voltage (30 – 160) @25°C/77°F	770 mV
Time Constant	
Wall	19 Sec.
Remote	24 Sec.
Connection	
Mini.	10" stripped (U.L. 1007) 22 A.W.G.
Std.	Terminal lug (16 A.W.G. Max)
Options, Miniature only	
Switch – 6A @ 24 VAC	SPDT
Switch – 6A @ 24 VAC	DPDT

Dimensions	<u>Length</u>	<u>Width</u>	<u>Height</u>
Mini.	3.4"	1.85"	1.15"
Mini. (Sub-base)	4.5"	2.75"	0.20"
Std.	5.2"	3.20"	1.85"

## Features

- Proportional control signal.
- Responsive time constant.
- Low voltage (Class II)
- Optional range selection.
- Wall or remote temperature sensing.
- Remote set point.
- Optional function switches.

# Power Switch



**900 Series Power Switch**

The 900 Series Power Switches are zero firing, multiple voltage controllers that are used for connecting line voltage potentials to resistive loads. Firing at zero voltage crossing reduces Radio Frequency Interference (RFI).

Each power switch controls one phase, and can be used in any connection arrangement or combination of phases without regard to phase rotation. Power switch(es) can be used in three phase applications, in the line, in the Delta, or in the Wye. The switch must be selected to accept the appropriate voltage potential and resulting KW connected load.

The 24 volt control source to the power switch is independent of the phase being controlled. The extruded aluminum heat sink must be located in a ventilated ambient with the fins mounted vertically (see temperature specification limitations). The cylindrical control section, including power and control leads, typically mount inside the control panel.

### IMPORTANT

**When power switch(es) are used in combination with the Sequencer to provide a "Vernier" control system, the Power Switch KW load should be selected to provide at least 125% of the largest sequencing KW step.**

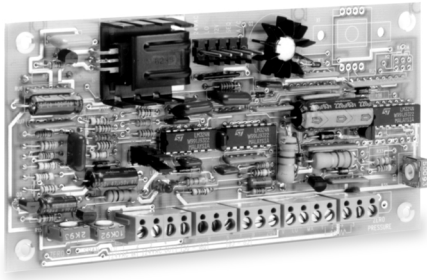
## Specifications 900 Series Power Switch

Models:	900-120/277	120, 208, 240 or 277 277 Volts	
	900-347/480	347 or 480 Volts	
	900-600	600 Volts	
Current, Max.		28 Amps	
Voltage, Limitations		+10%, -15%	
Hertz		50/60	
Ambient			
Heat Sink		50°C (120°F)	
Control Panel		75°C (165°F)	
Control			
Voltage		24V AC	
Power, (VA/Switch)		1.3 VA	
Wire			
Line, 8" Stripped, U.L.1015		12 A.W.G.	
Control, 8" Stripped, U.L.1015		22 A.W.G.	
Dimensions:	<u>Height</u>	<u>Width</u>	<u>Diameter</u>
Heat Sink	4.0"	5.75"	3.0"
	<u>Diameter</u>	<u>Radius</u>	
Logic Tube	1.75"	3.0"	

## Features

- Each power switch incorporates its own zero-firing logic, providing any combination or connection arrangement for single or three phase applications.
- Up to 12 power switches may be controlled from one 901 Series Logic. (For applications requiring more than 12 power switches consult factory.)
- No phasing required.

# Logic



## 901-D Series Logic

The 901-D Multiple Input Logic is designed to provide a proportional time base for operating one or more power switch(es) and/or the sequencer of the control system. The logic accepts an input signal (see Table 3) and develops a 24 volt output that is time proportioned to fire the power switch(es). The time proportioned output selects a percentage of the time base for connecting power switches to the load.

The load is disconnected from the line for the remaining period of the time base. The load is proportioned on/off for each five-second time base, proportionally providing power to the load. Time bases other than 5 seconds are available for special applications. Up to 12 power switches may be controlled from any one logic. (For applications requiring more than 12 power switches consult factory.)

Zero and span pots are available for field adjustment. Zero adjustment determines when power begins to modulate. The span adjustment determines when full power is on continuously and/or when sequencing steps are energized. The 24 volt control power must be sized to accommodate the total of all components; i.e., power switch(es), logic(s), and/or sequencer (including external relay loads as required).

## Specifications 901-D/DP Series Logics

Voltage, Nominal	24 VAC
Voltage, Limitations	+10%, -15%
Power	3 VA
Oscillator Time Base	5 Sec.
Output Triac Rating	1 Amp
Power Switch(es)	12
(Consult factory for more than 12)	
Span, 906-13AW Thermostat	
Factory Standard	2.0°F
Range	0.5° to 5.0°F
Zero Adjustable	Set Point

**Table 3**  
**901-D Multiple Input Options**

Input Stat Signal	Mfg.	Ranges	Factory Std. Calibration Span
10K	HCC	65 – 85°F	2°F
Temp. IC	HCC	30 – 160°F	7°F
Ohm	Others	0 – 135	10 – 130 Ohms
VDC	Others	2 – 10 2 – 20	2 – 10V DC —
mA	Others	2 – 10 2 – 20	2 – 10 mA —

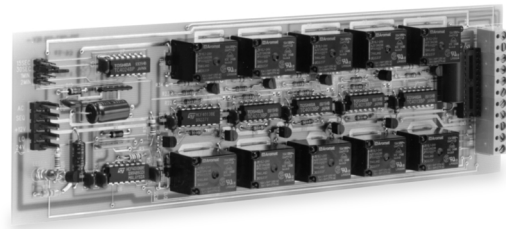
## 901-DP Pneumatic Input

0 – 15 psi	Others	0 – 15 psi	9 – 13 psi
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## Features

- Multiple (selectable) inputs on 901-D Series.
- Field adjustable zero and span for all inputs.
- Controls up to 12 power switches from one logic. (For applications requiring more than 12 power switches consult factory.)
- Low voltage control, requires 24 VAC power.

# Sequencer, Heating



## 901-HR Series Sequencer

The 901-HR Series Heating Sequencer is a “first on/last off,” low voltage, time based step controller. The sequencer is available in nine models (2 through 10 stages) of 24V AC non-isolated output control. The 901-D Logic is required to interface the thermostat input to the sequencer and provide 24V AC power to the sequencer through factory furnished cables.

A 24 volt power source is required to accommodate all control/controller components of the system plus the power required for the sequencer relays. The sequencer receives a signal from the logic to advance, reduce, or hold an appropriate number of stages at the termination of the preselected sequencer time base. This allows balancing of the load with respect to the proportional

band (span). Each stage is controlled within the span, regardless of the quantity of stages being controlled. Four time bases are available that may be selected for establishing the required time delay between stages for the application.

When the pulses from the logic to the sequencer are full “On” for the preselected sequencer time base, the sequencer will advance steps. Conversely, when the pulses are “zero,” the sequencer will reduce steps. When the pulse signal is modulating “On and Off,” the sequencer will “lock in” the specific quantity of stages over the span (proportional band) as required to balance the load. This feature allows calibration of up to ten stages inside the span within the limitations of the specification.

Selecting the appropriate sequencer time base for the application is critical, and the time delay (between advancing or reducing stages) can determine the ability of the system to respond to temperature of the input signal. When the proportional modulating (SCR) stage is functioning in the system with the sequencer, the system is commonly described as a “Vernier System”. The modulating stage furnishes proportional control in addition to the sequencing stages and therefore provides more accurate control of the load.

## Specifications 901-HR Series Sequencer

Time Delay (Time Base)			
Standard, Factory Set			30 Sec.
Option			15, 60, 120, Sec.
Stages			
Minimum			2
Maximum			10
Dimensions	<u>Length</u>	<u>Width</u>	<u>Height</u>
	8.0"	3.2"	1.25"

## Features

- Available in nine models, 2 through 10 stages.
- Four selectable time delay options.
- May use stand alone, as a sequencer, or in conjunction with modulation for Vernier applications.
- Interconnecting cable included.

### IMPORTANT

**When a sequencer is used in combination with power switch(es) to provide a “Vernier” control system the Power Switch KW load should be selected to provide at least 125% of the largest sequencing KW step.**

### CAUTION

**Vernier systems, modulation and sequencing, should not be used in remote direct sensing applications where close temperature control or fast response to temperature change is required.**

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## Hoffman|Controls