



# Power Protector Stabilizer

## WAVE Series

- User Manual -

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The following document applies toPPSWAVE

Thyatron started producing **Power Protector Stabilizers** in 1992. The company has over 1.000.000 pieces on the market. MFS series superiority originates from the **OEM design** of the product based on needs and demands born directly from field knowledge provided by the customer.



PPS WAVE is an incorporated **Power Protector Stabilizer and Thermostat** that supervises voltage, frequency, temperature, current\* and stabilizes voltage for normal operation of **commercial refrigeration appliances** (*appliances falling into EN/IEC 60335-2-89 scope*). PPS WAVE also has a function of randomized starting delay after the out of limits 3 minute cut off.

The product is split type - the **ECU (Electronic Control Unit)** and the **Trafo** (Autotransformer).

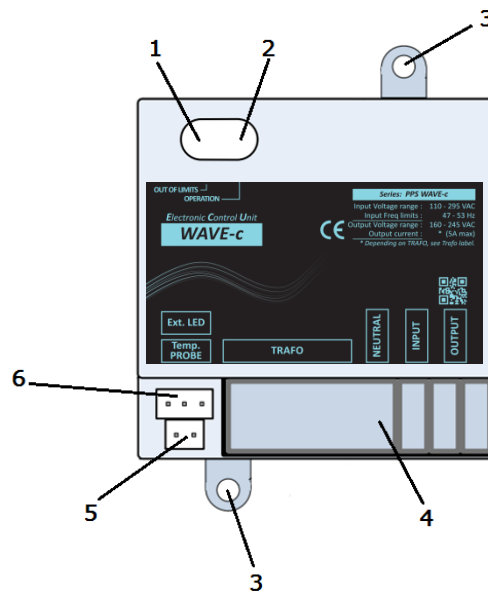
## PRODUCT FEATURES

- Voltage stabilizer<sup>1.4</sup>
- Electronic thermostat<sup>1.5</sup>
- Voltage & Frequency supervisor<sup>1.6</sup>
- Intelligent ambient temperature protection<sup>1.7</sup>
- Intelligent Time delay 2'30''+0''to30'' random (*zero at start up on production*)<sup>1.8</sup>
- Surge protection
- Reconnecting Voltage Hysteresis
- Diagnostic connection self control<sup>1.11</sup>
- Zero crossing
- Wide ambient temperature range from  $T_{\min} -40^{\circ}\text{C}$   $T_{\max} +65^{\circ}\text{C}$

*\*Current controlled output (on request)*

# 1 GETTING TO KNOW YOUR APPLIANCE

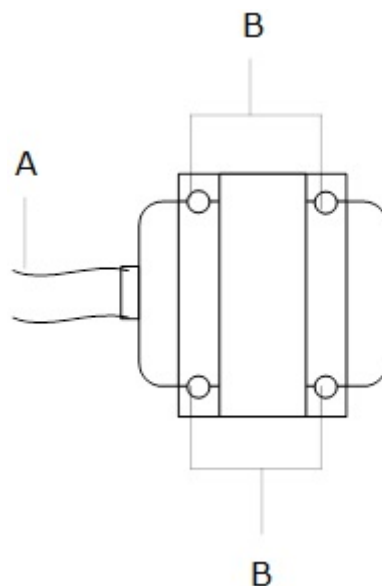
## 1.1 Electronic Control Unit -ECU



- |                    |                       |
|--------------------|-----------------------|
| 1. Red LED         | 4. Fast on terminals  |
| 2. Green LED       | 5. Temperature sensor |
| 3. Mounting points | 6. External LEDs      |

## 1.2 Autotransformer-Trafo

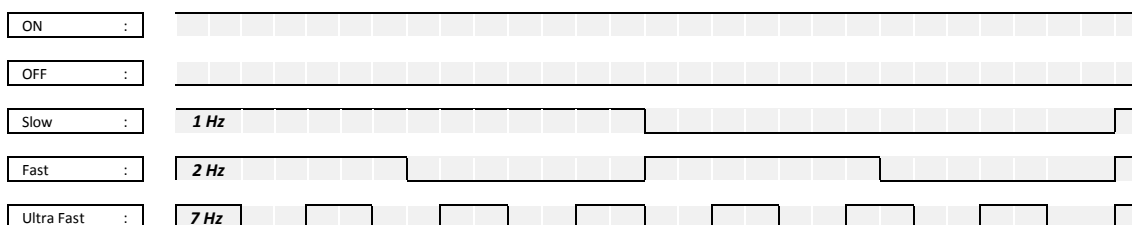
Electrical function: Non short circuit proof



- A. Connection cables - Fast On female terminal (Installation Guide)
- B. Mounting points

### 1.3 LEDS INDICATION

EVENT	RED LED	GREEN LED
Output Enabled <i>(Normal operation)</i>	OFF	ON
Output Disabled due Thermostat <i>(Normal operation)</i>	-	Blink Slow
3 minutes time delay	Blink Slow	-
Frequency out of limits	Blink Fast	-
Ambient Temperature out of limits <i>(see 1.5 paragraph)</i>	-	Blink Fast
<ul style="list-style-type: none"> <li>• Voltage/Frequency/Thermostat Out of limits after 3 minutes delay</li> <li>• Self Test Procedure</li> </ul>	ON	OFF
Self Test Recognize Fail	Blink Ultra Fast	OFF
PPS MFS Failure or No Power	OFF	OFF



### 1.4 VOLTAGE STABILIZATION

PPS WAVE performs voltage correction and stabilization using Autotransformer and Relays. PPS WAVE makes switching in order to keep the output voltage within limits.

Series	OUTPUT VOLTAGE limits
PPS WAVE-c	160 - 245 VAC $\pm 3\%$ (Low Voltage Reconnect 187 VAC)
PPS WAVE-n/ -i	196 - 245 VAC $\pm 3\%$

### 1.5 ELECTRONIC THERMOSTAT

The electronic thermostat is capable of adjusting (according to customer's request) the temperature from  $-28^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ . Another feature is that it has got an adjustable differential that ranges from  $+1$  to  $+10^{\circ}\text{C}$ .

Moreover, another significant characteristic is that it is able to run a self-diagnostic thermocouple check. If the unlikely event of a temperature sensor failure is detected then the device enters a temporal refrigeration mode with pre-determined (according to customer's request) on-off time duration.

## 1.6 VOLTAGE & FREQUENCY SUPERVISOR

PPS WAVE monitors voltage and frequency of main power and cuts off the output when the values of main power (voltage or frequency) come out of limits.

Series	INPUT VOLTAGE limits	INPUT FREQUENCY limits
PPS WAVE-c	110 - 295 VAC $\pm$ 3% with hysteresis	47 - 53 Hz $\pm$ 0.2Hz (50Hz Version) or 57 - 63 Hz $\pm$ 0.2Hz (60Hz Version)
PPS WAVE-n	165 - 295 VAC $\pm$ 3% with hysteresis	
PPS WAVE-i	145 -285 VAC $\pm$ 3% with hysteresis	

## 1.7 TEMPERATURE MONITORING

PPS WAVE has temperature sensor to monitor ambient temperature every 1 minute. When the temperature is higher than the upper limit or the curve of temperature rises abruptly over 15 minutes, then PPS WAVE cuts off the output to protect the cooler and itself. The PPS WAVE will reconnect the output, when the ambient temperature, fall below to the 50°C and the curve become into the limit.

Series	TEMPERATURE limits	CURVE of TEMPERATURE
PPS WAVE-c/ -n/ -i	+80 °C	d $\theta$ > 15 °C / 15 min

## 1.8 INTELLIGENT TIME DELAY

- Delayed start allows the cooling circuit to balance the pressure of cooling gases, preventing startup under high pressure, increasing the lifetime of compressor.
- Intelligent time delay protects network overload and voltage drop, in case of many coolers are installed in the same power line.
- Intelligent time delay is activated 3 mins delay after first 30 minutes continuous operation of life cycle. This function saves time on the production line, because there is no delay.

## 1.9 SURGE PROTECTION

PPS WAVE uses components to absorb surges in order to provide some protection to the commercial refrigerators from them.

## 1.10 RECONNECTING VOLTAGE HYSTERESIS

If PPS WAVE reconnects after a cut off and the line voltage fluctuates near the lower limit, the device uses a voltage window in order to avoid continuous cutoffs due to voltage drop from connecting and igniting of the unit.

## 1.11 STORAGE

Should not be stored in high temperature or high humidity condition. Usage, beyond the specified shelf life could compromise product long term reliability. The suitable condition is +5 to +35°C and less than 75%RH in Relative Humidity indoor. Shelf Life, 2 years.

## 1.12 APPROVALS

Approvals		
CE	LVD European Directive 2014/35/EU <ul style="list-style-type: none"> <li>• EN 61558-1:2005 +A1:2009</li> <li>• EN 61558-2-13:2009</li> <li>• EN 60730-1:2016</li> <li>• EN 60730-2-9:2010</li> </ul> <i>Type of automatic action of Control: type 2 action</i>	EMC European Directive 2014/30/EU <ul style="list-style-type: none"> <li>• EN 61000-6-1:2007</li> <li>• EN 61000-6-3:2007+A1:2011</li> <li>• EN 60730-1:2016</li> <li>• EN 60730-2-9:2010</li> <li>• EN 62041:2010</li> </ul> <i>EMC testing under nominal values of current and voltage</i>

## 2 SPECIFICATIONS

### 2.1 Power Protector Stabilizer WAVE

#### 2.1.1 Series: PPSWAVE-c

Series PPS WAVE-c		PPS WAVE-c			
Model of SeriesPPS WAVE-xxxC: <i>xxx: 045, 070, 090</i>		045	070	090	
Operating conditions	Nominal Voltage	220 - 240 VAC			
	Operation Voltage Bandwidth	90- 310 VAC			
	Ambient Temperature	T <sub>min</sub> -40°C T <sub>max</sub> +65°C			
	Humidity	0 - 85 %RH			
Input <i>(Control for a.c. only)</i>	Low Voltage	110VAC ±3%with hysteresis			
	High Voltage	295 VAC ±3%with hysteresis			
	Lower Freq. Limit (50/60 Hz)	47 Hz/ 57 Hz±0.2Hz			
	Upper Freq. Limit (50/60 Hz)	53 Hz/ 63 Hz±0.2Hz			
Output	Voltage range	160 - 245 VAC ±3%(Low Voltage Reconnect 187VAC)			
	Max. Current (A)	2.0	3.0	4.0	
	Continuous Operation(45 <sup>0</sup> C) Current (A) @ Low Voltage	1.5	2.2	3.0	
Start Up Time, Time Delay		- 3 minutes (2'30'' +0''to30''random) -Zero on Production Line for first 30 minutes continuous operation of life cycle			
Thermal protection		- Temperature limits +80 °C - Temperature differential 15°C / 15 minutes			
Plastic Housing		UL94 V-0 Flame Retardant			
Lifetime		Relay lifetime cycles100.000			
Connections		6.3mm x 0.8mm flat, terminal			
Cable Harness - Lengths		Available at 250, 550,1000 versions			
Insulation Class, Transformer Windings		F ( 155 °C)			
Total weight (Kg) (ECU, Trafo with cable 250mm)		2.1	2.5	3.3	
Electronic thermostat	Accuracy	NTC Sensor	± 0.5 °C(Operating Temp. Range: -30°C to +80°C)		
		PPS WAVE-c	± 0.5 °C		
	Target Temperature		-28to +50 °C		
	Thermal adjustable differential		+1to+10 °C		
	Type of	automatic action	type 2.B		
		disconnection	micro-disconnection on operation		
	Maximum intended click rate		10 per 60 min		
	Pollution degree		3		
Overvoltage category		III (4000 V)			



## 2.1.2 Series: PPS WAVE-i

Series PPS WAVE-i		PPS WAVE-i			
Model of Series PPS WAVE-xxxI:		045	070	090	120
<i>xxx: 045, 070, 090,120</i>					
Operating conditions	Nominal Voltage	220 - 240 VAC			
	Operation Voltage Bandwidth	90- 310 VAC			
	Ambient Temperature	T <sub>min</sub> -40°C T <sub>max</sub> +65°C			
	Humidity	0 - 85 %RH			
Input <i>(Control for a.c. only)</i>	Low Voltage	145VAC ±3%with hysteresis			
	High Voltage	285 VAC ±3%with hysteresis			
	Lower Freq. Limit (50/60 Hz)	47 Hz/ 57 Hz±0.2Hz			
	Upper Freq. Limit (50/60 Hz)	53 Hz/ 63 Hz±0.2Hz			
Output	Voltage range	200 - 245 VAC ±3%			
	Max. Current (A)	2.0	3.0	4.0	5
	Continuous Operation(45°C) Current (A) @ Low Voltage	1.5	2.2	3.0	4.5
Start Up Time, Time Delay		- 3 minutes (2'30'' +0''to30''random) -Zero on Production Line for first 30 minutes continuous operation of life cycle			
Thermal protection		- Temperature limits +80 °C - Temperature differential 15°C / 15 minutes			
Plastic Housing		UL94 V-0 Flame Retardant			
Lifetime		Relay lifetime cycles100.000			
Connections		6.3mm x 0.8mm flat, terminal			
Cable Harness - Lengths		Available at 250, 550,1000 versions			
Insulation Class, Transformer Windings		F ( 155 °C)			
Total weight (Kg) (ECU, Trafo with cable 250mm)		1.9	2.0	2.5	3.2
Electronic thermostat <i>(upon request)</i>	Accuracy	NTC Sensor	± 0.5 °C(Operating Temp. Range: -30°C to +80°C)		
		PPS WAVE-c	± 0.5 °C		
	Target Temperature		-28to +50 °C		
	Thermal adjustable differential		+1to+10 °C		
	Type of	automatic action	type 2.B		
		disconnection	micro-disconnection on operation		
	Maximum intended click rate		10 per 60 min		
	Pollution degree		3		
Overvoltage category		III (4000 V)			

## 2.1.3 Series: PPS WAVE-n

Series PPS WAVE-n		PPS WAVE-n			
Model of Series PPS WAVE-xxxn:		045	070	090	110
<i>xxx: 045, 070</i>					
Operating conditions	Nominal Voltage	220 - 240 VAC			
	Operation Voltage Bandwidth	90- 310 VAC			
	Ambient Temperature	T <sub>min</sub> -40°C T <sub>max</sub> +65°C			
	Humidity	0 - 85 %RH			
Input <i>(Control for a.c. only)</i>	Low Voltage	165VAC ±3% with hysteresis			
	High Voltage	270 VAC ±3%with hysteresis			
	Lower Freq. Limit (50/60 Hz)	47 Hz/ 57 Hz±0.2Hz			
	Upper Freq. Limit (50/60 Hz)	53 Hz/ 63 Hz±0.2Hz			
Output	Voltage range	196 - 245 VAC ±3%			
	Max. Current (A)	2.0	3.0	4.0	5.0
	Continuous Operation(45 <sup>0</sup> C) Current (A) @ Low Voltage	1.5	2.2	3.0	3.75
Start Up Time, Time Delay		- 3 minutes (2'30'' +0''to30'' random) - Zero on Production Line for first 30 minutes continuous operation of life cycle			
Thermal protection		- Temperature limits +80 °C - Temperature differential 15°C / 15 minutes			
Plastic Housing		UL94 V-0 Flame Retardant			
Lifetime		Relay lifetime cycles100.000			
Connections		6.3mm x 0.8mm flat, terminal			
Cable Harness - Lengths		Available at 250, 550,1000 versions			
Insulation Class, Transformer Windings		F ( 155 °C)			
Total weight (Kg) (ECU, Trafo with cable 250mm)		1.6	1.9	2.3	2.7
Electronic thermostat <i>(upon request)</i>	Accuracy	NTC Sensor	± 0.5 °C(Operating Temp. Range: -30°C to +80°C)		
		PPS WAVE-n	± 0.5 °C		
	Target Temperature		-28to +50 °C		
	Thermal adjustable differential		+1to+10 °C		
	Type of	automatic action	type 2.B		
		disconnection	micro-disconnection on operation		
	Maximum intended click rate		10 per 60 min		
	Pollution degree		3		
Overvoltage category		III (4000 V)			

### **3 FURTHER INFORMATION**

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