



# Power Protector Stabilizer WAVE Series

- User Manual -

The following document applies to PPS WAVE

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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).

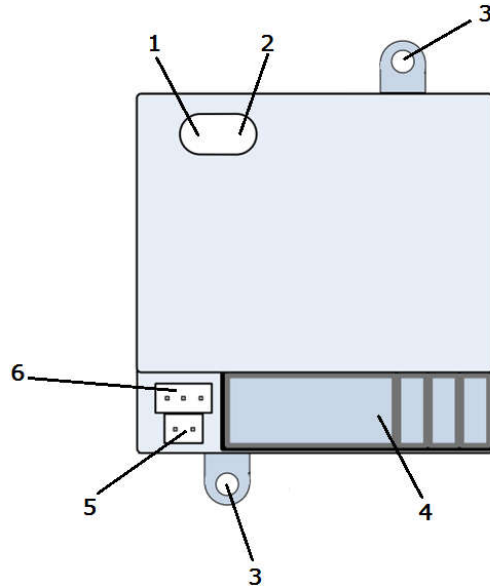
## PRODUCT FEATURES

- 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<sup>1.9</sup>
- Reconnecting Voltage Hysteresis<sup>1.10</sup>
- Diagnostic connection self control<sup>1.11</sup>
- Zero crossing
- Wide ambient temperature range from  $T_{\min}$  -40°C  $T_{\max}$  +65°C

*\*Current controlled output (on request)*

# 1. GETTING TO KNOW YOUR APPLIANCE

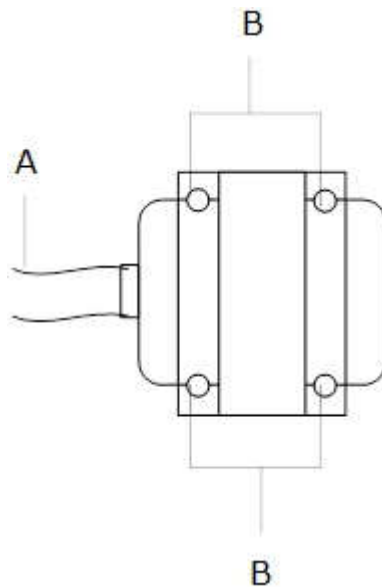
## 1.1. Electronic Control Unit - ECU



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

## 1.2. Autotransformer - Trafo

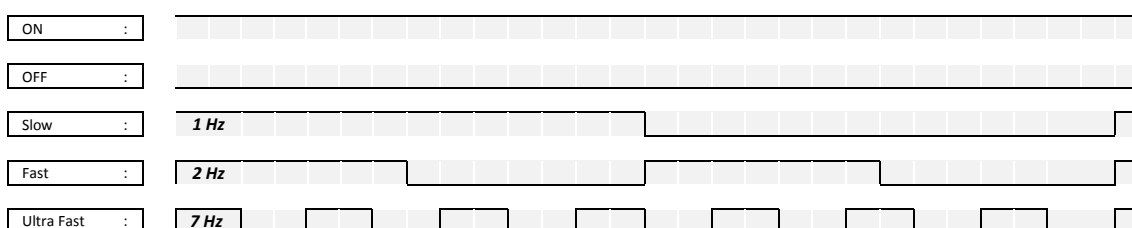
Electrical function: Non short circuit proof



- 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	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. SENSING ELEMENT MODE (Temp. Sensor: ok ;)  $\leftrightarrow$  TIME MODE (Temp. Sensor: failure ;) : Fault reaction time  $< 0,5\text{sec}$ .

## 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)
PPS WAVE-n	165 - 295 VAC $\pm$ 3% with hysteresis	57 - 63 Hz $\pm$ 0.2Hz (60Hz Version)

## 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 in to the limit.

Series	TEMPERATURE limits	CURVE of TEMPERATURE
PPS WAVE-c/ -n	+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 activate 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. DIAGNOSTIC CONNECTION SELF CONTROL

In order to secure the PPS WAVE against mistaken installation, the device is equipped with a correct sequence connection self-control diagnostic function. If during the installation procedure something goes wrong and the transformer cables will not be connected with the proper order to the ECU, then the device will not operate.

- Once the WAVE will be activated for the first time, the diagnostic control will be performed so as dysfunctional operation to be prevented. If the WAVE is turned-off in less than 30 minutes of continuous operation and then turned-on again, the diagnostic control will be performed again too. In case the WAVE exceeds 30 minutes of continuous operation, the diagnostic self-control will be disabled and in the event of turn-off and turn-on situation the WAVE will enter a three minute delay-on.
- The diagnostic control will be performed whenever the value of the input voltage is among 200 VAC to 250 VAC and ideally there should not be great fluctuations because that could affect the outcome of the diagnostic control.
- This particular diagnostic control does not cover the case in which there is linked another cable at the position of the yellow cable except the yellow one, as this would lead on to a certain destruction of the WAVE.
- If there is a faulty cable connection or a cable is not linked at all (**except the yellow and the blue one, these cables must be always be properly connected**), then after the diagnostic control the output voltage will not be activated, and depending the scenario the red LED will be blinking ultra-fast or the device will reset and perform the diagnostic control (depending on the faulty cable connection).

### 1.12. 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.

### 1.13. 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>

# 1. SPECIFICATIONS

## 1.1. Power Protector Stabilizer WAVE

### 1.1.1. Series: PPS WAVE-c

<u>Series PPS WAVE-c</u>		<u>PPS WAVE-c</u>			
<u>Model of Series PPS WAVE-xxxC:</u>		<b>045</b>	<b>070</b>	<b>090</b>	
<i>xxx: 045, 070, 090</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	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 187 VAC)			
	Max. Current (A)	2.0	3.0	4.0	
	Continuous Operation 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			
Life time		Relay lifetime cycles 100.000			
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		-28 to +50 °C		
	Thermal adjustable differential		+1 to +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)			

### 1.1.2. Series: PPS WAVE-n

Series PPS WAVE-n		PPS WAVE-n			
Model of Series PPS WAVE-xxxn: <i>xxx: 045, 070</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	165VAC ±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	196 - 245 VAC ±3%			
	Max. Current (A)	2.0	3.0	4.0	
	Continuous Operation Current (A) @ Low Voltage	1.5	2.2	3.0	
Start Up Time, Time Delay		<ul style="list-style-type: none"> <li>- 3 minutes ( 2'30" +0"to30" random)</li> <li>- Zero on Production Line for first 30 minutes continuous operation of life cycle</li> </ul>			
Thermal protection		<ul style="list-style-type: none"> <li>- Temperature limits +80 °C</li> <li>- Temperature differential 15 °C / 15 minutes</li> </ul>			
Plastic Housing		UL94 V-0 Flame Retardant			
Life time		Relay lifetime cycles 100.000			
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)					
Electronic thermostat	Accuracy	NTC Sensor	± 0.5 °C (Operating Temp. Range: -30°C to +80°C)		
		PPS WAVE-n	± 0.5 °C		
	Target Temperature		-28 to +50 °C		
	Thermal adjustable differential		+1 to +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)			



## Further Information

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