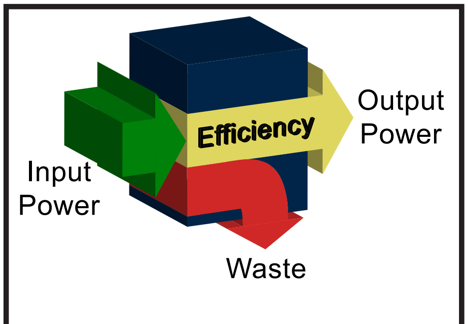
The PULS Advantage

Issue 1

Efficiency.....The Forgotten Feature

Efficiency is one of the most important features that every engineer must consider when selecting a power supply. When you use a power supply, energy flows through the product. Due to the efficiency of every component, not 100% of that energy can be used. The difference between the usable energy, and 100%



Simple Efficiency Diagram

is dissipated as heat, and heat is your enemy because it degrades the components in the power supply and other components in the electrical enclosure.

Let's say we have two power supplies, one is 92% efficient and the other is 96%. The 92% efficient one is close to 100%, so what is the point of going to 96%. Using these figures, we might think that the difference is only 4% (96%-92%=4%). But if we have a 100 watt power supply, the 92% efficient power supply loses 8 watts, and the 96% efficient power supply loses 4 watts. That is 50% less heat loss from the 96% efficient power supply.
Let's look at a real world example using two 480 watt power supplies. The PULS CP20.241 has an efficiency rating of 95.6%, and a competitive unit recently released that has an efficiency rating of 93.1%. The apparent difference is 2.5%. Not a big deal right? If we review the table below, we will see the true difference.

Model	Efficiency	% Losses	Losses
PULS CP20	95.6%	4.4%	21W
Competitor	93.1%	6.9%	33W
Difference	2.5%	2.5%	57%

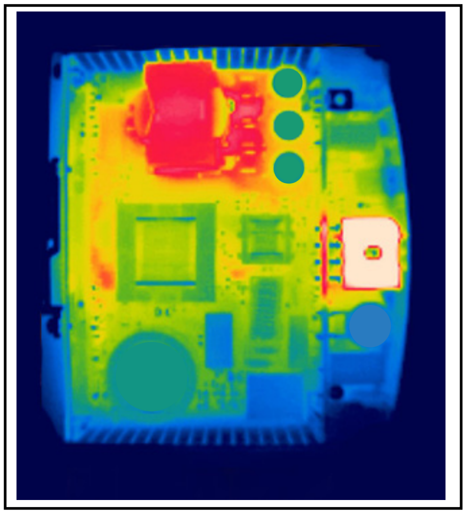
From this table, we can see that the actual heat loss difference is 57%, not the 2.5% we originally thought. A simple method to determine the true difference of heat loss between power supplies is to use the simple heat loss formula shown below.

$$\text{Heat Loss} = \left(\frac{\text{Output Watts}}{\text{Efficiency}}\right) - \text{Output Watts}$$

Simple Heat Loss Formula

Considerations of Heat

Heat is the number one enemy to a power supply because of the electrolytic capacitors. But many times there are far more sensitive electronic components inside an enclosure which can be affected by heat like PLC's, computers, and operator interface units. Heat can radically change the reliability and lifetime of the power supply and in many cases can force you to increase your enclosure size, install some form of cooling or derate the unit to compensate for high heat losses. The general rule of thumb as published by the capacitor manufacturers is that every 10°C increase in temperature results in a 50% decrease in life for the capacitor. Since capacitors are so sensitive to heat, a good design will also thermally separate the capacitors from heat producing components like transformers and bridge rectifiers. As can be seen from the thermal image below, the larger blue circle at the bottom, and the 3 smaller blue circles



Thermo Image of a PULS Power Supply

in the upper right are capacitors. Those capacitors are positioned so that either they are placed in a naturally cooler area (bottom), or they are separated by an air channel that protects them from heat and therefore extends their lifetime and reliability.

So by choosing a power supply with the highest efficiency and good thermal design can mean the difference between a highly reliable control system and a system where problems ultimately will surface.

Energy Savings

One other area that should be considered by the design engineer is the amount of energy consumption required to operate the load. If we look back at the same example of the two 480 watt power supplies, but this time from an energy standpoint, you will be surprised with the results. The power supply which was rated 93.1% efficient and had 33W of lost energy would from a simplistic calculation lose 1.65kW over a 50 hour work week. As compared to the 95.6% efficient CP20 efficient supply, with losses of only 1.05kW. Using an average kilowatt cost of 13¢ per kilowatt/hour, the lower efficient power supply would waste approximately $11.16 per year verses $7.10 per year for the CP20. Multiply this by the number of power supplies in a factory and the savings can be quite significant for a user over the life of the control system.

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By using PULS high efficiency power supplies it is possible to use a smaller power supply because no derating is necessary in most cases. The high efficiency keeps the power supply running cooler, does not add unnecessary heat to the cabinet, and overall energy saving can be achieved. These plus all the other features makes PULS the right choice for any application. How do competitive products compare with PULS? The table below tells the story.

MFG	Efficiency	Heat Loss (Watts)	Energy Waste Per Year
PULS - CP20	95.6%	22.09	$7.10
Competitor	93.1%	33	$11.16

Assumes 50 hour weekly operation and 13¢ cost per kWh

	MFG/Series	Efficiency	Output (Watts)	Input (Watts)	Heat Loss (Watts)	Heat in Panel Compared to PULS
5 Amp 1 Phase	PULS - CP5	94.3%	120	127.25	7.25	-
	Meanwell - SDR	91%	120	131.87	11.87	164%
	Delta Lyte / Sola - SVL	90%	120	133.33	13.33	184%
	Phoenix - Quint 4	89%	120	134.83	14.83	205%
	Omron - S8VK-G	89%	120	134.83	14.83	205%
	Sola - SDN	88%	120	136.36	16.36	226%
10 Amp 1 Phase	PULS - CP10	95.2%	240	252.1	12.1	-
	Meanwell - SDR	93.2%	240	257.51	17.51	145%
	Phoenix - Quint 4	93%	240	258.06	18.06	149%
	Omron -S8VK-G	91.5%	240	262.3	22.3	184%
	Delta Lyte / Sola - SVL	90%	240	266.67	26.67	220%
	Sola - SDN	88%	240	272.73	32.73	270%
20 Amp 1 Phase	PULS - CP20	95.6%	480	502.09	22.09	-
	Phoenix - Quint 4	94%	480	510.64	30.64	139%
	Meanwell - SDR	94%	480	510.64	30.64	139%
	Omron - S8VK-G	93%	480	516.13	36.13	164%
	Sola - SDN	90%	480	533.33	53.33	241%
	Delta - Lyte / Sola - SVL	88%	480	545.45	65.45	296%

Efficiency Comparison Chart