

# PIANO - Innovation with essential functionality

## Overview of contents

---

Chapter	Title	Page
1	<p>New PIANO power supplies for 60W and 90W applications</p> <p><b>Compact design with considerable user benefits</b></p> <p><i>The PIANO product family has recently been significantly increased. In 2018 the 120W, 240W and 480W performance classes will be joined by a 60W and a 90W version. The latter being the smallest 90W DIN-rail power supply on the market with dimensions of only 36x90x90mm (WxHxD).</i></p>	2
2	<p>Cost-efficient 480W power supply</p> <p><b>The perfect combination of high-end performance and essential functionality</b></p> <p><i>Another addition is the 480W power supply (PIC480.241D) with 100-240V wide range input. With an efficiency of 95% and a minimum service lifetime of 102,000 hours, this cost-optimised power supply is at the top of the league when it comes to performance.</i></p>	4
3	<p>Essential functionality without compromise</p> <p><b>Cost-efficient power supplies with first-class performance</b></p> <p><i>All three new power supplies fit perfectly into the existing PIANO range. The product family is aimed primarily at users who need reliable power supplies with a focus on essential functionality. When designing the PIANO power supplies, PULS engineers focused on this key attribute without compromising on familiar features such as efficiency, lifetime, reliability or size. This gives users exactly what they need for their system, without extensive functionality. The new power supplies deliver the highest quality in the core performance functions and a significant cost advantage during their lifetime. .</i></p>	6

# 1

## New 60W and 90W PIANO power supplies

### Compact design with considerable user benefits

With the new PIC60 and PIC90 DIN rail power supplies, PULS is continuing to expand the PIANO product family in the lower power range. Both compact power supplies will be available from the first quarter of 2018 for 60W and 90W applications. The new power supplies complement the other PIANO range family members and share the same focus on essential functionality such as efficiency, lifetime, reliability and size.



Figure 1: PIC60 and PIC90

#### High efficiency in a small footprint

Both power supplies are based on an innovative single-board design, meaning that they only require one printed circuit board and a reduced number of components. This design facilitates both the manufacture and testing of the devices. The design has a positive effect on the reliability of the power supplies as the number of potential sources of error is reduced.

The efficiency of both PIANOs is over 92% at full load and +40°C ambient temperature, which is about 2% above the average in this performance class. To achieve maximum efficiency from these small devices, the diodes have for the first time in this performance class been replaced by synchronous rectifiers based on MOSFETs.

The power supplies have exceptionally low power losses even in idle or standby mode at <0.5W. This makes the PIC60 and the PIC90 particularly appealing options for applications such as facility control. For example, in

building safety systems, power supplies often remain in standby mode for days or even weeks. By minimising power loss in idle status, energy costs can be significantly reduced over the long term.

Both the PIC60 and PIC90 have an AC 100-240V wide range input and can therefore be used worldwide. The output voltage (24-28Vdc) is adjustable. At ambient temperatures between -10°C and +55°C, the devices work at full power; in other words without derating.

The innovative circuit design sits within a compact housing of 36x90x90mm (WxHxD). This makes the PIC90 the smallest 90W DIN rail power supply on the market.

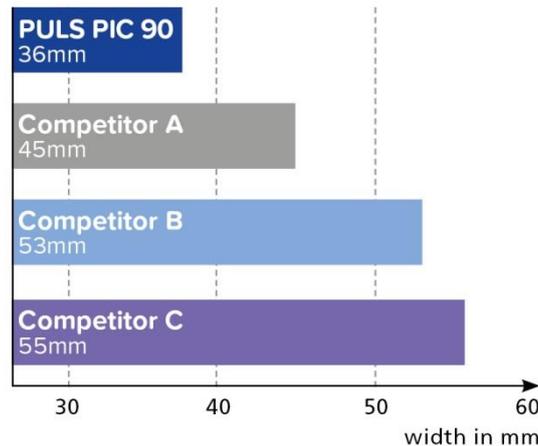


Figure 2: PIC90 width comparison against competitors

**Push-in or screw – users decide**

For the first time users will be able to choose between push-in and screw terminals for the PIC60 and PIC90 power supplies. The push-in terminals reduce installation time, and are extremely reliable in environments prone to shock and vibration. In addition, they are ideally suited for robot-assisted wiring processes. The screw terminals, that accommodate large diameter wires, are popular in environments with minimal shock and vibration.

**Essential functionality with quality performance**

The PIANO genes are clearly visible in the new PIC60 and PIC90. The key characteristic is the simplicity of the devices, without having to compromise on quality. The devices set new benchmarks in their respective performance classes in quality-critical functions such as efficiency, lifetime and size.

## 2

### Cost-efficient 480W power supply

## The perfect combination of high-end performance and essential functionality

With the PIC480.241D, PULS succeeds in bridging the gap between maximum performance and essential functionality. The user benefits from a 480W 24V power supply with wide-range input (100 - 240Vac) that can be used internationally and that has been developed with a focus on efficiency and reliability. The efficiency of the power supply is 95% and the minimum lifetime is 102,000 hours. This means the PIC480.241D as a cost-oriented power supply at the top of the league when it comes to performance.



Figure 3: Cost-efficient 24V / 20A power supply PIC480.241D

### Cost savings continue beyond purchase

The PIC480.241D is a powerful and robust plug and play device with wide range input and active PFC that is exceptionally easy to install and use. It provides full output power at ambient temperatures between -25°C and +55°C (with derating to +70°C).

The cost advantage over other 480W PULS power supplies is a result of simplified circuitry that facilitates easier and faster device manufacturing and testing. Added to this is the concentration on essential functionality such as efficiency, lifetime, reliability and size that is typical of the PIANO range. Extra features, such as a boost function, are reserved for the fully equipped PULS DIMENSION product family.

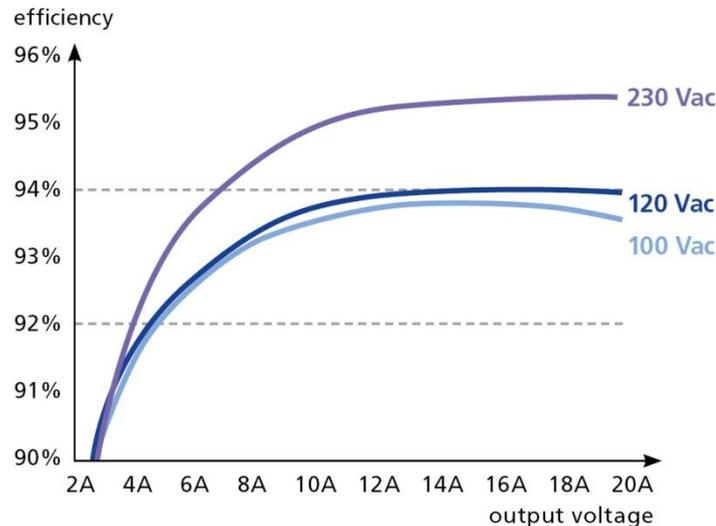


Figure 4: PIC480.241D efficiency values

During the usage phase, the PIC480.241D reduces energy costs thanks to its excellent efficiency level. The low power loss (>25W at full load and AC 230V) means less energy is wasted and therefore less heat generation in the overall system. Due to the high reliability level and the long lifetime, the level of maintenance work and cost is greatly reduced.

**Exceptionally compact 480W power supply**

The size of convection-cooled power supplies is also affected by the efficiency level. The devices require less volume to dissipate the heat loss into the environment. Thanks to the high efficiency level, the PIC480.241D is only 59mm wide and barely 810g in weight. With this compact design, the power supply ranks second in the 480W class, after the front-runner of the PULS DIMENSION CP20 at a width of 48mm.

The PIC480.241D is equipped with an aluminium housing giving it a wider temperature range. This 480W power supply is therefore perfectly thermally balanced across the entire input voltage range of 100 – 240Vac. The products in the PIANO family have a polycarbonate housing. The primary objective for PULS was to add the smallest possible 480W power supply to its PIANO range. In order to design power supplies in this performance class that are as compact as possible, aluminium is the perfect housing material as the metal acts as an additional heat sink.

This results in further potential savings for users. The slim design allows a higher packing density in the system, saves space in the warehouse and during transport and in turn reduces costs.

### **Reduced system downtime and safety**

Like all PULS 480W power supplies, the PIC480.241D also has a DC-OK relay contact for remote monitoring and a Hiccup<sup>plus</sup> mode. The latter is a safety precaution to protect both the device and the system in the event of a short-circuit or overload. If there is an overload that causes the output voltage to drop below 13V or a short circuit, the power supply provides continuous current for 3-5 seconds. Then it automatically switches to the safe Hiccup<sup>plus</sup> mode and sets a timeout of 7 seconds, followed by another start attempt.

Thanks to the long timeout of 7 seconds the effective current is well below the nominal current even in the event of a short-circuit. Cables, switching contacts and connection points are not overstressed.

## **3**

---

### **PIANO – Essential functionality without compromise**

### **Cost-efficient power supplies with first class performance**

The PIANO DIN rail power supplies exclude additional features such as power reserves. However, a reduction in certain features does not compromise the core functionality of the power supplies. All PIANO devices are fully geared to efficiently, reliably and continuously supply systems while taking up as little space as possible.

#### **Saving system costs**

When selecting from the PIANO portfolio there are multiple options based on geographic-specific requirements, even in the selection phase. The devices differ in application-specific details. This gives users the ability to choose a power supply with the features they really need and to save costs. For example, if plants or systems are operating exclusively in Europe, China or India, no wide range input (100 - 240Vac) is required. Therefore, PIANOs are always available as versions with or without wide range input in every performance class.

Most PIANO power supplies are based on a single-board design, meaning all components are on one PCB. The design facilitates both the manufacturing and testing process of the devices, which in turn affects the price. Users can save money at the purchase phase, which makes the power supplies an appealing option for cost-conscious applications.

Due to the high efficiency values, the devices are extremely compact. The narrow installation width, saves valuable space in the system and at the warehouse.

PIANO power supplies can permanently contribute to reducing operating costs thanks to their high efficiency and long lifetime.

#### **High reliability**

PIANO power supplies are highly reliable and this is reflected in the outstanding MTBF (Mean Time Between Failures) figures. For example, the 24V 5A PIC120.241C achieves an MTBF of 1.72 million hours at +40°C ambient temperature (SN 29500, IEC 61709).

The MTBF indicates how often a device fails as a statistical average. Although every power supply manufacturer endeavours to minimise the number of failures, it is inevitable that a technical product will fail with a certain degree of probability. The frequency of failures is referred to as the failure rate  $\lambda$  (lambda). The MTBF is the reciprocal of  $\lambda$ .

The failure rate is a statistical loss which is applied from the first hour of operation. Early failures are not taken into account as the manufacturer should exclude faulty power supplies being delivered to the customer. Wear effects are of no concern to the MTBF either, as the focus is on the phase when no age-related failures occur.

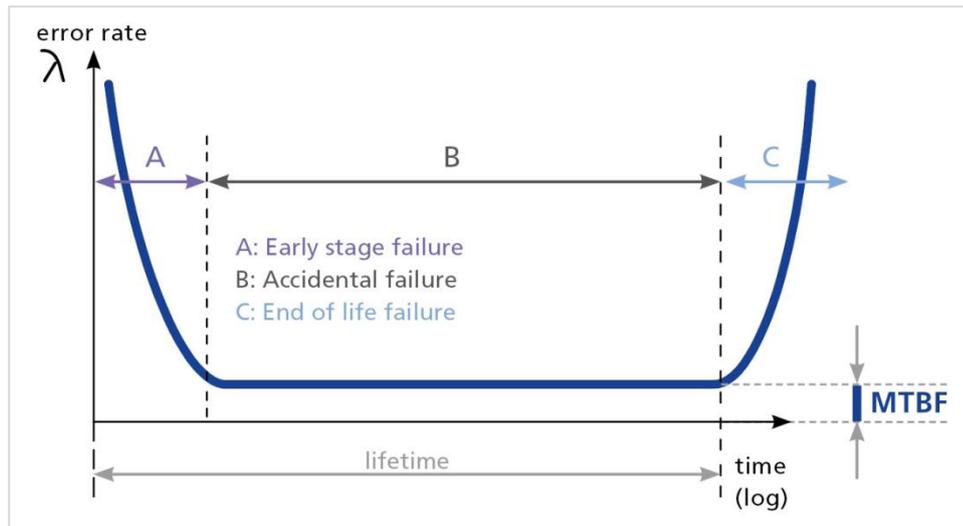


Figure 5: MTBF bath tub curve

Low temperatures are the critical factor for a low failure rate or high MTBF. Heat is therefore always at the expense of reliability. The importance of high efficiency levels becomes clear as less heat generation means lower power losses.

By using efficient and reliable PIANO power supplies, users significantly reduce system downtime and save on maintenance costs

**Mechanically and electrically robust**

PIANO power supplies are aesthetically pleasing with their attractive polycarbonate housings. The material used by PULS offers high strength, impact resistance and hardness and is suitable for use up to an ambient temperature of +70°C. The reliability was tested by PULS engineers in the lab using stress tests such as shock and vibration tests as well as temperature tests.



Figure 6: Mechanically and electrically robust: PIC240.241D

The high efficiency levels of the devices mean it is possible to avoid using a metal housing. Due to the low power losses, the PIANO housing does not need to act as a heat sink. This has made it possible to integrate even the powerful 480W PIC480.241C into a plastic housing.

For the user, the polycarbonate housing offers a cost benefit but also a significant weight advantage over metal housings. For example, the PIC480.241C at a width of 49mm weighs just 620g.

From an electrical point of view, PIANO power supplies are also extremely robust. For example, the devices can withstand strong input transients equal to 230% of the nominal input voltage. This high immunity is ensured across the entire load range.

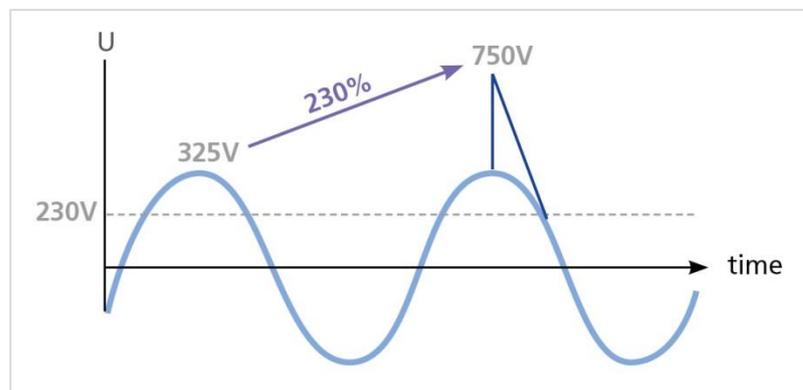


Figure 7: High immunity with strong input transients

### Cross-range compatibility

Many PULS customers now also integrate the cost-efficient PIANO products along with the top of the range DIMENSION power supplies.

The PIANO devices are easily compatible across ranges thanks to excellent efficiency, lifetime and reliability. This makes the proven PULS technology the perfect option for cost-conscious applications.