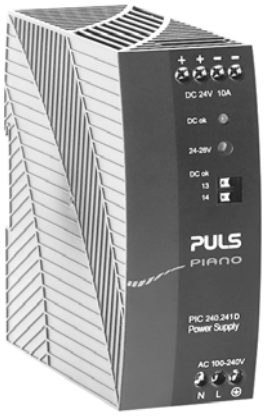
PULS

PIANO-Series

PIC240.241D

24V, 10A, SINGLE PHASE INPUT



POWER SUPPLY

- AC 100-240V Wide-range Input
- Active PFC
- Cost Optimized without Compromising Quality or Reliability.
- Width only 49mm
- Efficiency up to 95.2%
- Full Power Between -25°C and +55°C
- DC-OK Relay Contact
- 3 Year Warranty

GENERAL DESCRIPTION

These PIANO series units are extraordinarily compact, industrial grade power supplies that focus on the essential features needed in today's industrial applications. The excellent cost/performance ratio presents many new and exciting opportunities without compromising quality or reliability.

The mechanically robust housing is made of a high-grade, reinforced molded material, which permits the units to be used in surrounding temperatures up to 70°C.

The unit is equipped with a wide-range input voltage stage, which makes the unit suitable for global use.

The addition of a DC-OK signal makes the unit suitable for many industry applications such as: process, automation and many other critical applications where preventive function monitoring can help to avoid long downtimes.

SHORT-FORM DATA

Output voltage	DC 24V	
Adjustment range	24 - 28Vdc	
Output current	10A	at 24V, amb <55°C
	6.25A	at 24V, amb <70°C
	8.6A	at 28V, amb <55°C
	5.4A	at 28V, amb <70°C
Output power	240W	ambient <55°C
	150W	ambient <70°C
Output ripple	< 100mVpp	20Hz to 20MHz
AC Input voltage	AC 100-240V	±10%
Mains frequency	50-60Hz	±6%
AC Input current	2.17A / 1.18A	at 120 / 230Vac
Power factor	0.98 / 0.93	at 120 / 230Vac
AC Inrush current	14A / 26A peak	at 120 / 230Vac, 40°C
Efficiency	94.0% / 95.2%	at 120 / 230Vac
Losses	15.3W / 12.1W	at 120 / 230Vac
Temperature range	-25°C to +70°C	operational
Derating	6W/°C	+55 to +70°C
Hold-up time	typ. 32ms/ 32ms	at 120 / 230Vac
Dimensions	49x124x124mm	WxHxD
Weight	540g / 1.2lb	

ORDER NUMBERS

Power Supply	**PIC240.241D**	24-28V Standard unit with DC-OK contact
Accessory	YR2.DIODE	Redundancy module
	UF20.241	Buffer module

MARKINGS

c UL US LISTED IND. CONT. EO. UL 508

c TÜV US UL 60950-1

CE EMC, LVD

INDEX

TERMINOLOGY AND ABREVIATIONS

PE and ⏚ symbol	PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol ⏚.
Earth, Ground	This document uses the term "earth" which is the same as the U.S. term "ground".
T.b.d.	To be defined, value or description will follow later.
AC 230V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)
230Vac	A figure with the unit (Vac) at the end is a momentary figure without any additional tolerances included.
50Hz vs. 60Hz	As long as not otherwise stated, AC 100V and AC 230V parameters are valid at 50Hz mains frequency. AC 120V parameters are valid for 60Hz mains frequency.
may	A key word indicating flexibility of choice with no implied preference.
shall	A key word indicating a mandatory requirement.
should	A key word indicating flexibility of choice with a strongly preferred implementation.

1. INTENDED USE

This device is designed for installation in an enclosure and is intended for the general professional use such as in industrial control, office, communication, and instrumentation equipment.

Do not use this power supply in equipment, where malfunction may cause severe personal injury or threaten human life.

2. INSTALLATION REQUIREMENTS

This device may only be installed and put into operation by qualified personnel.

This device does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect.

If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.

Mount the unit on a DIN-rail so that the input terminals are located on the bottom of the unit.

This device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid (e.g. cable conduits) by more than 15%!

Keep the following installation clearances: 40mm on top, 20mm on the bottom, 5mm on the left and right sides are recommended when the device is loaded permanently with more than 50% of the rated power. Increase this clearance to 15mm in case the adjacent device is a heat source (e.g. another power supply).

A disconnecting means shall be provided for the output of the power supplies when used in applications according to CSA C22.2 No 107.1-01.

⚠ WARNING Risk of electrical shock, fire, personal injury or death.

- Do not use the power supply without proper grounding (Protective Earth). Use the terminal on the input block for earth connection.
- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not modify or repair the unit.
- Do not open the unit as high voltages are present inside.
- Use caution to prevent any foreign objects from entering the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surfaces may cause burns.

3. AC-INPUT

AC input	nom.	AC 100-240V	suitable for TN-, TT- and IT mains networks
AC input range	min.	90-264Vac	continuous operation
	min.	264-300Vac	< 500ms
Allowed voltage L or N to earth	max.	300Vac	continuous, IEC 62477-1
Input frequency	nom.	50–60Hz	±6%
Turn-on voltage	typ.	81Vac	steady-state value, see Fig. 3-1
Shut-down voltage	typ.	63Vac / 71Vac	at no load / nominal load, steady-state value, see Fig. 3-1
External input protection	See recommendations in chapter 22.3.		

		AC 100V	AC 120V	AC 230V	
Input current	typ.	2.60A	2.17A	1.18A	at 24V, 10A, see Fig. 3-3
Power factor*)	typ.	0.99	0.98	0.93	at 24V, 10A, see Fig. 3-4
Crest factor**)	typ.	1.6	1.7	2.0	at 24V, 10A
Start-up delay	typ.	360ms	260ms	200ms	see Fig. 3-2
Rise time	typ.	60ms	60ms	60ms	at 24V, 10A const. current load, 0mF load capacitance, see Fig. 3-2
	typ.	230ms	230ms	230ms	at 24V, 10A const. current load, 10mF load capacitance, see Fig. 3-2
Turn-on overshoot	max.	200mV	200mV	200mV	see Fig. 3-2

*) The power factor is the ratio of the true (or real) power to the apparent power in an AC circuit.
**) The crest factor is the mathematical ratio of the peak value to RMS value of the input current waveform.

Fig. 3-1 **Input voltage range, typ.**

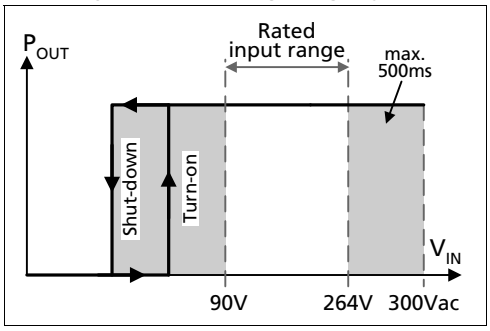


Fig. 3-2 **Turn-on behavior, definitions**

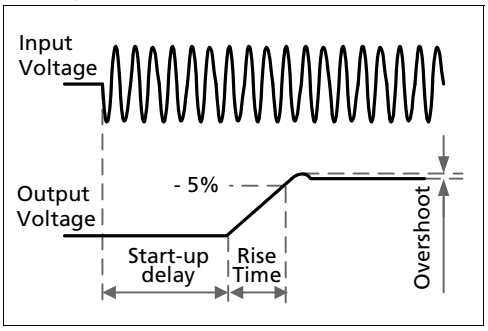


Fig. 3-3 **Input current vs. output load at 24V**

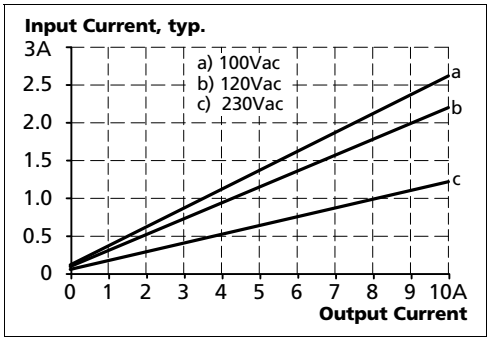
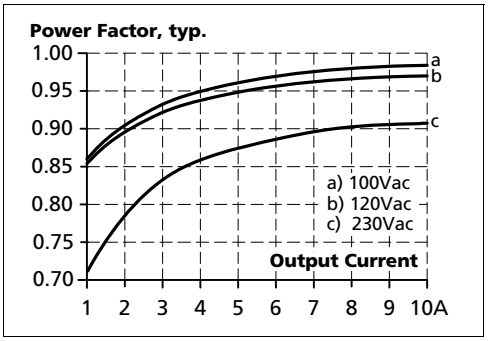


Fig. 3-4 **Power factor vs. output load**



4. DC-INPUT

Do not operate this power supply with DC-input voltage.

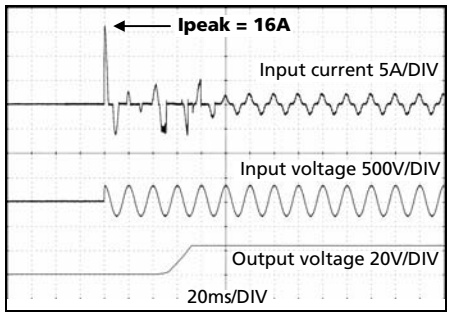
5. INPUT INRUSH CURRENT

An active inrush limitation circuit (NTCs, which are bypassed by a relay contact) limits the input inrush current after turn-on of the input voltage.

		AC 100V	AC 120V	AC 230V	
Inrush current	max.	14.5A_{peak}	17A_{peak}	32A_{peak}	at 40°C, cold start
	typ.	7A_{peak}	8.5A_{peak}	16A_{peak}	at 25°C, cold start
	typ.	11.5A_{peak}	14A_{peak}	26A_{peak}	at 40°C, cold start
Inrush energy	max.	0.2A²s	0.3A²s	1A²s	at 40°C, cold start

*) The charging current into EMI suppression capacitors is disregarded in the first microseconds after switch-on.

Fig. 5-1 **Input inrush current, typical behavior**
230Vac input, 24V 10A output, 25°C ambient



6. OUTPUT

Output voltage	nom.	DC 24V	
Adjustment range	min.	24-28V	guaranteed
	max.	30V***)	at clockwise end position of potentiometer
Factory settings	typ.	24.1V	±0.2%, at full load, cold unit
Line regulation	max.	5mV	90-264Vac
Load regulation	max.	100mV	static value, 0A → 10A; see Fig. 6-1
Ripple and noise voltage	max.	100mVpp	20Hz to 20MHz, 50Ohm
Output current	nom.	10A	at 24V, ambient temperature <55°C, see Fig. 6-1
	nom.	6.25A	at 24V, ambient temperature <70°C, see Fig. 6-1
	nom.	8.6A	at 28V, ambient temperature <55°C, see Fig. 6-1
	nom.	5.4A	at 28V, ambient temperature <70°C, see Fig. 6-1
Output power	nom.	240W	ambient temperature <55°C
	nom.	150W	ambient temperature <70°C
Overload behaviour		continuous current	output voltage > 13Vdc, see Fig. 6-1
		Hiccup^{PLUS} mode**)	output voltage < 13Vdc, see Fig. 6-1
Short-circuit current	min.	11A*)	load impedance 50mOhm, see Fig. 6-1
	max.	15A*)	load impedance 50mOhm, see Fig. 6-1
	typ.	4.8A	average (R.M.S.) current, load impedance 50mOhm, see Fig. 6-1
Output capacitance	typ.	2 850µF	included inside the power supply

*) Discharge current of output capacitors is not included.

**) Hiccup^{PLUS} Mode
At heavy overloads (when output voltage falls below 13V), the power supply delivers continuous output current for 5s. After this, the output is switched off for approx. 7s before a new start attempts with duration of 1a are automatically performed. This cycle is repeated as long as the overload exists. If the overload has been cleared, the device will operate normally.

***) This is the maximum output voltage which can occur at the clockwise end position of the potentiometer due to tolerances. It is not guaranteed value which can be achieved. The typical value is about 28.5V.

Fig. 6-1 **Output voltage vs. output current, typ.**

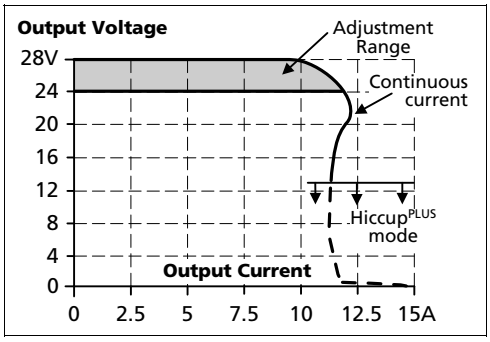
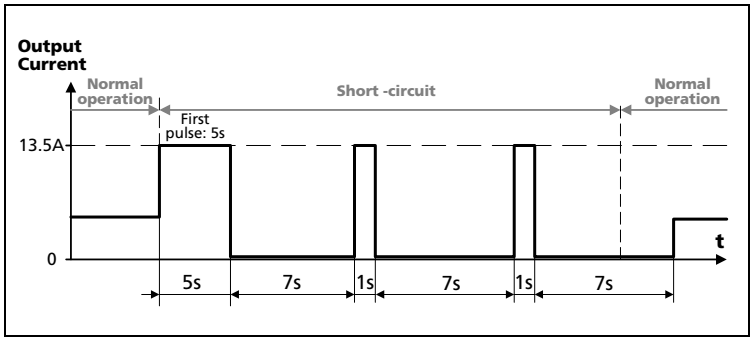


Fig. 6-2
Short-circuit (50mOhm) on output, Hiccup^{PLUS} mode, typ.



7. HOLD-UP TIME

		AC 100V	AC 120V	AC 230V	
Hold-up Time	typ.	65ms	65ms	65ms	at 24V, 5A, see Fig. 7-1
	min.	53ms	53ms	53ms	at 24V, 5A, see Fig. 7-1
	typ.	32ms	32ms	32ms	at 24V, 10A, see Fig. 7-1
	min.	26ms	26ms	26ms	at 24V, 10A, see Fig. 7-1

Fig. 7-1 **Hold-up time vs. input voltage**

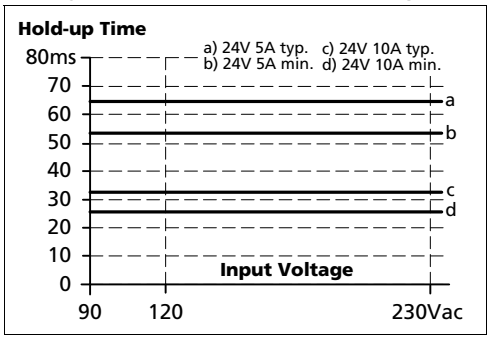
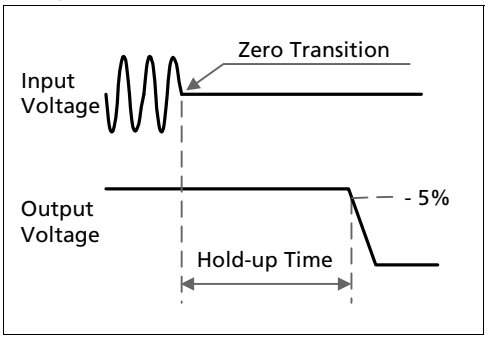


Fig. 7-2 **Shut-down behavior, definitions**

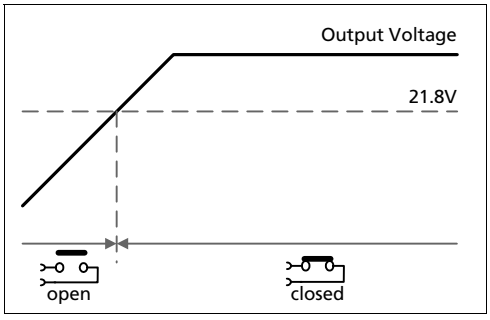


8. DC-OK RELAY CONTACT

This feature monitors the output voltage, which is produced by the power supply itself. It is independent of a back-fed voltage from a unit connected in parallel to the power supply output (e.g. redundant application).

Threshold voltage	typ.	21.8V (fixed)	
Contact closes	As soon as the output voltage reaches 21.8V.		
Contact opens	As soon as the output voltage falls below 21.7V.		
Contact ratings	max.	60Vdc 0.3A, 30Vdc 1A, 30Vac 0.5A	resistive load
	min.	1mA at 5Vdc	min. permissible load
Isolation voltage	See dielectric strength table in section 18.		

Fig. 8-1 **DC-ok relay contact behavior**



9. EFFICIENCY AND POWER LOSSES

		AC 100V	AC 120V	AC 230V	
Efficiency	typ.	93.2%	94.0%	95.2%	at 24V, 10A
Average efficiency*)	typ.	92.7%	93.1%	93.9%	25% at 2.5A, 25% at 5A, 25% at 7.5A. 25% at 10A
Power losses	typ.	4.0W	4.0W	3.4W	at 24V, 0A
	typ.	9.0W	8.5W	7.5W	at 24V, 5A
	typ.	17.5W	15.3W	12.1W	at 24V, 10A

*) The average efficiency is an assumption for a typical application where the power supply is loaded with 25% of the nominal load for 25% of the time, 50% of the nominal load for another 25% of the time, 75% of the nominal load for another 25% of the time and with 100% of the nominal load for the rest of the time.

Fig. 9-1 **Efficiency vs. output current at 24V, typ.**

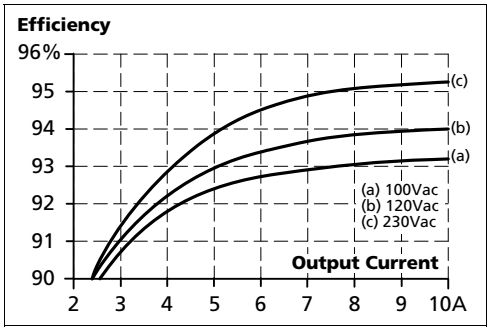


Fig. 9-2 **Losses vs. output current at 24V, typ.**

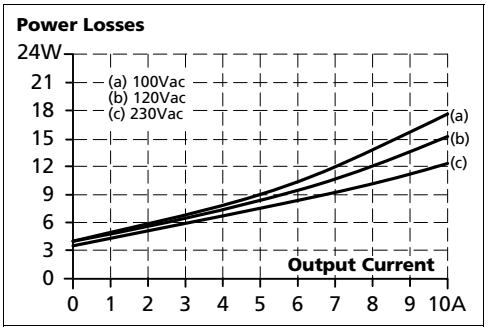


Fig. 9-3 **Efficiency vs. input voltage at 24V, 10A, typ.**

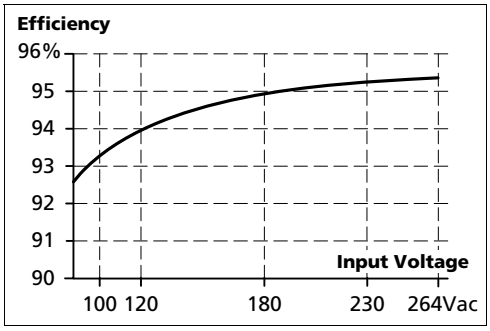
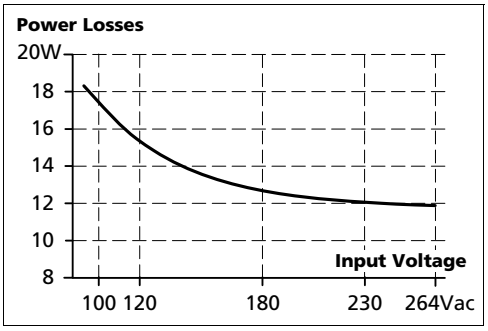


Fig. 9-4 **Losses vs. input voltage at 24V, 10A, typ.**



10. LIFETIME EXPECTANCY AND MTBF

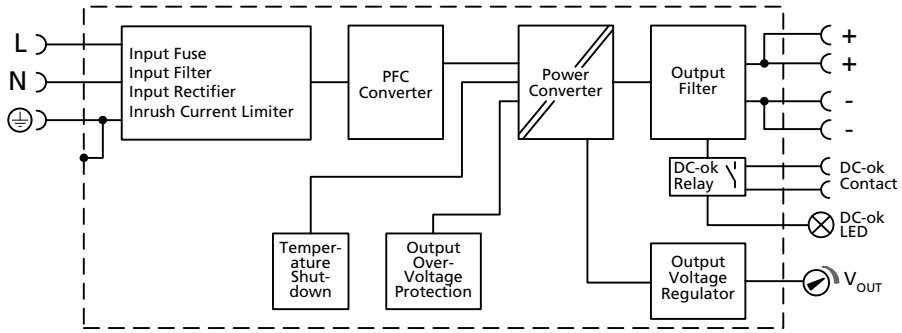
	AC 100V	AC 120V	AC 230V	
Lifetime expectancy*)	89 000h	93 000h	103 000h	at 24V, 5A and 40°C
	252 000h*)	262 000h*)	291 000h*)	at 24V, 5A and 25°C
	47 000h	55 000h	74 000h	at 24V, 10A and 40°C
	133 000h*)	156 000h*)	209 000h*)	at 24V, 10A and 25°C
MTBF**) SN 29500, IEC 61709	655 000h	736 000h	822 000h	at 24V, 10A and 40°C
	1 149 000h	1 267 000h	1 391 000h	at 24V, 10A and 25°C
MTBF**) MIL HDBK 217F	323 000h	345 000h	374 000h	at 24V, 10A and 40°C; Ground Benign GB40
	441 000h	471 000h	508 000h	at 24V, 10A and 25°C; Ground Benign GB25
	72 000h	78 000h	85 000h	at 24V, 10A and 40°C; Ground Fixed GF40
	94 000h	101 000h	111 000h	at 24V, 10A and 25°C; Ground Fixed GF25

*) The **Lifetime expectancy** shown in the table indicates the minimum operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification. The manufacturer of the electrolytic capacitors only guarantees a maximum life of up to 15 years (131 400h). Any number exceeding this value is a calculated theoretical lifetime which can be used to compare devices.

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailure, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.
The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of e.g. 1 000 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it can not be determined if the failed unit has been running for 50 000h or only for 100h.

11. FUNCTIONAL DIAGRAM

Fig. 11-1 **Functional diagram PIC240.241D**



12. TERMINALS AND WIRING

The terminals are IP20 finger safe constructed and suitable for field and factory wiring.

	Input and output	**DC-OK-Signal**
Type	screw terminals	push-in terminals
Solid wire	max. 6mm²	max. 1.5mm²
Stranded wire	max. 4mm²	max. 1.5mm²
American Wire Gauge	AWG20-10	AWG28-16
Max. wire diameter	2.8mm (including ferrules)	1.6mm (including ferrules)
Wire stripping length	7mm / 0.28inch	7mm / 0.28inch
Screwdriver	3.5mm slotted or cross-head No 2	not required
Recommended tightening torque	1Nm, 9lb.in	not applicable

Instructions:

a) Use appropriate copper cables that are designed for minimum operating temperatures of:
75°C for ambient up to 55°C and
90°C for ambient up to 70°C minimum.
b) Follow national installation codes and installation regulations!
c) Ensure that all strands of a stranded wire enter the terminal connection!
d) Do not use the unit without PE connection.
e) Unused terminal compartments should be securely tightened.
f) Ferrules are allowed.