TECHNICAL SPECIFICATION

GPR360-56A

Isolated AC-DC Rack-Mount Power Supply
Universal Input; Single Output; 360W@56V/6.45A

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OVERVIEW

The GPR360-56A is an isolated AC-DC converter for POE and Telecom applications. It is packaged in an industry standard mechanical configuration and delivers up to 6.45A of output current, or 360 Watts of output power, with full load efficiency of typically 92% at Vin of 230Vac. This unit can operate over a universal AC input range, even up to 300Vac, and provides a precisely regulated single output voltage at 56V.

The GPR360-56A features excellent electrical and thermal performance with creative circuit design, self-cooling internal fan, and optimized component placement. With two different LED status signals, I2C/PMbus™ control, and hot plug/parallel operation, the GPR360-56A offers flexibility for various POE and telecom applications. The unit's design integrates protection circuits such as UVP, OVP, OCP, OTP, SCP to assure users highly reliable rack performance. The module complies with UL/EN/IEC62368 safety and additional EN61000 EMC requirements.

APPLICATIONS

- Telecom Equipment and POE Systems
- Industrial Automation
- Distributed Power Architectures
- Instruments and Test Equipment
- Amplifiers and Base Stations
- LAN/WAN Hardware Racks
- Enterprise Networking Racks

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FEATURES

- Wide input voltage range: Universal AC input up to 300Vac/45-55Hz without damage
- Hot pluggable with forced current sharing
- 92% efficient from 50% to 100% load
- Delivers up to 6.45Adc current or 360W power with internal cooling fan
- Active PFC (typical:0.99@115Vin, 0.98@230Vin)
- Industry standard mechanical outline
  - 10.22"L x 3.25"W x 1.58"H
  - 259.5mm × 82.6mm × 40.1mm
- I2C Communication (PMbus™ compliant)
- Full protection for Input UVP, Output OVP, Output OCP, SCP, OTP

- Wide operating temperature range (-10˚ -70˚C). Powers up at -40˚C
- ROHS Directive 2002/95/EC Compliant
- UL62368-1 international safety standard approved
- Meets EN61000-x international EMC standards

SCOPE

This document describes the specifications of GPR360-56A isolated AC/DC power supply.

ABSOLUTE MAXIMUM RATINGS

Stresses that exceed the specified ratings stated in this datasheet can cause permanent damage to the unit. The ratings are absolute stress ratings; functional operation of the unit is not implied at conditions in excess of those given in the data sheet. Exposure to all absolute maximum ratings simultaneously for extended periods could adversely affect the unit's long term reliability.

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ELECTRICAL SPECIFICATIONS @ 25°C

Parameter	Symbol	Min	Typical	Max	Unit
Operating Input Voltage	V_{IN}	90	—	264	Vac
Operation Transient **Non-operating continuous**				300 315	
Operating Frequency		47	—	63	Hz
Max Input Current **(V_{IN}=100V, P_O=360W)**	$I_{IN,max}$			5.0	A
Input No Load Power (V_{IN} =Nominal Input, I_O=0, Module enabled)		—	—	8	W
Input Standby Power (V_{IN} =Nominal Input, Module disabled)		—	4	5	W
Inrush Current with Cold Start	230V_{IN}	—	50	—	A
Power Factor (Nominal Input and Full Load)	λ	0.95	0.98	—	
Leakage Current				3.5	mA
Input Protection			Fuse in Line Input		

NOTE: Unless otherwise indicated, specifications apply to overall operating input voltages, resistive loads, and room temperature at 25ºC.

DC OUTPUT SPECIFICATIONS

(Spec is required at +25ºC if not specified)

Parameters	Condition & Description	Min	Nominal	Max	Unit
Output Voltage	Half load condition	55.44	56.00	56.56	V
	No trim requirement				
Output Load		0		6.45	A
Load Regulation	From Open to Full (Nominal Input)			±2% V_{OUT}	V
Line Regulation	All Range (50% load)			±1% V_{OUT}	V
Thermal regulation				±0.03% V_{OUT}/ ºC	V
Min Load	No requirement				A
Ripple and Noise	115/230 in Full load (20k-20M bandwidth/10μf Tan-capacitor)		±0.7%Vout	±1% V_{OUT}	V

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Parameters	Condition & Description	Min	Nominal	Max	Unit
External Capacitive load	Main Power, full load			2000	μF
Dynamic 1 (1A/us)	25% to 75% to 25% load			±4% V_{OUT}	V
Dynamic 2 (1A/S)	5-50% and 50%-100% load			±5% V_{OUT}	V
Recovery Time	Back to 1% V_{OUT}			500	μS
Turn On Overshoot				5%	V
Delay time	Nominal Input to 90% output			3	s
Rise time	10% output to 90% output, Monotonic. No external capacitor		50	100	mS
Output Indicator	LED and signal Indicator & PMbus				
Efficiency	230V input/50% load (-56 V_{OUT})		92		%
Current Sharing	Forced current sharing@>50%load			5%	%
Holdup Time	Nominal Input & Full Load & droop to 90% of output voltage		20		mS

PROTECTION CIRCUITS

Parameters	Condition & Description	Min	Nominal	Max	Unit
Input Under Voltage (UVP)	Auto-Recovery			85	Vac
Output Over Current (OCP)	Auto-Recovery	110% of load		150% of load	A
Output Over Voltage (OVP)	Latch Mode			60	V
Over Temperature (OTP)	Auto-Recovery		80		℃ ambient
Short Circuit (SCP)	All conditions		No damage/smoke/fire		

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ENVIRONMENTAL SPECIFICATIONS

Parameters	Condition & Description	Min	Nominal	Max	Unit
Operating Ambient Temperature		-10	+25	55	°C
Working Temperature	For full load/input(<6000ft)	-10	+25	+70	ºC
	For full load/input(<10000ft)	-10	+25	+60	ºC
	Derating from 55ºC to 70ºC by 2.5%/ºC				
Storage Temperature	Tstg	-55		105	°C
Hot Spot Temperature	See application note for hot spot location			115	ºC
Airflow	Internal airflow direction from output to input				
Altitude	60ºC operation			10000/3048	Ft/m
	70ºC operation			6000/1829	Ft/m
Humidity		+5%		95%	

ISOLATION SPECIFICATIONS

Description	
Isolation Voltage from Input to Output	3000Vac@1Min
Isolation Voltage from Input to Earth-Chassis	1500Vac@1Min
Isolation Voltage from Secondary to Earth	500Vdc@1Min
Isolation Voltage from Signal to Earth	None

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EMC SPECIFICATIONS

EMC Item	Requirement	Criteria	Reference
Conducted Emissions	Class A + system box		EN55022 QP/AV Method
Radiated Emissions	Class A + system box		EN55022/FCC Controlled by system
Conducted Immunity	Level 2		EN55024, EN61000-4-3
SURGE	DM: ±2KV CM: ±4KV	B	EN61000-4-5, EN 55024 ETSI EN 300 386 V1.3.2
EFT	±2KV (Level 2)	B	EN61000-4-4, EN 55024 ETSI EN 300 386 V1.3.2
ESD	Touch: ±6KV Air: ±8KV	B	EN61000-4-2, EN 55024 ETSI EN 300 386 V1.3.2
	Touch: ±8KV Air: ±15KV for Case	R	EN61000-4-2, EN 55024 ETSI EN 300 386 V1.3.2
Harmonic	Class A	NC	EN 61000-3-2 ETSI EN 300 386 V1.3.2
Flicker		NC	EN 61000-3-3 ETSI EN 300 386 V1.3.2
Radiated Susceptibility (RS)	80M~2GHz 10V/m,80% AM (level 3)	A	EN 61000-4-3, EN 55024 ETSI EN 300 386 V1.3.2
Conducted Susceptibility (CS)	150KHz~80MHz 10V, 80% AM	A	EN 61000-4-6, EN 55024 ETSI EN 300 386 V1.3.2
Lightning AC Power Fault			GR-1089 Issue 4
Voltage Dips & Interruptions	See note below		EN 61000-4-11, EN 55024 ETSI EN 300 386 V1.3.2

Voltage Drop	Duration Time	Criteria
0% Ut	20 ms	B
70% Ut	500 ms	C
40% Ut	200 ms	C
0% Ut	5000 ms	C

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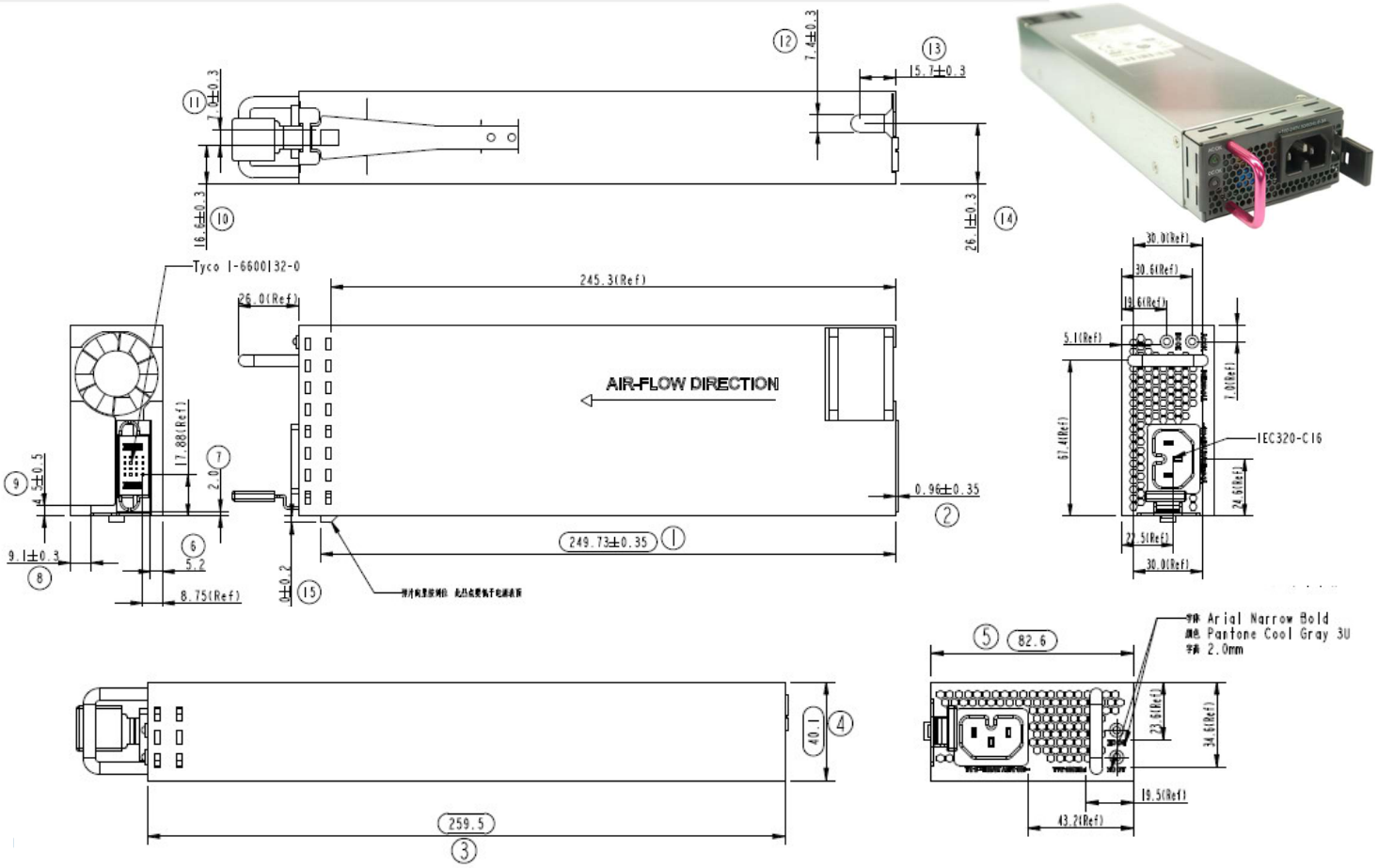
LED AND STATUS INDICATORS

There are two LEDs located in front panel to indicate input and PSU status. One is AC OK to indicate the input status, the other is DC OK to indicate PSU status.

Parameter	LED/Status	Min	Max	Unit
Status Signal Pin	ON/OFF	-0.3	30	Vdc
DC OK	Bi-color LED (Red & Green)	**Green:** Output Normal **Red:** PSU failure **Off:** Input over defined range Turn off PSU by signal		
AC OK	Single-color LED (Green)	**Green:** Input within defined range **Off:** Input over define range		

MECHANICAL PACKAGE

Description	
Dimensions – L x W x H	1.93" x 0.94" x 0.91" / 49mm x 24mm x 23.2mm
Weight g / oz	1.06 / 30 typical
Vibration	0.75 mm, 10Hz-55Hz, 20 minutes



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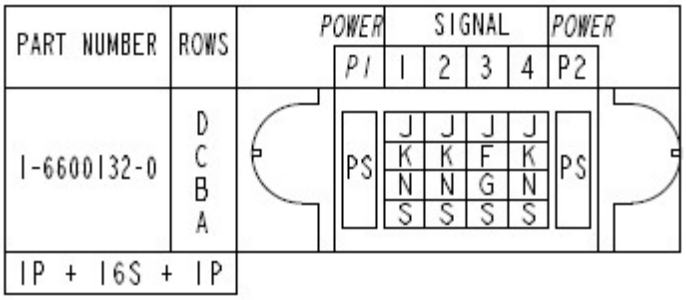
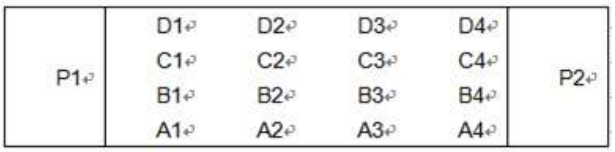
INPUT/OUTPUT CONNECTOR AND PIN ASSIGNMENT

Input connector: IEC320-C16. Application must use safety-compliant input cords/cables. The cable AWG must be rated to match maximum rated input current.

Output connector: Tyco 1-6600132-0, or equivalent

OUTPUT PIN ASSIGNMENTS





Pin	Designation	Type	Pin Length
A1	PS_Fail_L	Output	Normal
A2	I2C_Data	BiDi	Normal
A3	SOC_L	Output	Normal
A4	3P3V	Analog Input	Normal
B1	I2C_Clock	Input	Normal
B2	Logic_Ground	Signal_Return	Normal
B3	Offline_H	Input	Short
B4	Remote_Sense_N	Analog Input	Normal
C1	Power_Good	Output	Normal
C2	Current	Output Analog	Normal
C3	PS_Present_L	Output	Short
C4	Remote_Sense_P	Analog Input	Normal
D1	Active_Current_N	BiDi Analog	Normal
D2	Active_Current_P	BiDi Analog	Normal
D3	I2C_Address	BiDi	Normal
D4	SMB_Alert	Output	Normal

PIN DESCRIPTIONS

Notes:
Logic high: 3.0V-3.4V
Logic low: 0V-0.4V
All signal pins refer to signal return (B2)

P1/P2
P1 and P2 are for main outputs. P1 is for +56V output, P2 is for -56V. -56V (P2) is connected with signal return. All the signal pins should be based on signal return (B2)

A1 — PS_Fail_L
A1/PS_Fail_L is to indicate the PSU status.

When PSU at normal operation, the signal is logic high within 500mS after output voltage is lower than -52V

When PSU failed due to UVP, OTP, OCP, OSP, etc., the signal become logic low at early 2mS before output voltage drop to -51V.

A2 — SDA
I2C data wire by I2C standard

A3 — SOC_L
SOC_L is early warning of over current protection. When the load is over than 106% rated current, the Pin will become logic low at least 150mS before true protection. When the load is back to normal, the signal will become logic high within 1mS

A4 — 3P3V
This is for PSU internal use, not for system use. No connection for this pin.

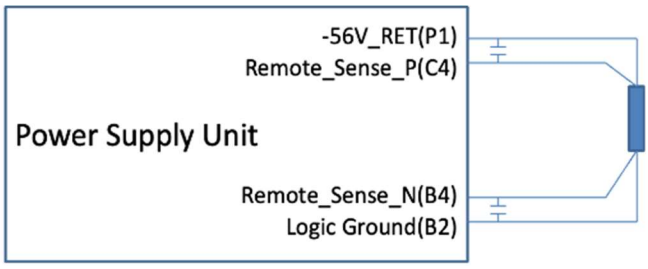
B1 — I2C_Clock
I2C clock wire by I2C standard

B2 — Logic Ground
Logic Ground for signal return

B3 — Offline_H (Short Pin)
Logic low to turn on PSU
Logic high to turn off PSU

B4 — Remote_Sense_N

C4 — Remote_Sense_P
To offset the voltage drop due to high current output trace, B4(Remote_Sense_N) and C4(Remote_Sense_P) can be used to keep output voltage stable at the load side. The max compensation voltage is 0.5V for one trace. One 0.47μF ceramic capacitor between B4(Remote_Sense_N) and B2(Logic ground) and between C4(Remote_Sense_P) and P1(-56V_RET). If not used, the B4 should be connected to B2 directly, C4 to P1



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C1 — Power_Good

Power_Good is to indicate the status of PSU. When output voltage is lower than -51V, the signal Power_Good should become logic high within 1s. When output voltage is higher than -49V, the signal Power_Good should become logic low at 2mS before output shut down.

C2 — Current

The signal is to indicate the output current. When load is from open load to full load, the C2 goes up 1V to 3V linearly. The tolerance is ±5% from 10% to 100% load.

C3 — PS_Present_L

The C3— PS_Present_L is to indicate physical connection when the PSU is plugged into system chassis. When the PSU is well-inserted into system box, the C3 is logic low. Otherwise, it is logic high

Inside of PSU, the signal is connected to signal grounding by 1Kohm resistor.

C4 — Remote_Sense_P

See the application of B4

D1 — Active_Current_P

D2 — Active_Current_N

These two signals are used for current sharing. If there are two PSU current sharing, all D1 and all D2 should be connected accordingly. The voltage difference of D1 and D2 is 3V (open load) to 1V (full load).

When the power shut down due to some reasons, the voltage difference is lower than 1V.

Note: Do not connect these two pins to signal grounding.

If there is no current sharing application, leave these two pins no connection.

D3 — I2C_Address

The host can shake hands with MCU or EEPRON of PSU by I2C_Address(D3).

D4 — SMB_Alert

At normal operation, D4— SMB_Alert is logic high. When the PSU fail due to some reasons, D4 goes logic low to inform host to read PSU status by PMBus. When D4 goes low, the D4 will keep low until recycle the AC input or Host send reset signal (command 03) to PSU to reset D4 by PMBus.

PMBUS™ AND EEPROM

The PSU has 8Kbytes of EEPROM and can communicate with a Host system controller via I2C using the PMBus1.2 standard.

The addresses for the internal MCU and EEPROM are:

Device	Address	Address Allocation (From high bit to low bit)							
MCU	0xBx	1	0	1	1	A2	A1	A0	R/W
EEPROM	0xAx	1	0	1	0	A2	A1	A0	R/W

A0 is the D3 of output connector, which can connect to logic high or low by system application
A1 is logic high, connect to 3.3V in PSU. Option for low by connecting resistor to signal grounding.
A2 is logic low, connect to signal grounding. Option for high by connecting resistor to 3.3V.

DEFINITION FOR EEPROM

Byte address (decimal)	Byte address (hex)	Item	Format	Value
00-01	00-01	Block signal	uint16	0XABAB
02	02	Block version	uint8	1
03	03	Block length	uint8	114
04-05	04-05	Block checksum	uint16	Checksum of block contents, excluding checksum word
06-07	06-07	Eeprom_size	uint16	40h (16Kbit)
08-09	08-09	Block_count	uint16	2
10-29	0A-1D	OEM_string	Char*20	GIP
30-49	1E-31	Product_number	Char*20	PSR360-56A
50-79	32-4F	Serial_number	Char*30	Manufacture Series Number
80-95	50-5F	Part_number	Char*16	0213XX
96-99	60-63	Part_version	Char*4	PSU version
100-119	64-77	Mfg_deviation	Char*20	Manufacture
120-121	78-79	Power_consumption	Int16	168h
122-125	7A-7D	Power_Type	Char*4	AC00
126-133	7E-85	Air_flow_direction	Char*8	OUT00000

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COMMANDS FOR GPR360-56A UNIT

Data in linear format: x = y * 2^n
(For reference only)
*** The PMBus address is 0xB4 for power supply-1 and address 0xB6 for power supply-2.
*** All data is transmitted and received least significant byte (LSB) first.

CODE	COMMAND	R/W	TYPE	UNITS	SCALING	EXAMPLE	COMMENTS
03	CLEAR_FAULTS	W	N/A			use SendByte command	
20	VOUT_MODE	R	BYTE				
3A	FAN_CONFIG_1_2	R	BYTE				
3B	FAN_COMMAND_1	R/W	WORD	Percent	N=0	(100 = 100%)	data commanded in duty cycle (%)
46	IOUT_OC_FAULT_LIMIT	R	WORD	Amps	N=-4	(228 = 14.25A)	
4A	IOUT_OC_WARN_LIMIT	R	WORD	Amps	N=-4	(204 = 12.75A)	
4F	OT_FAULT_LIMIT	R	WORD	°C	N=0	(105 = 105°C)	
51	OT_WARN_LIMIT	R	WORD	°C	N=0	(95 = 95°C)	
58	VIN_UV_WARN_LIMIT	R	WORD	Volts	N=-1	(160 = 80V)	
59	VIN_UV_FALT_LIMIT	R	WORD	Volts	N=-1	(140 = 70V)	
5D	IIN_OC_WARN_LIMIT	R	WORD	Amps	N=-4	(196 = 12.25A)	
5E	POWER_GOOD_ON	R	WORD	Volts	N=-5	(896 = 56.00V)	
5F	POWER_GOOD_OFF	R	WORD	Volts	N=-5	(832 = 52.00V)	
68	POUT_OP_FAULT_LIMIT	R	WORD	Watts	N=1	(625 = 1,250W)	
6A	POUT_OP_WARN_LIMIT	R	WORD	Watts	N=1	(578 = 1,156W)	
6B	PIN_OP_WARN_LIMIT	R	WORD	Watts	N=1	(671 = 1,342W)	
79	STATUS_WORD	R	WORD				
7A	STATUS_VOUT	R	BYTE				
7B	STATUS_IOUT	R	BYTE				
7C	STATUS_INPUT	R	BYTE				
7D	STATUS_TEMPERATURE	R	BYTE				
7E	STATUS_CML	R	BYTE				
7F	STATUS_OTHER	R	BYTE				
80	STATUS_MFG_SPECIFIC	R	BYTE				
81	STATUS_FAN_1_2	R	BYTE				
88	READ_VIN	R	WORD	Volts	N=-1	(481 = 240.5V)	
89	READ_IIN	R	WORD	Amps	N=-4	(180 = 11.25A)	
8B	READ_VOUT	R	WORD	Volts	N=-4	(896 = 56.00V)	
8C	READ_IOUT	R	WORD	Amps	N=-4	(316 = 19.75A)	
8D	READ_TEMPERATURE1	R	WORD	°C	N=0	(105 = 105 °C)	inlet temperature
8F	READ_TEMPERATURE3	R	WORD	°C	N=0	(85 = 85 °C)	hot spot temperature
90	READ_FAN_SPEED_1	R	WORD	RPM	N=5	(225 = 7200 RPM)	
96	READ_POUT	R	WORD	Watts	N=1	(100 = 200W)	
97	READ_PIN	R	WORD	Watts	N=1	(200 = 400W)	
98	PMBUS_REVISION	R	BYTE				
EA	WRITE_PROTECT (EEPROM) 56h=Write Disabled, 9Ah=Write Enabled	R/W	BYTE				
EB	FIRMWARE REVISION	R	WORD			010Ch = Revision 1.12	
EC	SCRATCHPAD	R/W	WORD				

---[NOTES]---

SCALING N=-4: 2^-4 = 1/16 unit resolution
SCALING N=-1: 2^-1 = 1/2 unit resolution
SCALING N=0 : 2^0 = 1 unit resolution
SCALING N=1 : 2^1 = 2 unit resolution
SCALING N=5 : 2^5 = 32 unit resolution

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ORDERING INFORMATION

Input Voltage	Output Voltage	Output Current	Aux Power Voltage	Aux Power Current	Model Number	Note
100VAC-240VAC	56V	6.45A	No	No	GPR360-56A	Base Model

All specifications are typical at nominal input, full load, at 25°C ambient unless otherwise noted. Specifications are subject to change without notice. Please consult our Applications Engineering office at 858-275-6423 for additional technical data and support or email us at info@brightworks-usa.com.