

PA900 PERFORMANCE SPECIFICATIONS

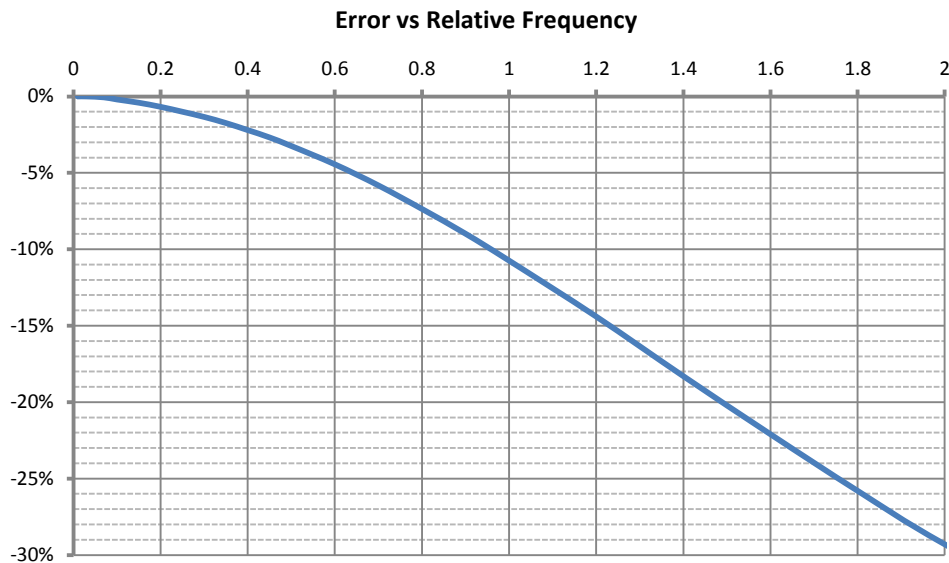
Accuracy specifications are valid under the following conditions-

- Following a 15 minute warm-up period after turning power ON in the PA900.
- For a period of 2 years after calibration in normal use. Continuous use at >75% maximum Specified Input Range levels reduces this to 6 months.
- For ambient temperatures $\pm 5^{\circ}\text{C}$ from calibration temperature. Add 0.005%rdg per $^{\circ}\text{C}$ outside of $\pm 5^{\circ}\text{C}$ from the calibration temperature.
- For voltages and currents at the PA900 terminals with crest factors <30:1 and within the Specified Input Range applicable for the channel type, current option and (if applicable) current range selection.
- DC floor specifications assume AUTOZERO is ON, and that an EXT DC ZERO adjustment has been performed following any significant change in the local environment or channel configuration. Add the relevant DC floor specification per $^{\circ}\text{C}$ outside of $\pm 1^{\circ}\text{C}$ from the calibration temperature if AUTOZERO is OFF.
- AC <100Hz accuracy and floor specifications are valid using Auto-Track HF limiting to 50 harmonics; for specifications when operating unfiltered with signals <100Hz use the <40kHz figures.
- Where accuracy is shown as %rdg then that is the percentage of the relevant AC+DC reading.

COMMON INPUT SPECIFICATIONS

Isolation	From any V or A terminal to PA900 chassis ground Impedance: $>1\text{G}\Omega <30\text{pF}$ 4500Vpk max without damage 2500Vrms max for <1s without damage 1000Vrms max continuous rated working voltage (CAT I/II) 600Vrms max continuous rated working voltage (CAT III) 300Vrms max continuous rated working voltage (CAT IV)
Display Resolution	As specified below and also limited by displayed number of digits (add $\pm \frac{1}{2}$ digit to accuracy specifications).
Interface Resolution	As specified below and also limited to 6 significant digits (add $\pm \frac{1}{2}$ digit to accuracy specifications)
HF Filtering	Fixed frequency low-pass filtering of 6kHz, 25kHz, 50kHz, 100kHz, 150kHz and 250kHz are available (100kHz and above are only available in W type channels).

The response of the HF Filters is typically as shown in the chart below.



VOLTAGE SPECIFICATIONS

Accuracy is given by the addition of-

- Base Accuracy
- Relevant Frequency Adder (if applicable)
- Relevant Floor Adder (use both DC and relevant AC floor adders for AC+DC measurements)

Self-Heating Adder

Relevant Harmonic Adder (if applicable).

For peak measurements accuracy is same but using 10* relevant Floor Adder.

In specifications below F is frequency in kHz. Self-heating has a nominal 1 minute time constant.

		S Channel Type	A Channel Type	W Channel Type
No Damage Input Range	<1ms	2500Vrms (<3000Vpk)		2000Vrms (<3000Vpk)
	<100ms	2000Vrms (<3000Vpk)		1500Vrms (<3000Vpk)
	<5s	1500Vrms (<2500Vpk)		1000Vrms (<2500Vpk)
	Continuous	1000Vrms (<1800Vpk)		700Vrms (<1800Vpk)
Specified Input Range	DC	0 to $\pm 1000V$		0 to $\pm 700V$
	AC	0.1 to 1000Vrms		0.1 to 700Vrms
	Peak	<1800V		<1800V
Impedance		1.2M Ω $\pm$ 1%		400K Ω $\pm$ 1%
Resolution		0.001V	0.1mV	0.001V
Base Accuracy		0.1%rdg	0.03%rdg	0.1%rdg
Frequency Adder		0.01-1Hz: 0.05%rdg <10kHz: (0.005*F)%rdg 10-40kHz: (0.05+(0.012*(F-10)))%rdg 40-100kHz: (0.41+(0.025*(F-40)))%rdg		0.01-1Hz: 0.1%rdg <40kHz: (0.002*F)%rdg 40-100kHz: (0.08+(0.004*(F-40)))%rdg 100-1000kHz: (0.32+(0.013*(F-100)))%rdg
Bandwidth (-3dB)		>700KHz		>2.5MHz
Floor Adder		DC: 0.003V AC<100Hz: 0.003V AC>100Hz: 0.005V	DC: 0.001V AC<100Hz: 0.002V AC>100Hz: 0.005V	DC: 0.004V AC<100Hz: 0.004V AC>100Hz: 0.007V
Self-Heating Adder		0.0005ppm rdg per Vrms ²		0.0015ppm rdg per Vrms ²
Single Harmonic Adder		<10kHz: 0.01%fund + 0.001V <80kHz: 0.05%fund + 0.005V	<10kHz: 0.005%fund + 0.0005V <80kHz: 0.05%fund + 0.005V	<10kHz: 0.015%fund + 0.0015V <100kHz: 0.03%fund + 0.005V <305kHz: 0.08%fund + 0.01V
Σ Harmonic Adder		<10kHz: 0.02%fund + 0.002V <80kHz: 0.1%fund + 0.01V	<10kHz: 0.015%fund + 0.001V <80kHz: 0.15%fund + 0.01V	<10kHz: 0.03%fund + 0.003V <100kHz: 0.06%fund + 0.007V <305kHz: 0.15%fund + 0.015V
CMRR		1 μ V per V.Hz		0.7 μ V per V.Hz
Inter-Channel Phase		(0.02° + 0.15°*F)		(0.02° + 0.07°*F)

CURRENT INPUT SPECIFICATIONS (ALL OPTIONS)

		H option	D option			X option	
			AUTO range	HI range	LO range	HI range	LO range
No Damage Input Range	<1ms	200Arms (<300Apk)	30Arms (<50Apk)	150Arms (<250Apk)	30Arms (<50Apk)	200Vrms (300Vpk)	20Vrms (30Vpk)
	<20ms	75Arms (<300Apk)	20Arms (<50Apk)	50Arms (<200Apk)	20Arms (<50Apk)	50Vrms (300Vpk)	10Vrms (20Vpk)
	<1s	50Arms (<200Apk)	20Arms (<50Apk)	30Arms (<150Apk)	5Arms (<25Apk)	30Vrms (300Vpk)	5Vrms (10Vpk)
	Continuous	30Arms	20Arms (<50Apk)	20Arms (<150Apk)	2Arms (<5Apk)	20Vrms (300Vpk)	2Vrms (10Vpk)
	Power Off	As Above	As LO Range			As Above	As HI Range
Specified Input Range	DC	0 to $\pm 30A$	0 to $\pm 20A$	0 to $\pm 20A$	0 to $\pm 1A$	0 to $\pm 15V$	0 to $\pm 0.5V$
	<100Hz	3mA to 30Arms	10 μ A to 20Arms	2mA to 20Arms	10 μ A to 1Arms	800 μ V to 15Vrms	20 μ V to 0.5Vrms
	>100Hz	20mA to 30Arms	150 μ A to 20Arms	15mA to 20Arms	150 μ A to 1Arms	2mV to 15Vrms	150 μ V to 0.5Vrms
	Peak	<200A	<50A	<150A	<1A	<18V	<0.5V
Impedance		<10m Ω	As HI/LO range	<20m Ω	0.57 Ω $\pm$ 10%	20.5K Ω $\pm$ 1%	10.25K Ω $\pm$ 1%

CURRENT OPTION H ACCURACY SPECIFICATIONS

Accuracy is given by the addition of-

Base Accuracy

Relevant Frequency Adder (if applicable)

Relevant Floor Adder (use both DC and relevant AC floor adders for AC+DC measurements)

Self-Heating Adder

Relevant Harmonic Adder (if applicable).

For peak measurements accuracy is same but using 10* relevant Floor Adder.

In specifications below F is frequency in kHz. Self-heating has a nominal 3 minute time constant.

	S Channel Type	A Channel Type	W Channel Type
Resolution	100uA	10uA	100uA
Base Accuracy	0.1%rdg	0.03%rdg	0.1%rdg
Frequency Adder	0.01-1Hz: 0.05%rdg <10kHz: (0.003*F)%rdg 10-40kHz: (0.03+(0.007*(F-10)))%rdg 40-100kHz: (0.24+(0.02*(F-40)))%rdg		0.01-1Hz: 0.1%rdg <40kHz: (0.0015*F)%rdg 40-100kHz: (0.06+(0.003*(F-40)))%rdg 100-1000kHz: (0.24+(0.012*(F-100)))%rdg
Bandwidth (-3dB)	>1.25MHz		>5MHz
Floor Adder	DC: 300uA AC<100Hz: 800uA AC>100Hz: 3mA	DC: 100uA AC<100Hz: 500uA AC>100Hz: 2mA	DC: 400uA AC<100Hz: 1mA AC>100Hz: 4mA
Self-Heating Adder	1.5ppm reading per Arms ²		
Single Harmonic Adder	<10kHz: 0.01%fund + 100uA <80kHz: 0.05%fund + 5mA	<10kHz: 0.005%fund + 80uA <80kHz: 0.03%fund + 5mA	<10kHz: 0.015%fund + 150uA <100kHz: 0.03%fund + 5mA <305kHz: 0.08%fund + 5mA
ΣHarmonic Adder	<10kHz: 0.02%fund + 200uA <80kHz: 0.1%fund + 7mA	<10kHz: 0.015%fund + 150uA <80kHz: 0.15%fund + 7mA	<10kHz: 0.03%fund + 300uA <100kHz: 0.06%fund + 7mA <305kHz: 0.15%fund + 10mA
CMRR	500pA per V.Hz		
V:A Phase	(0.01° + 0.015°*F)		(0.01° + 0.007°*F)
Inter-Channel Phase	(0.02° + 0.15°*F)		(0.02° + 0.07°*F)

CURRENT OPTION D ACCURACY SPECIFICATIONS

Current option D has two ranges (HI and LO). Where the specification varies between ranges there are separate specifications for each range denoted (HI) or (LO) as applicable, otherwise the specification applies to both ranges.

Accuracy is given by the addition of-

Base Accuracy

Relevant Frequency Adder (if applicable)

Relevant Floor Adder (use both DC and relevant AC floor adders for AC+DC measurements)

Self-Heating Adder

Relevant Harmonic Adder (if applicable).

For peak measurements accuracy is same but using 10* relevant Floor Adder.

In specifications below F is frequency in kHz. Self-heating has a nominal 3 minute time constant.

	S Channel Type	A Channel Type	W Channel Type
Resolution (HI)	100uA	10uA	100uA
Resolution (LO)	1uA	0.1uA	1uA
Base Accuracy	0.1%rdg	0.03%rdg	0.1%rdg
Frequency Adder	0.01-1Hz: 0.05%rdg <10kHz: (0.003*F)%rdg 10-40kHz: (0.03+(0.007*(F-10)))%rdg 40-100kHz: (0.24+(0.02*(F-40)))%rdg		0.01-1Hz: 0.1%rdg <40kHz: (0.0015*F)%rdg 40-100kHz: (0.06+(0.003*(F-40)))%rdg 100-1000kHz: (0.24+(0.012*(F-100)))%rdg
Bandwidth (-3dB)	>1.25MHz		>5MHz
Floor Adder (HI)	DC: 300uA AC<100Hz: 500uA AC>100Hz: 2mA	DC: 100uA AC<100Hz: 300uA AC>100Hz: 1.5mA	DC: 400uA AC<100Hz: 700uA AC>100Hz: 3mA
Floor Adder (LO)	DC: 2uA AC<100Hz: 3uA AC>100Hz: 10uA	DC: 1uA AC<100Hz: 1.5uA AC>100Hz: 8uA	DC: 3uA AC<100Hz: 4uA AC>100Hz: 15uA
Self-Heating Adder	2ppm reading per Arms ²		
Single Harmonic Adder (HI)	<10kHz: 0.01%fund + 70uA <80kHz: 0.05%fund + 3.5mA	<10kHz: 0.005%fund + 50uA <80kHz: 0.03%fund + 3.5mA	<10kHz: 0.015%fund + 100uA <100kHz: 0.03%fund + 3.5mA <305kHz: 0.08%fund + 4mA
Single Harmonic Adder (LO)	<10kHz: 0.01%fund + 0.4uA <80kHz: 0.05%fund + 20uA	<10kHz: 0.005%fund + 0.3uA <80kHz: 0.03%fund + 20uA	<10kHz: 0.015%fund + 0.5uA <100kHz: 0.03%fund + 20uA <305kHz: 0.08%fund + 30uA
ΣHarmonic Adder (HI)	<10kHz: 0.02%fund + 150uA <80kHz: 0.1%fund + 5mA	<10kHz: 0.015%fund + 120uA <80kHz: 0.15%fund + 5mA	<10kHz: 0.03%fund + 200uA <100kHz: 0.06%fund + 5mA <305kHz: 0.15%fund + 7mA
ΣHarmonic Adder (LO)	<10kHz: 0.02%fund + 1uA <80kHz: 0.1%fund + 30uA	<10kHz: 0.015%fund + 0.7uA <80kHz: 0.15%fund + 30uA	<10kHz: 0.03%fund + 1uA <100kHz: 0.06%fund + 30uA <305kHz: 0.15%fund + 40uA
CMRR (HI)	400pA per V.Hz		
CMRR (LO)	20pA per V.Hz		
V:A Phase	(0.01° + 0.015°*F)		(0.01° + 0.007°*F)
Inter-Channel Phase	(0.02° + 0.15°*F)		(0.02° + 0.07°*F)

CURRENT OPTION X ACCURACY SPECIFICATIONS

Current option X has two ranges (HI and LO). Where the specification varies between ranges there are separate specifications for each range denoted (HI) or (LO) as applicable, otherwise the specification applies to both ranges.

Accuracy is given by the addition of-

Base Accuracy

Relevant Frequency Adder (if applicable)

Relevant Floor Adder (use both DC and relevant AC floor adders for AC+DC measurements)

Relevant Harmonic Adder (if applicable).

For peak measurements accuracy is same but using 10* relevant Floor Adder.

In specifications below F is frequency in kHz.

	S Channel Type	A Channel Type	W Channel Type
Resolution (HI)	10uV	1uV	10uV
Resolution (LO)	1uV	0.1uV	1uV
Base Accuracy	0.1%rdg	0.03%rdg	0.1%rdg
Frequency Adder	0.01-1Hz: 0.05%rdg <10kHz: (0.003*F)%rdg 10-40kHz: (0.03+(0.007*(F-10)))%rdg 40-100kHz: (0.24+(0.02*(F-40)))%rdg		0.01-1Hz: 0.1%rdg <40kHz: (0.0015*F)%rdg 40-100kHz: (0.068+(0.004*(F-40)))%rdg 100-1000kHz: (0.308+(0.015*(F-100)))%rdg
Bandwidth (-3dB)	>1.25MHz		>3MHz
Floor Adder (HI)	DC: 100uV AC<100Hz: 50uV AC>100Hz: 300uV	DC: 75uV AC<100Hz: 30uV AC>100Hz: 250uV	DC: 300uV AC<100Hz: 70uV AC>100Hz: 500uV
Floor Adder (LO)	DC: 20uV AC<100Hz: 3.5uV AC>100Hz: 30uV	DC: 15uV AC<100Hz: 2.5uV AC>100Hz: 30uV	DC: 25uV AC<100Hz: 5uV AC>100Hz: 50uV
Single Harmonic Adder (HI)	<10kHz: 0.01%fund + 7uV <80kHz: 0.05%fund + 350uV	<10kHz: 0.005%fund + 5uV <80kHz: 0.03%fund + 350uV	<10kHz: 0.015%fund + 10uV <100kHz: 0.03%fund + 350uV <305kHz: 0.08%fund + 400uV
Single Harmonic Adder (LO)	<10kHz: 0.01%fund + 0.3uV <80kHz: 0.05%fund + 10uV	<10kHz: 0.005%fund + 0.1uV <80kHz: 0.03%fund + 10uV	<10kHz: 0.015%fund + 0.3uV <100kHz: 0.03%fund + 10uV <305kHz: 0.08%fund + 15uV
ΣHarmonic Adder (HI)	<10kHz: 0.02%fund + 15uV <80kHz: 0.1%fund + 500uV	<10kHz: 0.015%fund + 12uV <80kHz: 0.15%fund + 500uV	<10kHz: 0.03%fund + 20uV <100kHz: 0.06%fund + 500uV <305kHz: 0.15%fund + 700uV
ΣHarmonic Adder (LO)	<10kHz: 0.02%fund + 0.5uV <80kHz: 0.1%fund + 15uV	<10kHz: 0.015%fund + 0.3uV <80kHz: 0.15%fund + 15uV	<10kHz: 0.03%fund + 0.5uV <100kHz: 0.06%fund + 15uV <305kHz: 0.15%fund + 20uV
CMRR (HI)	15nV per V.Hz		
CMRR (LO)	1nV per V.Hz		
V:A Phase	(0.01° + 0.015°*F)		(0.01° + 0.007°*F)
Inter-Channel Phase	(0.02° + 0.15°*F)		(0.02° + 0.07°*F)

WATTS, VAR AND VA MEASUREMENT ACCURACY SPECIFICATIONS

Accuracy is given by the addition of-

Base Accuracy from table below

Floor Adder from table below (use both DC and AC floor adders for AC+DC measurements)

Fundamental Phase Adder from table below (for W or VAR only)

Frequency Adders from both Voltage and Current tables (if applicable)

Self-Heating Adders from both Voltage and Current tables

Relevant Harmonic Adders from both Voltage and Current tables (if applicable)

In the table below the following terms are used-

Vdc is the DC voltage applied to the V terminals

Adc is the DC current (voltage for the X option) applied to the A terminals

Vac is the ACrms voltage applied to the V terminals

Aac is the ACrms current (voltage for the X option) applied to the A terminals

VAfund is the fundamental VA

PFFund is the fundamental power factor (without regard to polarity)

K is 0.3 for Watts, harmonic VAR and harmonic VA otherwise 1.0

	S Channel Type	A Channel Type	W Channel Type
Base Accuracy	0.17%rdg	0.05%rdg	0.17%
Floor Adder	DC: Vdc*(DC Current Floor Adder) + Adc*(DC Voltage Floor Adder) + (DC Voltage Floor Adder)*(DC Current Floor Adder) AC: Vac*K*(AC Current Floor Adder) + Aac*K*(AC Voltage Floor Adder)		

POWER FACTOR MEASUREMENT ACCURACY SPECIFICATIONS

For a non-unity power factor primarily caused by non-linearity in the load (i.e. distortion of the current signal) or by significant non-fundamental components in the source–

$$\text{Max. Error} = \text{PF} - ((W + \text{the AC Floor Adder portion with } K = 0.3) / (VA + \text{the AC Floor Adder portion with } K = 1.0))$$

Note – this error is biased and is guaranteed to always result in a lower PF reading within the max. error stated

For a non-unity power factor primarily caused by phase shift in the load (i.e. a reactive load)–

$$\text{Max. Error} = ((VA + \text{the AC Floor Adder portion with } K = 0.3) / (VA + \text{the AC Floor Adder portion with } K = 1.0)) + (\text{PF} - \cos(\cos^{-1}(\text{PF}) + V:A \text{ phase for current input}))$$

For fundamental power factor–

$$\text{Max. Error} = (\text{PF} - \cos(\cos^{-1}(\text{PF}) + V:A \text{ phase for current input}))$$

PF = power factor reading, W = Watts reading, and VA = VA reading

FREQUENCY MEASUREMENT ACCURACY SPECIFICATIONS

Frequency Range	10ms period: 145Hz to 80kHz (S or A channel type) or 305kHz (W channel type) 20ms period: 44Hz to 80kHz (S or A channel type) or 305kHz (W channel type) 100ms period: 19Hz to 80kHz (S or A channel type) or 305kHz (W channel type) 300ms period: 9Hz to 80kHz (S or A channel type) or 305kHz (W channel type) LF: 0.19Hz to 1kHz VLF: 0.0099Hz to 65Hz
Min. Input (typ)	Voltage: 1Vpkpk Current, H option: 0.1Apkpk Current, D option: 0.1Apkpk (HI range) or 0.5mApkpk (LO range) Current, X option: 10mVpkpk (HI range) or 200uVpkpk (LO range)
Pulse Input	Minimum Pulse Width: 5us (S or A channel type) or 1.25us (W channel type) Duty Cycle: 10% to 90%
Measurement Period	Greater of 1 cycle or 100ms
Settling Time	Minimal DC content: greater of 3 cycles or 300ms Significant DC content: add 2 amplitude measurement periods
Accuracy and Resolution	<0.02% of reading

HARMONIC ANALYSIS

The voltage and current samples are analyzed by means of DFT analysis performed with 48 bit precision and 64 bit accumulation.

Window	Rectangular
Harmonic Bandwidth	LF and VLF measurement periods: the smallest of (F/2) or 1Hz Other measurement periods: the smallest of (F/2) or 100Hz Where F is the fundamental frequency
Maximum Harmonic	The smallest of - 500 th (harmonics over the 100th requires option H500) A frequency of 80kHz (S or A channel type) or 305kHz (W channel type) User configured lower limit