XiTRON By VITREK

XT2640 Series

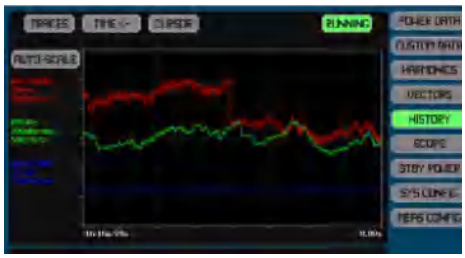
Precision Multi-Channel Power Analyzer

Vitrek's XT2640 is three power analyzers in a single chassis with a single interface. The XT2640 may have up to 4 Channels installed or optionally with the MU option combine units to grow to thousands of channels, which may be any combination of channel cards and with any combination of available current input options.

Quality and Reliability

Vitrek, founded in 1990, is the premier source of precision power testing and measuring equipment for industrial and consumer product development and manufacturing. Vitrek's sophisticated technology provides companies the edge in design verification and product manufacturability.

History Displays

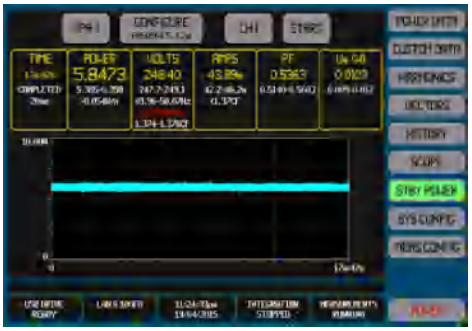


Vector Diagrams

Harmonics Displays with Limits

Oscilloscope Displays

Standby Power



INDUSTRIES SERVED

- Automated Production Testing
- Ballast Testing
- Consumer Products
- Engineering Labs
- Instrument Maintenance & Repair
- Peak Power & Consumption Measurements
- Light Output Verification
- Product Compliance Testing
- Test Labs

25
Years Industry
EXPERTISE

XT2640

Precision Multi-Channel Power Analyzer

Test Like You MEAN IT

XT2640 channels may be configured in any one (or none) of the 3 virtual power analyzers. Each virtual power analyzer may be configured for up to all channels installed. Each VPA is independently configured for multi-channel wiring configuration, signal filtering, default measurement coupling, display results smoothing and significant digits, VA/VAR combine method, and efficiency grouping. VPAs may optionally be configured to be synchronized to each other.

XVIEW Software

While all Vitrek precision test equipment is designed to be used in a completely stand-alone manner, there are times when external tools can aid or enhance the operation of an instrument.

XView software tools and drivers are designed to help easily configure an instrument from a single screen, or are used to view a complete set of measurements in a single screen.

Other XView tools are designed for data collection where results can be recorded in an Excel-compatible file for post-processing, insertion into reports, or simply for archival purposes.

Ordering Information

822-XT2640AD (STD)	Basic Power Analyzer chassis, with 26A element, 220-260ksps, 24bit effective resolution, 0.025% rdg (V) (1 thru 4 Channel)
822-XT2640WD	Basic Power Analyzer chassis, with 26W element, 850-1100ksps, 24bit effective resolution, 0.2% rdg, (V) (1 thru 4 Channel)
822-XT2640SD	Basic Power Analyzer chassis, with 26S element, 220-260ksps, 22bit effective resolution, 0.1% rdg (V) (1 thru 4 Channel)
822-XT2640ED	Basic Power Analyzer chassis, with 26E element, 220-260ksps, 24bit effective resolution, 0.05% rdg, (V), IEC 61000-3-2 compliant harmonic measurement. (1 thru 4 Channel)
822-26AD (Card)	Power Analyzer A Element, 220-260ksps, 24bit effective resolution, 0.025% rdg (V)
822-26WD (Card)	Power Analyzer W Element, 850-1100ksps, 24bit effective resolution, 0.2% rdg, (V)
822-26SD (Card)	Power Analyzer S Element, 220-260ksps, 22bit effective resolution, 0.1% rdg (V)
822-26ED (Card)	Power Analyzer E Element, 220-260ksps, 24bit effective resolution, 0.05% rdg, (V)

892-26GPIB	IEEE-488/GPIB interface option (note: this replaces the USB and Ethernet interfaces)
892-26xx OPT D (STD)	Standard current option, 2 ranges, 20Arms max
892-26xx OPT H	High current option, 1 range, 35Arms max
892-26xx OPT X	External current option, 2 ranges, 15Vrms input max
892-26xx OPT H500	Allows up to 500 harmonics on all W cards in a unit
892-26xx OPT MU	Multi Unit Option
892-26xx OPT EN	Built-in EN61000 compliance firmware for all cards in a unit
892-HC-7	Hard carrying case, pelican-type
892-RM-7	4U (7in height) rackmount kit for 4 channel units
892-280x Cable IEC	Connection Cable
LS-XT2640	Lead Set

XITRON By VITREK

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Poway, CA 92164
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www.vitrek.com

REV 3/19

A2LA ACCREDITED CERT #3678.01

*Please visit **www.vitrek.com** for ordering information.*

CE

1 DIMENSIONAL, ENVIRONMENTAL AND POWER SUPPLY SPECIFICATIONS

1.1 DIMENSIONAL

Nominal Dimensions	137mmH x 248mmW x 284mmD (5.4” x 9.75” x 11.2”) with feet not
Nominal Weight	extended 3.2kg (7lb) net, 5kg (11lb) shipping

1.2 ENVIRONMENTAL

Storage Environment	-20 to 75C (-4 to 167F) (non-condensing)
Operating Environment	0 to 40C (32 to 104F), <85% RH (non-condensing), Pollution
Operating Altitude	Degree 2 0 to 2000m (6560ft) ASL

1.3 POWER SUPPLY

Line Power	Installation Category II; 85-264Vrms, 45 to 65Hz, 40VA max. Internally fused with a non-user serviceable fuse

2 ELECTRICAL CHANNEL INPUT AND ACCURACY SPECIFICATIONS

Note:

All percentages are % of reading unless otherwise described.

2.1 INPUT ISOLATION SPECIFICATIONS

Valid for any V terminal to XT2640 chassis ground; any A terminal to XT2640 chassis ground; and between any V and any A terminal.

Impedance	>1GΩ || <30pF
Max. Voltage	4500V_{PK} max without damage 2500V_{RMS} max for <1s without damage 1000V_{RMS} max continuous rated working voltage (CAT I/ II) 600V_{RMS} max continuous rated working voltage (CAT III) 300V_{RMS} max continuous rated working voltage (CAT IV)

2.2 VOLTAGE MEASUREMENT SPECIFICATIONS

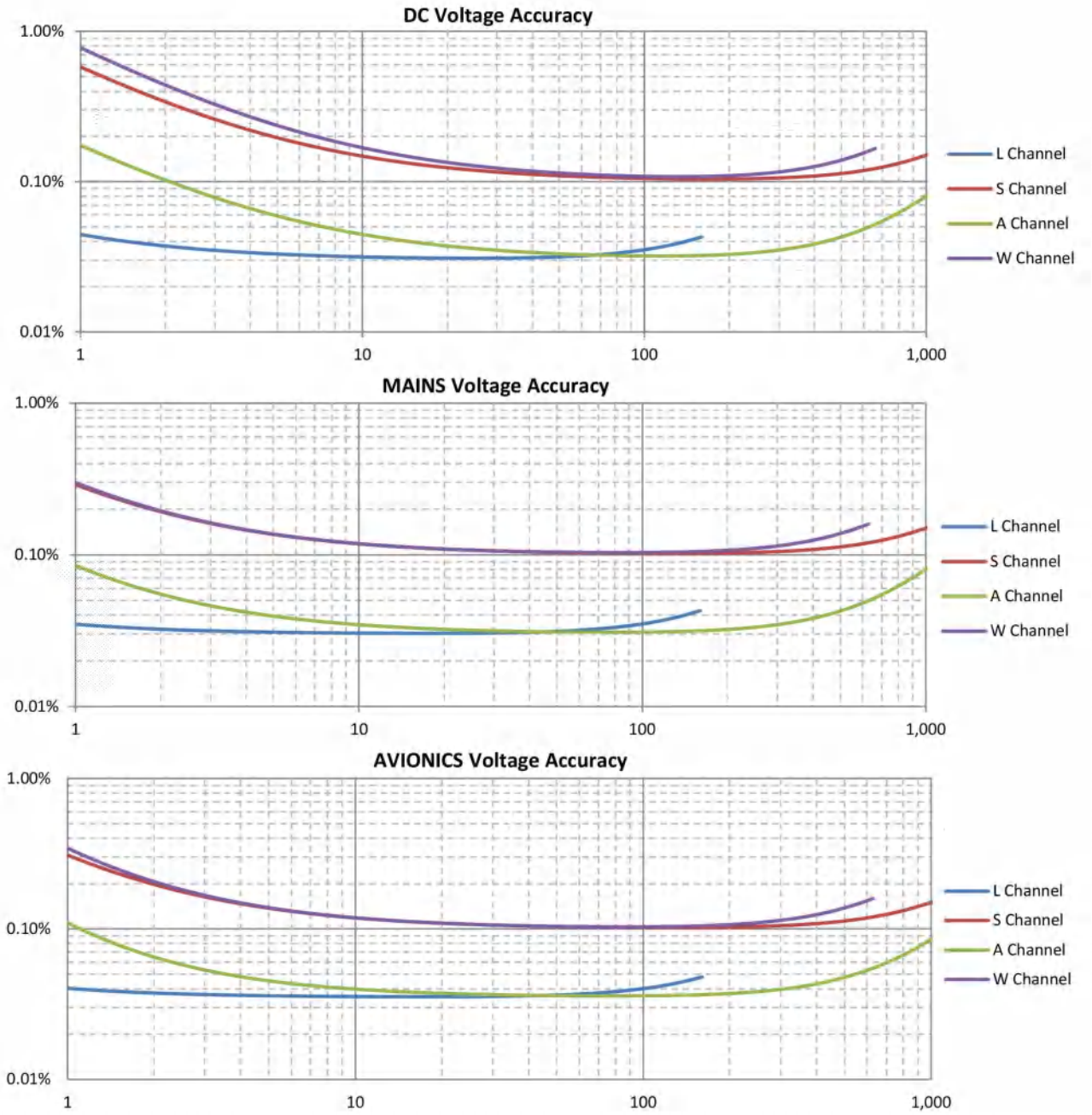
The specifications for voltage are independent of the current input option installed in the respective channel.

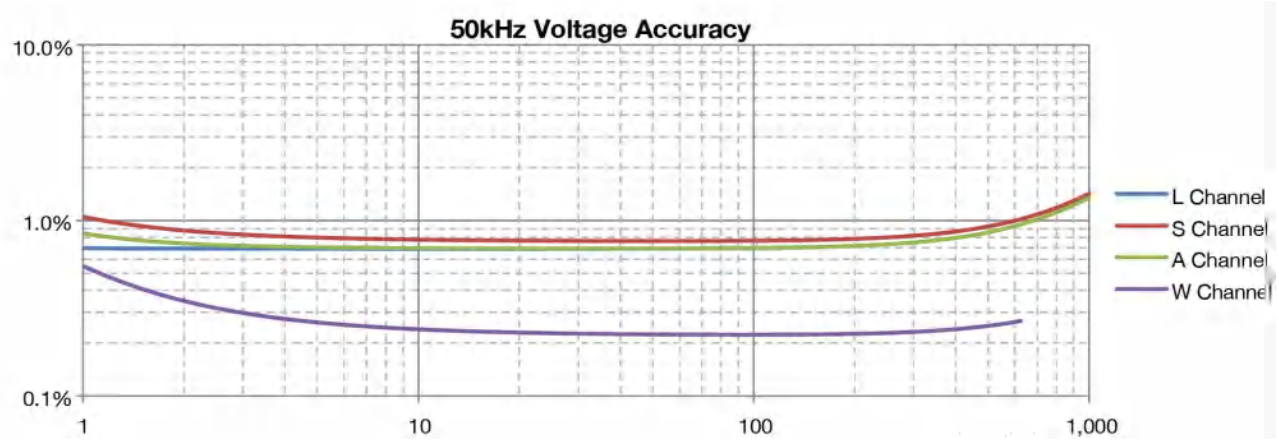
2.2.1 VOLTAGE INPUT CAPABILITY AND CHARACTERISTICS

Specification		S Channel Type	A Channel Type	L Channel Type	W Channel Type
No Damage Voltage Range	<1ms	<3000V_{RMS} and V_{PK}		<500V_{RMS} and 3000V_{PK}	<3000V_{RMS} and V_{PK}
	<100ms	<2000V_{RMS}		<300V_{RMS}	<1500V_{RMS}
	<5s	<1500V_{RMS}		<250V_{RMS}	<1000V_{RMS}
	Continuous	<1000V_{RMS}		<160V_{RMS}	<650V_{RMS}
	XT2640	As above			
Measurable Voltage Range	Unpowered	<1803V_{RMS} and V_{PK}		<182.3V_{RMS} and V_{PK}	<1803V_{RMS} and V_{PK}
Specified Voltage Range		<1000V_{RMS} and <1750V_{PK}		<160V_{RMS} and <175V_{PK}	<650V_{RMS} and <1750V_{PK}
Impedance Burden		1.201MΩ ± 0.25%		121kΩ ± 0.25%	399.5kΩ ± 0.25%
3dB Bandwidth (typical)		900kHz			3MHz

2.2.2 VOLTAGE MEASUREMENT ACCURACY

The charts below show guaranteed maximum voltage errors for DC, MAINS, AVIONICS, and 50kHz throughout a 1V to 1000V range of applied voltages expressed as % of reading and are valid within ±5C of the calibration temperature (add 0.005% per C beyond this) and where no significant common-mode is present. Following the charts is a table which can be used to calculate the guaranteed accuracies for applications other than shown in the charts and also for the computation of numerical errors.





2.2.2.1 PRIMARY VOLTAGE MEASUREMENT ACCURACY TABLE

Add relevant errors from the table below for the maximum error in primary voltage measurements (e.g. DC, AC, AC+DC, Rectified, Peak, Valley, Peak-Valley).

MAXIMUM SCALING ERRORS Apply to all results as shown below as a percentage of the reading If signal contains significant levels at multiple frequencies, apply to each level & frequency					
Specification		**S Channel Type**	**A Channel Type**	**L Channel Type**	**W Channel Type**
Base Scaling Error Apply to all results		0.1%	0.03%		0.1% (0.2% if 2ms LF/PERIOD)
Frequency Dependent Scaling Error Apply to all results other than DC or MAINS	**AVIONICS**	None	0.005%		None
	LF or VLF	0.01%			0.05%
	<10kHz	F*0.005%			F*0.002%
	10k-40kHz	0.05%+(F-10)*0.012%			
	40k-100kHz	0.41%+(F-40)*0.025%			0.08%+(F-40)*0.004%
	100k-1MHz	Typically $(F/1000)^2$*100%			0.32%+(F-100)*0.013%
	>1MHz	Not specified			Typically $(F/3500)^2$*100%
Self-Heating Scaling Error Apply to all results (only significant at higher voltages) 1 minute nominal time constant		0.05%*$(V_{AC+DC}/1000)^2$		0.5%*$(V_{AC+DC}/1000)^2$	0.15%*$(V_{AC+DC}/1000)^2$
Temperature Scaling Error Apply to all results if outside of ±5C from calibration temperature		0.005% per C outside of ±5C from calibration temperature			
Bandwidth Limit Scaling Error Apply if using USER bandwidth setting		10%*$(F/F_{BW})^2$, unspecified for F > 0.3*F_{BW}			
MAXIMUM FLOOR ERRORS Apply to all results as shown below in Volts (generally only significant at low input					
Specification		**S Channel Type**	**A Channel Type**	**L Channel Type**	**W Channel Type**
Base Floor Error Apply to all results		1.8mV	450µV	45µV	1.8mV
DC Floor Error Apply to DC and RECTIFIED results Apply to AC+DC results after multiplying by V_{DC}/V_{AC+DC}		3mV	1mV	100µV	5mV
AC Floor Error Apply to AC, AC+DC, and RECTIFIED results	MAINS, LF, VLF & F_{BW}≤10kHz	100µV/V_{RDG}	100µV/V_{RDG}	4µV/V_{RDG}	200µV/V_{RDG}
	AVIONICS & F_{BW}≤50kHz	300µV/V_{RDG}	300µV/V_{RDG}	8µV/V_{RDG}	650µV/V_{RDG}
	Otherwise	1.1mV/V_{RDG}	1.1mV/V_{RDG}	11µV/V_{RDG}	1.5mV/V_{RDG}
Peak Floor Error Apply to PK, VLY and PK-VLY results	MAINS, LF, VLF & F_{BW}≤10kHz	40mV	40mV	8mV	60mV
	AVIONICS & F_{BW}≤50kHz	75mV	75mV	11mV	125mV
	Otherwise	125mV	125mV	17mV	175mV
Common Mode Error Apply to AC, AC+DC, and RECTIFIED results Apply using voltage on V LO terminal relative to chassis ground. Error has 90° phase shift to common-mode voltage		1µV per V.Hz (11.5mV@230V/50Hz)		100nV per V.Hz (1.15mV@230V/50Hz)	700nV per V.Hz (8.05mV@230V/50Hz)
Adjacent Channel Error Apply to AC, AC+DC, and RECTIFIED results Apply using adjacent channel A LO or V LO terminal voltage relative to chassis ground. Error has 90° phase shift to adjacent channel voltage		300nV per V.Hz (3.45mV@230V/50Hz)		30nV per V.Hz (345µV@230V/50Hz)	210nV per V.Hz (2.415mV@230V/50Hz)

2.2.2.2 SECONDARY VOLTAGE MEASUREMENT ACCURACY TABLE

Specification		S Channel Type	A Channel Type	L Channel Type	W Channel Type
Crest Factor Error		(Total Floor Error from preceding table for PK results) / V_{AC}			
Form Factor Error		(Total Floor Error from preceding table for AC+DC results) / $V_{RECTIFIED}$			
Inter-Channel Error For 120° between equal amplitudes		(Relevant Voltage Errors from preceding table at the inter-channel voltage) + 0.0015%*F			
Harmonic or Spectrum Error		AC Voltage Errors from preceding table at V and F of the harmonic or spectrum point + (H/N)²*0.3% of reading + (if not fundamental) from below using the frequency of the harmonic or spectrum point			
	<10kHz	0.01% of V_{AC+DC}	0.006% of V_{AC+DC}		0.015% of V_{AC+DC}
	10k-115kHz	0.05% of V_{AC+DC}			0.03% of V_{AC+DC}
	115k-435kHz	Not Available			0.08% of V_{AC+DC}
Inter-Channel Fundamental Phase Error		0.02°+0.15°*F			0.01°+0.07°*F
Harmonic-Fundamental Phase Error (typical, BANDWIDTH configured as UNFILTERED)		0.02°+0.1°*F+0.001°*H			0.02°+0.03°*F+0.001°*H
%THD Error Errors shown are all expressed in % THD units		(0.005+0.000025*N)*%THD+0.00005*N*√N + from below using the frequency of highest included harmonic			
	<10kHz	0.025+1.25/V_{AC}	0.015+1/V_{AC}	0.015+0.2/	0.03+1.5/V_{AC}
	10k-115kHz	V_{AC} 0.15+3.5/V_{AC}		0.15	0.06+4/V_{AC}
	115k-435kHz	+0.35/V_{AC}	Not Available		0.15+4/V_{AC}

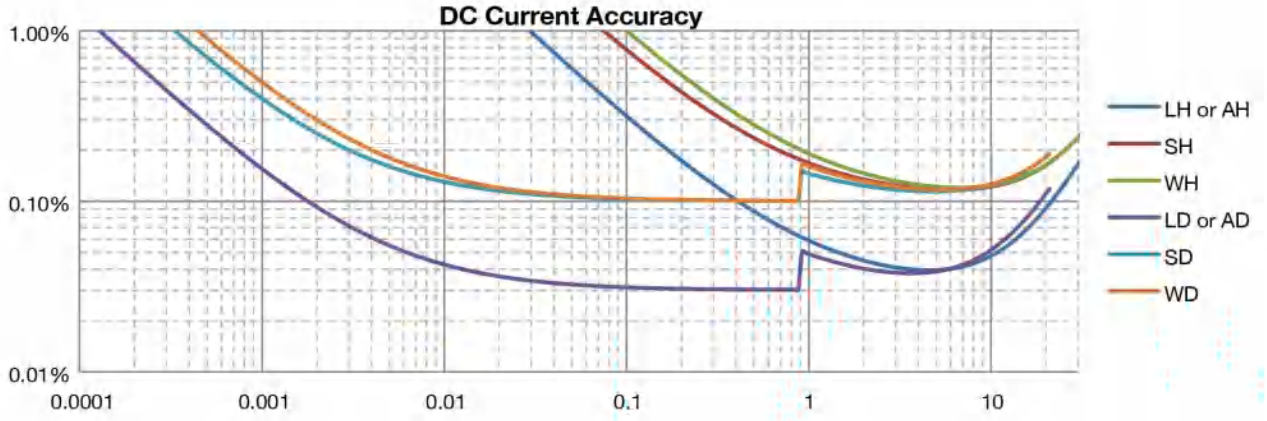
2.3 CURRENT MEASUREMENT SPECIFICATIONS

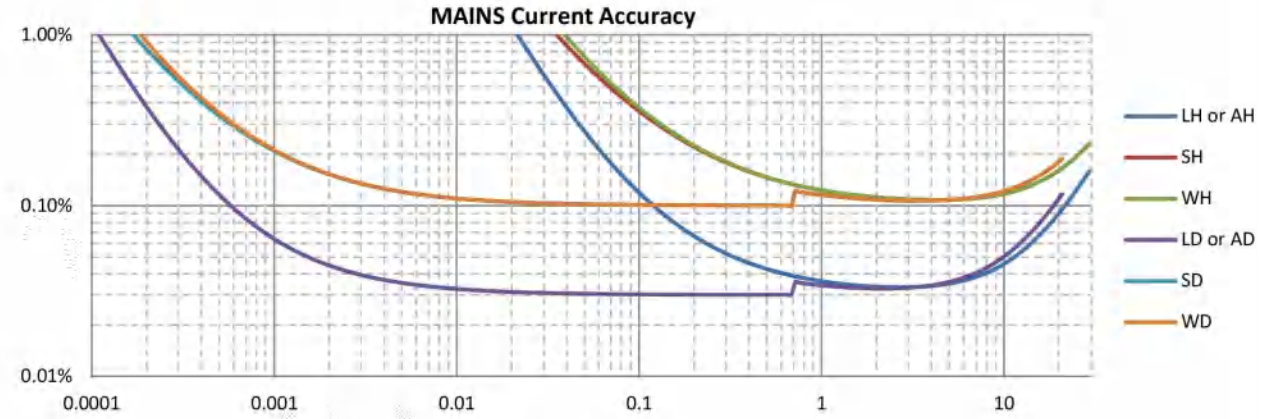
2.3.1 CURRENT INPUT CAPABILITY AND CHARACTERISTICS

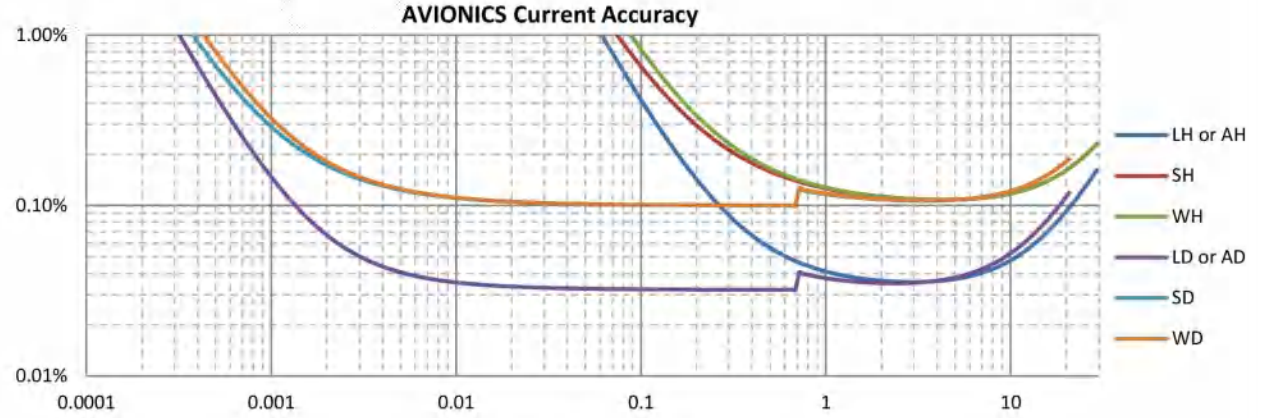
Specification		Channel Type	Option H	Option D HI Range or Auto-Range when on HI Range	Option D LO Range or Auto-Range when on LO Range	Option X HI Range	Option X LO Range
No Damage Current Range	<8ms	All	<200A_{RMS} and <300A_{PK}	<150A_{RMS} and <250A_{PK}	<60A_{RMS} and <150A_{PK}	<200V_{RMS} and <300V_{PK}	<20V_{RMS} and <30V_{PK}
	<40ms	All	<75A_{RMS}	<50A_{RMS}	<40A_{RMS}	<50V_{RMS}	<10V_{RMS}
	<1s	All	<50A_{RMS}	<30A_{RMS}	<5A_{RMS}	<30V_{RMS}	<5V_{RMS}
	Continuous	All	<30A_{RMS}	<20A_{RMS}	<2A_{RMS}	<25V_{RMS} and V_{PK}	<5V_{RMS} and V_{PK}
	XT2640 Unpowered	All	As Above	<2A_{RMS} and <150A_{PK}		<25V_{RMS} and <300V_{PK}	
Measurable Current Range		All	<225A_{RMS} and A_{PK}	<150A_{RMS} and A_{PK}	<1.02A_{RMS} and A_{PK}	<23.1V_{RMS} and V_{PK}	<0.576V_{RMS} and V_{PK}
Specified Current Range		All	<30A_{RMS} and <200A_{PK}	<20A_{RMS} and <140A_{PK}	<1A_{RMS} and A_{PK}	<15V_{RMS} and <20V_{PK}	<0.55V_{RMS} and V_{PK}
Impedance Burden		All	2.5mΩ to 7mΩ	4mΩ to 12mΩ	0.562Ω ± 0.75%	20.5kΩ ± 0.25%	10.25kΩ ± 0.25%
3dB Bandwidth (typical)		S, A or L	1.25MHz				
		W	5MHz			3MHz	

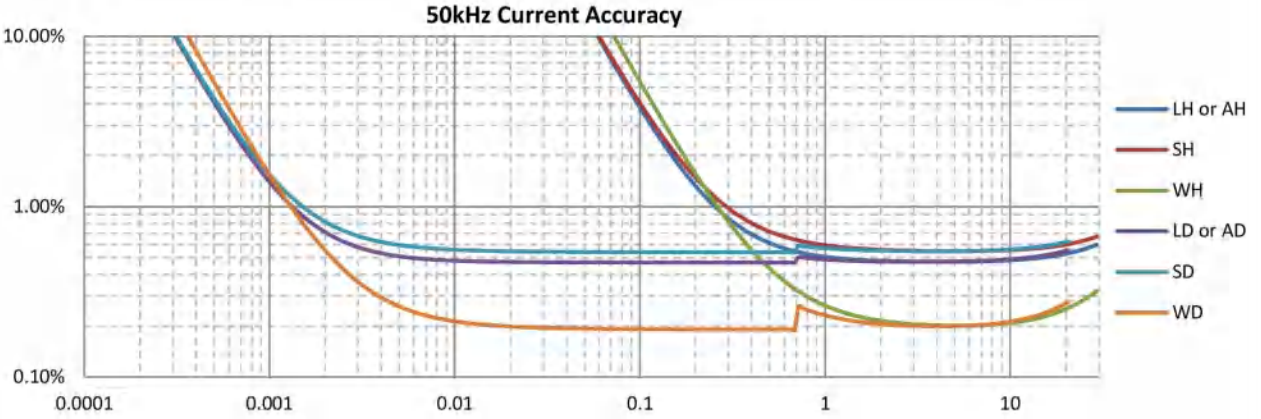
2.3.2.CURRENT MEASUREMENT ACCURACY

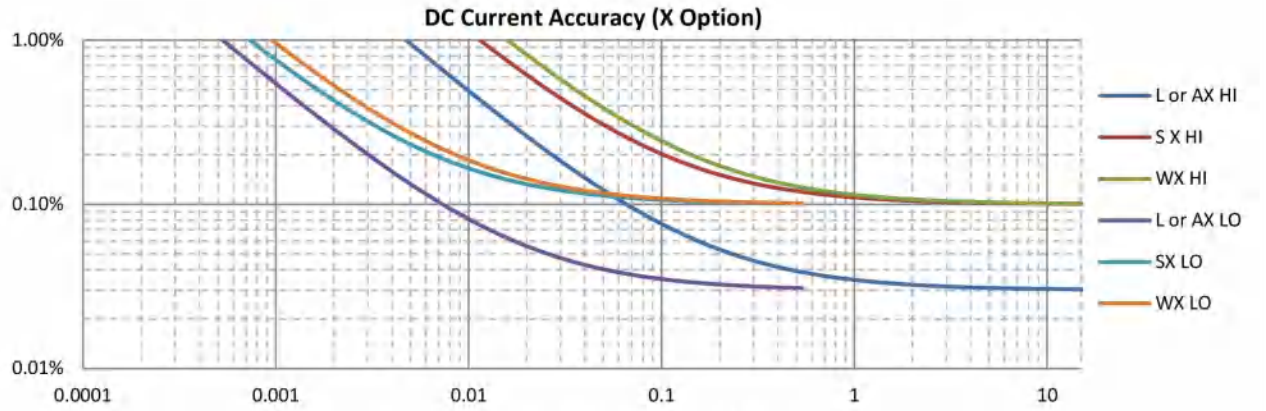
The charts below show guaranteed maximum current errors for DC, MAINS, AVIONICS, and 50kHz throughout a 100µA to 30Arange of applied currents expressed as % of reading and are valid within ±5C of the calibration temperature (add 0.005% per C beyond this) and where no significant common-mode is present. Following the charts is a table which can be used to calculate

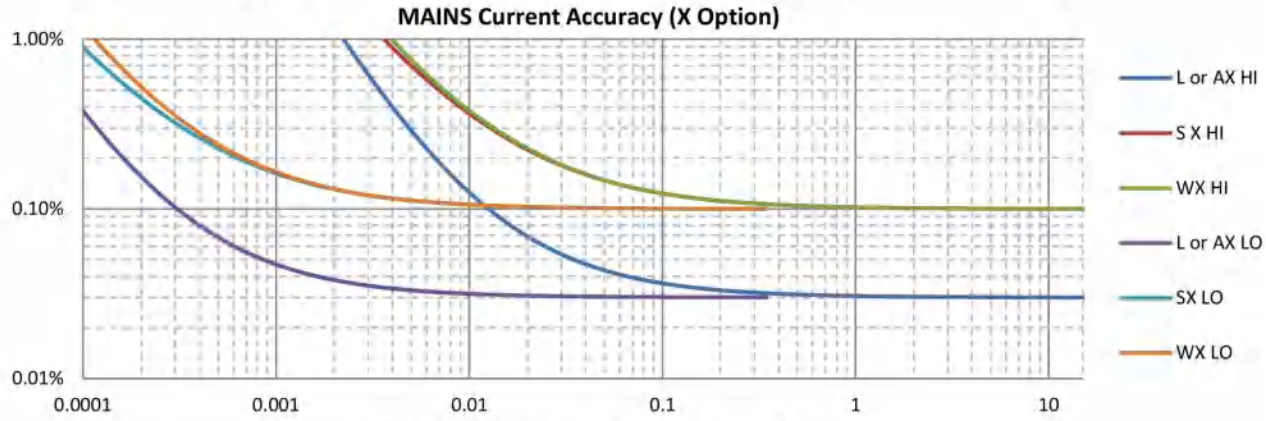


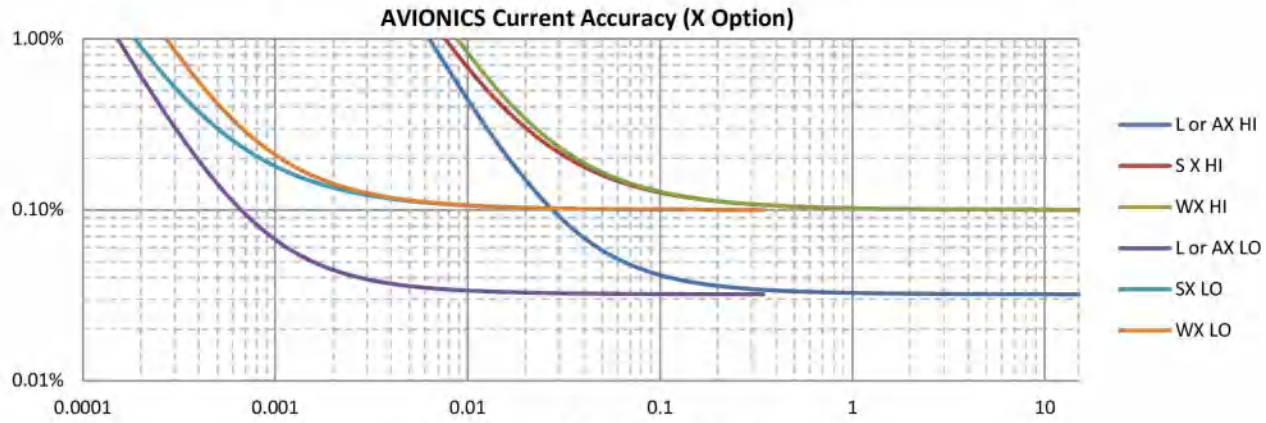

MAINS Current Accuracy
1.00%
0.10%
0.01%
0.0001
0.001
0.01
0.1
1
10
LH or AH
SH
WH
LD or AD
SD
WD

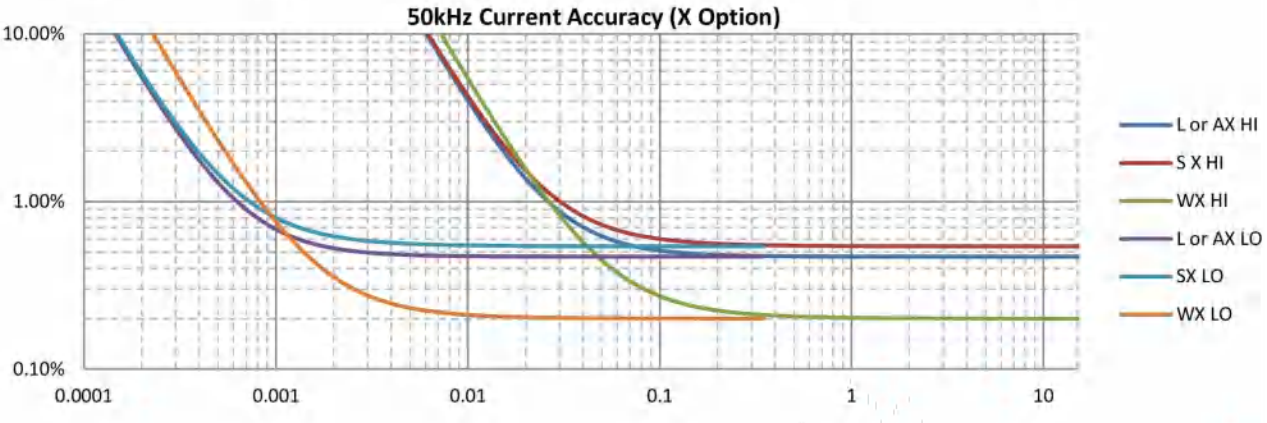

AVIONICS Current Accuracy
1.00%
0.10%
0.01%
0.0001
0.001
0.01
0.1
1
10
LH or AH
SH
WH
LD or AD
SD
WD


50kHz Current Accuracy
10.00%
1.00%
0.10%
0.0001
0.001
0.01
0.1
1
10
LH or AH
SH
WH
LD or AD
SD
WD


DC Current Accuracy (X Option)
1.00%
0.10%
0.01%
0.0001
0.001
0.01
0.1
1
10
L or AX HI
S X HI
WX HI
L or AX LO
SX LO
WX LO


MAINS Current Accuracy (X Option)
1.00%
0.10%
0.01%
0.0001
0.001
0.01
0.1
1
10
L or AX HI
S X HI
WX HI
L or AX LO
SX LO
WX LO

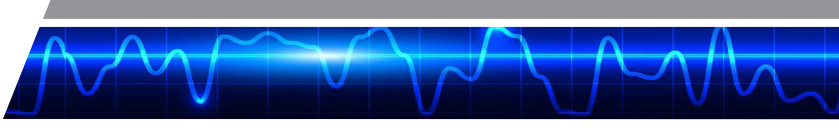

AVIONICS Current Accuracy (X Option)
1.00%
0.10%
0.01%
0.0001
0.001
0.01
0.1
1
10
L or AX HI
S X HI
WX HI
L or AX LO
SX LO
WX LO


50kHz Current Accuracy (X Option)
10.00%
1.00%
0.10%
0.0001
0.001
0.01
0.1
1
10
L or AX HI
S X HI
WX HI
L or AX LO
SX LO
WX LO

2.3.2.1 PRIMARY CURRENT MEASUREMENT ACCURACY TABLE

Add relevant errors from the table below for the maximum error in primary current measurements (e.g. DC, AC, AC+DC, Rectified, Peak, Valley, Peak-Valley).

MAXIMUM SCALING ERRORS Apply to all results as shown below as a percentage of the reading If signal contains significant levels at multiple frequencies, apply to each level &							
Specification		**Channel Type**	**Option H**	**Option D HI Range**	**Option D LO Range**	**Option X HI Range**	**Option X LO Range**
Base Scaling Error Apply to all results		A or L	0.03%				
		S or W	0.1% (0.2% if 2ms LF/PERIOD)				
Frequency Dependent Scaling Error Apply to all results other than DC or MAINS	LF or VLF	S, A or L	0.01%				
		W	0.05%				
	AVIONICS	A or L	0.002%				
		S or W	None				
	<10kHz	S, A or L	F*0.003%				
		W	F*0.0015%				
	10k-40kHz	S, A or L	0.03%+(F-10)*0.007%				
		W	F*0.0015%				
	40k-100kHz	S, A or L	0.24%+(F-40)*0.02%				
		W	0.06%+(F-40)*0.003%			0.06%+(F-40)*0.004%	
	100k-1MHz	S, A or L	Typically $(F/1250)^2*100\%$				
		W	0.24%+(F-100)*0.012%			0.3%+(F-100)*0.015%	
	>1MHz	W	Typically $(F/5000)^2*100\%$			Typically $(F/3000)^2*100\%$	
Self-Heating Scaling Error Apply to all results (only significant at higher currents) 3 minute nominal time constant		All	$0.00015\%*A_{AC+DC}^2$	$0.0002\%*A_{AC+DC}^2$	None		
Temperature Scaling Error Apply to all results if outside of ±5C from calibration temperature		All	0.005% per C outside of ±5C from calibration temperature				
Bandwidth Limit Scaling Error Apply if using USER bandwidth setting		All	$10\%*(F/F_{BW})^2$, unspecified above $0.3*F_{BW}$				
MAXIMUM FLOOR ERRORS Apply to all results as shown below in Amps (generally only significant at low input							
Specification		**Channel Type**	**Option H**	**Option D HI Range**	**Option D LO Range**	**Option X HI Range**	**Option X LO Range**
Base Floor Error Apply to all results		A or L	56µA	38µA	250nA	6µV	150nV
		S or W	225µA	150µA	1µA	23µV	600nV
DC Floor Error Apply to DC and RECTIFIED results Apply to AC+DC results after multiplying by A_{DC}/A_{AC+DC}		A or L	0.23mA	0.15mA	1µA	40µV	5µV
		S	0.45mA	0.3mA	2µA	80µV	6µV
		W	0.68mA	0.45mA	3µA	120µV	8µV
AC Floor Error Apply to AC, AC+DC, and RECTIFIED results	MAINS, LF, VLF & F_{BW}≤10kHz	S, A or L	$3.3µA/A_{RDG}$	$1.5µA/A_{RDG}$	$90pA/A_{RDG}$	$35nV/A_{RDG}$	$20pV/A_{RDG}$
		W	$5µA/A_{RDG}$	$2.5µA/A_{RDG}$	$125pA/A_{RDG}$	$50nV/A_{RDG}$	$50pV/A_{RDG}$
	AVIONICS & F_{BW}≤50kHz	S, A or L	$33µA/A_{RDG}$	$15µA/A_{RDG}$	$0.9nA/A_{RDG}$	$350nV/A_{RDG}$	$200pV/A_{RDG}$
		W	$50µA/A_{RDG}$	$25µA/A_{RDG}$	$1.25nA/A_{RDG}$	$500nV/A_{RDG}$	$500pV/A_{RDG}$
	Otherwise	S, A or L	$330µA/A_{RDG}$	$150µA/A_{RDG}$	$9nA/A_{RDG}$	$3.5µV/A_{RDG}$	$2nV/A_{RDG}$
		W	$500µA/A_{RDG}$	$250µA/A_{RDG}$	$12.5nA/A_{RDG}$	$5µV/A_{RDG}$	$5nV/A_{RDG}$
Peak Floor Error Apply to PK, VLY and PK-VLY results	MAINS, LF, VLF & F_{BW}≤10kHz	S, A or L	8mA	5mA	40µA	0.75mV	25µV
		W	10mA	6.5mA	50µA	0.9mV	30µV
	AVIONICS & F_{BW}≤50kHz	S, A or L	25mA	17mA	125µA	2.5mV	65µV
		W	30mA	20mA	150µA	3mV	80µV
	Otherwise	S, A or L	75mA	50mA	400µA	7.5mV	200µV
		W	90mA	60mA	500µA	10mV	250µV
Common Mode Error Apply to all results Apply using voltage on A LO terminal relative to chassis ground. Error has 90° phase shift to common-mode voltage		All	500pA per V.Hz (5.75µA@230V/50Hz)	400pA per V.Hz (4.6µA@230V/50Hz)	20pA per V.Hz (0.23µA@230V/50Hz)	15nV per V.Hz (0.172mV@230V/50Hz)	0.5nV per V.Hz (5.75µV@230V/50Hz)
Adjacent Channel Error Apply to all results Apply using adjacent channel A LO or V LO terminal voltage relative to chassis ground. Error has 90° phase shift to adjacent channel voltage		All	150pA per V.Hz (1.725µA@230V/50Hz)	120pA per V.Hz (1.38µA@230V/50Hz)	7pA per V.Hz (80.5nA@230V/50Hz)	7nV per V.Hz (80.5µV@230V/50Hz)	0.2nV per V.Hz (2.3µV@230V/50Hz)

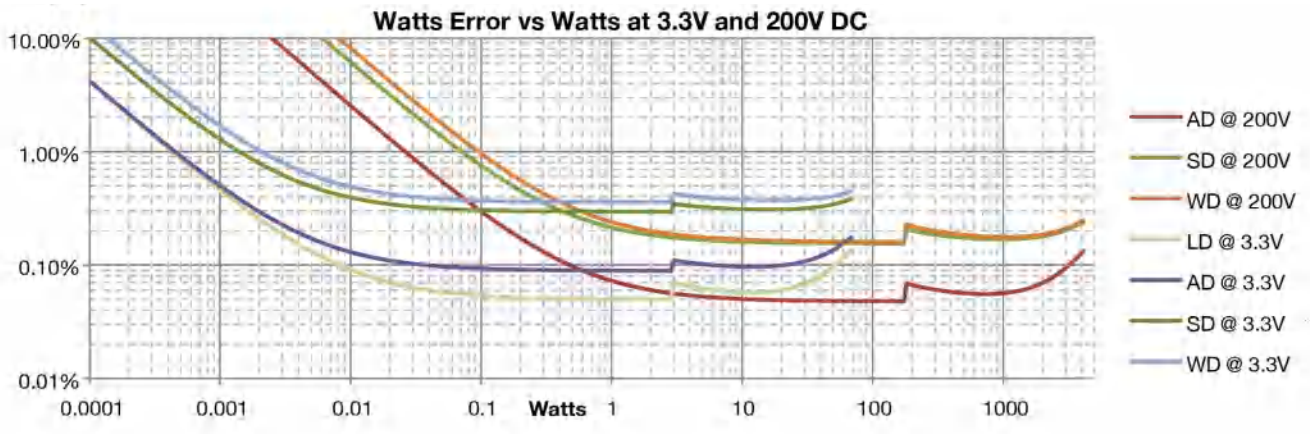


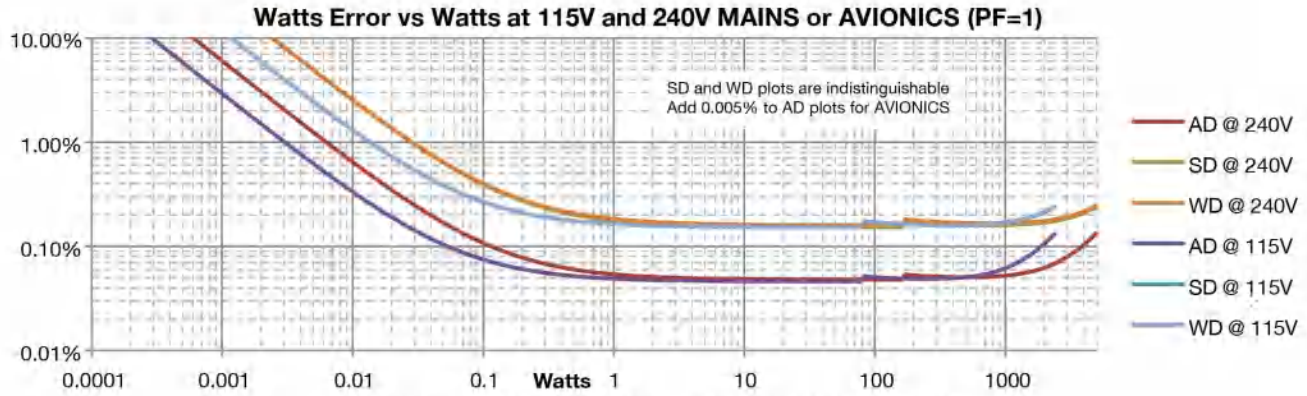
2.3.2.2 SECONDARY CURRENT MEASUREMENT ACCURACY TABLE

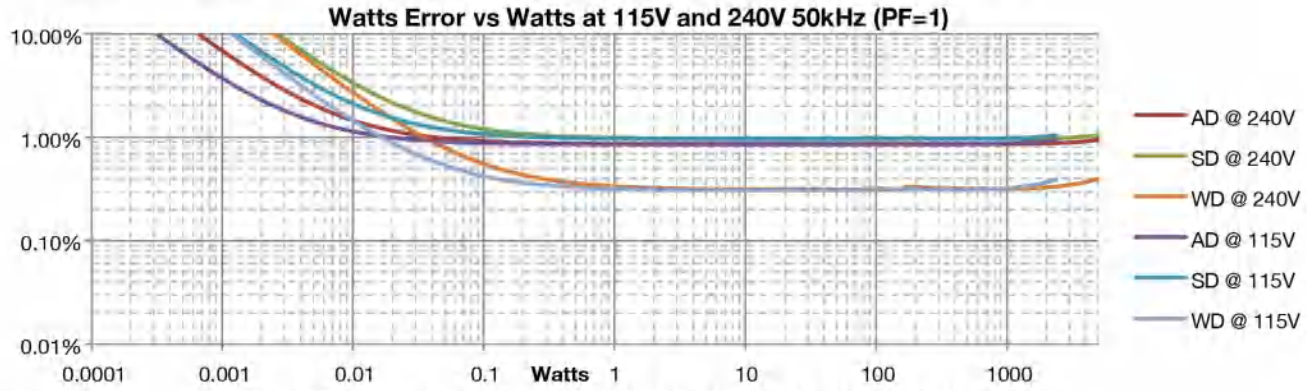
Specification		Channel Type	Option H	Option D HI Range	Option D LO Range	Option X HI Range	Option X LO Range
Crest Factor Error		All	(Total Current Floor Error from preceding table for PK results) / A_{AC}				
Form Factor Error		All	(Total Current Floor Error from preceding table for AC+DC results) / $A_{RECTIFIED}$				
Multi-Channel Error For similar current level and phase in each phase.	A_N (2ø3w)	All	Relevant Current Errors from preceding table for $A_{øA}$ + Relevant Current Errors from preceding table for $A_{øB}$ + 0.0005% of ($A_{øA}$ + $A_{øB}$)*F				
	$A_{øC}$ (3ø3w 2ch)	All	Relevant Current Errors from preceding table for $A_{øA}$ + Relevant Current Errors from preceding table for $A_{øB}$ + 0.0015% of ($A_{øA}$ + $A_{øB}$)*F				
	A_N (3ø4w)	All	Relevant Current Errors from preceding table for $A_{øA}$ + Relevant Current Errors from preceding table for $A_{øB}$ + Relevant Current Errors from preceding table for $A_{øC}$ + 0.0015% of ($A_{øA}$ + $A_{øB}$ + $A_{øC}$)*F				
Harmonic or Spectrum Error		All	AC Current Errors from preceding table at A and F of the harmonic or spectrum point + (H/N)²*0.3% of reading + (if not fundamental) from below using the frequency of the harmonic or spectrum point				
	<10kHz	A or L	0.006% of A_{AC+DC}				
	10k-115kHz	A or L	0.05% of A_{AC+DC}				
	<10kHz	S	0.01% of A_{AC+DC}				
	10k-115kHz	S	0.05% of A_{AC+DC}				
	<10kHz	W	0.015% of A_{AC+DC}				
	10k-115kHz	W	0.03% of A_{AC+DC}				
	115k-435kHz	W	0.08% of A_{AC+DC}				
Current-Voltage Fundamental Phase Error		S, A or L	0.005° + 0.015°*F				
		W	0.005° + 0.007°*F				
Harmonic-Fundamental Phase Error (typical, BANDWIDTH configured as UNFILTERED)		S, A or L	0.02°+0.1°*F+0.001°*H				
		W	0.02°+0.03°*F+0.001°*H				
%THD Error Errors shown are all expressed in %THD units.		All	(0.005+0.000025*N)*%THD+0.00005*N*√N + from below using the frequency of highest included harmonic				
	<10kHz	A or L	0.015+0.2/A_{AC}	0.015+0.15/A_{AC}	0.015+0.001/A_{AC}	0.015+0.025/A_{AC}	0.015+0.0006/A_{AC}
	10k-115kHz	A or L	0.15+2/A_{AC}	0.15+1.5/A_{AC}	0.15+0.01/A_{AC}	0.15+0.25/A_{AC}	0.15+0.006/A_{AC}
	<10kHz	S	0.025+0.2/A_{AC}	0.025+0.15/A_{AC}	0.025+0.001/A_{AC}	0.025+0.025/A_{AC}	0.025+0.0006/A_{AC}
	10k-115kHz	S	0.15+2/A_{AC}	0.15+1.5/A_{AC}	0.15+0.01/A_{AC}	0.15+0.25/A_{AC}	0.15+0.006/A_{AC}
	<10kHz	W	0.03+0.25/A_{AC}	0.03+0.18/A_{AC}	0.03+0.0012/A_{AC}	0.03+0.03/A_{AC}	0.03+0.001/A_{AC}
	10k-115kHz	W	0.06+2.5/A_{AC}	0.06+1.8/A_{AC}	0.06+0.012/A_{AC}	0.06+0.3/A_{AC}	0.06+0.01/A_{AC}
	115k-435kHz	W	0.15+2.5/A_{AC}	0.15+1.8/A_{AC}	0.15+0.012/A_{AC}	0.15+0.3/A_{AC}	0.15+0.01/A_{AC}

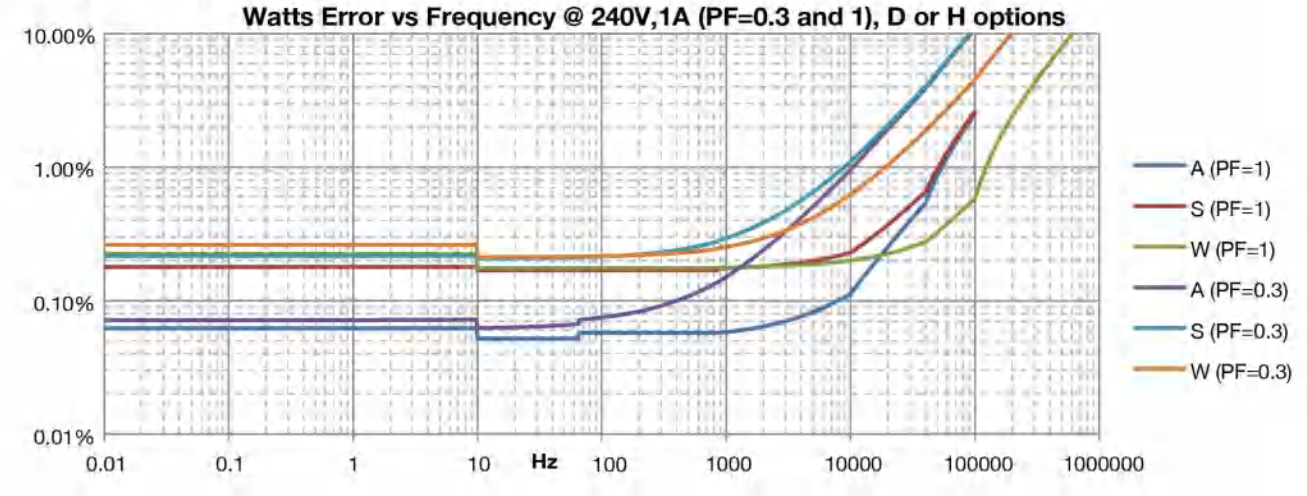
2.4 WATTS, VAR AND VA MEASUREMENT SPECIFICATIONS

The charts below show guaranteed maximum Watts errors for DC, MAINS, AVIONICS, and 50kHz from 100µW up to the highest available using a D option current measurement (H and X option current accuracies are similar within their respective range of currents and are not shown for clarity), expressed as % of Watts reading and are valid within ±5C of the calibration temperature (add 0.005% per C beyond this) and where no significant common-mode is present. Following the charts is a table which can be used to calculate the guaranteed accuracies for applications other than shown in the charts and also for the computation of




Watts Error vs Watts at 115V and 240V MAINS or AVIONICS (PF=1)
10.00%
1.00%
0.10%
0.01%
SD and WD plots are indistinguishable
Add 0.005% to AD plots for AVIONICS
0.0001
0.001
0.01
0.1
Watts
1
10
100
1000
AD @ 240V
SD @ 240V
WD @ 240V
AD @ 115V
SD @ 115V
WD @ 115V


Watts Error vs Watts at 115V and 240V 50kHz (PF=1)
10.00%
1.00%
0.10%
0.01%
0.0001
0.001
0.01
0.1
Watts
1
10
100
1000
AD @ 240V
SD @ 240V
WD @ 240V
AD @ 115V
SD @ 115V
WD @ 115V


Watts Error vs Frequency @ 240V,1A (PF=0.3 and 1), D or H options
10.00%
1.00%
0.10%
0.01%
0.01
0.1
1
10
Hz
100
1000
10000
100000
1000000
A (PF=1)
S (PF=1)
W (PF=1)
A (PF=0.3)
S (PF=0.3)
W (PF=0.3)

2.4.1 WATTS, VAR AND VA MEASUREMENT SPECIFICATIONS

2.4.1.1 PRIMARY WATTS, VAR AND VA MEASUREMENT ACCURACY TABLE

Add relevant errors from the table below for the maximum error in all Watts, VA and VAR measurements except harmonic Watts.

Note that by definition DC Watts and DC VA are identical, and DC VAR is zero

MAXIMUM SCALING ERRORS

Apply to all results as shown below as a percentage of the reading

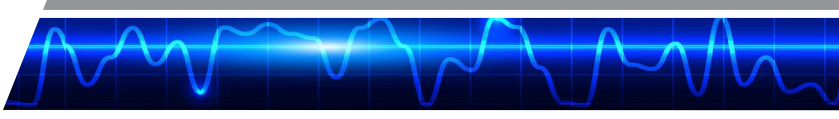
If signal contains significant levels at multiple frequencies, apply to each level &

Specification		Channel Type	Option H	Option D HI Range	Option D LO Range	Option X HI Range	Option X LO Range
Base Scaling Error Apply to all results		A or L	0.045%				
		S or W	0.15% (0.3% if 2ms LF/PERIOD)				
Frequency Dependent Scaling Error Apply to AC component of all results other than DC or MAINS	LF or VLF	S, A or L	0.01%				
		W	0.05%				
	AVIONICS	A or L	0.005%				
		S or W	None				
	<10kHz	S, A or L	F*0.006%				
		W	F*0.0025%				
	10k-40kHz	S, A or L	0.06%+(F-10)*0.014%				
		W	F*0.0025%				
	40k-100kHz	S, A or L	0.48%+(F-40)*0.032%				
		W	0.1%+(F-40)*0.005%			0.1%+(F-40)*0.0055%	
	100k-1MHz	S, A or L	Typically $(F/1100)^2$*150%				
		W	0.4%+(F-100)*0.018%			0.43%+(F-100)*0.02%	
	>1MHz	W	Typically $(F/5000)^2$*150%			Typically $(F/3000)^2$*150%	
Self-Heating Scaling Error Apply as % of Power reading to all results using voltage and current Self-Heating Errors from previous tables		All	Add Voltage and Current Self-Heating Errors				
Temperature Scaling Error Apply to all results if outside of ±5C from calibration temperature		All	0.005% per C outside of ±5C from calibration temperature				
Bandwidth Limit Scaling Error Apply to AC component of all results if using USER bandwidth setting		All	20%*$(F/F_{BW})^2$, unspecified above 0.3*F_{BW}				

MAXIMUM FLOOR ERRORS

Apply to all results as shown below in Watts, VA or VAR as applicable (generally only significant at low input

Specification	Channel Type	Option H	Option D HI Range	Option D LO Range	Option X HI Range	Option X LO Range
Base Floor Error Apply to all results	L	(V_{AC+DC}*56µA) + (A_{AC+DC}*45µV)	(V_{AC+DC}*38µA) + (A_{AC+DC}*45µV)	(V_{AC+DC}*250nA) + (A_{AC+DC}*45µV)	(V_{AC+DC}*6µA) + (A_{AC+DC}*45µV)	(V_{AC+DC}*0.15µA) + (A_{AC+DC}*45µV)
	A	(V_{AC+DC}*56µA) + (A_{AC+DC}*450µV)	(V_{AC+DC}*38µA) + (A_{AC+DC}*450µV)	(V_{AC+DC}*250nA) + (A_{AC+DC}*450µV)	(V_{AC+DC}*6µA) + (A_{AC+DC}*450µV)	(V_{AC+DC}*0.15µA) + (A_{AC+DC}*450µV)
	S or W	(V_{AC+DC}*225µA) + (A_{AC+DC}*1.8mV)	(V_{AC+DC}*150µA) + (A_{AC+DC}*1.8mV)	(V_{AC+DC}*1µA) + (A_{AC+DC}*1.8mV)	(V_{AC+DC}*23µA) + (A_{AC+DC}*1.8mV)	(V_{AC+DC}*0.6µA) + (A_{AC+DC}*1.8mV)
DC Floor Error Apply to DC and AC+DC results using the Voltage and Current DC Floor Errors from previous tables	All	(V_{DC}*Current DC Floor Error) + (A_{DC}*Voltage DC Floor Error) + (Current DC Floor Error*Voltage DC Floor Error)				
AC Floor Error (VA and VAR only) Apply to AC and AC+DC VA & VAR results using voltage and current AC Floor Errors from previous tables	All	(V_{AC}*Current AC Floor Error) + (A_{AC}*Voltage AC Floor Error)				
Common Mode Error (VA and VAR only) Apply to AC component of VA and VAR results using the Voltage and Current Common Mode Errors from previous tables.	All	(V_{AC}*Current Common Mode Error) + (A_{AC}*Voltage Common Mode Error)				
Common Mode Error (Watts only) Apply to AC component of Watts results using the Voltage Common Mode Error from previous table	All	(A_{AC}*Voltage Common Mode Error)				
Adjacent Channel Error Apply to AC component of all results using the Voltage and Current Adjacent Channel Errors from previous tables	All	(V_{AC}*Current Adjacent Channel Error) + (A_{AC}*Voltage Adjacent Channel Error)				
Phase Floor Error (Watts only) Apply to AC and AC+DC Watts results	S, A or L	VA_{FUND}*(PF_{FUND} - cos($\cos^{-1}(PF_{FUND})$ + 0.015°*F)) Alternately, as a worst case (at PF=0) this can expressed as F*0.028% of VA				
	W	VA_{FUND}*(PF_{FUND} - cos($\cos^{-1}(PF_{FUND})$ + 0.007°*F)) Alternately, as a worst case (at PF=0) this can expressed as F*0.013% of VA				



2.4.1.2 HARMONIC WATTS MEASUREMENT ACCURACY TABLE

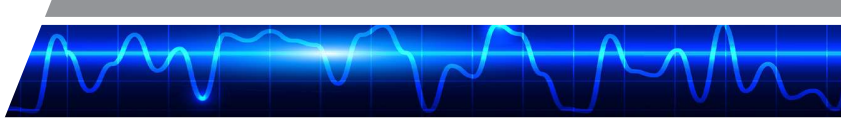
Specification		Channel Type	Option H	Option D HI Range	Option D LO Range	Option X HI Range	Option X LO Range
		All	AC Watts Errors other than Phase Floor Error from preceding table at levels and F of the harmonic or spectrum point + (H/N)²*0.5% of reading + from below using the frequency of the harmonic or spectrum point				
Harmonic or Spectrum Watts Error	<10kHz	A or L	0.006% + (0.004%+0.028%*F)/PF				
	10k-115kHz		0.05% + (0.004%+0.028%*F)/PF				
	<10kHz	S	0.01% + (0.004%+0.028%*F)/PF				
	10k-115kHz		0.05% + (0.004%+0.028%*F)/PF				
	<10kHz	W	0.015% + (0.004%+0.013%*F)/PF				
	10k-115kHz		0.03% + (0.004%+0.013%*F)/PF				
	115k-435kHz		0.08% + (0.004%+0.013%*F)/PF				

2.5.1 PF MEASUREMENT ACCURACY TABLE

Add relevant errors from the table below for the maximum error in PF measurements. For PF_{FUND} apply only the Base Floor and Phase Errors.

Note: DC PF is 1.0 by definition and has no error; the table below applies to AC, AC+DC and FUND PF results.

Specification	Channel Type	Option H	Option D HI Range	Option D LO Range	Option X HI Range	Option X LO Range
Base Floor Error Apply to all PF results	L	$(56\mu A/A_{AC+DC}) + (45\mu V/V_{AC+DC})$	$(38\mu A/A_{AC+DC}) + (45\mu V/V_{AC+DC})$	$(250nA/A_{AC+DC}) + (45\mu V/V_{AC+DC})$	$(6\mu A/A_{AC+DC}) + (45\mu V/V_{AC+DC})$	$(0.15\mu A/A_{AC+DC}) + (45\mu V/V_{AC+DC})$
	A	$(56\mu A/A_{AC+DC}) + (450\mu V/V_{AC+DC})$	$(38\mu A/A_{AC+DC}) + (450\mu V/V_{AC+DC})$	$(250nA/A_{AC+DC}) + (450\mu V/V_{AC+DC})$	$(6\mu A/A_{AC+DC}) + (450\mu V/V_{AC+DC})$	$(0.15\mu A/A_{AC+DC}) + (450\mu V/V_{AC+DC})$
	S or W	$(225\mu A/A_{AC+DC}) + (1.8mV/V_{AC+DC})$	$(150\mu A/A_{AC+DC}) + (1.8mV/V_{AC+DC})$	$(1\mu A/A_{AC+DC}) + (1.8mV/V_{AC+DC})$	$(23\mu A/A_{AC+DC}) + (1.8mV/V_{AC+DC})$	$(0.6\mu A/A_{AC+DC}) + (1.8mV/V_{AC+DC})$
AC Floor Error Apply to all PF results using voltage and current AC Floor Error from previous tables, this error always causes a reduced PF reading	All	$-PF_{RDG}*((\text{Current AC Floor Error}/A_{RDG}) + (\text{Voltage AC Floor Error}/V_{RDG}))$				
DC Floor Error Apply to AC+DC PF result after multiplying by (1-PF)	L	$(0.23mA/A_{AC+DC}) + (0.1mV/V_{AC+DC})$	$(0.15mA/A_{AC+DC}) + (0.1mV/V_{AC+DC})$	$(1\mu A/A_{AC+DC}) + (0.1mV/V_{AC+DC})$	$(40\mu A/A_{AC+DC}) + (0.1mV/V_{AC+DC})$	$(5\mu A/A_{AC+DC}) + (0.1mV/V_{AC+DC})$
	A	$(0.23mA/A_{AC+DC}) + (1mV/V_{AC+DC})$	$(0.15mA/A_{AC+DC}) + (1mV/V_{AC+DC})$	$(1\mu A/A_{AC+DC}) + (1mV/V_{AC+DC})$	$(40\mu A/A_{AC+DC}) + (1mV/V_{AC+DC})$	$(5\mu A/A_{AC+DC}) + (1mV/V_{AC+DC})$
	S	$(0.45mA/A_{AC+DC}) + (3mV/V_{AC+DC})$	$(0.3mA/A_{AC+DC}) + (3mV/V_{AC+DC})$	$(2\mu A/A_{AC+DC}) + (3mV/V_{AC+DC})$	$(80\mu A/A_{AC+DC}) + (3mV/V_{AC+DC})$	$(6\mu A/A_{AC+DC}) + (3mV/V_{AC+DC})$
	W	$(0.68mA/A_{AC+DC}) + (5mV/V_{AC+DC})$	$(0.45mA/A_{AC+DC}) + (5mV/V_{AC+DC})$	$(3\mu A/A_{AC+DC}) + (5mV/V_{AC+DC})$	$(120\mu A/A_{AC+DC}) + (5mV/V_{AC+DC})$	$(8\mu A/A_{AC+DC}) + (5mV/V_{AC+DC})$
Phase Error Apply to all PF results	S, A or L	$(PF_{FUND} - \cos(\cos^{-1}(PF_{FUND}) \pm 0.015°*F))$ Alternately, as a worst case (at PF=0) this can expressed as F*0.00028				
	W	$(PF_{FUND} - \cos(\cos^{-1}(PF_{FUND}) \pm 0.007°*F))$ Alternately, as a worst case (at PF=0) this can expressed as F*0.00013				



2.6 FREQUENCY MEASUREMENT SPECIFICATIONS

Frequency Range	FUND setting of MAINS: 45Hz to 65Hz FUND setting of AVIONICS: 300Hz to 900Hz Otherwise- LF/PERIOD setting of VLF: 0.0099Hz to 65Hz LF/PERIOD setting of LF: 0.19Hz to 1kHz LF/PERIOD setting of 300ms period: 9Hz to 305kHz (W channel type) or 80kHz (other channel types) LF/PERIOD setting of 100ms period: 19Hz to 305kHz (W channel type) or 80kHz (other channel types) LF/PERIOD setting of 20ms period: 44Hz to 305kHz (W channel type) or 80kHz (other channel types) LF/PERIOD setting of 10ms period: 145Hz to 305kHz (W channel type) or 80kHz (other channel types) LF/PERIOD setting of 2ms period: 495Hz to 305kHz (W channel type) or 80kHz (other channel types) If BANDWIDTH set to USER setting then upper limit is 0.5*setting
DC Level	DC offset is automatically eliminated
Min. Input (typical)	Voltage: 0.5Vrms (W, S or A channel type) or 75mVrms (L channel type) at fundamental Current, H option: 0.05Arms at fundamental Current, D option: 0.04Arms (HI range) or 0.3mArms (LO range) at fundamental Current, X option: 5mVrms (HI range) or 150µVrms (LO range) at fundamental
Min. Pulse Width (typical)	Greater of - 1.25µs (W channel type) or 5µs (other channel types) 0.001% of measurement period 10% of signal period
Update Period (nominal)	As shown below for FREQ SPEED settings of FAST/NORMAL/SLOW respectively - LF/PERIOD setting of VLF: greater of 1/2/15s or 1 cycle LF/ PERIOD setting of LF: greater of 1/1/5s or 1 cycle LF/ PERIOD setting of 300ms period: 0.25s/0.75s/2s LF/PERIOD setting of 100ms period: 55ms/250ms/1s LF/PERIOD setting of 20ms period: 25ms/200ms/700ms LF/PERIOD setting of 10ms period: 10ms/100ms/300ms LF/PERIOD setting of 2ms period: 2ms/50ms/150ms
Resolution	W Channel Type: 0.000125%/Update Period in seconds Otherwise: 0.0005%/Update Period in seconds
(nominal) Maximum	0.01% + Resolution
Settling Time (nominal) Error	Greater of (x2 if significant DC content) - a) 2 amplitude periods b) 2 frequency measurement periods c) 4 cycles of the signal

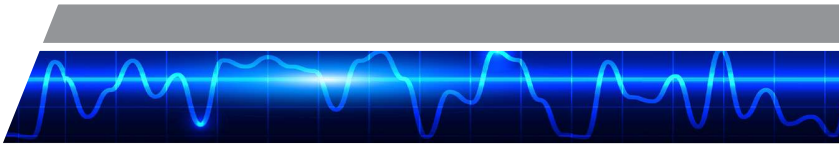
3 MECHANICAL CHANNEL INPUT AND ACCURACY SPECIFICATIONS (MT TYPE)

3.1 INPUT CAPABILITIES AND CHARACTERISTICS

Input Terminals	SPD (Speed) : BNC (isolated from XT2640 chassis), configurable as analog or digital input TRQ (Torque) : BNC (isolated from XT2640 chassis), configurable as analog or digital input DIR (Direction) : BNC (isolated from XT2640 chassis), digital input
Input Common-Mode	Up to -15Vpk to +15Vpk specified Up to -30Vpk to +30Vpk with no damage
Analog Input Range	Up to -12Vdc to +12Vdc specified Up to -15Vpk to +15Vpk specified Up to -30Vpk to +30Vpk with no damage
Digital Input Range	LO: <0.8V (nominal) HI: >2V (nominal) Up to -30Vpk to +30Vpk with no damage
Input Impedance	Each input nominally 150kΩ to XT2640 chassis ground

3.2 DIGITAL INPUT MEASUREMENT SPECIFICATIONS

Digital Frequency Timing	Signal must be LO for >500ns Signal must be HI for >500ns Frequency measurement up to 500kHz (typically 900kHz) Minimum measurable frequency limited by user set measurement period
DIR Setup/Hold Timing	DIR must be stable for >550ns prior to and after active edge of SPD input
Maximum Frequency Error	Measurement Period >10ms: 0.01% Measurement Period ≤10ms: 0.015%



3.3 ANALOG INPUT MEASUREMENT SPECIFICATIONS

Maximum Input Error	0.05% + 1mV Add (0.005% + 50µV) per C outside of ±5C from calibration temperature

4 ANALYSIS SPECIFICATIONS

4.1 INTEGRATION SPECIFICATIONS

Start Delay Time	Zero to 99 days, 99 hours, 99 minutes, 99 seconds (1 second resolution) 0.01% + 8ms maximum error
Integration Time	Manual (unrestricted period of time), or 1 second to 99 days, 99 hours, 99 minutes, 99 seconds 0.01% + 1ms maximum error
Maximum Data	(0.01% + 1ms) (not for integrated average data) + (0.03/measurement period in seconds)% per year error

4.2 HARMONIC ANALYSIS SPECIFICATIONS

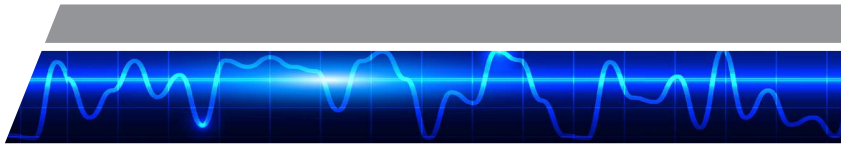
Method	DFT performed at each frequency on same set of sampled signals (there is no discontinuity throughout the analysed frequency range)
Window Maximum	F > (2/measurement period): Hann (also called Hanning) Otherwise: Rectangular
Harmonic	The smaller of - a) A frequency of 435kHz (W type channels) or 115kHz (otherwise) b) 500th (harmonics over the 100th requires option H500) c) HARMONICS setting d) If BANDWIDTH set to USER: 0.5*setting/fundamental frequency
Harmonic Bandwidth	Nominally the greater of- a) The smaller of fundamental frequency or 2/(LF/PERIOD measurement period) b) If FUND set to AVIONICS: 20Hz c) (Fundamental Frequency*Maximum Harmonic/2250)
Measurement	Nominally (1/Harmonic Bandwidth)
Period Update Interval	Nominally the greater of - a) LF/PERIOD measurement period b) Harmonic Measurement Period (from above) c) 0.25ms x Σ(Maximum Harmonic for each channel configured for harmonics)
Data Available	Volts, Amps and Watts amplitudes for each configured harmonic Volts and Amps as a percentage of the fundamental of the same signal Volts and Amps THD as a percentage of the fundamental of the same signal Volts and Amps THD as a percentage of the AC+DC amplitude of the same signal V and A Phase of fundamental relative to the voltage fundamental of the lowest numbered channel in the VPA V and A Phase of each non-fundamental harmonic relative to the fundamental of the same signal
Accuracy	See relevant Voltage, Current and Watts accuracy specifications

4.3 SPECTRUM ANALYSIS SPECIFICATIONS

Method	DFT performed at each frequency on same set of sampled signals (there is no discontinuity throughout the analysed frequency range)
Window	Hann (also called Hanning)
Frequency Resolution	0.01Hz to 1kHz Nominally (1/ Frequency Resolution)
Measurement Period	Minimum is 100 x Frequency Resolution
Maximum Frequency	Maximum is the lowest of nominally - a) 16384 x Frequency Resolution (under some circumstances as low as 8192 x Frequency Resolution) b) 435kHz (W type channels) or 115kHz (otherwise)
Data Available	Volts, Amps and Watts amplitudes for each configured spectrum
Accuracy	frequency See relevant Voltage, Current and Watts accuracy specifications

4.4 CYCLE VIEW SPECIFICATIONS

Signal Range	As specifications for Voltage and Current



Cycle Period Time	From 2.3us (W type channels), 8.7us (otherwise) up to 100 seconds
Resolution Method	1/512th of a cycle
Maximum Error	Mean cycle formed by asynchronously sampling all cycles within measurement period As Voltage and Current Specifications for PK data (Watts = multiplication of V and A waveforms)

4.5 SCOPE SPECIFICATIONS

Signal Range	As specifications for Voltage and Current
Timebase	1/2/5 settings from 5us/div to 20s/div
Capture Depth	Up to 32k points per signal
Capture Resolution	<0.00005% of specified maximum measurable peak Voltage or Current
Sampling Period (nominal)	Greater of - 1.1µs (W type channels) or 4.1µs (otherwise) 0.03% of timebase setting
Maximum Error	As Voltage and Current Specifications for PK data (Watts = multiplication of V and A waveforms)

4.6 HISTORICAL DATA COLLECTION SPECIFICATIONS

Collection Time	Automatically continuously variable between 1 measurement period and 584.5 million years (collection is automatically stopped after this time has elapsed but this is untested at the time of writing)
Time Resolution	Note: this is the resolution by which you can determine when an event occurred, not that of the XT2640 detecting events. All events are captured. The greater of- a) 1 pixel of displayed data (front panel) or 1 increment of the requested time interval (interface) b) 1 measurement period of the data being recorded c) A maximum of 1/4096th of the elapsed historical data collection time (typically 1/8192th).
Data Capture	Every measurement is included in the maximum, average and minimum data for each increment of the time resolution interval regardless of the time resolution.

4.7 DATA LOGGING SPECIFICATIONS

Logged Measurements	Up to 16 measurement data per record (each of which can be 1 measurement or up to 500 harmonic measurements)
Data per Record	Up to 8003 data per record
Internal FIFO	32Mbyte (always in binary format, 4 bytes per data)
Buffer Internal Memory	≥2Gbyte (always in binary format, 4 bytes per data) non-volatile Typically 5Mbytes/sec maximum sustained mean write rate
External Data File Format	ASCII (CSV, scientific format) or Binary
Timestamp	Record number + optional date and time (1 second resolution)
Maximum File Size	4Gbyte
Maximum Records	Only limited by maximum file size
Start Delay Time	Zero to 99 days, 99 hours, 99 minutes, 99 seconds (1 second resolution) 0.01% + 8ms maximum error
Run Time	Manual (unrestricted period of time), or 1 second to 99 days, 99 hours, 99 minutes, 99 seconds (1 second resolution) 0.01% + 8ms maximum error
Log Interval	0.002 second, or 0.01 second to 99 hours, 99 minutes, 99.99 seconds (0.01 second resolution) 0.01% maximum error ± 2ms non-accumulating error