

1600XA Series

Distributed By:
B. J. Wolfe Enterprises
 (800) 554-1224
 Fax (818) 889-8417



- -55°C to +85°C Operation
- Meets MIL-STD-810 & MIL-STD-202
- 10.6W/In³ Power Density
- Wide 2:1 Input Voltage Range
- Efficiency to 82%
- >200,000 Hours MTBF (Ground Fixed)

General Description

The **1600XA** series is a family of ruggedized, high performance 16 watt single, dual and triple output DC/DC converters that are specifically designed to withstand the temperature extremes, shock & vibration and line noise found in demanding industrial applications. All models are designed to meet the latest UL, CSA, and VDE safety standards.

Operating from wide (2:1) input voltage ranges of 9 to 18, 18 to 36 or 36 to 72 VDC; twenty four models provide output combinations of 5, 12, 15, ± 5 , ± 12 , ± 15 , 5 ± 12 and 5 ± 15 VDC. Standard features include 1400 VDC input/output isolation, low output ripple & noise, continuous short circuit protection and output over voltage protection (all outputs). Efficiency is as high as 82%. A remote ON/OFF control input and internal input filter are standard on all units.

Long field life is insured by extensive reliability screening at CDI. As part of the normal production processing, each unit is subjected to burn-in during which the input power is cycled on/off and the output load is switched from 0% to 100%. Per MIL HDBK 217F, the MTBF is greater than 700,00 hours at +25 °C (ground benign).

Each model complies with the shock, vibration, acceleration, altitude and humidity requirements of MIL-STD-810E. All modules also meet the requirements of MIL-STD-202E.

Each **1600XA** module is packaged in a compact 2.0 x 2.0 x 0.375 inch metal case, yielding a power density as high as 10.6W/In³. Six sided continuous shielding virtually eliminates radiated emissions. Full operation is specified over the wide temperature range of -55°C to +85°C.

Model Selection Guide

Model Number	Input				Output			Efficiency @FL (%)	Case
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA)	Over Voltage (VDC)		
	Nominal	Range	No-Load	Full-Load					
1605S12XA	12	9 - 18	45	1667	5.0	3200	6.8	80	A, A1
1612S12XA	12	9 - 18	45	1640	12.0	1300	15.0	81	A, A1
1615S12XA	12	9 - 18	45	1650	15.0	1060	18.0	81	A, A1
1605D12XA	12	9 - 18	40	1667	±5.0	±1600	±6.8	80	A, A1
1612D12XA	12	9 - 18	45	1640	±12.0	±665	±15.0	81	A, A1
1615D12XA	12	9 - 18	45	1650	±15.0	±535	±18.0	81	A, A1
1605S24XA	24	18 - 36	34	833	5.0	3200	6.8	80	A, A1
1612S24XA	24	18 - 36	34	810	12.0	1300	15.0	82	A, A1
1615S24XA	24	18 - 36	34	815	15.0	1060	18.0	82	A, A1
1605D24XA	24	18 - 36	34	833	±5.0	±1600	±6.8	80	A, A1
1612D24XA	24	18 - 36	34	810	±12.0	±665	±15.0	82	A, A1
1615D24XA	24	18 - 36	34	815	±15.0	±535	±18.0	82	A, A1
1605S48XA	48	36 - 72	32	411	5.0	3200	6.8	81	A, A1
1612S48XA	48	36 - 72	32	405	12.0	1300	15.0	82	A, A1
1615S48XA	48	36 - 72	32	408	15.0	1060	18.0	82	A, A1
1605D48XA	48	36 - 72	32	411	±5.0	±1600	±6.8	81	A, A1
1612D48XA	48	36 - 72	32	405	±12.0	±665	±15.0	82	A, A1
1615D48XA	48	36 - 72	32	408	±15.0	±535	±18.0	82	A, A1
1605/12T12XA	12	9 - 18	50	1667	5/±12	2000/±250	6.8/±15	75	A, A1
1605/15T12XA	12	9 - 18	50	1667	5/±12	2000/±200	6.8/±15	79	A, A1
1605/12T24XA	24	18 - 36	45	832	5/±12	2000/±250	6.8/±15	81	A, A1
1605/15T24XA	24	18 - 36	45	832	5/±15	2000/±200	6.8/±18	75	A, A1
1605/12T48XA	48	36 - 72	35	406	5/±15	2000/±250	6.8/±18	79	A, A1
1605/15T48XA	48	36 - 72	35	401	5/±15	2000/±200	6.8/±18	81	A, A1

**MINIATURE, WIDE INPUT RANGE
RUGGEDIZED, INDUSTRIAL GRADE
16W DC/DC CONVERTERS**

Distributed By:
B. J. Wolfe Enterprises
(800) 554-1224
Fax (818) 889-8417

1600XA Series

Electrical Specifications

Input Specifications:

Input Voltage Range ⁽¹⁾	See Model Selection Guide
Input Filter	Ω (Pi) Network
Reverse Polarity Input Current	12A, Max.
Input Surge Current	20A at 10 Sec.
Short Circuit Current Limit	150% of I_{in}
Under Voltage Shutdown	8 VDC
Remote On/Off Control	
Supply On	5.5 VDC or Open Circuit
Supply Off	0 VDC to 0.8 VDC
Logic Input Reference	Negative (-) Input
Logic Compatibility	TTL Open Collector or CMOS Open Drain
Converter Standby Current	32 mA

Output Specifications:

Voltage and Current Ratings ⁽²⁾	See Model Selection Guide
Output Voltage Accuracy:	
Single/Dual Outputs	$\pm 1\%$, Max.
Triple Outputs; Primary	$\pm 1\%$, Adj to Zero
Auxiliaries	$\pm 5\%$, Max.
Voltage Adjustment ⁽³⁾	$\pm 5\%$, Max.
Voltage Balance ⁽⁴⁾ :	
Dual Outputs	$\pm 1\%$, Max.
Triple Outputs (Auxiliaries)	$\pm 1\%$, Max.
Ripple & Noise ⁽⁵⁾	1% Pk-Pk of V_{out}
Minimum Load	10% of Full Load
Line Regulation ⁽⁶⁾ :	
3.3 VDC Outputs	$\pm 0.3\%$, Max.
Single/Dual Outputs	$\pm 0.5\%$, Max.
Triple Outputs; Primary	$\pm 0.2\%$, Max.
Auxiliaries	$\pm 0.0\%$, Max.
Load Regulation ⁽⁷⁾ :	
Single Outputs	$\pm 0.2\%$, Max.
Dual Outputs	$\pm 1.0\%$, Max.
Triple Outputs; Primary	$\pm 0.5\%$, Max.
Auxiliaries	$\pm 5.0\%$, Max.
Temperature Coefficient @ FL	$\pm 0.01\%/^{\circ}\text{C}$
Transient Recovery Time ⁽⁸⁾	200 μs
Short Circuit Protection ⁽⁹⁾	All outputs by Input current limiting
Over Voltage Protection	See Model Selection Guide

General Specifications:

Efficiency ⁽¹⁰⁾	See Model Selection Guide
Isolation Voltage (1 min.)	1400 VDC, Min. Meets requirements of MIL-STD- 202F, method 301

Isolation Resistance	$>10^9 \Omega$, Meets requirements of MIL-STD-202F, method 302, test condition B.
Isolation Capacitance	140 pF
Acceleration	Per MIL-STD-810E, method 513.4, procedure II. Opera- tional test (centrifuge) 12g's (manned aerospace vehicles)
Shock	Per MIL-STD-810E, method 516.4, procedure I. Functional shock 40g's.
Vibration	Per MIL-STD-810E, method 514.4, procedure I, category 6 (equipment installed in helicopters).
Altitude	Per MIL-STD-810E, method 500.3, procedure III Rapid decompression, 40,000 ft. 100 kHz, Min.
Switching Frequency	

Environmental Specifications:

Operating Temperature	-55°C to $+85^{\circ}\text{C}$ (Ambient)
Max. Case Temperature	$+100^{\circ}\text{C}$
Storage Temperature Range	-55°C to $+125^{\circ}\text{C}$
Derating	See Derating Curves
Humidity	Per MIL-STD-810E, method 507.3, procedure I. Natural non-hazardous items, cycle 1,240 hours.
Cooling	Free-air Convection
EMI/RFI	Six-sided Metal Case

Physical Characteristics:

Case Size	2.0 x 2.0 x 0.375 inches (51 x 51 x 9.52 mm)
Case Material	Coated Copper
Weight	2.8 Oz (79g)
Shielding	Six-sided, Continuous
Shielding Connection	
12V, 24V Input Models	Pin 3 (- Input)
48V Input Models	Pin 4 (+ Input)

Reliability Specifications:

MTBF; Ground Benign, @ $+25^{\circ}\text{C}$	$>705,000$ Hours
--	------------------

Specifications typical @ $+25^{\circ}\text{C}$ with nominal input voltage and under full output load conditions, unless otherwise noted. Specifications subject to change without notice.

Specification Notes:

- Contact the factory for information on other input/output combinations.
- Total output power should not exceed the specified output ratings for any particular model. Please contact factory for 3.3 V_{out} versions.
- To trim the output voltage DOWN, connect a 5%, $\frac{1}{4}$ W resistor (R_{T1}) between the plus (+) output and trim pins of the converter. To trim the output voltage UP, connect a 5%, $\frac{1}{4}$ W resistor (R_{T2}) between the minus (-) output and trim pins. For UP/DOWN trimming capability, connect a 10k potentiometer between the plus (+) and minus (-) outputs, with the wiper arm connected to the trim pin. The trim resistors or potentiometers can be connected at the converter pins or at the load. If connected at the load, the resistance of the circuit paths becomes part of the feedback loop, improving load regulation. If the load is some distance from the converter, the use of #20 gauge wire is recommended to avoid excessive voltage drop due to the resistance of the circuit paths.
- Voltage balance is measured with balanced loads applied.
- Line regulation is measured by monitoring the output voltage while the input line is varied from low line to high line. Dual outputs and auxiliary outputs on triple output models are loaded equally.
- Load regulation is measured at nominal input voltage while the output load is varied. For single output units the load variation is $\frac{1}{4}$ load to full load. For dual output models, the load variation is no load to full load (with outputs loaded equally). For triple output units the load variation is no load to full load on the primary output and $\frac{1}{4}$ load to full load on auxiliary outputs. Auxiliary outputs are loaded equally.
- Transient response is measured on the primary output for a 50% load change (50% load to full load).
- For further protection, it is recommended that an external, slow-blow line fuse be connected to the converter input lines.
- Efficiency is specified at nominal input line and full load.

For Easy Ordering Use

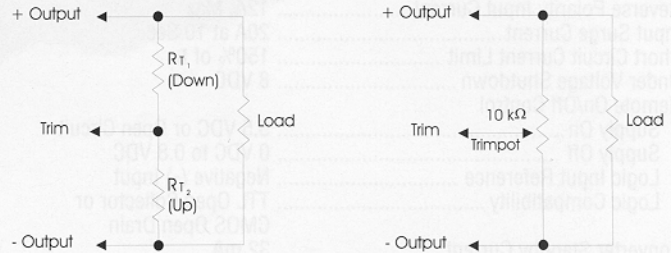
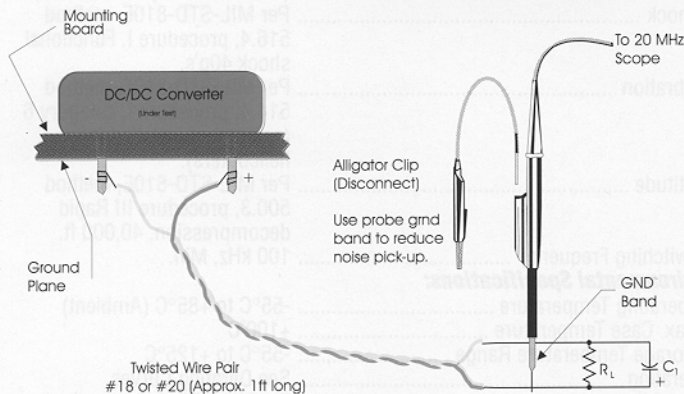


1600XA Series

Distributed By:
B. J. Wolfe Enterprises
(800) 554-1224
Fax (818) 889-8417

Minimizing Common Mode Noise & Reflected Ripple Current

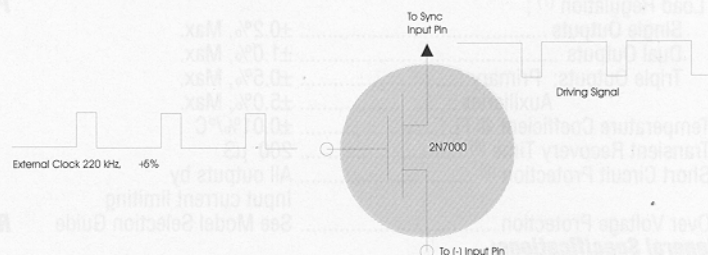
When the converter is driven by a low impedance source, no external filter components are required. However, if the input power to the converter comes through long wires, it is recommended that a low ESR capacitor be placed across the input pins. The use of "twisted pair" wires to connect the input of the converter to the power source will minimize common mode noise and reflected ripple.



External Trimming

External Clock Synchronization.

All models in the 1600XA series can be synchronized to an external clock by driving the sync pin directly with an open collector - open drain (1TTL). The signal frequency must be 220 kHz, $\pm 5\%$ (20% low, 80% high duty cycle).

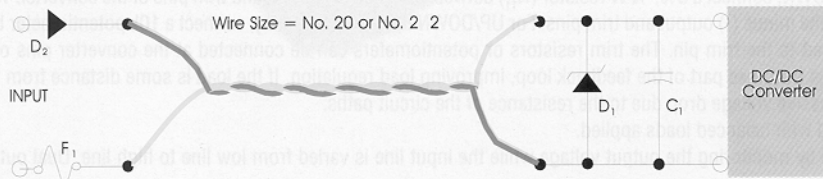


Input Line Protection; Overvoltage and Reverse Voltage

Although the 1600XA series includes internal protection circuits, it's recommended the user connect a IN62XX type diode and a slow-blow fuse as shown below.

Measuring Output Ripple & Noise

True converter output ripple and noise can be measured by attaching a twisted wire pair (about 1 foot in length) with three twists per inch between the converter outputs and an appropriate load. Connect a 33 μ F electrolytic capacitor (C_1) across the load. Using a scope with a minimum bandwidth of 20 MHz and a probe with the ground clip disconnected, measure the ripple at the connection of the load and twisted pair wires. This eliminates the "common mode noise" that interferes with measurements made directly at the converter output pins.



D_1 = IN62XX (or 1.5KExx) Motorola series diode. Diode must be rated so as not to conduct until 110% of V_{in} Max

D_2 = D2 should be a Schottky type diode selected for a minimum forward voltage. Diode must be rated for $I_o = 2I_n$ Min.

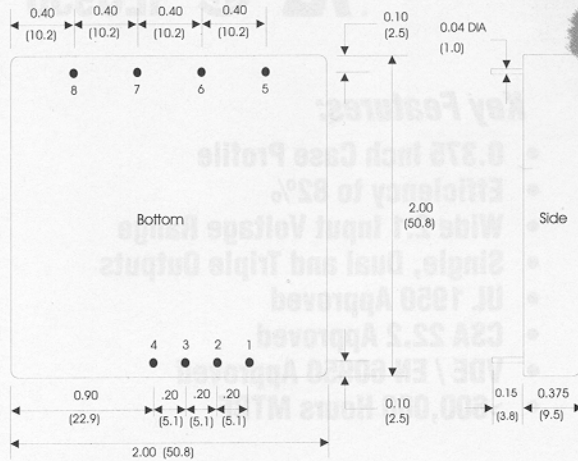
F_1 = Slow Blow Fuse

C_1 = Low ESR Capacitor, 2 μ F to 10 μ F Tantalum Electrolytic or Unifrote SMC 100A or AVX SUPRA

External Clock Synchronization

Input Protection and Connection Using "Twisted Pair" Wires

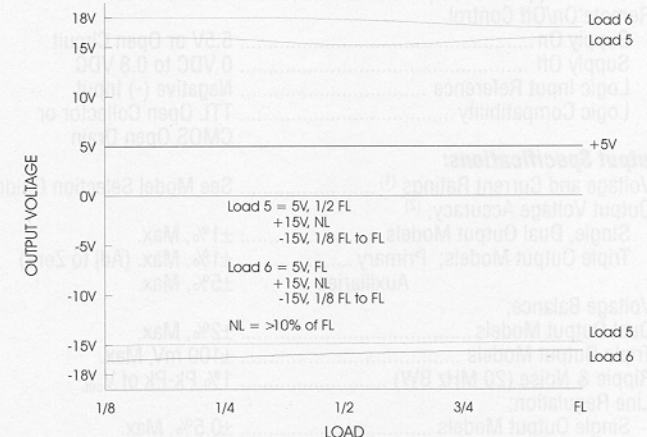
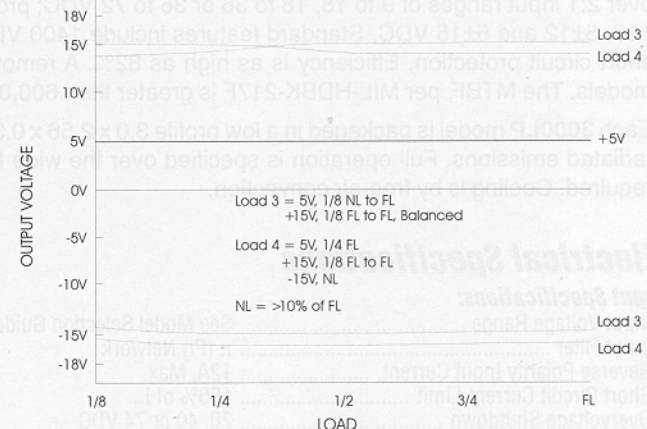
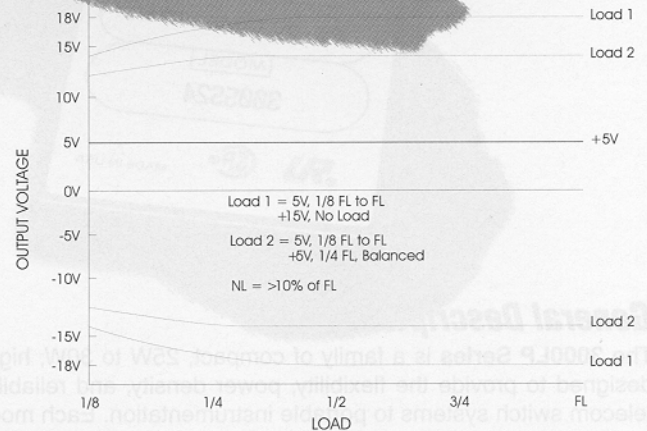
Mechanical Configuration - Case A



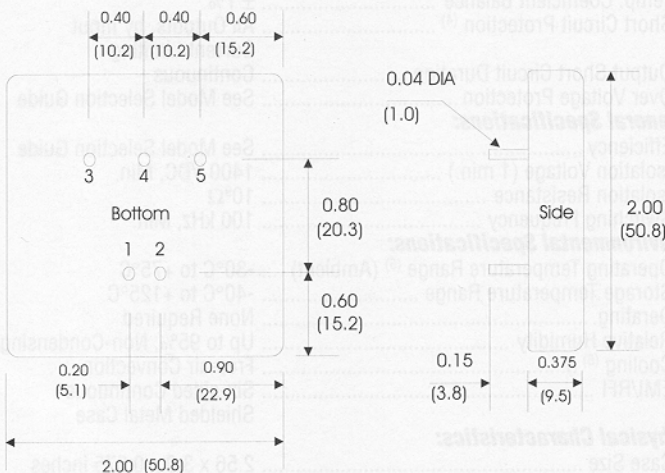
Pin Out - Case A

Pin	Single Output	Dual Output	Triple Output
1	Remote On/Off	Remote On/Off	Remote On/Off
2	Sync	Sync	Sync
3	- Input	- Input	- Input
4	+ Input	+ Input	+ Input
5	Trim	Trim	- Output (AUX)
6	- Output	- Output	Common
7	+ Output	Common	-5V Output
8	No Pin	+ Output	+ Output (AUX)

Triple Output Load Regulation



Mechanical Configuration - Case A1



Pin-Out; Case A1

Pin	Single Output	Dual Output
1	+V Input	+V Input
2	-V Input	-V Input
3	+V Output	+V Output
4	Trim	± Common
5	-V Output	-V Output

Note: All dimensions are typical in inches (mm).
 Tolerance X.XX = ± 0.02, (± 0.5)
 X.XXX = ± 0.010, (± 0.25)

Ordering Information:

- For models that are available in both the "A" or "A1" package, the "A" case is considered a standard. Models with case "A" packaging do not require a suffix on the part number.
- For models that are available in both the "A" or "A1" package, the "A1" case is an alternate. Models with case "A1" packaging must be designated with an "A1" suffix (i.e. **1615D48XA-A1**).