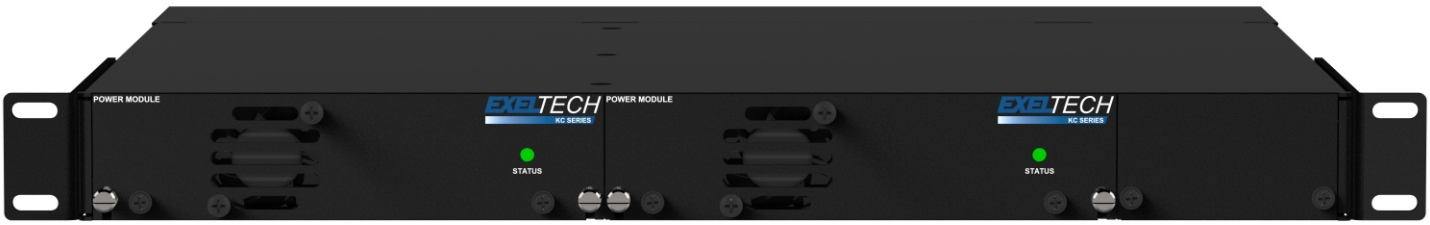
KC SERIES OPERATION AND INSTALLATION MANUAL



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CAUTIONS AND WARNINGS

CAUTION: It is essential to read and understand all Warnings, Cautions, and Notes before any connections are made to the unit or system. If further assistance is needed call (800) 886-4683 and ask for Customer Service.

ATTENTION: Il est essentiel de lire et de comprendre tous les avertissements, précautions et notes avant connexions sont faites à l'unité ou du système. Si une assistance supplémentaire est nécessaire appelez (800)-886-4683 et demandez le service à la clientèle.

WARNING: The inverter is designed to operate from a battery. Performance cannot be guaranteed when a charger or power supply is used without a battery in the circuit. The Inverter might sustain damage with a battery in the circuit.

AVERTISSEMENT: Le variateur est conçu pour fonctionner à partir d'une batterie. Performance ne peut pas être garantie si un chargeur ou d'alimentation est utilisé sans une batterie dans le circuit. L'onduleur peut subir des dommages avec une batterie dans le circuit.

WARNING: Inverter chassis and neutral AC must be connected together with either of the battery connections and bonded to earth ground to comply with most code requirements.

ATTENTION: L'onduleur de châssis et neutre ca doit être connecté avec l'une des deux bornes de la batterie et ensuite connecté à la terre pour se conformer aux exigences du code.

WARNING: Inverter should be installed in Restricted Access Location.

ATTENTION: L'onduleur doit être installé dans un endroit à accès restreint.

WARNING: A means of disconnect shall be provided external to the inverter in the installation process.

AVERTISSEMENT: Un moyen de déconnexion doit être fournie externes à l'onduleur dans le processus d'installation.

CAUTION: Check batteries and battery cables for correct polarity and voltage. The polarity of the leads is critical to avoid damage to the unit or the system.

ATTENTION: Vérifiez les piles et les câbles de batterie pour la polarité et la tension. La polarité de la mène est essentiel pour éviter d'endommager l'appareil ou le système.

CAUTION: Observe all national and local electric codes during installation.

ATTENTION: Respectez tous les codes nationaux et locaux lors de l'installation.

Table of Contents

Introduction
1.0

Thank you for purchasing the finest sine-wave inverter in the power conversion industry. Exeltech's journey to excellence includes the first affordable sine wave inverter, first modular inverter system, first N+1 redundant inverter system, and the cleanest sine wave output in the industry. Exeltech strives to manufacture products of the highest possible quality and is dedicated to 100% customer satisfaction. Proudly built in the USA, Exeltech is committed to TL 9000 standards and beyond, adding people and procedures continually to further improve quality and customer service. We welcome you as a customer to the Exeltech family. Congratulations!

Exeltech's KC series inverter systems are offered in 1U, 2U, and 4U cage sizes and are equipped with 1kW power modules. They are extremely low in Total Distortion; specified to 2%, and typically better than 1.5%. Total Harmonic Distortion is typically 0.8 to 0.9%. Remaining distortion is a result of residual switching noise, which amounts to a very clean 25 kHz sine wave superimposed on the fundamental output. No significant harmonics of 25 kHz exist. This spectral purity will exist over the inverter's entire operating envelope, including non-linear and reactive loads. As long as peak output current remains less than 200% of rated current for a period of 3 seconds, total harmonic distortion will remain within the 2% spec. Peak current capability of the inverter is key to understanding it's operational envelope. As long as the inverter is supplying less than this amount, it will function properly and operate virtually any load.

Many inverters are rated in volt-amperes (VA), as opposed to watts (W). This is an attempt to make an inverter or UPS (Uninterruptible Power Supply) appear larger than it really is. The only fair way to specify these products is in Watts, which is power the inverter can actually deliver. If Exeltech inverters were specified in VA, our 1000 Watt inverter could be rated at 1250 VA @ 0.8 PF, 1410 VA @ 0.7 PF, or an incredible 2000 VA @ 0.5 PF. It is confusing to specify a product in VA, because the power factor must also be specified.

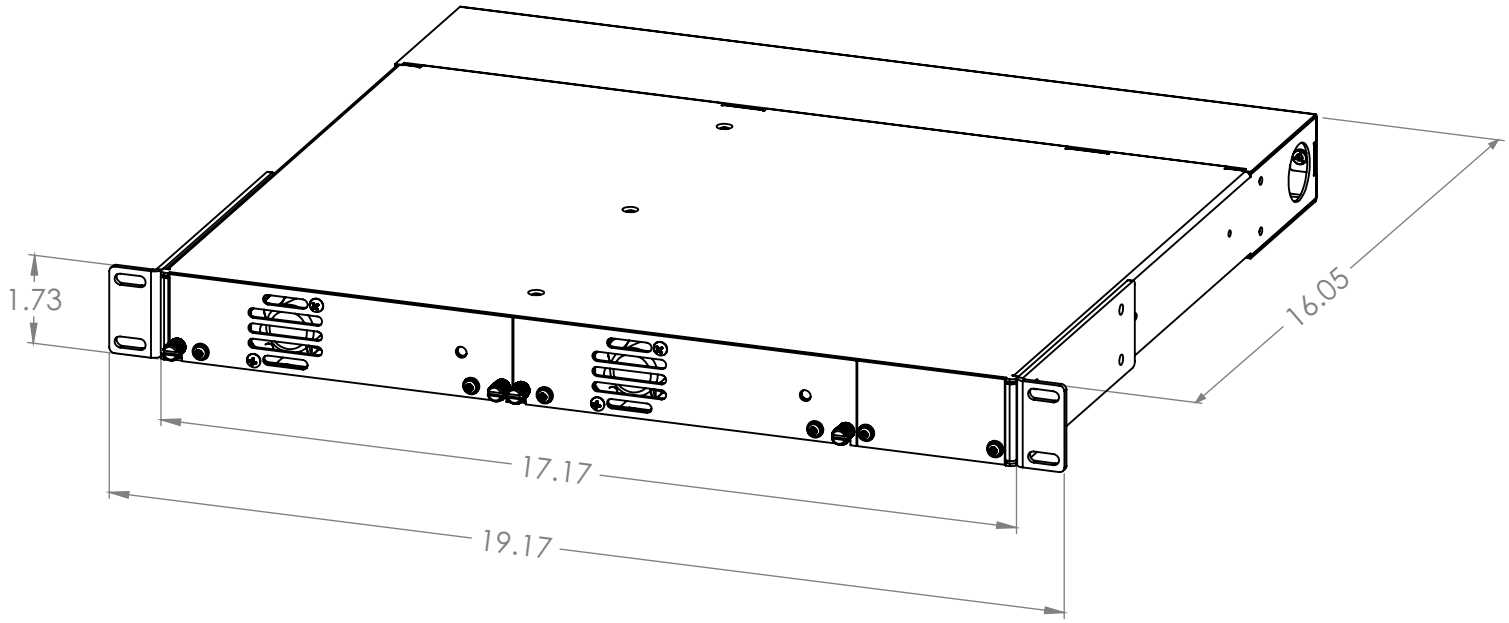
The inverter can maintain a spectrally pure output with any load due to a specially designed non-linear control loop in the primary DC to DC converter. This circuitry is one of three circuits which protect the inverter from any overload condition.

Adhere to this manual, and your inverter will provide years of trouble-free service.

1.1 System Overview

This document provides system application and specification information on Exeltech's KC Inverter System. The system is comprised of the following components:

· Power Module Cage Assembly (Single Phase Configuration)
· Power Module (1,000 Watts)



Description

The power module cage assembly and power modules comprise of a DC to 120V AC line to neutral power inverter system. The KC inverter system is a modular design and allows each system to be tailored for specific needs. Systems can range in phase relation, output power, level of redundancy, and a variety of other options. This is done by selecting different combinations of modules in the system.

The Inverter produces a true sine wave output with minimal distortion. Both line and load distortion are also minimal. (See Section 6.0)

1.2 Modules Overview

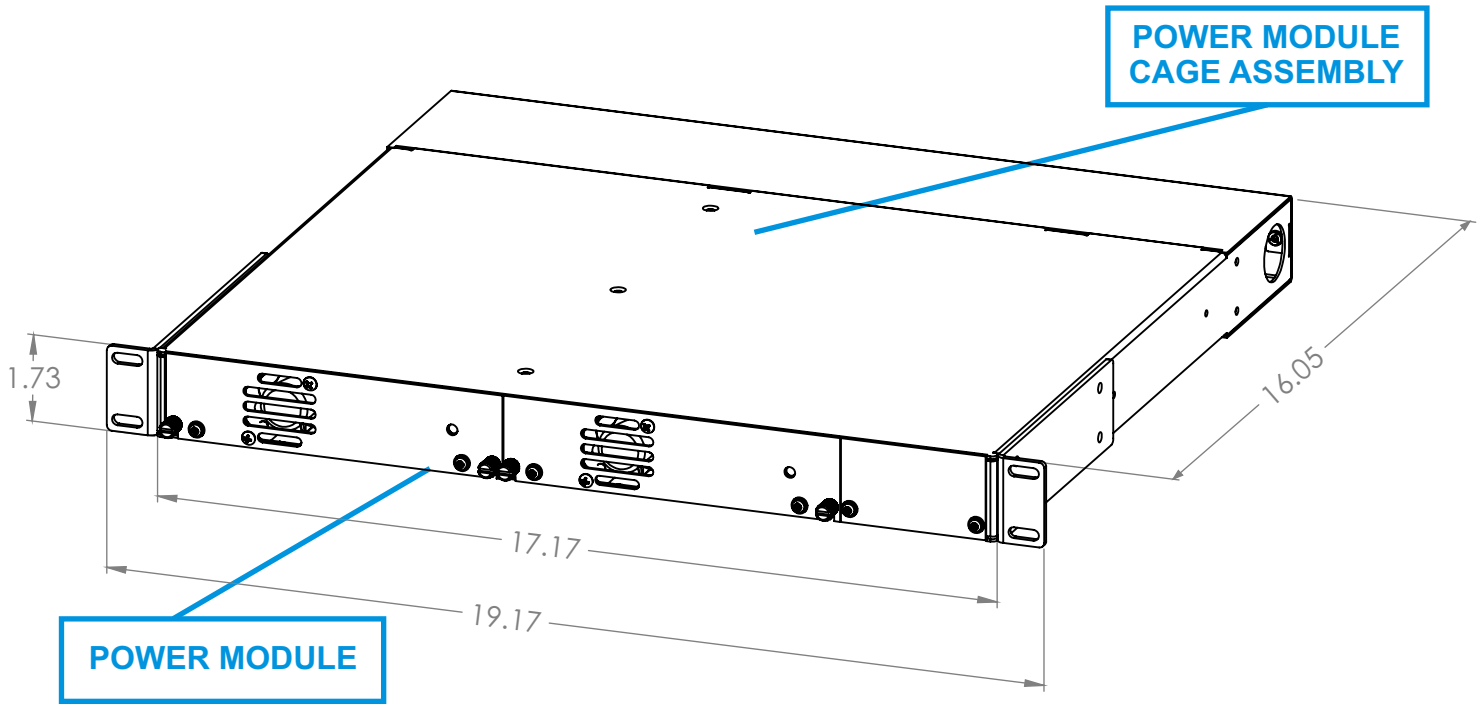
The KC Series inverters are a modular design and allows each system to be tailored for specific needs. Systems can range in output power, input voltage, redundancy, and a variety of other options. This is done by selecting different combinations of modules to create a KC inverter system.

1.2.1 Power Module Cage Assembly

The 19'' 1U cage assembly can be designed to accept DC input of either positive or negative. It will house from 1 to 2 inverter power modules resulting in a system output of up to 2,000 Watts.

1.2.2 Power Modules

The power module is the backbone of the KC inverter system and is the majority of the modules in all systems. Each module is capable of producing 1000 Watts of continuous output power.



Standard Features 2.0

2.1 System Configuration

The system can be configured from 1,000 to 2,000 Watts (1 to 2 power modules),

Remote On/Off Switch:
A set of terminals are provided to turn the inverter system on and off from a remote location(See Section 6.3 for location). The connection for the remote switch is on terminal block (P105) located under the rear access cover. Connect a series switch between terminal 1 & 2 on the P105 terminal block to turn the inverter on. The maximum current in this connection is under 0.1 ADC, and has a maximum open circuit voltage of either 24, 48, 108 or 120 VDC. An appropriately rated switch should be used.

Over Voltage Protection:
The inverter system will shutdown immediately if the DC voltage exceeds the set limits. When the voltage returns to the normal range, the inverter system will immediately restart. There is a small amount of hysteresis built into the over voltage turn off set point to avoid the possibility of turning off and on rapidly. An over voltage greater than 10% above the limit may cause damage.

Under Voltage Protection:
The inverter system will shutdown when the DC voltage goes below the set limit. When the voltage rises to approximately 15% above the low voltage set limit, the inverter system will turn back on.

2.2 Power Modules

DC Voltage Inputs:
24V, 48V, 108V and 120V DC inputs are available. It is recommended to have a maximum ripple voltage of less than 5% with the peaks not going above Vmax and below Vmin.

AC Voltage Outputs:
120V AC outputs are available (+/- 2%) at 50Hz, 60Hz, 400Hz (+/- 0.1%).

Load Sharing:
By control system design, the power modules will automatically load share current with other power modules. The load sharing occurs immediately when a module is either added or removed from a power module cage assembly. If a module fails for any reason, the remaining modules will immediately redistribute the load among themselves.

Cooling:
A microprocessor controlled variable speed fan is located on the face plate of the power module. The fan will operate when the module senses an appropriate combination of temperature and power.

Over Temperature Protection:
Each power module will go into thermal shutdown when its internal temperature exceeds the maximum set point. The power module will provide its full rated output up to the temperature listed in the specification sheet. Ambient temperatures in excess of the maximum specification will likely result in thermal shutdown unless the load is reduced appropriately (see detailed specifications for derating). When the power module shuts down, the cooling fans will continue to run. The power module will automatically restart when it has sufficiently cooled.

Overload/Short Circuit Protection:
If the load attempts to draw current in excess of this value, the output waveform will be “clipped” so that this limit is never exceeded. The power module has a continuous output of 1000 Watts. In addition, the power module is also able to provide a 3 second surge of up to 2000 Watts (depending on the battery voltage and internal temperature). This surge current is available to supply the inrush current demanded by electronic or motor loads. If the surge persists for longer than 3 seconds, the waveform will be “clipped” in an attempt to reduce the output to under 1000 Watts. If “clipping” the waveform is ineffective in reducing the output below 1000 Watts (as would be the situation for an overload/short circuit condition), the power module will shut down after a period of about 7 seconds. Once shut down, it requires cycling the inverter system's ON/OFF switch to reset from this condition. The cause of the overload/short circuit condition must be removed prior to cycling the ON/OFF switch, otherwise, the inverter system will shut down again after the 7 second delay.

Installation 3.0

3.1 Location

The inverter is a highly sophisticated piece of electronic equipment. As such, its location warrants some special consideration. The inverter system should be mounted in a location where only non-conductive pollution may occur such as an office or laboratory environment. For full power capability, the temperature must be within the Operating Environment Specifications. The unit may be operated at elevated temperatures if the loading is reduced. See Physical Specifications for Operating Environment Specifications.

The inverter must be sheltered from the weather. Keep it away from condensing water.

Air is drawn into the system through the front panel mounted fans, and exits through vent holes in the top and rear. Adequate clearance is required in the front, rear, and top for both cooling and to provide access space for maintenance. See Physical Specifications, Mounting Clearance Requirements, for details.

Choosing a mounting location is critical to the performance and life span of the inverter. Heat and moisture are the two worst enemies of any electronic device.

When choosing a mounting location, consider the following requirements:
1. The inverter must be sheltered from the elements. Select a clean, dry location.
2. The inverter requires adequate ventilation for cooling. With proper cooling the inverter will operate efficiently and meet its published ratings. Do not obstruct air circulation. Air is drawn into the inverter through the front panel mounted fans, and exits through vent holes in the top and rear of the inverter.
3. The inverter should be mounted as close to the battery as possible. Shorter lengths of wire have less resistance, which translates to increased efficiencies (See Section 3.2.1 Wiring Charts).

3.2 Wiring

DC Input Connections:
Positive (+) and Negative (-) input terminals are 5/16" studs. They are provided under the Rear Cover.
Use 5/16'' lugs and appropriate gauge wire for your specific model and distance from the battery.
(Recommended Torque = 85 in-lbs.)

AC Output Connections:
Output 6 pole terminal blocks are UL listed connection.
Use appropriate wire gauge with insulated crimp ring terminal for #8 screws. (Screws max torque 12 in-lbs)
Over-torque could result in damage to housing, terminal or Back plane.

How to Size a Breaker for the Utility AC Input or Load AC Output:
1. Take the maximum capacity of the inverter system in Watts. Divide that number by rated system output voltage (VAC).

Example: 11,000W/117VAC = 94A

2. Choose a breaker that is widely available in a value that is close to but higher than the result. In the above example that would typically be either a 100A or 125A breaker.

NOTE: Never use a breaker that exceeds the rating of the wires in the feed. (E.g. Do not use a 100A breaker on a wire that is only rated for 50A)

3.2.1 Wiring Charts

DC INPUT WIRING:

How much current does my EXELTECH inverter draw from my batteries?

Take the output power (Po) of the inverter and divide it by 0.89 (89% efficiency worst case). This gives you the input power (Pin) of the inverter. Now divide the input power by the voltage of the battery bank (Vbat). This is the current in amps (DC Amps) that the inverter draws from the battery.

Po / 0.89 = Pin; Pin / VBat = DC Amps

The voltage drop between the inverter and the battery should be less than 2% of the Low-Line DC battery voltage. The proper cable size can be verified in the National Electrical Code Book.

Wiring between inverter and battery bank should be as short as possible and of a gauge as larger or larger than that called for in the chart. This manual covers many different input voltages. Find the correct row for the inverter, read across to the column corresponding to the distance between the inverter and battery bank, and then read the size of the wire cable which is needed.

Wires for a 1KW load:

MODEL	LESS THAN 5'	LESS THAN 10'	LESS THAN 15'	LESS THAN 20'
12 VDC	2 AWG	00 AWG	0000 AWG	0000 AWG
24 VDC	6 AWG	4 AWG	2 AWG	0 AWG
32 VDC	12 AWG	8 AWG	6 AWG	4 AWG
48 VDC	14 AWG	10 AWG	8 AWG	8 AWG
66 VDC	16 AWG	14 AWG	12 AWG	10 AWG
108 VDC	18 AWG	18 AWG	16 AWG	14 AWG

Note: the table specifies standard wire sizes (not smaller than 18 AWG) that will provide less than a 2% voltage drop at Low-line Input voltage and Rated Output Power.

Wires for a 5KW load:

MODEL	LESS THAN 5'	LESS THAN 10'	LESS THAN 15'	LESS THAN 20'
12 VDC	0000 AWG	500 MCM	750 MCM	1000 MCM
24 VDC	2 AWG	00 AWG	000 AWG	500 MCM
32 VDC	4 AWG	2 AWG	0 AWG	00 AWG
48 VDC	8 AWG	4 AWG	4 AWG	2 AWG
66 VDC	10 AWG	8 AWG	6 AWG	4 AWG
108 VDC	12 AWG	12 AWG	10 AWG	8 AWG

Operation 4.0

4.1 Start Up Procedure (Single Phase System)

NOTE: Refer to Section 6.3 for system connections.

STEP 1: Make sure the inverter system is mounted securely.

STEP 2: Remove the rear access cover of the inverter system.

STEP 3: Do not connect the AC load until all steps are complete.

STEP 4: Verify that the ON/OFF switch located on the (customer installed) remote switch is in the “OFF” position.

STEP 5: Verify the battery cable polarity. Reversed polarity will lead to power module - damage.

STEP 6: Verify the battery voltage is within the specifications of the inverter.

STEP 7: Verify DC breaker or fuse is open and leads are not energized.

STEP 8: Connect the positive cable from the battery bank to the positive terminal of the inverter's backplane.

STEP 9: Connect negative cable from battery bank to negative terminal of the inverter's backplane.

NOTE: If the battery system is being utilized by other equipment it may be necessary to pre-charge the inverter's DC buss. Pre-charge the input capacitors of the inverter by connecting one lead of a 50 ohm, 50 Watt resistor to the negative terminal of the battery bank and the other lead to the negative terminal of the inverter. The time to pre-charge the input capacitors will be about 5 seconds.

STEP 10: Close the DC breaker or insert the fuse to energize cables and the inverter's DC bus.

STEP 11: Turn the inverter “ON”. The switch is located on the (customer installed) remote switch.

STEP 12: Measure the output voltage at the LOAD terminals on the backplane. The reading should be the nominal AC voltage +/- 1%.

STEP 13: Check the total power requirement of all equipment to be powered by the inverter system. Make sure that it is less than the rated output power if the inverter.

STEP 14: Close the LOAD breakers to energize the equipment.

Maintenance
5.0

5.1 Common Maintenance

Preventative maintenance required on Exeltech products is minimal. Under normal circumstances, the only maintenance required is a regular visual inspection of the inverter to check for signs of dirt, dust, corrosion or other damage. Inverters that are used in harsh environments such as mining or marine, should be inspected more frequently as well as cleaned if dusty or dirty. Accumulated dust may block airflow and impede cooling which can cause overheating. The units should also be checked thoroughly for loose hardware or damaged wiring caused by excessive shock or vibration.

Since the inverter system is modular, repair is done on each module as necessary. If a module fails, turn the system off remove and replace with a new module. Call Exeltech for an RMA number, then send the failed module to Exeltech. Repairs are done at Exeltech only.

Inverters not in use (ie; stock) should be powered up and run partially loaded for a few hours every 12 months. This will help keep the electrolytic capacitors from depolarizing. These units should be stored in a manner so that exposed contacts are subject to minimal oxidation.

5.2 Power Module Replacement

***Turn off the system with the customer installed remote switch.**

STEP 1: Alternately loosen the two thumb screws on front panel of the power module two turns at a time. They should become completely loose from the power module cage assembly, yet remain captive in the power module front panel.

STEP 2: Remove the power module by pulling on the thumb screws.

STEP 3: Install the new power module, insuring that the grooves on the heat sink are aligned with the PEM nuts on the power cage..

STEP 4: Slide the power module in until it just touches the rear connector.

STEP 5: Tighten the left and right thumb screws using the procedure below. The power module will not seat in the connector until the thumb screws are completely screwed into the power module cage assembly. The power module cannot be quickly inserted into the power module cage assembly. There is a 3 step procedure that occurs during installation of the power module.

a) The input capacitors are pre-charged.
b) All electrical connections to the power module occur.
c) The power module is powered up and brought on line with the rest of the modules.

In order for these things to occur in the correct sequence and timing, the screws are designed to stop the installation of the power module before any electrical contact takes place in the card edge connector. As the thumb screws are tightened, the above events are forced to happen in sequence and fairly slowly.

1) The power module should be placed in the cage just to the point of starting the thumb screws.

2) Turn the Left screw in 2 turns. DO NOT ATTEMPT TO SCREW ALL THE WAY AT ONCE. SCREW STRIPPING MAY RESULT.

3) Turn the Right screw in 2 turns. DO NOT ATTEMPT TO SCREW ALL THE WAY AT ONCE. SCREW STRIPPING MAY RESULT.

4) Repeat 2 and 3 until the power module is completely seated.

***Annual maintenance (tightening connections)**

Specifications
6.0

6.1 Power Module Electrical Specifications

INPUT POWER (PER EACH POWER MODULE)

MODEL VOLTAGE	MINIMUM (TYPICAL)	SYSTEM (TYPICAL)	MAXIMUM (TYPICAL)	TYPICAL EFFICIENCY @ FULL POWER	PEAK EFFICIENCY @ 1/2 POWER
24V	20.8V	27.6V	30V	> 89%	> 91%
48V	41.6V	55.2V	60V	> 89%	> 91%
108V	93.6V	124.2V	135V	> 89%	> 91%
120V	104V	138V	150V	> 89%	> 91%

OUTPUT POWER (PER EACH POWER MODULE)

CONTINUOUS POWER	SURGE POWER (3 seconds)	NO LOAD POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	WEIGHT LBS.
1000W	2000W	9W	120V +/-2%	8.3 A	3.8
1000W	2000W	9W	277V +/-2%	3.6 A	3.8
1000W	2000W	9W	230V +/-2%	4.3 A	3.8

GENERAL

CONDITIONS	MINIMUM	TYPICAL	MAXIMUM
WAVEFORM	-	SINUSOIDAL	-
LINE REGULATION	-	.1%	2%
LOAD REGULATION	-	1%	2%
DISTORTION	-	1.5%	2%
FREQUENCY	-.1%	60Hz	+.1%

PHYSICAL SPECIFICATIONS

Power Module Dimensions: **1.7**" x **7**" x **12.7**" (H x W x D)

Weight: 3.8 lbs

PROTECTION CIRCUITRY

Over Voltage:	Shutoff at maximum input voltage, per input table.
Under Voltage:	Shutoff at minimum input voltage, per input table.
Thermal:	Shuts off due to over temperature condition.
Output Short:	Unit shuts off: electronically limited. Manual reset required.

ENVIRONMENTAL

Temperature:	-25°C to +40°C full power, derated -25% per 10°C above 40°C.
Humidity:	5 to 95% non-condensing
Altitude:	-60m to 3,048m (-197ft. To 10,000ft.) Altitudes >10,000ft. thermally derate from 40°C to 30°C.
Cooling:	Thermostatically controlled variable speed forced air.
Warranty:	Full year parts and labor.

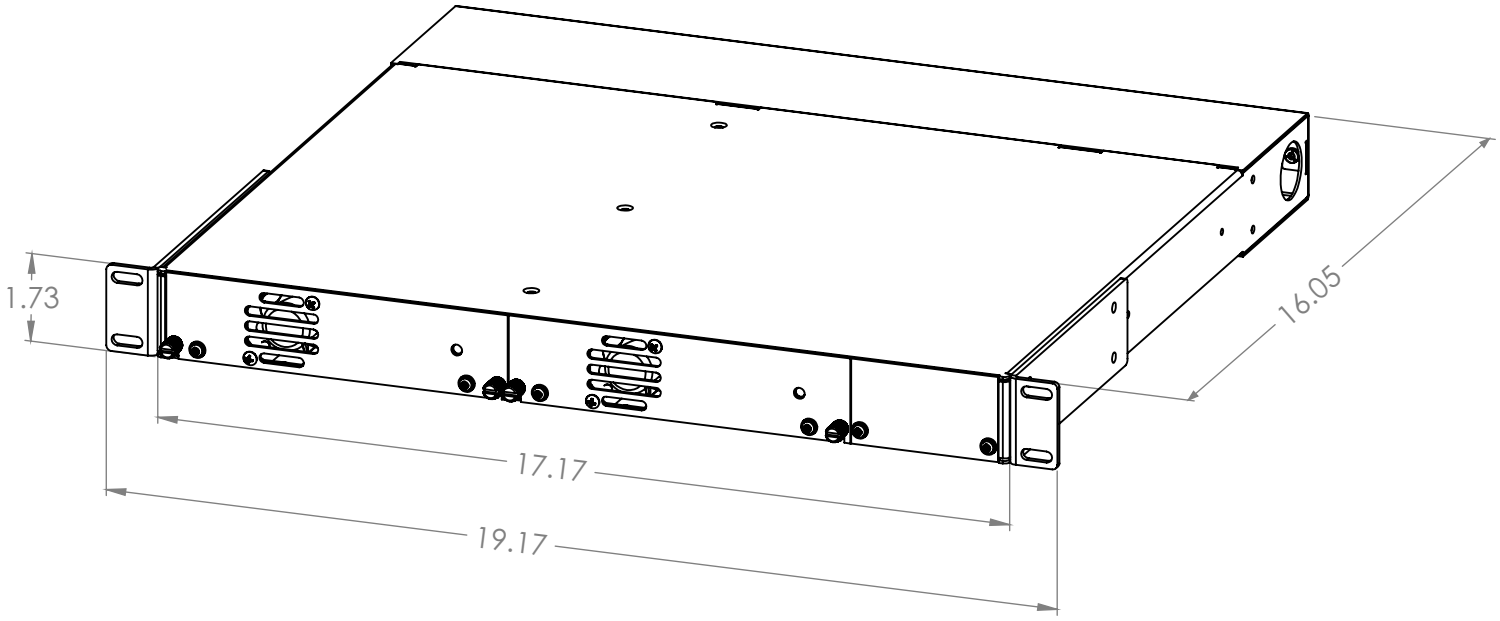
MECHANICAL

Two case sizes are available:
All are 1.75" high X 16" deep.

19 inch Wide:	(includes hardware for rack or shelf mounting)
23 inch Wide:	(includes hardware for rack or shelf mounting)

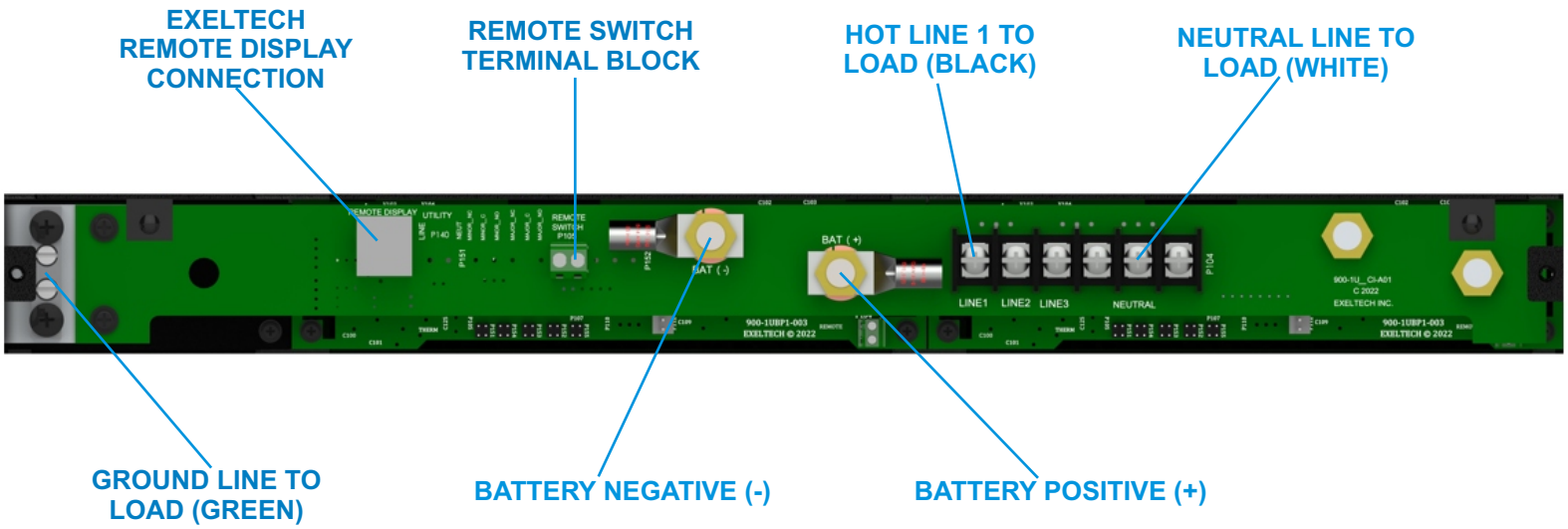
6.2 Mechanical Specs/Drawings

19” 1U Inverter System



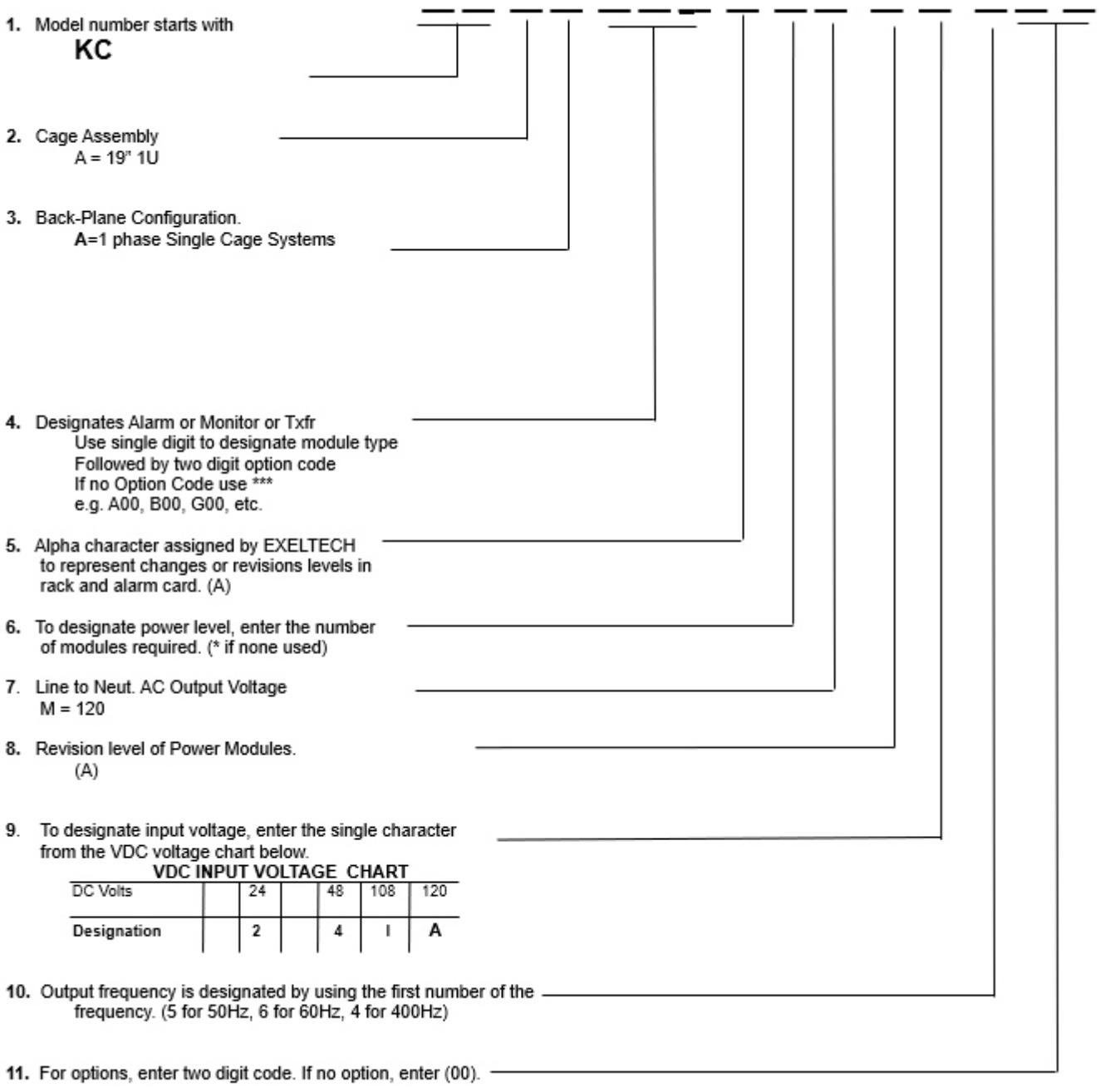
6.3 Backplane Connections

19” 1U Single Phase Inverter System



Part Numbering System
7.0

KC SERIES SYSTEM PART NUMBER



1. Model number starts with
   KC

2. Cage Assembly
   A = 19" 1U

3. Back-Plane Configuration.
   A=1 phase Single Cage Systems

4. Designates Alarm or Monitor or Txfr
   Use single digit to designate module type
   Followed by two digit option code
   If no Option Code use ***
   e.g. A00, B00, G00, etc.

5. Alpha character assigned by EXELTECH to represent changes or revisions levels in rack and alarm card. (A)

6. To designate power level, enter the number of modules required. (* if none used)

7. Line to Neut. AC Output Voltage
   M = 120

8. Revision level of Power Modules.
   (A)

9. To designate input voltage, enter the single character from the VDC voltage chart below.

VDC INPUT VOLTAGE CHART

DC Volts		24		48	108	120
Designation		2		4	I	A

10. Output frequency is designated by using the first number of the frequency. (5 for 50Hz, 6 for 60Hz, 4 for 400Hz)

11. For options, enter two digit code. If no option, enter (00).

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931- KC1M* - * 0B

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