EXELTECH

Manufacturer of UL Listed Products

Manufacturer of True Sine Wave Power Inverters and Related Products

LC SERIES POWER INVERTERS

- **N+1 REDUNDANT**
- **EXPANDABLE**
- **REMOTE SWITCHING**
- **TRUE SINE WAVE**
- **“HOT” INSERTABLE**
- **2000 WATT MODULES**
- **OPTIONAL SNMP**

Exeltech’s LC series inverter systems are equipped with 2KW power modules, this now provides double the output power within similar space requirements as are top selling MX series inverters. Modules are "hot" insertable, power levels are expandable, and modules can be added or replaced without interruption in power to your critical loads.

The LC system can be configured for power levels from 2KW to 60KW single phase with 120VAC, 277VAC or 230VAC outputs. Up to 120KW at 240VAC bi-phase or 180KW at 208VAC or 480VAC three-phase with many input and output voltages also available.

A monitoring module plus any number of additional 2KW power modules combine to make a standard LC inverter. This type of system can be expanded as power requirements increase, and upgraded to be N+1 redundant as desired. The LC system can be configured with Exeltech’s static transfer switch and maintenance bypass switch up to 20KW per phase. Also an optional customer interface cage with up to 5 DC breakers is available. .

The LC system is extremely compact and lightweight. Power modules weigh only 9 lbs each and are equipped with LCD screens for quick access of system data.

Output voltage is precisely regulated, so that no measurable voltage change occurs on the output as input voltage fluctuates. Similarly, less than 0.5 volt change in output voltage will occur when the output load varies from 0 to 100% of rated power. With distortion of 2% maximum, this inverter offers the cleanest sine wave power available.

LC SERIES MODULE OVERVIEW

The LC 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 LC inverter system.

1.2.1 Power Module Cage Assembly

The cage assembly can be designed to accept DC input of either positive or negative. It will house from 1 to 6 inverter power modules resulting in a system output of up to 12,000 Watts. It will also house an optional monitoring module (recommended). The left most power module is the system's master module. The next power module to the right is the system's redundant (backup) master module. For redundant operation the system MUST include a monitoring module. The monitoring module is required to initiate a transfer of control to the backup master module.

1.2.2 Power Modules

The power module is the backbone of the LC inverter system and is the majority of the modules in all systems. Each module is capable of producing 2000 Watts of continuous output power. Each module can perform all of the functions to operate as a system's master module. The module will only perform the system master function when placed in the power module cage assembly location identified in the previous section. Each power module is equipped with an LCD display that can show power module status information as well as system status information.

1.2.3 Monitoring Module

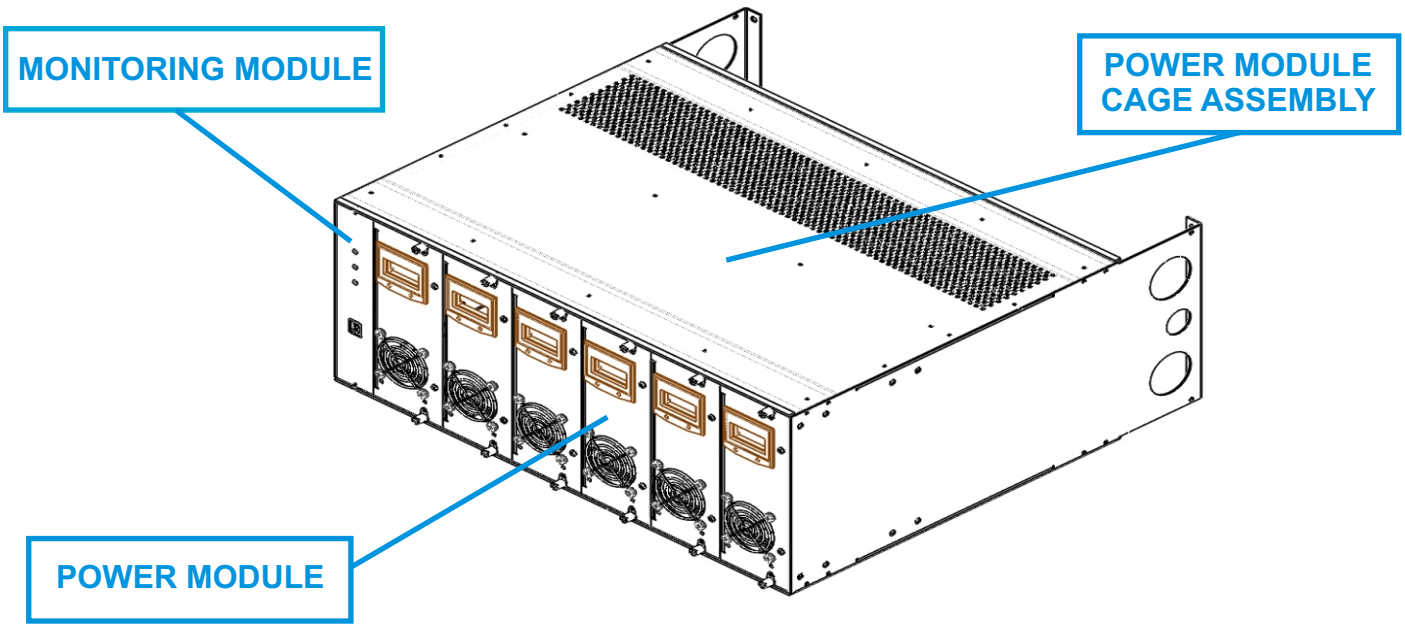
The monitoring module provides a visual representation of different alarms created by the system. Each monitoring module has an ON/OFF switch for the system. If a monitoring module is not used the remote switch must be used to turn the system on and off. A monitoring module is required to detect a master power module failure and switch to the secondary master power module if it is available. There are a few different options available to monitor the LC inverter system.

1. **Alarm Card:**

With the alarm card, system monitoring is basic and is seen manually through power module LCD displays. Pre set alarms (Alarm1/Minor & Alarm 2/Major) are provided via dry form C relay contacts on the inverter systems backplane. Use of the other connections on the back plane may result in damage to the module or system.

2. **Monitor Card:**

With the monitor card, system data is more detailed and can be seen either manually through power module LCD displays or through Ethernet connection which allows for remote monitoring of system data. Each phase's information can be reported via the Ethernet connection. The data can be sent to a PC to be viewed and logged or reported via SNMPv2 or an optional secure SNMPv3. Programmable alarms (Alarm1/Minor & Alarm 2/Major) are provided via dry form C relay contacts on the inverter systems backplane. Product Status is used to program alarms. Use of the other connections on the back plane may result in damage to the module or system.



LC SERIES SYSTEM OVERVIEW

The LC system can be configured from 2,000 to 12,000 Watts (1 to 6 power modules), with or without an optional monitoring module (highly recommended). With the monitoring module and a sufficient number of power modules, the system provides N+1 redundancy.

Remote On/Off Switch:
A set of terminals are provided to turn the inverter system on and off from a remote location. The connection for the remote switch is on a remote alarm connector located under the rear access cover. Connect battery negative 'Bat(-)' to the 'Sw1' terminal 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, or 108 VDC. An appropriately rated switch should be used. The remote switch and front panel switch are "OR'd" together so if either switch is on, the inverter system will turn on, and both must be off for shut down. When using the remote switch, insure the front panel switch is in the "OFF" position to control the inverter system with the remote switch.

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. The inverter system monitoring module will set an alarm when the inverter system reaches a voltage 5% above the low voltage set limit. When the voltage rises to approximately 15% above the low voltage set limit, the inverter system will turn back on and the alarm condition will clear.

Power Modules

DC Voltage Inputs:
24V, 48V, and 108V 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, 277V, and 230V AC outputs are available (+/- 6%) at 50Hz, 60Hz, or 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. Fan speed is monitored, and reported to the inverter system monitoring module. Fan speed can be displayed on the power module's LCD display.

Over Temperature Protection:
Each power module will go into thermal shutdown when its internal temperature exceeds the maximum set point. Approximately 5C prior to thermal shutdown, a warning alarm will be sent to the inverter system monitoring module, and will also be displayed on the power module's LCD display. 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 alarm condition will persist and 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 2000 Watts. In addition, the power module is also able to provide a 3 second surge of up to 4000 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 2000 Watts. If “clipping” the waveform is ineffective in reducing the output below 2000 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.There is a 30 second delay between surges and the inverter will attempt 3 times then shut down and require a hard restart from the ON/OFF switch on the front of the inverter or on the remote switch.

2.3 Monitoring Module

Alarm Card:

Alarm LEDs:
The alarm card will monitor and display different alarms from the system through the LED’s on the front panel.

On/Off Switch:
The on/off switch is located on the front plate of the alarm card. It is used to turn the inverter system on and off.

Relay Contacts for Alarms:
Dry relay contacts are available on the backplane to be used with pre set alarms (Alarm1/Minor & Alarm 2/Major).

*Alarm Cards with thumb screws are Hot Swappable and can be replaced without interruptions to the system.

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On/Off Switch:
The on/off switch is located on the front plate of the monitor card. It is used to turn the inverter system on and off.

Relay Contacts for Alarms:
Dry relay contacts are available on the backplane to be used with programmable alarms (Alarm1/Minor & Alarm 2/Major).

Ethernet Monitoring:
An Ethernet port is available on the front panel to connect to a network for remote monitoring of the system. This includes the industry standard Modbus over Ethernet or SNMPv2 remote monitoring or an optional secure SNMPv3 connection.

*Monitor Cards with thumb screws are Hot Swappable and can be replaced without interruptions to the system.

LC SERIES POWER INVERTER 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	> 88%	> 91%
48V	41.6V	55.2V	60V	> 88%	> 91%
108V	93.6V	124.2V	135V	> 88%	> 91%

OUTPUT POWER (PER EACH POWER MODULE)

CONTINUOUS POWER	SURGE POWER (3 seconds)	NO LOAD POWER	OUTPUT VOLTAGE	OUTPUT CURRENT	WEIGHT LBS.
2000W	4000W	15W	120V +/-2%	16.7 A	9
2000W	4000W	15W	277V +/-2%	7.2 A	9
2000W	4000W	15W	230V +/-2%	8.7 A	9

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

Dimensions: 8.65” x 3.2” x 16.25” (H x W x D)

Weight: 9lbs

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.

Monitoring Module Electrical Specifications

Electrical Specifications

Inverter Voltage Reading:	True RMS Voltage +/- 1%
Inverter Current Reading:	True RMS Current +/- 1%
Frequency Reading:	1/10 Hz resolution
DC Voltage Reading:	Nominal DC Voltage +/- 1%

Physical Specifications

Dimensions: 8.65” x 3.2” x 16.25” (H x W x D)

Weight: < 1.5 lbs

LC SERIES 12KW SYSTEM SPECIFICATIONS

INPUT POWER

MODEL VOLTAGE	MINIMUM (TYPICAL)	SYSTEM (TYPICAL)	MAXIMUM (TYPICAL)	MAXIMUM CURRENT
24V	20.8V	27.6V	30V	700A
48V	41.6V	55.2V	60V	350A
108V	93.6V	124.2V	135V	160A

OUTPUT POWER

CONTINUOUS POWER	SURGE POWER (3 seconds)	OUTPUT VOLTAGE	OUTPUT CURRENT	WEIGHT LBS. (With Monitoring Module)
12000W	24000W	120V +/-2%	100 A	69
12000W	24000W	277V +/-2%	43.3 A	69
12000W	24000W	230V +/-2%	52.2 A	69

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

Dimensions: 8.75” x 21” x 20” (H x W x D)
8.75” x 23” x 20” (H x W x D) (Includes rack/shelf mounting hardware)

Mounting Clearance Requirements Above: 1.75” (1 U)
Front: 18”
Rear: 18”

Access: Rear for Installation and Maintenance and Front for Operation

Control: Microprocessor control, Ethernet based monitoring

Options: Pre-charge Circuit Panel PN: 800-DCPRE-400

Accessories: Blank Position Cover Panel PN: 020-00411-400
Relay Rack Mounting Bracket PN: 020-00317-401
Surface Mounting Bracket PN: 020-00222-400

LC SYSTEMS POWER MODULE

DC Voltage Inputs:
24V, 48V, and 108 VDC 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, 277V and 230V AC outputs are available (+/- 6%) at 50Hz, 60Hz, or 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. Fan speed is monitored, and reported to the inverter system monitoring module. Fan speed can be displayed on the power module's LCD display.

Over Temperature Protection:
Each power module will go into thermal shutdown when its internal temperature exceeds the maximum set point. Approximately 5C prior to thermal shutdown, a warning alarm will be sent to the inverter system monitoring module, and will also be displayed on the power module's LCD display. 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 alarm condition will persist and 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 2000 Watts. In addition, the power module is also able to provide a 3 second surge of up to 4000 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 2000 Watts. If “clipping” the waveform is ineffective in reducing the output below 2000 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.

LC SYSTEMS ALARM CARD

The alarm card can be added to 19” and 23” power module cages.

The alarm card is powered by the inverter or utility.

Each alarm card is specific to one input voltage.

AC & DC alarms only (Non-Programmable)

No data reporting through Ethernet.

Data can be monitored via power module LCD display.

Faceplate Displays:

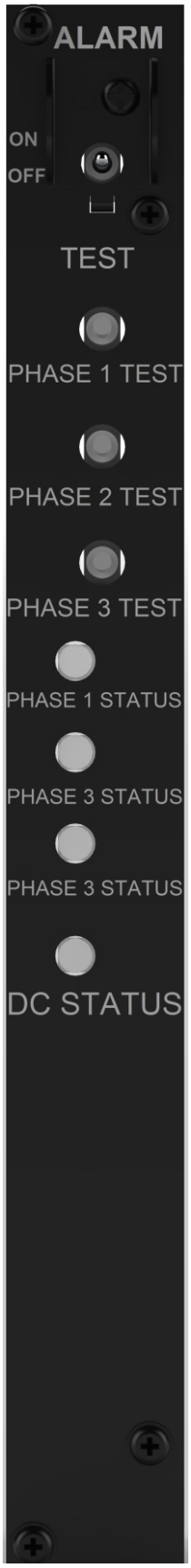
INVERTER SWITCH:
Up is “ON” and Down is “OFF”

PHASE TEST BUTTONS:
Test the following functions for each phase:
- -AC ALARMS
- -AC LED STATUS
- -MASTER TOGGLE

PHASE STATUS LED:
Will be green when AC power is in specs

DC STATUS LED:
Will be green when the DC power is in specs

*Alarm Cards with thumb screws are Hot Swappable and can be replaced without interruptions to the system.



LC SYSTEMS MONITOR CARD

It is now possible to monitor all of your remote power stations from a single location. You can have up to the minute verification that all of your remote power systems are 100% operational. For example, the remote power system can report that it is currently running at 90% of its rated capacity.

Operation
Normal operation of the monitor card is similar to the alarm card previously described in this document. The biggest difference is the remote monitoring of the system data.

Remote Monitoring
Ethernet connection allows for remote monitoring of system data. Each phase's information can be reported via an Ethernet connection. The data can be sent to a PC to be viewed and logged or reported via SNMPv2 or an optional secure SNMPv3. Programmable Alarm 1/Minor and Alarm 2/Major are provided via dry form C relay contacts. Use of the other alarm ports on the back plane may result in damage to the module or system.

Differences from Alarm Card:

-Remote data monitoring

-Not limited to a specific input voltage

-Allows for programmable alarms

-Built in microprocessor that allows for a wider range of system data. Data can be monitored both remotely and via power module LCD display.

Faceplate Displays:

INVERTER SWITCH:
Up is “ON” and down is “OFF”

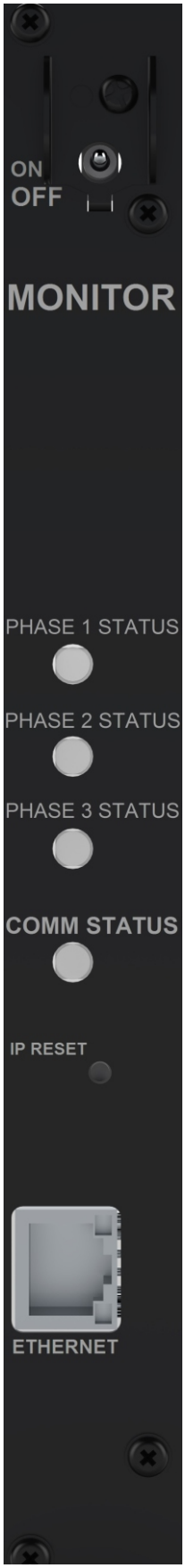
PHASE STATUS LED:
Will be green when AC power is in specs

COMM STATUS:
Will be green when monitor card is communicating to another device.

IP RESET:
When pushed it will Reboot the communication port

Ethernet Port:
Allows connection to the inverter system via Ethernet cable

*Monitor Cards with thumb screws are Hot Swappable and can be replaced without interruptions to the system.



STATIC TRANSFER SWITCH SYSTEM

SOLID STATE SCR-BASED SWITCHING WITH ZERO TRANSFER TIME:

Detect time inverter to commercial power: < 4 msec.
Detect time commercial power to inverter: < 4 msec.
Transfer time when changing primary: 0 msec.

LED ALARMS:

LED Phase Indicators: Indicates the status of the primary and secondary source as well as the status of the MBS.

LED Status Indicators: Displays the overall status of the STS System.

LED Source Indicators: Three LED indicators per phase display the Inverter, Utility, and Output Status for each phase.

CONTACT CLOSURES (REMOTE ALARMS):

PROGRAMMABLE ALARMS: Two programmable relay alarms are available on the backplane.

REMOTE MONITORING OVER ETHERNET: Monitors all alarms, AC and DC current and voltage, and AC frequency.

10/100/ DHCP (default) / **STATIC IP** (configurable)

Product Status: Lightweight Java based application with a simple GUI used to monitor system conditions and log conditions history.

SNMP v1 Monitoring: SNMP Traps over Ethernet can be used to monitor all system information. The ".mib" file is provided on the Exeltech website.

Modbus TCP/IP: System status information is also available via Modbus communications over Ethernet. Modbus tables are available on the Exeltech website.

FORCED CONVECTION COOLING: Fan is operated based on internal SCR temperature and load power level.

PRIMARY SOURCE SELECT SWITCH

RECOMMENDED TO BE USED WITH MAINTENANCE BYPASS SWITCH

LC SERIES PART NUMBERING SYSTEM

LC SERIES SYSTEM PART NUMBER

1. Model number starts with
LC

2. Cage Assembly
1 = 19"
2 = 23”

3. Configuration.
B=1 phase Single Cage Systems
E=2 phase Single Cage Systems
F=3 phase Single Cage Systems
U=1 phase Stacked Rack Systems
V =2 phase, Stacked Rack Systems
W =3 phase, Stacked Rack Systems
X=2 phase, master phase, Stacked Systems “23T”
Y=2 phase, phase inverter, Stacked Systems “23T”

4. Designates the type of System “brain”
A00= Alarm Card (120VAC)
B00= Monitor Card (120VAC)
G00= Alarm Card (277VAC)
H00= Monitor Card (277VAC)

5. Alpha character assigned by EXELTECH to represent changes or revisions levels in rack and alarm card.
Current Revision = A

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

7. Enter the character code from **L**C System Design Chart. M = 120, 7 = 277

8. Revision level of Power Modules.
- = (REV. 1)
A = (REV.2)

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

VDC INPUT VOLTAGE CHART

DC Volts	12	24	32	48	66	108
Designation	**1**	**2**	**B**	**4**	**E**	**I**

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).