



*60 Vista Drive
Versailles, OH 45380-0286
1.800.MIDMARK
www.midmark.com*

Operating Manual

**for the
Series 301-1001 & Series 301-1003
Motive DC Controllers**

MMDCOM09_Rev.B_5.0

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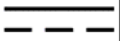







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1 Safety Precautions

1.1 Hazards and Other Symbols

The following symbols are relevant to either this manual or the power system.

SYMBOL	TITLE	Description
	ALTERNATING CURRENT	
	DIRECT CURRENT	
	ATTENTION	Attention: consult ACCOMPANYING DOCUMENTS
	ELECTRICAL HAZARD	Indicates an electrical hazard may exist
	Follow Operating Instructions Note: On ME EQUIPMENT "Follow instructions for use".	
	Low Battery	Symbol used for low battery on the remote display device.
	Product Powered by DC	Symbol used for indicating that the power supply is currently running off of DC power [battery]. Used on the remote display device.
	Product Powered by AC	Symbol used for indicating that the power supply is currently running off of AC power [wall power]. Used on the remote display device.
	Earth Ground	

1.2 Warnings and Cautions



All operating instructions should be thoroughly reviewed prior to the use of the system. Warnings and instructions should be followed while installing or operating the system.

Definitions:

CAUTION: indicates a hazardous situation, which if not avoided, may result in minor or moderate injury or product or property damage.

WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in serious injury or death.

CAUTION:



The AC power conductors must be assembled to a certified plug assembly by a qualified technician. For compliance to the safety and EMC specifications, the plug assembly must meet the requirements dictated within this operations manual.



Appropriate airflow is required for this system to operate correctly under normal and fault conditions. The user must provide airflow of 19 CFM for adequate operation if a fan is not included in the configuration purchased from MIDMARK.

WARNING:



DO NOT allow untrained technicians install, modify or otherwise handle this equipment. This equipment is intended to be installed into an Original Equipment Manufacturer's product in a controlled setting with precise work instructions and trained assembly personnel.



DO NOT operate the power system without the covers completely installed and the connectors attached properly. The covers provide safety from potentially dangerous voltages.



Do not connect or disconnect the system while power is applied. Do not open or in any other manner change the access to the internal portion of the system while power is applied.



Do not allow the system to come in contact with fluids. Do not operate the system if wet.

1.3 Conditions of Acceptability



CAUTION: When installed in an end-product, consideration must be given to the following;

- €# Appropriate airflow is required for this unit to operate correctly under normal and fault conditions. Thermal testing must be performed as part of the end-product investigation.
- €# This unit can be installed as an open or closed frame in the end product. Suitable fire enclosure must be provided as part of the end-use system investigation. The component shall be installed in compliance with enclosure, mounting, packing, casualty and segregation requirements of end-use system requirements.
- €# Leakage testing must be performed on end-use system.
- €# IEC 60601-1-4 not performed and must be considered for end-use system.
- €# Clause 15b limitation of Voltage and/or Energy must be performed on end-use system.
- €# Mains AC input fusing may be required on end-use equipment.
- €# DC output short circuit and reverse polarity testing shall be considered on end use equipment.
- €# DC output fusing shall be considered as part of the end-use equipment.
- €# Equipment has not been evaluated for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide; end-use equipment.
- €# Equipment has not been evaluated for use with Oxygen enriched atmospheres; end-use equipment requirement.
- €# Component shall be properly bonded to the main protective earth termination in the end-use system and comply with end-system bonding impedance requirements.
- €# Complies with requirements for US for outside the patient environment. (May require an isolation transformer for use within patient environment as part of end system equipment.)

This product contains electrical components. Observe local, state and federal guidelines for proper disposal. The end product manufacturer should be contacted for procedures. For further information on disposal, contact MIDMARK at 1-800-MIDMARK.



2 System Overview

2.1 Application

The 301 Line of Motive DC Controllers are Medical Grade systems designed specifically for use with Sealed Lead Acid [SLA] Absorbent Glass Matt [AGM] Batteries in Mobile Point of Care [MPOC] products for Hospitals and Long Term Health Care facilities. The product uses microprocessor based technology for intelligent charging, reconditioning, state of charge monitoring and DC power control. It is designed and manufactured to meet EN 60601 Medical Safety Standards and has a compact open or closed frame design for flexibility in hospital retrofit or OEM applications.

2.2 Power

MIDMARK Series 301 Motive DC Controllers uniquely combine the “By-Pass” feature of AC Systems with the high efficiency and long run times of traditional DC Systems. It uses an automatic transfer of load to ensure smooth uninterrupted supply switching from AC Wall power to DC Battery power.

The 301 has the capability of powering multiple DC devices up to a combined load of 150 watts while simultaneously providing 150 Watts of charging power to the battery. The battery choices available for the Series 301 will charge in approximately 5.5 hours. The exact charging time will be dependent on the health of the battery as well as other battery specific variables. The battery will charge to approximately 80% of charge in approximately 4 hours [stage 2 complete; reference below].

2.3 Charging

There are 3 stages of intelligent charging algorithms; bulk, absorption and float. The bulk stage provides the initial charge to the battery using constant current and high voltage. The second stage, absorption, reconditions the battery through a controlled charge with constant voltage and diminishing current. The last stage, float, conditions the battery using a safe constant voltage and low current to accept a complete and full charge.

2.4 Monitoring

The system has an on-board microprocessor that monitors multiple sensors for use with the State of Health [SoH] predictions; DC voltage, DC current, ambient temperature, battery temperature, total charge, discharge amp hours since activation and battery experience. A key monitoring feature is Event Logging which logs key information

each time the battery experiences a specific event. Using the power system's memory, up to 1000 events can be logged and used for diagnostics and maintenance scheduling. Using the host system's memory, the total number of events is limited only by the host system's available storage capacity.

2.5 Alarm

The alarm is an audible buzzer at a frequency of 2.4 kilohertz nominal at an audible intensity of typically 92 decibels at 10 centimeters. The alarm may be enabled or disabled by the user. If disabled, the alarm will not sound for ANY circumstance. The alarm, if enabled, will alarm if the battery power goes below a pre established voltage threshold indicating an imminent need for charging and/or discontinuing computer usage.

2.6 Communication/Software

The system communication software includes two user interfaces; the Main User's interface and the Advanced Functions interface. These interfaces are provided on the display on the host computer. The information provided in these interfaces is ported to the host computer via a standard USB connection between the Series 301 Power Monitor and the host computer. The Main User's interface is also available through a remote display mounted directly to the cart. It is constructed to mimic the display as viewed on the host computer's display. It is essentially identical however it does not include the time to charge/discharge information.

Main User's Interface

The Main User's interface provides a variety of information to the user [typically the Nurse] relating to

1. The current connection as AC or DC
2. Whether the unit is charging the battery

3. Whether the battery charge is low
4. Whether the unit is being shutdown due to insufficient battery charge
5. Whether the unit is recovering severely discharged battery
6. The current charge status of the battery
7. The status of the battery charge to either (1) the time remaining until discharge or (2) the time remaining to full charge

The Main User interface can be resized using the standard window resizing feature.

If this display is cancelled, the “x” in the upper right hand corner is activated; the software will continue to run. The HES logo icon is displayed in the notification area of the windows toolbar.

Advanced Functions

The Advanced Functions screen provides a variety of detailed information to be used for evaluation of the power system and the components attached. It also allows for the System Setup of the different types of batteries, the length to scheduled maintenance and other one time set up parameters.

There are two available Advanced Functions. The Advanced Function used by the user’s IT department or other skilled technician is that which is described in this manual. There is another Advanced Function available to MIDMARK as the manufacturer or, in limited and controlled instances, to the Cart OEM if deemed

necessary by MIDMARK. There are two different passwords providing access to these Advanced Functions.

To completely exit the software and turn off the MIDMARK Series 301 interface to the computer, the user must select the “Software Exit” tab beneath the “File” pull down menu on the Advanced Functions display screen. This will turn off the software and remove the icon from the notifications toolbar.

2.7 Intended Use

The Power System is intended for use within a powered cart application. The system provides a sustainable and rechargeable source of energy for mobile applications. The system is intended for indoor use within an office environment. The system is not intended to experience significant vibration or physical shock. The system is intended to be placed within a protective enclosure provided by the cart manufacturer that will, among other things, eliminate its exposure to liquids or materials that may unintentionally be dropped onto the system.

3 System Description

3.1 Enclosure

The Enclosure is to envelop the components (mother board, power supplies and interface board) and to provide safety. The enclosure is made out of steel and is earth grounded when connected to a wall outlet or other grounded AC source of power [AC source interface is provided by the cart manufacturer].

The enclosure is optional to the use of the system. If the Series 301 enclosure is not used in an OEM configuration, then the OEM's enclosure must provide the essential elements typically provided by the Series 301 enclosure.

3.2 Power Supplies

The power supplies are open frame switching power supplies that provide output power of 150 Watts each with active Power Factor Correction [PFC]. They accept universal inputs from 85 to 265 Volts, 47-63 hertz of AC. The supplies are fully approved [independently] to EN60950 and IEC 60601 Medical Safety Requirements.

3.3 Mother Board

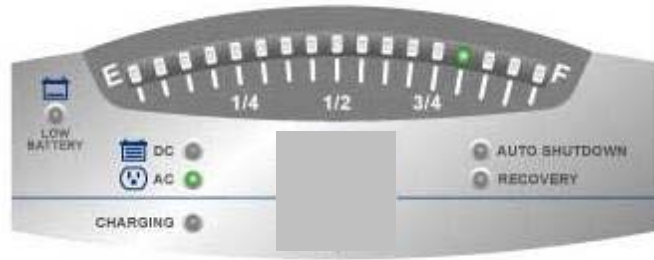
The mother board is the main system element, the primary circuit board, containing the intelligence and the logical connections by which the other components of the system communicate. It is also the location of onboard memory used to store SoH monitoring of events and the operational firmware.

3.4 Interface board

The Interface board consists of multiple connectors providing the main power interfaces to the host computer and the attached components [including an optional remote distribution board interface] as well as the control interfaces; a Universal Serial Bus (USB) connector, Remote display connector, 2 temperature sensor connectors and a fan connector.

3.5 Remote display

The Remote display is the remote user interface representing the information necessary for normal operation of the power system and cart. The Remote display displays, among other items, a gas gauge representation of the charge state of the battery.



Remote Display

3.6 Temperature Sensors

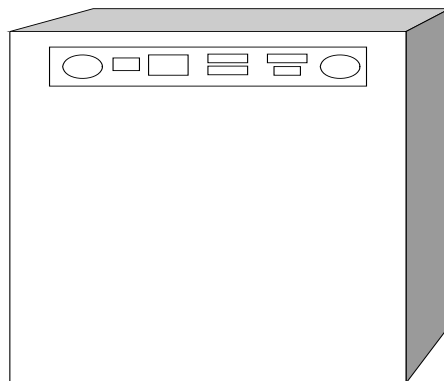
The temperature sensors provide both the ambient temperature of the system controller as well as the internal temperature of the SLA battery.

3.7 Fan Control

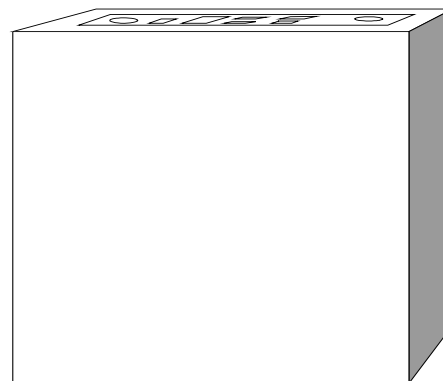
The system provides fan power that is switched to an “on” state when the battery is being charged in stage #1 or stage #2 or if the temperature is above a threshold condition. In all other conditions the fan is in the “off” state.

4 System Connection

The system connection is through an Interface board on the Power System enclosure. The Interface board can be mounted facing one of two directions in relation to a face of the enclosure [reference below]. This allows multiple mounting configurations through the use of the same hardware. In configuration #1, the AC Power is on the left near the USB connection as depicted below while configuration #2 [enabling the use of the other face of the



Front Mount of Interface Board



Top Mount of Interface Board

enclosure for I/O] swaps the AC Power and the “DC Outputs and Battery Outputs” end for end. Each configuration will have the I/O clearly marked. It will be readily distinguishable as well, through the physical differences in the cabling. The DC Outputs and Battery have blue, red and black Anderson® Power Pole connectors while the AC cable, a much heavier gage, has a pigtail.

For Series 301-1001 Controller

AC Power USB Remote display Thermal Sensor I²C bus Thermal Sensor I²C bus DC Output(s) and Battery(s)

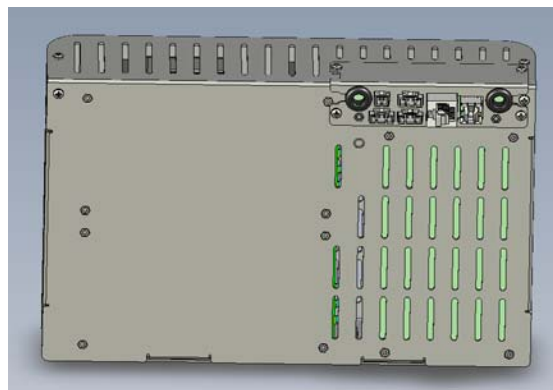
Distribution Brd (Optional) I²C bus Fan

Illustration of Interface Board Depicting System I/O Configuration #1

AC Power Fan Distribution Brd (Optional) I²C bus Remote display USB DC Output(s) and Battery(s)

Thermal Sensor I²C bus Thermal Sensor I²C bus

Illustration of Interface Board Depicting System I/O Configuration #2



**Series 301-1001
(Config #2; Front Mount Shown)**

For Series 301-1003 Controller

AC Power USB Remote display Thermal Sensor I²C bus Thermal Sensor I²C bus DC Output(s) and Battery(s)

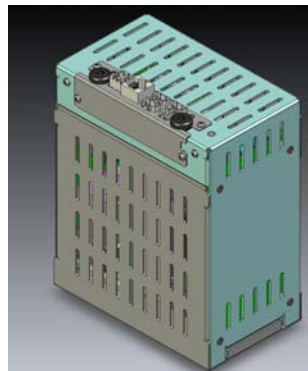
Distribution Brd (Optional) I²C bus Fan

Illustration of Interface Board Depicting System I/O Configuration #1

AC Power Fan Distribution Brd (Optional) I²C bus Remote display USB DC Output(s) and Battery(s)

Thermal Sensor I²C bus Thermal Sensor I²C bus

Illustration of Interface Board Depicting System I/O Configuration #2



Series 301-1003
(Config #1; Top Mount Shown)

We recommend, when possible, to connect the battery to the system prior to providing AC power to the system. This allows the system to reset with a battery attached; a more common configuration.

The diagram below represents the basic system connection. The following paragraphs provide detail regarding each connection.

System Interconnect Figure

4.1 AC Power

AC Power is applied to the system through a medically approved AC power cord. AC Power is assumed to be consistent with standard wall power [European or U.S.]. The delivered system leaves this 3 conductor cable in a pigtail configuration for the OEM's use in the Cart enclosure. A medically approved RFI filter for the AC plug must be used in support of EN60601 EMC requirements. The suggested part is listed below.

tyco
Electronics

CORCOM Product Guide

corcom

For UL544 Health Care Equipment

EAH, EBH Series


UL Recognized
CSA Certified
VDE Approved



EAH Series

This is a new generation of compact medical RFI filters with an IEC socket. A new design in internal structure and manufacturing process makes this series cost effective. This health care series supersedes the H series by providing superior differential mode performance while still maintaining a maximum leakage current of 2 micro amps.

EBH Series

Also a compact medical RFI filter with IEC socket, the EBH series is a cost effective alternative to the H series. Electrically the EBH provides enhanced differential mode performance compared to both the EAH and the H series. These filters provide RFI common and differential mode performance while still allowing medical equipment to meet UL leakage current specifications for medical and dental equipment.

Additional information on UL544 specification is listed in Appendix C.

Note: When using the models with an IEC connector, remember that the leakage current of the companion line cord, GA400, is more significant than that of the filter - which may disqualify this line cord from use in patient care applications.

Electrical Schematic



Specifications

Maximum leakage current, each line-to-ground

@ 120 VAC 60 Hz: 2 μ A
@ 250 VAC 50 Hz: 5 μ A

Hipot rating (one minute):

line-to-ground 1500 VAC
line-to-line 1450 VDC

Operating frequency:

50/60 Hz

Rated voltage (max.):

250 VAC

Minimum insertion loss in dB:

Line-to-ground in 50 ohm circuit

Current Rating	.01	.05	.1	.15	.5	1	5	10	30
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EAH Models

1A	8	21	29	32	42	45	32	30	19
3A	-	5	10	15	25	27	30	27	22
6A	-	-	5	6	19	21	24	20	15
10A	-	-	1	5	9	12	12	12	12

EBH Models

1A	8	21	29	32	42	45	32	25	19
3A	-	5	10	15	25	27	30	27	22
6A	-	-	5	8	17	20	24	23	18
10A	-	-	-	3	8	12	12	12	12

Line-to-line in 50 ohm circuit

Current Rating	1	1.5	5	10	30
----------------	---	-----	---	----	----

EAH Models

1A	5	13	28	32	25
3A	4	6	20	27	28
6A	2	5	19	25	27
10A	1	5	15	22	27

Current Rating	.15	.5	1	5	10	30
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EBH Models

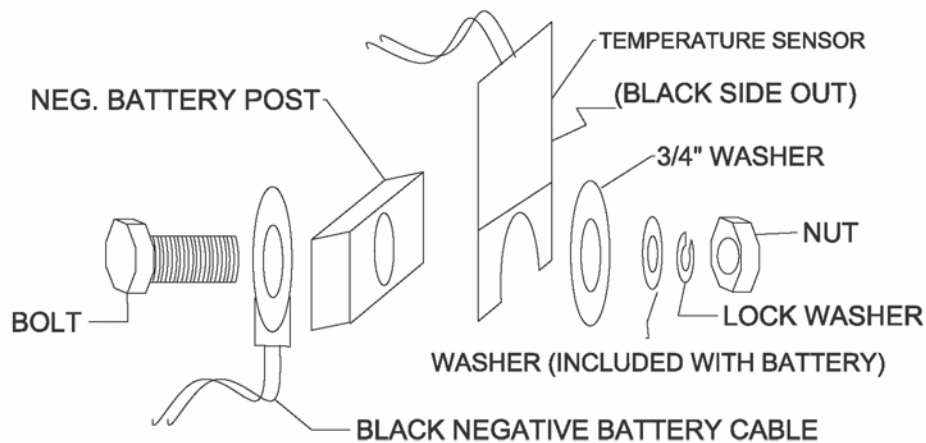
All Ratings	1	10	18	30	31	31
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4.2 Sealed Lead Acid Batteries

The battery (or batteries) is (are) connected to the power system through “in-line” Anderson® Power Pole connectors; positive red and negative black. Two connectors are used for each pole of the battery. If two batteries are used, they must be connected in a “parallel” configuration thereby providing 12 volts to the system.

The cart manufacturer is responsible for the connection from the battery to the Power Poles. The recommended gage of wire for the connection from the battery pole to the Power Pole connector is insulated stranded 16 AWG for each of the two wires per battery terminal.

The system configuration, one or two batteries, will determine if one or two temperature sensors are necessary. The temperature sensors are connected to the negative pole of each battery. The sensors are addressed uniquely thereby providing access to each battery temperature independently.



INSTALLATION INSTRUCTIONS

- 1) PUT THE BOLT INCLUDED WITH THE BATTERY THROUGH THE NEGATIVE BATTERY CABLE
- 2) THEN INTO THE NEGATIVE BATTERY POST
- 3) PLACE THE BATTERY TEMPERATURE SENSOR ON OPPOSITE SIDE OF THE NEGATIVE BATTERY POST
- 4) INSERT THE 5/16" INNER DIA. 3/4" OUTER DIA. WASHER AFTERWARDS
- 5) INSERT THE WASHER INCLUDED WITH THE BATTERY
- 6) INSERT LOCK WASHER INCLUDED WITH THE BATTERY
- 7) INSERT NUT AND TIGHTEN

The battery temperature sensors are controlled using an I²C bus. Each item is specifically addressed therefore the connection to each can be through any I²C

connector. In the above diagram, therefore, any I²C connection can be interchanged with any other without any functional effect.

4.3 Host Computer

The host computer connects to the power system through a standard USB connection. The cart uses a standard USB cable and connector to interface to the power system USB header.

When connecting the system to the host computer it may take up to 30 seconds for Windows to recognize the system and begin communication. If this does not occur, please contact the manufacturer.

If the host computer is a laptop and its associated battery is left installed, the Series 301 will not operate correctly. The time estimations for charging and discharging will be effected by the requirement to charge and discharge the laptop battery.

While calling for charge current to charge the laptop battery, the System 301 will over estimate the current necessary to support the loads attached to the system and will not factor in the reduced current need after the laptop battery reaches full charge. This will result in a significant error during the discharge cycle as the laptop battery requires recharging from the System 301 battery.

If the laptop battery is in place while charging, the Series 301 will estimate the time remaining to discharge accurately however the total current required to charge both the laptop battery and Series 301 battery[s] may exceed the available wattage available from the system. This may cause the system to shut down due to over current draw [reference error conditions in future sections] or it may cause the Series 301 batteries to charge more slowly than anticipated due to the unanticipated draw from the laptop battery.

It is strongly recommended to remove the laptop's battery prior to use with the Series 301 system. The time available to the PC is unchanged since the Series 301 battery depletion will be similar regardless of the laptop battery's presence; the system will require the Series 301 batteries to be recharged regardless of the state of the laptop battery.

4.4 Remote display

The remote display uses a standard Category 5 connection (CAT5) to the system; **straight through type [not patch type]**. This is used for the convenience of a standard cable and does not infer that the system is compatible for use within a networked system.

4.5 DC Output Power

The DC Output Power is provided through two "in-line" Anderson® Power Poles; Red positive and blue negative.

System Interconnect Figure

4.6 Fan and Thermal Sensor

The optional remote distribution board and thermal sensor connections are interchangeable. They are addressed through an I²C bus protocol and will operate appropriately with any connection to the bus.

The Thermal sensors are marked "94" or "Bat 1" for Battery 1 and "98" or "Bat 2" for Battery 2, in concert with their appropriate permanent addresses as manufactured, if more than one sensor is necessary. These channels will correspond with the designations on the Advanced Function Screen references. The User should note which of the batteries is designated as 1 and which is designated as 2 prior to final OEM system assembly. **DO NOT** use two battery sensors of the same address in the same system. This will cause bus address conflicts and will not provide reliable data.

The connector type is that which is meant for few connect/disconnect cycles and should not be abused through repeated connections.

5 Installation of Software

Host PC Software

The licensed Host software will be provided by MIDMARK for customer use. The PC software is easy to install from a CD. The CD will prompt the user through typical Windows setup instructions.

It is critical that the appropriate driver is loaded for the MIDMARK product. If the driver is not loaded appropriately the system will not function. The driver is part of the software provided.

6 Initial Testing and Error Conditions

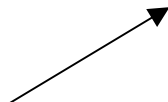
6.1 Remote display

The Advanced Function screen provides a convenient LED Test. This test will cycle through all of the LEDs on the Remote display providing an easily recognizable sequence of on/off for each. A failed LED will not light. If the LEDs are not sequencing, then the processor or a connector has failed.

6.2 Battery

If AC power is not connected and the battery is appropriately connected and has charge, then the Pop Up on the host computer [Main User's Interface Screen] will provide a time to discharge. Also, the LED indicator on both the Remote display and the Pop Up will indicate DC Power. The time to discharge calculation may take up to 5 minutes to display due to the delay in the power system evaluating data and preparing a state of charge [SoH] approximation. Prior to evaluation, the time to discharge may display solid "--marks with a flashing on/off colon. The flashing on/off colon indicates that the system is operational and communicating.

The LOW BATTERY indicator will activate if the battery power is below a prescribed limit.



Main User's Interface

If the batteries are not connected and the AC power is connected to the wall outlet, the display will show AC power and Recovery. The system is trying to recover since the disconnected batteries indicate, since they are not connected, a very low voltage battery condition. After a time threshold is reached without battery voltage increasing, the charging system stops trying to recover the batteries and indicates a Charger Time Out or Bad Battery condition. This error will be provided to the event log.

6.3 AC Power

When the system is plugged into a working standard AC Outlet [the end use system provides the interface to wall power], the WALL/AC indicator and the CHARGING indicator will be active on both the Remote display and the Pop Up. The CHARGING indicator will flash while charging and will turn off if the battery is fully charged.

The time to charge estimation may take more than five (5) minutes to calculate and stabilize.

6.4 System Communication with the Host

The system communication is operational if the host Pop Up displays valid information from the system. If the communication is not operational, a USB error message will be displayed, or, the Pop Up will display static information.

6.5 Sleep Mode

Sleep Mode is a very low power state used for long-term storage, shipping, and protection against over-discharging a battery. In this state the Remote display LEDs and USB port do not operate.

The System will enter Sleep Mode under the following conditions:

1. The battery is connected to an unpowered system – this allows a system to be stored or shipped while the battery is connected without discharging the battery.
2. The battery charge level is very low – sleep mode is automatically entered to prevent further discharge of the battery.
3. Software command from the Advanced Functions Screen. This command may be used to preserve battery charge if the system will be stored without AC power for an extended period.

The system will wake up from Sleep Mode when AC power is applied. Remote display and USB operation are restored. The system will remain awake as long as a battery with sufficient charge level is connected.

6.6 Error Conditions

The Series 301 has three error conditions. The event log will record each error condition if it occurs. The error conditions are Over Temperature, Over Load and Charger Time Out. The Remote Display will simultaneously flash both the Recovery LED and either the DC or AC LED depending on whether the system is running off of battery or AC power.

6.6.1 Over Temperature

If any of the temperature sensors sense a temperature above a prescribed threshold, the system isolates the battery[s], no more current flows in or out, until the system is plugged into an available AC wall outlet. If it is already plugged into a wall outlet, it must be unplugged and re plugged to clear the error condition.

6.6.2 Over Load

If the system senses a current draw in excess of fifteen [15] amps for the load devices, the system isolates the output until the system is plugged into an available AC wall outlet. If it is already plugged into a wall outlet, it must be unplugged and re plugged to clear the error condition.

6.6.3 Charger Time Out or Bad Battery

If the system senses that the charge time has exceeded reasonable limits, the system isolates the battery[s], no more current flows in or out, until the system is plugged into an available AC wall outlet. If it is already plugged into a wall outlet, it must be unplugged and re plugged to clear the error condition.

6.7 System Reset

It would be highly unusual for the system to require a reset. There is a very unique set of circumstances that could affect the performance of the system.

If the system were to “hang up” and the Remote Display was inconsistent with the pop up Main User Screen on the PC, it would indicate that the User Interface was no longer performing correctly. In this situation, the following sequence of events should be followed until the system is operating correctly.

- €# Plug the unit into the wall; assess if the unit has recovered
- €# Unplug the unit from the wall; assess if the unit has recovered
- €# If possible, select the “Exit Software” choice from the “File” pull down menu on the Advanced Functions screen. Cycle the USB connection to the PC. Restart the software; assess if the unit has recovered.
- €# Cycle the USB connection to an alternate USB connection on the PC; assess if the unit has recovered.

If the system were to display that the USB connection has failed. Simply wait a few seconds for it to recover. If it does not recover, cycle the USB connection on the PC. If this does not recover the communication [after waiting for 10 or more seconds], then cycle the USB connection to another USB connection on the PC. If these events do not recover the communications, then resort to the steps listed in the paragraph above.

IF the Remote Display is not lit, regardless of the state of the PC interface display, this means that the controller is at fault. If it is not the connection between the Remote Display and the controller [cycle each connection to check] then the product should be returned for investigation.

7 Operation

7.1 Turn On

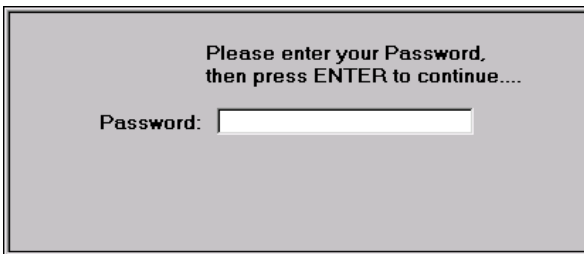
After the initial assembly, connection of the system and the installation of the user software the user must power on the unit and open the Advanced Function Screen to provide the initial setup parameters for use.

The unit may be in “Sleep Mode” for shipping and storage purposes, or if the battery is disconnected or at a very low charge level [reference the next section for explanation]. To Power On the system and bring it out of sleep mode, it must be initially connected to an AC Outlet. Once the Remote display LEDs are illuminated and the battery has sufficient charge, AC power may be removed and the unit will maintain operation.

To open the Advanced Function Screen, the user must select the “ADVANCED” button on the Main User’s Screen.

Main User's Interface

The system will ask for a password to allow access to the Advanced Function Screen. The password will be set by the manufacturer and disclosed to the appropriate personnel.



Please enter your Password,
then press ENTER to continue....

Password:

Password Entry Screen

7.2 Sleep Mode

Sleep Mode is a very low power state used for long-term storage, shipping, and protection against over-discharging a battery. In this state the Remote display LEDs and USB port do not operate.

The System will enter Sleep Mode under the following conditions

1. The battery is connected to an unpowered system – this allows a system to be stored or shipped while the battery is connected without discharging the battery.
2. The battery charge level is very low – sleep mode is automatically entered to prevent further discharge of the battery.
3. Software command from the Advanced Functions Screen. This command may be used to preserve battery charge if the system will be stored without AC power for an extended period.

The system will wake up from Sleep Mode when AC power is applied. Remote display and USB operation are restored. The system will remain awake as long as a battery with sufficient charge level is connected.

7.3 System Set Up

The Advanced Function Screen has a “Series 301 Setup” panel found under “Setup” in the main menu bar. This must be selected to access the edit of the initial system parameters.

The Setup parameters are stored in the Series 301. If the PC is changed, the Setup parameters remain with the Series 301. The email parameters are the only exceptions. The email parameters remain with the PC.

Advanced Function Interface

The user will then have several setup options available through the pull down selection. The user must provide various configuration parameters and system settings defining the configuration and settings for the specific application. The following paragraphs will address each of the relevant screens and the associated parameter settings.

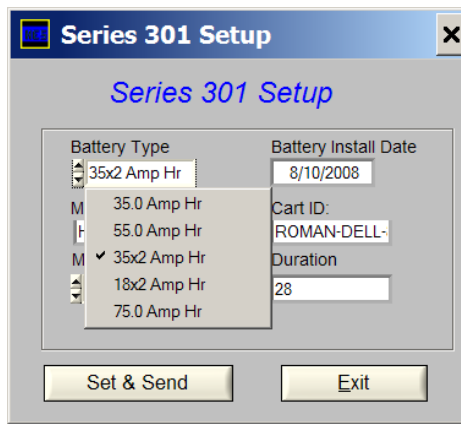
7.3.1 Series 301 Setup

Series 301 Setup Screen

The screenshot shows a window titled "Series 301 Setup" with a close button (X) in the top right corner. The window content is titled "Series 301 Setup" in blue text. Below the title, there are several configuration fields arranged in two columns:

Battery Type	Battery Install Date
35x2 Amp Hr	8/10/2008
Model Type	Cart ID:
Hes 102	ROMAN-DELL-
Maintenance Cycle	Duration
In Weeks	28

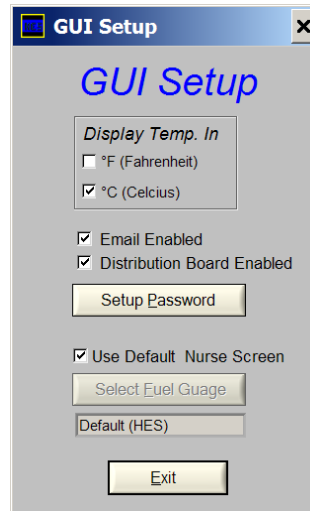
A dropdown menu is open for the "Maintenance Cycle" field, showing two options: "In Weeks" (which is selected with a checkmark) and "Amp Hours". At the bottom of the window, there are two buttons: "Set & Send" and "Exit".



The System Setup screen allows the user to enter data containing the identity of the system components. This data includes: types of battery, service date, model type, cart ID, maintenance cycle and duration. The following is a brief description of each field.

- €# Set Battery; this field is used to select the proper battery type that is installed. A pull down menu provides the supported battery sizes.
- €# Service Date: The Service date [current date] is automatically updated when the user completes the required fields and activates the “SET & SEND” button.
- €# Model Type: This field is used to enter the battery Model Type.
- €# Cart ID: This field is used to enter the Cart ID. The Cart ID may be the specific serial number of the cart or the cart designator. This field is user defined.
- €# Maintenance Cycle: This menu allows the user to select the maintenance cycle. There are two cycle types available. This selects the method of alerting the supporting technician to the need for scheduled maintenance.
 1. Number of weeks; counts the number of weeks from initialization
 2. Amp Hours: counts the total number of amp hours from initialization
- €# The value represented in the “DURATION” text box represents the threshold value of the chosen maintenance cycle. Only integer values are acceptable. Upon reaching the set threshold, an alert is automatically generated.
- €# Set & Send: This icon button is used to send the information to the device and to save it to a file to be read when using the maintenance screen.
- €# Exit: This icon is used to close this screen and return to the diagnostic screen

7.3.2 GUI Setup

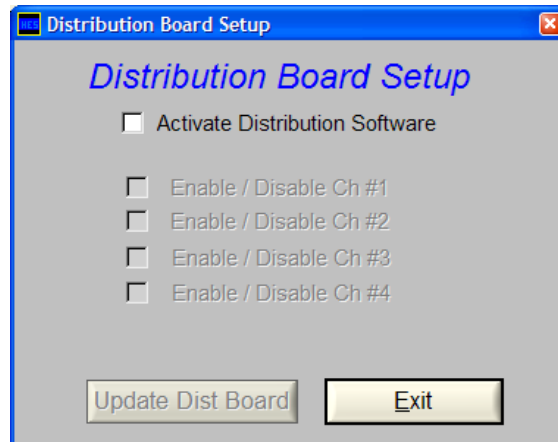


GUI Setup Screen

The GUI Setup screen allows the user to

- €# Change the temperature display parameter between Fahrenheit and Celsius
- €# Activate the Email functionality of the system
- €# Activate the optional distribution board
- €# Change the default Diagnostic Screen Access password to a user defined password
- €# Change the Main User Interface Screen [also referred to as the Nurse Screen] from the default screen to a user defined [OEM Logo] screen that would be developed by HES and made available. This screen may look graphically different. This alternate screen would be defined and specified by the user prior to shipment of the equipment and would be available in the software package.

7.3.3 Distribution Board Setup [optional]



The Distribution Panel provides a secondary DC power interconnect that is remote to the power system enclosure. This remote panel provides four DC power output channels that can be switched on or off from this screen [if this option is purchased].

If active, the Advance Function Screen provides a corresponding active green LED beside the channel that is active. Further, the Advanced Function screen provides the ability to check the current of each of these channels by selecting the channel in question, to the right, beside the meters. The current and voltage of the channel selected will be represented by the meters on the Advanced Function Screen.

- €# The “Update Dist Board” will send the selections of activation and channel enable/disable to the power system.

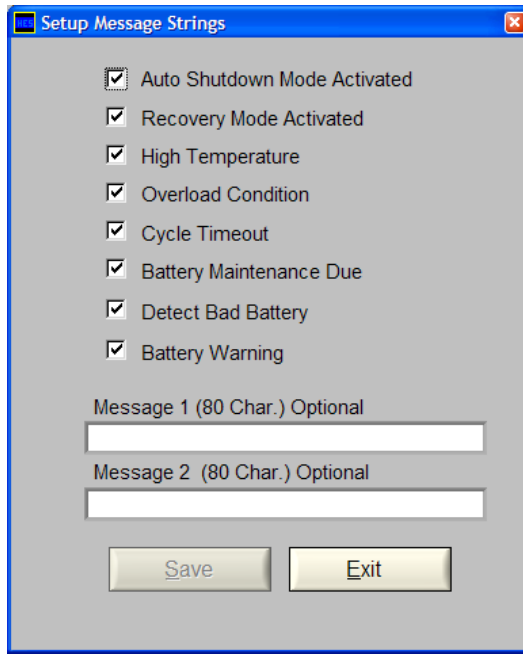
- €# The updates will be retained in nonvolatile memory. The last settings, therefore, will be present until the “Update Dist Panel” is activated. The screen does not represent the state of the current settings.

7.3.4 Email Setup



Email Setup Screen

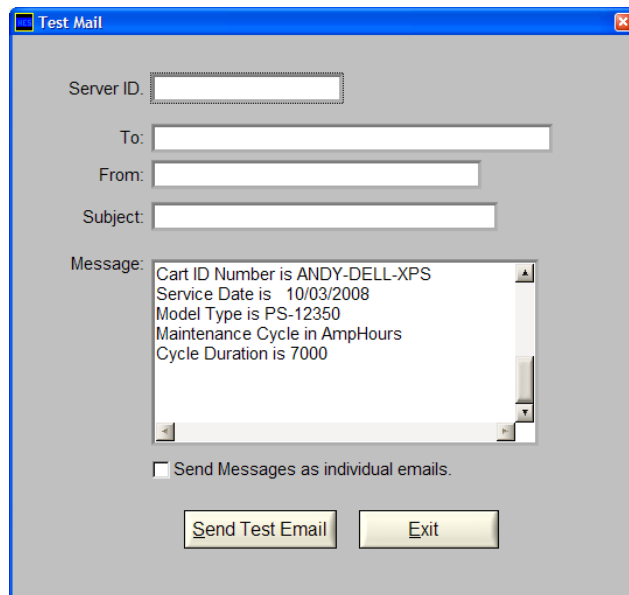
- €# The IP Address is the address of the mail server of the network which this device is within.
- €# The Senders Email is the address assigned by the network administrator that represents the Cart/Power System creating the email [multiple email addresses may be used]
- €# The Recipients Email is the address of the location that the email alerts will be sent to.
- €# The Subject is a user defined field that will be in the “Subject” field of the email
- €# The Message Options button icon opens the following screen



Setup Message Screen

The various selections within the Setup Message screen represent events that, if achieved, trigger an email alert. The email will be structured as described earlier. The message sections are user definable optional fields.

7.3.5 Test Email



Test Email Screen

This function provides a testing capability for the user to evaluate the information that has been provided in setting up the email.

7.3.6 Sleep Mode Activation

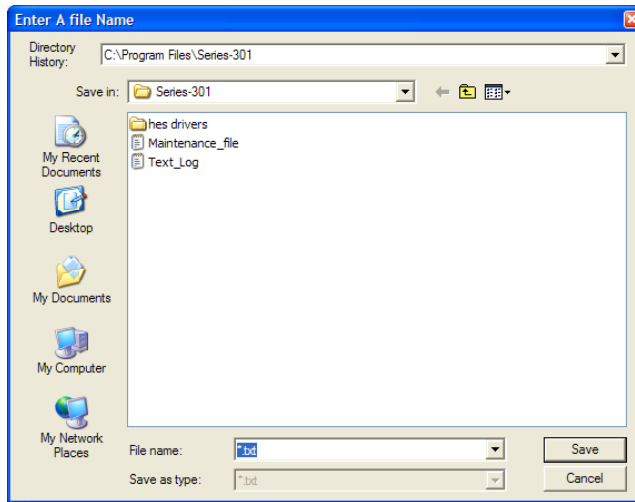
This provides the user the ability to put the Series 301 into Sleep Mode through the use of software control. If activated, the user has 10 minutes to shutdown the system prior to the system entering sleep mode.

7.3.7 Buzzer

This allows the user to turn the Buzzer on or off. If the buzzer is selected as “disabled”, the buzzer will not work under any circumstance. If “enabled”, the buzzer will be active if the prescribed parameters are met indicating action must be taken to either (1) charge the battery by plugging into AC wall power or (2) or shut the system down to avoid the risk of lost data.

7.3.8 Upload EEPROM Data

This setup function is provided for the manufacturer of the Series 301 to upload new EEPROM data, event log data, from the system to the host PC. The data is located in a file within the HES folder. This provides for an upload of ALL of the available event log data. The Event Log feature displays only the most recent events on the screen.



7.4 Charging

Subsequent to initializing the system, the Series 301 will either be placed in the charging or discharging state. In the charging state, the AC power connection is plugged into the available wall AC outlet. During this state, the user has access to both the Remote display and the Main User's Screen Pop Up; both of which are displaying key performance data.

Note: It is recommended that upon initialization, a full charge is applied to the battery prior to the initial use of the cart.

Note: It is recommended that the battery is stored in full, or close to full state for optimum longevity of the battery.

Main User's Interface

- €# The Gauge; this provides the current charge of the battery. As the battery charges, the illuminated LED indicates the level of charge in the battery.
- €# Time Remaining; this provides an estimate of the time remaining before the battery has completed the charge cycle. This is an estimate based on a variety of parameters including the state of charge of the battery. This indicator is available on the Pop Up only.
- €# Wall/AC; this LED indicates that the system power is coming from the AC-wall outlet.
- €# Charging; this LED is displayed if the battery is in the charging state. The LED blinks while charging and is off if the battery is fully charged.
- €# Auto Shutdown; this LED represents that the battery has entered into an auto shutdown mode due to low battery power. This LED will not become active while charging.
- €# Recovery; this LED is used to indicate that the battery has entered an over discharged condition. This happens when the battery power is detected to be below a predetermined level of charge. The Deep Discharge Reconditioning is an algorithm to charge batteries in a “RECOVERY” mode; a very controlled slow charge that charges the battery without creating a run away or high temperature condition. This unique process provides the best chance to recover a battery that has been over discharged. This process may take 24 hours or more.

There are two buttons on the Main User’s Screen Pop Up; these buttons are:

- §’ Advanced; this allows the user to enter into the Advanced Function screen. After selecting this icon, the user is prompted to enter a password. The Main User is not expected to be allowed access to the Advanced Function screen. The intent of the Advanced Function Screen is to provide a tool for a trained technician.
- §’ Exit; this icon is used to exit the program. This does not turn the program off, it simply eliminates the Main User’s interface screen. The program continues to run and provides an icon in the notification tool bar that can be activated to turn the Main User screen back on again.

If charging with a notebook battery in place, the load current may change significantly based on the charge algorithm required by the notebook. This may affect the algorithms used to predict charge time remaining. After the notebook battery reaches a full charge, the Series 301 will predict the charge time remaining more accurately and with more stability. **We recommend, if using a laptop with the Series 301, that the laptop is used without its internal laptop battery installed.**

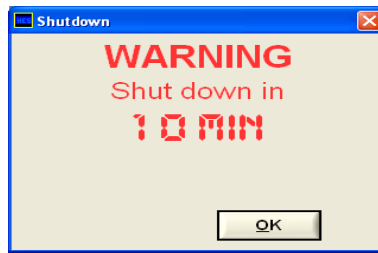
7.5 Discharging

The Discharging state is an alternative state that the system can be in after initialization. The Discharging state is when AC Power is unplugged from the wall outlet. The battery will be discharging as it is used by the components available on the cart consuming the available battery energy.

Main User's Interface

- €# The Gauge; this provides the current charge of the battery. As the battery charges, the illuminated LED indicates the level of charge in the battery.
- €# Time Remaining; this provides an estimate of the time remaining before the battery is completely discharged. This is an estimate based on a variety of parameters including the state of charge of the battery. This indicator is available on the Pop Up only.
- €# Low Battery; this LED is displayed if the battery charge is reduced to a preset threshold determining low battery level. If the Gauge indicates one of the lower 3 level indicators, then the battery is low.
- €# DC; this LED indicates that the system power is coming from the batteries.
- €# Wall/AC; this LED indicates that the system power is coming from the AC-wall outlet. This will not be active in the discharge mode.
- €# Charging; this LED is displayed if the battery is in the charging state. The LED blinks while charging and is off if the battery is fully charged. This will not be active in the discharge mode.
- €# Auto Shutdown; this LED represents that the battery has entered into an auto shutdown mode due to low battery power.

A dialog box appears warning the user;

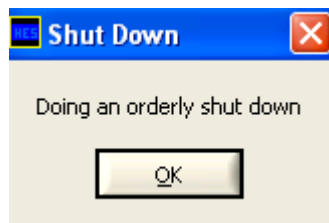


Shut Down Warning

When the LED begins to flash, it indicates that there are less than 5 minutes before the system will perform an orderly shutdown. A dialog box appears warning the user that 5 minutes are remaining will appear. [The dialog box is identical to the 10 minute dialog box except it references 5 minutes.]

There will also be audible alarm from the power system that will sound every 10 seconds until the system shuts down.

If the user fails to turn the system off, the system will perform an orderly shutdown and the following dialog box will appear;



Shut Down in Process

Prior to the Auto Shutdown routine, if the low battery threshold is reached, the following dialog box will appear to prompt the user to plug in the power system to charge the battery. If this is not done, the Auto Shutdown sequence begins.



Low Battery Prompt

€# Recovery; this LED is used to indicate that the battery has entered an over discharged condition. This happens when the battery power is detected to be below a predetermined level of charge. The Deep Discharge

Reconditioning is an algorithm to charge batteries in a “RECOVERY” mode; a very controlled slow charge that charges the battery without creating a run away or high temperature condition. This unique process provides the best chance to recover a battery that has been over discharged. This process may take 24 hours or more.

There are two buttons on the Main User’s Screen Pop Up; these buttons are:

- §’ Advanced; this allows the user to enter into the Advanced Function screen. After selecting this icon, the user is prompted to enter a password. The Main User is not expected to be allowed access to the Advanced Function screen. The intent of the Advanced Function Screen is to provide a tool for a trained technician.
- §’ Exit; this icon is used to exit the program. This does not turn the program off, it simply eliminates the Main User’s interface screen. The program continues to run and provides an icon in the notification tool bar that can be activated to turn the Main User screen back on again.

If a laptop with an internal battery is used with the Series 301 power system, the laptops battery may request higher or lower current than the laptop is using to either charge its internal battery or to run from its internal battery. This configuration will operate but the algorithms in the Series 301 will not work effectively in regard to time remaining estimations. **We recommend, if using a laptop with the Series 301, that the laptop is used without its internal laptop battery installed.**

Remote Display Summary Diagram

8 Field Diagnostics

The HES Series 301 provides access to an interface screen that provides information concerning

- €# CURRENT OPERATIONAL PARAMETERS
- €# EVENT LOG
- €# BATTERY MAINTENANCE SCHEDULE
- €# DATA LOGGER; HISTORY OF USE
- €# REMOTE DISPLAY LED TEST
- €# FAN TEST
- €# BUZZER TEST

Advanced Functions Screen Interface

8.1 Advanced Functions Description

This screen contains various system information, configurations and settings.

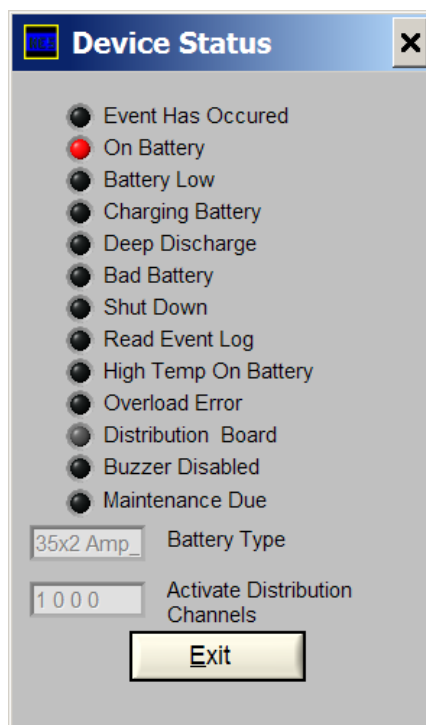
8.2 Pull Down Menus

There are four pull down menus (1) File, (2) View, (3) Setup and (4) About. The File option provides an exit back to the Main Menu and the ability to terminate the software.

The Setup Option is described in earlier sections.

The About Option provides information regarding the developer of the software and the current revision being used.

The View Option provides the following screen.



View Screen

The View Screen provides a summary view of the current state of the system.

8.3 Gauge and LED Indicators

The Gauge and LED Indicators are the same as found on the Main User's pop-up screen.

8.4 Thermal Sensors

There are up to three thermal sensors. The top most thermometer display is the ambient internal temperature of the Power System enclosure. The second and the optional third are the temperature of the respective posts of the 1st and 2nd battery [Battery #1 and Battery #2 respectively]. The sensors display the current temperature. If the temperature rises beyond the prescribed threshold, the bar will change color from green to red to indicate a risk. If the heat continues to rise beyond a further threshold, the system will automatically shut down, provide a warning pop up on the host PC and provide an event describing system "overheat condition". Also, the Remote display will flash both the "recovery" LED and either AC or DC LEDs, depending on whether the system is charging or discharging, when an overheat condition is met.

8.5 DC Voltmeter

The DC voltmeter is used to display the Power Supply generated [Load] DC voltage or the Battery voltage in either charge or discharge state.

The displayed measurement is dependent upon the source selected [Output] just to the right of the Amp meter.

8.6 Amp Meter

The Amp Meter displays the current being consumed by either the load or the battery when charging. The measurement displayed is dependent upon the source [Output] that is selected just to the right of the Amp meter.

8.7 Output

There are two Output selections. The first, and the default, is the Load current and the voltage created from the AC power through the power supply. The second is the battery voltage and current.

8.8 System Diagnostics

8.8.1 Events Log

This is a linked icon on the event pop up screen described in a later section.

8.8.2 Maintenance Schedule

This is a linked icon to the Maintenance pop up screen described in a later section.

8.8.3 Data Logger

This is a link to the Data Logger screen described elsewhere in this document.

8.8.4 LED Test

This provides an LED test for the user to quickly verify the operation of each LED. This test turns each LED on and off sequentially on the remote display.

8.8.5 Current Watts

This is the calculated estimate of the power, in watts, available in the battery.

8.8.6 Firmware Version

This is the current version of the device operational firmware.

8.8.7 GUI Version

This is the current version of the device graphical user interface version.

8.8.8 Exit

This icon returns control to the Main User's screen.

8.9 Event Log Screen

The screenshot shows a window titled "Event Handler" with a close button in the top right corner. Below the title bar is a yellow "Exit" button. The main area contains a table with the following data:

Date	Time	Type	Charge	Load Volts	Load Amps	Batt Volts	Batt Amps	Controller Temp	Batt. #1 Temp	Batt. #2 Temp
6/5/2008	13:36:4	On AC	100%	3.11	0.00	13.17	33.33	24	25	24
6/5/2008	13:36:34	Full Batt	100%	14.60	0.00	14.60	0.19	24	25	25
6/19/2008	15:23:44	power-up	100%	6.63	0.00	14.58	55.86	28	0	23
6/19/2008	15:23:44	On AC	100%	7.62	0.00	14.57	48.87	28	0	23
6/19/2008	15:24:24	Full Batt	100%	14.63	0.00	14.66	0.00	28	0	23
6/19/2008	15:47:24	On Batt	100%	13.63	0.08	13.63	0.07	29	0	23
6/20/2008	7:58:48	power-up	100%	1.66	0.00	13.13	9.37	23	0	24
6/20/2008	7:58:48	On AC	100%	3.09	0.00	13.13	8.19	23	0	24
6/20/2008	7:59:28	Full Batt	100%	14.58	0.00	14.60	0.24	24	0	24
6/23/2008	9: 1:24	power-up	100%	5.63	0.00	13.59	0.00	30	0	24
6/23/2008	9: 1:24	On AC	100%	6.63	0.00	13.59	0.00	30	0	24
6/23/2008	9: 2: 4	Full Batt	100%	14.67	0.02	14.67	0.00	30	0	24
6/23/2008	9:32: 6	power-up	100%	5.78	0.00	14.25	0.00	30	0	24
6/23/2008	9:32: 6	On AC	100%	6.84	0.00	14.25	0.00	30	0	24
6/23/2008	9:32:46	Full Batt	100%	14.69	0.02	14.69	0.00	30	0	24

Event Log Screen

The Event Log function provides the user with a tabular view of the sequence of events experienced by the power system. Events depicted are items such as battery charge, low battery, shut down and a variety of others.

Exit; this icon allows the user to terminate this screen and return to the Advanced Functions screen.

8.9.1 Event Log File

All of the events from the device are converted to ASCII text and then automatically saved to "Log_file.csv" in the "Series 301" folder under Program Files. If the log file already exists, the data is appended to the file. If the file does not exist, the file is created and then the header is written before the function starts to read each of the events.

The event log file has a ".csv" extension allowing it to be loaded into Excel; a sample of which is shown below.

Sample of an Event Log loaded into Excel

The screenshot shows an Excel spreadsheet titled 'log_file.csv' with a 'Battery Cycle Profile' table. The table has 15 columns: Date, Time, Type, Num, Status, Voltage, Current, Charge, Time, R-Vol, R-Cur, Temp1, Temp2, and Temp3. The data consists of 26 rows of battery cycle records, each with a date of 2/1/2007 and various time, status, and temperature readings.

Date	Time	Type	Num	Status	Voltage	Current	Charge	Time	R-Vol	R-Cur	Temp1	Temp2	Temp3
2/1/2007	9:43:42	On A	1	0x8000	1315	13	1378	60	8192	1	55	35022	2311
2/1/2007	9:49:44	Batt Ch	2	0x9000	1297	13	1378	60	24576	2	55	35384	2311
2/1/2007	10:38:14	On A	3	0x8000	1318	13	1398	60	8192	3	55	36294	2311
2/1/2007	10:38:15	Batt Ch	4	0x9000	1318	13	1398	60	24576	4	55	36295	2311
2/1/2007	10:39:14	On A	5	0x8100	1319	13	1398	60	8192	5	55	36354	2311
2/1/2007	10:39:14	Batt Ch	6	0x9100	1318	13	1398	60	24576	6	55	36354	2311
2/1/2007	10:40:0	On A	7	0x8100	1313	13	1398	60	8192	7	55	36400	2311
2/1/2007	10:40:1	Batt Ch	8	0x9100	1313	13	1398	60	24576	8	55	36401	2311
2/1/2007	11:18:1	On A	1	0x8000	1299	13	1408	60	8192	1	55	40681	2311
2/1/2007	11:18:2	Batt Ch	2	0x9000	1299	13	1408	60	24576	2	55	40682	2311
2/1/2007	12:22:41	On A	3	0x8000	1307	12	1433	60	8192	3	55	44561	2311
2/1/2007	12:22:43	Batt Ch	4	0x9000	1307	12	1433	60	24576	4	55	44563	2311
2/1/2007	12:25:56	On A	5	0x8100	1321	13	1433	60	8192	5	55	44756	2311
2/1/2007	12:25:58	Batt Ch	6	0x9100	1319	13	1433	60	24576	6	55	44758	2311
2/1/2007	12:30:58	On A	1	0x8000	1321	13	1433	60	8192	1	55	45058	2311
2/1/2007	12:32:15	On A	2	0x8000	1311	13	1433	60	8192	2	55	45135	2311
2/1/2007	12:32:15	Batt Ch	3	0x9000	1311	13	1433	60	24576	3	55	45135	2311
2/1/2007	12:34:18	On A	4	0x8000	1321	13	1433	60	8192	4	55	45258	2311
2/1/2007	12:37:56	On A	5	0x8100	1307	13	1433	60	8192	5	55	45476	2311
2/1/2007	12:37:56	Batt Ch	6	0x9100	1307	13	1433	60	24576	6	55	45476	2311
2/1/2007	13:1:15	On A	7	0x8100	1321	12	1443	60	8192	7	55	46875	2311
2/1/2007	13:1:15	Batt Ch	8	0x9100	1321	12	1443	60	24576	8	55	46875	2311
2/1/2007	13:3:5	On A	9	0x8100	1322	13	1443	60	8192	9	55	46985	2311
2/1/2007	13:3:5	Batt Ch	10	0x9100	1322	13	1443	60	24576	10	55	46985	2311
2/1/2007	13:5:46	On A	11	0x8100	1319	13	1443	60	8192	11	55	47146	2311
2/1/2007	13:5:46	Batt Ch	12	0x9100	1321	13	1443	60	24576	12	55	47146	2311

9 Maintenance

9.1 Maintenance Screen

The 'Maintenance Screen' dialog box contains the following information:

- Maintenance Schedule**
- Battery Install Date: 8/10/2008
- Battery Type: 35x2 Amp Hr
- Model Type: Hes 102
- Cart ID: ROMAN-DELL-86
- Maintenance Cycle: 28 Weeks
- Percentage of Usage (Weeks): A progress bar showing approximately 20% usage.
- Exit button

This screen is an information screen and provides the technician with information of the last maintenance that was performed on the device.

The data on this screen is:

1. The date of the last service
2. The type of battery
3. The battery model installed
4. The Cart ID
5. The maintenance schedule event
6. A bar graph indicating age of the battery in weeks or amp hours

Exit; this icon is used to exit the screen and return to the diagnostic screen.

9.2 General Maintenance

The Series 301 system requires no calibration or periodic maintenance. Regular cleaning is not necessary. There are no materials consumed through operation. Product failure or product modification/update must be performed or authorized by HES or its certified agent.


The end use system may require maintenance that may affect the Series 301 system; fan cleaning for example.

There are no serviceable parts within the system except the coin cell battery. The system uses a replaceable Lithium coin cell battery to retain date information however; its longevity is theoretically 45 years based on the current draw required. The manufacture's represented shelf life is 10 years however; therefore the battery may require replacement at approximately 10 years. The failure of the battery is non critical. Replacement of this battery should be done by a trained technician or the product may be returned to HES. The battery is as follows;

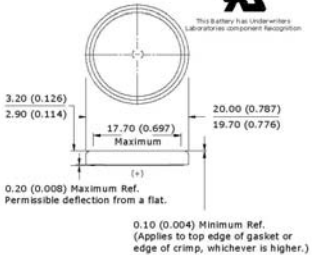
PRODUCT DATASHEET

Energizer
1-800-383-7323 USA/CAN
www.energizer.com

ENERGIZER NO. CR2032



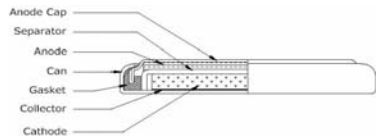
Industry Standard Dimensions
mm (inches)



Specifications

Classification: "Lithium Coin"
Chemical System: Lithium / Manganese Dioxide (Li/MnO₂)
Designation: ANSI / NEDA-5004LC, IEC-CR2032
Nominal Voltage: 3.0 Volts
Typical Capacity: 240 mAh (to 2.0 volts)
(Rated at 15K ohms at 21°C)
Typical Weight: 3.0 grams (0.10 oz.)
Typical Volume: 1.0 cubic centimeters (0.06 cubic inch)
Max Rev Charge: 1 microampere
Energy Density: 198 milliwatt hr/g, 653 milliwatt hr/cc
Typical Li Content: 0.109 grams (0.0038 oz.)
UL Listed: MH12454
Shipping: For complete details, please reference:
Global (except US): Special Provision A45 of the International
Air Transport Association Dangerous
Goods Regulations
United States: 49 CFR 173.185

Cross Section



Anode Cap
Separator
Anode
Can
Gasket
Collector
Cathode

9.3 Battery Maintenance

The main SLA battery[s] will need to be replaced periodically as they lose their ability to be recharged. To accomplish this task please perform the following.

- €# Unplug the system from AC wall power
- €# On the Advanced Functions display, under the file pull down menu, choose the “software exit” selection
- €# Turn off the PC and all other devices powering the system
- €# Disconnect the battery[s] from their harness and remove from the system
- €# Reconnect new battery[s] to the respective harness
- €# Plug the system into the available AC wall power [it will have gone to sleep]
- €# Restart the devices including the PC
- €# Restart the Series 301 Software
- €# From the Main User screen, go to the Advanced Functions screen. On the Advanced Functions screen, select the “Setup” pull down menu. Select the “Series 301 Setup” choice. Update the battery information inclusive of the Battery Install Date. Activate the “Set & Send” button. All duration and battery information will be reset.

10 Potential Hazards, Interference and Avoidance

There are no potential interference issues through normal usage. Potential hazards are limited to the use of standard AC connectivity. It is the responsibility of the Original Equipment Manufacturer [OEM] to install this product appropriately and to take precautions regarding the AC connectivity features and safe operator use. Refer to the Safety Precautions section of this manual.

There are no waste products or residue generated by this device.

The environmental conditions for transportation and storage are as generally commercially accepted; there are no unique or special concerns. Refer to the Technical Specification section of this manual for applicable Operating and Transportation environmental requirements.

11 Warranty Statements

NEW EQUIPMENT LIMITED WARRANTY MIDMARK CORPORATION

MIDMARK, warrants to the original customer ("Buyer") that the products manufactured by it are free from defects in parts, materials and workmanship. **MIDMARK makes no warranty expressed, implied or statutory regarding merchantability, fitness or adequacy for a particular purpose or use.**

Buyer waives all claims relating to products manufactured by MIDMARK unless MIDMARK receives the same in writing within one (1) year after the date the products are shipped to the Buyer. Claims for shortages, however, are waived if not received in writing within thirty (30) days after the date of shipment.

Buyer's exclusive remedy and MIDMARK's sole liability on any claim, whether tort, contract or warranty, shall be limited to servicing the products returned, prepaid, to MIDMARK's facility for that purpose and to the replacement or repair, in HES's discretion, of any parts found to be defective upon examination by MIDMARK.

MIDMARK shall not be liable under any circumstances for any special, incidental or consequential damages to the Buyer or any third party resulting from the use of equipment manufactured by MIDMARK.

MIDMARK shall not be liable under any circumstances to the original Buyer or any other person where claimed damages result from abnormal conditions of operation or abuse.

Notwithstanding the foregoing, Buyer may not bring any action under or arising out of this warranty unless such action is commenced within two (2) years after the cause of action has accrued.

WARRANTY #9211N

EQUIPMENT REPAIR LIMITED WARRANTY MIDMARK CORPORATION

MIDMARK, warrants to the original customer ("Buyer") that equipment repaired by it will be free from defects involving those repairs for a period of ninety (90) days after shipment. **MIDMARK makes no other warranty whatsoever, expressed, implied or statutory regarding such repairs.**

Buyer waives all claims relating to the products MIDMARK repairs unless received in writing by MIDMARK within ninety (90) days after shipment of such repaired product.

Buyer's exclusive remedy and MIDMARK's sole liability on any claim, whether tort, contract or warranty, shall be limited to the labor cost of repair and parts if the product previously repaired by MIDMARK is returned to its facility, prepaid, provided MIDMARK determines that such product's failure has resulted from repairs previously made by MIDMARK.

MIDMARK shall not be liable under any circumstances to the Buyer for costs of calibrations to instruments not repaired by MIDMARK or for the loss of calibration resulting from equipment failure during or after any stated warranty when such equipment has been repaired, altered in any way whatsoever or calibrated by any facility other than MIDMARK.

MIDMARK shall not be liable under any circumstances for the special, incidental or consequential damages to the Buyer or any third party resulting from the use of equipment repaired or calibrated by MIDMARK.

MIDMARK shall not be liable under any circumstances to the Buyer or any other person where claimed damages result from abnormal conditions of operation or abuse.

Notwithstanding the foregoing, Buyer may not bring any action under or arising out of this warranty unless such action is commenced within two (2) years after the cause of action has accrued.

WARRANTY #9211R

SOFTWARE LIMITED WARRANTY
MIDMARK CORPORATION

MIDMARK, warrants to the original customer ("Buyer") that each software product manufactured by it is free from defects in materials and workmanship for a period of ninety (90) days from date of delivery. MIDMARK **makes no warranty expressed, implied or statutory regarding merchantability, fitness or adequacy for a particular purpose or use.**

Buyer waives all claims relating to each software package developed by MIDMARK unless MIDMARK receives the same in writing within one (1) year after the date the software is shipped to Buyer. Claims for shortages, however, are waived if not received in writing within fifteen (15) days after the date of shipment.

Buyer's exclusive remedy and MIDMARK 's sole liability on any claim, whether tort, contract or warranty, shall be limited to, at HES's option, repairing the product returned, prepaid, to MIDMARK 's facility for that purpose or replacing the same, provided it is found to be defective upon examination by MIDMARK.




MIDMARK shall not be liable under any circumstances for any special, incidental or consequential damages to the Buyer or any third party resulting from the use of said software product nor shall MIDMARK be liable in anyway whatsoever for any errors contained therein.

MIDMARK shall not be liable under any circumstances to the Buyer or any other person where claimed damages result from abnormal conditions of operation or abuse or from improper maintenance or installation on the hardware product, or from Buyer supplied software interfacing.

Notwithstanding the foregoing, Buyer may not bring any action under or arising out of this warranty unless such action is commenced within two (2) years after the cause of action has accrued.

WARRANTY #9211S

12 System Specification

CLASSIFICATION	
Type of protection against electrical shock	Class I Equipment
Degree of protection against electric shock	Not classified- no applied parts
Classification according to the degree of protection against ingress of water as detailed in the current edition of IEC 529	Ordinary protection only, IPX0. Not protected against ingress to moisture.
Methods of sterilization or disinfection	Part of end use equipment.
Equipment not suitable for use in the presence of flammable mixtures	Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
Mode of operation	Suitable for continuous operation at rated load
IDENTIFICATION, MARKING AND DOCUMENTS	
Marking on the outside of equipment or equipment parts	Reference following sections Component for use in end system application
Protective packaging requirements	The product is not inherently fragile beyond that of standard electronic equipment; however, care should be taken in protecting the container against damage that might effect electronic equipment. Shipping containers will have the following markings applied as required by the certifications. <p style="text-align: center;">⚡# FRAGILE ⚡# KEEP AWAY FROM RAIN</p> The symbols will be applied with stencil or labels. The color shall be black. The location, size and frequency will be as described in the requirement document.
Type of battery and mode of insertion	Approved Lithium coin Cell mounted in an approved coin cell holder. Not intended to be changed by the operator. Use of a tool required to access.
Indicator lights and push-buttons	Red indicator LEDs are not used. Yellow LEDs indicate battery level. Green LEDs used to indicate mode of operation. No push buttons utilized.
EMC Certification	Reference copy of TUV summary statement found directly after this table.
INPUT	
Voltage	100 to 240 VAC [tolerance $\pm 10\%$] 
Frequency Range	50/60 Hertz
Power Factor Correction	0.96 to 0.98
Inrush Current (Typical)	30A @ 100 VAC, 60A @ 200 VAC
Current	6.4 AC Amperes maximum
INPUT/OUTPUT: DC BATTERY	
Voltage	3 to 15 VDC 
Current	20 Amps DC Max (with 0 amp Load current)
Maximum Power	300 Watts max (with no load)
OUTPUT: DC LOAD	
Voltage	10.5 to 15 VDC 

Current	20 Amps DC Max (with 0 amps battery current)
Maximum Power	300Watts max (with no battery)
OUTPUT: FAN	
Format	Custom
Voltage	12 VDC \pm 5%
Current	.2 Amps DC Max Internally limited
OUTPUT: TEMP SENSORS	
Format	Digital Communication: I ² C
INPUT/OUTPUT: USB	
Format	USB 2.0, slave, electrically isolated
OUTPUT: REMOTE DISPLAY	
Format	Digital communication; I ² C
GENERAL	
Isolation: I/P to O/P	4000 VAC
I/P to Ground	1500 VAC
Efficiency	78% Typical
EMC	TUV: IEC 60601-1-2:2004 Edition 2.1 EN 60601-1-2:2001
Testing Standards	The equipment has been evaluated to the following standards: €# UL 60601-1(2003), 1 st Edition ‘Medical Electrical Equipment, Part 1: General Requirements for Safety’ €# CAN/CSA C22.2 No 601.1 M90(1990) 2 nd Edition ‘Medical Electrical Equipment, Part 1: General Requirements for Safety’ €# EN 60601-1(1990), 2 nd Edition1 ‘Medical Electrical Equipment, Part 1: General Requirements for Safety’ + A1(93) + A2(95) €# IEC 60601-1(1998) ‘Medical Electrical Equipment, Part 1: General Requirements for Safety’ +A1:1991 +A2:1995
ENVIRONMENTAL	
Operating	10 to 40 degrees Celsius; 50 to 104 degrees Fahrenheit; requiring 19 CFM fan or greater
Transport/Storage	-25 to 85 degrees Celsius; -13 to 185 degrees Fahrenheit
Relative Humidity	0% to 93% non-condensing
MECHANICAL	
Construction	Open Frame or Sheet Metal
Dimensions	Various [for reference 6.75” x 8.5” x 1.4”]
AC Input	Customer Supplied AC Plug; 3 wire pigtail supplied
DC Output (2 each)	Anderson® Power Poles
Fan Connection	Polarized latching 2 pin (reference: Molex C-Grid SL Style)
Temp Sensors (2 each)	Polarized latching 4 pin (reference: Molex C-Grid SL Style)
Remote Display [remote display]	CAT 5
USB	USB Commercial Standard
BATTERY PROFILES	
User Selectable	2 x 18 Amp Hour parallel (36 total)
FEATURES	
Intelligent Charging	3 stage charging algorithms in accordance with battery manufacturer’s specifications. If over discharge is detected, auto switchover to deep discharge recovery mode.
Recovery	Deeply discharged battery reconditioning controls the recovery of over discharged batteries to prevent venting under normal charge conditions.
Dedicated Charging	Full 10.0 Amp charging while simultaneously providing up to 10.0 Amps to the load devices; 300 watts total power.

Auto Transfer	Automatically transfers the load from the rail supply to the battery when AC is removed.
Intelligent Battery Monitoring (Algorithm Based)	DC Voltage, DC Current, Ambient Temp, Battery Temp, Total Charge/Discharge amp/hours since activation, User Selectable SLA/AGM battery profiles.
Event Logging	Captures the usage characteristics of Charge/Discharge cycles of the battery. Up to 1000 events can be logged and used for diagnostics and maintenance scheduling.
Remote Display [Remote display]	True battery capacity, source of power, low battery, full charge, shut down warning, recovery mode.
Communications/software	On screen software package, data retrieval software package, real time on screen monitoring via USB, intelligent shutdown of computer and attached peripherals, remote system diagnostics and email alerts to network administrator.
Thermal Safety	Thermal sensors provide shut down if the battery exceeds a temperature specified by the manufacturer as “abnormal”. The default temperature is 50 degrees Celsius [or 122 degrees Fahrenheit].

13 TUV Certification Statement

30761396.001 Hoffmann 301 Series

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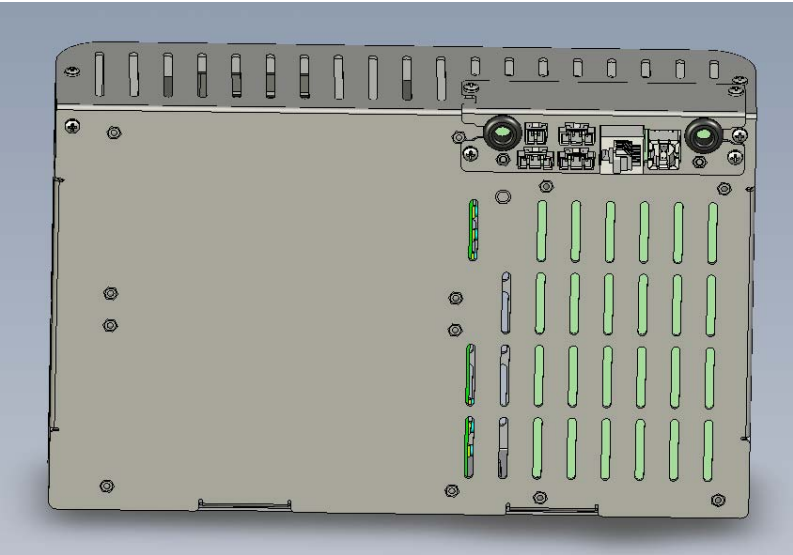


Test Report Number: Prübericht Nr.		30761396.001 Hoffman 301 Series		Test Report Summary	
Applicant: Auftraggeber:	Hoffman Engineering Corporation 8 Riverbend Drive Stamford, CT 06907	Tel: (860) 349-7067 Fax: (203) 425-8910 Email: asadlon@H-E- Systems.com	Andy Sadlon		
Type of Equipment: Gegenstand der Prüfung:	Intelligent Battery Charger/Monitor System	Trademark: Ursprungszeichen:			
Models Number: Bezeichnung:	Series 301 - Motive DC Controller				
Standards: Prüfgrundlage:	See Details Below	Date of testing:	May 29 – June 4 2007		
Standard Number	Description	Severity Level or Limit	Minimum Acceptable Performance Criteria	Summary Result	
IEC 60601-1-2: 2004 Edition 2.1	Medical electrical equipment General requirements for Electromagnetic Compatibility	Severity Level or Limit	See Details Below	Complied	
EN 60601-1-2: 2001	Medical electrical equipment General requirements for Electromagnetic Compatibility	Severity Level or Limit	See Details Below	Complied	
IEC 61000-4-2: 2001	Electrostatic Discharge Immunity	±2, ±4 and ±6 kV Contact Discharge, ±2, ±4 and ±8 kV Air Discharge	36.202.1 j)	Complied	
IEC 61000-4-3: 2006	Radiated Electromagnetic Field Immunity	3 V/m, 4 Exposures, Vertical and Horizontal 80-2500 MHz, 1kHz 80% AM	36.202.1 j)	Complied	
IEC 61000-4-4: 2005	Electrical Fast Transient Immunity	±2kV AC Mains ±1kV I/O Ports	36.202.1 j)	Complied	
IEC 61000-4-5: 2005	Surge Immunity	±2kV Common Mode ±1kV Differential Mode	36.202.1 j)	Complied	
IEC 61000-4-6: 2006	Conducted RF Immunity	3Vrms, 150kHz - 80 MHz, 1kHz 80% AM Applied to AC Mains and I/O ports	36.202.1 j)	Complied	
IEC 61000-4-8: 2001	Power Frequency Magnetic Field Immunity	3 A/m 50 Hz, and 60Hz 3 orthogonal orientations	36.202.1 j)	Complied	
IEC 61000-4-11: 2004	Voltage Dips & Variations	10ms >95% Dip (0.5 Periods) 100ms 60% Dip (5 Periods) 500ms 30% Dip (25 Periods) 5sec >95% Interruption (250 Periods)	36.202.1 j)	Complied	
EN 55011:1998 + A1: 1999 + A2: 2002, CISPR 11: 2004	Conducted and Radiated Emissions	Class B, Group1	NA	Complied	
IEC 61000-3-2: 2005	Power Harmonics	Class A	NA	Complied	
IEC 61000-3-3: 2002	Voltage Fluctuation (Flicker)	Section 5	NA	Complied	
Place of Test: Prüfört:	TUV Rheinland of North America 12 Commerce Road, Newtown, CT 06470 USA E-mail: info-new@tuv.com Phone: (203) 426-0888 Web: http://www.tuv.com Fax: (203) 429-4009		 FOR THE SCOPE OF ACCREDITATION UNDER NVLAP LAB CODE 200111-0		
Test Result: Prüfergebnis	Unit presented for testing Complies with criteria as shown above. Additional Information is contained in the following pages.				
Tested By: Der Sachverständige:	Dieter Baldamus	Checked By: Geprüft:	Bruce Fagley		
August 2, 2007 Date, Signature Datum, Unterschrift		August 2, 2007 Date, Signature Datum, Unterschrift			

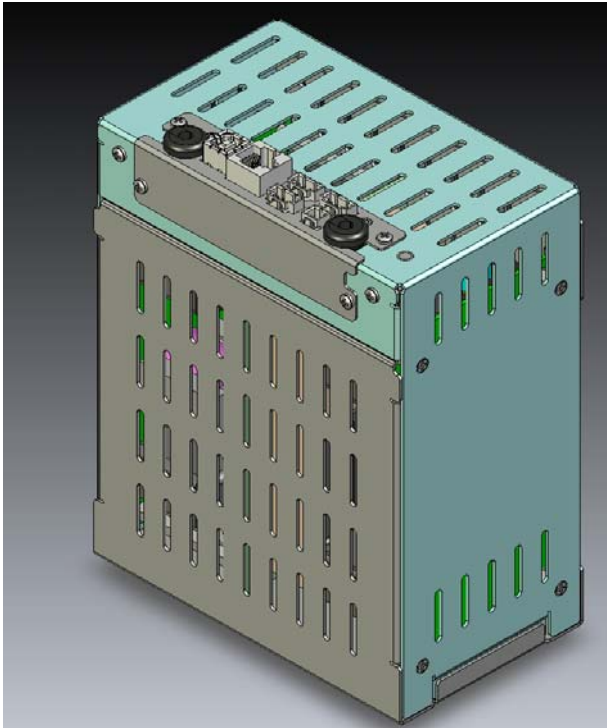
The test results contained in this report refer exclusively to the product(s) presented for testing. No liability may be assumed for models or products not referred to herein. This test report may not be published or duplicated in part without permission of the testing body. This test report by itself does not constitute authorization for the use of any TÜV Rheinland test mark. This report must not be used by the applicant to claim product endorsement by TÜV Rheinland, NVLAP or any agency of the U.S. Government.

TUV Rheinland of North America, Inc., North American Headquarters, 12 Commerce Road, Newtown, CT 06470 - Tel (203)426-0888 - Fax (203)426-4009

14 Appendix A: Series 301 Configurations.



Series 301-1001
(Front Mount Shown)



Series 301-1003
(Top Mount Shown)