1. INTRODUCTION

1.1. General Product Description and Overview

MicroCab 1500 is the newest generation of high reliability outdoor power systems that SENS has been producing for over a quarter-century. Optimized to power critical industrial and communications loads, SENS' MicroCab 1500 offers multiple technologies that enhance reliability and system uptime, including:

- Patented SENS-designed switchmode power converters specially designed to survive outdoor environments including severe electrical transients and extreme temperatures,
- Completely sealed electronics compartment that protects power converters, breakers and other components from environmental attack, dirt and corrosion
- Generous convection cooling and thermal protection to insure reliable operation in the hottest climates
- Optional high temperature batteries designed for long life in hot climates
- Optional battery heaters and battery system insulation to improve battery performance in cold climates, and improve battery life in hot climates.

MicroCab 1500 also includes a comprehensive alarm system with information available via either Form C contacts or native Modbus. In addition to alarms, all operating parameters of MicroCab such as output voltage and current are accessible via network connection.

2. AGENCY STANDARDS AND CERTIFICATIONS

2.1. Safety Agency Standards

2.1.1. UL listed for the United States (UL_{US}) and Canada ($_{C}UL$) to UL 1012 and CSA 22.2 No. 107.1

2.2. FCC Standards Emissions

2.2.1. 47-CFR-15 (FCC Part 15) Class B

2.3. Seismic Standards

2.3.1. Seismic Certified to IBC 2000 (referencing ASCE 7-98 and ICC AC-156), IBC 2003 (referencing ASCE 7-02 and ICC AC-156), IBC 2006 (referencing ASCE 7-05 and ICC AC-156), IBC 2009, IBC 2012 and California Building Code 2007, 2010 with optional Seismic Approval.

2.4. California Energy Commission (CEC)

2.4.1. California Code Of Regulations Title 20, Sections 1601 through 1608 – Battery Charging system Systems and Self-Contained Lighting Controls

3. AC MAINS SUPPLY

3.1. Input Supply

3.1.1. The AC input voltage range is 100-240VAC.

3.1.2. The AC input is single phase.

3.1.3. The AC input frequency range is 47-63Hz.

3.2. Input Tolerances

3.2.1. The AC input voltage tolerance is $\pm$10%.

3.2.2. The charging system reduces its output power below 90VAC; a hard shutdown occurs at 70VAC.

3.3. Input Inrush Current Limiting

3.3.1. The system does not draw excessively high AC current when AC voltage is applied and all capacitors are fully discharged. Inrush current will not trip charging system input protection. This applies to any AC voltage within specification.

4. EFFICIENCY AND POWER FACTOR

4.1. Efficiency

4.1.1. Charging system efficiency is up to 93%

4.1.2. The standby AC draw of the system is less than 10W

4.2. Power Factor

4.2.1. The system contains active power factor correction. The power factor is 0.95 or greater at maximum rated load current.

5. OUTPUT

5.1. Output Voltage and Adjustment Range

5.1.1. For 12VDC nominal output models the adjustment range is 0-17V. The factory float setting is 13.5V.

5.1.2. For 24VDC nominal output models the adjustment range is 0-34V. The factory float setting is 27.0V.

5.2. Output Current

5.2.1. The output current of the charging system is up to 45A for 12VDC and 24VDC nominal outputs.

5.2.2. Redundancy options are optional for all current levels other than the maximum 45A.

5.3. Battery Temperature Compensation

5.3.1. Battery temperature compensation is standard. The nominal voltage-temperature (V-T) curve changes output voltage when the temperature of the TC probe is between 0°C and +50°C at the rate of – 0.18% per degree C.

5.3.2. The slope for user-programmed battery settings is programmable from 0.00% per degree C to -0.30% per degree C.

5.3.3. The factory voltage setting corresponds with +25°C.

5.4. Output Regulation

5.4.1. Line and load voltage regulation is better than ±0.5% of the set value at 25°C.

5.5. Output Ripple

5.5.1. 1% (≤20kHz bandwidth) or 30mVrms (>20kHz bandwidth) without battery attached.

5.6. Output Stability

5.6.1. The charging system will operate in a stable fashion with or without a battery connected.

5.7. Dead Battery Charge

5.7.1. The system will charge a fully discharged battery from zero volts.

6. BATTERIES

6.1. Standard Battery Types

6.1.1. VRLA batteries are standard.

6.1.2. High temperature VRLA models are available.

6.2. Non-standard Battery Types

6.2.1. Other battery types are supported by the charging system including AGM, Flooded lead-acid, Ultracapacitors, and NiCd.

7. PROTECTION

7.1. Input Protection

7.1.1. The AC input to the system is protected by a UL489 listed 2 pole AC input breaker

7.2. Charging System Protection

7.2.1. Soft Start

7.2.1.1. Soft start gradually increases current with a maximum of 5 seconds to full-required output

7.2.2.Load Dump Protection

7.2.2.1. Output voltage over-shoot is limited to 15% to prevent damage to connected devices in case battery is disconnected while charging system is running.

7.2.3.Reverse Polarity Protection

7.2.3.1. Charging system does not start into a reverse connected battery. The charging system recovers automatically after removal of a fault condition. Connection of a running charging system to a reverse polarity battery does not damage the charging system.

7.2.4.Battery Fault Protection

7.2.4.1. Application of output voltage up to 40.0 volts does not damage the charging system.

7.2.4.2. Incompatible battery detection to prevent charging 12V batteries with a 24V setting.

7.2.5.Output Blocking Protection

7.2.5.1. High surge current prevented from flowing to charge the output capacitors when a charging system is connected to a battery

7.2.5.2. Serves as an “OR” diode to isolate a non-functioning charging system from others in a redundant charging system configuration.

7.3. Charging Output Protection

7.3.1. The output of the charging system is protected by a 60A single pole charging output breaker

7.4. Battery Output Protection

7.4.1. The battery connection is protected by a 60A single pole battery output breaker

7.5. DC Load Protection

7.5.1. The system allows for quantity 1 to 4 DC load breakers

7.5.2. Each breaker is selectable from 10A, 20A, 30A, 40A, and blank options

8. OPTIONAL SYSTEM ITEMS

8.1. Low Voltage Load Disconnect (LVLD)

8.1.1. The LVLD disconnects the batteries from the DC loads at the End of Discharge threshold. The End of Discharge threshold is factory set to 10.5V. The loads are reconnected when the battery voltage reaches 12.9V.

8.1.2. The LVLD settings are configurable via the keypad or the SENS Setup Utility.

8.2. Thermal Management

8.2.1.Heaters

8.2.1.1. The battery heating system keeps the battery temperature above 0°C in external ambient environments down to -30°C.

8.2.1.2. The heating system is AC powered and thermostatically controlled.

8.2.1.3. The heaters are located underneath each battery shelf.

8.2.2.Insulation

8.2.2.1. Cabinet insulation thermally insulates the cabinet walls of the battery compartments. The heaters and insulation keep the battery temperature above 0°C in external ambient environments down to -40°C.

8.2.3.Fans

8.2.3.1. The thermally controlled fans provide ventilation to the battery compartments in temperatures above 40°C.

8.3. Supplemental Surge Protection

8.3.1.Supplemental surge protection provides additional surge protection for the system from damage due to lightning, transients, and power surges.

8.3.1.1. The AC protective device is UL 1449 listed, the nominal discharge current is 20kA and the protection level is 1000V.

8.3.1.2. The DC protective device is UL 1449 listed, the nominal discharge current is 20kA and the protection level is 250V.

9. USER INTERFACE

9.1. Local Interface

9.1.1. The user interface includes a 2 X 20 character backlit LCD displaying plain language text, a multicolor LED panel showing system status, and a user control panel with five multifunction buttons.

9.2. Remote Interface

9.2.1.Modbus

9.2.1.1. System status is also available via Modbus. Modbus RS485 communication is standard. Modbus TCP/IP is optional.

9.2.2.SENSbus

9.2.2.1. Connection to the SENS Setup Utility is also available via SENSbus RJ45 port or Micro USB port if optional TCP/IP Modbus module is included.

9.3. Digital Meter

9.3.1. System is equipped with a 2% accuracy meter for indicating DC output voltage and 5% accuracy meter for indicating DC output current.

9.4. Settings and Adjustments

9.4.1. Three levels of security are selectable via the User Interface Mode menu using the front panel keypad. Control software prevents conflicts between operating voltage setpoints, temperature compensation system and alarm setpoints.

9.4.1.1. Normal (Non-expert) mode allows minor, routine adjustments from the front panel

9.4.1.1.1. Adjust charging mode: Float, manual equalize, auto boost/auto equalize

9.4.1.1.2. Adjust manual equalize time

9.4.1.1.3. Run battery test

9.4.1.2. Expert mode enables nearly any adjustment from the front panel

9.4.1.2.1. Adjust output voltages and current limit

9.4.1.2.2. Change battery type

9.4.1.2.3. Change number of battery cells

9.4.1.2.4. Initiate commissioning charge

9.4.1.2.5. Turn on/off temperature compensation system, and adjust compensation slope as specified in Paragraph 5.6.

9.4.1.2.6. Activate or deactivate alarms and other indications

9.4.1.2.7. Adjust alarm threshold values, including ground fault resistance
9.4.1.2.8. Adjust normal equalize time
9.4.1.2.9. Activate/adjust battery test mode duration, voltage and interval of automatic test
9.4.1.2.10. Set alarm relay delay duration
9.4.1.2.11. Set “equalize delay after restart”
9.4.1.2.12. Activate/silence audible alarm feature
9.4.1.3. Monitor Only (Lockout) mode prevents any front panel adjustment.

10. INDICATIONS AND ALARMS

10.1. Alarm Indication
10.1.1. Any alarm indication causes plain language text to appear on the LCD, and changes the appropriate LED. Normal LED indication is green. Alarm LEDs are red. Warning LEDs are amber. Multiple alarms result in the relevant LEDs changing color and multiple alarm message screens on the LCD. Alarm status is also available via Modbus communications.
10.2. Three alarm Form C relays are standard: Major Alarms, Minor Alarms, and Summary Alarm. Alarm assignment can only be changed with the SENS Setup Utility.
10.2.1. Major Alarms
10.2.1.1. AC Line Failure
10.2.1.1.1. Indicates AC input voltage is not applied or is outside of allowed 90-265 VAC range.
10.2.1.2. High DC Voltage
10.2.1.2.1. Indicates DC output voltage is above factory alarm setpoint or the programmed level.
10.2.1.3. Overvoltage Shutdown
10.2.1.3.1. Indicates that the charging system has executed a high voltage shutdown and DC output voltage is above factory alarm setpoint or the programmed level.
10.2.1.4. Charging system Failure
10.2.1.4.1. Indicates the charging system is not able to provide the current demanded by the battery and/or load or is providing more current than the charging system’s control system is commanding.
10.2.1.5. Reverse Polarity
10.2.1.5.1. Indicates a battery is connected backwards.
10.2.1.6. Invalid Settings
10.2.1.6.1. Indicates invalid settings
10.2.1.7. Incompatible Battery
10.2.1.7.1. Indicates a 12V battery is connected to a 24V charging system or a 24V battery is connected to a 12V charging system.
10.2.1.8. Low Current
10.2.1.8.1. Indicates current drawn from the charging system is below factory alarm setpoint.
10.2.1.9. Battery Check
10.2.1.9.1. Indicates Battery Check Failure, the batteries are unable to support the DC connected loads.

10.2.1.10. LVLD Active
10.2.1.10.1. Indicates that optional Low Voltage Load Disconnect (LVLD) is active. The batteries are now disconnected from the load. When the battery voltage returns to the LVLD threshold the load will again be connected.
10.2.1.11. Charger Module Fault
10.2.1.11.1. Indicates one or more individual charger(s) are in an alarm state.
10.2.2. Minor Alarms
10.2.2.1. Low DC Voltage
10.2.2.1.1. Indicates battery has discharged and DC output voltage is below factory alarm setpoint or the programmed level.
10.2.2.2. Thermal Foldback
10.2.2.2.1. Indicates charging system output is reduced to protect the charging system from over-heating damage. The charging system will not be able to produce full output until the ambient temperature is lowered.
10.2.2.3. SENSbus Not Active
10.2.2.3.1. Indicates the charging system cannot communicate using SENSbus when load sharing and/or remote accessories are connected.
10.2.2.4. Battery On Discharge
10.2.2.4.1. Indicates battery is beginning to discharge and DC output voltage is below factory alarm setpoint or the programmed contacts.
10.2.2.5. DC/AC Surge Replacement
10.2.2.5.1. Indicates that the optional supplemental surge protectors need to be replaced.
10.2.3. Summary Alarms
10.2.3.1. The summary alarm is the sum of all major and all minor alarms.

11. COMMUNICATIONS

11.1. Configuration and Firmware Updates
11.1.1. The SENS MicroGenius Setup Utility is a custom configuration and diagnostics software utility that runs on a Windows PC via a USB port. Use this software to configure the charging system or load new firmware using SENS custom programming cable.
11.2. Data Communications
11.2.1. SENSbus
11.2.1.1. Provides the ability to communicate with SENS Setup Utility and optional accessories.
11.2.2. Modbus
11.2.2.1. Provides the ability to monitor the system remotely and receive information using serial RS-485 connections. TCP/IP connection is optional.

12. ENVIRONMENTAL

12.1. Operating Range
12.1.1. Operating temperature: -40C to +40C at full rated output, -40C to +70C with automatic output current reduction
12.1.2. Approximately 5 seconds warm-up time required for operation below -20C
12.1.3. Storage temperature: -40C to +80C
12.1.4. Humidity: 5% to 95%, non-condensing

12.1.5. Altitude: 0-2000 meters; without derating

12.2. Cooling

12.2.1. Natural convection cooled

13. MECHANICAL

13.1. Enclosure Material and Finish

13.1.1. Cabinet Construction

13.1.1.1. Cabinet construction is 1/8” 5052 aluminum. All joints are continuously welded.

13.1.2. Cabinet Finish

13.1.2.1. Cabinet finish is polyester high-reflective power coat.

13.2. Mounting Configurations

13.2.1. Wallmount mounting brackets are standard

13.2.2. Floormount mounting brackets are optional

13.2.3. Toplift brackets are optional

13.3. Protection Ratings

13.3.1. Charging and control compartment is rated NEMA 4X, IP66.

13.3.2. Battery compartments are rated NEMA 3RX, IP33.

13.4. Seismic Ratings

13.4.1. UBC seismic zone 4 tested

13.4.2. IBC certified for wall mount charging systems only when properly installed to an Sds value of 2.50g for grade, below grade and roof-level installations in essential facilities requiring post-event functionality.

13.5. Field Wiring

13.5.1. Intended for permanent installation using hard-wired electrical conduit

14. STANDARD NAMETPLATE DATA

14.1. The standard permanent adhesive nameplate contains the following data:

14.1.1. SENS name, address and web site address

14.1.2. Product description

14.1.3. Model number

14.1.4. Serial number

14.1.5. Date of manufacture

14.1.6. Input voltage rating

14.1.7. Input frequency rating

14.1.8. Input current rating

14.1.9. Nominal output voltage rating

14.1.10. Output current rating

14.1.11. Applicable safety and EMC agency marks

14.1.12. Applicable IBC seismic certification

15. DRAWINGS AND DOCUMENTS

15.1. User manual documentation

15.1.1. Safety instructions

15.1.2. Model number breakout

15.1.3. Performance specifications

15.1.4. System overview

15.1.5. Mounting instructions

15.1.6. Wiring details
15.1.7. Operation procedures
15.1.8. Troubleshooting table
15.1.9. Detailed dimensional drawing
15.1.10. Wiring diagram

16. QUALITY ASSURANCE, INSPECTION, AND TEST

16.1. The standard assembly process prescribes the tests and calibration that are performed on the product. These activities include, but are not limited to the following:
16.1.1. Insulation breakdown test using a “hipot” device to the standards prescribed in UL standards
16.1.2. Performance testing to insure that the product meets its critical performance specifications
16.1.3. Calibration to the correct output, alarm and shutdown voltages
16.1.4. Correct function of alarms

17. WARRANTY

17.1. SENS warrants its products to be free of defects in material or workmanship for a period specified in standard contract documents or terms and conditions. Contact SENS for a complete statement of warranty.

18. CHANGES TO SPECIFICATION

18.1. In order to meet evolving customer requirements, changes to the product and to this specification may be made without notice from time to time.

END OF SPECIFICATION

