NU2– Smart Power Supply (SPS) User's Manual

October, 2018—Version 3

GENERAL DESCRIPTION

The Smart Power Supply (SPS) is an innovative, Quad Output, field programmable power supply. Each of the four outputs can provide four Amps (4A) for a total of sixteen Amps (16A) in either 12VDC or 24VDC. Outputs are protected by Digital Circuit Breaker (DCB) that allow for automatic SPS recovery after the short/overload condition is corrected. Setup and Programming is achieved locally via Bluetooth from iOS or Android mobile devices or remotely over TCP IP Ethernet connection via Web Browser utilizing user friendly Graphical User Interface (UI).

SPS is an Uninterruptable Power Supply with zero (0) switching time delay. Utilizing lead acid backup batteries, the SPS maintain its outputs voltages and currents when main power interruptions occur. Microprocessor controlled; three stages battery charging schemas are used to verify battery is fully charged, to extend battery life and provide the user with charging speed options such as Normal/ Fast/ Accelerated modes. Priority outputs disconnect performs Smart Load Shedding (SLS) to preserve battery's power and to slow down battery's depletion. Also, an automatic Low Battery Disconnect (LBD) circuits are used to prevent battery to deplete below manufacturer recommended voltage threshold. Depleting battery power below the rated threshold has the potential of damaging the equipment and shortens the battery's life span. Additionally (patent pending) when connected to NU2's Universal Interface Board (UIB), then, Smart Load Shedding (SLS) is managed all the way to the door level. That is, the SPS/UIB can remove power from power consuming fail safe devices based on parameters such as: a) upon AC loss; b) time delayed for x seconds; or, c) when battery has drained to a certain voltage.

Power & backup battery connections are protected against reverse polarity and battery mismatch such as connecting a 12V battery while configuring the power supply to deliver 24V. SPS configuration is done via Bluetooth and standard Web browser use. An on board graphical LCD display presents roughly fifty parameters such as SPS voltages, currents, temperature, and humidity with an optional 2nd LCD connector for maintenance purposes or enhanced status viewing. Two programmable relays that trigger on multiple alert conditions and a flexible fire alarm disconnect that is selected by output channel are native as well. An on board OSDP compliant RS-485 interfaces can integrate with other OEM OSDP compliant products including NU2's Universal Interface Board (UIB) line of products and the Multi Door Controller (MDC) as well as any OEM products that are OSDP compliant. Version upgrades of SPS firmware is easily achieved via Browser connection.

A set of additional connections such as four supervised auxiliary inputs, external temperature probes, fire alarm connection, gesture control and JTAG programming ports are built in. There additional connections allow for further configuration and functionality of the versatile SPS and the rest of NU2's products.
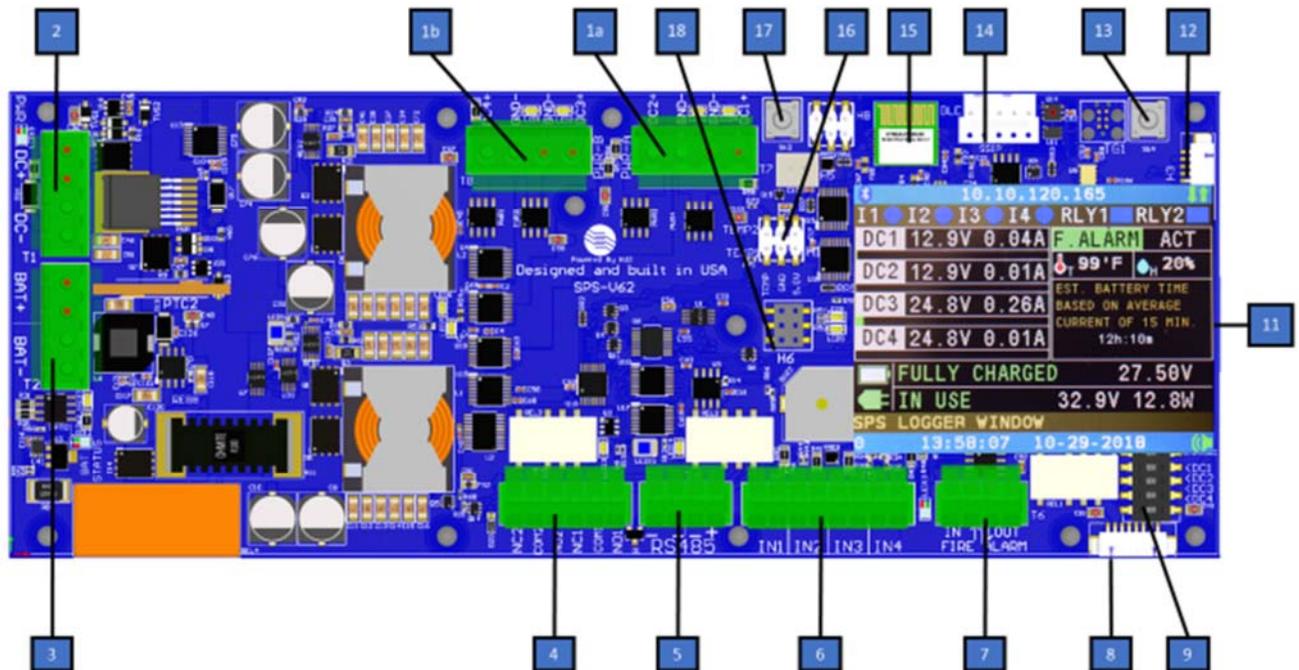
HARDWARE DESCRIPTION

Figure 1: SPS Top View & I/O Description

1a – Outputs 1 & 2, 4A ea, Digital Circuit Breaker

1b – Outputs 3 & 4, 4A ea, Digital Circuit Breaker

2 – DC power in 33VDC/350W

3 – Battery connector, 12V; 24V

4 – Dry contacts, form C for 2 relays, programmable functionality

5- OSDP compliant, RS-485 communication port

6 – 4 programmable, Supervised Inputs

7 – Fire alarm IN/OUT connector

8 – Optional, Data and Communication Web Communication Module

9 – Fire alarm output's selector; SPS as Standalone/Web selector

10 – Intentionally left blank

11 – Multi page graphical display

12 - Optional, 2nd Display port

13 – Function Switch

14 – Factory use

15 – Microprocessor and Bluetooth antenna

16 – External Temperature probes

17 – Display Joystick, page selector

18 – Hand gesture, display manager

SPS Inputs and Outputs

1. Output channels (1a & 1b): SPS is driven by two 8A regulators known as Regulator A and Regulator B. Each regulator drives a pair of output (1&2) and (3&4) - output pairs deliver the same output voltage. The output's voltage can be configured between 9.5V and 26.5V in increments of 0.1 volt. Configuration can be achieved either locally via Bluetooth devices (iOS or Android) or remotely via built in Web applications. No need for specialized client software. Output's channels are protected against short/overloaded conditions with an automatically resettable Digital Circuit Breaker (DCB). The digital fuse automatically restores power after the short/overloaded condition is corrected.

Maximum output current is 4A per individual channel with a displayed warning when exceeding 3.5A. If maximum current for a pair of joined outputs is exceeded, then, load shading will commence as follows:

- When the sum of the load current of Channel 1 and 2 (regulator A) or 3 and 4 (regulator B) approaches 8.0A, then, stable power will continue to be provided for 2 minutes and the local buzzer will sound. If the overload condition is not corrected within a 2 minutes window, then, corresponding outputs 2 or 4 (even channels) will be disabled for a duration of one minute. This step is repeated until the regulator's combined load is reduced to 8.0A or under. (See image #3 below).

- When the sum of load current of Channel 1 and 2 or 3 and 4 exceeds 8.0A, Output 2 and 4 respectively will be disabled immediately for 1 min. This sequence is repeated until the regulator's load is reduced to under 8.0A. (See image #3 below).

2. DC Input Connector: 33V +/- 1V @ 350W for 12V/ 24VDC output.

3.Backup Battery connector: 24V or 12V Lead Acid battery, featuring three stages of intelligent charging, adjusted according to the battery's manufacturer's specifications. The SPS provides information about the battery's state of charge, "time remaining" under average load (in case of AC loss) and battery health - good/ replace. Battery protection is provided for conditions such as:

a. Reversed polarity
b. Battery mismatched to programmed output voltage [installing just one 12V when two batteries (24V) are expected]

Real time battery voltage, charging current and "time remaining" is shown on the graphical display providing a major advantage of not needing to manually measure values.

Based on specialty algorithm, the SPS performs periodic and autonomous battery health and quality level tests. No manual action is needed. These microprocessors-based tests involve forcing the battery to take over the full field load and then, using the specialized algorithm, the software analyzes battery's health and "time remaining". The microprocessor monitors a variety of special conditions and sets its test environment such that no interruption to field devices occurs during the short period test. Go/no go test results are displayed to the user on the graphical display.

If the battery failed the quality test, then, via user's configurations options (Bluetooth/Web), various alerts can be generated via local buzzer, activation of the auxiliary relays, and/or sending email/SMNP messages.

BATTERY—Load Shedding

In the event of AC Loss and to preserve battery's energy for essential tasks, the SPS can remove the power from any of its four programmable outputs based on one of three parameters.

a. Immediately following the AC loss

b. After a pre-defined time-delay period

c. When battery is depleted to a pre-defined voltage level

Additionally, when connected to NU2's Universal Interface Board (UIB), then, load shedding is managed all the way to the door level. That is, the SPS/UIB can remove power from power consuming fail safe locks (devices) based on the same three mentioned parameters.

BATTERTY—Usage Graphs

Using the optional remote web module, users can view an individual graph, one per output as well as the battery, to show valuable historical power behavior.

4. Auxiliary Relay Outputs: 2 form "C" relays are available. Each relay has C, N/C and N/O terminal rated at 2A. Each relay can be activated for a variety of reasons such as:

1) ALERT_TRIGGER_NONE
2) ALERT_TRIGGER_AC_LOSS
3) ALERT_TRIGGER_BATTERY_FAIL
4) ALERT_TRIGGER_BATT @ 10V
5) ALERT_TRIGGER_BATT @ 24V
6) ALERT_TRIGGER_REMOTE_CONTROLLED
7) ALERT_TRIGGER_EXCEED_CURRENT_ANY
8) ALERT_TRIGGER_EXCEED_CURRENT_OP1
9) ALERT_TRIGGER_EXCEED_CURRENT_OP2
10) ALERT_TRIGGER_EXCEED_CURRENT_OP3
11) ALERT_TRIGGER_EXCEED_CURRENT_OP4

Relays are triggered after user defined time delay interval of 0-999 seconds. Relays can be triggered by one or multiple events of SPS. Actual trigger cause is displayed on the graphical display.

5. RS485 serial Interface: OSDP compliant RS-485 interface. Four-pin connector is duplicated (in/out) to allow multiple connections with up to 24 other OSDP compliant devices that are compliant with NU2's API and control the devices from a single GUI/UI interface point. This communication port connects multiple devices such as the Universal Interface Board (UIB) and Multi Door Controller (MDC) to create a single solution whereby all device's programming and status is shared and displayed

6. Control Inputs: Four (4) general-purpose supervised control inputs are available. When activated, each input can be configured to perform a certain action. The list below provides the different options: (Cont. Pg 6)

1) NONE
2) SEND_ EMAIL
3) ENABLE OUTPUT 1
4) ENABLE OUTPUT 2
5) ENABLE OUTPUT 3
6) ENABLE OUTPUT 4
7) DISABLE OUTPUT 1
8) DISABLE OUTPUT 2
9) DISABLE OUTPUT 3
10) DISABLE OUTPUT4

Note 1: Dependency between a control input and an output is restricted to one dependency. Duplicate programming will be rejected.

Note 2: Control Input that controls output 2 or 4, will be disabled during 1-minute load shading explained above.

7. Fire Alarm Input and Output: Fire Alarm circuitry is expecting a Normally Closed (N/C) contact from the building's fire alarm system to terminals – F/A IN. The Fire Alarm OUT is a duplication of the IN status via a dry contact relay. This allows cascading multiple devices. Check local codes for compliance requirements. The Fire Alarm LED is normally green and turns red when the Fire Alarm circuit is activated (alarm condition). A timer is initiated when Fire Alarm is activated. The time elapsed from activation is displayed on the LCD in minutes and hours. Additional "non-CPU dependent" features and functionalities are available via switch selection as noted at #9 below.

8. DCC Connecter: (When using the optional Data and Communications Controller module (DCC). The DDC Connector is an eight-conductors mini connector that supports communications via OSDP/RS-485 and 5VDC power to the DCC controller. The DCC has an Ethernet RJ-45 connector, to allow connection of the SPS to the customer's network/Internet. DCC's program allows connection from any browser while providing the users with graphical HTML status and configuration views.

Figure 2. Typical HTML view of SPS and 2

9. Fire Alarm & DCC/Stand Alone Control DIP SWITCH (SW1-2 to 4): DC1-DC4 - when are in ON position (shift right): Upon fire alarm activation, will disable the corresponding outputs shown as DC1-DC4. SW1-1: Master/Slave. Switch left when in 'stand alone' mode and not using DCC.
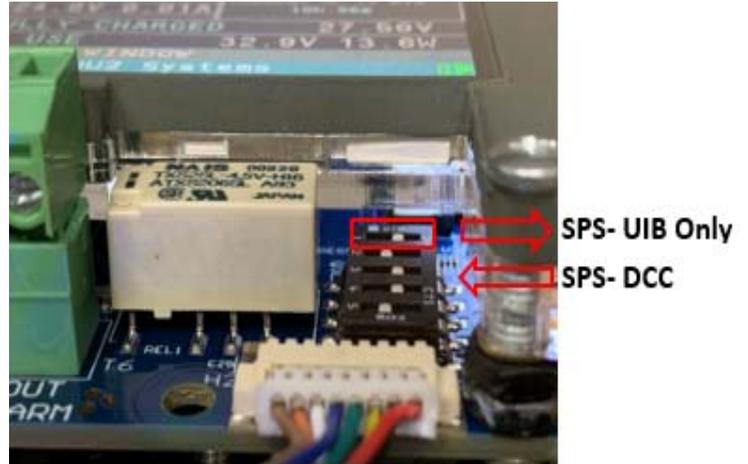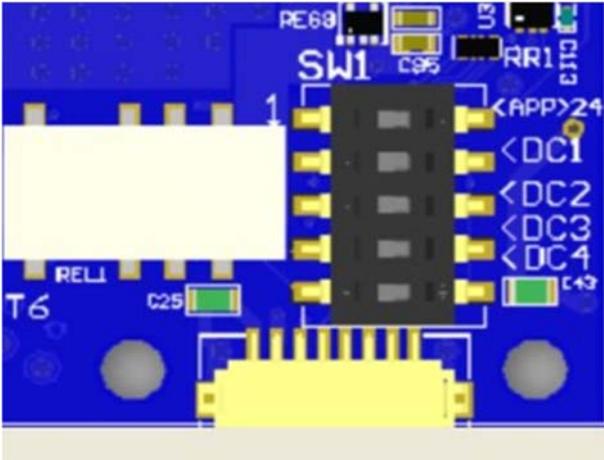

Figure 3. F/A and DCC enable/disable switch selection

10. Intentionally left blank

11. LCD Display (320x240): A 320x240 pixel graphical display is provided onboard the SPS. The LCD display displays various SPS configurations and status in real time. Depending on configuration, the display alternates between several informative status screens. Unless interrupted via the hand gesture control (item #18) or momentary switch (item #17), the display's content changes on user selectable time intervals.

There are various configuration and status reporting on the LCD, some of which are noted below:

SCREEN #2

Figure 4. **Main Display**: Under normal conditions, the Main display screen provides a variety of important pieces of information such as IP address, device name, time, location, voltages, currents, battery health, fire alarm, temperature and humidity as well as others. The following is a quick glance at most provided information.
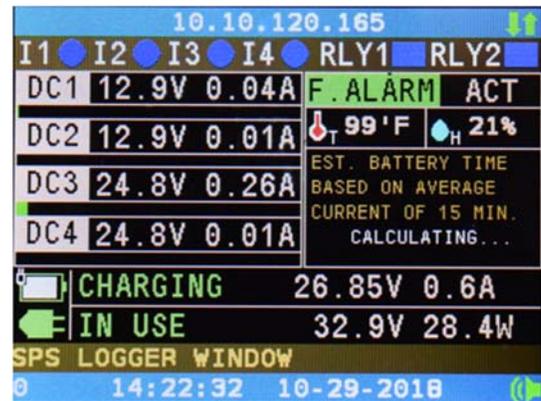
Figure 5. **Header Name**: The SPS name is displayed at the top header line. Header name is used to help the user identify the device's location such as "2nd FL – East Closet" and for discovering the device through mobile BLE server (iPhone/Android/Web application). Header name can be configured thorough the above applications and is limited to 20 characters.
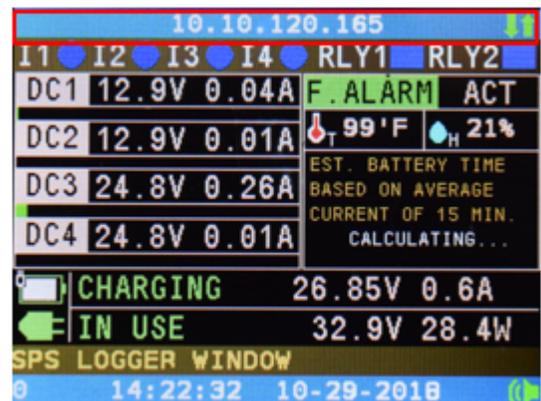
Figure 6. **Footer name:** Located at the bottom of the Display. The programmable footer information can contain ainformation the user wishes to display such as installing company's name, service phone number etc. Footer line also displays the controller's address on the RS-485 chain. (0 in the sample image)
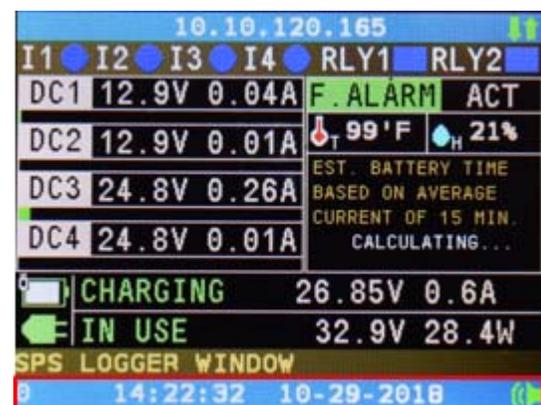
Figure 7. **Input Status:** Icons shows status of four supervised Inputs each with corresponding input's status circular color dot.

Blue— inactive state

Green— active state
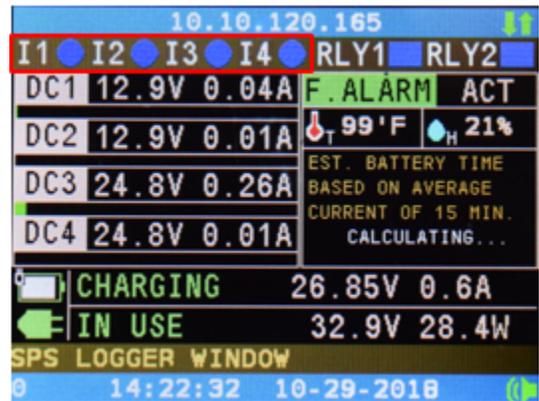
Input's functionality is described above.

Figure 8. **Output Status:** SPS has four isolated outputs. Each output's voltage and current are displayed. When disabled - Output text color is Gray and Voltage/current is displayed as 0.0 V and 0.0A (via BLE/ Web device or any alert condition).

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Figure 9. **Current Graph:** Four current graphs, one associated with each output channel. As current increases/decreases, current bar increases/decreases in length and graph's color is changed based on Alert current conditions as set by iOS/ Android/ Web.

•Green— If current is 0-50% of alert current

•Yellow— If current is 50-75% of alert current

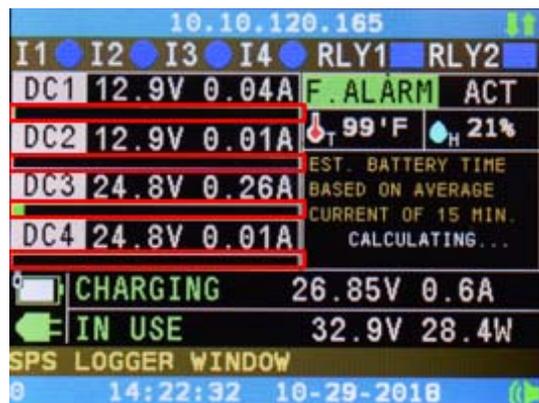•Red— If current is greater than 75% of alert current

Figure 10. **Battery indicator:** Battery indicator is enabled when battery is connected to SPS. Other symbols such as battery voltage, estimated standby power duration and others are displayed. Note that some information such as battery charging current and other calculations may be unavailable during certain calculations cycles
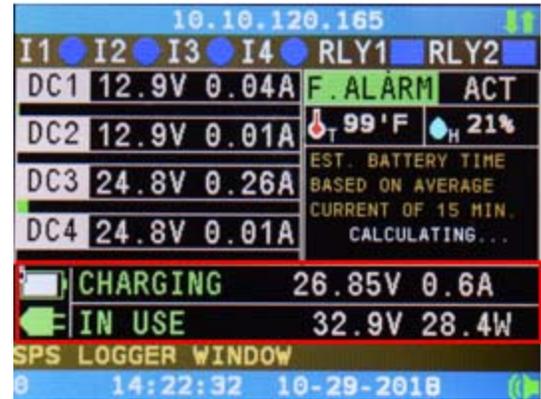

Figure 11. **Input Power Supply:** DC input voltage in Volts and total delivered power in Watts are displayed.

.Figure 12. **Board temperature:** The enclosure's temperature is displayed. This temperature is used in various calculations and alarm generation. Additional onboard temperature probe used for optional fan control. Two optional, external temperature probes are available. See item #19.

Figure 13. **Humidity:** Enclosures/closet humidity is monitored and displayed in percentage.

Figure 14. **Display Intensity:** Display's illumination's intensity can also be configured by Mobile/Web application. This is shown as a percentage adjacent to the symbol. LCD intensity cannot be configured below 10% and above 100% and it is configured in 10% steps.

Figure 15. **Fire Alarm Status:** Monitors and displays building's fire alarm status as noted at Items #7 & #9 above. Alarm status color is Green when normal and Red when in alarm condition. Off Status color is Gray. An elapse timer shows F/A fault duration in 999h:59m format.
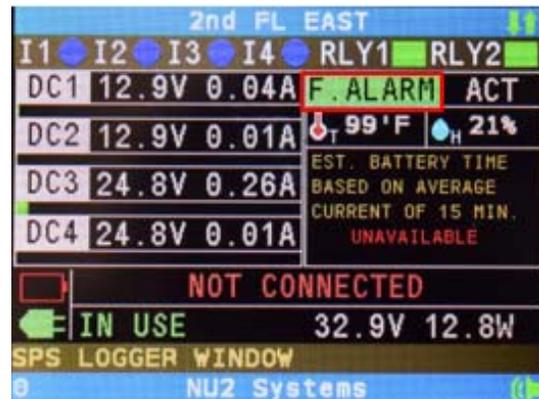
SCREEN #2

Figure 16. **Screen #2:** various information elements are displayed, such as IP address, firmware version, external temperature probes 1 & 2 etc.

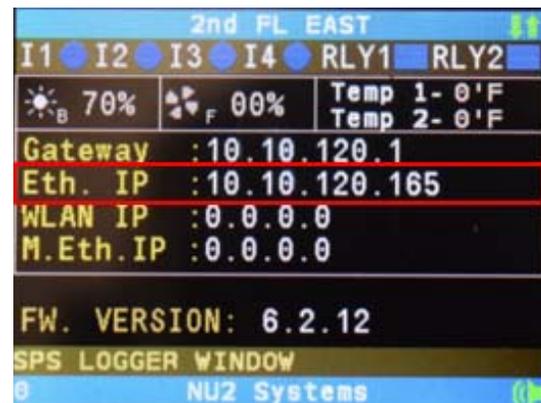Figure 17. Screen 2: Presents the followings when optional DCC is connected:

Figure 18. **IP Address:** Automatic discovery displays the device's IP address and other pertinent network information. There is no need to use discovery software. Connection to the SPS and its related devices such as the UIB and MDC is achieved by using a standard internet browser. See Figure #5