ixnav Digital Battery Monitoring SmartShunt Installation Guide

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Contents

Important Notices

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This digital battery monitoring unit product is warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, LXNAV will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labour, provided that the customer pays for shipping costs. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alterations or repairs.

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To obtain warranty service, contacts your local LXNAV dealer or contact LXNAV directly.

Safety

Symbols for warning indications

The following warning indications are used in this manual in the context of safety.
Notes with a red triangle indicates that great potential danger exists that can lead to serious injury or death. It also describes procedures which are critical and may result in loss of data or any other critical situation.

A Yellow triangle is shown for parts of the manual which should be read very carefully and are important when operating the E500/E700.

A bulb icon is shown when a useful hint is provided to the reader.
Pass on the safety instructions to other users.
General rules and laws concerning safety and accident prevention must always be observed.

General information

LXNAV SMARTSHUNT is smart battery monitoring unit compatible with NMEA2000 network standard. It accurately measures DC voltages of up to three batteries bounded in series and includes shunt for current measurements. It estimates state of charge, state of health and remaining time until empty battery. Up to three temperatures can be measured.
It supports multiple types of batteries and can be configured through any LXNAV Exxx device or via webpage accessible over internal Wi-Fi hotspot.
Parameters set there are available on NMEA2000 network to any device such as LXNAV's E350, E500 etc.
LXNAV SMARTSHUNT is available in three versions with 100, 300 and 500 A shunt. All of them are 25 mV. For proper installation read next chapters carefully.

- **Figure 1: SMARTSHUNT – top view**

Mounting recommendation

SMARTSHUNT has flat bottom and should be mounted with two screws to solid surface next to battery packs to minimize wire length from battery terminals to connector on SMARTSHUNT. With this, measurement error is minimized to minimum.

⚠ Do not work on the electrical system while it is energized.
Do not install the Smart SHUNT near inflammable substances.
Do not place the Smart SHUNT in a wet, humid or high temperature compartments.
Unauthorized modifications exclude manufacturers' liability for any resulting damage.
Do not mix batteries of various brands, voltages or capacities.

NMEA2000 specifications

Table 1: NMEA2000 specifications

Parameter	Description
Compatibility	NMEA2000 compatible
Bit rate	250 kbps
Connection	A coded M12 connector

Connectors

Power supply & battery inputs B1-B3
LXNAV SMARTSHUNT is powered from 4-pin terminal connector from which it also measures voltages of up to three batteries. Maximum allowable voltage on each +Bx terminal is 65 V. When installing, try to make sense wires as short as possible and keep them away from high current sources like cables, electric motors etc.

- **Figure 2: Battery terminals**

Table 2: Battery connector pinout

Pin name	Description
+B1 (+Supply)	Power supply for device and measuring port for first battery
+B2	Measuring terminal for second battery
+B3	Measuring terminal for third battery
GND (-Supply)	Common ground terminal for all three batteries, also for power Supply

External temperature sensor inputs
Each external NTC 10 kΩ temperature sensor is supplied with SMARTSHUNT for additional information of battery status. With it we can calculate even more precise capacity of battery that changes with temperature. Besides that, lifetime of battery also depends on temperature of environment, where battery is stored. Sensor is supplied on 1 m long cable that fits in two pin connectors labeled from T1 to T3. On the other side of cable is ring lug terminal with mounting whole diameter of 3.7 mm. When installing system keep in mind that each sensor number refers to same battery number. For example, sensor T1 is for battery pack B1, T2 for B2 and T3 for B3.

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Figure 3: NTC sensors inputs T1-T3

Shunt

SMARTSHUNT is low side current sense device and it must be placed between load and ground. Wire the terminal labelled BATTERY – to battery ground and LOAD – to ground from system load. Depends on power needs use suitable cross sections of cables and screw them with appropriate ring lugs, that are compatible with shunt's bolt thread size of M10.

Tighten the shunt bolt with a maximum torque of 21Nm.

Table 3: Cable cross sectional area

| Cont.Current	Area
500A	220mm2
400A	150mm2
300A	95mm2
200A	50mm2
100A	25mm2

NMEA2000 compatible M12 connector

M12 5-pin A-coded connector on top of unit is compatible with NMEA2000 and has standard pinout. When installing, follow the recommendations of NMEA2000 network wiring. Always use free Tee connector on existing network. Make sure that connectors are tightened together properly to seal metal contacts inside and prevent oxidation.

- **Figure 4: M12 N2K connector on SMARTSHUNT**

- **Figure 5: NMEA2000 M12 Male connector pinout (view from unit side)**
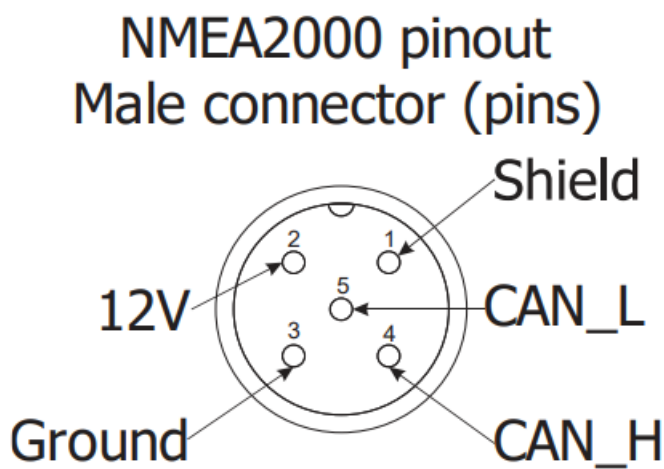
LED Indications

SMARTSHUNT unit features two RGB LEDs on top side for quick status indication. One for general status of unit while the other is for battery state of charge indication. All possible modes are described in tables below:

- Status LED:

Table 4: Status LED color description

Colour	Description
Blinking blue LED with 1 Hz	Working CAN network
Blinking blue LED with 10 Hz	Initialization of WIFI network
Solid blue LED	WIFI initialized, configuration disabled
Solid violet LED	WIFI initialized, configuration enabled
Blinking red LED	Hardware fault

- Battery LED:

Table 5: Battery LED color description

Colour	Description
Blinking red LED 1 Hz	SMARTSHUNT is not configured
Solid red LED	State of charge <30 %
Solid yellow LED	State of charge <50 %
Solid green LED	State of charge >50 %

Configuring SMARTSHUNT

For proper operation SMARTSHUNT must be configured prior use. Configuration can be performed via WiFi connection or NMEA2000 network with one of LXNAV devices.
There are several parameters that should be either selected from available options or written by the user. Selecting right parameters is crucial for correct calculations and displaying warnings.

Table 7: Battery parameters

Battery parameter	Options
Bank type	Main battery, primary battery, secondary battery, auxiliary battery, port battery, starboard battery, bow battery, stern battery, solar battery, starter battery, battery bank 1, battery bank 2 and "other" battery
Chemistry type	Lead Acid, Li-Ion, Ni-Cad, Zn-O, Ni-Mh
Battery type	Flooded, GEL, AGM
Nominal voltage	6 V, 12 V, 24 V, 32 V, 36 V, 42 V, 48 V
Rated capacity	Should be set by the user according to battery capacity
Temperature	Celsius, Fahrenheit, Kelvin

Table 6: Shunt parameters

Shunt parameter	Options
Peukert exponent	Dependency between battery capacity and discharge rate. Valid values 1.0 ~ 1.5 Initial value is set automatically based on battery chemistry.
Charging efficiency	Charger's efficiency. Valid values 0.6 ~ 1.0 Value is constantly modified during battery lifetime.
Temperature coefficient	Dependency between battery capacity and environment temperature. Valid values 0.0 ~ 1.0
Voltage at battery full (V)	Charger's float voltage. Initial value is set automatically based on battery chemistry and nominal voltage.
Current at battery full (A)	Charger's float current. Initial value is set automatically based on battery chemistry and rated capacity.
Voltage at battery empty (V)	Battery empty voltage. Initial value is set automatically based on battery chemistry and nominal voltage.
Config button action	No action: WiFi is always on and ready for configuration; WiFi power: button press enables or disables WiFi. When enabled, it gets automatically in config mode; WiFi config: WiFi is enabled all the time, with pressing button SMARTSHUNT enters, or exit, config mode;
SoC low limit (%)	0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

Alert parameters:
Parameter values in this menu can be freely selected by the user. When measurements are outside limited values, warning message will be sent to NMEA2000 network and shown on screen of Exxx device. List of available alerts is written bellow:

Table 8: Alarm parameter

Alert parameter	Options
Low voltage	Alert will show up when voltage on battery will be bellow selected value
High voltage	Alert will show up when voltage on battery will be above selected value
High charge current	Set the maximum charging current
High discharge current	Set upper limit of current that can be drawn by devices
Low temperature	Set low temperature limit for alert
High temperature	Set high temperature limit for alert
Low state of charge	Set when to alert battery remaining capacity

⚠️ **Press ''SAVE'' to keep your settings**

Configuring via WIFI

SMARTSHUNT has integrated WIFI hot spot to which you can connect with smart phone or any other device that allows web browsing. It can be automatically connected with scanning QR code bellow serial number. You may get a message from the system, that there may not be available internet connection but just simply run your web browser and type in config.lxnav.com. With pressing enter, configuration page will show up. Before changing any parameter, user should put SMARTSHUNT in config mode. That means violet status LED must be lit. In any other mode, settings will not be saved. For enabling WIFI or putting it in config mode press Config button for more than a second.

Configuration webpage that will show up consist of four pages easily selectable on top of the screen: Home, Battery config, Shunt config and Info page.

Homepage
On home page user can view all current data of system in real time that are result of selected values on config pages, for example voltages, temperatures, current drawn, state of charge etc. as well as peak recorded values and history of alarm messages.

Battery configuration
On this page user configures battery type with all necessary data that are mandatory for correct calculations of battery state and health.

Please do not access to the browser via QR code for configuration, because browser does not support popup windows and saving configuration will not be possible.

⚠ The only way is to open browser and visit config.lxnav.com. Then you can change and save configuration settings.

Shunt configuration page
All the necessary data related to current measurements should be filled out in this page. There is also button setting for desired WIFI action.

Info page
On this page are all information about device. Its serial number, hardware and software version.

Configuration via LXNAV Exxx device
Second option for configuration of SMARTSHUNT is via any Exxx device. Assuming that the NMEA2000 network is established battery and shunt configuration pages are accessible under different paths under setting menus. In following two chapters are written paths where menus can be found and their window previews. For operating and calibrating external devices on Exxx units refer also to Exxx user manual.

Battery setup
Parameters related to battery packs should be set in menu that is accessible under this path: Settings->Network->Device calibration->Battery

Shunt setup
Second configuration menu is found under:
Settings->Network->Connected devices-> Device details->Device setup

Parameters there relates to measurements between shunt's terminals. There is also information about WiFi hotspot name and password under which is SMARTSHUNT accessible.

Inside shunt setup is submenu Alerts configuration with user selectable parameters limits for warning messages. There are seven warnings available in total.

First operation

Smart Shunt will start to operate normally and indicate real values after initial cycle. Initial cycle is finished, when first time are fulfilled conditions for battery full (Voltage must be higher than voltage setting for full and charge current must drop below full current setting)
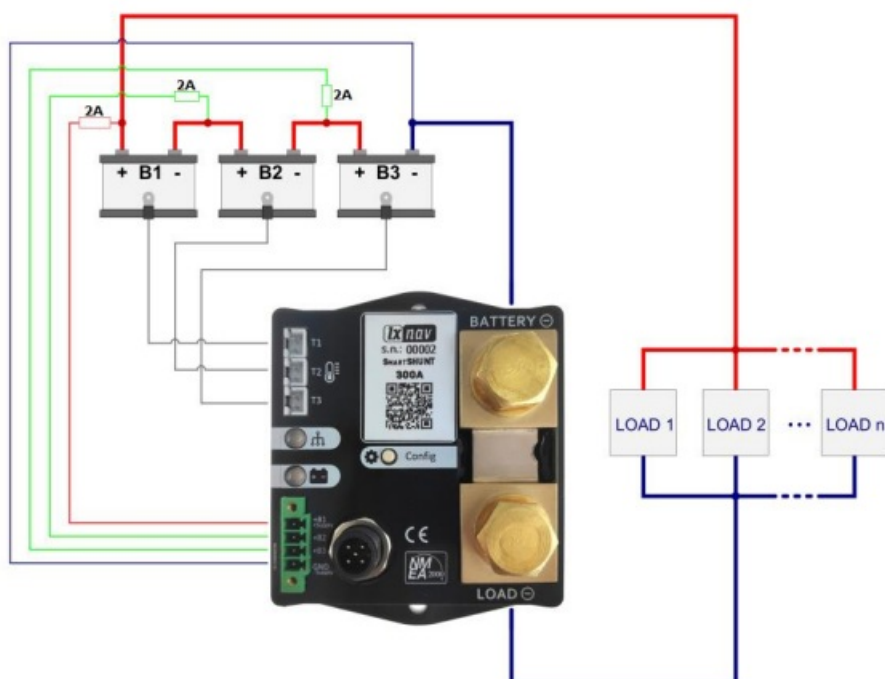To get really good performance, smart shunt will need more charge/discharge cycles, to tune also other parameters like charge efficiency….

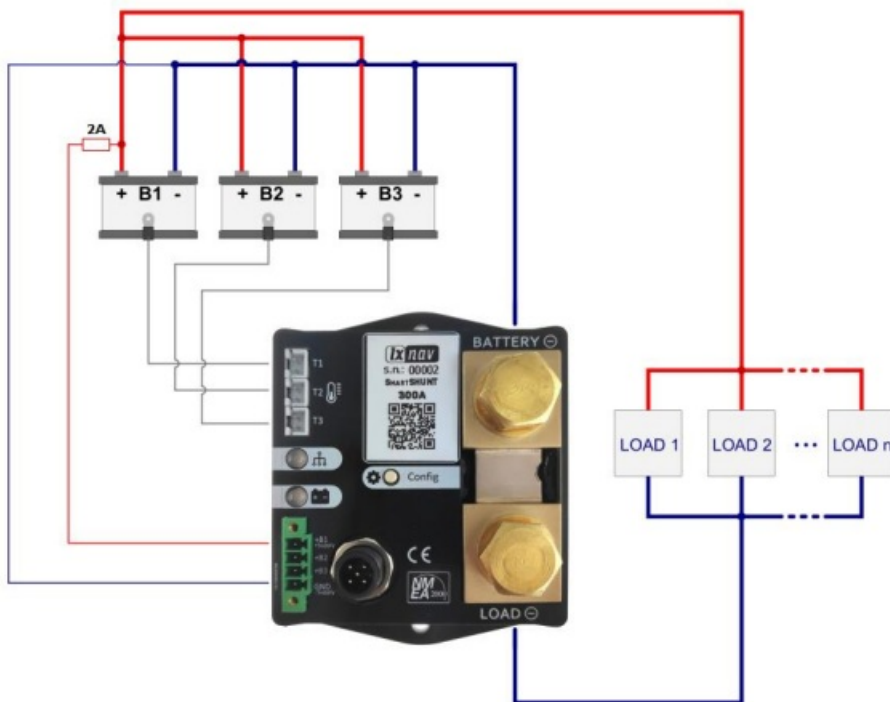## Dimensions
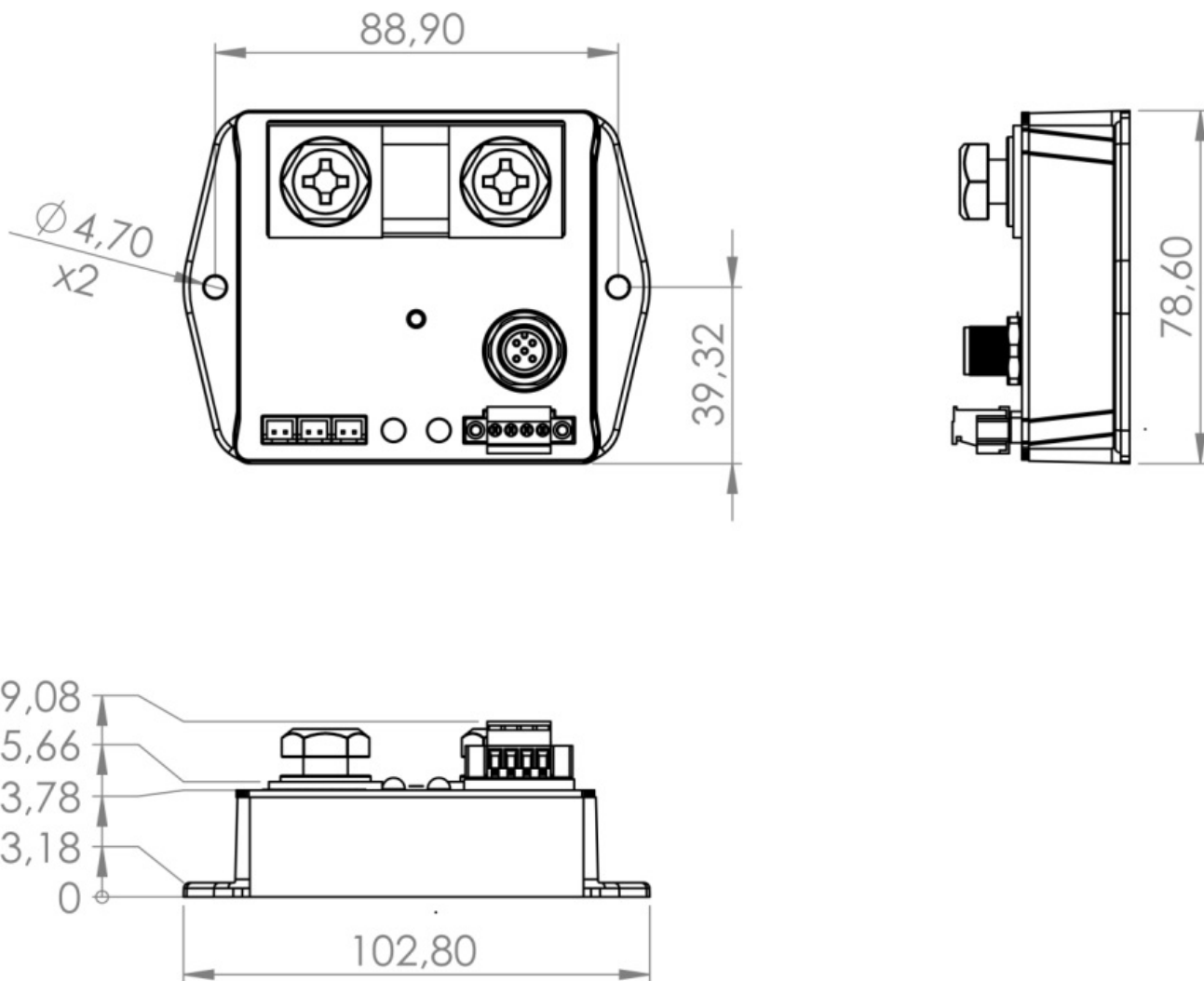
Wiring

Figure bellow shows example wiring with combination of three battery packs. In case user has fewer batteries, leave dedicated terminals empty.

Revision history

Date	Revision	Description
JUNE 2023	1	Smart SHUNT Safety updates

Customer Support

Documents / Resources

ixnav Digital Battery Monitoring SmartShunt [pdf] Installation Guide
Digital Battery Monitoring SmartShunt, Battery Monitoring SmartShunt, Monitoring SmartShunt, SmartShunt

References

- **lx Home - LXNAV Marine**
- **User Manual**