

BTS

Battery Test System 2/4 Channel



Instruction manual

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1. Product description

The C-GO Battery Test System from IVRA Electronics will make 12V and 24V battery testing and/or reconditioning easy and efficient. Normal battery testing will be easy using our intuitive menu and 7" touchscreen. Connect the batteries and temperature sensor, set the right testing parameters and press start is all you have to do. The Battery Test system will test lead-acid(Gel /AGM) and lithium ion batteries and show a detailed report on the 7" touchscreen when the test is finished. An option is to write the result to a flash drive. Another feature of the battery test system is testing 12V and 24V chargers.

Potential applications







- Battery quality control
- Reconditioning batteries
- Checking batteries so they can be redeployed



The BTS consists of:

1. A high quality metal powder coated housing.
2. A 7 inch touch display.
3. Two or four battery test channels.
4. Up to three built in chargers (12V or 24V or 12V-24V combination).
5. One built in discharge module.
6. Two or four SB50 to Crocodile clamps battery test leads.
7. Two or four temperature sensors with 3.5mm jack cable.
8. One power cord IEC-C13.
9. SB50 to XLR charger test lead.
10. USB – 3.5mm jack serial cable.

Symbols:

| | |
|---|--|
|  | You must obey the safety instructions. |
|  | Read the user instruction before use |
|  | For indoor use only |
|  | Do not use in a damp environment or in rain. |
|  | Do not dispose of the BTS as household garbage. In order to save the environment it must be disposed of with care in accordance with local regulations. |
|  | The BTS meets the CE requirements valid in Europe. |













2. Safety instructions

- Do not charge the Li-ion battery at temperatures below 0°C. First transport the Li-ion battery and the BTS to a location where the temperature is higher and then start the test/charging procedure.
- Charge specified batteries only. Do not recharge non-rechargeable batteries.
- Charge the batteries only if there is proper ventilation. Especially around the batteries. While charging, a small amount of explosive gasses can be generated in the batteries. inadequate ventilation in combination with open fire or sparks can lead to dangerous situations.
- Do **not** connect or disconnect the battery while the BTS is testing the battery. E.g. to reduce risk of sparking.
- Batteries are capable of providing a lot of energy in a short time span. Prevent short circuits in any way. For example walking over the cables or damaging the cables or connector by improper use.
- Only use cables supplied with the BTS.
- Do not use the BTS if the cables are damaged.
- If the power cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard. If the BTS is defective, do not try to repair it.
- The BTS should never be used in a very damp or wet environment (for instance outdoors), never pour fluids over it or submerge it in water.
- The system must not be exposed to chemical substances or vapours.
- Make sure the BTS is positioned stable.
- Keep a free zone of 20cm around the BTS to ensure that heat, generated during operation, can be removed.
- Do not place the BTS in direct sunlight.
- Do not place the BTS in an environment that contains mechanical vibrations(i.e. Compressors, etc.) or where a lot of heat is generated(Heaters, Ovens, etc.).
- The ventilation slots of the BTS have to be kept free of excessive dust built up.
- Make sure the BTS is connected to an appropriately earthed wall outlet.

3. Product overview



Overview inputs/outputs battery test system

| BTS Type | 4-channel | 2-channel |
|---|---|------------------------------------|
|  | 7" touchscreen | |
|  | Battery input channel 1 | ---- |
|  | Temperature sensor input channel 1 | ---- |
|  | Battery input channel 2 | Battery input channel 1 |
|  | Temperature sensor input channel 2 | Temperature sensor input channel 1 |
|  | Battery input channel 3 | Battery input channel 2 |
|  | Temperature sensor input channel 3 | Temperature sensor input channel 2 |
|  | Battery input channel 4 | ---- |
|  | USB (for flash drive) | |
|  | Temperature sensor input channel 4 | ---- |
|  | Mains power entry connector including fuse holder | |
|  | 3.5mm jack serial input connector | |

4. BTS power on

Power on battery test system using the power switch on the power entry connector after the power cord is connected.

Connect all battery cables to the inputs and the temperature sensor cables to the temperature sensor inputs.

5. Language selection

The BTS supports the languages English, Nederlands, Deutsch.

To select a language, press “Hardware overview”

The screenshot displays the main control interface of the Battery Test System (BTS). On the left, there are four buttons labeled 'Channel 1' through 'Channel 4'. Below these are 'Stop channel 1' and 'Test battery channel 1'. The central area contains configuration options: 'Battery type' with radio buttons for 'Gel', 'AGM', and 'LiFePO4'; 'C5 capacity' with an empty input field; 'Description' with an empty text box; and 'Number of discharge cycles' with radio buttons for '1', '2', and '3'. On the right, a vertical menu includes 'Main menu', 'Results', and 'Hardware overview', which is highlighted with a green border. The bottom section features a status panel on the left showing 'Status Standby', '12.70 V', '0.00 A', '0% (0%)', and '23°C', along with 'Cycle: 0:00:00' and 'Total: 0:00:00'. To the right of the status panel is a graph with a vertical axis ranging from -10 to 5 and a horizontal axis showing time intervals from 0:01 to 0:06.

In the next screen press “Language”

Battery Test System V1.00 Apr 14 2022 10:44:55

| Load | 12V Charger | 12V Charger | 24V Charger | Charger 4 |
|--|--|--|--|-------------|
| Actual 0.00 V 0.00 A Polarity: Ok Errors:0000 DAC U:1023 DAC I:0 Setpoint DAC U:1023 DAC I:0 DAC C:0 | Inactive Actual 4.42 V 0.00 A Setpoint 0.00 V 0.00 A | Inactive Actual 4.42 V 0.00 A Setpoint 0.00 V 0.00 A | Inactive Actual 0.00 V 0.01 A Setpoint 0.00 V 0.00 A | Not present |

Main menu
Results
Hardware overview
Calibrate SB50 @ 0V
Language

In the next screen choose the required language:

English
Nederlands
Deutsch

Main menu

6. Battery test

6.1. Connect battery

Mount the battery sensor to the minus pole and connect the crocodile clamps to the battery. The battery cable and the battery sensor cable must have been connected to the same channel number.

6.2. Steps to start a battery test

1. Select the channel to which the battery has been connected

The screenshot displays the battery test configuration interface. On the left, a vertical list of channel buttons (Channel 1 to Channel 4) is shown, with Channel 1 highlighted in green. To the right of the channels are several input fields: 'Battery type' with radio buttons for Gel, AGM, and LiFePO4; 'C5 capacity' with a text input field; 'Description' with a text input field; and 'Number of discharge cycles' with radio buttons for 1, 2, and 3. Below these fields is a status panel showing 'Standby', '12.70 V', '0.00 A', '0% (0%)', and '23°C'. At the bottom of the status panel, 'Cycle: 0:00:00' and 'Total: 0:00:00' are displayed. To the right of the status panel is a graph with a y-axis ranging from -10 to 5 and an x-axis ranging from 0:01 to 0:06. On the far right, there are three navigation buttons: 'Main menu', 'Results', and 'Hardware overview'. At the bottom left, there are two buttons: 'Stop channel 1' and 'Test battery channel 1'.

2. Enter the battery parameters:
 - a. Select the battery type.
 - b. Enter the C5 capacity. (The C5 capacity is the specified capacity for a 5 hours discharge.)
 - c. Description is optional, but useful in the list of results.
 - d. When a battery has not been charged properly, it can be worthwhile to recondition the battery by increasing the discharge/charge cycles. If you do not wish to recondition the battery you can leave the default option to 1.

The voltage 12V/24V is automatically detected. 24V batteries can only be tested if the BTS has also a 24V charger inside (Option for 4-channel model only).

A set of two 12V batteries in series must be split and the 12V batteries must be tested separately because their capacities may differ.

Usually only 24V Lithium ion battery packs are tested as 24V batteries.

The screenshot shows the software interface for testing a battery on Channel 1. The 'Battery type' section is highlighted with a red box and contains three radio button options: Gel, AGM, and LiFePO4. The 'C5 capacity' field is also highlighted with a red box. Below these, the 'Description' field is empty, and the 'Number of discharge cycles' section has three radio button options: 1 (selected), 2, and 3. The interface includes navigation buttons for 'Channel 1' through 'Channel 4', 'Stop channel 1', and 'Test battery channel 1'. On the right side, there are buttons for 'Main menu', 'Results', and 'Hardware overview'. At the bottom, a status panel displays 'Standby', '12.70 V', '0.00 A', '0% (0%)', and '23°C'. It also shows 'Cycle: 0:00:00' and 'Total: 0:00:00'. To the right of the status panel is a graph with a y-axis from -10 to 5 and an x-axis from 0:01 to 0:06.

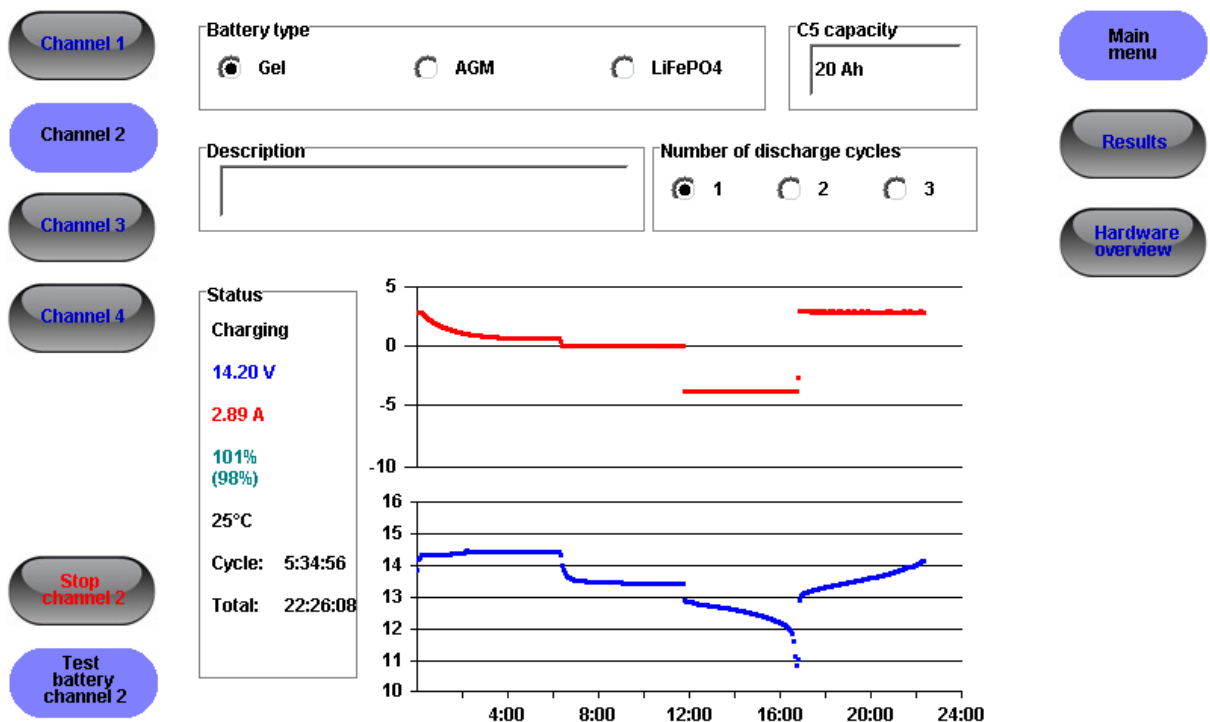
3. Start the test by the button "Test battery channel x"

The interface displays the following elements:

- Channel Selection:** Buttons for Channel 1, Channel 2, Channel 3, and Channel 4. Channel 1 is highlighted with a blue background.
- Battery Configuration:**
 - Battery type:** Radio buttons for Gel (selected), AGM, and LiFePO4.
 - C5 capacity:** A text input field containing "20 Ah".
- Test Parameters:**
 - Description:** An empty text input field.
 - Number of discharge cycles:** Radio buttons for 1 (selected), 2, and 3.
- Status Panel:**
 - Status:** Standby
 - Voltage:** 12.70 V
 - Current:** 0.00 A
 - Charge Level:** 0% (0%)
 - Temperature:** 23°C
 - Cycle:** 0:00:00
 - Total:** 0:00:00
- Graph:** A coordinate system with a vertical axis from 10 to 5 and a horizontal axis from 0:00 to 0:06. No data is plotted.
- Navigation:** Buttons for Main menu, Results, and Hardware overview.
- Control:** Buttons for Stop channel 1 and Test battery channel 1. The Test battery channel 1 button is highlighted with a green border.

4. During the test, the status of the test is shown (in this example channel 2 is shown):
- Charge phase. This can be one of:
 - Stand by
 - Waiting for internal device. (The internal discharge unit is shared over all battery channels and in the 4 channel model there are less chargers than channels. Thus it can occur that a battery must wait for a charger or for the discharge unit.)
 - Charging
 - Discharging
 - Ready
 - Testing external charger
 - Actual battery voltage
 - Actual battery current
 - Discharge capacity compensated for temperature. (Between brackets is the capacity uncompensated for temperature.) These values are percentages of the C5 capacity.
 - Actual battery temperature
 - Actual discharge or charge cycle elapsed time
 - Total elapsed time

The two graphs show the battery current (red line) and the battery voltage (blue line) during the test.



If the test is ready, the “Stop channel x” button has to be used before another battery can be tested. This button might also be used to abort a running test.

5. To observe the list of results, press the Results button

The screenshot shows the software interface with the following elements:

- Channel Selection:** Channel 1, Channel 2, Channel 3, Channel 4.
- Battery type:** Radio buttons for Gel (selected), AGM, and LiFePO4.
- C5 capacity:** Input field showing 20 Ah.
- Description:** Empty text field.
- Number of discharge cycles:** Radio buttons for 1 (selected), 2, and 3.
- Status:** Charging, 14.20 V, 2.89 A, 101% (98%), 25°C.
- Cycle:** 5:34:56
- Total:** 22:26:08
- Graph:** A line graph with two y-axes. The top axis ranges from -10 to 5, and the bottom axis ranges from 10 to 16. The x-axis shows time from 4:00 to 24:00. A red line starts at approximately 3.5, drops to 0 by 8:00, and then fluctuates between -4 and -5. A blue line starts at approximately 14.5, drops to 13.5 at 8:00, and then fluctuates between 11 and 14.
- Navigation Buttons:** Main menu, Results (highlighted with a green border), Hardware overview, Stop channel 2, Test battery channel 2.

The result list is shown as in this example:

The screenshot shows the software interface with the following elements:

- Results List:**

| Result nr | Channel | Battery type | C5 capacity | Discharged | Temperature | Elapsed time | Status |
|-----------|-----------|--------------|-------------|------------|-------------|--------------|-----------|
| 1 | Channel-2 | LiFePO4 | 20Ah | 94% | 24°C | 16:44 | Completed |
| 2 | Channel-1 | LiFePO4 | 20Ah | 188% | | 27:38 | Completed |
| 3 | Channel-3 | LiFePO4 | 20Ah | 89% | | 30:29 | Completed |
- Selected result details:**
 - Result nr: 1
 - Channel: 2
 - Battery type: LiFePO4
 - C5 capacity: 20Ah
 - Discharged: 94% (94%)
 - Temperature: 24°C
 - Elapsed time: 16:44
 - Status: Completed
- Navigation Buttons:** Main menu, Results, Hardware overview, CLEAR ALL RESULTS.

At the left part of the screen, the list of results comprehends:

- Red triangle in case the result has an error
- Result sequence number
- Channel number
- Battery type
- Battery C5 capacity

- f. Discharge capacity compensated for temperature. This value is a percentage of the C5 capacity. If more than 1 discharge has been performed, all results are listed. F.e. 88%/89%/89%
- g. Elapsed time
- h. Status (completed or not)
- i. Description

In case the test was a charger test the items d. e. f. are replaced by “Charger test” and the charger current and voltage during the test.

Another result can be selected by touching it.

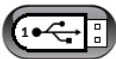
At the right part of the screen the selected result is showed in more detail: Uncompensated capacity, average temperature during test and error description are additionally shown.

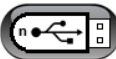
The screenshot displays the application interface. On the left, a table titled "Results" lists three test entries. The second entry is selected and highlighted in blue. On the right, a detailed view titled "Selected result" shows the parameters for the selected test. A vertical sidebar on the far right contains several navigation buttons: "Main menu", "Results", "Hardware overview", a USB icon, and "CLEAR ALL RESULTS". At the bottom of the detailed view, there is a USB icon with the number "1" next to it.

| Results | | |
|---------|-----------------------------|-----------------|
| 1 | Channel-2 LiFePO4 20Ah 94% | 16:44 Completed |
| 2 | Channel-1 LiFePO4 20Ah 188% | 27:38 Completed |
| 3 | Channel-3 LiFePO4 20Ah 89% | 30:29 Completed |

| Selected result | |
|-----------------|------------------------|
| Result nr | 2 |
| Channel | 1 |
| Battery type | LiFePO4 |
| C5 capacity | 20Ah |
| Discharged | 188% (187%) |
| Temperature | 24°C |
| Elapsed time | 27:38 |
| Status | Completed |
| Error | More than 150% charged |

In case a flash drive (FAT32 format) is present:

The button  can be used to store the selected result (same information as on screen) to the flash drive.

The button  can be used to store all results (same information as on the list on screen) to the flash drive.

The information is stored on the flash drive as an ASCII text file.

The button “Clear all results”, will clear the complete result list. However the running tests (not yet in this list) are unaffected. This cannot be undone.

7. Charger test

The BTS can test both 12V and 24V chargers. Even if the BTS has no internal 24V charger.

7.1. Connect charger

If the charger has no XLR connector:

Connect the plus and minus cables of the charger to the crocodile clamps of the BTS cable.

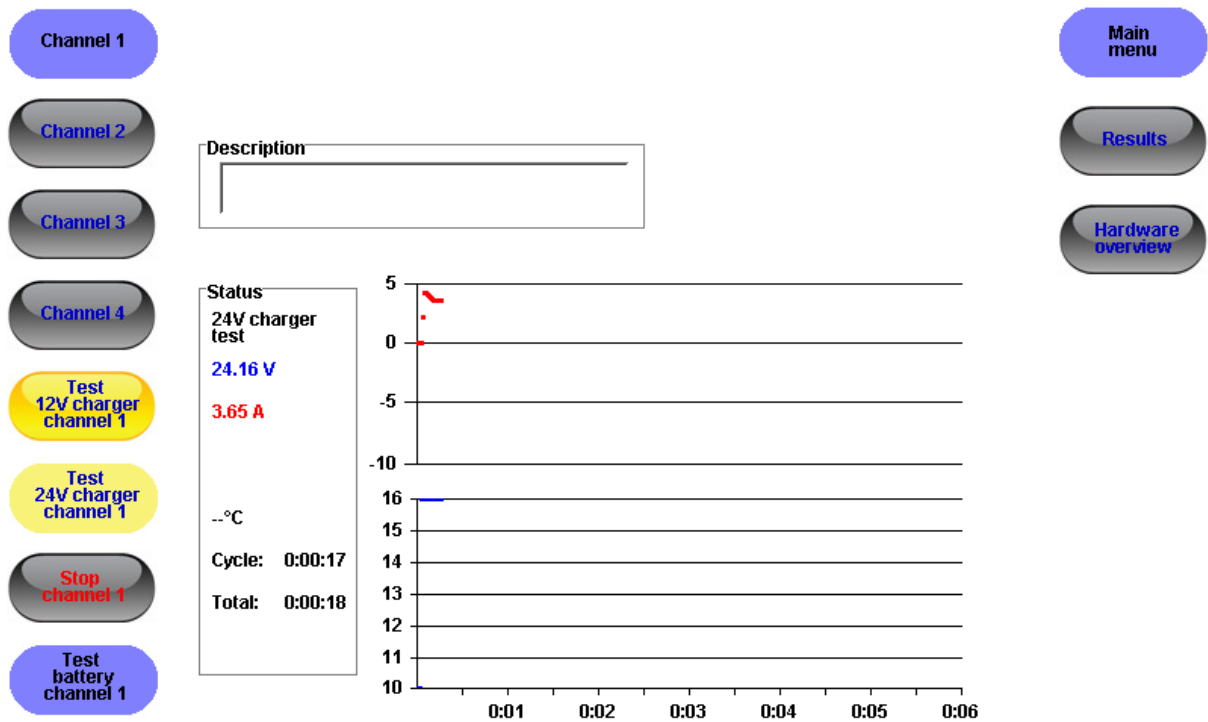
If the charger has an XLR connector:

Connect the SB50-XLR cable to one of the channels of the BTS instead of the cable with crocodile clamps. Connect the charger to the XLR cable.

Switch on the charger.

7.2. Steps to start a charger test

1. Select the appropriate channel and press the yellow “Test 12V charger channel x” or “Test 24V charger channel x” button. Be sure to select the right voltage.



2. After 2 minutes the test is finished. The result can be viewed in the same way as the battery results.

8. BTS - PC connection

A USB – 3.5mm jack serial cable is included to connect the BTS to a PC or laptop.

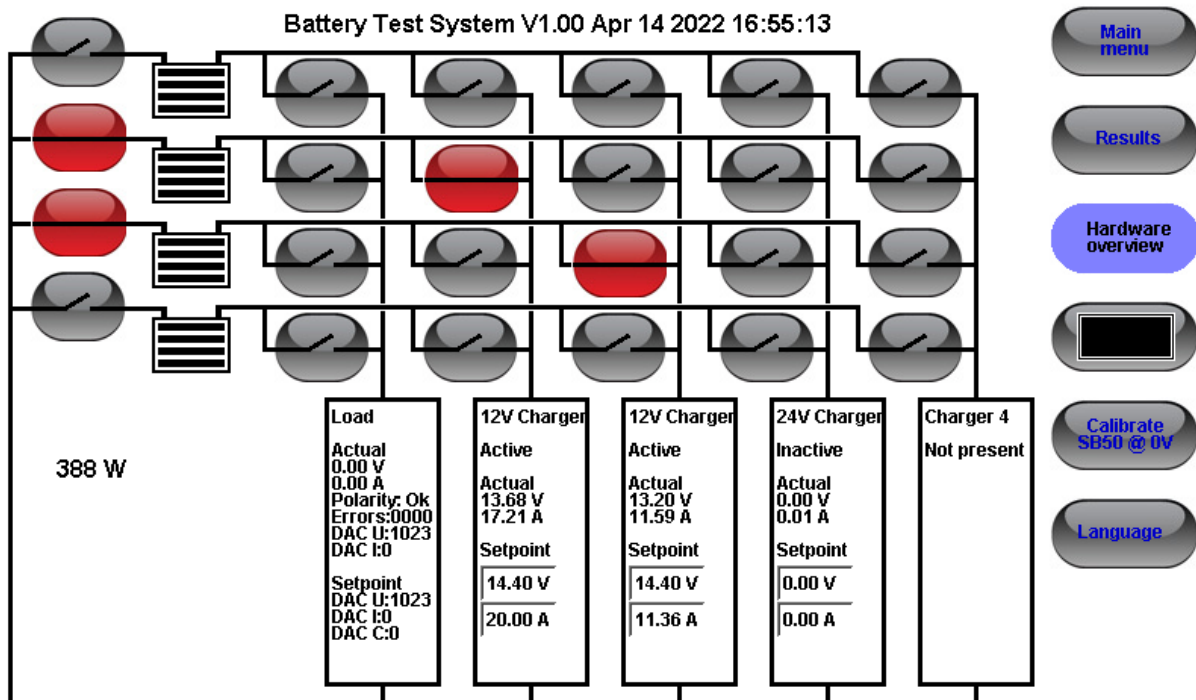
In this way it is possible to transmit the following information from the BTS to PC/laptop:

- Real time data for each channel: voltage, current, temperature, status
- Results

This cable can also be used for software update of the BTS.

9. BTS advanced

In the hardware overview screen the actual switches and measurements for the internal chargers and load can be observed:



If the charge/discharge cables have been removed and the voltages in the main menu are not 0V, the button “Calibrate SB50 @0V” can be used to calibrate the voltage offsets.

10. Troubleshooting

During tests an error can occur. See the tables below for explanation of the error messages and codes.

| Message | Possible causes and solution |
|--------------------------|--|
| Battery temperature high | The battery tested has a problem or thermal overrun. Probably defect battery |
| More than 150% charged | The battery capacity entered is not correct or the battery has a problem |
| Internal charger error | See table below for charger error codes |
| Internal load error | See table below for load error codes |

| Charger error code | Description | Possible causes and solution(s) |
|--------------------|---------------------|--|
| 01 | Current offset high | Charger is defect. Contact your supplier. |
| 02 | Control loop error | Charger is defect. Contact your supplier. |
| 03 | Gate check fail | Charger is defect. Contact your supplier. |
| 04 | Temperature low | You are at Antarctica or charger is defect. Contact your supplier. |
| 05 | Temperature high | Insufficient cooling. Leave more space around the BTS |
| Other codes | | Contact your supplier |

| Load error code | Description | Possible causes and solution(s) |
|-----------------|---------------------------|--|
| 01 | FAN blocked | Check if the fans at the backside are not blocked from outside. |
| 02 | FAN blocked | Check if the fans at the backside are not blocked from outside. |
| 04 | Heatsink temperature high | Insufficient cooling. Leave more space around the BTS |
| 08 | Power limited | Battery capacity too high for 24V battery |
| 10 | Power limited | Battery capacity too high for 24V battery |
| 20 | Watchdog | Hardware problem. Contact your supplier. |
| 40 | Communication timeout | Hardware problem. Contact your supplier. |
| 80 | NTC not connected | Hardware problem. Contact your supplier. |
| 100 | NTC not connected | Hardware problem. Contact your supplier. |
| 200 | Output voltage low | During the external charger test, the output was overloaded. Switch the BTS off/on and test another charger. |
| 400 | Stop signal active | Hardware problem. Contact your supplier. |
| 800 | GUI not running | Hardware problem. Contact your supplier. |

11. Specifications

General

| BTS Type | 4-channel | 2-channel |
|--|--|----------------|
| Dimensions | 440 x 350 x 178 mm | |
| Weight | <TBD> KG | <TBD> KG |
| Mains voltage | 200 – 250Vac (nominal single phase) | |
| Mains frequency | 50/60 Hz | |
| Battery channels | 4 | 2 |
| 3.5mm jack battery temperature sensor inputs | 4 | 2 |
| Number of internal chargers | 3 | 2 |
| Internal charger nominal voltages | 12V/24V/combination | |
| Output voltage range (charging) | 0-18V(12V) or 0-36V(24V) | |
| Output current range (charging) | 0-20A(12V) or 0-12A(24V) | |
| Number of internal discharge units | 1 | |
| Internal discharge unit nominal voltages | 12V/24V | |
| Internal discharge unit current | 0-40A | |
| Internal discharge unit maximum power | 600W Above 35 °C ambient temperature the maximum discharge power is derated | |
| Battery discharge rate (C5) | 20-200 Ah(User configurable) | |
| Supported battery voltages | 12V/24V | |
| Discharge current measurement accuracy | < 1% Full Scale | |
| Discharge voltage measurement accuracy | < 1% Full Scale | |
| 3.5mm jack serial input | 1 | |
| Female USB2.0 type A port for flash drive | 1 | |
| USB flash drive format | FAT32 | |
| Touchscreen | 7 Inch | |
| Firmware upgrade | Yes, using USB cable | |
| Cooling | Active, 4 fans | Active, 3 fans |
| Use | For indoor use only | |
| Ambient temperature range, active | 0 – 40°C | |
| Ambient temperature range, storage | -15 - +50°C | |
| Maximum air humidity | 95% (non condensing) | |
| IP Class | IP20 | |
| Standardization | CE (EMC, RoHS) | |
| Standards | EN-61326-1, EN61010-1, EN 60335-2-29 | |

Supported batteries

| | |
|------------------------------------|---|
| Battery types | Gel / AGM / LiFePO4 |
| Battery nominal voltage | 12V / 24V (if internal 24V charger present) |
| Battery C5 capacity | 20 – 200 Ah |
| Charge current (main charge phase) | Max. 29% of C5 capacity |
| Charge voltage (absorption phase) | Gel: 14.4V(12V) or 28.8V(24V) AGM: 14.7V(12V) or 29.4V(24V) LiFePO4: 14.4V(12V) or 28.8V(24V) |
| Charge current (post charge phase) | Gel: 10% of main charge current AGM: 25% of main charge current LiFePO4: no post charge |
| Discharge current | Max. 20% of C5 capacity |
| End of discharge voltage | 10.5V (12V) / 21V (24V) |

Supported external chargers to be tested

| | |
|---------------------------|---------------------------|
| Charger nominal voltage | 12V / 24V |
| Test voltage | 12.5V (12V) / 25.0V (24V) |
| Max. test charger current | 40A (12V) / 20A (24V) |



EC Declaration of conformity

We: **IVRA Electronics B.V.**
Address: **Delta 105**
6825 MN Arnhem, the Netherlands

herewith declare under our sole responsibility that:

Product: **Battery Test System(BTS)**
Article numbers: **--**

to which this declaration relates, is in conformity with the requirements of:

| | |
|-------------------------------------|---|
| <i>Directive:</i> | <i>Applied European standards:</i> |
| Low voltage (2006/95/EC) | Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers |
| EMC (204/108/EC) | EN-61326-1 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements EN61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements |

**RoHS
(2011/65/EC)**

This certificate is not valid yet!

provided that the equipment is installed and used according to our instructions.

Date of issue: 2th April 2022

Signed:

(project manager)