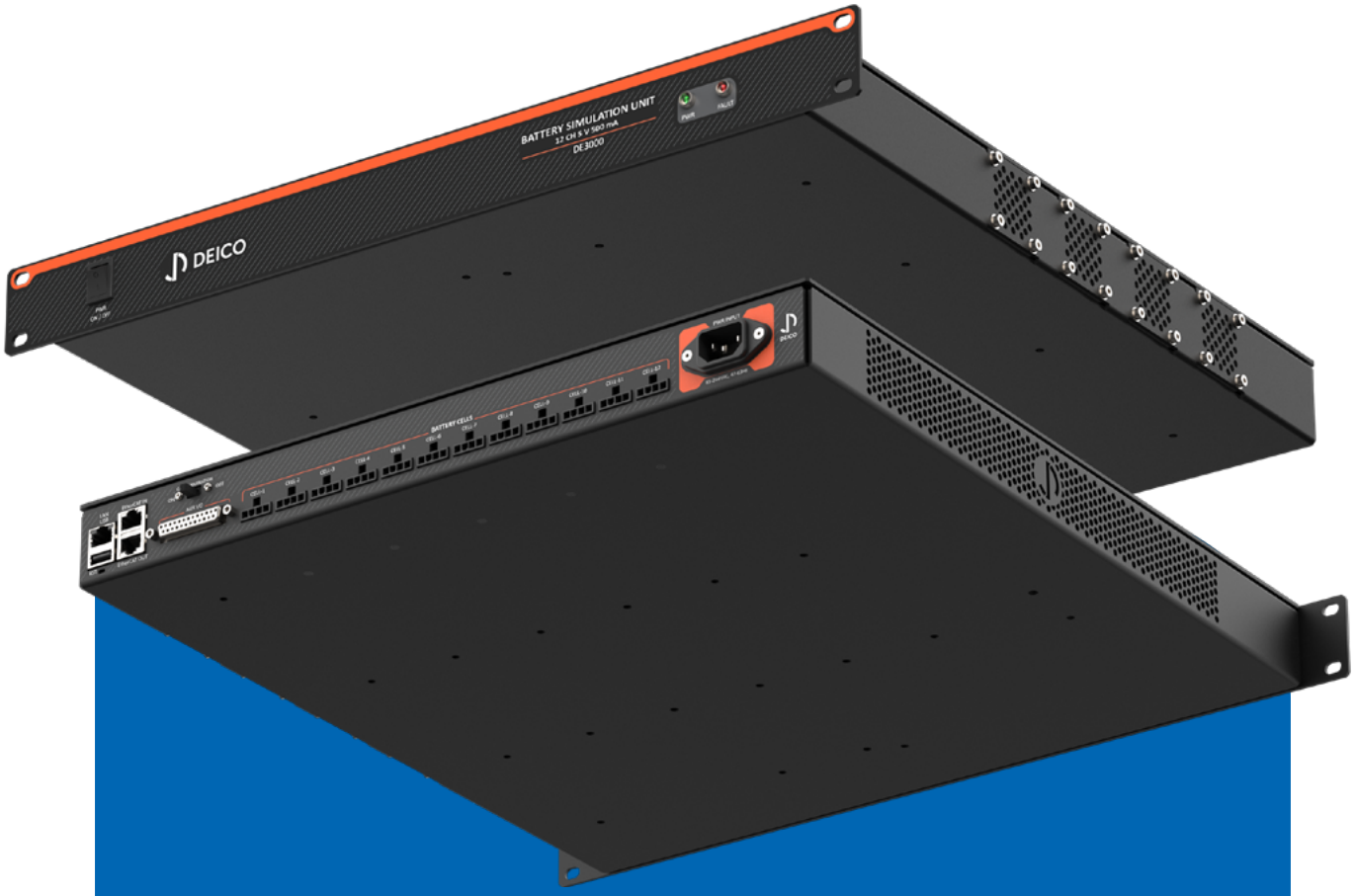
User Manual



DE3000

Battery Simulation Unit

12 CH 5 V 500 mA

DEICO

www.deico.com.tr

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1. Introduction

This manual provides comprehensive guidance on setting up and operating the DE3000 Battery Simulation Unit 12 CH 5 V 500 mA. It includes detailed instructions on using the graphical user interface (GUI), configuring communication modes (Ethernet or CAN), and understanding the effects of communication modes on messaging protocols. Additionally, the document explains the structure and usage of message packages for effective device communication and control.

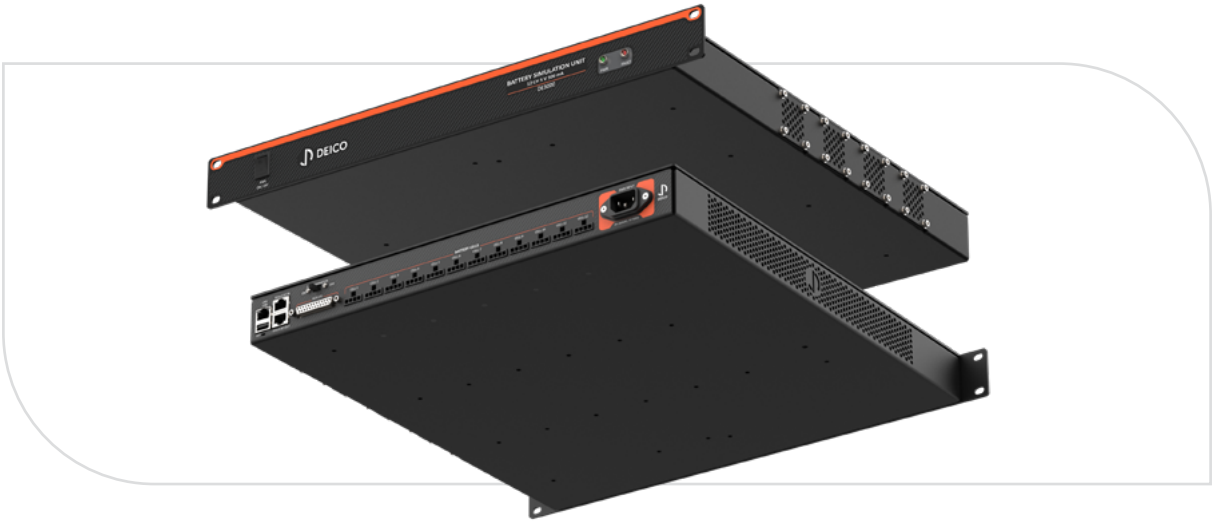


Figure 1: DE3000 Battery Simulation Unit 12 CH 5 V 500 mA

1.1. Introduction to DE3000 Battery Simulation Unit 12 CH 5 V 500 mA

DE3000 Battery Simulation Unit 12 CH 5 V 500 mA provides a safe and efficient method for battery, grid storage, and automotive companies to accurately simulate a broad range of battery pack and cell conditions. DE3000 consists of 12 individually controlled simulated cells and several auxiliary analog and digital I/O channels. Integrated computing allows the unit to be configured for custom battery profiles and simulated events. Multiple units can be combined in series to simulate higher channel count battery packs.

1.1.1. Features of DE3000 Battery Simulation Unit 12 CH 5 V 500 mA

- 1 U rack-mountable instrument designed to meet all the testing requirements of battery-sensitive products
- 12 independent battery simulation channels
- 1600 V DC isolation
- Auxiliary analog and digital I/O connections
- Up to 5 V and 500 mA source and sink capability per channel
- Ethernet, USB, EtherCAT, and high-speed CAN control interfaces are available for remote control and configuration (Note: USB and EtherCAT interfaces are not currently available for customer use and may be supported in a future release.)

- Easy control via DEICO's user-friendly DEICO Battery Simulator Control Panel
- Fast integration into existing software environments with the provided API library

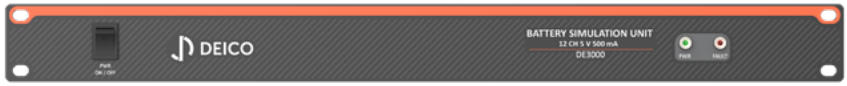


Figure 2: Front View of DE3000 Battery Simulation Unit 12 CH 5 V 500 mA

DE3000 Battery Simulation Unit 12 CH 5 V 500 mA is turned on and off us via the Power Switch located on the front panel. Also, there are two LEDs placed on the front panel to indicate operation status.

Table 1: Power LED

Power Indicator LED	Condition
Constant green	Operating
Off	System off

Table 2: Fault LED

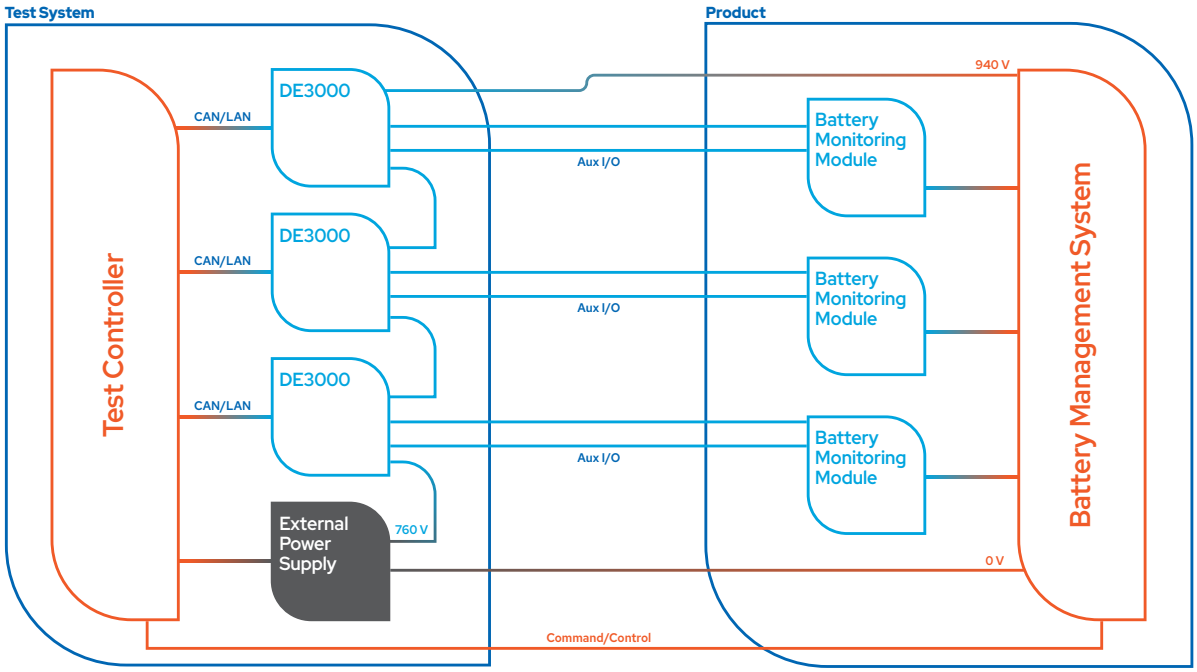
Fault Indicator LED	Condition
Constant red	System error
Blinking red	Communication error
Off	System off

Figure 3: Rear View of DE3000 Battery Simulation Unit 12 CH 5 V 500 mA

Communication ports, auxiliary inputs and outputs, and battery cells are reached from the rear panel.
The outputs of the DE3000 can be connected in series to simulate a battery pack. This configuration should be carried out with extreme caution as hazardous voltages can be generated due to the additive nature of the cell outputs. For example, 12 cells in series with each cell at 5 volts will generate 60 V total. An example to such configuration can be found in application example section.

1.2. Application Example

DE3000 Battery Simulation Unit 12 CH 5 V 500 mA can be used to simulate both separate battery cells and battery packs. In the example below, three DE3000 Battery Simulation Units are stacked above a 760 V external power supply to provide an overall pack voltage of 940 V. Additionally, Aux I/O pins can be used to read external analog signals or simulate voltage-output sensors to meet different simulation scenarios.



Typical applications of DE3000 Battery Simulation Unit 12 CH 5 V 500 mA include;

- HIL testing,
- BMS validation, verification, and production testing,
- Testing of any battery-sensitive electronic device,
- Battery pack simulation, up to 320 cells.

2. Installation

To install the DE3000 Battery Simulation Unit 12 CH 5 V 500 mA, the instructions below should be followed.

- Mount the DE3000 Battery Simulation Unit 12 CH 5 V 500 mA in a 19-inches rack. DE3000 occupies 1 U of space. The cooling air flows from left to right when looked from the front of the unit. Additional units can be mounted above and below the unit requiring no additional space between them.
- Make wiring connections according to the needs of the device to be tested. Use Figure 5 and Table 3 as a reference before making connections. Figure 6 is an example for wiring.
- Connect the AC power cord to the back panel of the unit and to a properly grounded power receptacle. Turn on the device using the switch placed the front panel of the unit.
- When connecting to the device via CAN, make sure the CAN-Termination switch is in the correct position according to the setup.

1. Ethernet USB LAN RST
2. EtherCAT
3. Auxillary I/O
4. CAN Term ON/OFF
5. Cell Connections
6. AC Power Input

Figure 4: Rear Panel Connections of DE3000 Battery Simulation Unit 12 CH 5 V 500 mA

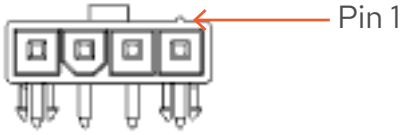


Figure 5: Pin Numbering of Cell Connections (Connector Part No: 0039303046)

Table 3: Cell Connector Connections

Pin Number	Connection
Pin 1	Sense+
Pin 2	Vout+
Pin 3	Vout-
Pin 4	Sense-

Vout+ and Vout- connections are cell simulator outputs with the capability of both sourcing and sinking current. Sense+ and Sense- connections are used for remote sensing Vout+ and Vout- signals.

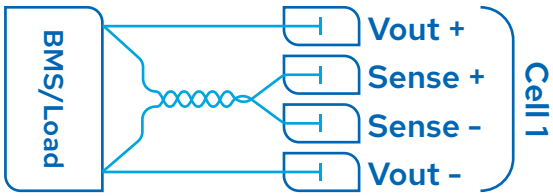


Figure 6: Wiring for Remote Sense

Caution

The connection order shown in Figure 6 is not in line with the connector signal assignment in DE3000. It is given for illustration purposes.

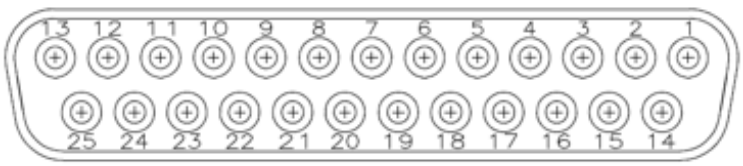


Figure 7: Aux I/O Connections (Connector Part No: L77SDB25S1ACH4F)

Table 4: Aux I/O Connection Description

Signal	Description
Analog Inputs 1-8	Single-ended inputs. Capable of measuring 0 to 5 V DC.
Analog Output 1-2	Can be configured to output voltages of 0 to 5 V DC.
CAN+, CAN-	Controller area network connections.
Digital I/O 1-8	Digital I/O 1-8 3.3 V digital I/Os that can be configured as inputs or outputs capable of sourcing and sinking up to 5 mA.
GND	Ground.

Table 5: Aux I/O Connector Signal Assignment

Pin Number	Connection
Pin 1	Analog In #1
Pin 2	Analog In #3
Pin 3	Analog In #5
Pin 4	Analog In #7
Pin 5	GND
Pin 6	Analog Out #1
Pin 7	GND
Pin 8	Digital I/O #2
Pin 9	Digital I/O #4
Pin 10	Digital I/O #6
Pin 11	Digital I/O #8
Pin 12	GND
Pin 13	CANH
Pin 14	Analog In #2
Pin 15	Analog In #4
Pin 16	Analog In #6
Pin 17	Analog In #8
Pin 18	GND
Pin 19	Analog Out #2
Pin 20	Digital I/O #1
Pin 21	Digital I/O #3
Pin 22	Digital I/O #5
Pin 23	Digital I/O #7
Pin 24	GND
Pin 25	CANL

3. Specifications

3.1. Cell Simulation

Specification	Minimum	Typical	Maximum	Notes
Sink & Source Voltage	0 V	—	5 V	—
Output Voltage Accuracy	—	±500 µV (±0.01%)	±3.5 mV (±0.07%)	—
Output Voltage Resolution	—	75 µV	—	—
Sink & Source Current	—	—	500 mA	—
Current Resolution	—	100 µA	—	(on readback)
Current Accuracy	—	±500 µA (±0.2%)	±3.3 mA (±0.6%)	(on readback)
Current Limiting Accuracy	—	2%	—	—
Channel to Channel Isolation	—	1600 V DC	—	—

3.2. Auxiliary I/O Specifications

Specification	Minimum	Typical	Maximum	Notes
Digital I/O Number	—	8	—	Bidirectional
Digital I/O Logic Level	—	3.3 V	—	—
Analog Input Number of Channels	—	8	—	—
Analog Input Voltage	0 V	—	5 V	—
Analog Input Voltage Resolution	—	0.5 mV	—	—
Analog Input Voltage Accuracy	—	±3 mV (±0.06%)	±20 mV (±0.4%)	—
Analog Output Number of Channels	—	2	—	—
Analog Output Voltage	0 V	—	5 V	—
Analog Output Voltage Resolution	—	0.8 mV	—	—
Analog Output Voltage Accuracy	—	±5 mV (±0.1%)	±30 mV (±0.6%)	—

3.3. Physical Specifications

Specification	Typical
Dimensions	482.6 mm x 456 mm
Height	44.5 mm
Weight	5000 g

4. Maintenance

4.1. Cleaning Instructions

To clean the DE3000 Battery Simulation Unit 12 CH 5 V 500 mA, the steps below should be followed.

- Power down the unit.
- Clean with a damp cloth.

4.2. Calibration

The recommended calibration interval is 1 year. Please contact DEICO for information regarding calibration.

5. Operating Basics

5.1. Obtaining and Installing the Battery Simulator Control Panel

A setup file will be provided along with the Battery Simulator to install the Battery Simulator Control Panel application. Following steps shows the installation process by using the setup file.

5.1.1. Selecting Additional Tasks

At first step, user is prompted to select additional tasks. These tasks are creating a desktop shortcut and installing Ixxat VCI 4.0.939.0 drivers. If user wants to install the Ixxat VCI 4.0.939.0 drivers, this option must be selected. If the drivers are not already installed, user can install drivers by selecting this option.

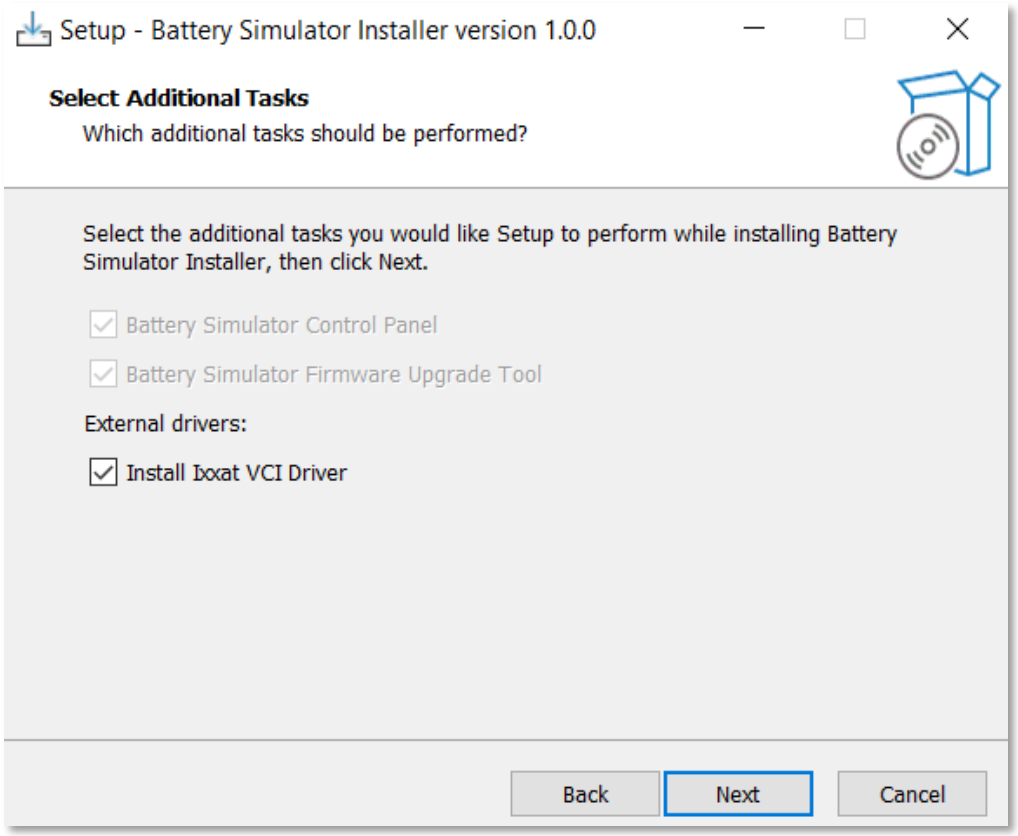


Figure 8: Setup - Selecting Additional Tasks

5.1.2. Installing Ixxat VCI 4.0.939.0 Drivers

After following “the Next”, installation starts. If user selects the option “Ixxat VCI 4.0.939.0”, another installation window automatically appears to install the drivers.

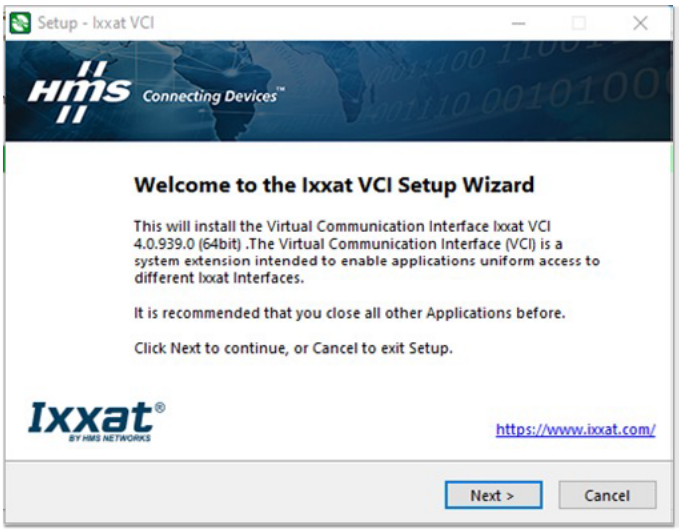


Figure 9: Setup - Installing Drivers

Driver installation wizard asks user to agree to license agreement. User must accept the terms of this agreement before continuing with the installation.

To complete driver installation, the components to be installed. In this step, this step can be proceeded with the default component selections.

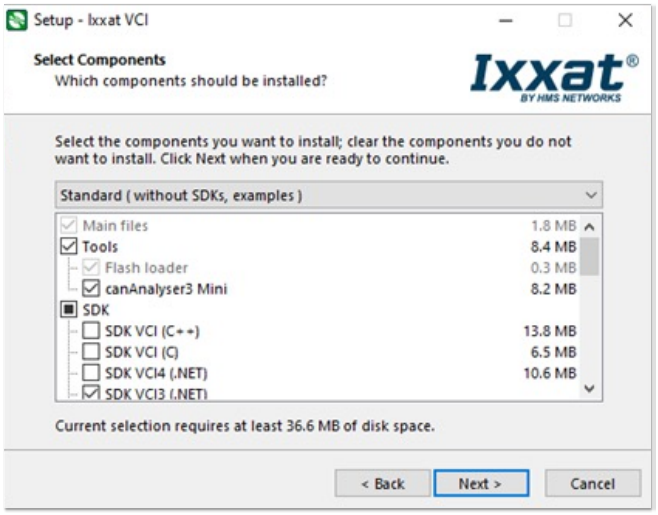


Figure 10: Setup - Installing Components

After this step, driver installation is completed.

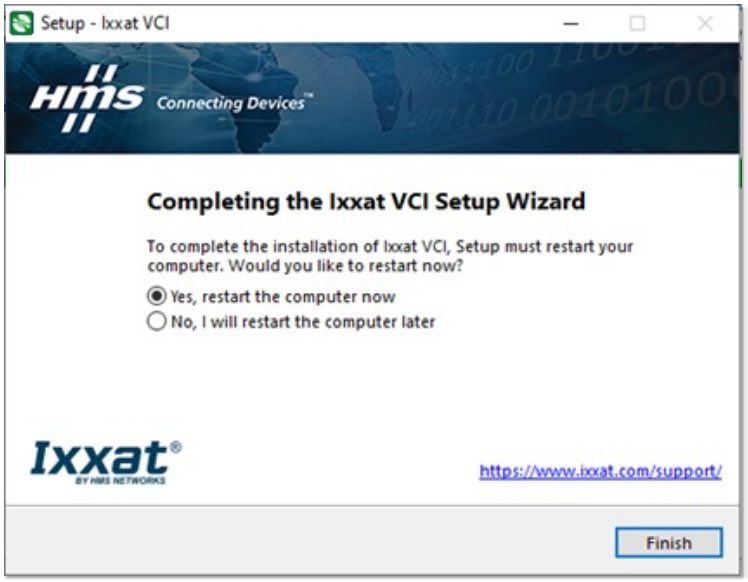


Figure 11: Setup - Completing Driver Installation

5.2. Completing Battery Simulator Control Panel Installation

The installation is finished by clicking "Finish".

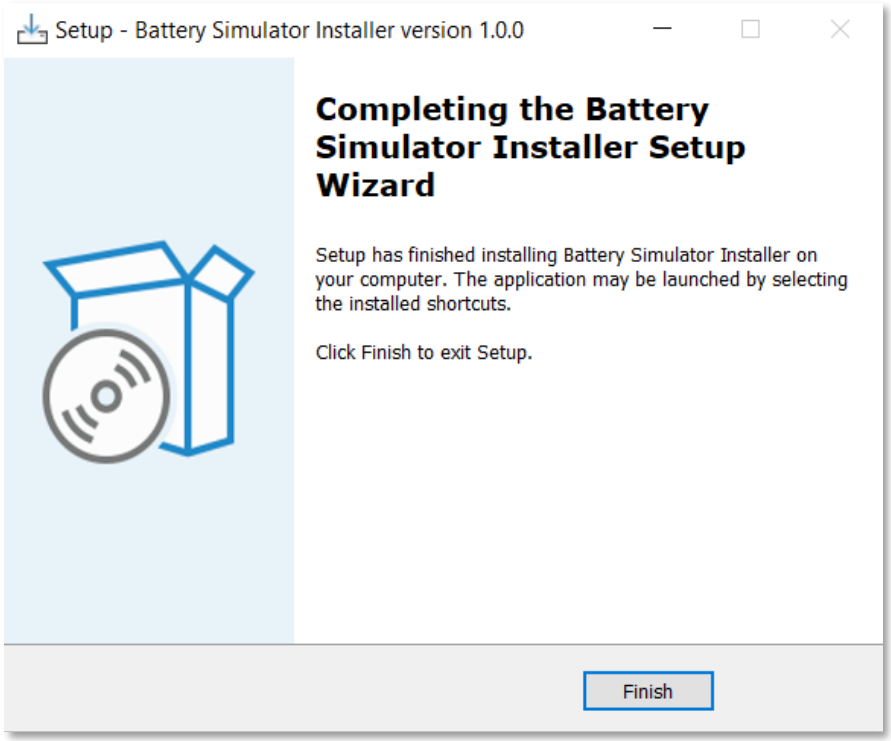


Figure 12: Completing Installation

5.3. Allow the App for UDP Communication

To allow the app for UDP communication, the steps below should be followed.

- Open “Windows Defender Firewall” control panel.
- Click “Allow an app or feature through Windows Defender Firewall”.

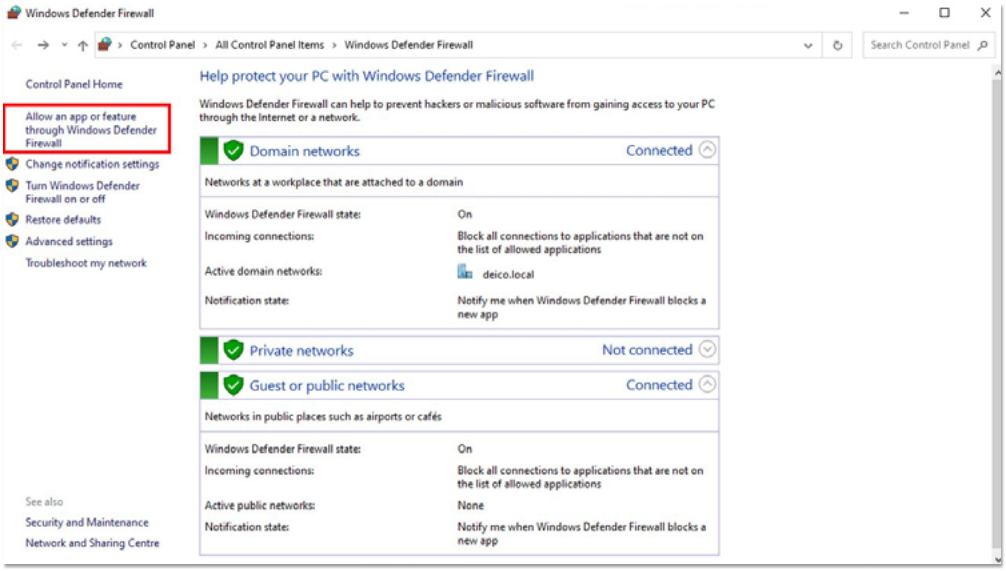


Figure 13: Allow an App Through Windows Defender Firewall

- Click “Change settings” button.

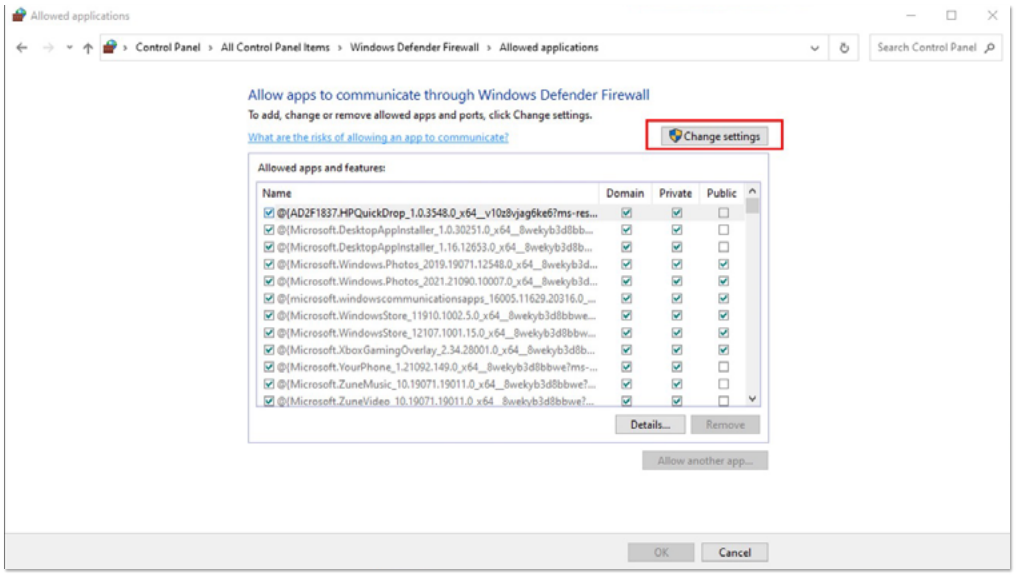


Figure 14: Allow an App Through Windows Defender Firewall

- Click “Allow another app” button.

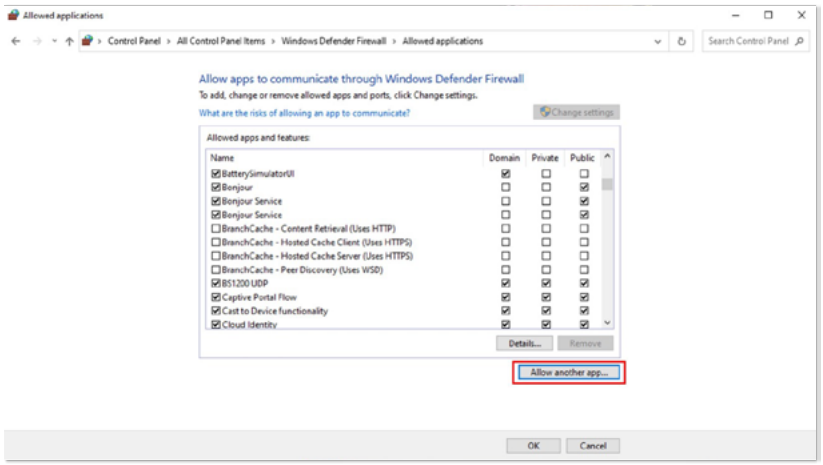


Figure 15: Add the App

- Paste the file path of the file named "BatterySimulatorControlPanel.exe" and click "Add" button.

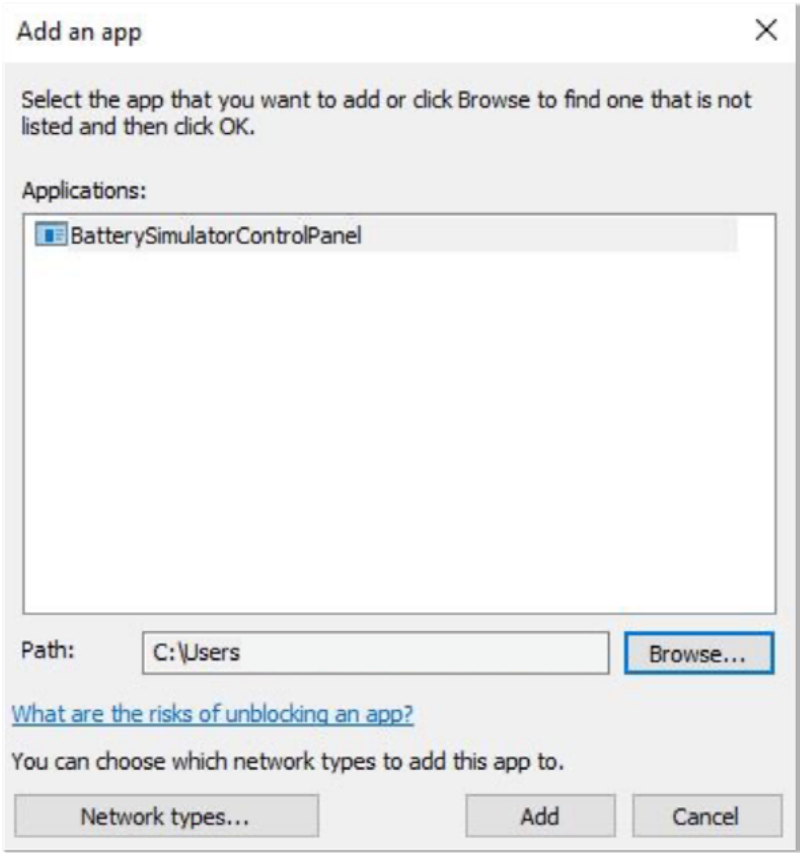


Figure 16: Select the App

- Allow public access and private access to the file that has been added and click "OK" button.

5.4 Using Battery Simulator Control Panel

Important Notes

If this software tool is going to be used over an Ethernet connection, it should be ensured that there is an active Ethernet connection between the device and the computer running the software.

If this software tool is going to be used over a CAN connection, it should be ensured that the device's CAN lines are connected to the computer via an IXXAT USB-to-CAN converter. This software is designed to work with IXXAT USB-to-CAN devices. All tests have been conducted using the IXXAT USB-to-CAN V2 Automotive (Product No: 1.01.0283.22042).

When the application starts, a control window will appear.

Figure 17: Battery Simulator Control Panel Main Screen

5.4.1. Adding a Device

To add a device, the steps below should be followed.

- To add a device, click the "Add" button.
- Select the device communication preference in the window opened.
- If the device will communicate via Ethernet, enter the IP address, TCP port, and UDP port information.

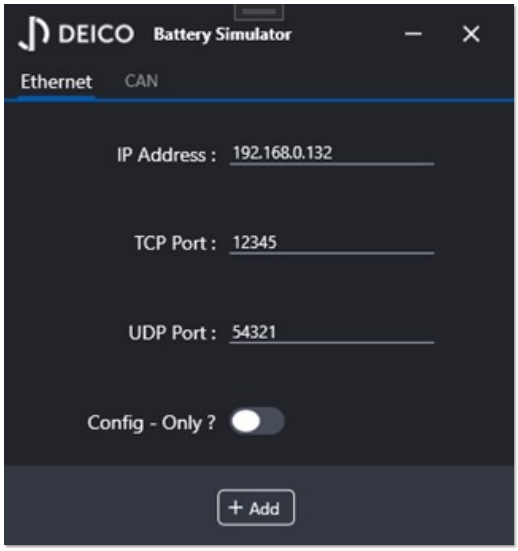


Figure 18: Ethernet Communication Information

- If the device will communicate via CAN, choose the CAN Port and enter the device ID information.

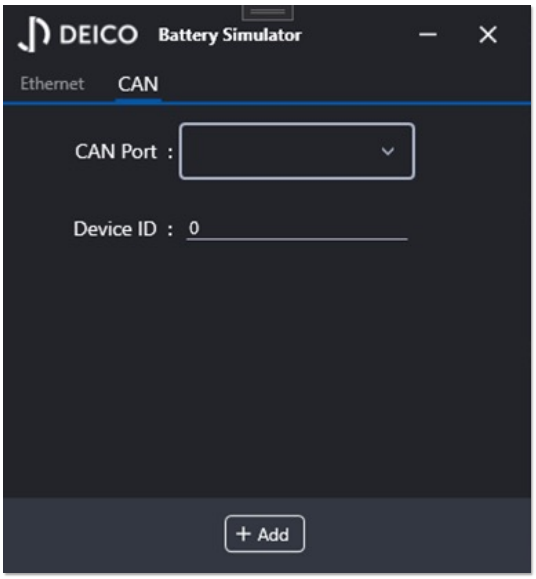


Figure 19: CAN Communication Information

- Click the "Add" button.
- The "Connected" message is shown upon successful device connection.
- The "Connection Failed" message is shown upon failed device connection.

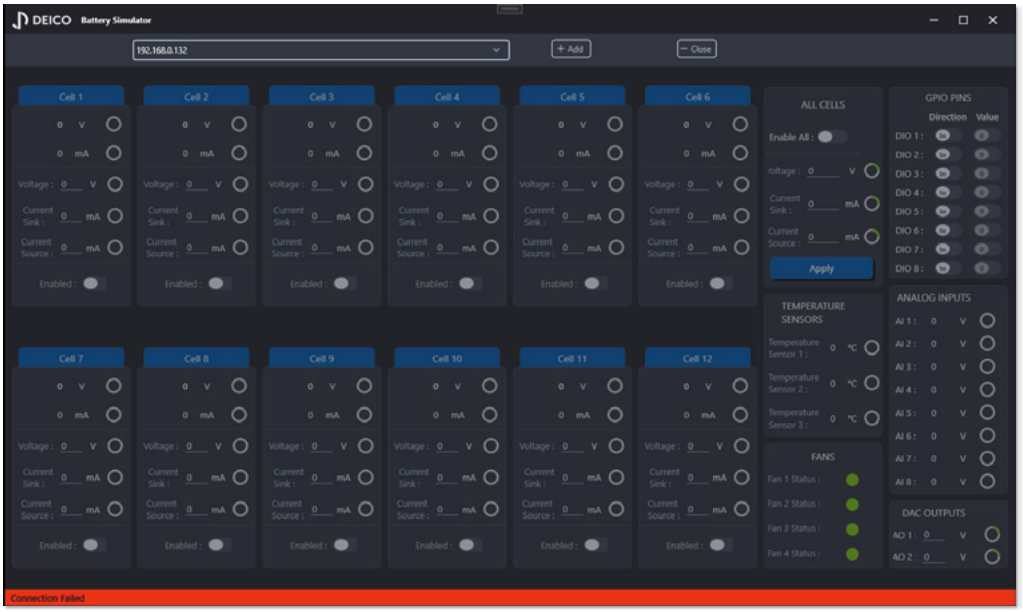


Figure 20: Connection Failed Message Screen

5.4.2. Communication with Battery Simulator

The communication starts automatically after adding the device. After the connection is established, queries are sent to the device periodically. The query responses received from the device are transferred to the GUI.

5.4.2.1. Controlling Cells

Each cell can be controlled through panels named as cell[number].

- The periodically queried cell voltage and current are displayed in the area shown in Figure 21.
- Set the "Enabled" button to either enable or disable a cell.
- Enter the desired voltage value in the voltage field and press the Enter key to set the cell voltage.
- Enter the desired value in the Current Sink field and press the Enter key to set the Current Sink value.
- Enter the desired value in the Current Source field and press the Enter key to set the Current Source value.

Figure 21: Cell Panel

5.4.2.2. Simultaneously Controlling All Cells

All cells can be controlled simultaneously from the "All Cells" panel.

- Set the "Enabled All" button to either enable or disable all cells.
- Enter the desired voltage value in the voltage field and click the "Apply" button to set the voltage value for all cells.
- Enter the desired value in the current sink field and click the "Apply" button to set the current sink value for all cells.
- Enter the desired value in the current source field and click the "Apply" button to set the current source value for all cells.

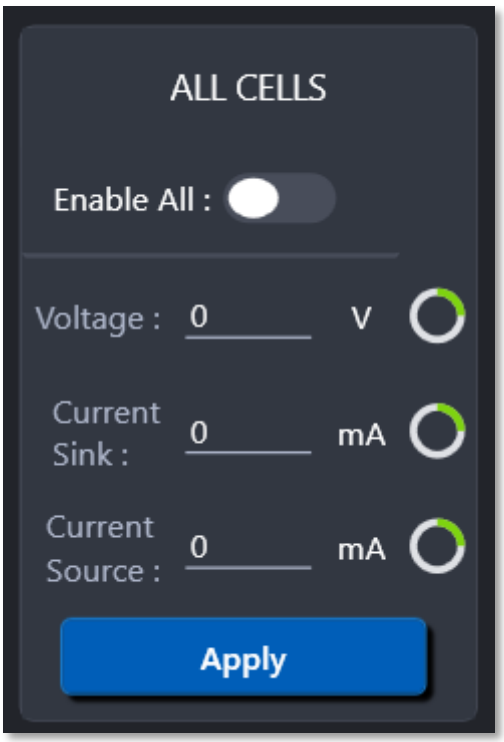


Figure 22: All Cells Panel

5.4.2.3. Controlling DAC Outputs

DAC OUTPUTs can be controlled from the "DAC OUTPUTS" panel.

- Enter the desired value in the AO 1 field and press the Enter key to set the voltage value for AO 1.
- Enter the desired value in the AO 2 field and press the Enter key to set the voltage value for AO 2.

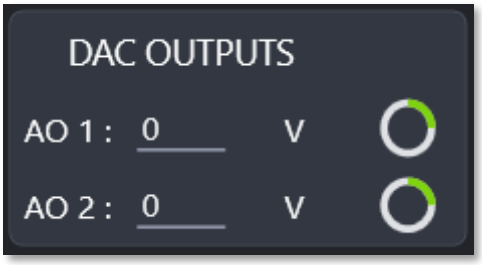


Figure 23: DAC Outputs Panel

5.4.2.4. Controlling GPIO Pins

GPIO pins can be controlled from the "GPIO PINS" panel.

- Set the DIO direction value by selecting "In" or "Out" using the "Direction" button on the selected DIO's row.
- After setting the DIO direction to "Out," change the DIO value by setting the "Value" button to either 0 or 1.

Figure 24: GPIO Pins Panel

5.4.2.5. Temperature Sensors

The status of 3 temperature sensors can be monitored in the "TEMPERATURE SENSORS" panel.

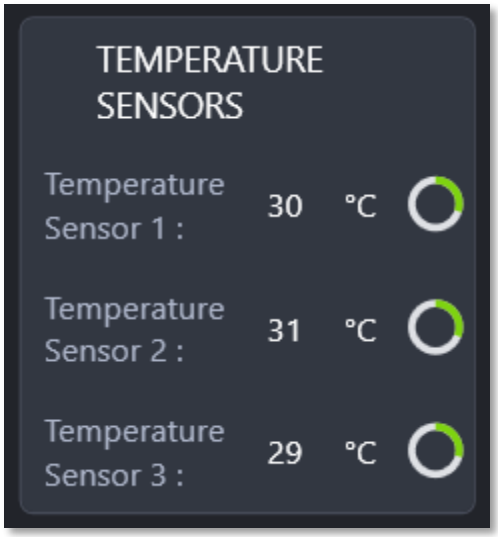


Figure 25: Temperature Sensors Panel

5.4.2.6. Fans

The status of 4 fans can be monitored in the “FANS” panel.

Figure 26: Fans Panel

5.4.2.7. Analog Inputs

The voltage value of 8 analog inputs can be monitored in the “ANALOG INPUTS” panel.

Figure 27: Analog Inputs Panel

5.4.2.8. Remove a Device

- To remove a device, select it from the combobox and press the “Close” button.

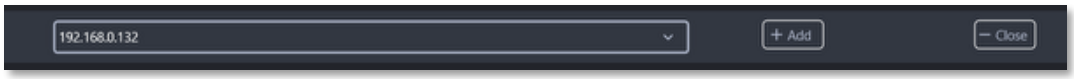


Figure 28: Removing Device

5.4.3. Configuration Settings

The steps below can be followed to modify configuration settings:

- Click the “Add” button to change the configuration of a device.
- Enter the device’s IP address, TCP port, and UDP port information in the opened window.
- Click the “Config-Only” button.

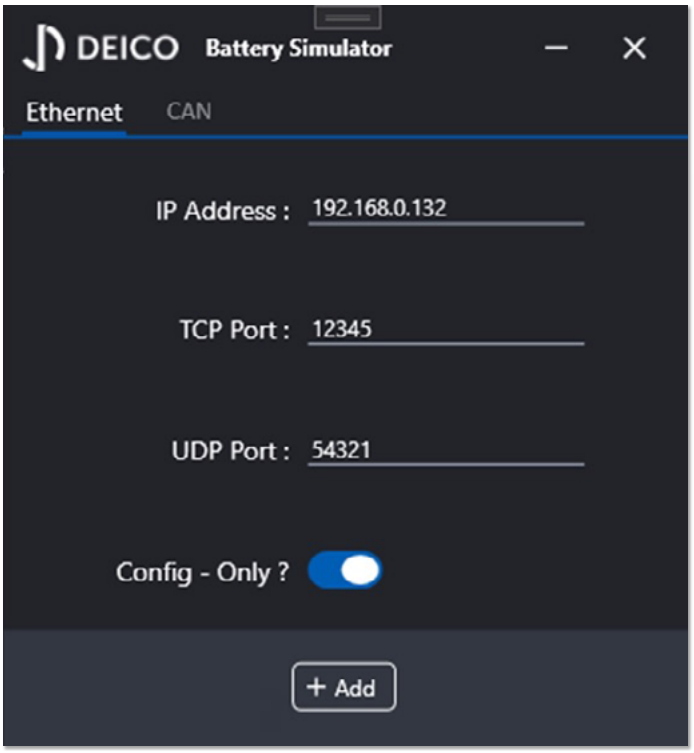


Figure 29: Add Device Window

- Click the “Add” button.
- Enter the desired information in the opened configuration settings window and click the “Apply and Restart” button.

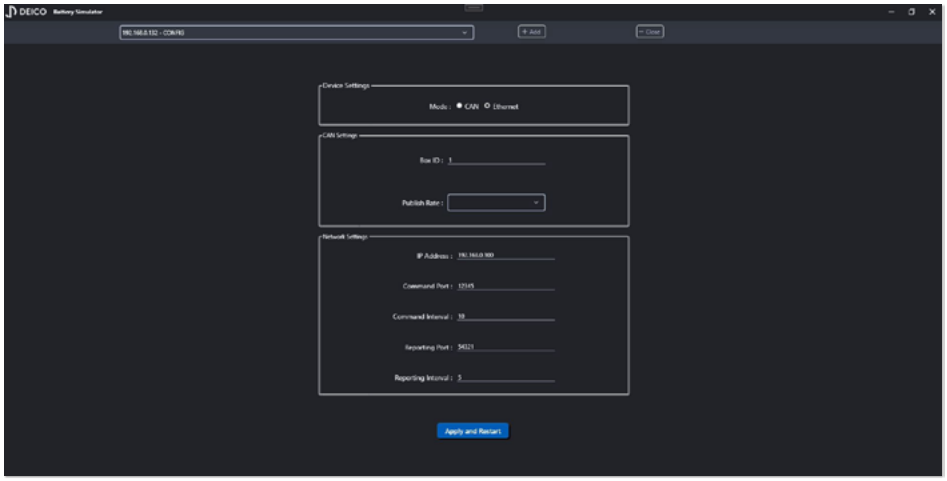


Figure 30: Configuration Settings Window

5.4.3.1. Device Settings

- Change the device communication mode by selecting the "CAN" or "Ethernet" option from the "Device Settings" panel.

5.4.3.2. CAN Settings

- Modify CAN settings on the "CAN Settings" panel.
- Change the Box ID value by entering the desired value in the Box ID field.
- Select one of the values in the Publish Rate field.

5.4.3.3. Network Settings

- Modify Ethernet settings on the "Network Settings" panel.
- Change the IP address value by entering the desired value in the IP Address field.
- Change the Command Port value by entering the desired value in the Command Port field.
- Set the Command Interval value by entering the desired value in the Command Interval field.
- Modify the Reporting Port value by entering the desired value in the Reporting Port field.
- Set the Reporting Interval value by entering the desired value in the Reporting Interval field.

5.5. Using Battery Simulator Firmware Upgrade Tool

When the application starts, the Firmware Upgrade Tool window appears.

Important Note

After powering on the device, ensure that the Ethernet connection between the device and the computer to be used for the update is properly established.

Caution

During the update process, make sure that the application is not closed and the device is not powered off.

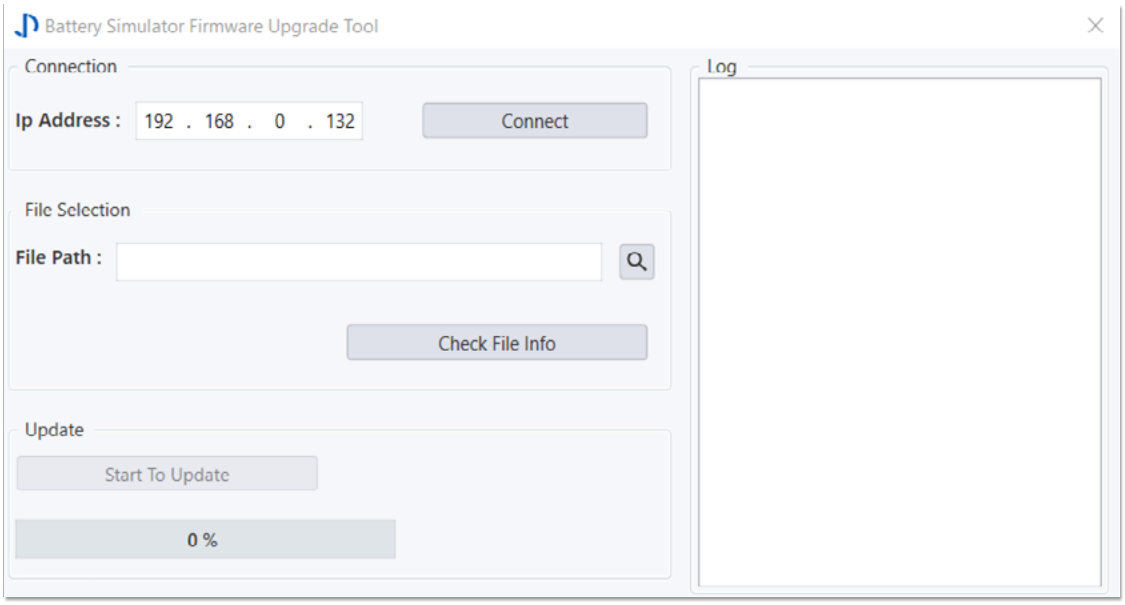


Figure 31: Battery Simulator Firmware Upgrade Tool Main Screen

- To connect to the device, enter the device's IP address in the designated field.
- Click the "Connect" button.
- Once connected, the version information will be displayed in the log window.
- From the "File Selection" section, choose the firmware file to upload.
- Click the "Check File Info" button.

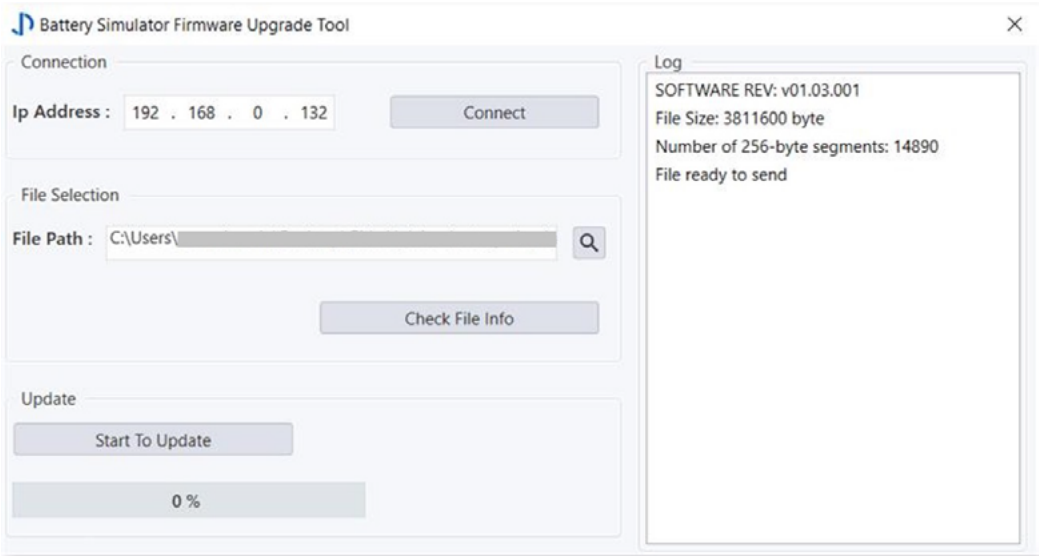


Figure 32: File Ready to Send Message

- A message saying "File ready to send" will appear in the log window if the file is valid.
- Click the "Start To Update" button.

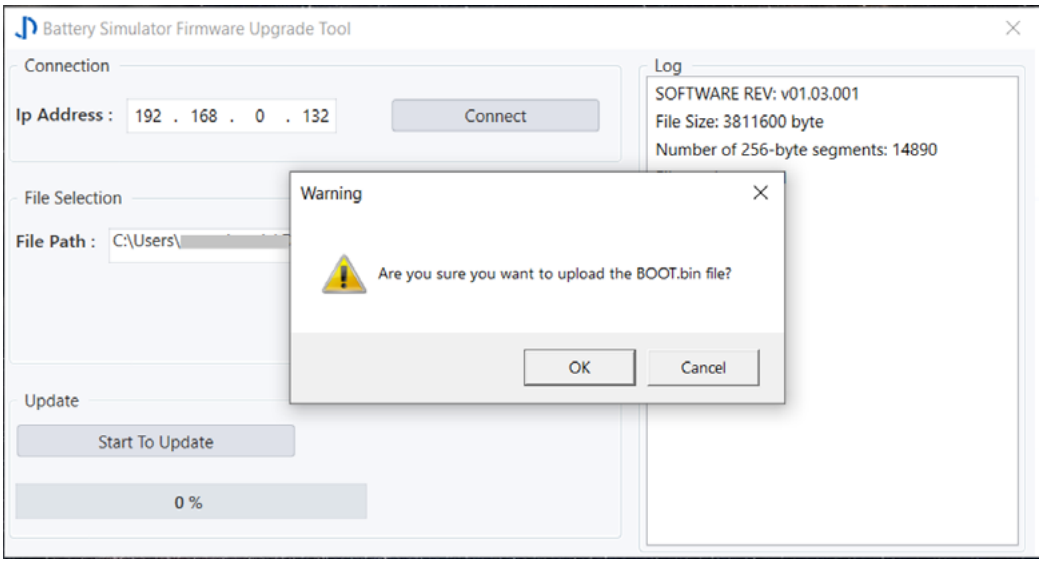


Figure 33: Are You Sure You Want to Upload Pop-up

- A confirmation popup will appear: "Are you sure you want to upload the file?" Click "OK" to proceed.
- The update will take about 15 minutes. The progress can be monitored through the progress bar displayed on the screen.

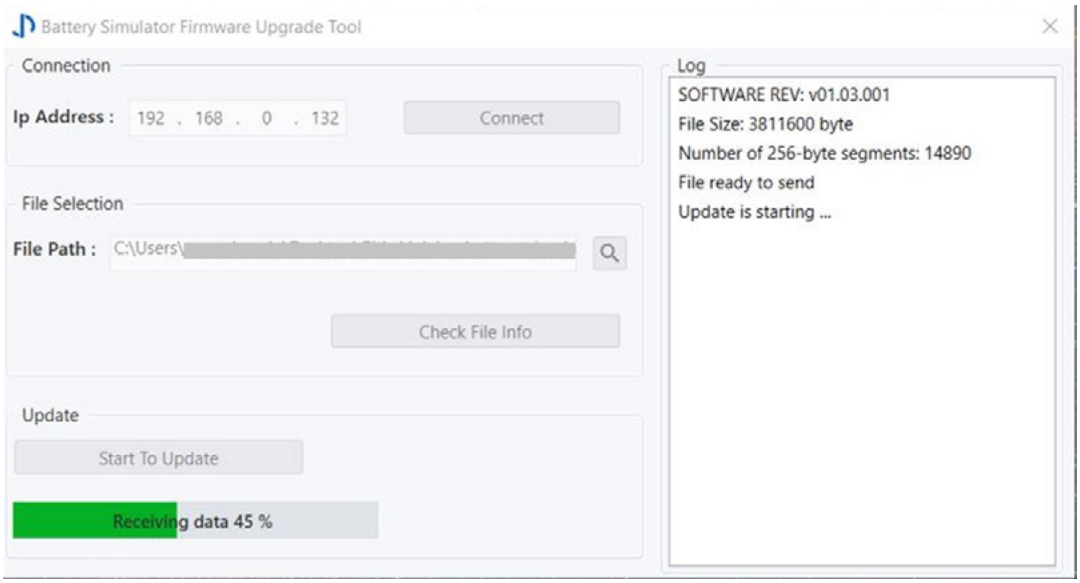


Figure 34: Monitoring Update Process

- Once the update is successfully completed, the following message will appear: "Update Completed. Please turn off and on the device."

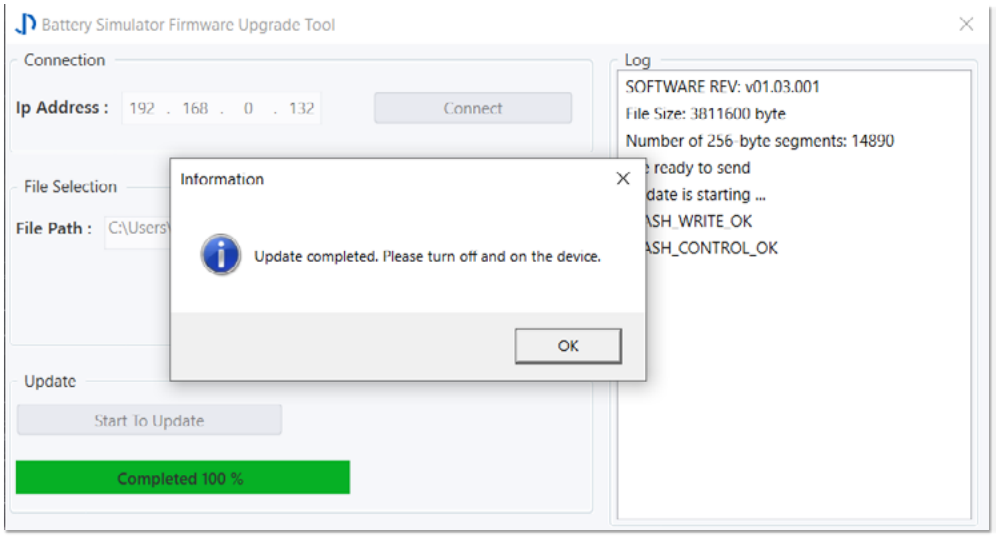


Figure 35: Update Completed Pop-up

6. Communication Protocols

This device communicates over two distinct interfaces: one utilizing Ethernet and the other based on the CAN protocol. The Ethernet interface supports both TCP and UDP communication over different ports. The usage of these communication infrastructures varies depending on the device's operating modes. There are two configuration parameters that determine the mode of operation: the Ethernet/CAN mode and the HIL Mode, which can be toggled ON or OFF. Based on these modes, the set of message packets allowed for communication with the device changes. Detailed information on which message packets are valid in each mode is presented in the corresponding table. The structure and content of these message packets are provided in subsequent sections of this document.

Comm. Mode (ETH/ CAN)	HIL Toggle (ON/ OFF)	TCP Receive (Asenkron) Control Message Sets	UDP Send (Asenkron) Query Information Message Sets	CAN Send (Periodic) Periodic Information Message Sets	Can Receive (Asenkron) Control Message Sets
CAN	HIL OFF	MSG_SET_CONFIG1 MSG_SET_CONFIG2	MSG_CONFIG1_QUERY MSG_CONFIG2_QUERY	MSG_STATUS MSG_CELL_VOLTAGES_READBACK_1_4 MSG_CELL_VOLTAGES_READBACK_5_8 MSG_CELL_VOLTAGES_READBACK_9_12 MSG_CELL_CURRENTS_READBACK_1_4 MSG_CELL_CURRENTS_READBACK_5_8 MSG_CELL_CURRENTS_READBACK_9_12 (Optional) MSG_DIO_STATES_1_8 (Optional) MSG_AI_VALUES_1_4 (Optional) MSG_AI_VALUES_5_8	MSG_HIL_MODE_START_STOP_TRIG MSG_CELL_VOLTAGE_SETPOINTS_1_4 MSG_CELL_VOLTAGE_SETPOINTS_5_8 MSG_CELL_VOLTAGE_SETPOINTS_9_12 MSG_DIO_SETPOINTS_1_8 MSG_AO_SETPOINTS_1_2 MSG_BOX_MODE_MSG_CONFIG MSG_CELL_CURRENT_SET_ALL MSG_CELL_CURRENT_SINK_SETPOINT MSG_CELL_CURRENT_SOURCE_SETPOINT MSG_CELL_VOLTAGE_SET_ALL MSG_CELL_VOLTAGE_SETPOINT MSG_CELL_ENABLE_ALL MSG_CELL_ENABLE MSG_SOFT_RESET
CAN	HIL ON			MSG_STATUS MSG_CELL_VOLTAGES_READBACK_1_4 MSG_CELL_VOLTAGES_READBACK_5_8 MSG_CELL_VOLTAGES_READBACK_9_12 MSG_CELL_CURRENTS_READBACK_1_4 MSG_CELL_CURRENTS_READBACK_5_8 MSG_CELL_CURRENTS_READBACK_9_12 (Optional) MSG_DIO_STATES_1_8 (Optional) MSG_AI_VALUES_1_4 (Optional) MSG_AI_VALUES_5_8	

Comm. Mode (ETH/ CAN)	HIL Toggle (ON/ OFF)	TCP Receive (Asenkron) Control Message Sets	UDP Send (Asenkron) Query Information Message Sets	CAN Send (Periodic) Periodic Information Message Sets	Can Receive (Asenkron) Control Message Sets
ETH	HIL OFF	MSG_HIL_MODE_START_STOP_TRIG MSG_CELL_VOLTAGE_SETPOINTS_1_4 MSG_CELL_VOLTAGE_SETPOINTS_5_8 MSG_CELL_VOLTAGE_SETPOINTS_9_12 MSG_DIO_SETPOINTS_1_8 MSG_AO_SETPOINTS_1_2 MSG_BOX_MODE_MSG_CONFIG MSG_CELL_CURRENT_SET_ALL MSG_CELL_CURRENT_SINK_SETPOINT MSG_CELL_CURRENT_SOURCE_SETPOINT MSG_CELL_VOLTAGE_SET_ALL MSG_CELL_VOLTAGE_SETPOINT MSG_CELL_ENABLE_ALL MSG_CELL_ENABLE MSG_SET_CONFIG1 MSG_SET_CONFIG2 MSG_SOFT_RESET	MSG_BS1200_STATUS MSG_CELL_VOLTAGES_READBACK_1_4 MSG_CELL_VOLTAGES_READBACK_5_8 MSG_CELL_VOLTAGES_READBACK_9_12 MSG_CELL_CURRENTS_READBACK_1_4 MSG_CELL_CURRENTS_READBACK_5_8 MSG_CELL_CURRENTS_READBACK_9_12 MSG_DIO_STATES_1_8 MSG_AI_VALUES_1_4 MSG_AI_VALUES_5_8 MSG_CONFIG1_QUERY	NOT INITIALIZED	NOT INITIALIZED
ETH	HIL ON			NOT INITIALIZED	NOT INITIALIZED

6.1. Communication States and Behaviours

The transition between the device's Ethernet and CAN modes can be managed via the MSG_SET_CONFIG1 and MSG_SET_CONFIG2 messages. These messages also allow configuration of the device's BOX ID, as well as its CAN and Ethernet settings.

Upon receiving either of these messages, the device performs a software restart to apply the specified configuration.

Fault Condition: If there is a problem in communication with any cell during the initial start-up of the device, the Fault Indicator LED will illuminate red.

6.2. Message Definitions

6.2.1. Ethernet Communication

- Protocol: TCP and UDP
- TCP Messages: Used for device configuration.
- UDP Messages: Used for getting device information queries.
- TCP and UDP messages are encapsulation of CAN messages
- TCP message timeout is 20 seconds
- IP, TCP Port and UDP Ports can be adjusted
- Default Ethernet Protocol Parameters
- IP Address: 192.168.0.132
  - TCP Port: 12345
  - UDP Port: 54321
  - UDP Response Port: 58431
- LAN Configurations can be reset to default by pressing LAN RESET button for approximately 10 seconds.

Important Note

The Battery Simulator Firmware Upgrade Tool communicates over UDP using ports 54312 and 54313. Therefore, it is strongly recommended that the user avoids using these ports in the device's UDP configuration to prevent communication conflicts.

6.2.1.1. TCP Messages (Control Message Sets)

The following messages can be received via TCP for configuration purposes:

Message ID	Message Name	Message Definition
0xA000	**MSG_CELL_VOLTAGE_SETPOINTS_1_4**	Set voltage level at cell 1-4
0xB000	**MSG_CELL_VOLTAGE_SETPOINTS_5_8**	Set voltage level at cell 5-8
0xC000	**MSG_CELL_VOLTAGE_SETPOINTS_9_12**	Set voltage level at cell 9-812
0x0200	**MSG_DIO_SETPOINTS_1_8**	Set direction and output DIO
0x0220	**MSG_AO_SETPOINTS_1_2**	Set analog outputs
0x0400	**MSG_BOX_MODE_MSG_CONFIG**	Configure HIL configurations
0x0480	**MSG_CELL_CURRENT_SET_ALL**	Set current levels at all cells
0x04A0	**MSG_CELL_CURRENT_SINK_SETPOINT**	Set sink current level
0X04B0	**MSG_CELL_CURRENT_SOURCE_SETPOINT**	Set source current level
0X0500	**MSG_CELL_VOLTAGE_SET_ALL**	Set voltage level at all cells
0X0510	**MSG_CELL_VOLTAGE_SETPOINT**	Set voltage level at desired cell
0x0540	**MSG_CELL_ENABLE_ALL**	Enable all cells
0x0550	**MSG_CELL_ENABLE**	Enable desired cell
0x0560	**MSG_SET_CONFIG1**	Change configuration of device
0x0570	**MSG_SET_CONFIG2**	Change configuration of device
0x0580	**MSG_SOFT_RESET**	Restart software

Message structure can be seen in the table below. The values are represented in big-endian format (MSB first).

Byte Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frame	**Frame1**				**Frame2**				**Frame3**				**Frame4**			
Definition	00	00	Message ID		00	00	00	00	CHANGES ACCORDING TO MESSAGE ID							

6.2.1.1.1. MSG_CELL_VOLTAGE_SETPOINTS_1_4

Value	Byte Numbers	Resolution	Range
Cell_1_Voltage Value	9-10	0.0001 V	0-5 V
Cell_2_Voltage Value	11-12	0.0001 V	0-5 V
Cell_3_Voltage Value	13-14	0.0001 V	0-5 V
Cell_4_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.1.2. MSG_CELL_VOLTAGE_SETPOINTS_5_8

Value	Byte Numbers	Resolution	Range
Cell_5_Voltage Value	9-10	0.0001 V	0-5 V
Cell_6_Voltage Value	11-12	0.0001 V	0-5 V
Cell_7_Voltage Value	13-14	0.0001 V	0-5 V
Cell_8_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.1.3. MSG_CELL_VOLTAGE_SETPOINTS_9_12

Value	Byte Numbers	Resolution	Range
Cell_9_Voltage Value	9-10	0.0001 V	0-5 V
Cell_10_Voltage Value	11-12	0.0001 V	0-5 V
Cell_11_Voltage Value	13-14	0.0001 V	0-5 V
Cell_12_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.1.4. MSG_DIO_SETPOINTS_1_8

Value	Byte Numbers	Resolution	Range
DIO Value	9	1 or 0 for each bit	0-255
DIO Direction	10	1 or 0 for each bit	0-255

6.2.1.1.5. MSG_AO_SETPOINTS_1_2

Value	Byte Numbers	Resolution	Range
DIO Value	9-10	0.0001 V	0-5 V
DIO Direction	11-12	0.0001 V	0-5 V

6.2.1.1.6. MSG_BOX_MODE_MSG_CONFIG

Value	Byte Numbers	Range
DIO Set Enable for HIL	9 (Bit number 0)	1 or 0
AO Set Enable for HIL	9 (Bit number 1)	1 or 0
DIO Broadcast Enable for HIL	9 (Bit number 2)	1 or 0
AI 1-4 Broadcast Enable for HIL	9 (Bit number 3)	1 or 0
AI 5-8 Broadcast Enable for HIL	9 (Bit number 4)	1 or 0

6.2.1.1.7. MSG_CELL_CURRENT_SET_ALL

Value	Byte Numbers	Resolution	Range
Source Current All	9-10	0.1 mA	0-500 mA
Sink Current All	11-12	0.1 mA	0-500 mA

6.2.1.1.8. MSG_CELL_CURRENT_SINK_SETPOINT

Value	Byte Numbers	Resolution	Range
Channel Number	9	1	1-12
Sink Current Value	10-11	0.1 mA	0-500 mA

6.2.1.1.9. MSG_CELL_CURRENT_SOURCE_SETPOINT

Value	Byte Numbers	Resolution	Range
Channel Number	9	1	1-12
Source Current Value	10-11	0.1 mA	0-500 mA

6.2.1.1.10. MSG_CELL_VOLTAGE_SET_ALL

Value	Byte Numbers	Resolution	Range
Voltage Value	9-10	0.0001 V	0-5 V
Source Current Value	10-11	0.1 mA	0-500 mA

6.2.1.1.11. MSG_CELL_VOLTAGE_SETPOINT

Value	Byte Numbers	Resolution	Range
Channel Number	9	1	1-12
Source Current Value	10-11	0.0001 V	0-5 V

6.2.1.1.12. MSG_CELL_ENABLE_ALL

Value	Byte Numbers	Range
Enable All Channels	9 (Bit number 0)	1 or 0

6.2.1.1.13. MSG_CELL_ENABLE

Value	Byte Numbers	Resolution	Range
Channel Number	9	1	1-12
Source Current Value	10 (Bit number 0)	-	1 or 0

6.2.1.1.14. MSG_SET_CONFIG1

Value	Byte Numbers	Resolution	Range
Device Mode	9 (Bit number 0)	0 -> CAN Mode 1 -> Ethernet Mode	
Box ID	10	1	0-255
CAN Baudrate	13-14	125 -> 125 Kbit/s 250 -> 250 Kbit/s 500 -> 500 Kbit/s 1000 -> 1000 Kbit/s	

6.2.1.1.15. MSG_SET_CONFIG2

Value	Byte Numbers	Resolution	Range
IP Address[0]	9	1	0-255
IP Address[1]	10	1	0-255
IP Address[2]	11	1	0-255
IP Address[3]	12	1	0-255
TCP Port	13–14	1	0-255
UDP Port	15–16	1	0-255

6.2.1.1.16. Example TCP Message

Byte Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frame	**Frame1**				**Frame2**				**Frame3**				**Frame4**			
Definition	00	00	00	0A	0	0	0	0	B8	0B	98	08	4C	04	88	13

6.2.1.2. UDP Messages (Query and Response)

The following messages can be queried via UDP:

Message ID	Message Name	Message Definition
0x0100	**MSG_STATUS**	Status of device
0x0120	**MSG_CELL_VOLTAGES_READBACK_1_4**	Voltage readback of cells no. 1-4
0x0130	**MSG_CELL_VOLTAGES_READBACK_5_8**	Voltage readback of cells no. 5-8
0x0140	**MSG_CELL_VOLTAGES_READBACK_9_12**	Voltage readback of cells no. 9-12
0x0180	**MSG_CELL_CURRENTS_READBACK_1_4**	Current readback of cells no. 1-4
0x0190	**MSG_CELL_CURRENTS_READBACK_5_8**	Current readback of cells no. 1-4
0x01A0	**MSG_CELL_CURRENTS_READBACK_9_12**	Current readback of cells no. 1-4
0x0280	**MSG_DIO_STATES_1_8**	DIO readback values
0x02A0	**MSG_AI_VALUES_1_4**	Analog input readback channel no. 1-4
0x02B0	**MSG_AI_VALUES_5_8**	Analog input readback channel no. 5-8
0x02C0	**MSG_CONFIG1_QUERY**	Device configuration query (device mode, BOX ID, CAN baudrate)
0x02D0	**MSG_CONFIG2_QUERY**	Device configuration query (IP address, TCP port, UDP port)

These messages are sent through query from their message IDs.

The message structure that the device send from UDP Port can be seen in the table below. The values are represented in big-endian format (MSB first).

Byte Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frame	**Frame1**				**Frame2**				**Frame3**				**Frame4**			
Definition	00	00	Message ID		00	00	00	00	CHANGES ACCORDING TO MESSAGE ID							

6.2.1.2.1. MSG_STATUS

Value	Byte Numbers	Resolution	Range
Fan_Fail_1	9 (Bit number 0)	-	0-1
Fan_Fail_2	9 (Bit number 1)	-	0-1
Fan_Fail_3	9 (Bit number 2)	-	0-1
Fan_Fail_4	9 (Bit number 3)	-	0-1
Temperature_1	10	1 Deg C	0-255 Deg C
Temperature_2	11	1 Deg C	0-255 Deg C
Temperature_3	12	1 Deg C	0-255 Deg C
Error Code OutofRange	13 (Bit number 0)	-	0-1
DeviceActive	13 (Bit number 1)	-	0-1

6.2.1.2.2. MSG_CELL_VOLTAGES_READBACK_1_4

Value	Byte Numbers	Resolution	Range
Cell_1_Voltage Value	9-10	0.0001 V	0-5 V
Cell_2_Voltage Value	11-12	0.0001 V	0-5 V
Cell_3_Voltage Value	13-14	0.0001 V	0-5 V
Cell_4_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.2.3. MSG_CELL_VOLTAGES_READBACK_5_8

Value	Byte Numbers	Resolution	Range
Cell_5_Voltage Value	9-10	0.0001 V	0-5 V
Cell_6_Voltage Value	11-12	0.0001 V	0-5 V
Cell_7_Voltage Value	13-14	0.0001 V	0-5 V
Cell_8_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.2.4. MSG_CELL_VOLTAGES_READBACK_9_12

Value	Byte Numbers	Resolution	Range
Cell_9_Voltage Value	9-10	0.0001 V	0-5 V
Cell_10_Voltage Value	11-12	0.0001 V	0-5 V
Cell_11_Voltage Value	13-14	0.0001 V	0-5 V
Cell_12_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.2.5. MSG_CELL_CURRENTS_READBACK_1_4

Value	Byte Numbers	Resolution	Range
Cell_1_Current Value	9-10	0.1 mA	0-500 mA
Cell_2_Current Value	11-12	0.1 mA	0-500 mA
Cell_3_Current Value	13-14	0.1 mA	0-500 mA
Cell_4_Current Value	15-16	0.1 mA	0-500 mA

6.2.1.2.6. MSG_CELL_CURRENTS_READBACK_5_8

Value	Byte Numbers	Resolution	Range
Cell_5_Current Value	9-10	0.1 mA	0-500 mA
Cell_6_Current Value	11-12	0.1 mA	0-500 mA
Cell_7_Current Value	13-14	0.1 mA	0-500 mA
Cell_8_Current Value	15-16	0.1 mA	0-500 mA

6.2.1.2.7. MSG_CELL_CURRENTS_READBACK_9_12

Value	Byte Numbers	Resolution	Range
Cell_9_Current Value	9-10	0.1 mA	0-500 mA
Cell_10_Current Value	11-12	0.1 mA	0-500 mA
Cell_11_Current Value	13-14	0.1 mA	0-500 mA
Cell_12_Current Value	15-16	0.1 mA	0-500 mA

6.2.1.2.8. MSG_DIO_STATES_1_8

Value	Byte Numbers	Resolution	Range
DIO States	9	1	0-255

6.2.1.2.9. MSG_AI_VALUES_1_4

Value	Byte Numbers	Resolution	Range
AI_1_Voltage Value	9-10	0.0001 V	0-5 V
AI_2_Voltage Value	11-12	0.0001 V	0-5 V
AI_3_Voltage Value	13-14	0.0001 V	0-5 V
AI_4_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.2.10. MSG_AI_VALUES_5_8

Value	Byte Numbers	Resolution	Range
AI_5_Voltage Value	9-10	0.0001 V	0-5 V
AI_6_Voltage Value	11-12	0.0001 V	0-5 V
AI_7_Voltage Value	13-14	0.0001 V	0-5 V
AI_8_Voltage Value	15-16	0.0001 V	0-5 V

6.2.1.2.11. MSG_CONFIG1_QUERY

Value	Byte Numbers	Resolution	Range
Device Mode	9 (Bit number 0)	0 -> CAN Mode 1 -> Ethernet Mode	
Box ID	10	1	0-255
CAN Baudrate	13-14	125 -> 125 Kbit/s 250 -> 250 Kbit/s 500 -> 500 Kbit/s 1000 -> 1000 Kbit/s	

6.2.1.2.12. MSG_CONFIG2_QUERY

Value	Byte Numbers	Resolution	Range
IP Address[0]	9	1	0-255
IP Address[1]	10	1	0-255
IP Address[2]	11	1	0-255
IP Address[3]	12	1	0-255
TCP Port	13–14	1	0-255
UDP Port	15–16	1	0-255

6.2.1.2.13. Example UDP Query

When the device receives this message;

Byte Number	1	2	3	4
Frame	**Frame1**			
Definition	00	00	20	01

the device will return the message as reading Cell Voltage1 as 3V, Cell Voltage1 as 2.2V, Cell Voltage1 as 1.1V and Cell Voltage1 as 5V.

Byte Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Frame	**Frame1**				**Frame2**				**Frame3**				**Frame4**			
Definition	00	00	20	01	0	0	0	0	B8	0B	98	08	4C	04	88	13

6.2.2. CAN Communication

- Baudrate: 1000 Kbit/s (can be reconfigurable)
- BOX ID: 0 (can be reconfigurable)
- Massage Transmission Interval: 5ms
- CAN Termination can be adjusted from the rear panel of the device

6.2.2.1. Control Message Sets

The following control messages are used when operating in CAN mode. The values are represented in big-endian format (MSB first).

Within the ***MSG_BOX_MODE_MSG_CONFIG*** message, the parameters ***DIO Set Enable for HIL*** and ***AO Set Enable for HIL*** are used to configure whether Digital I/O (***MSG_DIO_SETPOINTS_1_8***) and Analog Output (***MSG_AO_SETPOINTS_1_2***) can be controlled in HIL mode.

Arbitration ID	Message Name	Message Definition	HIL Mode
0x8000 + BOX_ID	**MSG_HIL_MODE_START_STOP_TRIG**	Activate and deactivate HIL mode	OK
0xA000 + BOX_ID	**MSG_CELL_VOLTAGE_SETPOINTS_1_4**	Set voltage level at cell 1-4	OK
0xB000 + BOX_ID	**MSG_CELL_VOLTAGE_SETPOINTS_5_8**	Set voltage level at cell 5-8	OK
0xC000 + BOX_ID	**MSG_CELL_VOLTAGE_SETPOINTS_9_12**	Set voltage level at cell 9-812	OK
0x0200 + BOX_ID	**MSG_DIO_SETPOINTS_1_8**	Set direction and output DIO	OK (Optional)
0x0220 + BOX_ID	**MSG_AO_SETPOINTS_1_2**	Set analog outputs	OK (Optional)
0x0400 + BOX_ID	**MSG_BOX_MODE_MSG_CONFIG**	Configure HIL configurations	X
0x0480 + BOX_ID	**MSG_CELL_CURRENT_SET_ALL**	Set current levels at all cells	X
0x04A0 + BOX_ID	**MSG_CELL_CURRENT_SINK_SETPOINT**	Set sink current level	X
0X04B0 + BOX_ID	**MSG_CELL_CURRENT_SOURCE_SETPOINT**	Set source current level	X
0X0500 + BOX_ID	**MSG_CELL_VOLTAGE_SET_ALL**	Set voltage level at all cells	X
0X0510 + BOX_ID	**MSG_CELL_VOLTAGE_SETPOINT**	Set voltage level at desired cell	X
0x0540 + BOX_ID	**MSG_CELL_ENABLE_ALL**	Enable all cells	X
0x0550 + BOX_ID	**MSG_CELL_ENABLE**	Enable desired cell	X
0x0580 + BOX_ID	**MSG_SOFT_RESET**	Restart software	OK

6.2.2.1.1. MSG_HIL_MODE_START_STOP_TRIG

Value	DATA (Byte Numbers)	Resolution	Range
Enable HIL	1 (Bit Number 0)	1 -> Activate HIL Mode 0 -> Deactivate HIL Mode	1 or 0

6.2.2.1.2. MSG_CELL_VOLTAGE_SETPOINTS_1_4

Value	DATA (Byte Numbers)	Resolution	Range
Cell_1_Voltage Value	1-2	0.0001 V	0-5 V
Cell_2_Voltage Value	3-4	0.0001 V	0-5 V
Cell_3_Voltage Value	5-6	0.0001 V	0-5 V
Cell_4_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.1.3. MSG_CELL_VOLTAGE_SETPOINTS_5_8

Value	DATA (Byte Numbers)	Resolution	Range
Cell_5_Voltage Value	1-2	0.0001 V	0-5 V
Cell_6_Voltage Value	3-4	0.0001 V	0-5 V
Cell_7_Voltage Value	5-6	0.0001 V	0-5 V
Cell_8_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.1.4. MSG_CELL_VOLTAGE_SETPOINTS_9_12

Value	DATA (Byte Numbers)	Resolution	Range
Cell_9_Voltage Value	1-2	0.0001 V	0-5 V
Cell_10_Voltage Value	3-4	0.0001 V	0-5 V
Cell_11_Voltage Value	5-6	0.0001 V	0-5 V
Cell_12_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.1.5. MSG_DIO_SETPOINTS_1_8

Value	DATA (Byte Numbers)	Resolution	Range
DIO Value	1	1 or 0 for each bit	0-255
DIO Direction	2	1 or 0 for each bit	0-255

6.2.2.1.6. MSG_AO_SETPOINTS_1_2

Value	DATA (Byte Numbers)	Resolution	Range
DIO Value	1-2	0.0001 V	0-5 V
DIO Direction	3-4	0.0001 V	0-5 V

6.2.2.1.7. MSG_BOX_MODE_MSG_CONFIG

Value	DATA (Byte Numbers)	Range
DIO Set Enable for HIL	1 (Bit number 0)	1 or 0
AO Set Enable for HIL	1 (Bit number 1)	1 or 0
DIO Broadcast Enable for HIL	1 (Bit number 2)	1 or 0
AI 1-4 Broadcast Enable for HIL	1 (Bit number 3)	1 or 0
AI 5-8 Broadcast Enable for HIL	1 (Bit number 4)	1 or 0

6.2.2.1.8. MSG_CELL_CURRENT_SET_ALL

Value	DATA (Byte Numbers)	Resolution	Range
Source Current All	1-2	0.1 mA	0-500 mA
Sink Current All	3-4	0.1 mA	0-500 mA

6.2.2.1.9. MSG_CELL_CURRENT_SINK_SETPOINT

Value	DATA (Byte Numbers)	Resolution	Range
Channel Number	1	1	1-12
Sink Current Value	2-3	0.1 mA	0-500 mA

6.2.2.1.10. MSG_CELL_CURRENT_SOURCE_SETPOINT

Value	DATA (Byte Numbers)	Resolution	Range
Channel Number	1	1	1-12
Source Current Value	2-3	0.1 mA	0-500 mA

6.2.2.1.11. MSG_CELL_VOLTAGE_SET_ALL

Value	DATA (Byte Numbers)	Resolution	Range
Voltage Value	1-2	0.0001 V	0-5 V

6.2.2.1.12. MSG_CELL_VOLTAGE_SETPOINT

Value	DATA (Byte Numbers)	Resolution	Range
Channel Number	1	1	1-12
Source Current Value	1-2	0.0001 V	0-5 V

6.2.2.1.13. MSG_CELL_ENABLE_ALL

Value	DATA (Byte Numbers)	Range
Enable All Channels	1 (Bit number 0)	1 or 0

6.2.2.1.13. MSG_CELL_ENABLE_ALL

Value	DATA (Byte Numbers)	Range
Enable All Channels	1 (Bit number 0)	1 or 0

6.2.2.1.14. MSG_CELL_ENABLE

Value	DATA (Byte Numbers)	Resolution	Range
Channel Number	1	1	1-12
Source Current Value	2 (Bit number 0)	-	1 or 0

6.2.2.1.15. Example CAN Message

Setting the BOX ID as 0, the message sets Cell Voltage1 to 3V, Cell Voltage1 to 2.2V, Cell Voltage1 to 1.1V and Cell Voltage1 to 5V.

Arbitration ID: A0 (Hexadecimal)
DLC: 8
Data: B8 0B 98 08 4C 04 88 13 (Hexadecimal)

6.2.2.2. Periodic Information Message Sets

These messages are sent periodically every 5ms. The values are represented in big-endian format (MSB first).

Within the ***MSG_BOX_MODE_MSG_CONFIG*** message, the parameters D***IO Broadcast Enable for HIL***, ***AI 1-4 Broadcast Enable for HIL*** and ***AI 5-8 Broadcast Enable for HIL*** are used to configure the periodic availability of Digital I/O (***MSG_DIO_STATES_1_8***) and Analog Input (***MSG_AI_VALUES_1_4*** and ***MSG_AI_VALUES_5_8***) status in HIL mode.

Arbitration ID	Message Name	Message Definition	HIL Mode
0x0100 + BOX_ID	**MSG_STATUS**	Status of device	OK
0x0120 + BOX_ID	**MSG_CELL_VOLTAGES_READBACK_1_4**	Voltage readback of cells no. 1-4	OK
0x0130 + BOX_ID	**MSG_CELL_VOLTAGES_READBACK_5_8**	Voltage readback of cells no. 5-8	OK
0x0140 + BOX_ID	**MSG_CELL_VOLTAGES_READBACK_9_12**	Voltage readback of cells no. 9-12	OK
0x0180 + BOX_ID	**MSG_CELL_CURRENTS_READBACK_1_4**	Current readback of cells no. 1-4	OK
0x0190 + BOX_ID	**MSG_CELL_CURRENTS_READBACK_5_8**	Current readback of cells no. 1-4	OK
0x01A0 + BOX_ID	**MSG_CELL_CURRENTS_READBACK_9_12**	Current readback of cells no. 1-4	OK
0x0280 + BOX_ID	**MSG_DIO_STATES_1_8**	DIO readback values	OK (Optional)
0x02A0 + BOX_ID	**MSG_AI_VALUES_1_4**	Analog input readback ch no. 1-4	OK (Optional)
0x02B0 + BOX_ID	**MSG_AI_VALUES_5_8**	Analog input readback ch no. 5-8	OK (Optional)

6.2.2.2.1. MSG_STATUS

Value	DATA (Byte Numbers)	Resolution	Range
Fan_Fail_1	1 (Bit number 0)	-	0-1
Fan_Fail_2	1 (Bit number 1)	-	0-1
Fan_Fail_3	1 (Bit number 2)	-	0-1
Fan_Fail_4	1 (Bit number 3)	-	0-1
Temperature_1	2	1 Deg C	0-255 Deg C
Temperature_2	3	1 Deg C	0-255 Deg C
Temperature_3	4	1 Deg C	0-255 Deg C
Error Code OutofRange	5 (Bit number 0)	-	0-1
DeviceActive	5 (Bit number 1)	-	0-1

6.2.2.2.2. MSG_CELL_VOLTAGES_READBACK_1_4

Value	Byte Numbers	Resolution	Range
Cell_1_Voltage Value	1-2	0.0001 V	0-5 V
Cell_2_Voltage Value	3-4	0.0001 V	0-5 V
Cell_3_Voltage Value	5-6	0.0001 V	0-5 V
Cell_4_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.2.3. MSG_CELL_VOLTAGES_READBACK_5_8

Value	Byte Numbers	Resolution	Range
Cell_5_Voltage Value	1-2	0.0001 V	0-5 V
Cell_6_Voltage Value	3-4	0.0001 V	0-5 V
Cell_7_Voltage Value	5-6	0.0001 V	0-5 V
Cell_8_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.2.4. MSG_CELL_VOLTAGES_READBACK_9_12

Value	Byte Numbers	Resolution	Range
Cell_9_Voltage Value	1-2	0.0001 V	0-5 V
Cell_10_Voltage Value	3-4	0.0001 V	0-5 V
Cell_11_Voltage Value	5-6	0.0001 V	0-5 V
Cell_12_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.2.5. MSG_CELL_CURRENTS_READBACK_1_4

Value	Byte Numbers	Resolution	Range
Cell_1_Current Value	1-2	0.1 mA	0-500 mA
Cell_2_Current Value	3-4	0.1 mA	0-500 mA
Cell_3_Current Value	5-6	0.1 mA	0-500 mA
Cell_4_Current Value	7-8	0.1 mA	0-500 mA

6.2.2.2.6. MSG_CELL_CURRENTS_READBACK_5_8

Value	Byte Numbers	Resolution	Range
Cell_5_Current Value	1-2	0.1 mA	0-500 mA
Cell_6_Current Value	3-4	0.1 mA	0-500 mA
Cell_7_Current Value	5-6	0.1 mA	0-500 mA
Cell_8_Current Value	7-8	0.1 mA	0-500 mA

6.2.2.2.7. MSG_CELL_CURRENTS_READBACK_9_12

Value	Byte Numbers	Resolution	Range
Cell_9_Current Value	1-2	0.1 mA	0-500 mA
Cell_10_Current Value	3-4	0.1 mA	0-500 mA
Cell_11_Current Value	5-6	0.1 mA	0-500 mA
Cell_12_Current Value	7-8	0.1 mA	0-500 mA

6.2.2.2.8. MSG_DIO_STATES_1_8

Value	Byte Numbers	Resolution	Range
DIO States	1	1	0-255

6.2.2.2.9. MSG_AI_VALUES_1_4

Value	Byte Numbers	Resolution	Range
AI_1_Voltage Value	1-2	0.0001 V	0-5 V
AI_2_Voltage Value	3-4	0.0001 V	0-5 V
AI_3_Voltage Value	5-6	0.0001 V	0-5 V
AI_4_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.2.10. MSG_AI_VALUES_5_8

Value	Byte Numbers	Resolution	Range
AI_5_Voltage Value	1-2	0.0001V	0-5 V
AI_6_Voltage Value	3-4	0.0001V	0-5 V
AI_7_Voltage Value	5-6	0.0001V	0-5 V
AI_8_Voltage Value	7-8	0.0001V	0-5 V

6.2.2.2.10. MSG_AI_VALUES_5_8

Value	Byte Numbers	Resolution	Range
AI_5_Voltage Value	1-2	0.0001 V	0-5 V
AI_6_Voltage Value	3-4	0.0001 V	0-5 V
AI_7_Voltage Value	5-6	0.0001 V	0-5 V
AI_8_Voltage Value	7-8	0.0001 V	0-5 V

6.2.2.2.11. Example CAN Information Message

Setting the BOX ID as 0, the message gives the information for Cell Voltage1 as 3 V, Cell Voltage2 as 2.2 V, Cell Voltage3 as 1.1 V and Cell Voltage4 as 5 V

Arbitration ID: 120 (Hexadecimal)
DLC: 8
Data: B8 0B 98 08 4C 04 88 13 (Hexadecimal)

7. Safety Guidelines

Caution

Do not operate the DE3000 Battery Simulation Unit 12 CH 5 V 500 mA in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it for repair.

8. Warranty

This warranty is applicable to the DE3000 Battery Simulation Unit 12 CH 5 V 500 mA manufactured by DEICO. The warranty covers all components of the product. The warranty period offered for this product is 2 years starting from the date of purchase.

The DE3000 Battery Simulation Unit 12 CH 5 V 500 mA should be used under normal operating conditions and in accordance with the manufacturer's specified instructions. The warranty is non-transferable and applies only to the original purchaser or end-user. Unauthorized repairs or modifications may void the warranty. The warranty does not cover damages resulting from normal wear and tear.

Authorized service centers designated by DEICO will provide free repair services during the warranty period. If repair is not feasible, DEICO will replace the product with the same model or an equivalent one.
To avail warranty service, purchase receipt should be retained. The product should be in its original packaging and accompanied by the original accessories.

The warranty does not cover, but is not limited to, the following:

- Damages resulting from user error or improper use.
- Damages caused by natural disasters, floods, fires, etc.
- Damages resulting from unauthorized repairs or modifications.

For warranty service or any warranty-related inquiries, please contact DEICO's customer service department.