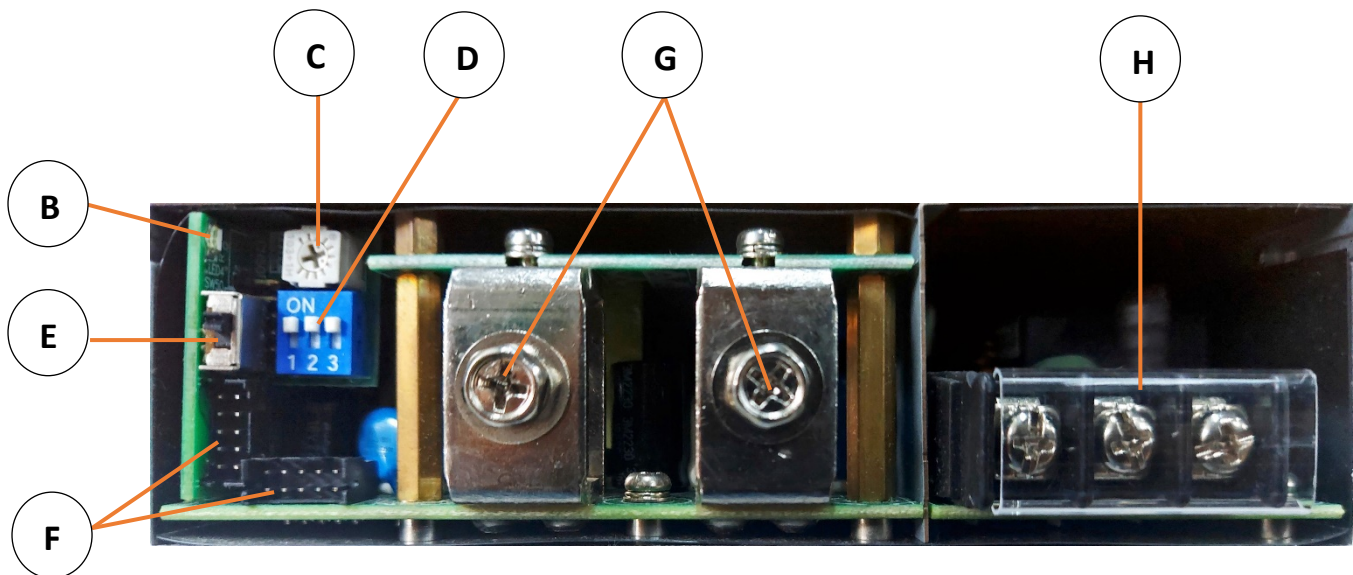
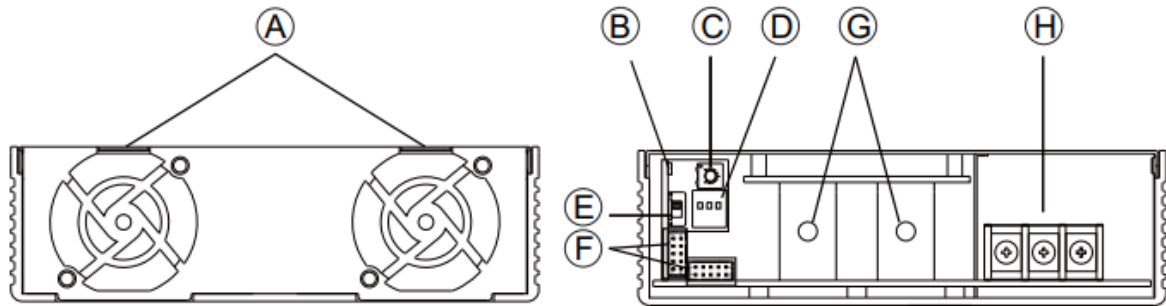


## HARDWARE

### Supply Panel Description:

([Datasheet](#))



**A** - Ventilation holes for fans

**B** - LED indicator: Indicates the status of supply and the load condition

**C** - SVR: For DC voltage Settings

**D** -DIP Switch: For device addressing when using the communication interface

**E** - SW50: Used to stabilize parallel signals when multi-supplies in parallel connection

**F** - Functions Pins: Used for monitoring and control functions (CN46 and CN47)

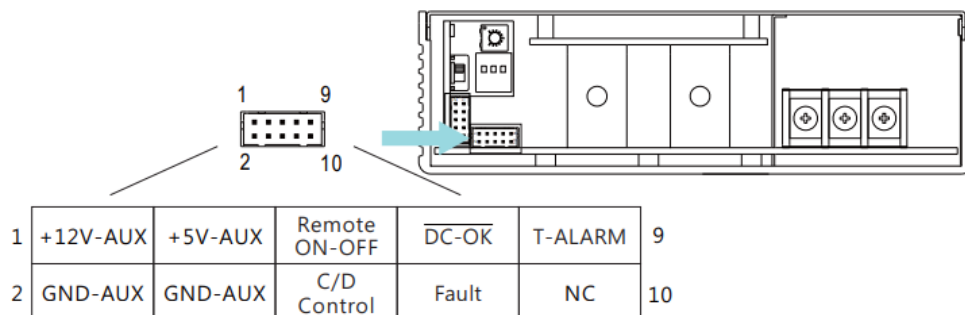
**G** - DC Terminals

**H** - AC Terminals

## LED Indicator:

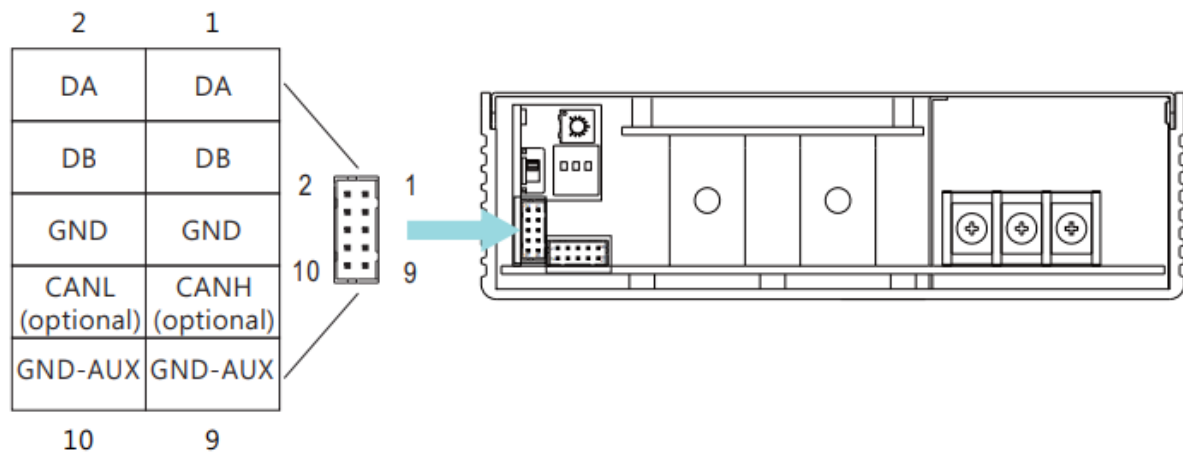
LED Indicator	Status
Green	Operating (AC to DC, work as an ordinary power supply)
Green (Flashing)	Recycle (DC to AC, work as a grid tie inverter)
Red	Abnormal (OTP, OLP, fan-lock, etc...)

## Pin Assignment of CN46:



Pin No.	Function	Description
1	+12V-AUX	Auxiliary voltage output, 11.4~12.6V, referenced to GND-AUX (pin 2,4). The maximum output current is 0.5A. This output is not controlled by the Remote ON/OFF control
2,4	GND-AUX	Auxiliary voltage output GND. The signal return is isolated from the output terminals (+V & -V).
3	+5V-AUX	Auxiliary voltage output, 4.5~5.5V, referenced to GND-AUX (pin 2,4) only for Remote ON/OFF used. This output is not controlled by the Remote ON/OFF control.
5	Remote ON-OFF	The unit can turn the output ON/OFF by electrical signal or dry contact between Remote ON/OFF and +5V-AUX(pin 3) (Isolated signal, referenced to GND-AUX.)
6	C/D Control	High (4.5 ~ 5.5V) : Battery Charging mode Low (-0.5 ~ 0.5V) : Battery Discharging mode
7	DC-OK	High (4.5 ~ 5.5V) : When the $V_{out} \leq 80\% \pm 5\%$ . Low (-0.5 ~ 0.5V) : When $V_{out} \geq 80\% \pm 5\%$ . The maximum sourcing current is 4mA and only for output.
8	Fault	High (4.5 ~ 5.5V) : When the $V_{ac} \leq 165V_{rms}$ , OLP, SCP,OTP,OVP,AC Fail, fan lock, islanding protection. Low (-0.5 ~ 0.5V) : When $V_{ac} \geq 175V_{rms}$ and when power supply work normally. The maximum sourcing current is 4mA and only for output.
9	T-ALARM	High (4.5 ~ 5.5V) : When the internal temperature exceeds the limit of temperature alarm, or when any of the fans fails Low (-0.5 ~ 0.5V) : When the internal temperature is normal, and when fans work normally.

### Pin Assignment of CN47:



Pin No.	Function	Description
1,2	DA	Differential digital signal for parallel control
3,4	DB	
5,6	GND	Negative output voltage signal. Certain function reference. It can not be connected directly to the load.
7	CANH	Data line used in CANBus interface
8	CANL	Data line used in CANBus interface
9,10	GND-AUX	Auxiliary voltage output GND. The signal return is isolated from the output terminals (+V & -V).

### Functional Description of DIP Switch:

Each unit should have their unique and own device address to communicate over CANBus. This DIP switch only takes effect when the communication interface is used. It is not necessary to set this switch in general use

### Description of Bidirectional Operation:

The output range of the BIC-2200 covers DC: 10V - 112V; AC: 180 - 264Vac / 47-63Hz, which can be used to applications with various voltage requirements, such as battery test equipment. To cope with different application occasions, there are two modes for selection, bi-direction auto-detect mode and programmable bidirection battery mode.

#### **Bi-direction auto-detect mode :**

This is the default factory setting, AC to DC or DC to AC conversion is controlled by BIC-2200 automatically according to operation mechanism below.

Condition	Conversion
$V_{\text{Target}} > V_{\text{DC}}$	AC to DC
$V_{\text{Target}} < V_{\text{DC}}$	DC to AC

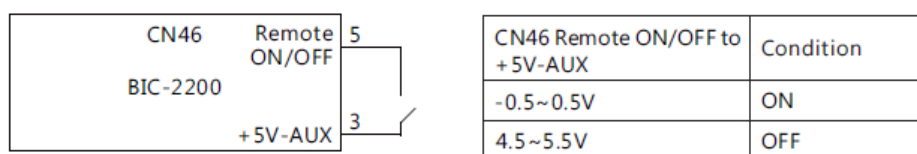
### Bi-direction battery mode:

After bi-direction battery mode is activated, users can switch the supply between AC to DC or DC to AC conversion by CANBus.

In bi-direction battery mode, although users can determine direction of the conversions on their demand, however if the setting voltage does not match the actual DC end voltage, AC to DC (charging) or DC to AC (discharging) conversion may not work as expected. Here are examples that will cause conversion errors :

1. During AC to DC conversion if battery voltage is higher than the value of command VOUT\_SET (charge voltage), the BIC-2200 will perform DC to AC conversion instead, but limiting discharge current at 5% of rated current. If you want to ensure AC to DC conversion working properly, please make sure value of command VOUT\_SET is higher than the battery voltage.
2. During DC to AC conversion if battery voltage is lower than the value of command VOUT\_SET\_REV, the BIC-2200 will perform AC to DC conversion instead, but then limiting charge current at 5% of rated current. To ensure DC to AC conversion working properly, please make sure value of command VOUT\_SET\_REV is lower than the battery voltage.

### Remote Control Operation:



- Built-in remote ON/OFF control circuit, which is used to turn on/off the supply.
- Please be aware that “remote ON/OFF and “+5V-AUX” on CN46 should be linked together to allow the unit to operate normally; if kept open, there will be no output.
- Maximum input voltage 5.5V.

## CANBus Protocol:

CANBus communication interface provides control and monitoring functions. It is helpful when users intent to modify the parameters remotely. Users can read and write the parameters through the bus, which includes bi-directional battery mode switch, ON/OFF, charge voltage/ current, discharge voltage/ current, temperature, etc.

### **CANBus Addressing:**

Each BIC-2200 unit should have their unique and own device address to communicate over the CANBus. PIN 1 - PIN 3 of the DIP switch allows users to designate an address for their supply units (with maximum of 8 addresses). Please refer to below for the detailed setup advice.

Model No.	DIP Switch Position		
	1	2	3
0	ON	ON	ON
1	OFF	ON	ON
2	ON	OFF	ON
3	OFF	OFF	ON
4	ON	ON	OFF
5	OFF	ON	OFF
6	ON	OFF	OFF
7	OFF	OFF	OFF

## Protections:

### **Anti-islanding Protections:**

BIC-2200 is designed to refer to IEC 62116(2008), the supply shuts off within 2 seconds when AC is cut or abnormal. Please be aware that it is necessary to install an AC circuit breaker that complies with grid-tie standard in your country before the supply.

### **Over Temperature Protection (OTP) and Alarm:**

Built-in thermal detection circuit, once the internal temperature exceeds a threshold value, the supply will shut down automatically (the fans will still be running to cool down the supply). Please switch off the supply, remove all possible causes and then leave the supply

cooling down to a normal working temperature (approximate 10 minutes – 1 hour) before repower on again.

**AC Fail Protection:**

When AC voltage/frequency is abnormal, BIC-2200 will enter protection mode to prevent damaging itself or affect quality of the grid no matter which conversion it is, D/A or A/D. The supply will restore automatically when AC voltage/frequency back to normal.

**Short Circuit Protection:**

When there is short circuit at AC/DC end of BIC-2200, the supply will enter protection mode and shut down. Repower on to restore after short-circuit condition is resolved.

**Over Current Protection:**

In AC to DC conversion, when the load current exceeds 110%±5% of the rated current, protection mode will be triggered. Repower on to restore after over-current condition is resolved.

**DC Over Voltage Protection:**

When the DC end voltage is too high, the DC over-voltage protection circuit will be triggered. Repower on to restore after over-voltage condition is resolved.

## CAN Module (USB CAN A)



- |   |                              |  |
|---|------------------------------|--|
| 1 | <b>TX indicator:</b>         | Blinks when CAN is sending data  |
| 2 | <b>PWR indicator:</b>        | Power indicator, light up red when the USB port is connected                             |
| 3 | <b>RX indicator:</b>         | Blinks when CAN is receiving data  |
| 4 | <b>Reset button:</b>         | Press before power on then release after power on to restore factory settings            |
| 5 | <b>120Ω resistor switch:</b> | Switch to CAN terminal side to enable 120Ω resistor, switch to the other side to disable |

The USB CAN A module by waveshare ([USB-CAN-A - Waveshare Wiki](#)) works on serial communication. It adopts STM32 chip solution, stable and reliable communication. The chip converts the serial communication data frames into CAN compatible frames. Using this module we can communicate with the power supply.

The module works proper on sending the user data in a particular format over serial which it will then decode and send the desired data over CAN bus. The frame information can found in the following link : [Frame Format](#)

# SOFTWARE

## GUI:

### Readings Tab:

The screenshot shows a software window titled "GUI Window" with a tabbed interface. The "Readings" tab is selected. The window is divided into several sections. Callout A points to the "COM Port" dropdown menu and the "Refresh", "Start", "Stop", "Resume Updates", and "Pause Updates" buttons. Callout B points to the "Input Voltage", "Output Voltage", "Output Current", "Temperature", "Reference Output Voltage", "Reference Output Current", "Reference Discharge Voltage", and "Reference Discharge Current" labels. Callout C points to the "Operation" status indicators, which include "Fan Fail", "Over Temperature", "DC Over Voltage", "DC Over Current", "Short Circuit", "AC Fail", "DC Status", "High Temperature", "HV Over Voltage", "Is Slave", "Is Master", "Secondary DD Output Voltage", "Primary PFC", "Active Dummy Load", "Device Initialized", "EEPROM Data Access", "Is AC/DC", "Is DC/AC", "Is Auto-Detect", and "Is Battery". Callout D points to the "Operation" toggle switch (OFF/ON), the "Output Voltage", "Output Current", "Discharge Voltage", and "Discharge Current" input fields, and the "Set Reference" button.

GUI Window

Readings Details Mode

COM Port :  Refresh Start Stop Resume Updates Pause Updates

Input Voltage :  
Output Voltage :  
Output Current :  
Temperature :  
Reference Output Voltage :  
Reference Output Current :  
Reference Discharge Voltage :  
Reference Discharge Current :

Operation :  
Fan Fail :  
Over Temperature :  
DC Over Voltage :  
DC Over Current :  
Short Circuit :  
AC Fail :  
DC Status :  
High Temperature :  
HV Over Voltage :  
Is Slave :  
Is Master :  
Secondary DD Output Voltage :  
Primary PFC :  
Active Dummy Load :  
Device Initialized :  
EEPROM Data Access :  
Is AC/DC :  
Is DC/AC :  
Is Auto-Detect :  
Is Battery :

Operation : ☐ OFF ☐ ON  
Output Voltage :  (38V - 65V)  
Output Current :  (0A - 40A)  
Discharge Voltage :  (38V - 65V)  
Discharge Current :  (0A - 40A)  
Set Reference

A - COM PORT Selection Section

B – Readings Section (Updates every 1 second)

C – Flags Section (Updates every 1 second)

D – Reference Input Section

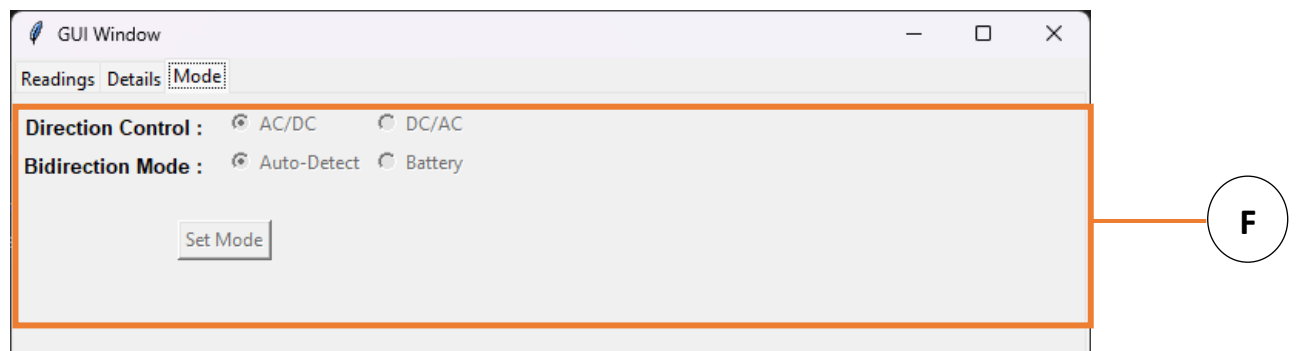


### Details Tab:



E – Manufacture's Details Section

### Mode Tab:



F – Mode and Direction Input Section

## A – COM PORT Selection Section:

COM Port :	<input type="text"/>	<input type="button" value="Refresh"/>	<input type="button" value="Start"/>	<input type="button" value="Stop"/>	<input type="button" value="Resume Updates"/>	<input type="button" value="Pause Updates"/>
------------	----------------------	--	--------------------------------------	-------------------------------------	---	--

Component	Description
COM Port	A list showing the available Com ports
Refresh	To refresh the com port list
Start	To start the serial communication on the selected com port in the <b>COM Port</b> list and hence starting CAN communication with the power supply
Stop	To stop the serial communication on the selected com port and hence stopping CAN Communication with the power supply (disabled until serial communication is started)
Resume Updates	To resume the readings and flags data updates (updates every one second) (enabled only when the updates are paused by <b>Pause Updates</b> and serial communication is started)
Pause Updates	To pause the readings and flags data updates (enabled only when the updates are resumed by <b>Resume Updates</b> and serial communication is started)

## B – Readings Section:

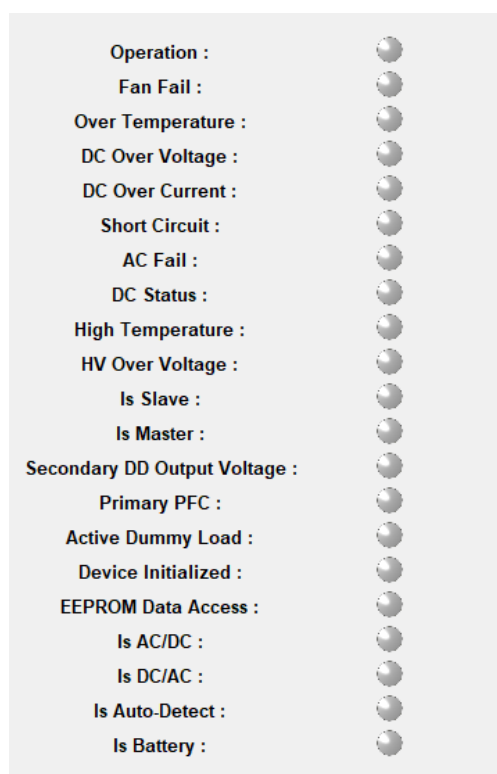
(Disabled until Serial Communication is not started)

**Input Voltage :**  
**Output Voltage :**  
**Output Current :**  
**Temperature :**  
**Reference Output Voltage :**  
**Reference Output Current :**  
**Reference Discharge Voltage :**  
**Reference Discharge Current :**

Component	Description	Display Range	Tolerance	Default	
				Auto-detect mode	Battery mode
Input Voltage	AC Voltage reading value	180 – 240V	± 10V	N/A	N/A
Output Voltage	DC Voltage reading value	0 – 56V	± 0.48V	N/A	N/A
Output Current	DC current reading value	-45 – 54A	± 0.45A	N/A	N/A
Temperature	Internal ambient temperature	-40 – 110°C	± 5°C	N/A	N/A
Reference Output Voltage	Charge voltage set value	38 – 65V	± 0.48V	48V	50.4V
Reference Output Current	Charge current set value	0.45 – 49.5A	± 0.45A	49.5A	40A
Reference Discharge Voltage	Discharge voltage set value	38 – 65V	± 0.48V	38V	38V
Reference Discharge Current	Discharge current set value	-38.3 – -0.45A	± 0.45A	-38.3A	-32.2A

## C – Flags Section:

(Disabled until Serial Communication is not started)



This section various flags which are set by the power supply during its operation each having different meaning. These various flags are displayed using led's which are to the right on the above figure. These led's will turn green, red or remain grey depending on the flags given by the power supply. Detailed table explaining each flag is given below. (Initially before starting communication all the led's are grey)

Components	Led Colour		
	Green	Red	Grey
Operation	Supply is ON	N/A	Supply is OFF
Fan Fail	N/A	Fan is Locked	Fan working normally
Over Temperature	N/A	Internal temperature abnormal	Internal temperature normal
DC Over Voltage	N/A	DC over voltage protected	DC voltage normal
DC Over Current	N/A	DC over current protected	DC current normal
Short Circuit	N/A	Shorted circuit protected	Shorted circuit do not exist
AC Fail	N/A	AC range abnormal	AC range normal
DC Status	N/A	DC turned off	DC turned on

Components	Led Colour		
	Green	Red	Grey
High Temperature	N/A	Internal temperature abnormal	Internal temperature normal
HV Over Voltage	N/A	HV over voltage protected	HV voltage normal
Is Slave	Supply is a slave	N/A	N/A
Is Master	Supply is a master	N/A	N/A
Secondary DD output voltage	N/A	Secondary DD output voltage status TOO LOW	Secondary DD output voltage status NORMAL
Primary PFC	N/A	Primary PFC OFF or abnormal	Primary PFC ON normally
Active Dummy Load	N/A	Active dummy load off	Active dummy load on
Device Initialized	Device has initialized	Device is uninitialized	N/A
EEPROM Data Access	N/A	EEPROM data access error	EEPROM data access normal
Is AC/DC	Direction Is AC to DC	N/A	N/A
Is DC/AC	Direction Is DC to AC	N/A	N/A
Is Auto-Detect	In auto-detect mode	N/A	N/A
Is Battery	In battery mode	N/A	N/A

## D – Reference Input Section

(Disabled until Serial Communication is not started)

Operation : ☐ OFF ☒ ON

Output Voltage :  ( 38V - 65V )

Output Current :  ( 0A - 40A )

Discharge Voltage :  ( 38V - 65V )

Discharge Current :  ( 0A - 40A )

Component	Description	Adjustable Range	Tolerance
Operation	Operating Status of supply	OFF or ON	N/A
Output Voltage	Charge voltage setting	38 – 65V	± 0.48V
Output Current	Charge current setting	0.45 – 49.5A	± 0.45A
Discharge Voltage	Discharge voltage setting	38 – 65V	± 0.48V
Discharge Current	Discharge current setting	-38.3 – -0.45A	± 0.45A
Set Reference	To process the input values and send commands to supply accordingly	N/A	N/A

## E – Manufacturer's Detail Section

(Disabled until Serial Communication is not started)

**Manufacturer's Name :**  
**Manufacturer's Model Name :**  
**Firmware Revision :**  
**Manufacturer's Date :**  
**Product Serial Number :**

Component	Description
Manufacturer's Name	Power Supply manufacturer's name
Manufacturer's Model Name	Power Supply manufacturer's model name
Firmware Revision	Power Supply revision number
Manufacturer's Date	Power Supply manufacturer's date
Product Serial Number	Power supply serial number

## F - Mode and Direction Input Section

(Disabled until Serial Communication is not started)

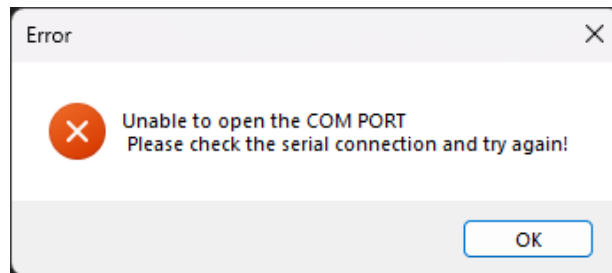
**Direction Control :** ☒ AC/DC ☐ DC/AC  
**Bidirection Mode :** ☒ Auto-Detect ☐ Battery

Component	Description	Adjustable Range
Direction Control	Sets the direction of power supply (only enabled when supply is in battery mode)	AC/DC or DC/AC
Bidirection Mode	Sets the control mode of power supply <b>(Note : When the bidirectional mode is changed, the power supply needs to be rebooted)</b>	Auto-Detect or Battery
Set Mode	To process the input values and send commands to supply accordingly	N/A

## Warnings and Errors:

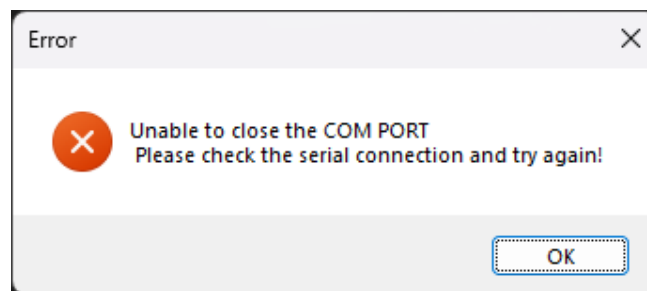
There will be pop up messages in case of an error or a warning indicating the user about the problem which occurred during execution. The following are pop up messages and their meaning and how to handle them.

### **COM Port Opening Error:**



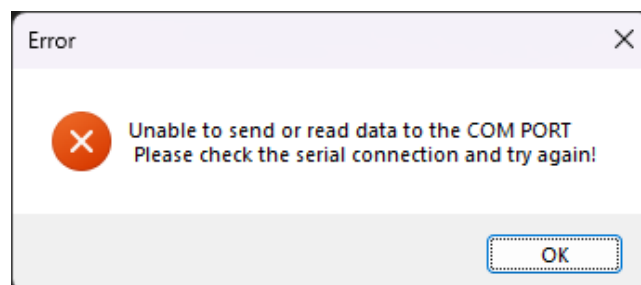
This error comes when the application is unable to open the serial port selected in the **COM Port** list. Please make sure the correct com port is selected and try again. If the error still persists then trying unplugging the can module and re-plugging it. This should in most cases solve the error.

### **COM Port Closing Error:**



This error comes when the application is unable to close the serial port selected in the **COM Port** list. Please make sure the correct com port is plugged in and not disconnected. If the error still persists then trying running the application again.

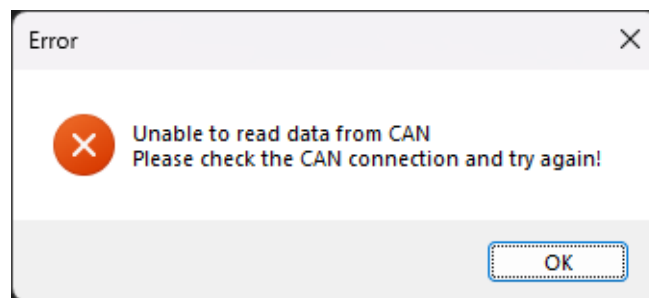
### **COM Port send/read Error:**



This error comes when the application is unable to send data or read data from to the serial port selected in the **COM Port** list. Please make sure the correct com port is plugged in and not disconnected. Also make sure the correct com port is selected and try again. If the error

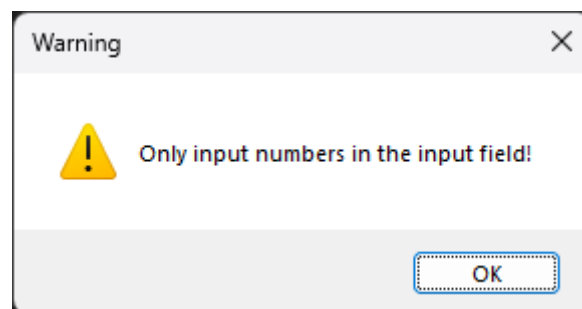
still persists then trying unplugging the can module and re-plugging it or re-running the application

#### **CAN Bus read Error:**



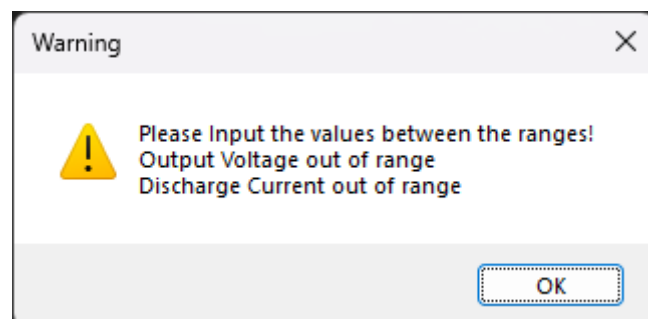
This error comes when the application is unable to communicate with the can bus i.e the power supply. Please make sure there is proper connection between the CAN wires of the can module and the power supply including the ground connection. Try switching Off the power supply, disconnecting the serial port, disconnecting the wires and making a fresh connection.

#### **Wrong Input Warning:**



This warning comes when the user inputs any other character apart from numbers in the input field. Please make sure there is not space or any unwanted characters in the input field. (Decimal point is allowed)

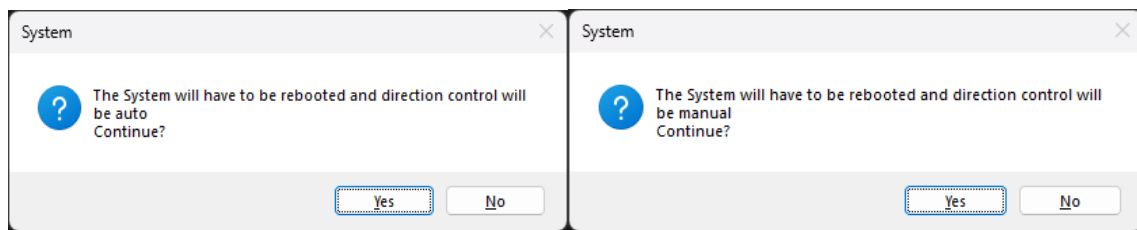
#### **Wrong Range Warning:**



This warning comes when the user inputs a number which is not in the range specified in the datasheet as well as the GUI. Please make sure the value is between proper range defined for each input field.

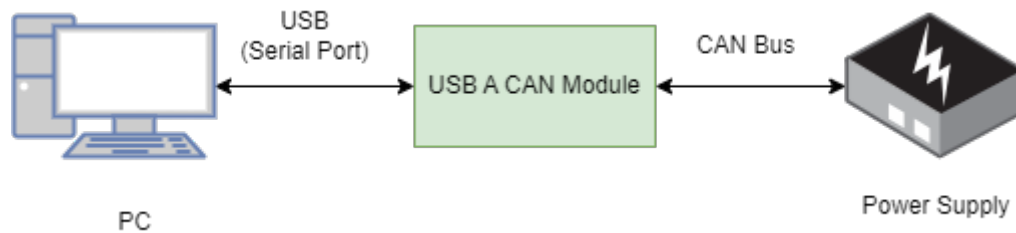


### Mode Change Confirmation:



Either one of the confirmations comes (depending on the current control mode as well as user selected mode) when the user wants changes the control mode of the power supply. It indicates that the supply must be rebooted in order to have the changes reflected. Clicking Yes will send the command for mode change and the serial communication will be stopped. It must be started manually again. If clicked No, no changes will be done and no need of reboot. (Please note if no confirmation comes then it means that the selected control mode is already the one the supply is working on)

## CONNECTIONS



### **Steps:**

1. Set the ID of the BIC-2200 to "0", that is setting the DIP switch to ON/ON/ON positions.
2. In the USB CAN A module ON the 120 ohm resistor by placing the switch on top in ON position
3. Connect the CANH, CANL, and GND pins of USB CAN A module to the CANH (Pin7), CANL (PIN 8) and GND-AUX (PIN9) pins of CN47 connector of power supply
4. Connect the USB CAN A module to the PC and run the application named app.exe
5. Select the desired COM Port from the COM port list and press Start
6. If any error occurs, please look in the Warning and Errors Section of the document
7. The user can Pause and Resume the Readings and Flags update by pressing the Pause Updates and Resume Updates Buttons respectively
8. The user can input in the fields given to change the voltage and current of the power supply
9. If the user wishes to change the control mode or direction of the power supply, they must navigate to the Mode Tab to the necessity.
10. Finally, short circuit ON-OFF (PIN5) and +5-AUX (PIN3) pins of the CN46 connector on the supply to remote on it to charge the batteries or provide energy to the loads.
11. If the user wishes to stop the serial communication, it can be done by pressing the Stop Button (Please Note that the power supply will remain ON in this case)