

Neosys Technology Inc.

IGT-20/ IGT-21/ IGT-22 Industrial Gateway

User Manual

Revision 1.4

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Declaration of Conformity

FCC This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

CE The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

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Safety Precautions

Read these instructions carefully before you install, operate, or transport the system.

- Install the system or DIN rail associated with, at a sturdy location
- Install the power socket outlet near the system where it is easily accessible
- Secure each system module(s) using its retaining screws
- Place power cords and other connection cables away from foot traffic. Do not place items over power cords and make sure they do not rest against data cables
- Shutdown, disconnect all cables from the system and ground yourself before touching internal modules
- Ensure that the correct power range is being used before powering the device
- Should a module fail, arrange for a replacement as soon as possible to minimize down-time
- If the system is not going to be used for a long time, disconnect it from mains (power socket) to avoid transient over-voltage

Service and Maintenance

- ONLY qualified personnel should service the system
- Shutdown the system, disconnect the power cord and all other connections before servicing the system
- When replacing/ installing additional components (expansion card, memory module, etc.), insert them as gently as possible while assuring proper connector engagement

ESD Precautions

- Handle add-on module, motherboard by their retention screws or the module's frame/ heat sink. Avoid touching the PCB circuit board or add-on module connector pins
- Use a grounded wrist strap and an anti-static work pad to discharge static electricity when installing or maintaining the system
- Avoid dust, debris, carpets, plastic, vinyl and styrofoam in your work area.
- Do not remove any module or component from its anti-static bag before installation

About This Manual

This manual introduces Neosys IGT-20/ IGT-21/ IGT-22 industrial grade gateway that can be deployed in a complex communication network. The manual covers IGT-20/ IGT-21/ IGT-22 connections, LED indicators, initial setup and installation of the system.

Revision History

Version	Date	Description
1.0	May. 2017	Initial release
1.1	Sep. 2017	Login via Ethernet update
1.2	Mar. 2018	Added IGT-21
1.3	Dec. 2020	Added IGT-22
1.4	Sep. 2021	Updated IGT-20/ IGT-21 Sysfs Mapping

1. Introduction

Neosys IGT-20/ IGT-21/ IGT-22 are rugged industrial grade ARM-based gateway. Based on Texas Instruments' Sitara AM335x family and coupled with Debian operating system, IGT-20/ IGT-21/ IGT-22 are in compliance with CE/FCC, shock, vibration, etc. certifications.

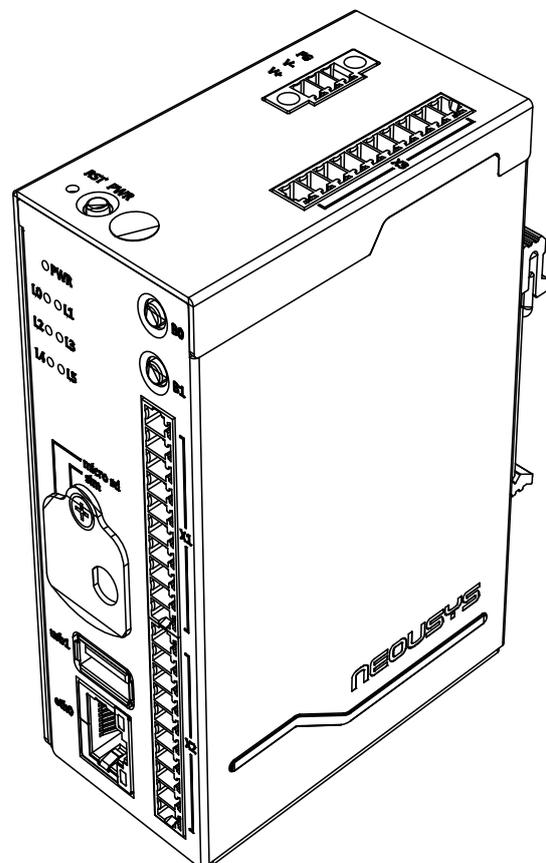
1.1 IGT-20/ IGT-21/ IGT-22 Overview

Neosys IGT-20/ IGT-21/ IGT-22 accept a wider range of power inputs from 8~25 VDC and has I/Os that are applicable to a range of industrial grade sensors. It also has four (4) built-in isolated digital inputs channels that accept discrete signals from various sensors or buttons/ switches and four (4) built-in isolated digital output channels to control actuators and indicators.

Network and communication wise, there are built-in mini-PCIe slot and a USIM holder for wireless network access through 3G, 4G or WiFi (mini PCIe WiFi module). There is also an opening at the top for SMA connector to boost wireless signals.

The system features an external and an internal microSDHC slots. The separate storage slot design allows system files and user data to be stored on different cards. The design can also expedite OS deployment for mass production scenarios.

As a gateway, users can take advantage of six programmable status LED indicators and two function buttons to operate IGT-20/ IGT-21/ IGT-22 without using a keyboard/ mouse.



1.2 IGT-20/ IGT-21/ IGT-22 Hardware Specifications

System Specification

	IGT-20	IGT-21	IGT-22
Processor	Texas Instrument Sitara AM3352		
Memory module	1GB DDR3L SDRAM (onboard)		
Power input	8~25 VDC		
Real time clock (RTC)	Not supported		Supported

Input/ Output Interface

Ethernet:	10/ 100Mbit full-duplexed x1		
USB port	USB2.0 x1		
Storage expansion	Dual microSDHC (internal x1, external x1)		
Serial port	Two RS-232/ 422/ 485 ports, configurable Up to 115.2kbps Auto flow control with RS-485	1x RS232 1xRS485 Up to 115.2kbps Auto flow control with RS-485	
Console port	3-wired RS-232 x1		
LED indicator	LED indicator (user definable) x6		
Function button	Function button (user definable) x2		
CAN bus (IGT-21 only)	Isolated CAN bus port, 2.0A and 2.0B		
Wireless expansion	mini PCIe + SIM slot x1 (USB signal only)		

Digital Input

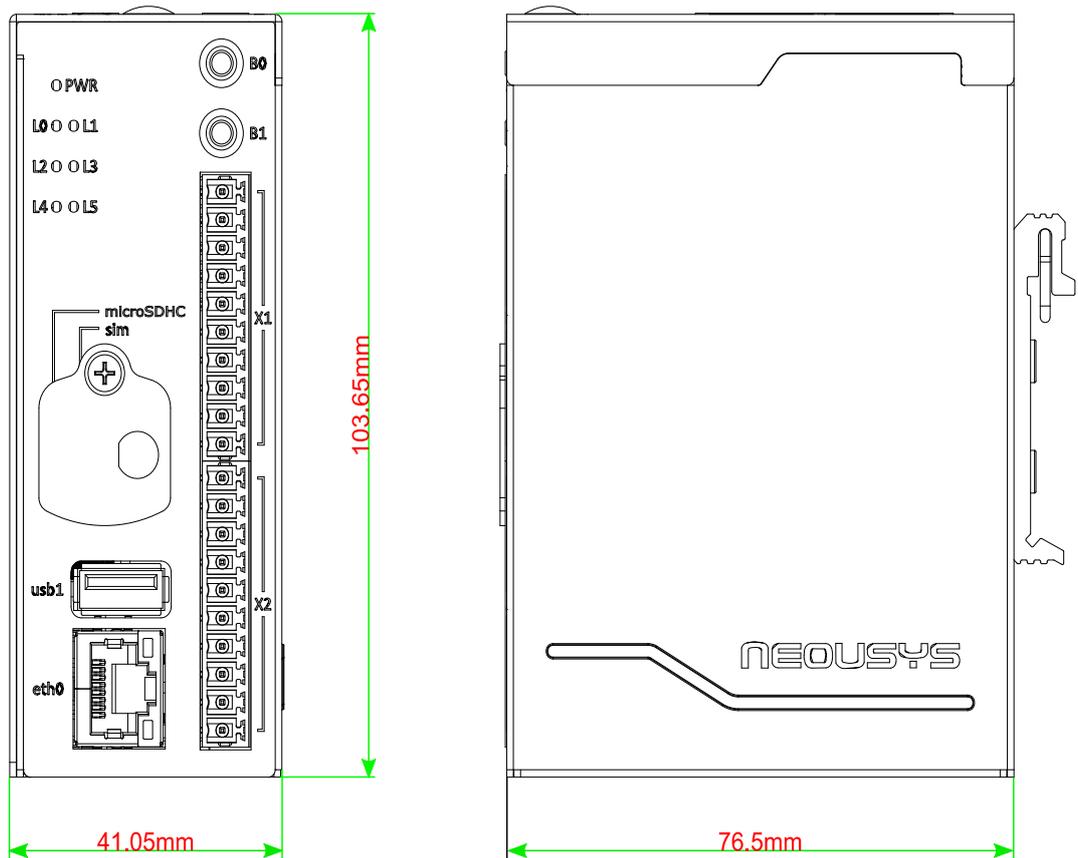
Digital input	Built-in isolated digital input channels x4	Built-in isolated digital input channels x8
Interface	Photo-coupler	
Isolation voltage	2500Vms	
Logic "0" voltage	5~24V	11~24V
Logic "1" voltage	0~1.5V	0~1.5V
Connector pitch	3.81mm	

Digital Output

Digital output	Built-in isolated digital output channels x4	Built-in isolated digital output channels x8
Interface	N-channel MOSFET	
Isolation voltage	2500Vms	
Output voltage	Up to 24VDC	
Output current	100mA	
Connector pitch	3.81mm	

1.3 Enclosure Dimensions

Neosys IGT-20/ IGT-21/ IGT-22 enclosure dimensions come in a footprint measuring just 103.65 (H) x 41.05 (W) x 76.5 (D) mm. The compact dimensions make it easy to setup and deploy in areas where space is limited. It also comes with a DIN clip for DIN-rail mounting purposes.



2. System Overview

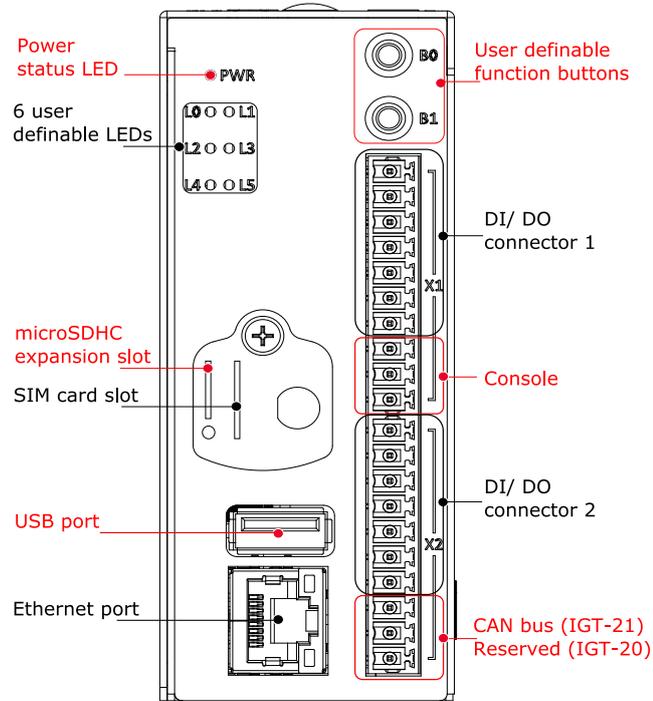
Upon receiving and unpacking your IGT-20/ IGT-21/ IGT-22 system, please check immediately if the package contains all the items listed in the following table. If any item(s) are missing or damaged, please contact your local dealer or Neosys Technology.

2.1 IGT-20/ IGT-21/ IGT-22 Packing List

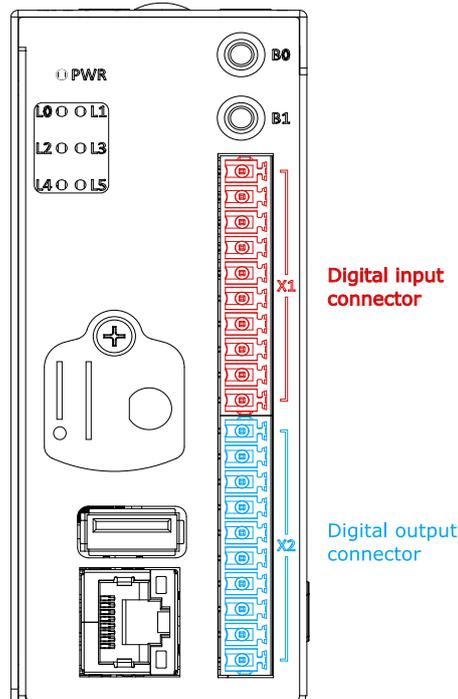
System Item	IGT-20/ IGT-21/ IGT-22	Qty
1	IGT-20 series gateway	1
2	3-pole terminal block	1
3	10-pole terminal block	3
4	Cover plate	1
5	M3 flat screw	1
6	DIN-rail clip set	1

2.2 Enclosure Front Panel View

On the system's front panel, there is a power status indicator LED, six user-definable LEDs, microSDHC expansion slot, SIM card slot, USB port, Ethernet port, two user-definable function buttons, two DI/ DO connectors (note the difference between IGT-20/ IGT-21 and IGT-22), console and reserved ports.



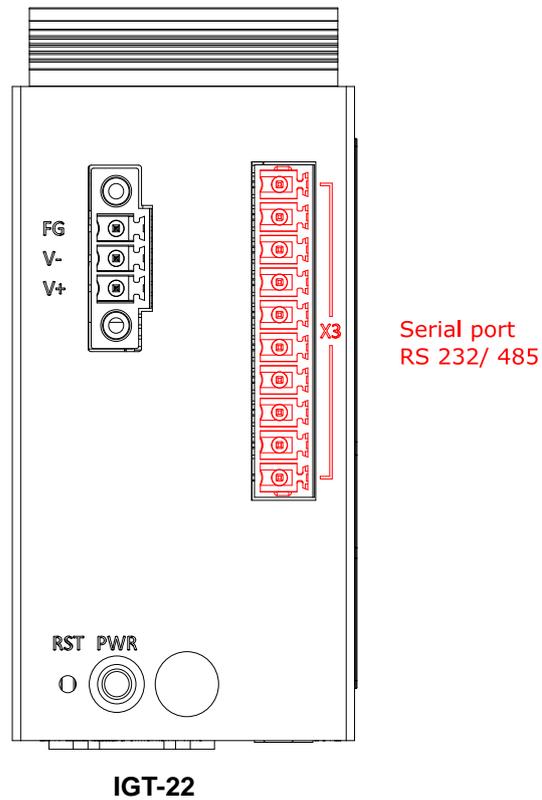
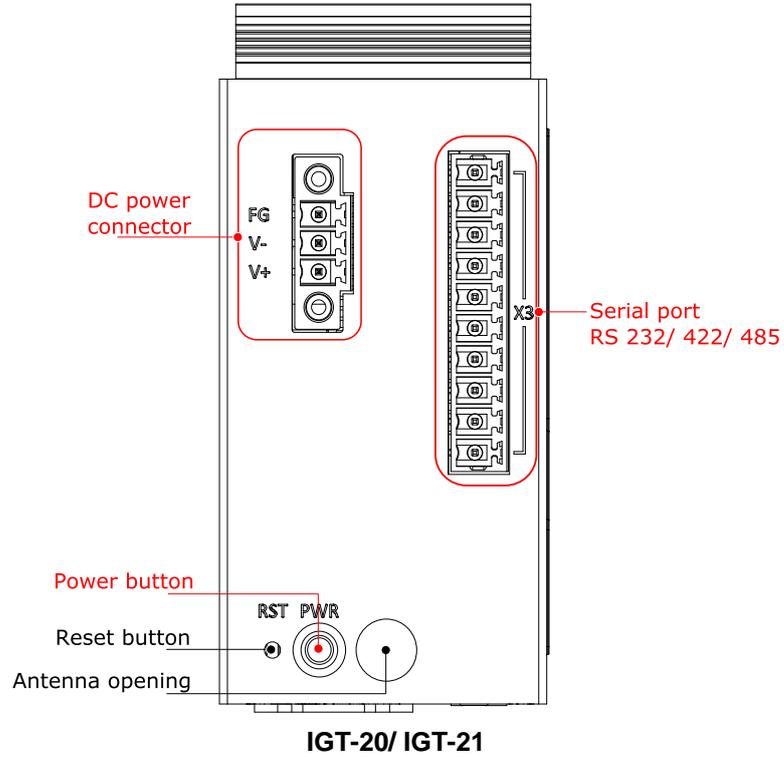
IGT-20/ IGT-21



IGT-22 digital input connector

2.3 Enclosure Top View

Top of the enclosure features a 3-pin DC power connector, serial port RS-232/ 422/ 485 (note the difference between IGT-20/ IGT-21 and IGT-22), power button, reset button and an antenna opening.

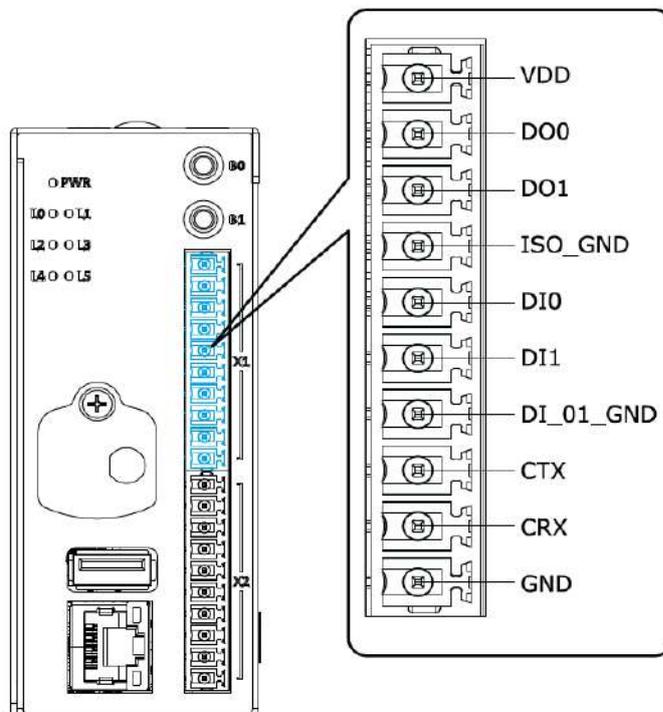


3. Digital I/O and DC Connector

There are three I/O connectors on IGT-20/ IGT-21/ IGT-22, each serving a different purpose and function. They consist of digital input/ output, console and serial port. There is also a DC connector at the top of the system.

3.1 IGT-20/ 21 Digital I/O Connector 1 Pin Definition

The X1 connector is located at the front panel of the system. It has digital input/ output functions and console port connection capability. For initial login via console port, you **MUST** connect through connector 1's console.

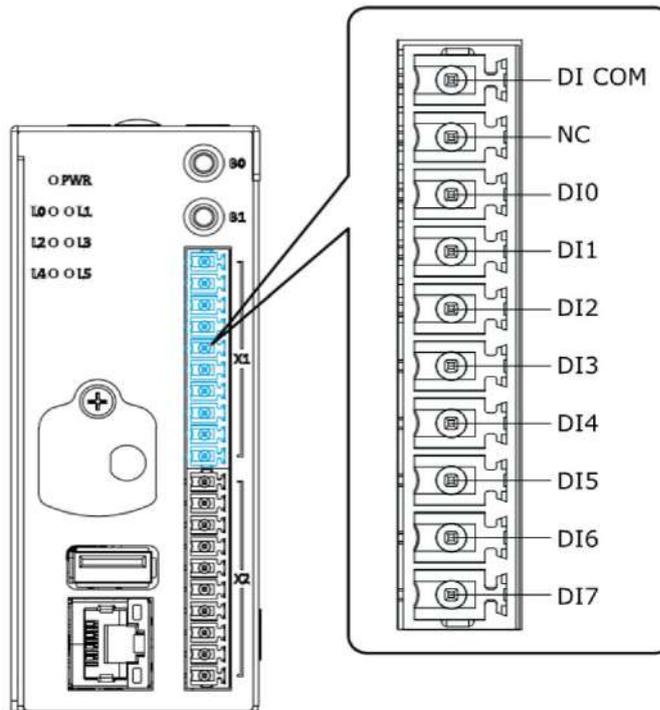


IGT-20/ IGT-21 Digital I/O Connector X1 Pin Definition

Pin	Signal
VDD	Clamp voltage for inductive load. Ignore this pin if no inductive load
DO0	Digital output pin 0
DO1	Digital output pin 1
ISO_GND	Common of digital output, isolated ground. Connect this pin to ground of
DI0	Digital input pin 0
DI1	Digital input pin 1
DI_01_GND	Common of DI0 and DI1
CTX	Tx of console port
CRX	Rx of console port
GND	Ground of console port.

3.2 IGT-22 Digital I/O Connector 1 Pin Definition

The X1 connector is located at the front panel of the system. It has digital input/output functions and console port connection capability. For initial login via console port, you **MUST** connect through connector 1's console.

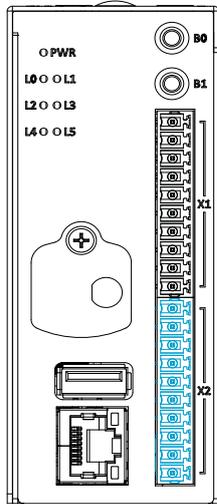


IGT-22 Digital I/O Connector X1 Pin Definition

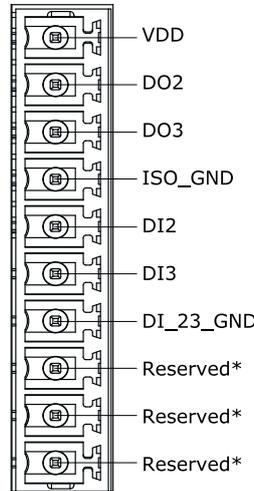
Pin	Signal
DI COM	Common of digital input
NC	No connection (DO NOT connect to this pin)
DI0	Digital input pin 0
DI1	Digital input pin 1
DI2	Digital input pin 2
DI3	Digital input pin 3
DI4	Digital input pin 4
DI5	Digital input pin 5
DI6	Digital input pin 6
DI7	Digital input pin 7

3.3 IGT-20/ 21 Digital I/O Connector 2 Pin Definition

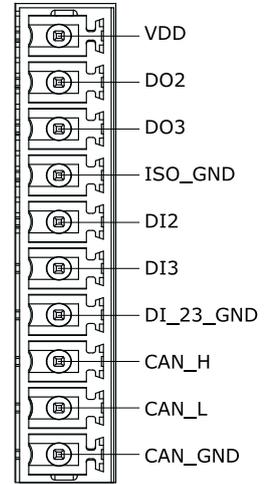
The X2 connector is located at the front panel of the system. The connector has digital input/ output functions.



X2 connector



IGT-20 pin definition



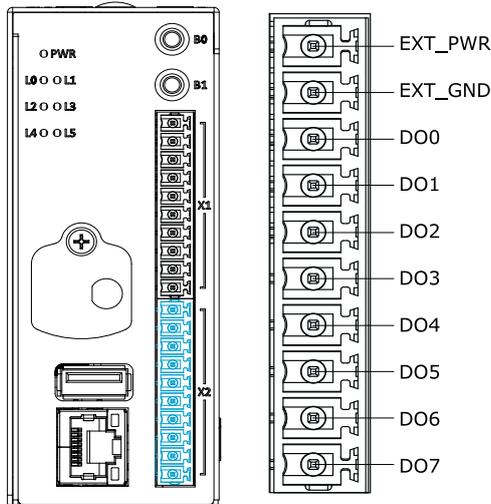
IGT-21 pin definition

IGT-20/ IGT-21 Digital I/O Connector X2 Pin Definition

Pin	Signal
VDD	Clamp voltage for inductive load. Ignore this pin if no inductive load
DO2	Digital output pin 2
DO3	Digital output pin 3
ISO_GND	Common of digital output, isolated ground. Connect this pin to ground of driving voltage
DI2	Digital input pin 2
DI3	Digital input pin 3
DI_23_GND	Common of DI2 and DI3
CAN_H (IGT-21)	CAN high signal (IGT-21)
CAN_L (IGT-21)	CAN low signal (IGT-21)
CAN_GND (IGT-21)	CAN bus ground, this pin connects to ISO_GND internally (IGT-21)

*DO NOT connect to reserved pins on IGT-20

3.4 IGT-22 Digital I/O Connector 2 Pin Definition

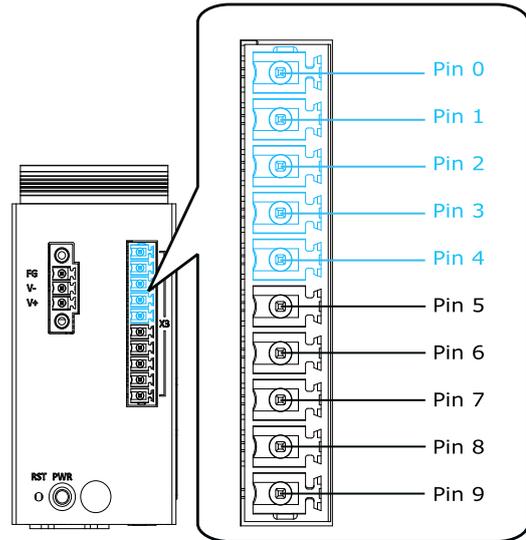


IGT-22 Digital Output Connector X2 Pin Definition

Pin	Signal
DO_PWR	External power supply for isolated digital outputs
DO_GND	Ground of the external power supply for isolated digital outputs
DO0	Digital output pin 0
DO1	Digital output pin 1
DO2	Digital output pin 2
DO3	Digital output pin 3
DO4	Digital output pin 4
DO5	Digital output pin 5
DO6	Digital output pin 6
DO7	Digital output pin 7

3.5 Serial Port Definition

Located at the top of the enclosure, there are two sets of pin definitions on system's serial port (RS-232/ 422/ 485). In the preinstalled Debian operating system, the first set of pins are mapped to ttyS1 and the second set of pins are mapped to ttyS2.



IGT-20/ IGT-21 Serial Port Pin Definition

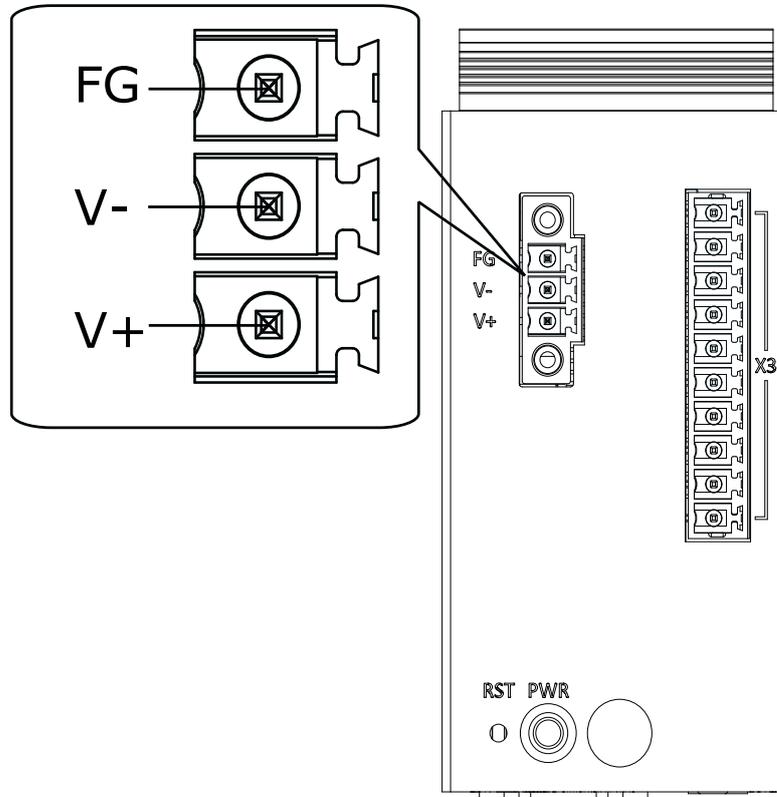
Port \ Pin	RS-422	RS-485	RS-232
0	TX+ of ttyS1	Data+ of ttyS1	Rx of ttyS1
1	TX- of ttyS1	Data- of ttyS1	-
2	RX+ of ttyS1	-	Tx of ttyS1
3	RX- of ttyS1	-	-
4	Ground connection		
5	TX+ of ttyS2	Data+ of ttyS2	Rx of ttyS2
6	TX- of ttyS2	Data- of ttyS2	-
7	RX+ of ttyS2	-	Tx of ttyS2
8	RX- of ttyS2	-	-
9	Ground of serial port. This pin connects to system digital ground.		

IGT-22 Serial Port Pin Definition

Port \ Pin	Signal
0	TX of ttyS1 (RS-232)
1	RX of ttyS1 (RS-232)
2	Data+ of ttyS2 (RS-485)
3	Data- of ttyS2 (RS-485)
4	Ground connection
5	Ground connection
6	DO NOT connect to this pin
7	CTX (Tx of console port)
8	CRX (Rx of console port)
9	Ground of serial port. This pin connects to system digital ground.

3.6 DC Connector Definition

The DC connector can be located at the top of the system.



DC Connector Pin

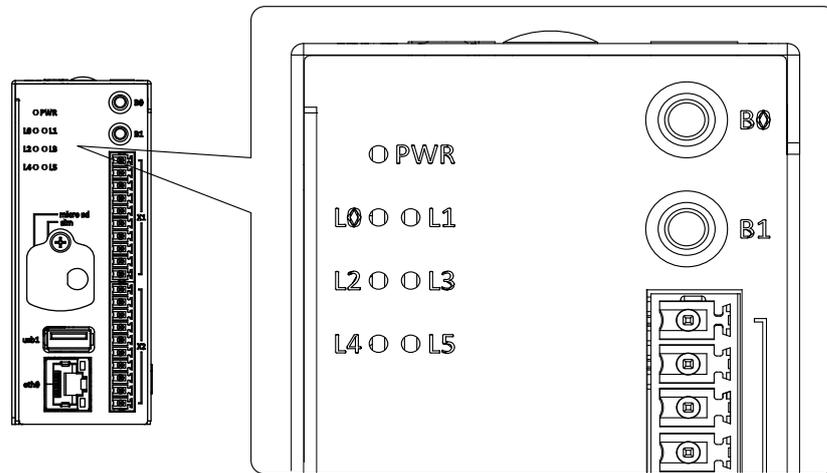
Pin	Definition
V+	V+ of DC input
V-	V- of DC input
FG	FG frame ground

4. System LED

The system has 6 user definable LED indicators for users to program accordingly to their needs. However, there are some LEDs that come with preset default statuses that will be mentioned in this chapter. Other LEDs you will find on the system include the Ethernet port and the power status LED.

4.1 System Status LED

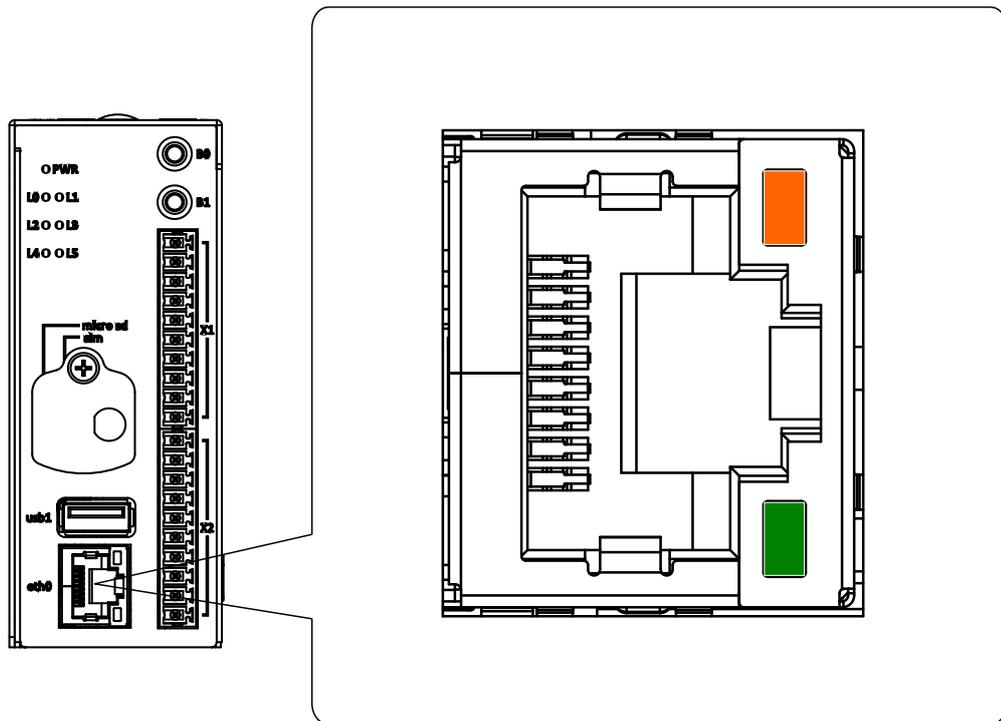
There are seven (7) system status LEDs that include a power status LED and six (6) programmable status LEDs where some may have predefined settings



Front panel LED indicators			
Label	Name	Status description	Preset status
PWR	Power button	Green: System on Off: System off	NA
L0	LED 1	Amber, User definable	By default, it acts as the system's heartbeat, blinking twice per second
L1	LED 2	Amber, User definable	NA
L2	LED 3	Amber, User definable	By default, it acts as the external microSDHC card's status LED
L3	LED 4	Amber, User definable	By default, it acts as the internal microSDHC card's status LED
L4	LED 5	Amber, User definable	NA
L5	LED 6	Amber, User definable	NA

4.2 Ethernet Port LED

The Ethernet port provides network connectivity. In addition to the console port, it is one of the two ports that may be used for system's initialization. The LED status indicator light functions are described as below.



LED indicator	LED color	Status description
Ethernet port LED		
Connection status	Amber	Steady on: Connection established Blinking: Data activity
Connection Speed	Green	Steady on: 100Mbps connection established Off: 10Mbps connection established

5. System Setup

The system setup involves programming LED definitions, hardware and DIN rail installation. However for this manual, we will be focusing on hardware and DIN rail installation only. Before you start, please make sure you have done the following:

It is recommended that only qualified service personnel should install and service this product to avoid injury.

During the process, please observe all ESD procedures to avoid damaging the equipment.

For internal, external microSDHC/ SIM card installation or replacement, make sure the system has powered off.

Before disassembling your system, please make sure the system has powered off with all cables (power, video, data, etc.) and antennae disconnected.

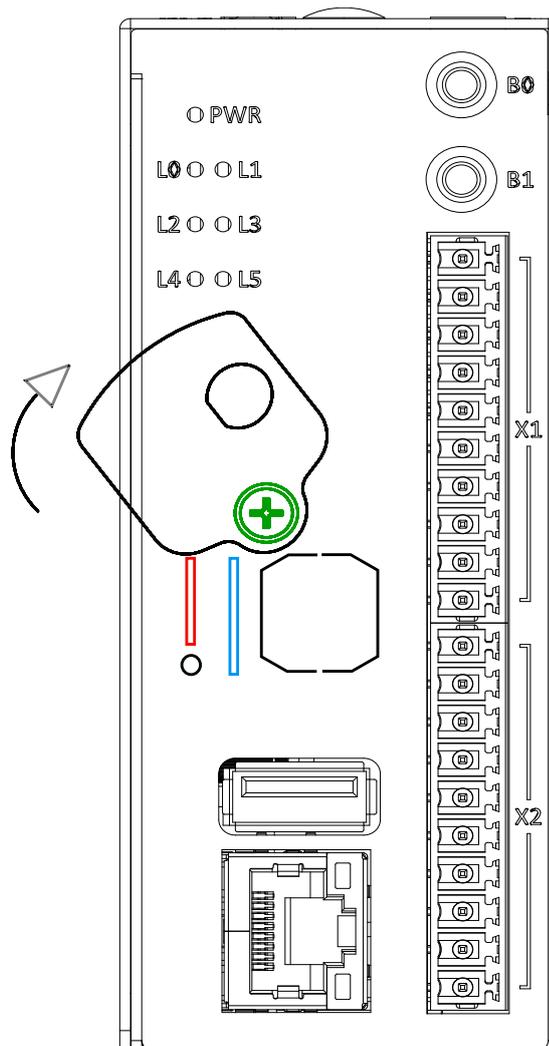
Place the system on a flat and sturdy surface (remove from mounts or out of server cabinets) before proceeding with the installation/ replacement procedure.

5.1 External microSDHC/ SIM Card Installation/ replacement

The external microSDHC/ SIM card slots can be located behind the cover-plate (dotted line) on the front panel. To replace or insert cards, you must loosen the screw securing the cover-plate to access the slots. The microSD card provides additional expansion storage while the SIM card offers wireless communication capability to the system.

Please ensure the system has powered off.

1. Loosen the screw (green) on the front panel just enough to move the cover-plate (dotted line) to the left to expose the microSDHC (red)/ SIM card (blue) slots.



2. If you already have cards in there and wanting to replace them, use your fingernail to push-in the card and the card will spring out just enough for you to retract them out of the slot.
3. The card insertion is directional. So gently insert the card, if you feel like the card is stuck, try turning the card around and try inserting it again. When properly inserted, you should hear a “click” sound.



WARNING

Prior to inserting the microSDHC or SIM card, please remember to power off the system as they are not hot-pluggable. Failure to do so may damage to the SIM card, system or result in data loss on the microSDHC card!



NOTE

The internal and external microSDHC cards are interchangeable. Either one can serve as expansion storage or system OS card. However during boot up, the system will detect the external slot for bootable OS before detecting the internal slot.

5.2 Internal microSDHC Card Installation/ Replacement

To access the internal microSDHC, you must disassemble the enclosure and cover.

To do so, please perform the following procedure:

1. Unfasten the screw on the side panel.



2. Unfasten the screw holding the cover plate.



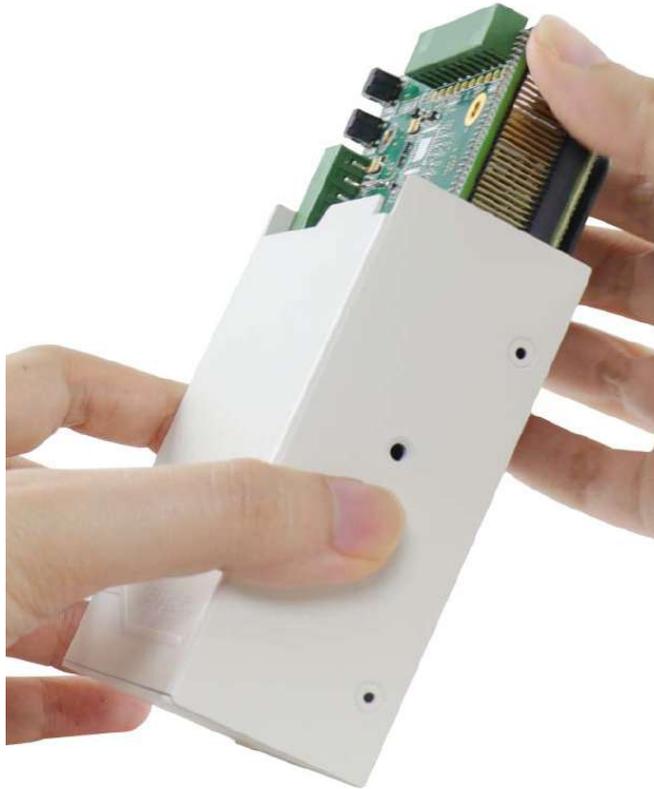
3. Place your thumbs firmly on the side of the cover and gently push upwards to remove it.



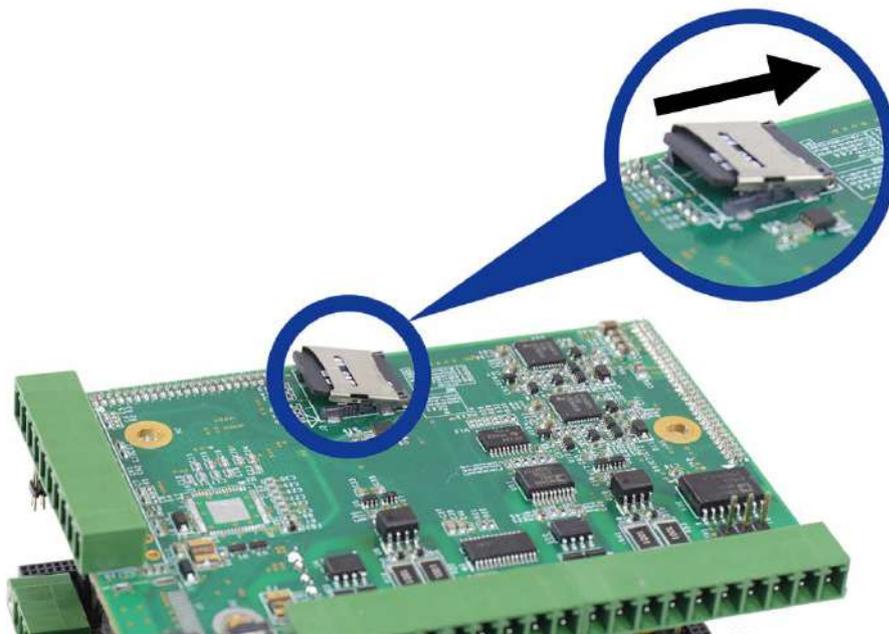
4. Once you have removed the cover, unfasten two screws that secure the PCBA in the enclosure.



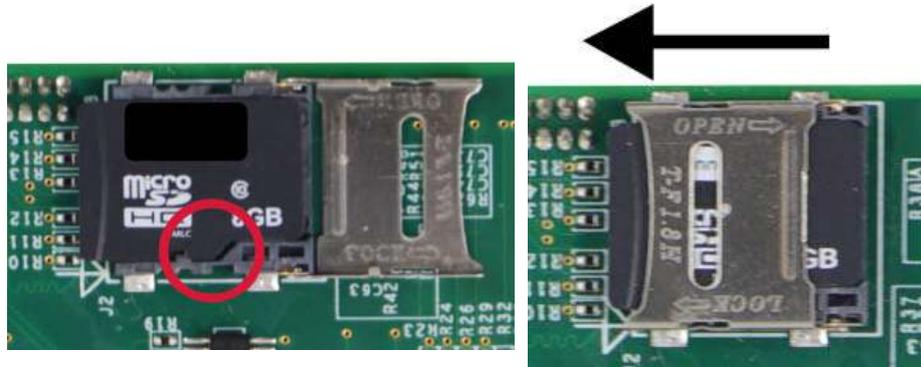
5. Gently pull the PCBA out of the enclosure.



6. With the orientation shown below, gently press down and slide the holder in the direction shown to unclip the microSDHC card. Flip open the holder to install/replace the microSDHC card.



7. Place the replacement microSDHC card in the slot, make sure the notch matches (indicated by the red circle), flip the holder over to sit on top of the microSDHC card and slot, push in the direction shown to secure microSDHC card.



Make sure the notch meets

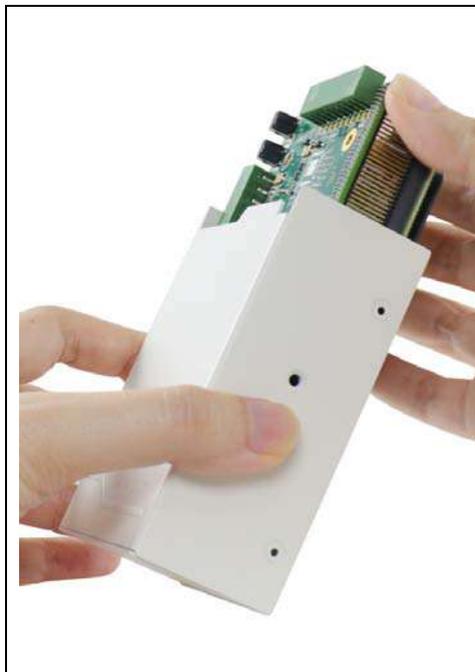
To secure the microSDHC card



NOTE

When in doubt which direction to lock and unlock the microSDHC card holder, please refer to the markings (OPEN/ LOCK) on the holder.

8. Gently slide the PCBA back into the enclosure, making sure the connectors\ buttons meet the enclosure openings.



Slide back into enclosure



Make sure connectors meet

- Secure the two screws holding the PCBA to the enclosure.



- Install the cover, fasten the screws to secure the enclosure cover and cover plate.



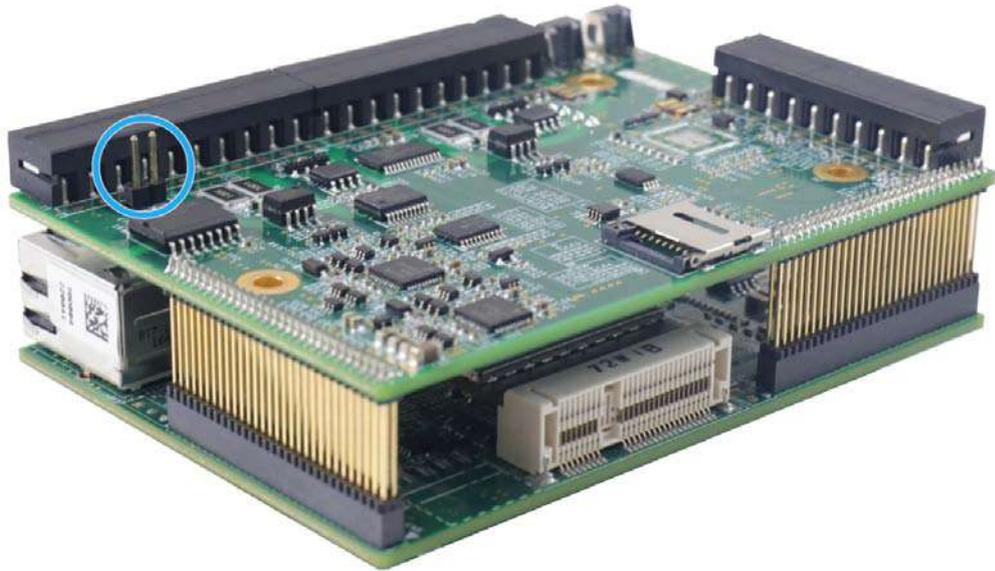
Secure enclosure cover



Secure cover plate

5.3 CAN bus Termination (IGT-21 Only)

For CAN bus termination, please refer to the section “[Internal microSDHC Card Installation/ Replacement](#)” on how to disassemble the system enclosure to gain access to the resistor jumper pins (indicated in the illustration below).

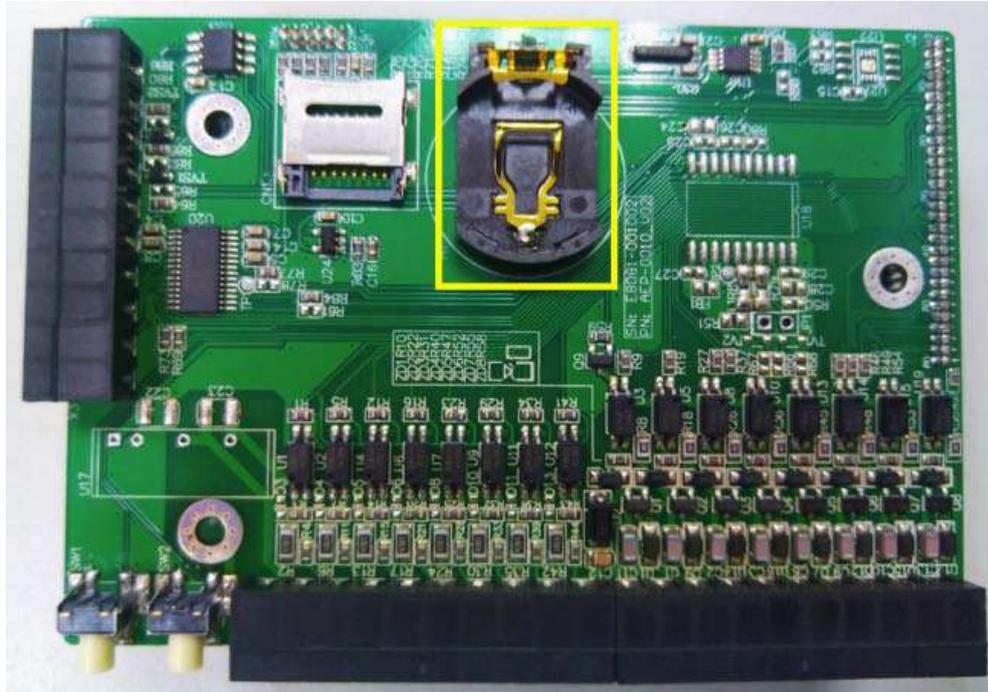


Jumper installed: resistance enabled

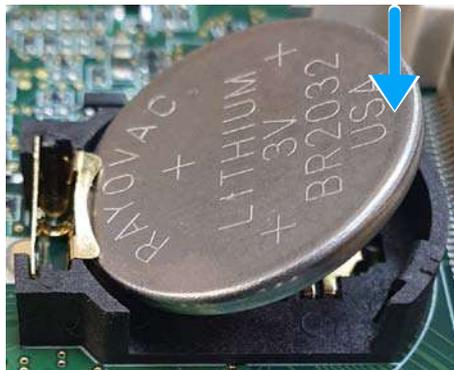
Jumper not installed: resistance disabled

5.4 Real Time Clock Installation (IGT-22 Only)

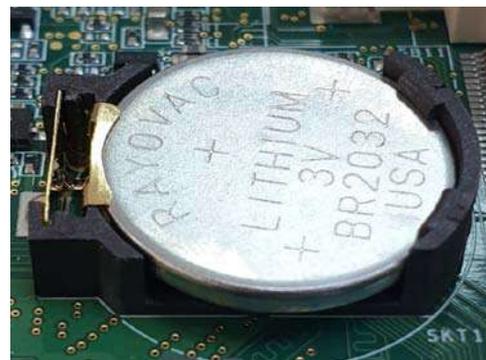
The location of the battery for the real time clock is shown below



To install the battery, insert the battery on a 45° angle as shown below and press down (indicated by the arrow) on the other end to clip the battery in place.



Insert battery at 45° angle



Battery clipped into place



NOTE

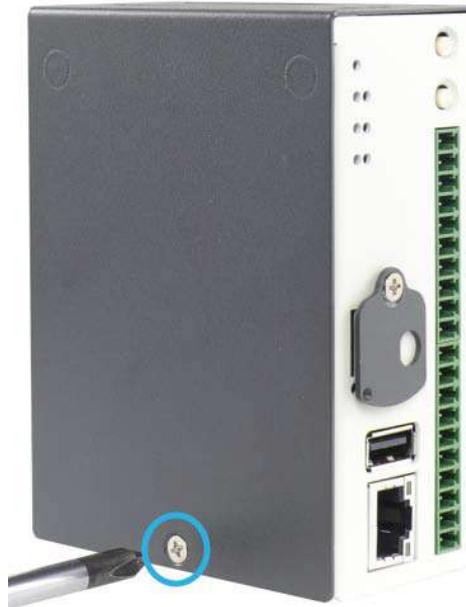
The BR2032 battery is not included with the purchase of the system. The battery is user provided and is responsible for the system's real-time clock.

5.5 PCIe Mini Installation

To access the PCIe Mini card, you must disassemble the enclosure and cover.

To do so, please perform the following procedure:

1. Unfasten the screw on the side panel.



2. Unfasten the screw holding the cover-plate.



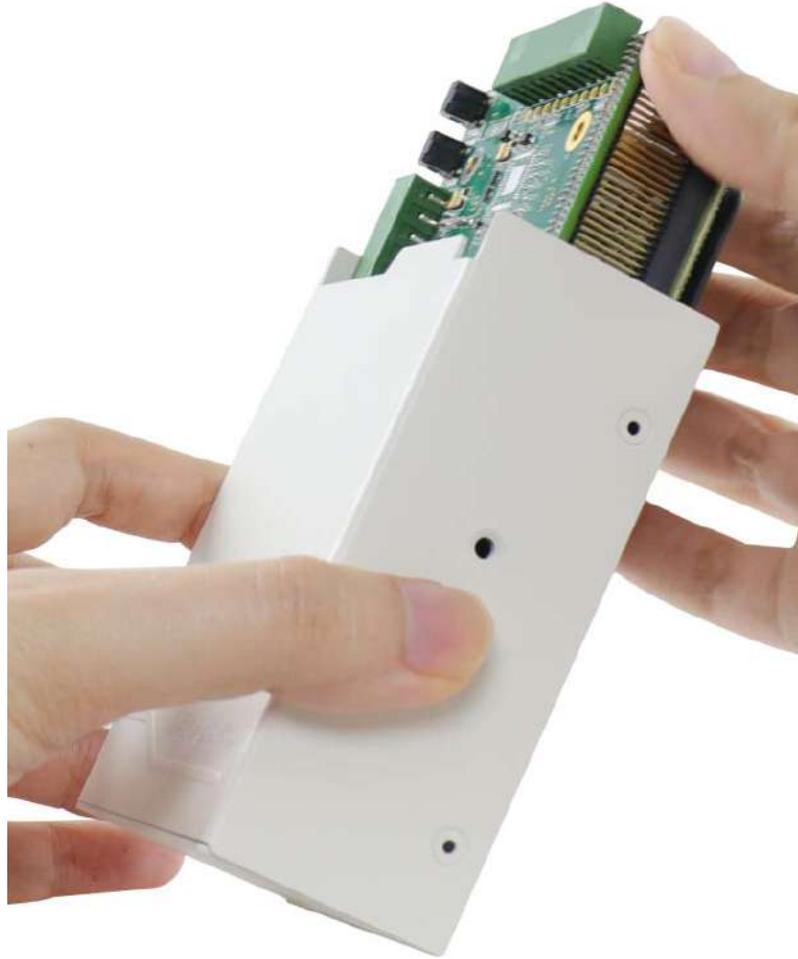
3. Place your thumbs firmly on the side of the enclosure and gently push upwards to remove the cover.



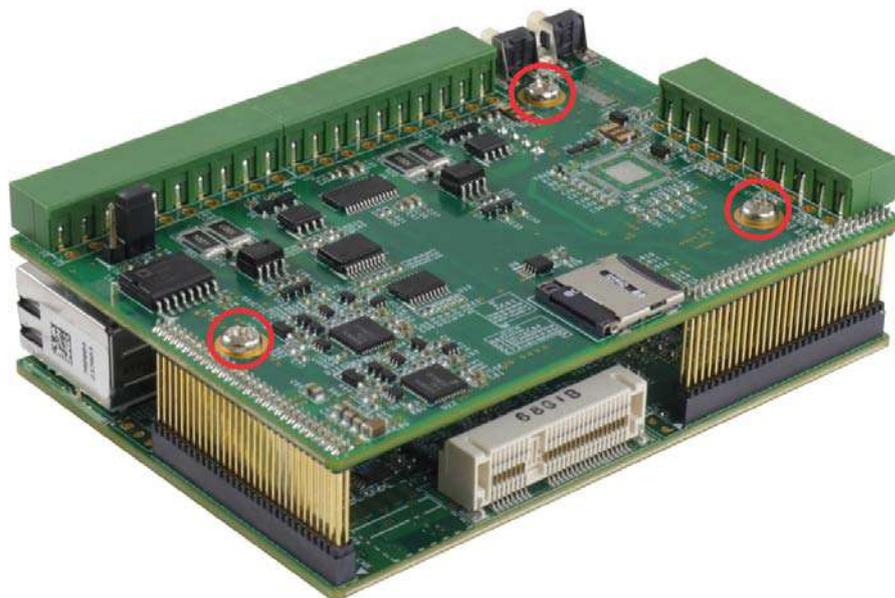
4. Once you have removed the cover, unfasten two screws that secure the PCBA in the enclosure.



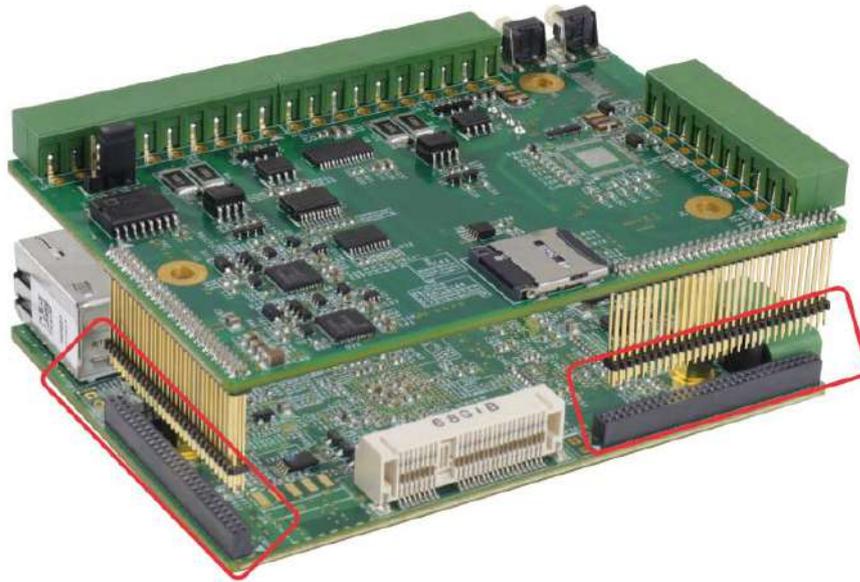
5. Gently pull the PCBA out of the enclosure.



6. Unfasten the three screws (indicated by red circles).



7. Separate the two PCBA layers apart by gently wiggling the pin/ connector section.



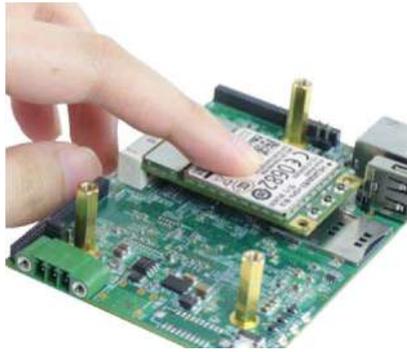
WARNING

Please be patient and gently wiggle the pin connector sections apart!
Excessive force may damage the pins or the connectors!

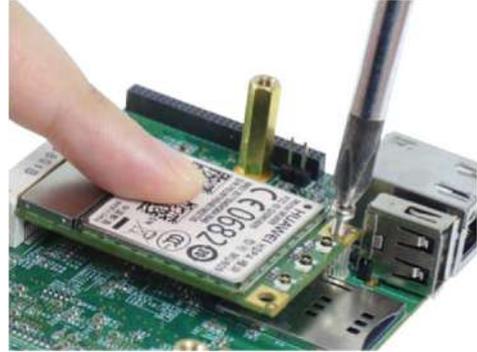
8. Locate the PCIe Mini slot and inset the module on a 45 degree angle.



9. Gently press the module down and secure the module with the dedicated screw.

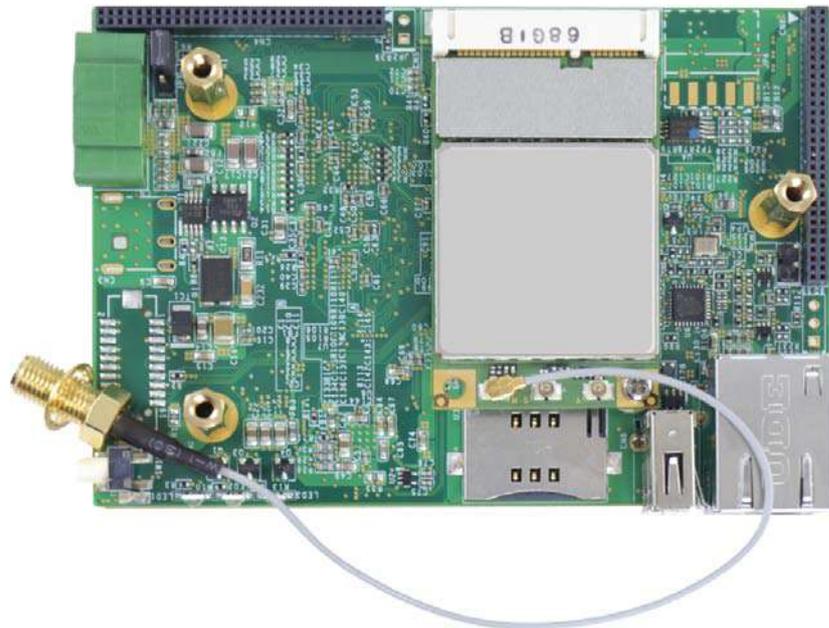


Gently press down



Secure with dedicated screw

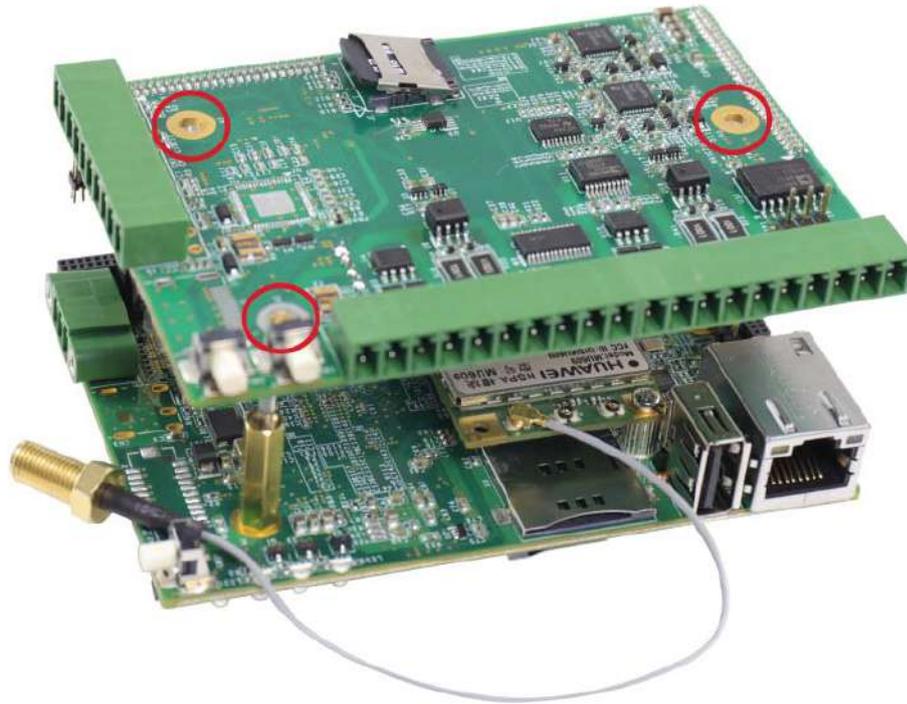
10. Clip-on PCIe Mini module's antennae (please refer to the module's user's manual on antennae cable connection).



NOTE

Please note how the antennae cable is routed. This is the recommended routing path to accommodate SMA-female connector installation.

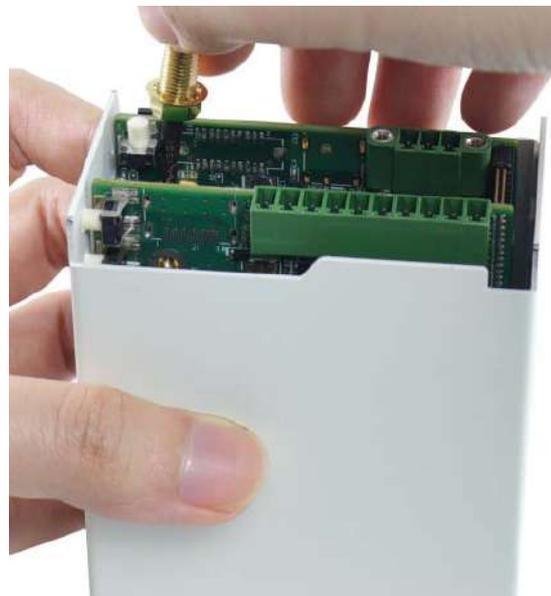
11. Matching the pins to the two connectors, stack the two PCBAs back together and fasten three screws (indicated by red circles) to secure the two PCBAs.



12. Insert the PCBA back into the enclosure, making sure the connectors\ buttons meet the enclosure openings and the SMA female connector is accessible.



Make sure connectors meet



Make sure SMA female connector is accessible

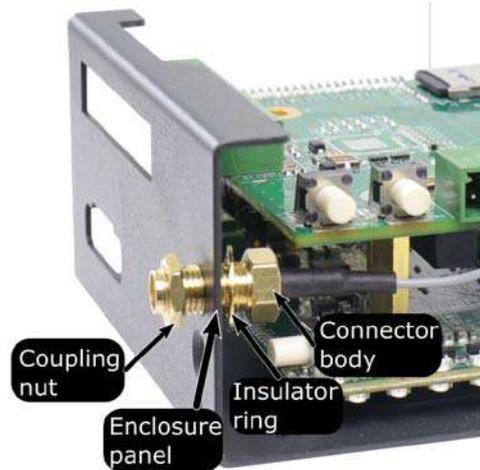
13. Secure the PCBA onto the enclosure by fastening the two screws.



14. Remove the antennae cover from the cover.



15. To install the SMA female connector, make sure the coupling nut sits outside the enclosure panel, insulator ring sits inside the enclosure panel with the connector body. Fasten the SMA female connector by turning the coupling nut and the connector body in opposite directions. Reinstall the cover and enclosure.



SMA female connector installation



Reinstall cover and enclosure



NOTE

Please fasten the SMA female connector before installing the cover and enclosure!

16. Secure the cover and cover plate by fastening respective screws.



Fastening the cover plate screw



Fastening the cover screw

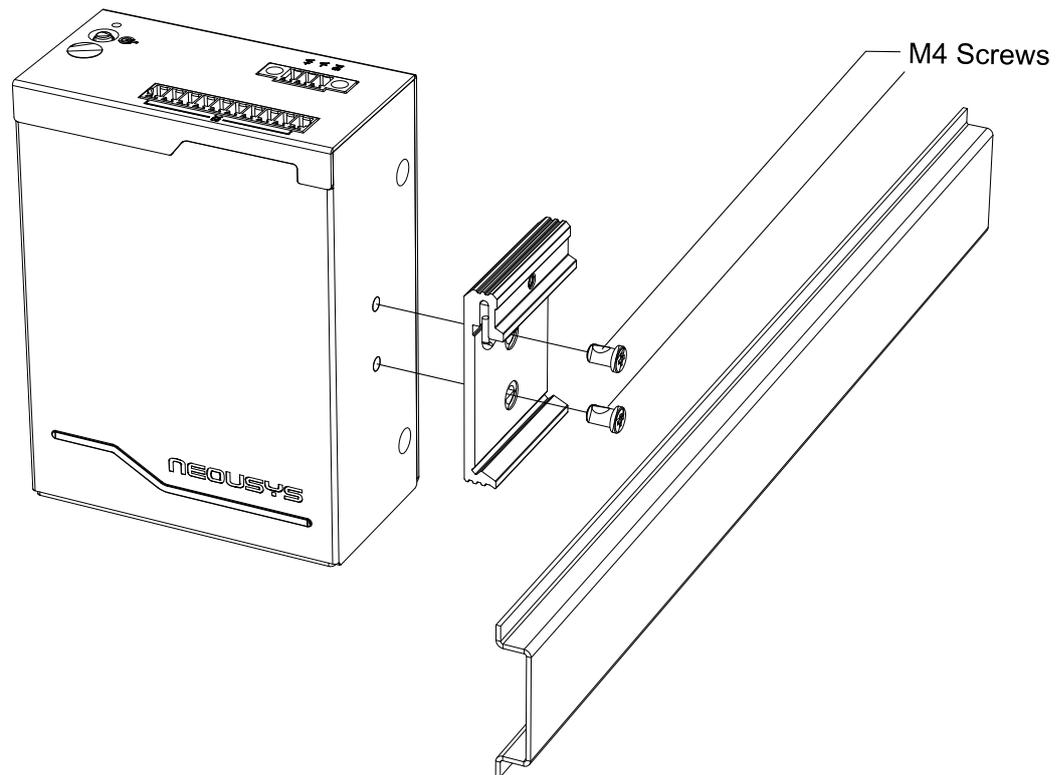
17. Install the antennae to complete the installation.



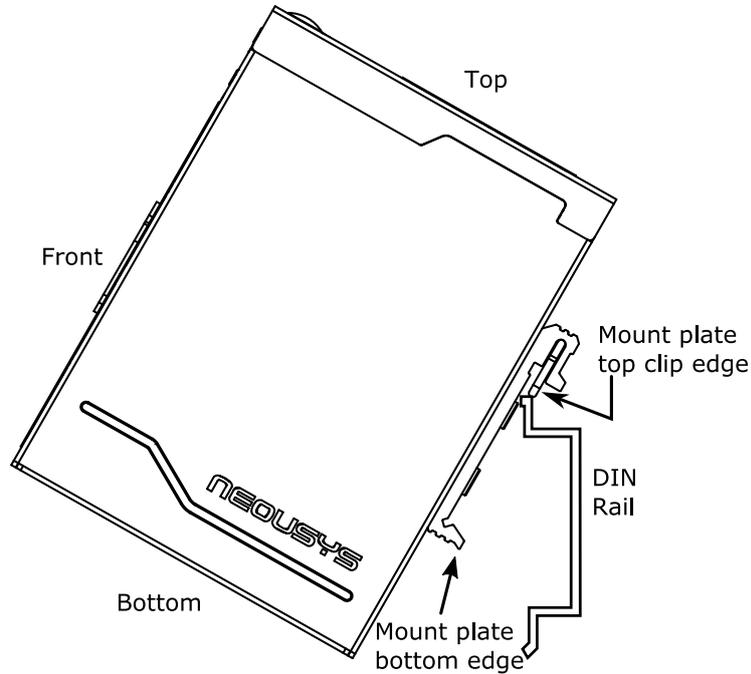
5.6 DIN Rail Installation

The DIN rail is easy to install and it is a convenient way to position the system once it has been initialized. The Din rail has been proven to be most beneficial in the industrial environment where space is limited. The mount plate comes with two M4 screws. Please refer to the illustration below to install the DIN clip/ rail.

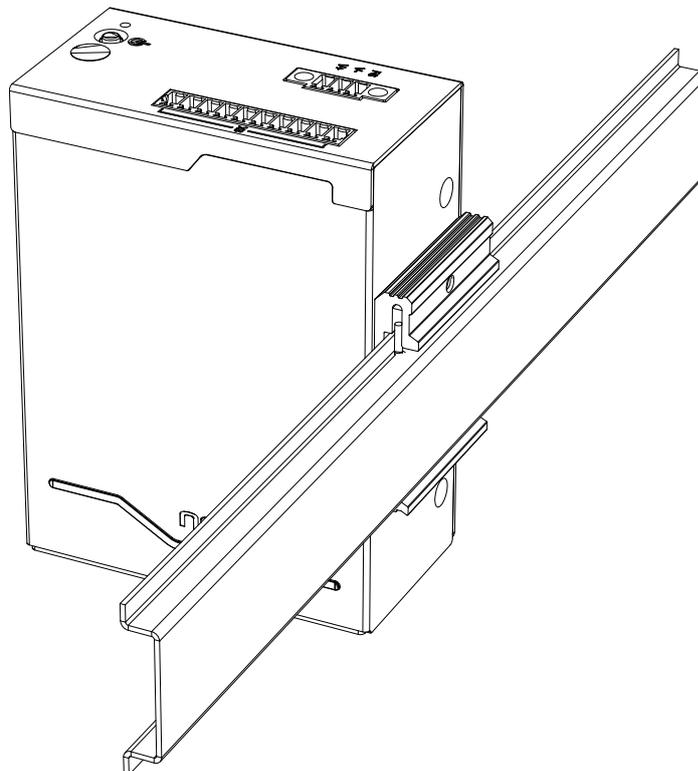
1. To install, secure the mount plate onto the rear of the system enclosure using the M4 screws provided.



- To install the mount plate onto the DIN rail, you must come over the top of the DIN rail, tilting downwards, overlap the top clip edge of the mount plate onto the DIN rail first, then firmly press the bottom-front of the enclosure to clip the bottom edge of the mount plate.



- Confirm the mount plate has indeed clipped onto the DIN rail for proper fit to complete the installation.



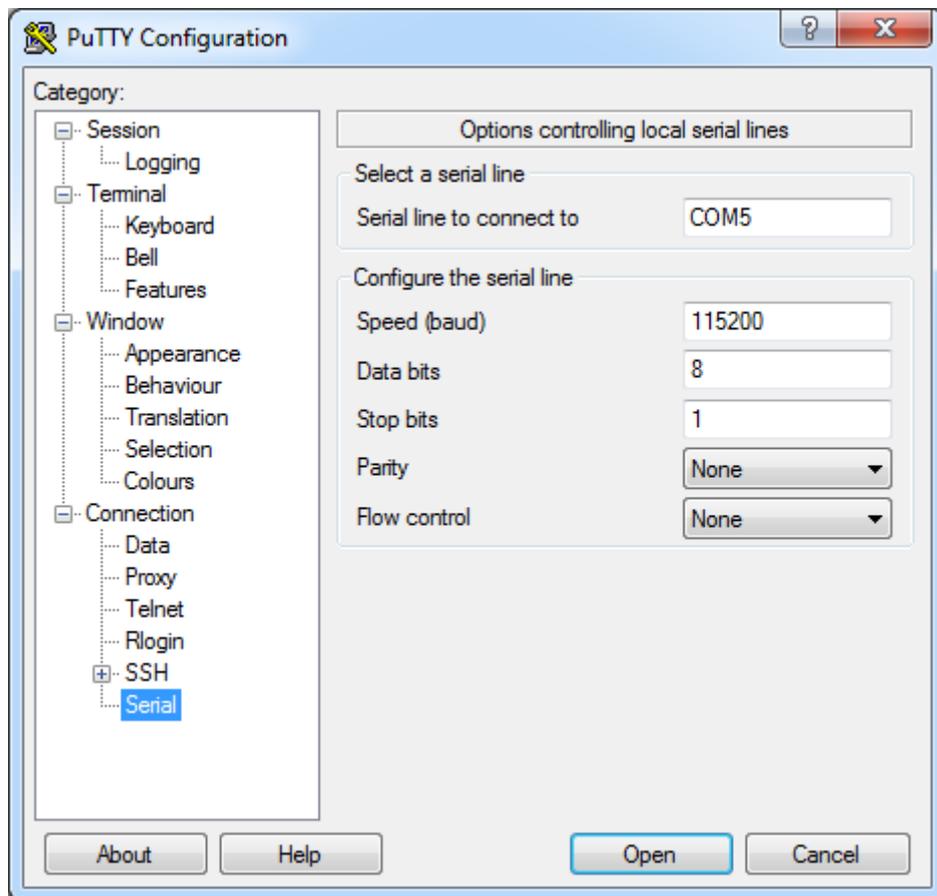
6. Initial Login

There are two ways to log into the system and setup the system. Method one is to login by connecting to the console port from host computer, and method two is to connect a host computer to the Ethernet port of IGT-20/ IGT-21/ IGT-22 and access via a SSH-supported terminal application such as PuTTY. We will be using IGT-20 as an example in this section.

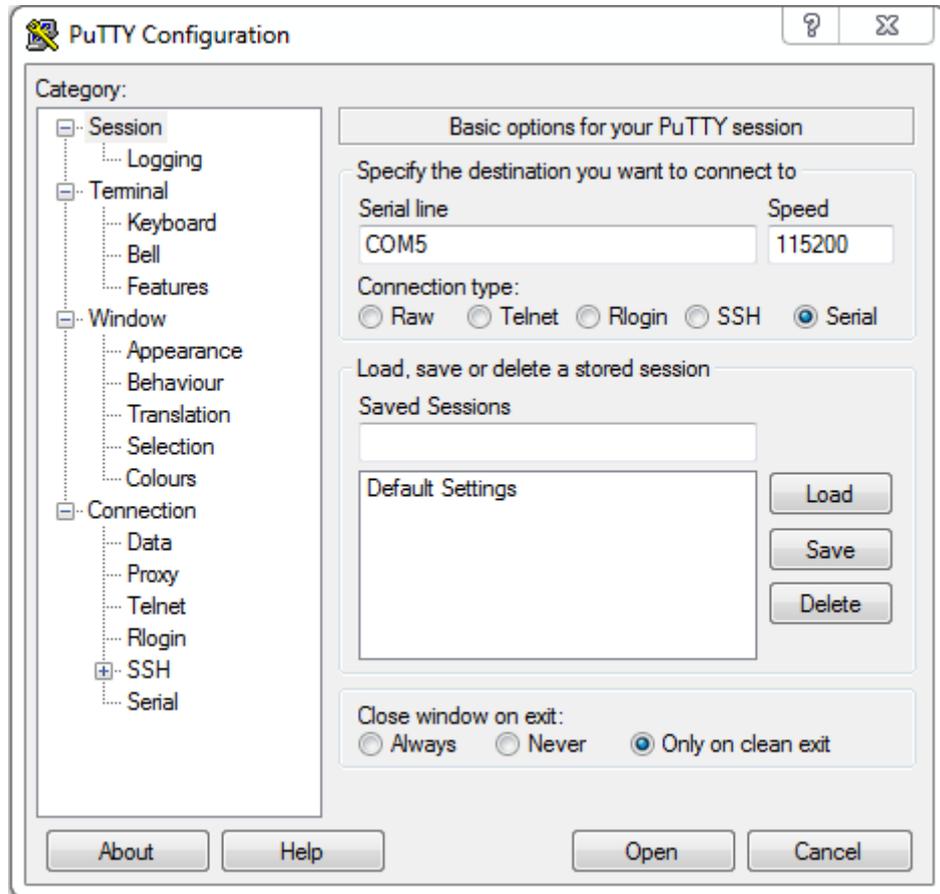
6.1 Login via Console Port

Establish a connection between your host computer and IGT-20 console port (connector 1, pins CTX, CRX and GND). Please note that a cross-over cable is required (CTX to Rx and CRx to Tx) and you must connect to system's [console port](#).

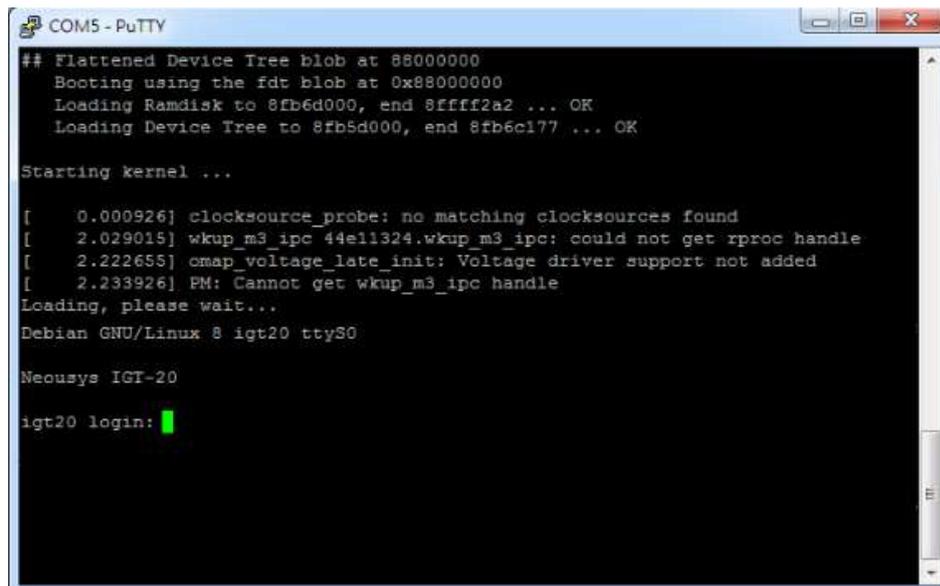
1. Right click on  `putty.exe`, click on "Run as administrator" to bring up the PuTTY Configuration window.
2. Go to Category > Serial, enter the COM port you connected your host computer to IGT-20 series and enter the following parameters:



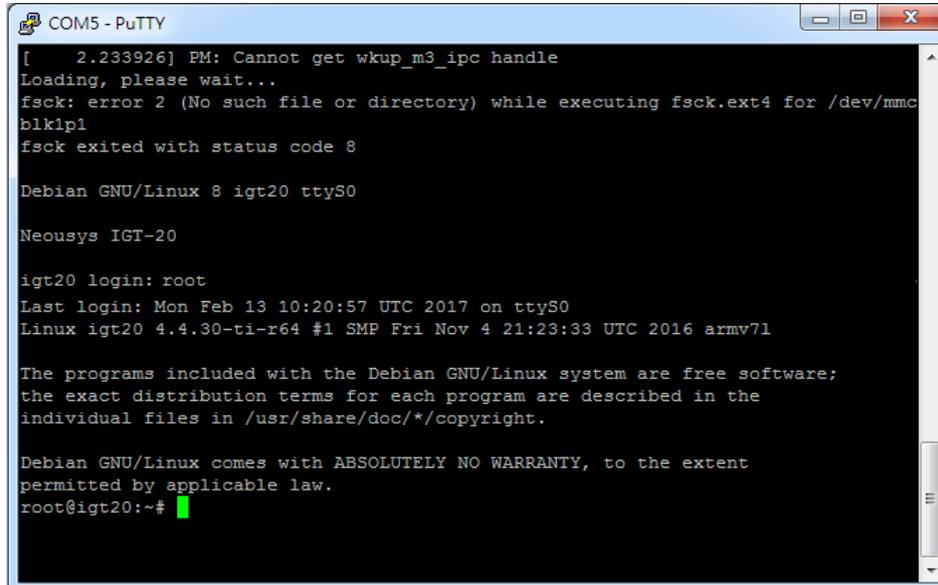
- Go back to Category > Session, select Serial and it should bring up the parameters set in the previous step. Click on “Open” when ready.



- A series of messages may appear, wait for “igt20 login:” prompt.



5. Enter “root” to login, password is not required and the Linux CLI prompt “root@igt20:~#” will appear. From here you may begin configuring your system.



```

COM5 - PuTTY
[ 2.233926] PM: Cannot get wkup_m3_ipc handle
Loading, please wait...
fsck: error 2 (No such file or directory) while executing fsck.ext4 for /dev/mmcblkp1
fsck exited with status code 8

Debian GNU/Linux 8 igt20 ttyS0

Neosys IGT-20

igt20 login: root
Last login: Mon Feb 13 10:20:57 UTC 2017 on ttyS0
Linux igt20 4.4.30-ti-r64 #1 SMP Fri Nov 4 21:23:33 UTC 2016 armv7l

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@igt20:~#
    
```



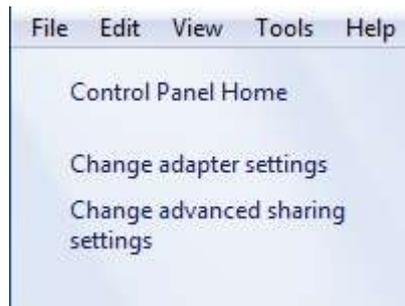
NOTE

Please remember to change the default password “root” to avoid unauthorized access.

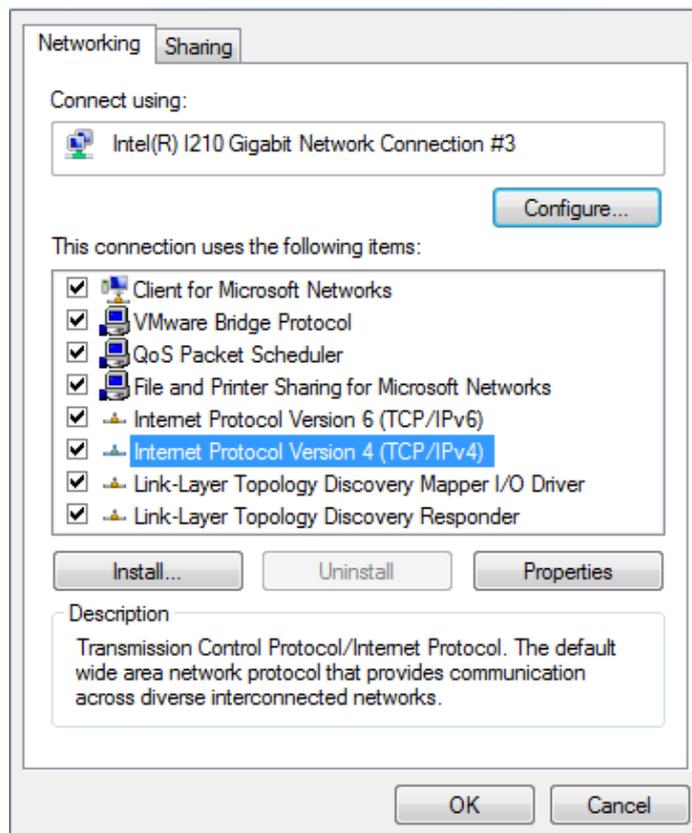
6.2 Login via Ethernet

Establish an Ethernet connection between your host computer and IGT-20 series, power on both systems. Please note that the Ethernet port on IGT-20 supports AUTO-MDIX meaning either a straight-through or cross-over cable can be used.

1. On your host computer, please go to “Start > Control Panel > View network status and tasks > Change adapter settings”.



2. Right click on the Ethernet adapter that has established a connection with IGT-20, click on properties and double click on **Internet Protocol Version 4 (TCP/IPv4)**.

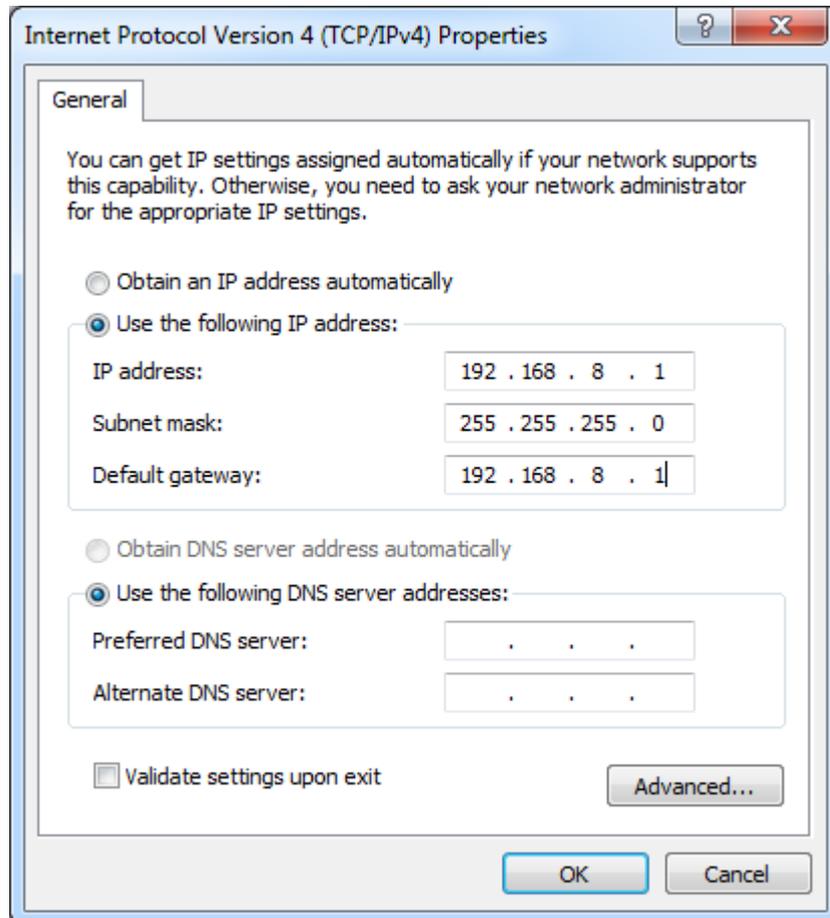


3. Enter the following IP parameters and OK.

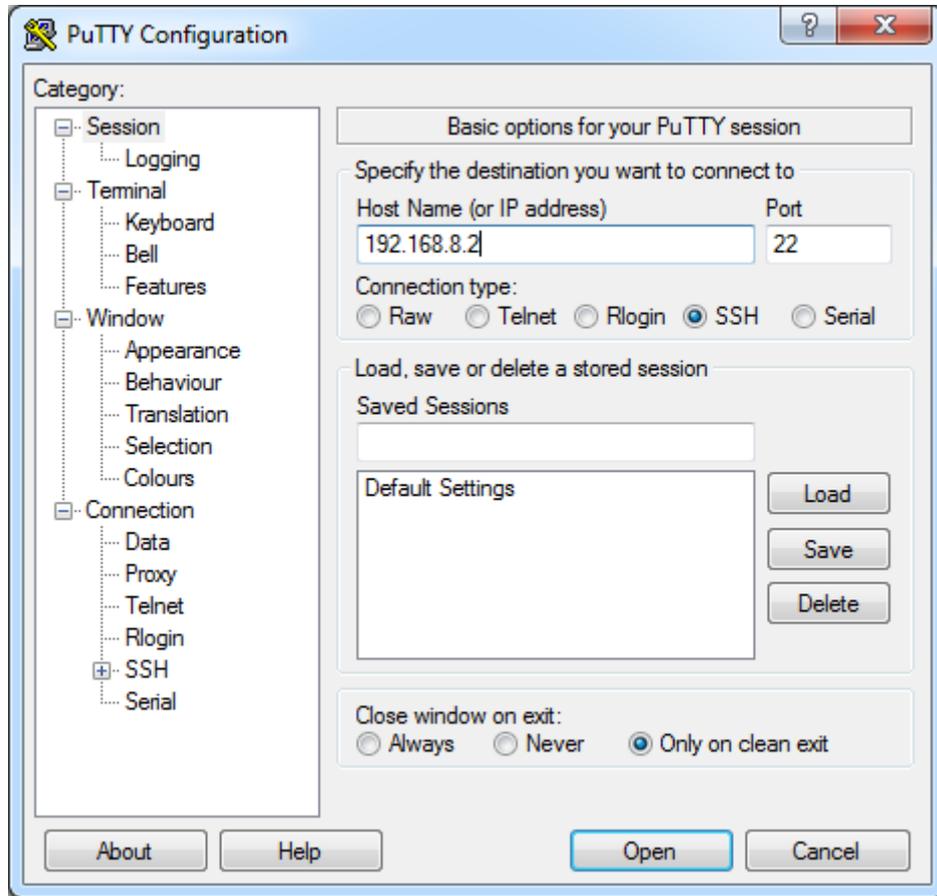
IP Address: 192.168.8.1

Subnet Mask: 225.225.225.0

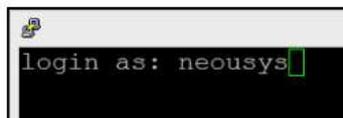
Default Gateway: 192.168.8.1



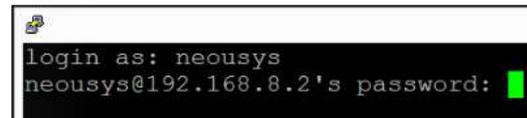
- Power on IGT-20 and right click on  putty.exe , click on “Run as administrator” to bring up the PuTTY Configuration window. Under “Session” category, select SSH, enter 192.168.8.2 as the destination you want to connect to. Click on Open when ready.



- A verification prompt may appear, click on Yes to continue and the PuTTY command prompt will show “login as:”, enter “neousys” and press Enter to continue. The default password is: 29169532.



Login

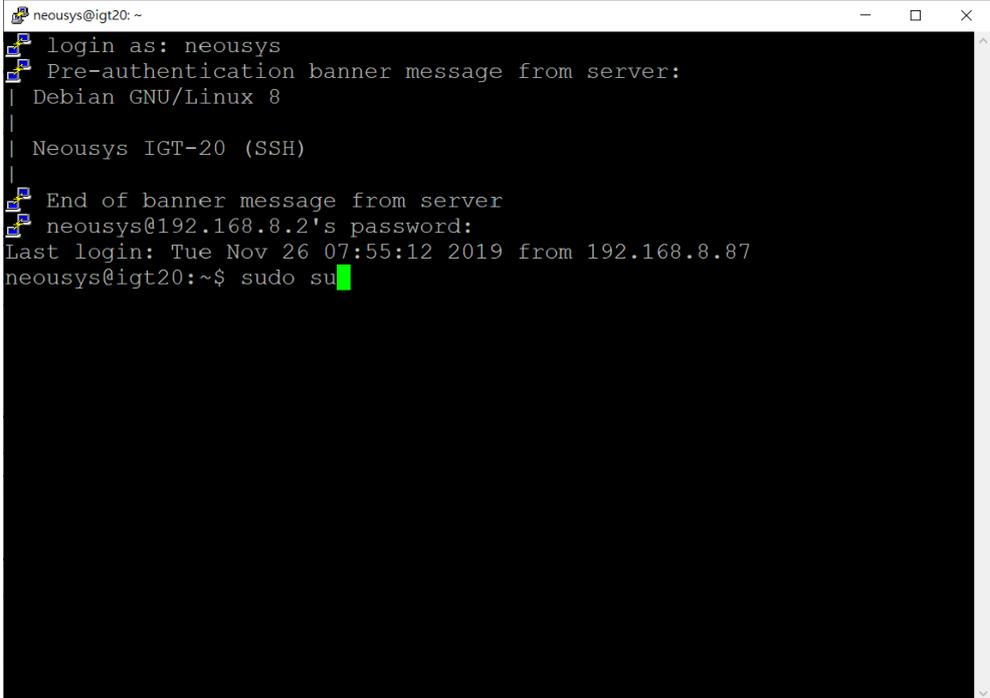


Enter password

 **NOTE**

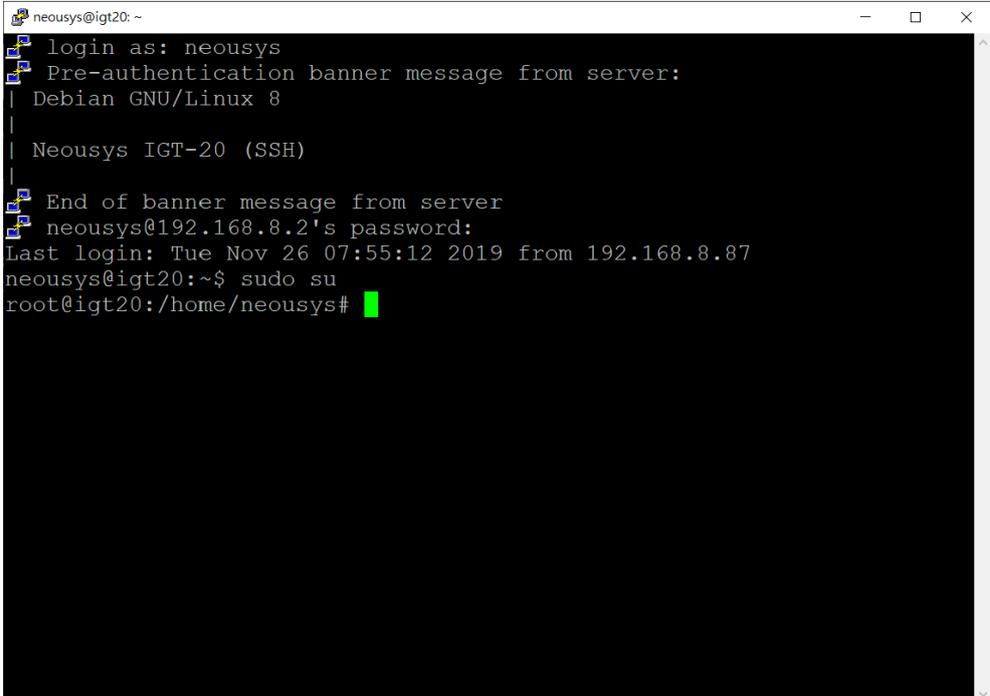
Please remember to change the default password “29169532” to one that you prefer for security purposes.

- To acquire root rights, type in “~\$ sudo su” and press Enter.



```
neousys@igt20: ~  
login as: neousys  
Pre-authentication banner message from server:  
| Debian GNU/Linux 8  
|  
| Neousys IGT-20 (SSH)  
|  
End of banner message from server  
neousys@192.168.8.2's password:  
Last login: Tue Nov 26 07:55:12 2019 from 192.168.8.87  
neousys@igt20:~$ sudo su
```

- The root prompt should appear



```
neousys@igt20: ~  
login as: neousys  
Pre-authentication banner message from server:  
| Debian GNU/Linux 8  
|  
| Neousys IGT-20 (SSH)  
|  
End of banner message from server  
neousys@192.168.8.2's password:  
Last login: Tue Nov 26 07:55:12 2019 from 192.168.8.87  
neousys@igt20:~$ sudo su  
root@igt20:/home/neousys#
```

6.3 Utility Script

There is a built-in script named `igt20/ igt21/ igt22` which facilitates serial port mode switching between RS-232, RS-422, RS-485 and test DI/ DO functions. Simply type `igt20/ igt21/ igt22 -h` and press enter after you successfully login as root. The usage of the script will be shown. The script covers the following functionalities:

- Get button F0/ F1 status (released button returns value 1)
- Get digital input DI status (no voltage input return value 1)
- Set and get LED L0~5 status (setting 1 to LED makes the light turn on. Be care that preset LED function might overwrite the value you set)
- Set and get digital output DO status
- Set and get digital enable pin status
 - IGT-20/ 21 with Debian 8: set to 0 to enable output
 - IGT-22: set to 1 to enable output
- Set mode to RS-485 and enable the termination resistor (IGT-20/ 21 only)
- Set termination resistor of CAN bus (IGT-21 only)

Appendix A

Sysfs Mapping

LEDs, user buttons, digital input and digital output on IGT-20 series support Linux sysfs. The section, [Utility Script](#) provides a quick access to these peripheral. However, integrated with users' own application, it's also possible to access to these peripherals via the mapped files. Please refer to the following table for mapping.

IGT-20 Sysfs Mapping

Category	Name	sysfs path	Supported Properties
LED	L0	/sys/class/leds/igt20::usr0	brightness
	L1	/sys/class/leds/igt20::usr1	invert
	L2	/sys/class/leds/igt20::usr2	trigger
	L3	/sys/class/leds/igt20::usr3	
	L4	/sys/class/leds/igt20::usr4	
	L5	/sys/class/leds/igt20::usr5	
Button	F0	/sys/class/gpio/gpio68	Value
	F1	/sys/class/gpio/gpio67	active_low edge
D/I	DI0	/sys/class/gpio/gpio26	Value
	DI1	/sys/class/gpio/gpio27	active_low
	DI2	/sys/class/gpio/gpio23	edge
	DI3	/sys/class/gpio/gpio61	
D/O	DO0	/sys/class/gpio/gpio44	Value
	DO1	/sys/class/gpio/gpio45	active_low
	DO2	/sys/class/gpio/gpio46	
	DO3	/sys/class/gpio/gpio47	
	DO_EN	/sys/class/gpio/gpio65	

IGT-21 Sysfs Mapping

Category	Name	sysfs path	Supported Properties
LED	L0	/sys/class/leds/igt21::usr0	brightness
	L1	/sys/class/leds/igt21::usr1	invert
	L2	/sys/class/leds/igt21::usr2	trigger
	L3	/sys/class/leds/igt21::usr3	
	L4	/sys/class/leds/igt21::usr4	
	L5	/sys/class/leds/igt21::usr5	
Button	F0	/sys/class/gpio/gpio68	Value
	F1	/sys/class/gpio/gpio67	active_low edge
D/I	DI0	/sys/class/gpio/gpio26	Value
	DI1	/sys/class/gpio/gpio27	active_low
	DI2	/sys/class/gpio/gpio23	edge
	DI3	/sys/class/gpio/gpio61	
D/O	DO0	/sys/class/gpio/gpio44	Value
	DO1	/sys/class/gpio/gpio45	active_low
	DO2	/sys/class/gpio/gpio46	
	DO3	/sys/class/gpio/gpio47	
	DO_EN	/sys/class/gpio/gpio65	

IGT-22 Sysfs Mapping

Category	Name	sysfs path	Supported Properties
LED	L0	/sys/class/leds/igt22::usr0	brightness
	L1	/sys/class/leds/igt22::usr1	invert
	L2	/sys/class/leds/igt22::usr2	trigger
	L3	/sys/class/leds/igt22::usr3	
	L4	/sys/class/leds/igt22::usr4	
	L5	/sys/class/leds/igt22::usr5	
Button	F0	/sys/class/gpio/gpio4	Value
	F1	/sys/class/gpio/gpio5	active_low edge
D/I	DI0	/sys/class/gpio/gpio116	Value
	DI1	/sys/class/gpio/gpio20	active_low
	DI2	/sys/class/gpio/gpio115	edge
	DI3	/sys/class/gpio/gpio114	
	DI4	/sys/class/gpio/gpio51	
	DI5	/sys/class/gpio/gpio52	
	DI6	/sys/class/gpio/gpio49	
	DI7	/sys/class/gpio/gpio50	
D/O	DO0	/sys/class/gpio/gpio111	Value
	DO1	/sys/class/gpio/gpio110	active_low
	DO2	/sys/class/gpio/gpio112	
	DO3	/sys/class/gpio/gpio113	
	DO4	/sys/class/gpio/gpio117	
	DO5	/sys/class/gpio/gpio104	
	DO6	/sys/class/gpio/gpio7	
	DO7	/sys/class/gpio/gpio103	
	DO_EN	/sys/class/gpio/gpio48	