

GCube4.0 (GPIB Logging IoT New Controller Design)

1.0 Product Overview

1. The GCube4.0 is able to process the data which is “sniff” out from the GPIB bus. The unit must connect to GPIB bus through its GPIB connector.
2. When a data or command byte is transmitted on the GPIB bus, the Data Acquisition Unit (DAU) is triggered to capture the data of the GPIB bus.
3. The captured data will be processed by Data Processing Unit(DPU) into human readable JSON message and send it over the cloud thru WiFi or LAN network.
4. The JSON message can be select by user to be store locally or send it over the cloud.

2.0 Specification

Input power	12V 2A
Processor	Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
Memory	2GB LPDDR4
Connectivity	2.4 GHz and 5.0 GHz IEEE 802.11b/g/n/ac wireless LAN 1 x Gigabit Ethernet 2 x USB 3.0 ports 2 x USB 2.0 ports 1 x GPIB Female connector
Video	2 x micro HDMI ports
LED Indicator	Power, Status, DAU power, Buffer Overflow
Switches	Power, Battery
Display	0.91” 128x32 OLED
SD card support	Micro SD card(Class 10) for loading operating system and data storage
Operating System	Raspbian GNU/Linux 10 (buster), Released date March 4 th 2021 Kernel version 5.10.17



Figure 1: GCube4.0 front view



Figure 2: GCube4.0 back view

3.0 LED Indicator

	Label	Color	Description
Power	POWER	Green	The LED turns ON when the unit receives power 12V 2A and OS successfully boot up.
Status	STATUS	Green	The LED turns ON when unit started to acquiring data.
		Orange	The LED turns ON when unit is starting up the acquisition program
		Red	The LED turns ON when unit is encounter error.
DAU Power	PWR	Green	The LED turns ON when the DAU receives power from USB cable.
Overflow	OVF	Amber	The LED turns ON when the DAU experiences data loss due to internal buffer overflowing.

4.0 GCube4.0 in Operation

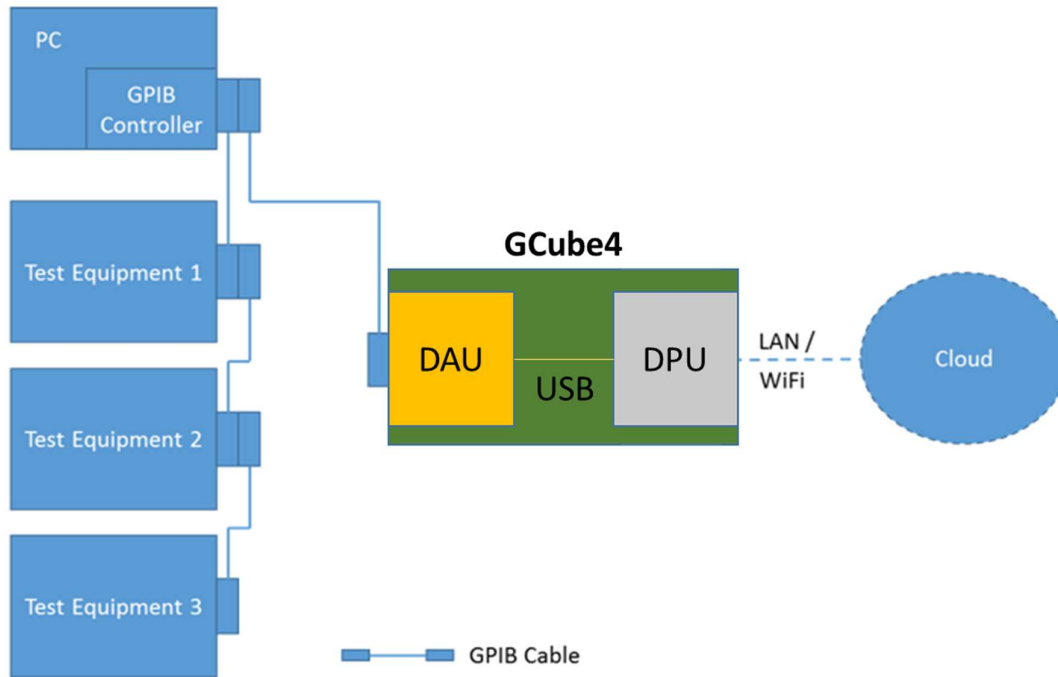


Figure 3: A typical use case of GCube4.0

1. The DAU captures data from the GPIB bus, timestamps them and transfer them to the DPU to process the raw data.
2. The process data can be stored locally or send over to cloud.
3. The sample output of the JSON message is as below:

```
{
  "Type": "TYPE_DPU",
  "Host": "GCube4.0",
  "ID": "Keysight-MY-01",
  "Timestamp": "2021-04-27T08:34:53+08:00",
  "User": "PETER",
  "Email": "Peter@123456.com",
  "Model": "CTSCDPU-01",
  "Firmware": "Firmware version 4.0",
  "DPU": "DPU version 4.0",
  "Uptime": "00:00:00:03"
}
```

5.0 Power Up Sequences

1. Connect the 12V 2A ac adapter to the 100V/240V wall outlet and LAN cable to GCube4.0.



Figure 4: LAN cable connection to GCube4.0

Turn on the GCube4.0 by sliding the POWER to ON and BATTERY to ON position as Figure .

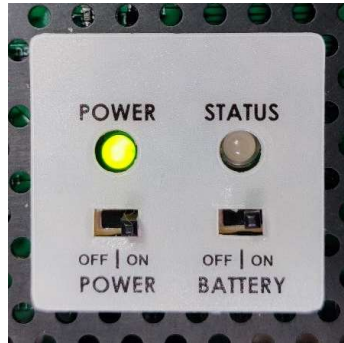


Figure 5: GCube4.0 Power LED

2. Wait for 17 seconds for OS to boot up.
3. Once OS is complete boot up, the STATUS orange LED will light up and display will show "Device Starting.." as shown in Figure 6.



Figure 6: GCube4.0 Status LED and display status

4. Wait for 14 seconds for the acquisition software loading and initialize.
5. Once the software is complete loading, the STATUS LED will turn green and the display will show "Collecting data" and IP address or else the STATUS LED will turn red if there is any error occurred with the error message show on display.



Figure 7: GCube4.0 complete loading

6. If the STATUS LED is still RED. Check the error message on the OLED display.

6.0 GCube4.0 Configuration

1. In order to change GCube4.0 configuration, user either can remotely login using SSH or connect GCube4.0 to monitor and keyboard.
2. After login, type “nano gpibsnif.ini” in the terminal. The .ini file will be open up as below

```

GNU nano 3.2 gpibsnif.ini
; Configuration/initialization file for gpib sniffer

[system]
IP address = 192.168.0.131      ; IP address of the server(NETWORK)
Local IP address = 127.0.0.1    ; IP address of the server(LOCAL)
ID = Keysight-MY-01            ; Cube unique id
Port = 11900                   ; Port number of JSON server listens on
Start = 1                      ; Auto start sniffing 1=auto start, 0=otherwise

[daemon]
Port = 11901                   ; Port number of gpib daemon

[message]
Maximum retry = 10             ; Maximum retry to send a message
Retry interval = 1             ; Retry interval in seconds
; Buffer CANNOT be more than 2^22 or 4194302 due to limited stack size
Buffer = 4194304               ; Maximum buffer size 4M bytes
Data = 1                      ; 1=include data, 0=otherwise
Events = 0                    ; 1=send event messages, 0=otherwise
Save to local = 0              ; 1= Save JSON Message to local storage, 0 = Send to network
Summary table = 0

[user]
PIC = Jaslyn                  ; Person in charge
Email = Jaslyn@123456.com      ; Email of the person incharge

[connection]
;Key in the SSID and password : "sudo nano /etc/wpa_supplicant/wpa_supplicant.conf"
WiFi = 1                      ; 0 = Off, 1 = on

[ping]
Interval = 0                  ; Minimum 1 second, 0 = Disable ping

```

Figure 8: gpibsnif.ini setting page

Section	Parameter	Value	Description
[system]	IP address	192.xxx.xxx.xxx	IP address of the server.
	Local IP address	127.0.0.1	local IP address. Default is 127.0.0.1
	ID	String	GCube4.0 unique ID
	Port	Number	Port number of JSON server listening on.
	Start	1 0	Auto start sniffing Manually start the sniffing.
[daemon]	port	Number	Port number of GCube4.0 daemon. It is port to use for server to access the GCube4.0 and inquire the status of the GCube4.0 or control the GCube4.0
[message]	maximum retry	Number	Maximum retry to send a JSON message to server.
	Retry interval	Seconds	Retry interval to send the JSON message to server when it is failed for first time.
	Buffer	Number	Default is 4194302. Buffer to hold the JSON message before sending out to server
	Data	1	Default is 1. Enable to sniff the GPIB communication data.
		0	Does not enable to sniff the GPIB data.

	Events	1	Enable to sniff the GPIB control line Interface Events or Interface Message.
		0	Default is 0. Does not enable the Interface Events
	Save to local	1	Save the JSON message to local drive/SD Card
		0	Does not save the JSON message to local drive
	Summary table	1	Only processed the last trigger GPIB data and store it in a table.
		0	Does not process the last trigger GPIB data
[user]	PIC	String	The name of the Person In Charge
	Email	String	Email address of the Person In Charge
[connection]	WiFi	1	Enable the WiFi connection. To change the WiFi SSID and password, type "sudo nano /etc/wpa_supplicant/wpa_supplicant.conf" in the terminal window.
		0	Disable the WiFi connection
[ping]	Interval	1	The interval time to send the ping/heartbeat from GCube4.0 to server.
		0	Disable the ping/heartbeat.

6.1 GCube4.0 Operation Mode

1. GCube4.0 can be operate in 2 modes which is non-encryption and encryption. When running in encryption mode, the JSON messages will be encrypted.
2. To change the settings, type "sudo nano /etc/init.d/gpibd".

```
# Carry out specific functions when asked to by the system
case "$1" in
  start)
    sleep 15
    echo "Starting gpibd"
    # run application you want to start
    #/home/pi/cube/gpibdump-static >> /home/pi/debuglog.log 2>&1 &
    /home/pi/cube/gpibdump-static
    #/home/pi/gpibdump-static -e
    ;;
  stop)
    echo "Stopping gpibd"
    # kill application you want to stop
    killall gpibdump-static
    ;;
  *)
    echo "Usage: /etc/init.d/gpibd {start|stop}"
    exit 1
    ;;
esac
```

Figure 9: encryption and non-encryption selection

3. Change the 2 lines and select either "/home/pi/cube/gpibdump-static"(non-encryption) or "/home/pi/gpibdump-static -e"(encryption).

4. Save the files and type “sudo reboot” to reboot the GCube4.0 for the setting to take effect.

7.0 Error Messages & Troubleshooting Guide

Error shown on display	Description & Troubleshooting
DAU can't start	<p>The DPU unable to detect the DAU unit.</p> <ul style="list-style-type: none"> • Check the USB cable between the DPU and DAU is it unplugged? • Check the DAU LED is it light up? • Reboot the GCube4.0 by switching the power switch to OFF and wait for 15seconds for the unit to gracefully shutdown. After that, switch it ON again.
DAU overflow	<p>The DAU buffer is full.</p> <ul style="list-style-type: none"> • Reboot the GCube4.0 by switching the power switch to OFF and wait for 15seconds for the unit to gracefully shutdown. After that, switch it ON again.
SYNC failed	<p>The DPU unable to get the sync byte from DAU.</p> <ul style="list-style-type: none"> • Reboot the GCube4.0 by switching the power switch to OFF and wait for 15seconds for the unit to gracefully shutdown. After that, switch it ON again.
Over temperature	<p>The unit CPU is getting too hot and it will auto shutdown.</p> <ul style="list-style-type: none"> • Check internal fan, is it malfunction? • Check surrounding temperature, is it too hot?
Network Error	<p>The unit unable to get DHCP IP or the DHCP server is down.</p> <ul style="list-style-type: none"> • Check the LAN cable is connected to LAN port? • Check whether the router or network switch is operating?
No route to host	<p>The unit trying to connect to wrong port number. Incorrect network or host configuration</p> <ul style="list-style-type: none"> • Check the gpibsnif.ini file, is it the port number is properly configure? • Check the network is it properly configure?
Server down	<p>The unit unable to connect with the server.</p> <ul style="list-style-type: none"> • Check whether server is up? • Check whether server is properly configure?
Invalid cert	<p>The unit unable to get the valid cert when running in encryption mode.</p> <ul style="list-style-type: none"> • Check the unit and server cert is properly installed?

8.0 Revision History

Rev.	Author	Change Details	Date of Release
1.0	S.K.Chan	First release	21-March-2022

Warning:

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Statement:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The equipment complies with FCC Radiation exposure limit set forth for uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.