

Janus-MM-4LP Linux Software User Manual

PC/104-Plus Dual or Quad CAN Port Module



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1. IMPORTANT SAFE HANDLING INFORMATION



WARNING!

ESD-Sensitive Electronic Equipment

Observe ESD-safe handling procedures when working with this product.

Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.

Always store this product in ESD-protective packaging when not in use.

Safe Handling Precautions

This board contains a high density connector with many connections to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation and connection to other equipment. The list here describes common causes of failure found on boards returned to Diamond Systems for repair. This information is provided as a source of advice to help you prevent damaging your Diamond (or any vendor's) embedded computer boards.

ESD damage – This type of damage is usually almost impossible to detect, because there is no visual sign of failure or damage. The symptom is that the board eventually simply stops working, because some component becomes defective. Usually the failure can be identified and the chip can be replaced. To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

Damage during handling or storage – On some boards we have noticed physical damage from mishandling. A common observation is that a screwdriver slipped while installing the board, causing a gouge in the PCB surface and cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on what is near the corner. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge to avoid possible shorting from this type of damage. However these design rules are not sufficient to prevent damage in all situations.

A third cause of failure is when a metal screwdriver tip slips, or a screw drops onto the board while it is powered on, causing a short between a power pin and a signal pin on a component. This can cause overvoltage / power supply problems described below. To avoid this type of failure, only perform assembly operations when the system is powered off.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. However our boards are generally very dense, and if the board has components very close to the board edge, they can be damaged or even knocked off the board when the board tilts back in the rack. Diamond recommends that all our boards be stored only in individual ESD-safe packaging. If multiple boards are stored together, they should be contained in bins with dividers between boards. Do not pile boards on top of each other or cram too many boards into a small location. This can cause damage to connector pins or fragile components.

Power supply wired backwards – Our power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy each IC that is connected to the power supply (i.e. almost all ICs). In this case the board will most likely will be unrepairable and must be replaced. A chip destroyed by reverse power or by excessive power will often have a visible hole on the top or show some deformation on the top surface due to vaporization inside the package. **Check twice before applying power!**

Overvoltage on digital I/O line – If a digital I/O signal is connected to a voltage above the maximum specified voltage, the digital circuitry can be damaged. On most of our boards the acceptable range of voltages connected to digital I/O signals is 0-5V, and they can withstand about 0.5V beyond that (-0.5 to 5.5V) before being damaged. However logic signals at 12V and even 24V are common, and if one of these is connected to a 5V logic chip, the chip will be damaged, and the damage could even extend past that chip to others in the circuit



2. INTRODUCTION

2.1 Description

The Janus-MM-4LP-XT family of I/O modules offers two or four opto-isolated CANbus 2.0B ports plus 16 digital I/O lines. Models are available in both the PC/104-*Plus* and PC/104 form factors. Janus-MM-4LP is based on Xilinx Artix-7 FPGA. This core houses the CAN controller logic and digital I/O logic providing data rates up to 1Mbps. Each CAN port supports standard and extended frames as well as expanded TX and RX message queues for enhanced performance. Each port has its own combination isolator and transceiver chip. The 16 digital I/O lines have a selectable voltage level of +3.3V or +5V.

2.2 Features

- 2 or 4 CAN 2.0B compatible ports
- Data rates up to 1Mbps
- Supports standard 11-bit identifier and extended 29-bit identifier frames
- Extended TX and RX message queues for enhanced performance
- 16 8-byte transmit message queues
- 31 8-byte receive message queues
- 16 receive filters
- Galvanically isolated transceivers
- ◆ 500V port-to-host and port-to-port isolation
- Jumper selectable biased split termination for improved noise reduction
- 16 digital I/O lines
- Latching I/O connectors for increased ruggedness
- PCI and ISA bus interfaces

2.3 Operating System Support

Windows Embedded 7 and Linux Ubuntu 12.04LTS Basic CAN driver included with APIs and monitor program

2.4 Mechanical, Electrical, Environmental

- PC/104-Plus form factor compliant, 3.55" x 3.775" (90mm x 96mm) without wings
- -40°C to +85°C ambient operating temperature
- Power input requirements: +5VDC +/- 5%
- PCI (3.3V) and ISA (5V) host interfaces
- MIL-STD-202G shock and vibration compatible

3. OPERATING SYSTEM

Linux Ubuntu-12.04

4. PCI Shared Library installation

Note : The shared library installation only needs to be set up once.

Step-1: Login as the "root" user by using "sudo –s" command as shown in the below screen, \$ sudo –s [sudo] password for user :

😣 🗖 🗊 root@user-OptiPlex-GX520: ~		
user@user-OptiPlex-GX520:~\$ sudo -s [sudo] password for user: root@user-OptiPlex-GX520:~# []		
	K .	

Step-2: Change the working directory to the release directory where the release content is copied as shown in the below screen.

cd dsc_release/DSC_CAN4_PCI_V2.5_20150714



Step-3: Execute the "**install**" script which will install the required shared libraries as shown in the below screen.

./install

After complete, install script it will display the message "Installation is complete"

```
🗴 🕒 🗉 🛛 root@user-OptiPlex-GX520: ~/dsc_release/DSC_CAN4_PCI_V2.5_20150714
root@user-OptiPlex-GX520:~# cd dsc_release/DSC_CAN4_PCI_V2.5_20150714/
root@user-OptiPlex-GX520:~/dsc_release/DSC_CAN4_PCI_V2.5_20150714# ls -l
total 1228
-rwxr-xr-x 1 root root 1214853 Sep 7 14:56 CAN
-rwxr-xr-x 1 root root
                           120 Sep 7 15:06 install
rwxr-xr-x 1 root root
                         14891 Sep 7 14:56 libCAN_PCI.so
-rw-r--r-- 1 root root 12373 Sep 7 14:56 pci_can.ko
-rwxr-xr-x 1 root root 121 Sep 7 15:00 startApp
root@user-OptiPlex-GX520:~/dsc_release/DSC_CAN4_PCI_V2.5_20150714# ./install
Installation should be done only once.
Installation is complete.
root@user-OptiPlex-GX520:~/dsc_release/DSC_CAN4_PCI_V2.5_20150714#
                                                                     k
```

5. Starting The Demo Application

Starting the demo application includes loading the driver and starting the application. It must be done with "root" privileges.

Step-1: Login as the "root" user by using "sudo -s" command as shown in the below screen,

\$ sudo –s

[sudo[password for user :

😣 🖻 🗉 root@user-OptiPlex-GX520: ~	
user@user-OptiPlex-GX520:~\$ sudo -s [sudo] password for user: root@user-OptiPlex-GX520:~# []	
	*

Step-2: Start the application by executing the "startApp" script as shown in the below screen.

./startApp

😣 🖻 🗊 root@user-OptiPlex-GX520: ~/dsc_release/DSC_CAN4_PCI_V2.5_20150714
root@user-OptiPlex-GX520:~# cd dsc_release/DSC_CAN4_PCI_V2.5_20150714/ root@user-OptiPlex-GX520:~/dsc_release/DSC_CAN4_PCI_V2.5_20150714# ls -l total 1228
-rwxr-xr-x 1 root root 1214853 Sep 7 14:56 CAN
-rwxr-xr-x 1 root root 14891 Sep 7 14:56 libCAN_PCI.so
-rw-rr 1 root root 12373 Sep 7 14:56 pci_can.ko -rwxr-xr-x 1 root root 121 Sep 7 15:00 <mark>startApp</mark>
root@user-OptiPlex-GX520:~/dsc_release/DSC_CAN4_PCI_V2.5_20150714# ./install Installation should be done only once. Installation is complete.
root@user-OptiPlex-GX520:~/dsc_release/DSC_CAN4_PCI_V2.5_20150714# ./startApp

The above step will start the CAN demo application.

6. Configuring CAN ports

The CAN Monitor demo application contains three tabs. Click on CAN Configuration 1 or 2 tab to configure the CAN ports, or click on the GPIO Configuration tab to configure the GPIO lines. In first two tabs, any two CAN ports can be configured using the "Configure" button provided on each tab.

😸 🖃 🗉 CAN Monitor	
CAN Configuration 1 CAN Configuration 2 GPIC	Configuration Configure
	Configure
Connection CAN-	Time to Type ID Len Data
Baud Rate 500kbps Connect	
Msg Type Standard Disconnected!	Click GPIO Configuration for
Write Message	GPIO test
ID 000 Len 8	Select CAN Configuration 1 (or)
Data(Hex)	Configuration 2 to select CAN Ports
00 00 00 00 00 00 00 00	2
· · · · · · · · · · · · · · · · · · ·	
Add List Clear List Write Message	Save Log Clear Log
Connection CAN-	Messages
	Time Op Type ID Len Data
Baud Rate 500kbps Connect	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected!	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8 Data(Hex)	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8 Data(Hex) 00 00 00 00 00 00 00 00	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8 Data(Hex) 00 00 00 00 00 00 00 00 	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8 Data(Hex) 00 00 00 00 00 00 00 Add List Clear List Write Message	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8 Data(Hex) 00 00 00 00 00 00 00 Add List Clear List Write Message	Time Op Type ID Len Data
Baud Rate 500kbps Connect Msg Type Standard Disconnected! Write Message ID 000 Len 8 Data(Hex) 00 00 00 00 00 00 00 Add List Clear List Write Message BOARD ID - 0x1101 FPGA ID - 0x110	Time Op Type ID Len Data Image: Save Log Clear Log Clear Log Image: Operation of the same log Image: Save Log Clear Log

A Pop-up window will appear by clicking on the "**Configure**" button when selecting any two CAN ports for each tab. After selecting, click on OK.

808	CAN Monitor					
	CAN Configuration 1 CAN (Configuration 2	SPIO Configuration			
-	CAN COMINGUISION 2	Singulation 2	Sino comgutation			Configure
	Connection	CAN-	Message	25		
	Baud Rate 500kbps		Time (Op Type ID	Len Data	
	Msg Type Standard	Connect			cli-	
		Disconnected	11		Clic	k Configure
	Write Message	_		ialog		
	ID 000 Len	8				
	Data(Hex)		Selecte	ed the CAN to b	e displayed on current ta	ib
				CAN 1	✓ CAN 2	
	Add List Clear List	Write Message		CAN 3	CAN 4	
	Add List	witte Message				og
	Connection	CAN-	r			
	Baud Rate 500kbps	Connect			ок	
	Msg Type Standard	Disconnected				
	Write Message					
	ID 000 Len	8				
	Data(Hex)					
	00 00 00 00 00	0 00 00 0	D			
		•				
	Add List Clear List	Write Message			Save Log	Clear Log
BOAR	D ID - 0x1101	FPGA ID - 0x1	100	PORTS - 4	INTERFACE	- PCI
	DIAMOND	CAN Monitor© 2 www.diamondsy	015 Diamond Syste stems.com	ems Corp.	Software Ver	rsion :2.5.0

Initially CAN numbers will be empty on each tab. After configuring the CAN ports, the selected CAN # number will be displayed.

8 CAN Monitor	
CAN Configuration 1 CAN Configuration 2 G	PIO Configuration
	Configure
Connection CAN-1	Messages
Baud Rate 500kbps	Time Op Type ID Len Data
Msg Type Standard Disconnected	
Write Message	Selected CAN Port number
	will be displayed
Data(Hex)	
00 00 00 00 00 00 00 00	
•	
Add List Clear List Write Message	Save Log Clear Log
Connection CAN-2	Messages
	Time Op Type ID Len Data
Baud Rate 500kbps Connect	₽
Msg lype Standard Disconnected!	
Write Message	
ID 000 Len 8	
Data(Hex)	
Add List Clear List Write Message	Save Log Clear Log
BOARD ID - 0x1101 FPGA ID - 0x11	LOO PORTS - 4 INTERFACE - PCI
CAN Monitor® 20 www.diamondsyst	15 Diamond Systems Corp. Software Version :2.5.0 tems.com

7. Setting CAN Baud Rate

The baud rate for each port can be configured using the drop-down menu for the particular CAN port. After selecting the desired baud rate, pressing "**Connect**" will configure the specified baud rate for that particular port.

-				
	CAN Monitor			
	CAN Configuration 1 CAN C	configuration 2 GPIO	Configuration	
				Configure
	Connection	CAN-1	Messages	
	Baud Rate 500kbps		Time Op Type ID	Len Data
	Msg Type Standard	Disconnected!		
	Write Message		Connect with select	ed Baud rate
	ID 000 Len	8		
	Data(Hex)			N
	00 00 00 00 00	00 00 00	Select Baud Rate	P2.
		-		
	Add List Clear List	Write Message		Save Log Clear Log
	Connection	CAN-2	Messages	
	Baud Rate 500kbps	Connect	Time Op Type ID 	Len Data
	Msg Type Standard	Disconnected!		
	Write Message			
	ID 000 Len	8		
	Data(Hex)			
	00 00 00 00 00	00 00 00		
		-		
	Add List Clear List	Write Message		Save Log Clear Log
BOAI	RD ID - 0x1101	FPGA ID - 0x1100	PORTS - 4	INTERFACE - PCI
	DIAMOND	CAN Monitor© 2015 www.diamondsystem	Diamond Systems Corp. s.com	Software Version :2.5.0

8. Changing CAN Baud Rate

To change the baud rate, click on "**Disconnect**" and select a new desired baud rate. Click on the "Connect" button.

🛛 😑 🗉 CAN Monitor					
	<u> </u>				
CAN Configuration 1 CAN Co	onfiguration 2 GPIO	Configuration			Configuro
					Conligure
Connection	CAN-1	Time On	Type ID	Len Data	
Baud Rate 500kbps 🔻	Disconnect	Op			
Msg Type Standard 👻	Connected!				
Write Message					
ID 000 Len	8	Click o	on Disconn	ect	
Data(Hex)					\$
00 00 00 00 00	00 00 00				
Add List Clear List	Write Message			Save Log	Clear Log
Connection	CAN-2	Messages			
Baud Bate Fookbor		Time Op	Type ID	Len Data	
Mag Tipo	Connect				
Msg type Standard	Disconnected				
Write Message	_				
ID 000 Len	8				
Data(Hex)					
00 00 00 00 00	00 00 00				
· · · · · · · · · · · · · · · · · · ·					
Add List Clear List	Write Message			Save Log	Clear Log
BOARD ID - 0x1101	FPGA ID - 0x1100	PC	DRTS - 4	INTERFAC	E - PCI
Artanon	CAN Monitor© 2015	Diamond Systems	Corp.	Software V	ersion :2.5.0

9. Setting CAN ID and Message Length

The CAN ID and message length can be configured by entering the desired values into the respective fields for that particular port.

× • •	CAN Monitor					
	CAN Configuration 1 CAN Co	onfiguration 2 GPIO	Configuration			
						Configure
	Connection	CAN-1	Messages			
	Baud Rate 500kbps -	Disconnect	Time Op Ty	/pe ID	Len Data	
	Msg Type Standard 🔻	Connected!	CAN ID			
	Write Message					
	ID 126 Len	8	CAN Messag	ge Length		
	Data(Hex)		13			
	Add List Clear List	Write Message			Save Log	ClearLog
		inter ressage			bare Log	
	Connection	CAN-2	Messages	vne ID	Len Data	_
	Connection Baud Rate 500kbps	CAN-2 Disconnect	Messages Time Op Ty 	/pe ID	Len Data	
	Connection Baud Rate 500kbps Msg Type Standard	CAN-2 Disconnect Connected!	Messages Time Op Ty 	/pe ID	Len Data	
	Connection Baud Rate 500kbps Msg Type Standard Write Message	CAN-2 Disconnect Connected!	Messages Time Op Ty 	/pe ID	Len Data	
	Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len	CAN-2 Disconnect Connected!	Messages Time Op Ty	/pe ID	Len Data	
	Connection Baud Rate 500kbps • Msg Type Standard • Write Message ID 228 Len Data(Hex)	CAN-2 Disconnect Connected!	Messages Time Op Ty 	/pe ID	Len Data	
	Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 00 00 00 00 00	CAN-2 Disconnect Connected!	Messages Time Op Ty 	vpe ID	Len Data	
	Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 00 00 00 00 00	CAN-2 Disconnect Connected!	Messages Time Op Ty	/pe ID	Len Data	Clearles
	Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 00 00 00 00 00 Add List Clear List	CAN-2 Disconnect Connected!	Messages Time Op Ty	/pe ID	Len Data	Clear Log
BOA	Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 00 00 00 00 00 Add List Clear List	CAN-2 Disconnect Connected!	Messages Time Op Ty	rpe ID	Len Data	Clear Log

10. Writing CAN Message

The CAN message data can be set by entering the desired CAN data into the Data (Hex) fields.

So CAN Monitor						
CAN Configuration 1 CAN C	configuration 2 GPIC) Configuratio	on			1
						Configure
Connection	CAN-1	Messa	ges			
Baud Rate 500kbps	Disconnect	Time	Ор Туре	ID	Len Data	
Msg Type Standard	Connected					
Write Massage	connected.					
write Message						
ID 126 Len	8					
Data(Hex)	cc 44 dd				ssages	
					8	
	•					
Add List Clear List	Write Message				Save Log	Clear Log
		-				
Connection	CAN-2	Messa	ges			
Connection	CAN-2	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps	CAN-2 Disconnect	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard	CAN-2 Disconnect Connected!	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard Write Message	CAN-2 Disconnect Connected!	Messa Time	g es Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len	CAN-2 Disconnect Connected!	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex)	CAN-2 Disconnect Connected!	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c	CAN-2 Disconnect Connected!	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e	CAN-2 Disconnect Connected!	Messa Time	ges Op Type	ID	Len Data	
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e Add List Clear List	CAN-2 Disconnect Connected!	Messa Time	ges Op Type	ID	Len Data	Clear Log
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e Add List Clear List	CAN-2 Disconnect Connected!	Messa	i ges Op Type	ID	Len Data	Clear Log
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e Add List Clear List	CAN-2 Disconnect Connected!	Messa	ges Op Type	ID • 4	Len Data	Clear Log

11. Transmitting CAN Message

The configured CAN-ID, Len, and CAN message data can be transmitted using the **"Write Message"** button. Transmitted messages will be displayed in the CAN message box for that particular CAN port.

😣 🗐 🗊 CAN Monitor								
CAN Configuration 1 CAN C	onfiguration 2 GPIO	Configuration	•					
		conniguration						Configure
Connection	CAN-1	Messar	165					comgare
	CAN-I	Time	Op	Туре	ID	Len	Data	
Baud Rate SUOKDPS	Disconnect	79046257	Wr	Std	126		11 AA 22 BB 3	33 CC 44 DD
Msg Type Standard 🔹	Connected!	79046718	Wr	Std	126	8	11 AA 22 BB 3	33 CC 44 DD
Write Message		79048456	Wr	Std	126	0 8	11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD
					1	•		
ID 126 Len	8			Tra	ansm	itted N	lessages	
Data(Hex)								
11 aa 22 bb 33	cc 44 ad							
			Clic	k on	Write	e Mess	age to tran	ismit
Add List Clear List	Write Message						Save Log	Clear Log
Common stiller	3							
I ODDOCTIOD		Mossar	105					
Connection	CAN-2	Messag Time	ges Op	Туре	ID	Len	Data	
Baud Rate 500kbps	CAN-2 Disconnect	Messag Time 79046336	Op Rd	Type Std	ID 126	Len 8	Data 11 AA 22 BB 3	33 CC 44 DD
Baud Rate 500kbps Msg Type Standard	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436	Op Rd Rd Rd	Type Std Std Std	ID 126 126 126	Len 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd Rd	Type Std Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd Rd	Type Std Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID ID 228 Len	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436 79048536	Dp Rd Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex)	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e	CAN-2 Disconnect Connected!	Messag Time 79046336 7904736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e Add List Clear List	CAN-2 Disconnect Connected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e Add List Clear List	CAN-2 Disconnect Connected!	Messag Time 79046336 7904736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std	ID 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD
Connection Baud Rate 500kbps Msg Type Standard Write Message ID 228 Len Data(Hex) 1a 2b 3c 4d 5e Add List Clear List	CAN-2 Disconnect Connected!	Messag Time 79046336 7904736 79047436 79048536	Op Rd Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 11 AA 22 BB 3 5ave Log	33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD 33 CC 44 DD Clear Log

12. Receive CAN Message

Received CAN message will be displayed in the CAN message box for that particular CAN port.

😣 🗐 🗊 CAN Monit	ог									N	
CAN Configur	ration 1	CAN Configurat	tion 2 GPIO	Configuratio	7						
				g						Cor	nfigure
C	onnec	tion CAN	-1	Messag	jes						
Baud Rate	500kbps		connect	Time	Op	Туре	ID	Len	Data		
Msg Type	Standard		sconnect	79046257 79046718	Wr Wr	Std Std	126 126	8 8	11 AA 22 BE 11 AA 22 BE	3 33 CC 44 3 33 CC 44	DD DD
			intected:	79047391 79048456	Wr Wr	Std Std	126 126	8 8	11 AA 22 BE 11 AA 22 BE	3 33 CC 44 3 33 CC 44	DD DD
write Me	essage										
	126	en 8									
Data(Hex)	22 bi	b 33 cc	44 dd								
Add List	Clear	r List Write	Message						Savelog	Clea	arlog
	cica	White	Message						Save Log	Cicc	n Log
C	onnec	tion CAN	-2	Messag	jes	_					
Co Baud Rate	500kbps	tion CAN	-2	Messag Time	Jes Op	Туре	ID	Len	Data		
Cu Baud Rate Msg Type	500kbps Standard		-2 sconnect	Messag Time 79046336 79046736	Op Rd Rd	Type Std Std	ID 126 126	Len 8	Data 11 AA 22 BE 11 AA 22 BE	33 CC 44 33 CC 44	DD DD
Co Baud Rate Msg Type Write Ma	ONNEC 500kbps Standard		-2 sconnect	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE	33 CC 44 33 CC 44 33 CC 44 33 CC 44 33 CC 44	DD DD DD DD
Baud Rate Msg Type Write Ma	Standard 228		-2 sconnect onnected!	Messag Time 79046336 79046736 79047436 79047436	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE	3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44	DD DD DD DD
Baud Rate Msg Type Write Me ID	Standard 228 L	tion CAN	-2 sconnect onnected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE	33 CC 44 33 CC 44 33 CC 44 33 CC 44 33 CC 44	DD DD DD DD
Baud Rate Msg Type Write Me ID Data(Hex) 1a 2b	Standard 228 L 3c 4d	tion CAN	-2 sconnect onnected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126	Len 8 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 31 AA 22 BE	33 CC 44 33 CC 44 33 CC 44 33 CC 44 33 CC 44	DD DD DD DD
Baud Rate Msg Type Write Mo ID Data(Hex) 1a 2b	Standard 228 L 3c 4d	tion CAN	-2 sconnect onnected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126 126 126 126	Len 8 8 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE	33 CC 44 33 CC 44 33 CC 44 33 CC 44 33 CC 44 33 CC 44	DD DD DD DD
Baud Rate Msg Type Write Me ID Data(Hex) 1a 2b Add List	Standard Standard 228 L 3C 4d Clear	tion CAN	-2 sconnect onnected!	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126 126 Ceived	Len 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 3 ages Save Log	3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 Cleal	DD DD DD DD
Baud Rate Msg Type Write Ma Data(Hex) 1a 2b Add List	Standard Standard 228 L 3c 4d Clear	tion CAN	-2 sconnect onnected! Message	Messag Time 79046336 79046736 79047436 79048536	Op Rd Rd Rd Rd	Type Std Std Std Std	ID 126 126 126 126 126	Len 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 30 A 22 BE	3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 Clean	DD DD DD DD
Baud Rate Msg Type Write Me ID Data(Hex) 1a 2b Add List BOARD ID - 0x110	Standard Standard 228 L 3C 4d Clear	tion CAN	-2 sconnect onnected! Message A ID - 0x1100	Messag Time 79046336 7904736 79047436 79048536	pes Op Rd Rd Rd Rd	Type Std Std Std Std	1D 126 126 126 126 126 Ceived	Len 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Data 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 11 AA 22 BE 3 ages Save Log INTERFAC	3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 3 33 CC 44 Clean	DD DD DD DD

13. GPIO Test

Click on the GPIO Configuration tab to configure DIO Port-A and Port-B as either input ports or output ports.



14. Setting DIO as Input Port

Click on DIO Port-A **Input** button to configure the DIO Port-A as an input port. In this case, Port-A value will be displayed.

😣 🗐 🗊 🖸	AN Monitor				
CA	N Configuration 1	CAN Configurat	ion 2 GPIO Confi	guration	
		Port-A I	put mode	Value on Port-A pi	ns
	DIO	Port - A	Input 🔿 Outp	ut 0x00 OK	
	DIO	Port - B	Input 🗌 Outp	ut Ox00 OK	
				Ø	
BOARD	D - 0x1101	FPG	ID - 0x1100	PORTS - 4	INTERFACE - PCI
	MOND	CAN M www.d	onitor© 2015 Diamo amondsystems.com	ond Systems Corp.	Software Version :2.5.0

15. Setting DIO as Output Port

Click on DIO Port-A **Output** button to configure the DIO Port-A as an output port. In this case, enter 8-bit port value and click on the Ok button to write to Port-A.



Similarly, Port-B can be configured as either an input or output port.

16. FPGA ID and Board-ID

FPGA ID: Displays FPGA version

E.g. 0X1100:- it's the Artix-7 series FPGA.

Board ID: Displays board ID

0x1101:- PCI Board.

0X1100:- ISA Board.

Ports: Displays number of CAN ports it can be either 2 or 4 ports.

Interface: Displays interface it can be either ISA or PCI.

😣 🖨 🗈 CAN Monitor				
CAN Configuration 1 CAN	Configuration 2	GPIO Configurat	ion	
DIO Port	- A input - B input	Output	0x00 OK	
				₽
BOARD ID - 0x1101	FPGA ID - 0	x1100	PORTS - 4	INTERFACE - PCI
DIAMOND	CAN Monitor© www.diamond	2015 Diamond S systems.com	ystems Corp.	Software Version :2.5.0

17. APIs to Configure and Manage CAN Ports

init_can(int can_ch): This API accepts the CAN interface number as an argument for the initialization. This will initialize CAN#0, CAN#1, CAN#2, and CAN#3 ports.

This function will return CAN file descriptor (fd). The return value of this function should be retained for all subsequent operations. Its prototype is defined in the can.h file. Declaring four CAN file descriptors which will retain its return values.

#include "can.h"

// TO initialize CAN#0 channel, pass the argument value as 0 to init_can function as shown below.

//Other declaration

...

```
can_fd_0 = init_can(0) ; // Will initialize CAN#0 channel
```

Similarly, CAN#n can be initialized by passing 'n' as argument to init_can function as shown below

can_fd_n = init_can(n);

...

Where, n varies from 1 to 3.

Baud rate configuration.

set_baudrate() : This function will configure the baud rate for the specified CAN port. By default it will not configure any baud rate.

// Set 500k Baud rate for CAN#n, where n varies from 0 to 3. Corresponding can fd values should be passed.
ret_val = set_baudrate(can_fd_0, CAN_SPEED_500K);

if (ret_val < 0)

{

```
printf("Error while setting the baud rate \n") ;
exit(0) ;
```

}

Use below macros for setting the different baud rates. These macros can also be found in can.h file.

CAN_SPEED_1M CAN_SPEED_800K CAN_SPEED_500K CAN_SPEED_250K CAN_SPEED_125K CAN_SPEED_100K CAN_SPEED_50K CAN_SPEED_20K CAN_SPEED_10K

CAN Transmit & Receive :

can_tx() & can_rx() : These function will be used to Transmit and Receive the CAN messages respectively.

CAN Transmit Prototype.

int can_tx(int can_fd, unsigned char msgType, unsigned int can_id, int len, unsigned char *data) ;

Assign the appropriate values, before calling the can_tx function.

```
can_fd_0: CAN descriptor, return value from init_can() function
msgType = MSG_STANDARD ; // or MSG_EXTENDED .
can_id = 0x12 ; // CAN ID, if the msgType is MSG_STANDARD then it can be 11-Bit CAN Message ID
       // if the msgType is MSG_EXTENDED then it can be 29-Bit CAN Message ID
len = 4 ; // CAN Transmit Data Length
data : CAN message data.
data[0] = 0x1A;
data[1] = 0xAB;
data[2] = 0x22;
data[3] = 0x4D;
ret_val = can_tx(can_fd_0, msgType, can_id, dlc, data);
if (ret_val < 0)
{
       printf("Error while transmitting the CAN message.\n");
       close(can_fd_0);
       exit(0);
}
The above sample code will transmit the CAN Standard message with CAN ID=0x12 of data length=4 and message
```

data = {0x1A, 0xAB, 0x22, 0x4D } ;

CAN Receive Prototype.

int can_rx(int can_fd, unsigned char *msgType, unsigned char *rx_data, unsigned int *can_id, unsigned char *can_msg_len) ;

Pass the appropriate pointers for calling the can_rx function.

```
if ( can_rx(can_fd_0, &msgType, data, &can_id, &dlc) )
```

{

```
If (msgType == MSG_STANDARD )
{
    // Received message is CAN Standard Message.
}
else if (msgType == MSG_EXTENDED)
{
    // Received message is CAN Extended Message.
}
// dlc : Received CAN Data Length
// can_id : Will contain the CAN Message ID
// Data of dlc length
printf("ID=%x DLC=%d Data : ", can_id, dlc);
for (i=0; i< dlc; i++ )
    printf("\n");
</pre>
```

Example programs for both transmit and receive can be found in the CANLib directory for the reference.

Compiling CAN Application using CANLib Library

Export the Library path using below command.

}

export LD_LIBRARY_PATH=\$ LD_LIBRARY_PATH:/path-to-CANLib

To compile the application, use the below command.

g++ can_app.c -ICAN –L/path-to-CANLib -o can_app