SBC9302
User's Manual

Revision History:

#	Version No.	Author	Created / modified on	Details of the changes made
1	0.1	BPM	11.09.2007	Created initial draft.
2	0.2	BPM	16.10.2007	Changes with respect to latest workspace.
3	0.3	PVR	14.11.2007	Formatting changes, added boot options etc.
4	0.5	PVR, PPJ	21.11.2007	Added jumper settings.
5	0.9	PVR, PPJ	24.11.2007	Added connector descriptions.
6	1.0	PVR, PPJ	24.02.2008	Corrected description of UART0 and UART1 functioning.
7	1.1	PVR	18.03.2008	Added PC/104 addressing information.
8	1.2	PVR	25.03.2008	Added description of GPIO pins usage and mechanical dimensions of board, corrected PC/104 pins description.

LIST OF ABBREVIATIONS

SBC9302 **S**ingle **B**oard **C**omputer based on EP**9302** processor
TFTP **T**rivial **F**ile **T**ransfer **P**rotocol
GPIO **G**eneral **P**urpose **I**nput **O**utput

Some Linux terminology, referred in this document:

root user = Linux user with administrative rights
File Manager = Konquerer (in KDE)
Terminal = Konsol (in KDE)
root terminal = Konsol with root login
shell = Linux bash shell
Development tools = Compilers and Workspace required for embedded Linux development.

Contents

1 Introduction

This document is a starting point for your development on SBC9302. Please go through this document, before switching on the board.
SBC9302 is based on Cirrus Logic EP9302 processor, which has ARM920T core. Many components in this board are ESD sensitive, proper care must be taken while handling the board.

2 SBC9302 Specifications:

2.1 Hardware:

- ARM9 processor (EP9302) @ upto 200 MHz
- On-board 8 MB Flash, 32 MB SDRAM
- Optionally, upto 16 MB Flash and upto 64 MB SDRAM
- 2 UARTs with option for RS232 / RS422 / RS485 / TTL (3.3V level)
- RJ45 Ethernet LAN interface
- 2 USB Host interface ports
- 1 USB device interface port
- PC/104 connector
- 5 channel 12 bit ADC
- Upto 23 GPIO (3.3 Volts TTL)
- RTC with battery-backup
- SD-Card interface
- Standard 20 pin JTAG interface
- Wall type power supply included.
- One serial cable and one USB cable included.

2.2 Software:

- Runs embedded Linux.
- Users may write stand-alone or Linux based applications to run on this board.
- CD contains sample programs.

2.3 Deliverables:

- SBC9302 board with specs as above.
- Power adaptor.
- One serial cable.
- CD with sample programs.
- User's manual.

2.4 Support:

- Technical support available through web-site (FAQ).
- Additional support available over email (at extra cost).

2.5 Board dimensions

Figure 1 below shows dimensions of SBC9302 board and of various connectors on the board.

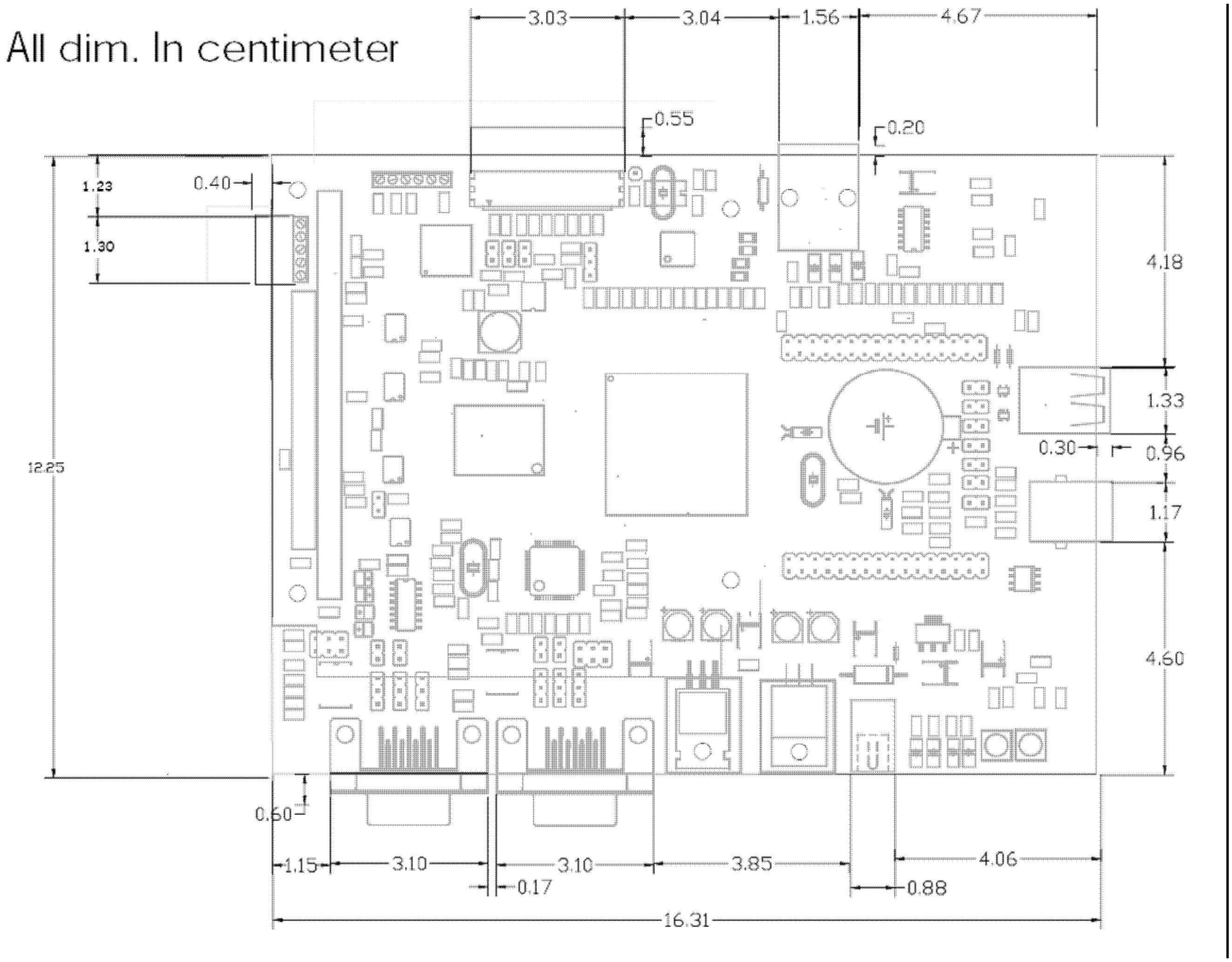

All dim. In centimeter
3.03
3.04
1.56
4.67
0.55
0.20
0.40
1.23
1.30
12.25
4.18
1.33
0.30
0.96
1.17
4.60
0.60
1.15
3.10
3.10
3.85
4.06
0.17
0.88
16.31

Figure 1

3 SBC9302 Development Setup:

Although stand-alone (no OS) applications can be run on SBC9302, it is primarily intended to run Linux based applications. The SBC9302 ships with Linux pre-installed. As described in the "specifications" section above, the board has many interfaces – including RS232 and Ethernet. During development, these 2 interfaces are very useful.
Figure 2 depicts typical setup required for developing Linux based or stand-alone applications for SBC9302.

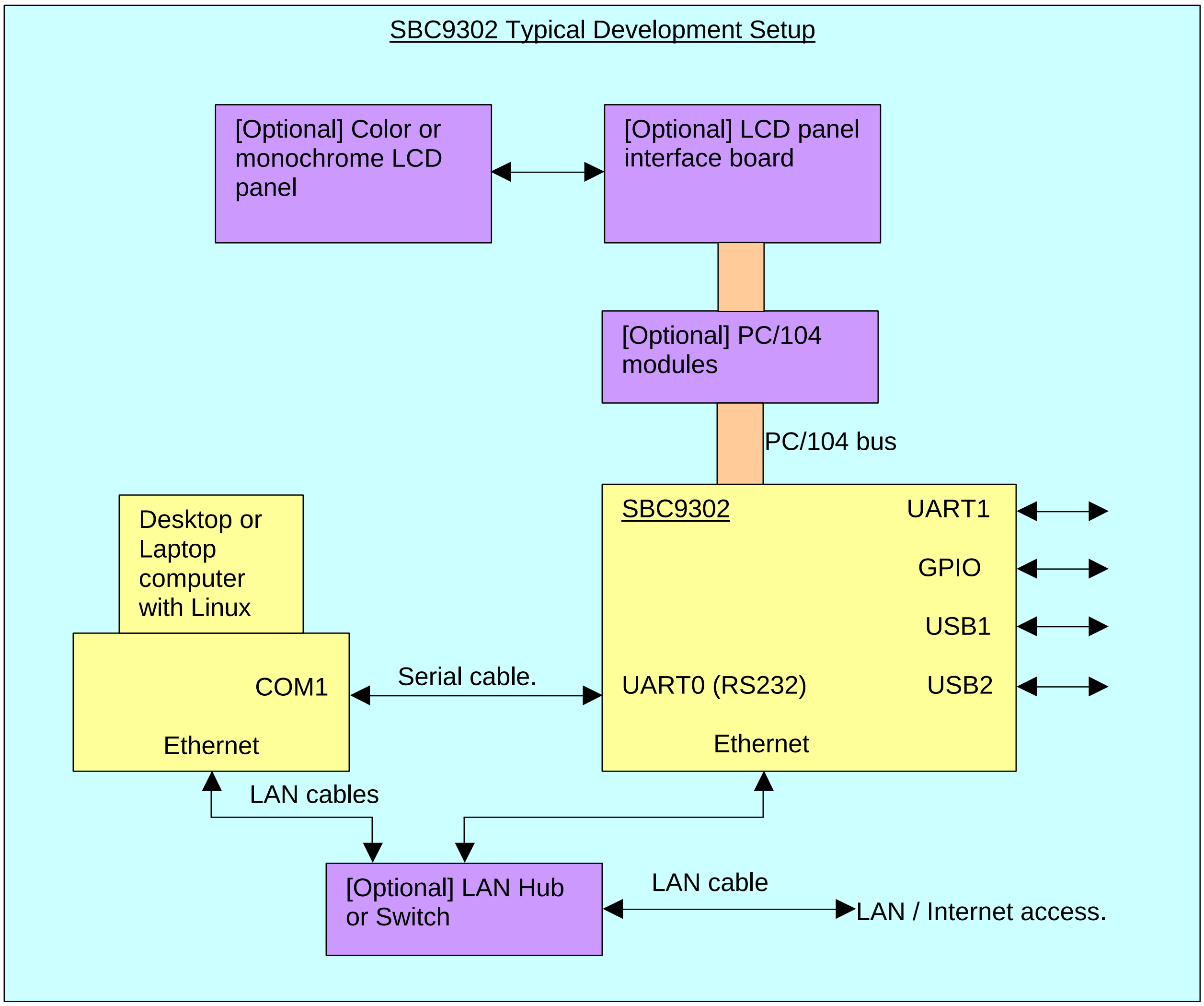


Figure 2

Items marked in Yellow are mandatory:

- SBC9302 deliverables include the serial cable. It also includes 1 Amp. power supply, suitable for SBC9302 board alone.
- Computer with Linux shall be arranged by user.

Items marked in Lavender are optional:

- If the computer does not need connection to LAN, then Hub/Switch may not be used. Instead, LAN cable maybe connected directly between Computer and SBC9302. Either straight or crossed cable maybe used, because the Ethernet physical layer on SBC9302 is capable of swapping Rx and Tx if necessary.

- PC/104 compatible modules are optional and maybe connected only if the applications requires them. E.g. some Industrial control applications may connect PC/104 compatible I/O module. CAUTION: Connecting PC/104 modules may require more current than what the standard power supply can provide. We recommend using 3 Amp. power supply (to be purchased separately).
- LCD panel interface board and LCD are also optional and maybe connected only if the applications requires them. CAUTION: Connecting LCD panel interface board and LCD may require more current than what the standard power supply can provide. We recommend using 3 Amp. power supply (to be purchased separately).

Other optional items not shown in Figure2:

- Various types of USB peripherals maybe optionally connected to USB1 and USB2 interfaces of SBC9302. Examples are USB keyboard, USB mouse, digital camera, webcam, pen-drive, printer…CAUTION: Some USB peripherals consume large amount of power and hence the standard power supply may not be enough in such situations. We recommend using 3 Amp. power supply (to be purchased separately).
- GPIO pins can be used to connect to various peripherals. Please check voltage levels and current drive capabilities in the EP9302 documentation.
- Other features of EP9302 – such as ADC, SPI interface and so on – are accessible to users through the 2 GPIO connectors. Suitable external devices maybe connected here.

It is possible to program the board through serial port or through Ethernet LAN, with the help of setup as shown above. Required software tools are either provided in the CD or are open source, so you may download from the Internet. Thus, no additional tool (apart from above setup) is needed for programming the board.

4 SBC9302 boot options and boot process:

The SBC9302 board has EP9302 processor. It provides various boot options, but only 2 are relevant for SBC9302 users. Hence, only those options are discussed here. Note that, this is a simplified description of boot process. For more detail description, you may refer to EP9302 documentation.

4.1 Serial boot mode:

In this mode, the EP9302 boots from it's internal boot ROM – it is pre-programmed when the EP9302 chip ships. There is a special program inside this boot ROM. Assuming that UART1 is connected to a computer, it attempts to communicate with it. If successful, the computer downloads a program (binary file); the EP9302 programs it into the on-board (parallel) flash. This boot mode is used to program the boot-loader or any other stand-alone application into the SBC9302 board. However, when SBC9302 board ships, a boot loader program is already programmed into the board; so most users may never need to use this boot option.

4.2 Parallel boot mode:

In this mode, the EP9302 boots from parallel flash. Thus the boot-loader (already programmed into the flash) will be executed when board is turned ON in this mode.
Selection between serial boot mode and parallel boot mode is done by using a jumper. Refer to the section on jumper settings for mode details.

4.3 Boot process:

Normally the SBC9302 should be powered ON in parallel boot mode. Only then Linux can boot up. Hence, it is assumed that board is powered ON in parallel boot mode, unless specified otherwise. The boot process follows number of steps, as described below:

1. The processor runs boot loader program (redboot) from flash.
2. It uses UART1 for user interface. Thus messages output by redboot can be seen on computer – if it is connected to UART1 with serial cable and if appropriate terminal program is running on it. Examples of terminal program are **Hyperterminal** (on Windows) and **minicom** (on Linux). COM port setting should be 57600 baud, 8 bits per character, 1 stop bit, no parity.
3. The redboot program can branch to one of the two possibilities – boot Linux or goto redboot command line mode. Default action is to boot Linux, but user can press Ctrl.C to goto redboot command line mode. This is useful for downloading new Linux images into flash (described later).
4. By default, redboot will load pre-programmed Linux images (**zImage** and **ramgisk.gz**) from flash to RAM and then run it.

5. The zImage is self extracting compressed image, so it will uncompress itself and then Linux starts running.
6. ramdisk.gz is compressed image of root file system. It is is also uncompressed into RAM and then root filesystem is mounted.
7. Linux uses UART1 as a TTY device. So messages output by Linux and shell prompt can be seen on computer – if it is connected to UART1 with serial cable and if appropriate terminal program is running on it. COM port setting should be 57600 baud, 8 bits per character, 1 stop bit, no parity.

When you see shell prompt in the terminal window, it means Linux is up and running. Now you can type standard Linux commands (like ls, pwd and so on) or type name of an application and press Enter to run that command or application. Note that supplied default configuration is such that the root user is automatically logged in when Linux is up.

5 Connectors, Jumpers and Switches:

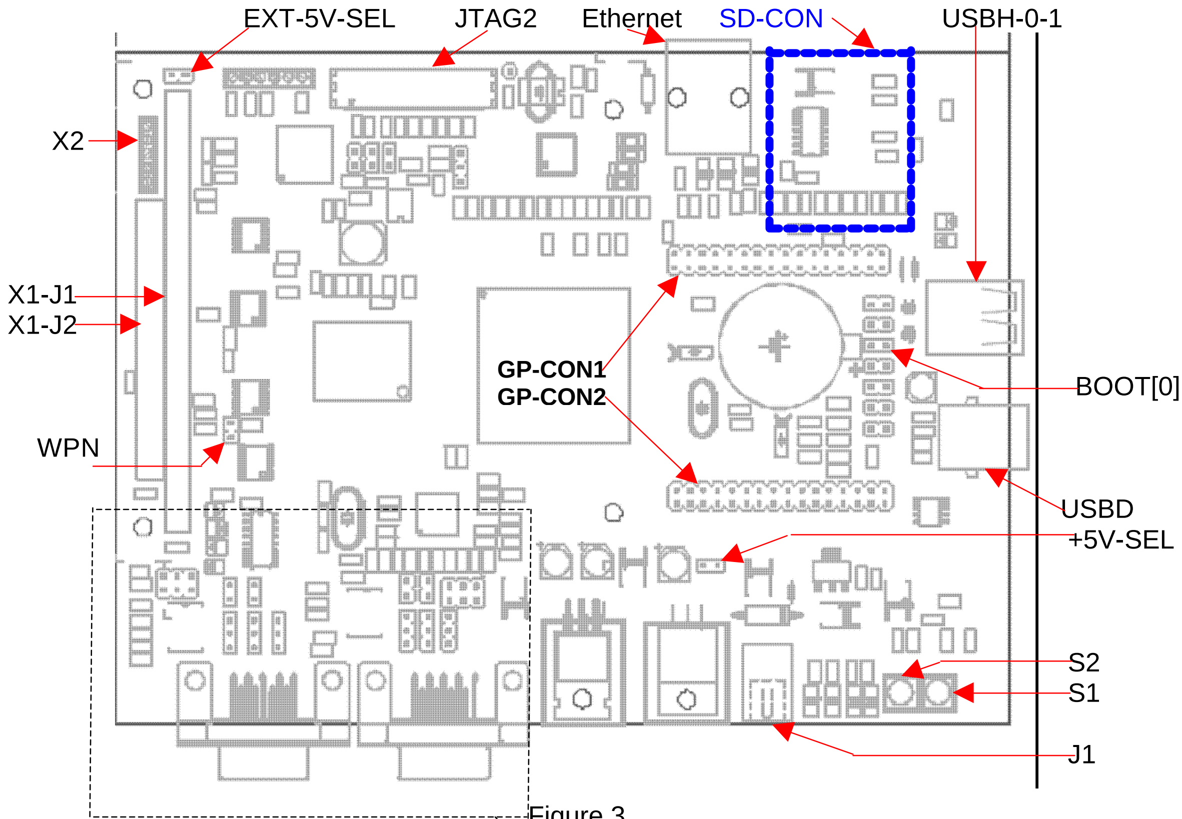


Figure 3

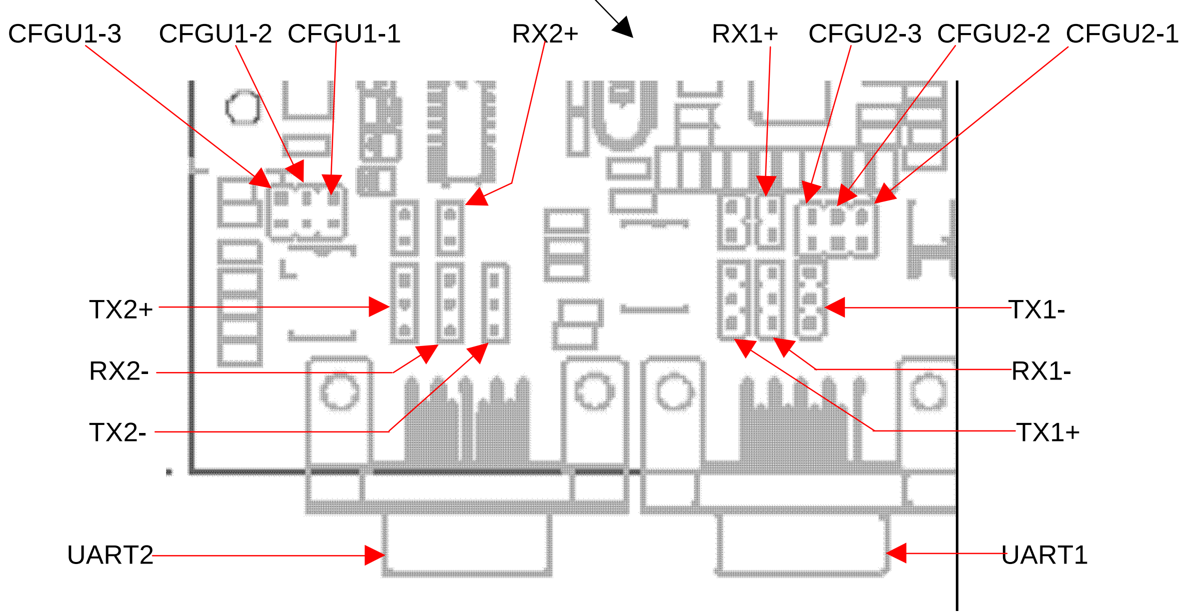


Figure 4

Locations and names of various connectors and jumpers are shown in Figure 3 and Figure 4.
Note: The processor EP9302 has 2 on-chip UARTs. EP9302 documentation refers to these as UART0 and UART1. Both these UARTs are made available to user through 2 separate DB9 connectors – named as UART1 and UART2 respectively. In other words:

- EP9302 UART0 is available on connector UART1.
- EP9302 UART1 is available on connector UART2.

Henceforth in this document, the word "UART1" refers to UART1 connector (i.e. EP9302 UART0) and the word "UART2" refers to UART2 connector (i.e. EP9302 UART1).

5.1 Jumper description:

Viewpoint Reference: Look at the SBC9302 board from front side. The 2 UART connectors should be near the lower edge. PC/104 connector should be near the left edge.
Conventions used:

- 2 pin jumpers: These can be shorted or open. These 2 conditions are noted as **Short** or **Open**, respectively.
- 3 pin jumpers: 3 conditions are possible in this case: middle and upper pin shorted, middle and lower pin shorted, or open (no pins shorted). These 3 conditions are noted as **Up**, **Down** or **Open**, respectively.

"Don't care" condition of a jumper is noted as **X**.
The jumper setting is clearly described in the table. Row marked with asterisk (*) indicates factory setting.
CAUTION: Only the jumpers described below maybe changed by users, that too within the restrictions as mentioned below. Changing setting of any other jumper (which is not described below) may cause permanent damage to the board.

Locations of various jumpers are shown in Figure 3 and Figure 4.

BOOT[0]

This jumper is used to select between serial boot mode and parallel boot mode.

	BOOT[0]	Selected boot mode
	Open	Serial boot mode
*	Short	Parallel boot mode

+5V-SEL and EXT-5V-SEL

These 2 are separate jumpers, but only one maybe shorted at any time, hence described together. With these jumpers, one of the 2 power sources can be selected: through power jack J1 or through power connector X2.

	+5V-SEL	EXT-5V-SEL	Selected power source
*	Short	Open	Power jack J1
	Open	Short	Power connector X2

CAUTION: Shorting both the above jumpers simultaneously can cause permanent damage to the board and/or to the power supply. Please short only one of the above 2 jumpers at any time.

WPN

This jumper can be used for flash "write-protection".

	WPN	Flash
*	Open	Not write protected
	Short	Write protected

CFGU1-3, CFGU1-2, CFGU1-1, RX1+, TX1+, TX1-, RX1-

These are 7 different jumpers, but should be operated together to select one of the 3 possibilities for operation of UART1:

	CFGU1-3	CFGU1-2	CFGU1-1	RX1+	TX1+	TX1-	RX1-	Selected UART1 operation
*	Open	Short	Open	Open	Up	Up	Up	UART1 works as (3 wire) RS232; RxD, TxD, GND signals available on connector **UART1**.
	Short	Open	Open	Short	Down	Down	Down	UART1 works as RS422; Tx+, Tx-, Rx+, Rx- signals available on connector **UART1**.
	Open	Open	Short	Open	Open	Open	Open	UART1 works as TTL (3.3V level); RxD, TxD, GND signals available on connector **GP-CON2**.

CAUTION: Any other combination of the above jumpers is invalid and may cause permanent damage to the board.

CFGU2-3, CFGU2-2, CFGU2-1, RX2+, TX2+, TX2-, RX2-

These are 7 different jumpers, but should be operated together to select one of the 3 possibilities for operation of UART2:

	CFGU2-3	CFGU2-2	CFGU2-1	RX2+	TX2+	TX2-	RX2-	Selected UART2 operation
*	Open	Short	Open	Open	Up	Up	Up	UART2 works as (3 wire) RS232; RxD, TxD, GND signals available on connector **UART2**.
	Short	Open	Open	Short	Down	Down	Down	UART2 works as RS422; Tx+, Tx-, Rx+, Rx- signals available on connector **UART2**.
	Open	Open	Short	Open	Open	Open	Open	UART2 works as TTL (3.3V level); RxD, TxD, GND signals available on connector **GP-CON2**.

CAUTION: Any other combination of the above jumpers is invalid and may cause permanent damage to the board.

CAUTION: For SBC9302 board versions earlier than V2.0, an errata related to UART1 and UART2 mode applies. If the revision number printed on the PCB is less than "SBC9302 V2.0", then please refer to the document SBC9302_Errata1.

5.2 Connector description:

Locations of various connectors are shown in Figure 3 and Figure 4.

J1

This is power socket. The supplied power supply (in India only) has power jack compatible with this socket. It provides 7.5VDC (maximum 1 Amp.) to the board. Other necessary voltages are generated on-board. If higher current is required, then power must be supplied through connector X2 and also jumper setting must be changed accordingly.

X2

This is a 5 pin relimate connector – alternative to standard power socket (J1). This should be used if more than 1 Amp. current is required (due to PC/104 add-on modules and/or external USB peripherals etc.)

Pin #	Signal
1	GND
2	-5V (not used on-board, but routed to PC/104 connector)
3	-12V (not used on-board, but routed to PC/104 connector)
4	+12V (not used on-board, but routed to PC/104 connector)
5	+5V

UART1

This connector brings out pins of UART1. Basically both the UARTs have 3 possibilities: RS232 or RS422 or TTL (3.3V level). One of these 3 options is selected through jumpers. Depending on the selected option, the signals available on this connector may vary.

When **UART1** is configured as **RS232**.	
Pin #	**Signal**
2	Tx of UART1
3	Rx of UART1
5	GND
1,4,6,7,8,9	No connection.
When **UART1** is configured as **RS422**.	
Pin #	**Signal**
2	Tx- of UART1
3	Rx- of UART1
4	Rx+ of UART1
5	Tx+ of UART1
1,6,7,8,9	No connection.

Note: If ((UART1 is not configured as RS422) and (UART1 is not configured as RS232)), then all pins of connector UART1 have no connection. In this case, UART1 signals (at 3.3V level) are available on GP-CON2.

UART2

This connector brings out pins of UART2. Basically both the UARTs have 3 possibilities: RS232 or RS422 or TTL (3.3V level). One of these 3 options is selected through jumpers. Depending on the selected option, the signals available on this connector may vary.

When **UART2** is configured as **RS232**.	
Pin #	**Signal**
2	Tx of UART2
3	Rx of UART2
5	GND
1,4,6,7,8,9	No connection.
When **UART2** is configured as **RS422**.	
Pin #	**Signal**
2	Tx- of UART2
3	Rx- of UART2
4	Rx+ of UART2
5	Tx+ of UART2
1,6,7,8,9	No connection.

Note: If ((UART2 is not configured as RS422) and (UART2 is not configured as RS232)), then all pins of connector UART2 have no connection. In this case, UART2 signals (at 3.3V level) are available on GP-CON2.

JTAG2

This connector brings out JTAG pins of the EP9302 processor. This is a standard 20 pin JTAG connector. Any third party JTAG based Emulator – which supports standard 20 pin JTAG connector – can be connected here. The pin description is as below:

Pin #	Signal
1	Vdd (3.3V)
2	Vdd (3.3V)
3	nTRST
4	GND
5	TDI
6	GND
7	TMS
8	GND
9	TCK
10	GND
11	No connection.
12	GND
13	TDO
14	GND
15	nRST
16	GND
17	No connection.
18	GND
19	No connection.
20	GND

X1-J1 and X1-J2 (PC/104)

These 2 connectors make up the PC/104 interface. Some of the standard PC/104 signals may not be available or may have somewhat modified meaning, as described below. The pin numbers of these connectors are as shown in Figure 5 (top view)

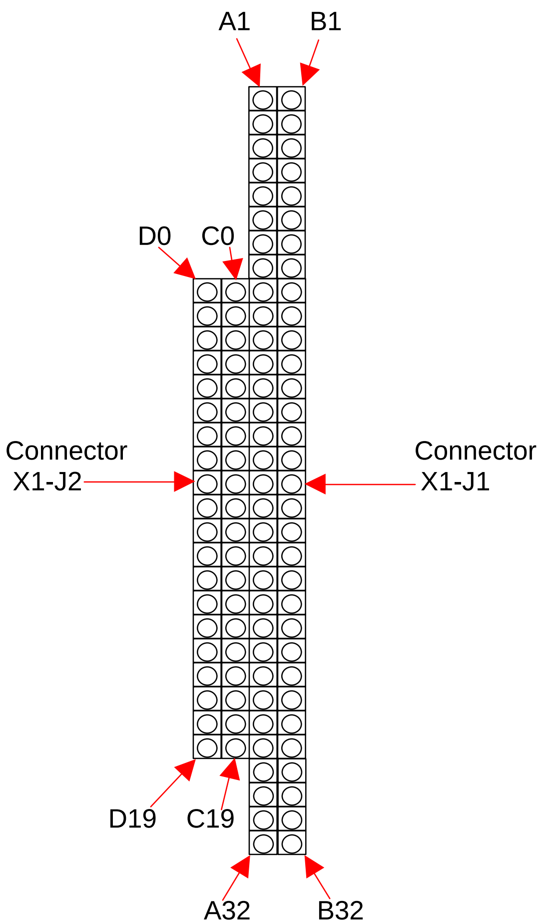


Figure 5

X1-J1		
Pin #	**Standard PC/104 Signal name**	**Signal, as available on SBC9302**
A1	IOCHCHK	No connection
A2-A9	SD7-SD0	DT7-DT0 of EP9302 (3.3 V level, 5V tolerant)
A10	IOCHRDY	WAITN pin of EP9302 (3.3 V level, 5V tolerant)
A11	AEN	Always low
A12-A31	SA19-SA0	AD19-AD0 of EP9302 (3.3 V level)
A32	0 V	GND
B1	0 V	GND
B2	RESETDRV	RST (goes high during CPU reset)
B3	+5 V	+5 V
B4	IRQ9	No connection
B5	-5 V	-5 V or no connection*
B6	DRQ2	No connection
B7	-12 V	-12 V or no connection*
B8	ENDXFR	No connection
B9	+12 V	+12 V or no connection*
B10	KEY	No connection
B11	SMEMW#	Always high
B12	SMEMR#	Always high
B13	IOW#	WRN of EP9302[$] (3.3 V level)
B14	IOR#	RDN or EP9302[$] (3.3 V level)
B15	DACK3	No connection
B16	DRQ3	No connection
B17	DACK1	No connection
B18	DRQ1	No connection
B19	REFRESH	No connection
B20	SYSCLK	14.7456 MHz clock (3.3 V level)
B21-B22	IRQ7-IRQ6	No connection
B23-B25	IRQ5-IRQ3	INT[2]-INT[0] pins of EP9302 (3.3 V level, **NOT** 5V tolerant)
B26	DACK2	No connection
B27	TC	EGPIO12 (i.e. DEOT1) of EP9302 (3.3 V level, **NOT** 5V tolerant)
B28	BALE	Low when address is in the range 0x1000_0000 to 0x1FFF_FFFF; high otherwise.
B29	+5 V	+5 V
B30	OSC	No connection
B31-B32	0 V	GND

X1-J2		
Pin #	**Standard PC/104 Signal name**	**Signal, as available on SBC9302**
C0	0 V	GND
C1	SBHE#	Always high
C2-C8	LA23-LA17	AD23-AD17 of EP9302 (3.3 V level)
C9	MEMR#	Always high
C10	MEMW#	Always high
C11-C18	SD8-SD15	DT8-DT15 of EP9302 (3.3 V level, 5V tolerant)
C19	Key	GND
D0	0 V	GND
D1	MEMCS16#	Should not be used.
D2	IOCS16#	Should not be used.
D3-D6	IRQ10-IRQ12, IRQ15	No connection
D7	IRQ14	No connection
D8	DACK0	No connection
D9	DRQ0	No connection
D10	DACK5	No connection
D11	DRQ5	No connection
D12	DACK6	No connection
D13	DRQ6	No connection
D14	DACK7	No connection
D15	DRQ7	No connection
D16	+5 V	+5 V
D17	MASTER	No connection
D18-D19	0 V	GND

* These pins are merely shorted with corresponding pins of connector X2. Thus, if these voltages are applied to the SBC9302 through connector X2, then and only then will these voltages be available on connector X1-J1.

$ These signals are generated by on-board CPLD. If address is in the range 0x1000_0000 to 0x1FFF_FFFF, then the WRN or RDN signals of EP9302 are passed onto X1-J1 connector; otherwise pins B13 and B14 of X1-J1 remain high, regardless of the status of WRN and RDN pins of EP9302.

Note: Signals highlighted in light-green color are generated by on-board CPLD and are outputs of SBC9302. The meaning of these signals can be changed on request for high volume customers.

CAUTION: Many signals on X1-J1 and X1-J2 connectors are marked as **NOT 5V tolerant**. These are inputs to the SBC9302 board. Users must take care that voltage on these pins shall never exceed 3.3V, as it may cause permanent damage to the board.

Ethernet

This is standard RJ45 connector. It provides Ethernet interface. Standard LAN cable with RJ45 jack can be connected here. The on-board Ethernet physical layer can automatically swap Tx and Rx lines. As a result, either straight or crossed LAN cable can be used.

SD-CON (SD-Card)

SD-Card can be inserted into this connector. It has standard SD-Card connector pin-out. This connector is on the bottom side of SBC9302 board.

USBH-0-1 (2 USB Host Interfaces)

This is a “double-decker” connector – i.e. 2 USB host interface connectors put together. Standard USB peripherals – like pen-drive, digital camera, webcam etc. – can be connected to either of these 2 USB host interfaces. Both these are standard USB type A connectors.

USBD (USB Device Interface)

This is a standard USB type B connector. It provides USB device interface. This can be connected to USB port of a computer, through standard USB cable.

GP-CON1

This connector brings out some of the GPIO pins and some other miscellaneous signals.

Pin #	Signal	Pin #	
1	EGPIO15	2	EGPIO0
3	EGPIO14	4	EGPIO1
5	EGPIO13	6	EGPIO2
7	EGPIO12	8	EGPIO3
9	FGPIO3	10	EGPIO4
11	FGPIO2	12	EGPIO5
13	FGPIO1	14	EGPIO6
15	HGPIO2	16	EGPIO7
17	HGPIO3	18	EGPIO8
19	HGPIO4	20	EGPIO9
21	HGPIO5	22	EGPIO10
23	ADC0	24	EGPIO11
25	ADC1	26	ADC4
27	ADC2	28	+5 V
29	ADC3	30	+3.3 V
31	GND	32	GND

GP-CON2

This connector brings out some of the GPIO pins and some other miscellaneous signals.

Pin #	Signal	Pin #	
1	GND	2	ASYNC
3	+3.3 V	4	ASDO
5	No connection	6	SCLK1
7	No connection	8	SFRM1
9	No connection	10	SSPRX1
11	DTRn	12	SSPTX1
13	RTSn	14	INT[3]
15	DSRN	16	INT[1]
17	CGPIO	18	INT[0]
19	ARSTN	20	ABITCLK
21	ASDI	22	CTSN
23	RxD of UART1 (TTL, 3.3V level)	24	TxD of UART1 (TTL, 3.3V level)
25	RxD of UART2 (TTL, 3.3V level)	26	TxD of UART2 (TTL, 3.3V level)
27	EECLK	28	+3.3 V
29	EEDAT	30	+5 V
31	GND	32	GND

CAUTION: All signals on GP-CON1 and GP-CON2 connectors are directly pins of EP9302 processor and these are **NOT 5V tolerant**. Users must take care that voltage on these pins shall never exceed 3.3V, as it may cause permanent damage to the board.

5.3 Switches description:

S1

This is a push-button for “user reset”. Pressing this switch momentarily will apply a reset pulse to the RSTOn pin of EP9302. It resets the entire processor, except certain system variables such as RTC, SDRAM refresh control/global configuration, and the Syscon registers. If PLLs are enabled, user reset does NOT disable or reset the PLLs. They retain their frequency settings.

S2

This is a push-button for “power-on reset”. Pressing this switch momentarily will apply a reset pulse to the PRSTn pin of EP9302. It resets the entire processor, without any exceptions.
We recommend using the S2 switch for resetting the SBC9302 board.

6 GPIO: Usage and Availability

On the EP9302 processor, there are total 37 GPIO pins. However, some of these pins may have alternate functions assigned by the EP9302 processor. Further, some other pins are used on the SBC9302 board. Some other pins are available to user as GPIO pins. The table below lists such information related to these GPIO pins: Please note that some GPIO pins maybe brought out on GPCON1 or GPCON2 connectors, yet those may not be available to user or maybe conditionally available. Please take care not to connect any external signal to such pins.

6.1 GPIO Table:

#	Pin name	Another name	I/O capability	Interrupt capability	Available on connector?	Connector Pin #	Available for user?	Functionality in SBC9302
1	PE0		Ip/Op/OD	No	No	N.A.	No	Boot LED
2	PE1		Ip/Op/OD	No	No	N.A.	No	Boot LED
3	PG0		Ip/Op/OD	No	GPCON2	27	[Note1]	SCL for RTC
4	PG1		Ip/Op/OD	No	GPCON2	29	[Note1]	SDA for RTC
5	PC0	CGPIO0	Ip/Op/OD	No	GPCON2	17	Yes	None.
6	PB7	EGPIO15	Ip/Op/OD	Yes	GPCON1	1	Yes	None.
7	PB6	EGPIO14	Ip/Op/OD	Yes	GPCON1	3	Yes	None.
8	PB5	EGPIO13	Ip/Op/OD	Yes	GPCON1	5	Yes	None.
9	PB4	EGPIO12	Ip/Op/OD	Yes	GPCON1	7	Yes	None.
10	PB3	EGPIO11	Ip/Op/OD	Yes	GPCON1	24	[Note2]	USB device
11	PB2	EGPIO10	Ip/Op/OD	Yes	GPCON1	22	[Note2]	USB device
12	PB1	EGPIO9	Ip/Op/OD	Yes	GPCON1	20	Yes	None.
13	PB0	EGPIO8	Ip/Op/OD	Yes	GPCON1	18	Yes	None.
14	PA7	EGPIO7	Ip/Op/OD	Yes	GPCON1	16	Yes	None.
15	PA6	EGPIO6	Ip/Op/OD	Yes	GPCON1	14	Yes	None.
16	PA5	EGPIO5	Ip/Op/OD	Yes	GPCON1	12	Yes	None.
17	PA4	EGPIO4	Ip/Op/OD	Yes	GPCON1	10	Yes	None.
18	PA3	EGPIO3	Ip/Op/OD	Yes	GPCON1	8	[Note3]	[optional] RS485 direction control
19	PA2	EGPIO2	Ip/Op/OD	Yes	GPCON1	6	Yes	None.
20	PA1	EGPIO1	Ip/Op/OD	Yes	GPCON1	4	Yes	None.
21	PA0	EGPIO0	Ip/Op/OD	Yes	GPCON1	2	Yes	None.
22	PF3	FGPIO3	Ip/Op/OD	Yes	GPCON1	9	[Note4]	SD-Card
23	PF2	FGPIO2	Ip/Op/OD	Yes	GPCON1	11	Yes	None.
24	PF1	FGPIO1	Ip/Op/OD	Yes	GPCON1	13	Yes	None.

25	PH2	HGPIO2	Ip/Op/OD	No	GPCON1	15	Yes	None.
26	PH3	HGPIO3	Ip/Op/OD	No	GPCON1	17	Yes	None.
27	PH4	HGPIO4	Ip/Op/OD	No	GPCON1	19	Yes	None.
28	PH5	HGPIO5	Ip/Op/OD	No	GPCON1	21	Yes	None.
29	MDIO		Ip/Op/OD	No	No	N.A.	No	Ethernet PHY
30	CTSn		Input	No	GPCON2	22	Yes	None.
31	DSRn / DCDn		Input	No	GPCON2	15	Yes	None.
32	RTSn		Output	No	GPCON2	13	Yes	None.
33	DTRn		Output	No	GPCON2	11	Yes	None.
34	ARSTn		Output	No	GPCON2	19	Yes	None.
35	INT3		Input	Yes	GPCON2	14	No	Ethernet PHY
36	INT1		Input	Yes	GPCON2	16	[Note5]	PC104
37	INT0		Input	Yes	GPCON2	18	[Note2]	USB device

Note1: This pin is used for RTC interface. This can be used as GPIO if RTC is not soldered on the board.
Note2: This pin is used for USB device interface. This can be used if components related to "USB device interface" are not soldered on the board.
Note3: By default, this can be used as GPIO. But optionally, it can be used as "direction control" pin for RS485 interface. This is possible if a 0 Ohm resistor is soldered on the board.
Note4: This pin is used for SD-Card interface. This can be used if components related to "SD-Card interface" are not soldered on the board.
Note5: This pin is used for PC/104 interface. This can be used if components related to "PC/104 interface" are not soldered on the board.
Note6: Some GPIO pins have input and output capability (direction selectable by software), some others have only input capability, and some others have only output capability. Pins are highlighted in different colors to distinguish such capabilities.

CAUTION: Soldering or de-soldering any part on / from the board will make warranty void. However, OE customers may request quotations for customized version of SBC9302 board. Some features on this board can be removed (in order to reduce power consumption and price). These features are:

- RTC with battery backup (by default, this feature is included).
- USB device interface (by default, this feature is included).
- RS485 direction control (by default, this feature is not included).
- SD-Card interface (by default, this feature is included).
- PC/104 interface (by default, this feature is included).

Note that Minimum Order Quantities (MOQ) apply for such customized version of board.
Please do not solder or de-solder any component on the board, because that will make the warranty void.

6.2 SBC9302Test board:

This is a small "test board" designed to connect to SBC9302 board through GPCON1 and GPCON2 connectors.

- It has 27 LEDs that can indicate the status of corresponding I/O pin (LED glowing means pin is defined as output and is LOW; LED off means either pin is defined as input or is HIGH).
- It has 3 jumpers connected to DTRn, RTSn and INT[1] pins. These are "input only" pins. On this test board, these pins are also pulled up. Thus if shorting link is placed on a jumper, the corresponding input pin will receive LOW level; otherwise it will receive HIGH level.
- It has 5 potentiometers. Two ends of potentiometers are connected to 3.3V and GND. The middle (variable) end is connected to analog inputs ADC0 through ADC4. User may turn these potentiometers to vary the analog voltage at the ADC inputs, in the range 0 to 3.3V.

Thus, the SBC9302Test board comes very handy while experimenting with the SBC9302 board.

7 PC/104 Addressing:

7.1 What is PC/104 bus:

PC/104 bus is basically designed for boards with x86 architecture CPU. The x86 architecture supports separate memory space and I/O space. The PC/104 bus has signals for both – memory space and I/O space. Signals for I/O space are:

- 16 bit address
- 8 or 16 bit data
- IOWN (active low Write strobe)
- IORN (active low Read strobe)
- Some other control signals

Signals for memory space are:

- 24 bit address
- 8 or 16 bit data
- MEMWN (active low Write strobe)
- MEMRN (active low Read strobe)
- Some other control signals

Common address and data lines are used for memory space and I/O space; but some control signals are different – notably the read and write strobes for memory space and I/O space are different.

7.2 How is PC/104 bus implemented on SBC9302:

The processor on this board is EP9302 – an ARM9 processor. Unlike x86 architecture, it has a single 32 bit address space. There is no such thing as "I/O". It means that if you want to connect external peripherals to this processor, those have to be "memory mapped". Thus this processor can not (by itself) support PC/104 bus, due to it's architectural difference as compared to x86.

However, we have attempted to support PC/104 bus as closely as possible, so that even third-party PC/104 modules can be connected to SBC9302. The SBC9302 board has a separate CPLD to generate some PC/104 control signals – which the processor does not generate by itself.

Please refer to PC/104 connector description: it marks such signals (that are generated by CPLD) with a different color. It is possible to change the functionality of such signals by changing the CPLD program. We can make such changes for OEM customers.

7.3 Address range:

The PC/104 control signals (notably IOWN, IORN, MEMWN, MEMRN) are activated only when the EP9302 processor accesses a certain address range. In fact, it is 0x1000_0000 to 0x10FF_FFFF. This is further divided, as described in the table below: (memory and I/O spaces are marked with different colors).

#	Description	Start address	End address	Size
1	PC/104 address range for SBC9302: i.e. PC/104 control signals can be active, only when address is in this range.	0x1000_0000	0x10FF_FFFF	16 MB
2	PC/104 memory space for SBC9302: i.e. MEMWN and MEMRN signals can be active only when address is in this range.	0x1000_0000	0x107F_FFFF	8 MB
3	PC/104 I/O space for SBC9302: i.e. IOWN and IORN signals can be active only when address is in this range.	0x1080_0000	0x10FF_FFFF	8 MB*
4	Address range reserved for "SLPIB" (LCD panel interface board - an SPJ product).	0x1000_0000	0x1007_FFFF	512 KB
5	Reserved address space (must not be used for any PC/104 module)	0x1008_0000	0x100F_FFFF	512 KB
6	Address range (within memory space) available for other PC/104 modules.	0x1010_0000	0x107F_FFFF	7 MB
7	Address range (within I/O space) available for other PC/104 modules.	0x1080_0000	0x10FF_FFFF	8 MB*

***** The actually usable I/O space is not 8 MB though, due to the fact that: PC/104 I/O space uses only 16 bit addresses. Thus total I/O space is by definition limited to 64KB only. This 64KB is mapped to the 8MB region 0x1080_0000 to 0x10FF_FFFF on the SBC9302. Further, most PC/104 modules that use I/O space often use only addresses within 0x0300 to 0x03FF (i.e. for the SBC9302, it will be 0x10*mn*_0300 to 0x10*mn*_03FF; where *m* is any hexadecimal digit in the range 8 through F and *n* is any hexadecimal digit in the range 0 through F). Thus actually used I/O space maybe even less.

7.4 Address selection for SPJ manufactured PC/104 modules:

LCD panel interface board:

SLPIB is an LCD panel interface board, fully compatible with SBC9302. It does not offer "address selection". Instead, it uses a fixed address range of 0x1000_0000 to 0x1007_FFFF.

Other:

Other PC/104 modules manufactured by SPJ also use only memory space. These boards usually provide 3 switches or jumpers for selecting one of the 7 possible address ranges. Though 3 jumpers can make 8 combinations, one is forbidden – because it is partly used by SLPIB and partly reserved for future use. This "forbidden" combination is marked in red below.

Jumper corresponding to A22	Jumper corresponding to A21	Jumper corresponding to A20	Start address	End address	Remark
ON	ON	ON	0x1000_0000	0x100F_FFFF	Partly used by SLPIB, partly reserved for future use.
ON	ON	OFF	0x1010_0000	0x101F_FFFF	1 MB available space.
ON	OFF	ON	0x1020_0000	0x102F_FFFF	1 MB available space.
ON	OFF	OFF	0x1030_0000	0x103F_FFFF	1 MB available space.
OFF	ON	ON	0x1040_0000	0x104F_FFFF	1 MB available space.
OFF	ON	OFF	0x1050_0000	0x105F_FFFF	1 MB available space.
OFF	OFF	ON	0x1060_0000	0x106F_FFFF	1 MB available space.
OFF	OFF	OFF	0x1070_0000	0x107F_FFFF	1 MB available space.

8 Development Tools:

Most of the tools required for developing applications for SBC9302 are supplied in the accompanying CD. However, these tools are not SPJ products. These are open source tools and can be downloaded from Internet. Important tools required are:

1. gcc compiler: This is native compiler – i.e. runs on Linux computer and generates executables for Linux computer. This is generally part of the Linux installation on the computer.
2. arm-elf-gcc: This is cross compiler – i.e. runs in Linux computer and generates executables for stand-alone ARM targets. This is is useful for generating executable file of boot-loader. Boot-loader is a stand-alone application, since it starts before Linux. This can be downloaded from Internet. This is also included on the accompanying CD.
3. arm-linux-gcc: This is cross compiler – i.e. runs in Linux computer and generates executables for ARM Linux targets. This is useful for generating Linux applications to run on SBC9302 board. This can be downloaded from Internet. This is also included on the accompanying CD.
4. make: This is Linux standard make utility, useful for building complex projects. This is generally part of the Linux installation on the computer.
5. minicom: This is a serial terminal utility – similar to Hyperterminal of Windows. This can be part of Linux OS installed on the computer. If not, this can be installed later – from the Linux installation CD/DVD. Alternatively, this can be also downloaded from internet.
6. tftp: Stands for Trivial File Transfer Protocol – it is a useful tool for transferring files over Ethernet LAN. This can be also part of Linux OS installed on the computer. If not, this can be installed later – from the Linux installation CD/DVD. Alternatively, this can be also downloaded from internet.

7. Many useful makefiles, configuration files and some shell scripts can be also considered part of the development tool. Many of these are supplied in the accompanying CD.

9 Preparing computer:

As described earlier, Linux computer is necessary. It is assumed that Linux OS is already installed on the user's computer. Several different Linux distributions are available. We have used computer with Mandriva Linux (spring 2007) installed in it. However, procedure described here should work well on other Linux distributions also – possibly with minor differences. Following steps maybe followed to make this computer ready for developing applications to run on SBC9302.

1. Login into Linux with your normal username (say user1).
2. Insert the accompanying CD into CD-ROM drive.
3. A new window may pop-up with contents of CD in it.
4. Open a root shell (Konsole) i.e. login as root.
5. The inserted CD will be generally automatically mounted in a folder /media/cdrom or some such. Goto that folder using cd command (e.g. `cd /media/cdrom`).
6. Type `sh install.sh` on command line and press Enter. The CD contains a shell script file – install.sh – the same will be executed now.
7. The script will ask for username. Enter your username. Then the script will automatically copy workspace into the home folder of this user. Suppose your username is "user1", then the workspace will be created in the folder /home/user1/sbc9302.
8. The script execution may go on for a few minutes (depends on your computer speed) as it copies several files from CD to your computer. Finally, it displays the message "Installation finished".
9. Now path to gcc compiles must be set. To do so, open the file /home/user1/.bash_profile. Locate PATH variable in it and change it to
   `PATH=$PATH:$HOME/bin:/usr/local/arm/3.2.1-elf/bin:/usr/local/arm/4.1.1-920t/bin`
10. Now you may close the root shell, log-off and login again with your normal username (say user1).
11. You may verify correct installation of all 3 versions of gcc. To do so, you may open a shell and:
    a. Type "gcc" and press Enter. You should see the message "gcc: no input files". This indicates that gcc compiler could be run, but since no input filename was specified, it did not perform any action.
    b. Similarly, type "arm-elf-gcc" and press Enter. You should see the message "gcc: no input files".
    c. Similarly, type "arm-linux-gcc" and press Enter. You should see the message "gcc: no input files".

    If any one of the above 3 compilers do not work as expected, then it means that workspace may not be correctly installed. You may repeat the process more carefully.

With the above steps, the workspace is installed and the computer is ready for developing applications to run on SBC9302. Here it is assumed that tftp and minicom are properly installed already.

10 Develop an application, download it into SBC9302 and run it:

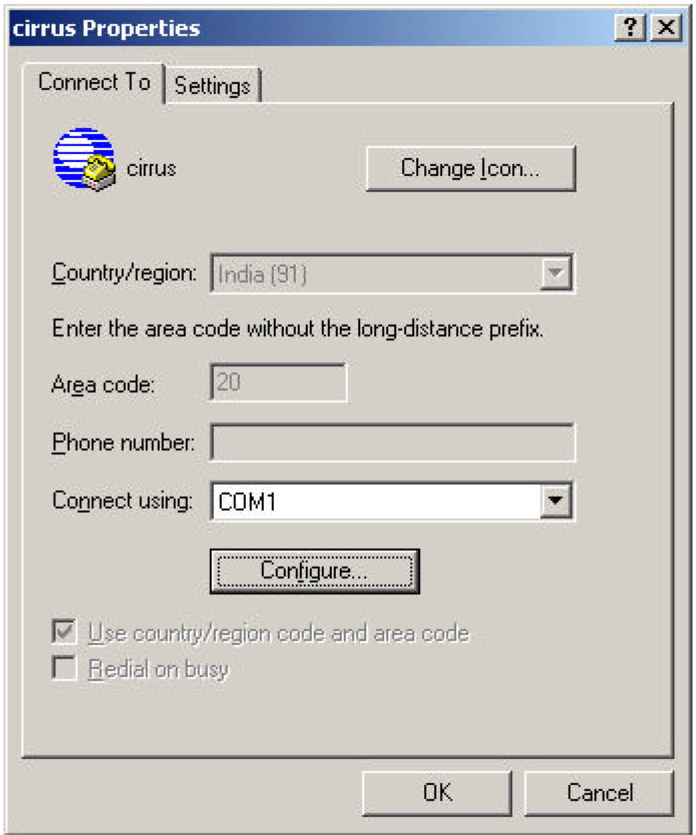
Although there are many ways to do this, the simplest way is described here.

1. Development setup as shown in Figure2 should be prepared.
2. The workspace installed in /home/user1/sbc9302 folder contains several sample applications. The simplest and fastest way of creating your own applications is to modify an existing sample application. These sample applications exist in folders named spj_appl1, spj_appl2 etc. under /home/user1/sbc9302/packages folder.
3. You may modify the main.c file in one such sample application folder. Note that by doing so, you are destroying the original sample application supplied by us. However, you can always install the original sample application again from the accompanying CD, as described in previous section.
4. When you are through with modifications in main.c, you may save it. Then select all object files in this folder – all files with extension .o – and delete those. Similarly, an (ARM) executable file also exists in this folder – it has the same name as the folder – i.e. spj_appl1 or spj_appl2 etc. Delete this executable file also.
5. Then start the shell window. Goto the folder /home/user1/sbc9302. Type "make" and press Enter. Your application will be built along with other necessary files and new Linux images will be created in the folder /home/user1/sbc9302/images/9302.
6. You will have to manually copy the images files (ramdisk.gz and zImage) into the TFTP root folder. E.g. if TFTP root folder is /home/user1/tftpboot, then copy these 2 files into that folder.

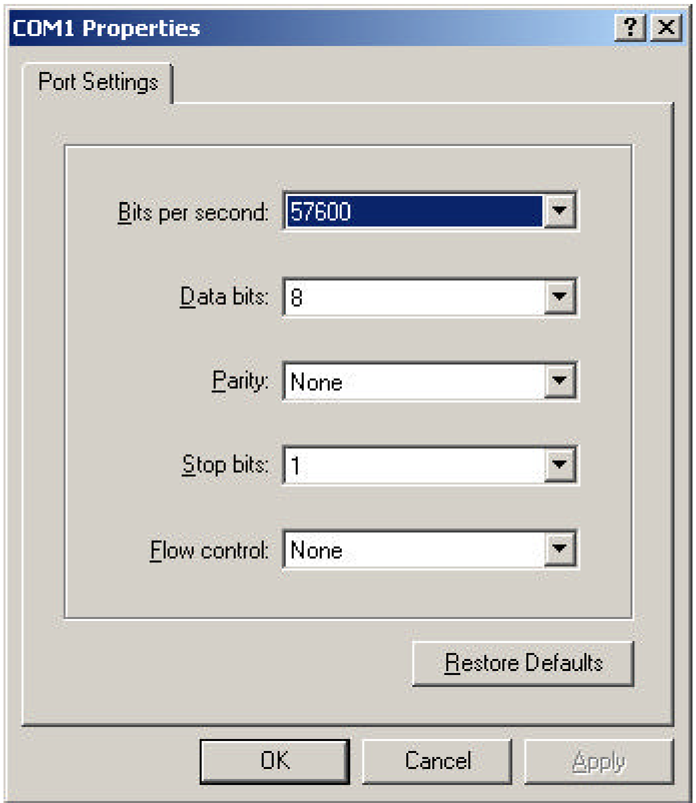
7. In the shell window, you may now start minicom. Use setting 57600,8,N,1.
8. Keep the SBC9302 board in parallel mode (this is the default factory setting). Turn it ON. Within 1-2 seconds, you should see the character '+' in minicom. This is output by the redboot boot-loader program.
9. After a while, you will see more messages from redboot. Finally, it will prompt you to "press Ctrl.C to abort". If you do not press any key for a few seconds (typically within 5 seconds), then it will go on to load Linux. You may press Ctrl.C to abort this, so that redboot command line prompt will be displayed.
10. At this prompt, you can type various redboot commands.
11. With these commands, you can configure IP address of SBC9302, download files from computer, program those into flash and so on. You may use following commands to program new Linux images into the board:
    a. You may use command "ip_address" to set IP address of SBC9302 and to inform IP address of host computer to it. Example:
       ip_address –l 192.168.1.200 –h 192.168.1.151
       What follows "-l" is local IP address, i.e. that of SBC9302. What follows "-h" is host IP address, i.e. that of the computer. Note that whatever IP address you assign to SBC9302 must be unique on your LAN.
    b. You may use command "load" to transfer an image from computer to the RAM of SBC9302, via Ethernet LAN. Example:
       load –r –v –b 0x800000 ramdisk.gz
       This will transfer the file /home/user1/tftpboot/ramdisk.gz from computer to SBC9302 RAM.
    c. You may use command "fix create" to burn the image from RAM to flash – so that it will be there even after power OFF. Example:
       fis create –b 0x800000 –l 0x300000 –f 0x60040000 –e 0x800000 –r 0x800000 ramdisk.gz
       This will program the image from RAM to flash, with the name "ramdisk.gz".
    d. Similarly, you may use load and fis create commands again to copy zImage into RAM and then burn it into flash, respectively. Example:
       load –r –v –b 0x80000 zImage
       fis create –b 0x80000 –l 0x200000 –f 0x60400000 –e 0x80000 –r 0x80000 zImage
       These will transfer the file /home/user1/tftpboot/zImage from computer to SBC9302 RAM and then program it into flash, with the name "zImage".
    e. Thus the 2 new Linux images have been programmed into flash.
12. Now reset the board. As usual, character '+' should appear in minicom window and redboot will start. But this time, do not press Ctrl.C. After waiting for about 5 seconds, it will start loading Linux images and then run it.
13. You will see several messages – output by Linux, during booting up – in the minicom window.
14. Finally, following message will appear: "`Please press Enter to activate this console.`"
15. Press Enter and you will see a command prompt. Now Linux is up and running on SBC9302. Now you can use general Linux commands by typing it's name in the minicom window and pressing Enter.
16. The executables of all sample applications are in the /usr/bin folder in SBC9302. These have names such as `spj_appl1`, `spj_appl2` etc. You may run your application simply by typing it's name and pressing Enter. E,g type `/usr/bin/spj_appl1` and press Enter. Your application should run.

11 Running SBC9302 (with windows)

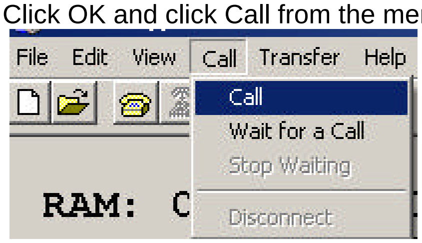
- Connect serial cable from uart1 to RS232 port of PC.
- Open HyperTerminal with following settings. (Select available COM port you have).



Click on configure and select COM port properties. Usually COM port numbering starts from COM1,COM2..
(If you are using usb2serial converter, it may use higher COM number. Check Device manager for list of available COM ports)
Use 576000 baud rate.



Click OK and click Call from the menu



Now connect the Power adaptor and switch ON the power.
On the terminal window, you will see some messages flashing.

Finally following message will appear.
Please press Enter to activate this console.

Press Enter and you will see a command prompt. Now SBC9302 is ready to work with a serial console. Here you can use general Linux commands.

```
BusyBox v1.1.3 (2007.05.14-06:16+0000) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

~ #
```

Now SBC9302 is running Linux, and what you see on serial console is like a Linux command shell (Of course with limited features)

Please go to the section “Running Applications” for more details.

12 Running SBC9302 (with Linux)

- To access SBC9302 in Linux, we have to setup minicom on the Linux desktop.
- Login as root on command line window, type minicom –s
- Select minicom settings by pressing Ctrl-A then Z. Go to Serial Port setup.

```
[configuration]
Filenames and paths
File transfer protocols
Serial port setup
Modem and dialing
Screen and keyboard
Save setup as dfl
Save setup as..
Exit
Exit from Minicom
```

- Select /dev/ttyS0 as serial device. Select lock file location as your home folder to avoid access restrictions. Baud rate must be 576000 and No flow control.

```
A -     Serial Device      : /dev/ttyS0
B - Lockfile Location      : /home/bhal/lock
C -    Callin Program      :
D -   Callout Program      :
E -     Bps/Par/Bits       : 57600 8N1
F - Hardware Flow Control  : No
G - Software Flow Control  : No

   Change which setting?

      Screen and keyboard
      Save setup as dfl
      Save setup as..
      Exit
      Exit from Minicom
```

- Now press escape and then save setup as dfl.
- Now open command line with your user login(not a root login)
- Type minicom it will open minicom window. You can check if the serial port setup is same as we entered earlier.

```
A -     Serial Device       : /dev/ttyS0
B - Lockfile Location       : /home/bhal/lock
C -    Callin Program       :
D -   Callout Program       :
E -     Bps/Par/Bits        : 57600 8N1
F - Hardware Flow Control : No
G - Software Flow Control : No

   Change which setting?

        Screen and keyboard
        Save setup as dfl
        Save setup as..
        Exit
        Exit from Minicom
```

Now exit this setup and switch on the board.

13 More about TFTP and redboot.

(Note: Messages as displayed on serial terminal are formatted in `Courier new`)

We load total 4 images on sbc9302 depending on the requirements.

1) Redboot - (Loaded from serial port) Do not change redboot , unless you are sure about what you are doing.
2) zImage – (Loaded from ethernet) Linux Kernel image.
3) Ramdisk.gz – (Loaded from ethernet) Linux root file system.
4) part.jffs2 – (Loaded from ethernet) JFFS2 file system partition.

Usually redboot will be fixed and need not be changed. Part.jffs2 will change only if you need to modify jffs2 partition size. So in practice, you may need to modify on zimage and ramdisk.gz
Linux images can be downloaded from redboot using TFTP protocol.
First , we have to setup TFTP Server.

13.1 TFTP Setup on Linux Machine.

Xinetd, TFTP and TFTP server packages must be installed to run tftp server on linux desktop.
Following instructions are applicable for mandriva Linux and should be similar for other distributions too.

Once xinetd and tftp server are installed, you will see a tftp file in /etc/xinetd.d/tftp path.
Few setting of tftp are done during installation.

Login as root in terminal window and edit this file.
Here, change the path of tftpboot folder as marked in following structure. Here my username is bhal so the path becomes /home/bhal/tftpboot. Replace it with your username.

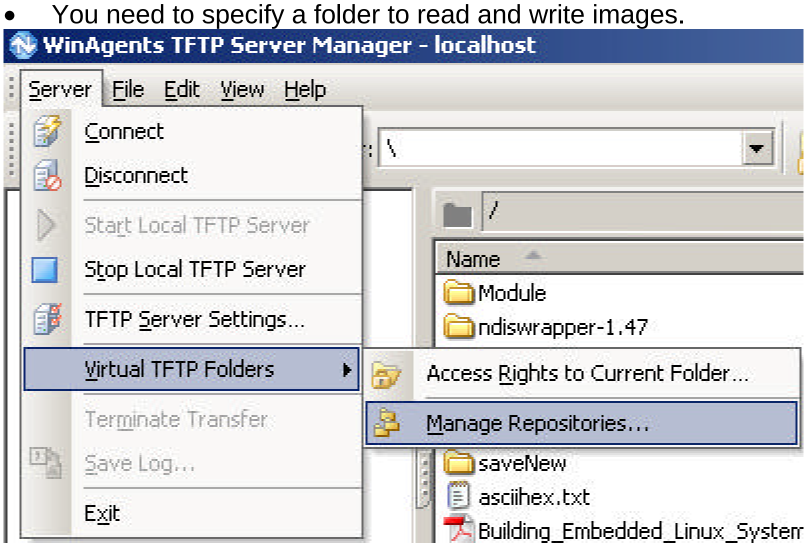
```
service tftp
{
      disable      = no
      socket_type        = dgram
```

```
        protocol            = udp
        wait                = yes
        user                = root
        server              = /usr/sbin/in.tftpd
        server_args         = -c -s /home/bhal/tftpboot
        per_source          = 11
        cps                         = 100 2
        flags               = IPv4
}
```

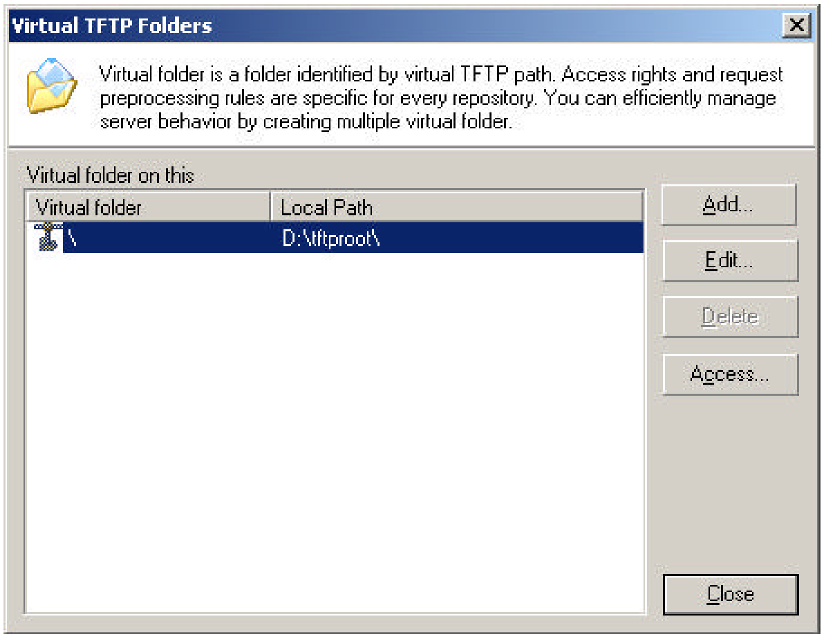
Now we need to restart xinetd service to make tftp functional. Reboot Linux desktop and tftp server must be functional now.
To verify it , refer section ***Loading Linux Images***

13.2 TFTP Setup on winXP Machine

- Basically we need two tools, hyper terminal and a TFTP server package (supplied in CD).
- Instead of hyper terminal, we can use any other terminal supporting serial protocols like tty,ansi.
- Install “tftpsetup.exe”
- You need to specify a folder to read and write images.



Goto Manage repositories…
Then select a folder to read and write from board.



Once we setup TFTP folder on windows machine, we can exchange files between windows machine and SBC9302 board. SBC9302 is a TFTP client and it reads or writes file to TFTP server.

To make TFTP work in SBC9302, we need to setup Ethernet.

13.3 Ethernet Setup in Redboot

Reset the board and press Ctrl-C when prompted to do so.

Executing boot script in 5.000 seconds - enter ^C to abort

It will go to the redboot prompt

RedBoot>

Here we can issue redboot commands.
To view current Ethernet settings in Redboot, type ip_address it will show the default settings.

```
RedBoot>ip_address
IP: 192.168.1.210/255.255.255.0, Gateway: 192.168.1.10
Default server: 192.168.1.151
```

It will display current IP address. Here 192.168.1.210 is IP address of SBC9302.
To change IP address and/or TFTP server, issue following command.

```
RedBoot> ip_address -l 192.168.1.200 -h 192.168.1.151
IP: 192.168.1.200/255.255.255.0, Gateway: 192.168.1.10
Default server: 192.168.1.151
```

Here 192.168.1.200 is IP address of SBC9302 and 192.168.1.151 is IP address of host machine where you have configured the TFTP server.

Now we can check ethernet connectivity by pinging the host.

```
RedBoot> ping -n 5 -h 192.168.1.151
Network PING - from 192.168.1.210 to 192.168.1.151
PING - received 5 of 5 expected
```


When it says it has received some packets out of expected., then there is ethernet connectivity between SBC9302 and TFTP server. Now the setup is ready to download images.

13.4 Default memory partitions

To check existing memory partitions issue following command on redboot prompt

```
RedBoot> fis list
Name              FLASH addr  Mem addr    Length      Entry point
RedBoot           0x60000000  0x60000000  0x00040000  0x00000000
ramdisk.gz        0x60040000  0x00800000  0x00300000  0x00800000
zImage            0x60400000  0x00080000  0x00200000  0x00080000
jffs2             0x60600000  0x00800000  0x00100000  0x00800000
FIS directory     0x607E0000  0x607E0000  0x0001F000  0x00000000
RedBoot config    0x607FF000  0x607FF000  0x00001000  0x00000000
```

13.5 Loading Linux Images

To re-load ramdisk.gz and zimage, we need to overwrite them. This is done by first loading the files into RAM and then writing these images from ram to flash. First load file to RAM

```
RedBoot> load -r -v -b 0x800000 ramdisk.gz
Using default protocol (TFTP)
|
Raw file loaded 0x00800000-0x00a43ac6, assumed entry at 0x00800000
```

Now overwrite ramdisk, It will ask for confirmation, since it already exists. Type y and press enter when asked.

```
RedBoot> fis create -b 0x800000 -l 0x300000 -f 0x60040000 -e 0x800000 -r 0x80000
0 ramdisk.gz
An image named 'ramdisk.gz' exists - continue (y/n)?y
... Erase from 0x60040000-0x60340000: ........................
... Program from 0x00800000-0x00b00000 at 0x60040000: ........................
... Unlock from 0x607e0000-0x60800000: .
... Erase from 0x607e0000-0x60800000: .
... Program from 0x01fe0000-0x02000000 at 0x607e0000: .
... Lock from 0x607e0000-0x60800000: .
```

It over writes ramdisk.gz

Now load zImage

```
RedBoot> load -r -v -b 0x80000 zImage
Using default protocol (TFTP)
/
Raw file loaded 0x00080000-0x00230b1f, assumed entry at 0x00080000
```

Now overwrite zimage, It will ask for confirmation, since it already exists. Type y and press enter when asked.

```
RedBoot> fis create -b 0x80000 -l 0x200000 -f 0x60400000 -e 0x80000 -r 0x80000 z
Image
An image named 'zImage' exists - continue (y/n)?y
... Erase from 0x60400000-0x60600000: ................
... Program from 0x00080000-0x00280000 at 0x60400000: ................
... Unlock from 0x607e0000-0x60800000: .
... Erase from 0x607e0000-0x60800000: .
```

```
... Program from 0x01fe0000-0x02000000 at 0x607e0000: .
... Lock from 0x607e0000-0x60800000: .
```

Here we have completed basic procedure to update the zimage and ramdisk.gz files.

To confirm whether the downloaded software works, we need to reset. Issue reset command.

```
RedBoot> reset
... Resetting.
```

The board software will reboot, do not interrupt redboot, let it load the Linux. Wait till you get following message

```
Please press Enter to activate this console.
```

Now press enter. It will display this message. Now, we have running a new Linux software.

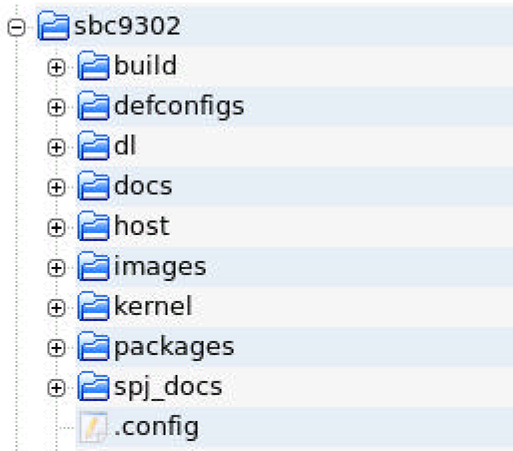
```
BusyBox v1.1.3 (2007.05.14-06:16+0000) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

~ #
```

14 Installation tips for desktop Linux

- Use older machine to install desktop Linux. It is difficult to get all necessary drivers when you install it on a new machine. Usually, manufacturer does not provide motherboard drivers for Linux. Drivers are usually inside the kernel. So it is better to use latest Linux distribution, so that we get all necessary drivers. Supplied Linux distribution was compiled in Apr07. So it is safe to use a PC, which was purchased before that. (Linux installation is supplied on, as it is basis and we are not supporting the same, users are free to use any Linux distribution.)
- Use Supplied DVD-ROM disk and install Mandriva Linux 2007.1, which includes necessary packages for development.
- Allocate at least 15-20GB free space for installation. Recommended sizes are: 8GB for root partition, 1.5GB for swap and 5-10GB for home partition.
- During installation there is an option to copy entire installation media to hard disk. Choose this option(It consumes 3-4GB from root partition).
- Keep selected packages. Additionally select entire development package during package selection. If you have second CD-ROM driver, you can as well load packages list (package_list.pl) from supplied CD-ROM. Packages can be also added, later after installation
- Create a separate login account for development. Do not use root login for general use. Switch to root login, only when it is necessary. Root has full permissions to the computer and you may destroy system files accidentally.
- If you have never worked in command line environment, go through the Linux documentation on internet to understand common terminal commands like cd, pwd, mkdir, ls, rm, cp, mv etc.
- Most users prefer dual boot installation. (Windows and Linux) thus you don't need extra computer. But it is painful to switch between windows and Linux frequently.
- After installation is finished, reboot and login as a new user (say your user id is user1).

15 Workspace contents:

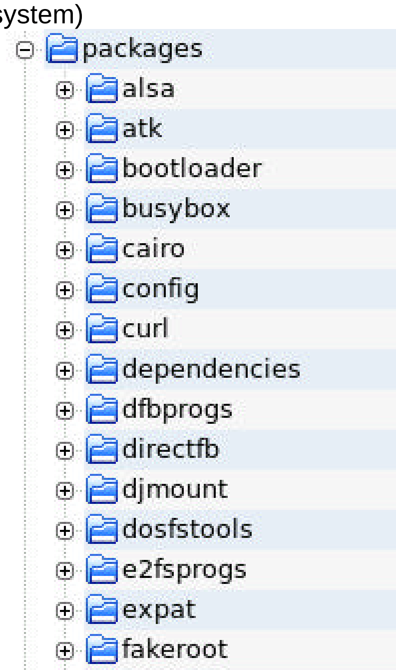
Lets have a look at our workspace. Open Home folder in file manager.
Goto /home/user1/sbc9302 in terminal



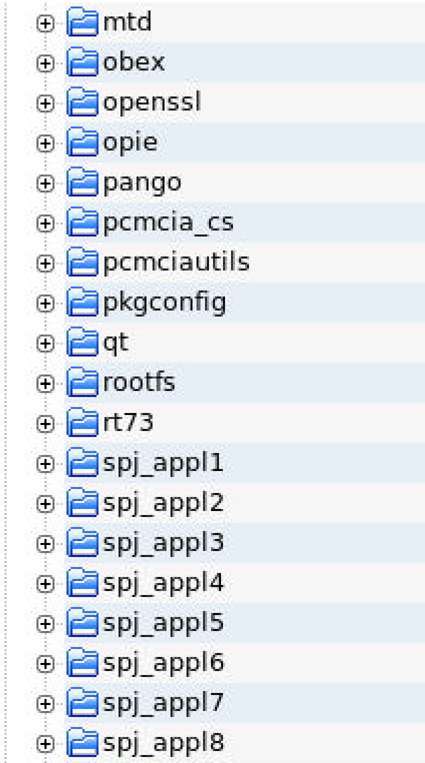
The contents of subfolders are.

build - Temporary folder where files are copied and built.
kernel - Linux kernel source directory. Kernel source is extracted and configured here.
Images - Linux images generated after build.
host - Folder for using configuration tools on host.
docs - Documentation from cirrus logic.
dl - Folder for saving downloaded source files.
spj_docs - Documentation from spj systems.
defconfigs – pre-defined kernel configurations from cirrus logic.
packages – contains user applications. A sample application is available under spj folder

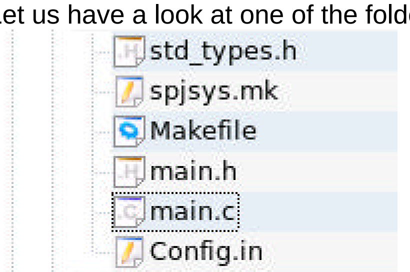
In packages folder, there are a lot of packages available. These packages will go to the ramdisk.gz file(root file system)



Go further in the packages folder. There we have lot of example applications. These examples are very simple and easy to understand. Users can modify, replace their own applications.



Let us have a look at one of the folder.



We have a sample linux application in this folder. A file main.c and other header files when compiled, generate an application called as spj_appl1. This application is located in /sbin folder on the SBC9302 board.

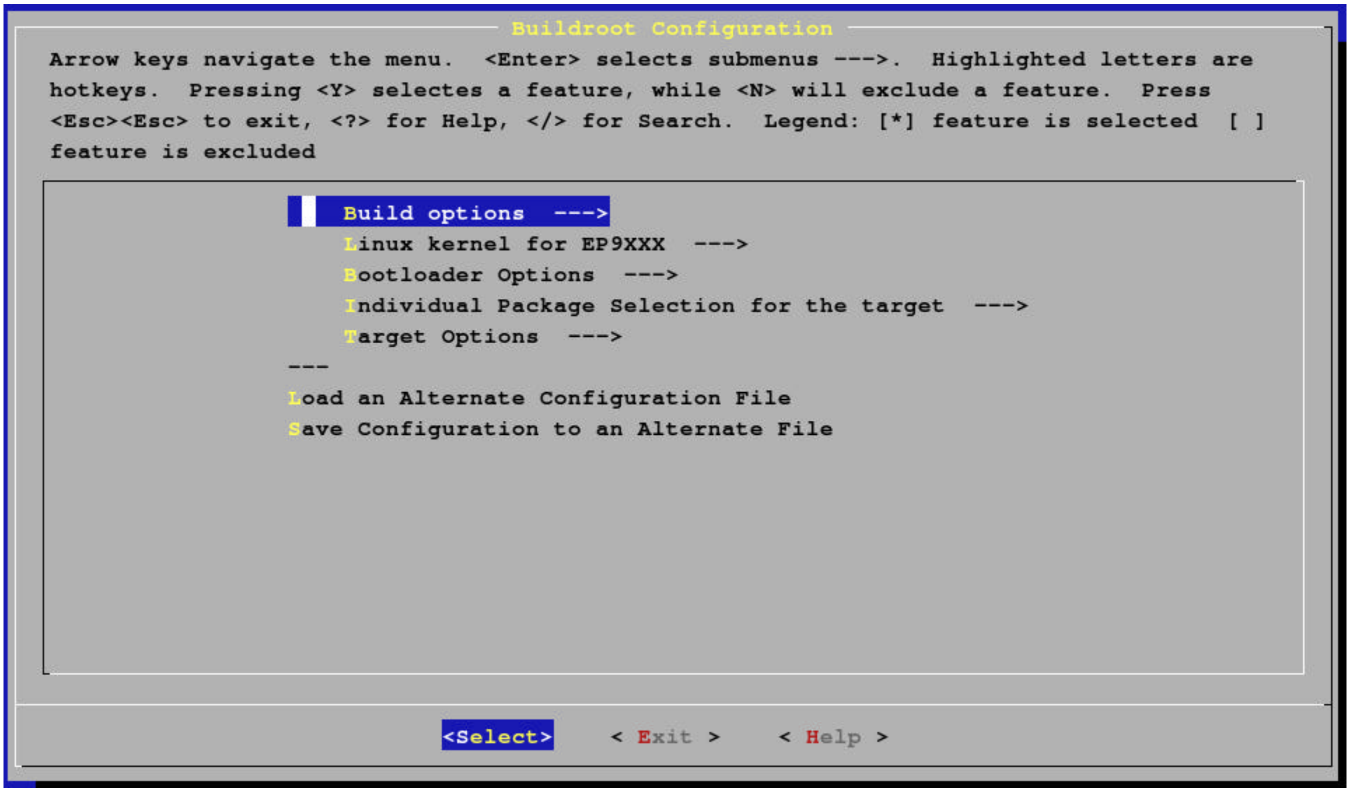
We can run this application from minicom terminal window as.

```
~ #spj_appl1
```

16 Workspace Configuration

Goto workspace folder sbc9302 with terminal window maximized

On command prompt type *make menuconfig*, it will display following configuration menu.



Select/add/remove/modify the configuration,. Save configuration and exit.

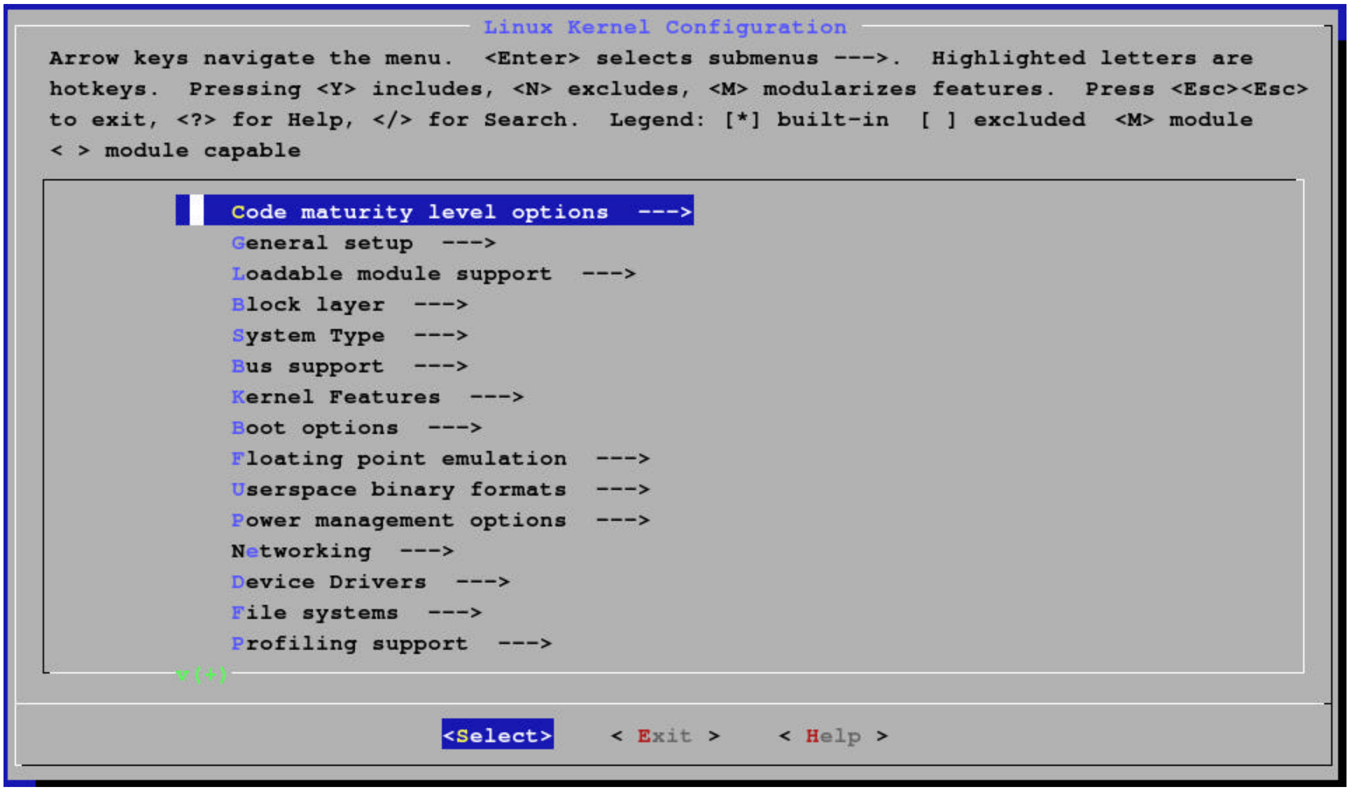
To build with new configuration, just type *`make`* and press enter.

This graphical configuration tool allows us to change the ramdisk options, thus having tight control over size of ramdisk.gz.

17 Kernel Configuration

Goto workspace folder sbc9302->kernel->linux-2.6.*
with terminal window maximized

On command prompt type *`make menuconfig`*, it will display similar configuration menu as displayed above.



Here we can add/modify/remove Linux kernel features. This graphical configuration tool allows us to change the kernel options, thus having tight control over size of zImage.