# RoBoard RB-100 Hardware Introduction

DMP Electronics Inc

Robotic Division

Aug 2010

# Agenda

- DMP SoC Family
- RB-100 Overview
- Hardware Introduction
- Accessory
- Application
- Q & A

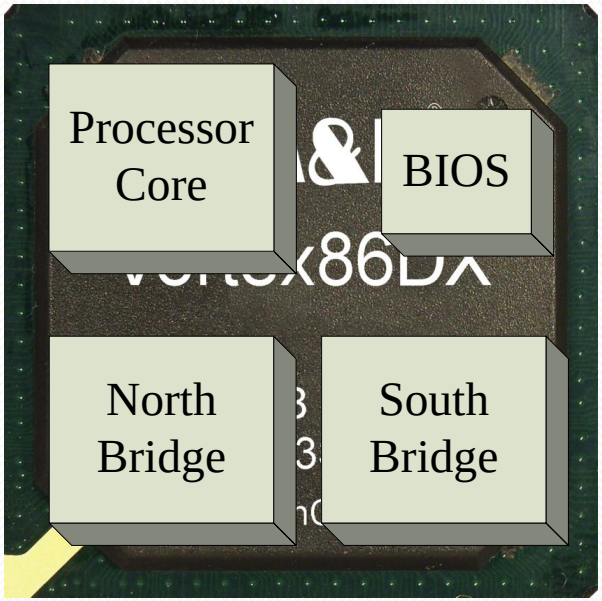
# DMP’s SoC Family

- Jul. 1998
- 386 – 40MHz
- 0.50 um process

- Feb. 2007
- 486 – 300MHz
- 0.13 um process

- Aug. 2008
- 486 – up to 1GHz
- 90 nm process

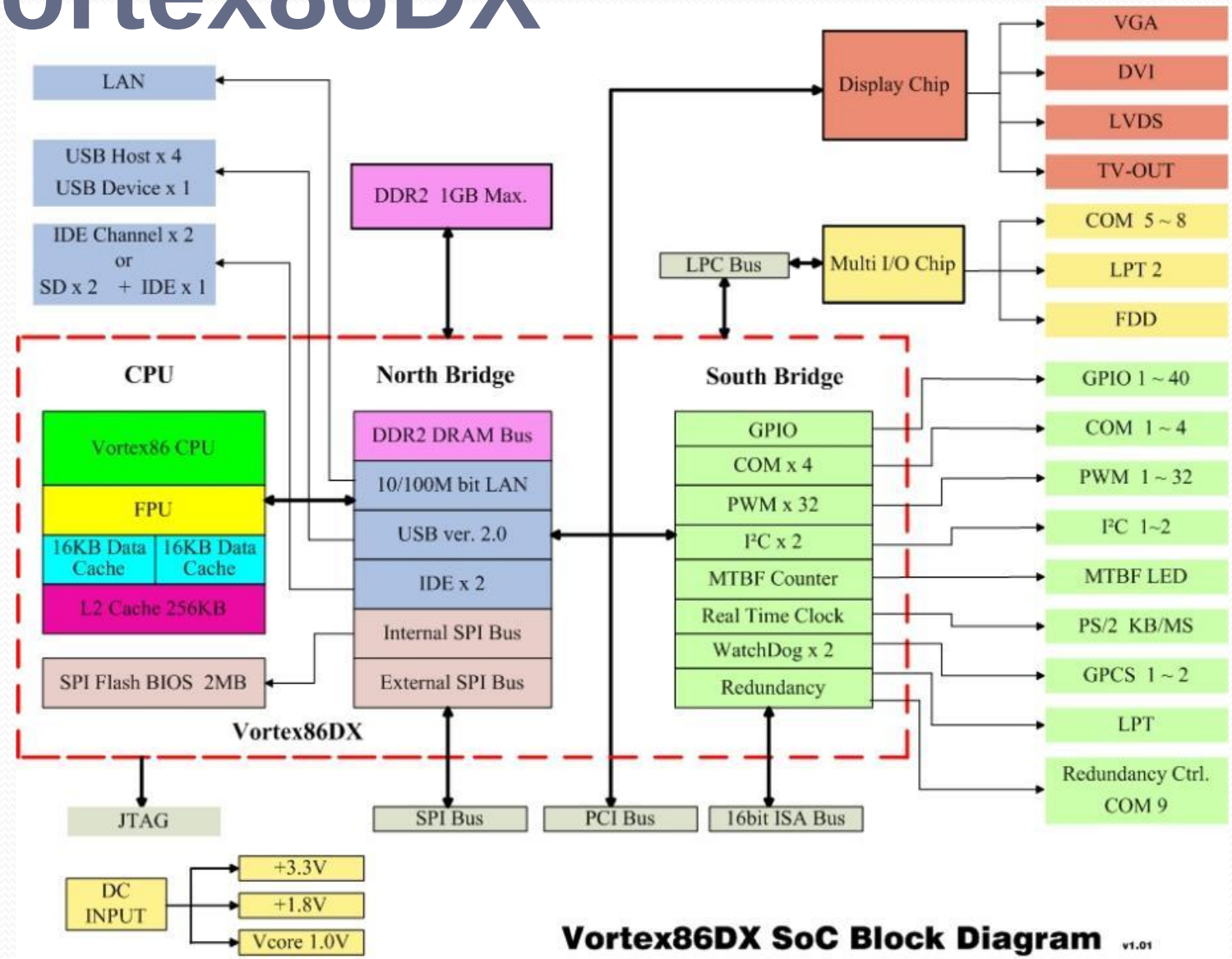
# Vortex86DX




4 in 1 SoC

- x86 Legacy Support
- Unique function for future Embedded
- Power Consumption, 2.3Watt@800MHz
- 10 Years Life Cycle , 2008~2017
- Best C/P Ratio ( Cost / Performance )

# Vortex86DX


LAN
USB Host x 4
USB Device x 1
IDE Channel x 2
or
SD x 2 + IDE x 1
DDR2 1GB Max.
Display Chip
VGA
DVI
LVDS
TV-OUT
LPC Bus
Multi I/O Chip
COM 5 ~ 8
LPT 2
FDD
CPU
North Bridge
South Bridge
Vortex86 CPU
FPU
16KB Data Cache
16KB Data Cache
L2 Cache 256KB
SPI Flash BIOS 2MB
DDR2 DRAM Bus
10/100M bit LAN
USB ver. 2.0
IDE x 2
Internal SPI Bus
External SPI Bus
GPIO
COM x 4
PWM x 32
I²C x 2
MTBF Counter
Real Time Clock
WatchDog x 2
Redundancy
GPIO 1 ~ 40
COM 1 ~ 4
PWM 1 ~ 32
I²C 1~2
MTBF LED
PS/2 KB/MS
GPCS 1 ~ 2
LPT
Redundancy Ctrl.
COM 9
Vortex86DX
JTAG
SPI Bus
PCI Bus
16bit ISA Bus
DC INPUT
+3.3V
+1.8V
Vcore 1.0V
Vortex86DX SoC Block Diagram v1.01

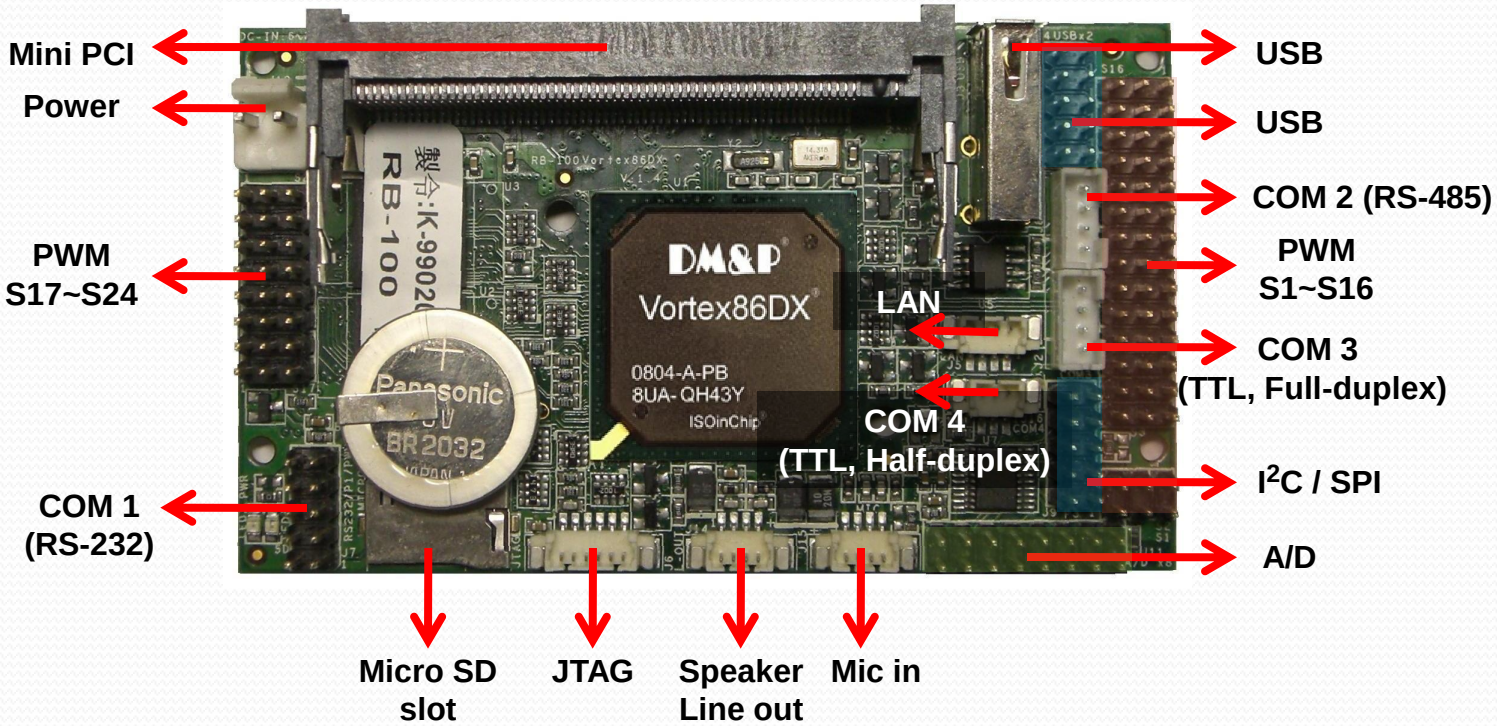
# OVERVIEW

# RoBoard RB-100

- Powerful, Tiny **Computer** dedicated to robotics applications
- Based on the **Vortex86DX**, a 32bit x86 CPU running at 1000MHz with 256MB DRAM
- Compatible with Windows, Linux and DOS
- Open Source C++ Library for RoBoard‘s unique I/O functions (sensors, actuators, etc.)

# RoBoard RB-100

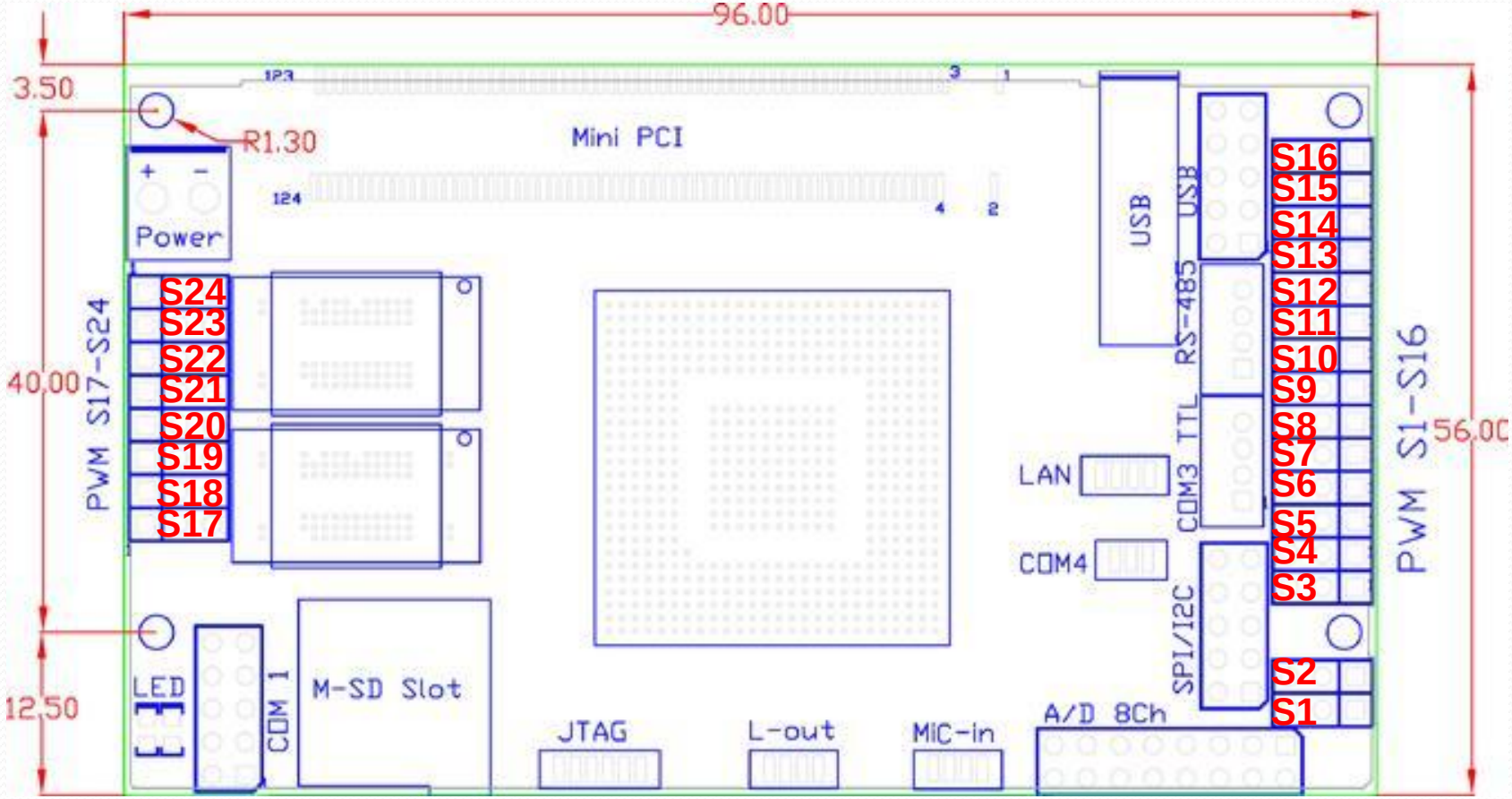
Size: 96 x 56mm



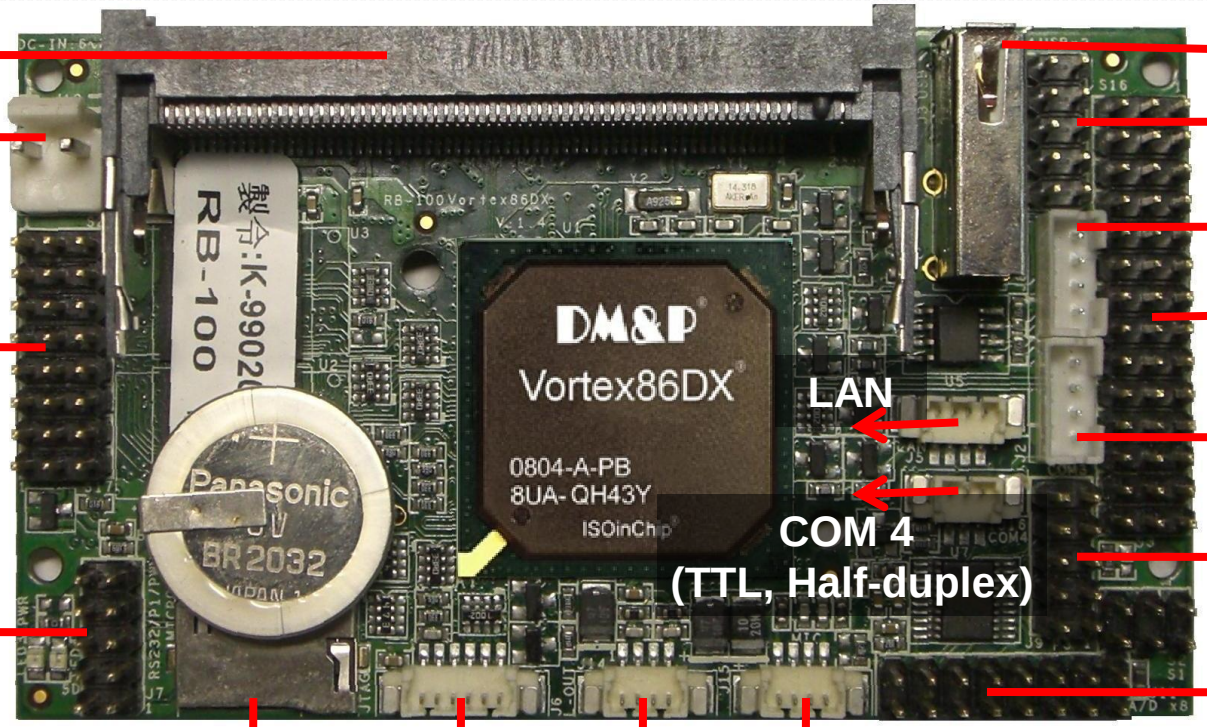

1. 1000MHz, 256MB DDR2
2. PC compatible
3. Build in PWM/GPIO 24Ch
4. USB v2.0 ports × 3
5. TTL COM ports × 2
6. RS-232 port × 1
7. RS-485 port × 1
8. $I^2C$ Bus
9. SPI Bus
10. Power consumption 5V@400mA (2W)
11. DC 6V-24V

# HARDWARE INTRODUCTION

# Locations

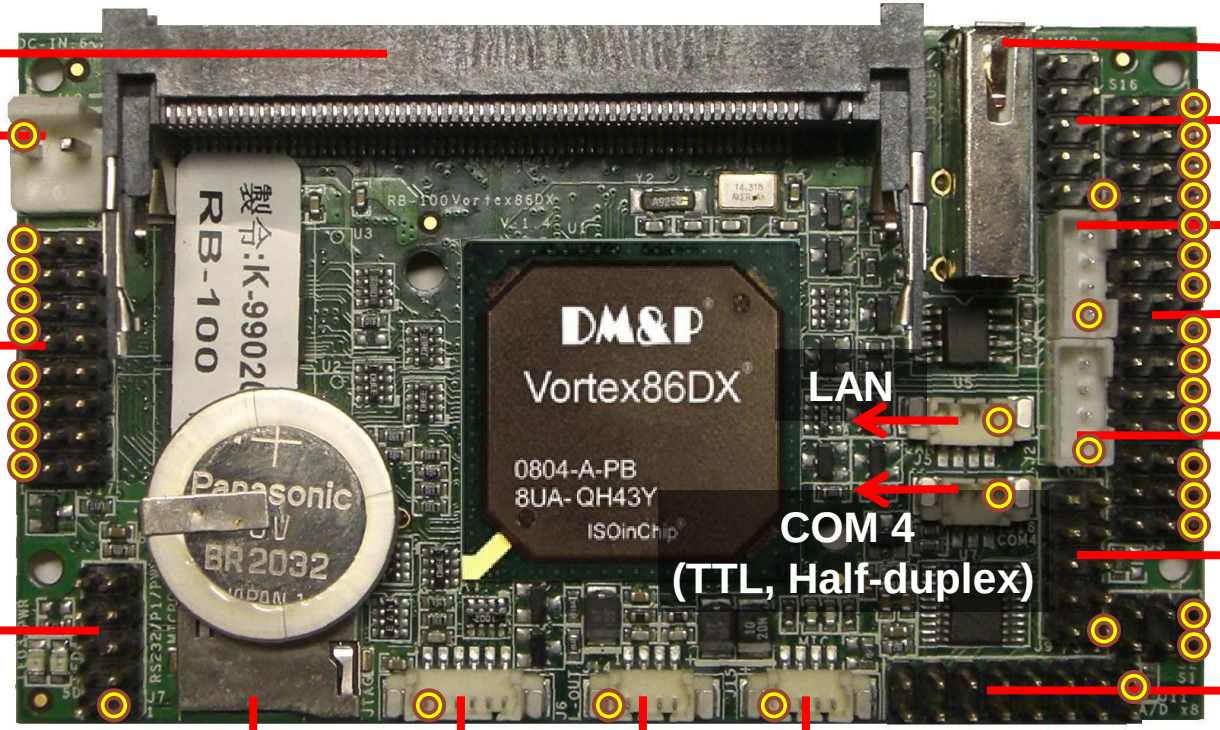

96.00
3.50
R1.30
Mini PCI
Power
+
-
S24
S23
S22
S21
S20
S19
S18
S17
PWM S17-S24
40.00
12.50
LED
COM 1
M-SD Slot
JTAG
L-out
MIC-in
A/D 8Ch
LAN
COM4
USB
USB
RS-485
COM3 TTL
SPI/I2C
S16
S15
S14
S13
S12
S11
S10
S9
S8
S7
S6
S5
S4
S3
S2
S1
PWM S1-S16
56.00

# Locations


Mini PCI
Power
PWM
S17~S24
COM 1
(RS-232)
Micro SD
slot
JTAG
Speaker
Line out
Mic in
USB
USB
COM 2 (RS-485)
PWM
S1~S16
COM 3
(TTL, Full-duplex)
I²C / SPI
A/D
LAN
COM 4
(TTL, Half-duplex)
DM&P
Vortex86DX
0804-A-PB
8UA-QH43Y
RB-100
Panasonic
BR2032

# Pin 1 Location

: Pin 1




Mini PCI

Power

PWM
S17~S24

COM 1
(RS-232)

Micro SD
slot

JTAG

Speaker
Line out

Mic in

LAN

COM 4
(TTL, Half-duplex)

USB

USB

COM 2 (RS-485)

PWM
S1~S16

COM 3
(TTL, Full-duplex)

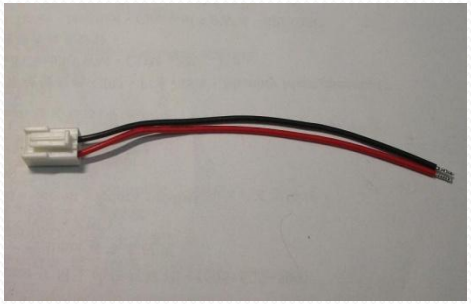
$I^2C$ / SPI

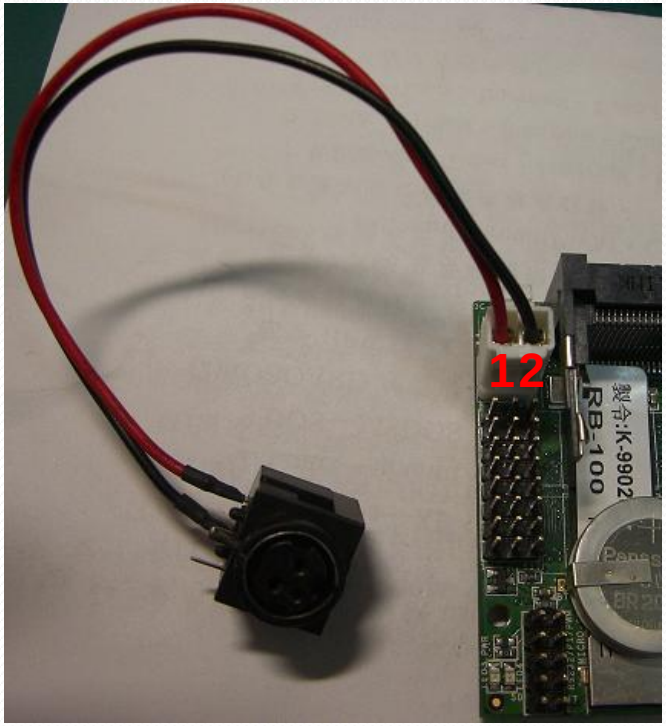
A/D

# Power connector

- DC 6V- 24V

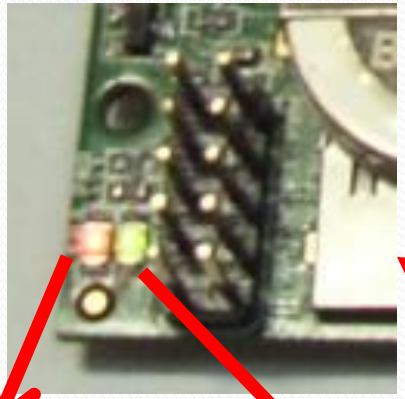
| Pin # | Signal Name | Line Color |
|---|---|---|
| 1 | Vxx | Red |
| 2 | GND | Black |





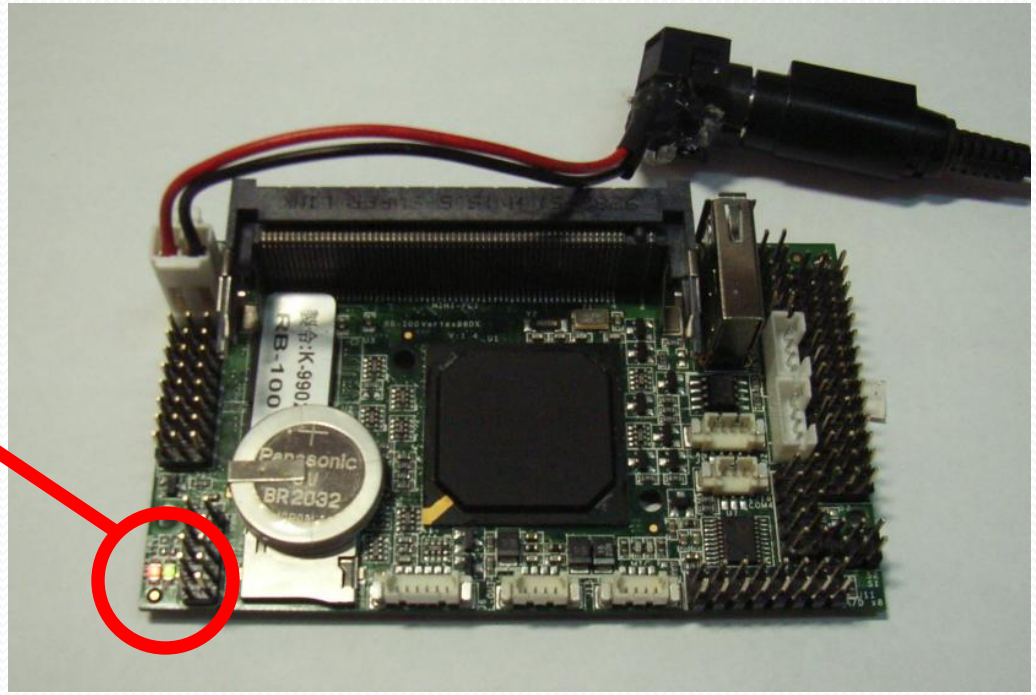
# Power connector

After connecting the Power/HD LED will light



Power LED

Hard disk LED
(MicroSD card)



# Hard Disk: MicroSD

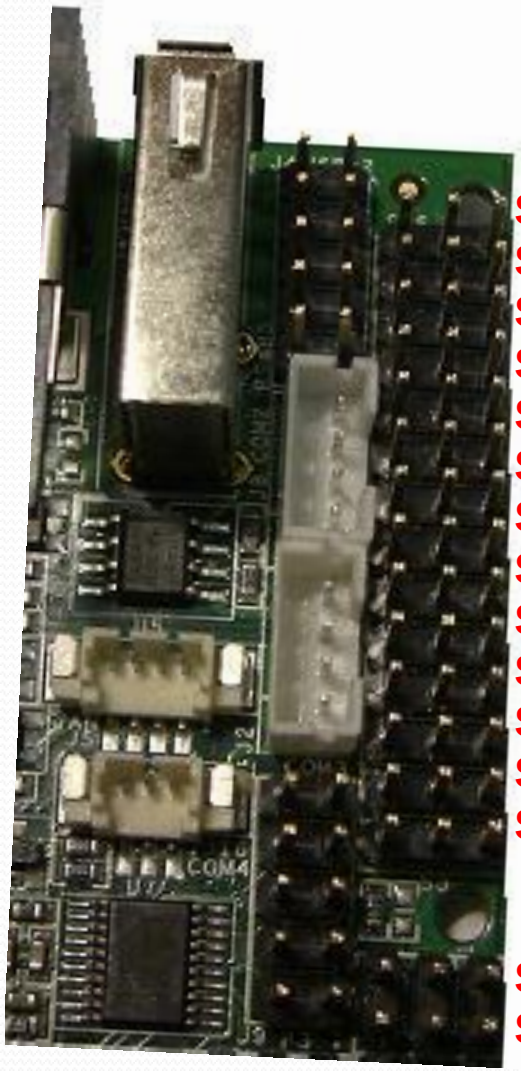
- As a hard disk, the MicroSD's speed affects RoBoard's performance dramatically.
  - A low-class MicroSD can make RoBoard boot/run very slowly.
- **Suggestions**
  - The speed of MicroSD should be at least **Class 6**.
  - Use MicroSD from credible manufacturers (e.g., SanDisk, Toshiba, …)

# PWM 24ch

| Pin # | Signal Name |
|---|---|
| 1 | GND |
| 2 | Vxx |
| 3 | GPXX |

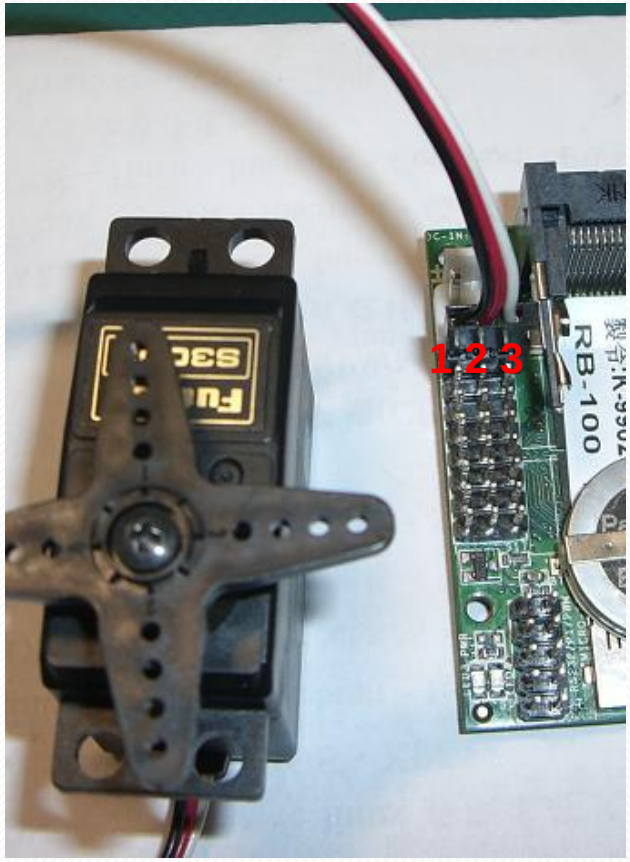
# PWM 24ch

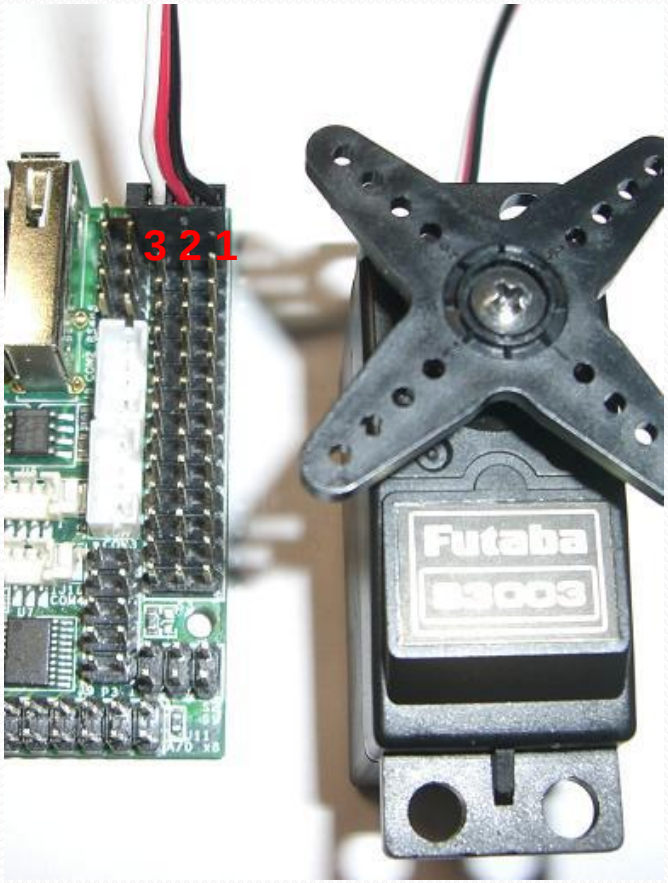
S24
S23
S22
S21
S20
S19
S18
S17
RB-100


S16
S15
S14
S13
S12
S11
S10
S9
S8
S7
S5
S4
S3
S2
S1

# PWM 24ch

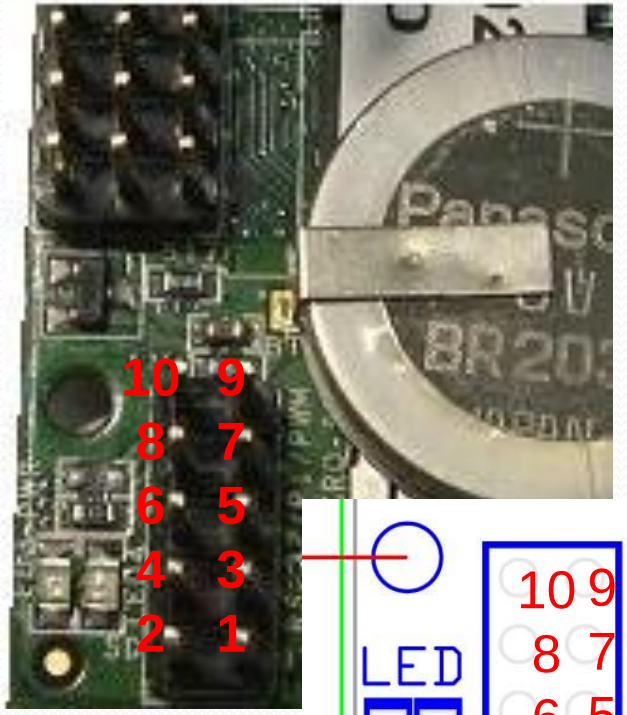
## Connection Example

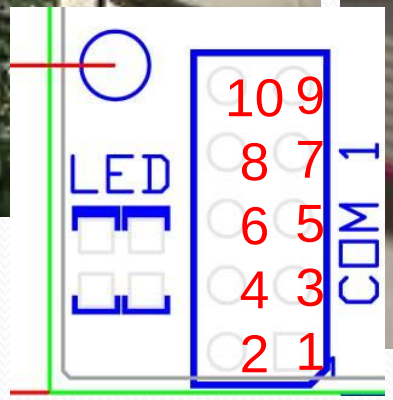


# COM 1 / RS-232

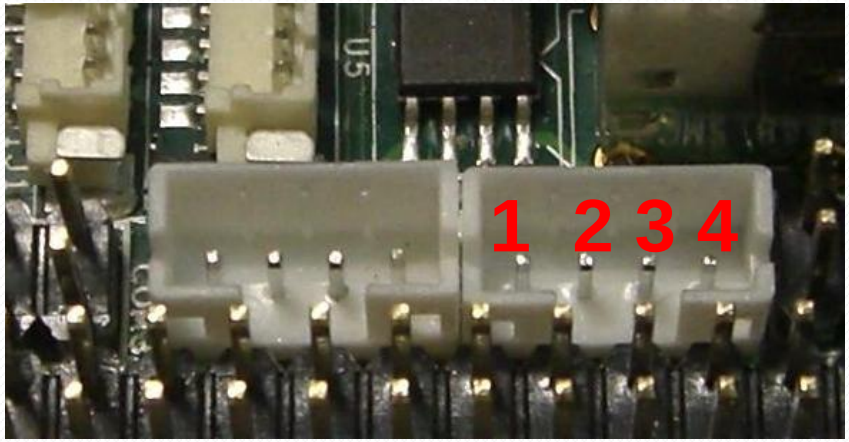
| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | DCD1 | 2 | RXD1 |
| 3 | TXD1 | 4 | DTR1 |
| 5 | GND | 6 | DSR1 |
| 7 | RTS1 | 8 | CTS1 |
| 9 | RI1 | 10 | VCC (5V) |

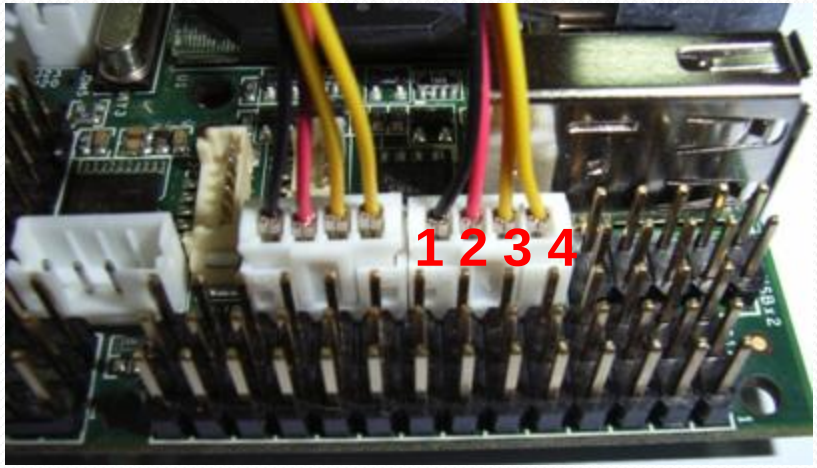


# COM 2 / RS-485

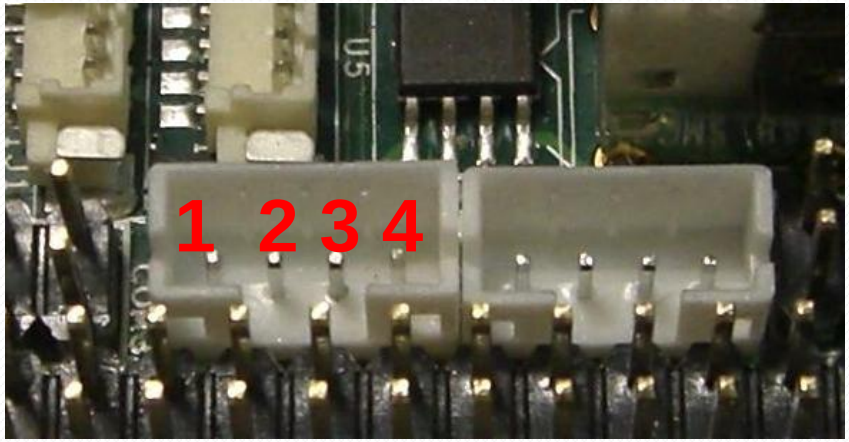
| Pin # | Signal Name | Line Color |
|---|---|---|
| 1 | GND | Black |
| 2 | Vxx | Red |
| 3 | RS485+ | Other |
| 4 | RS485- | Other |

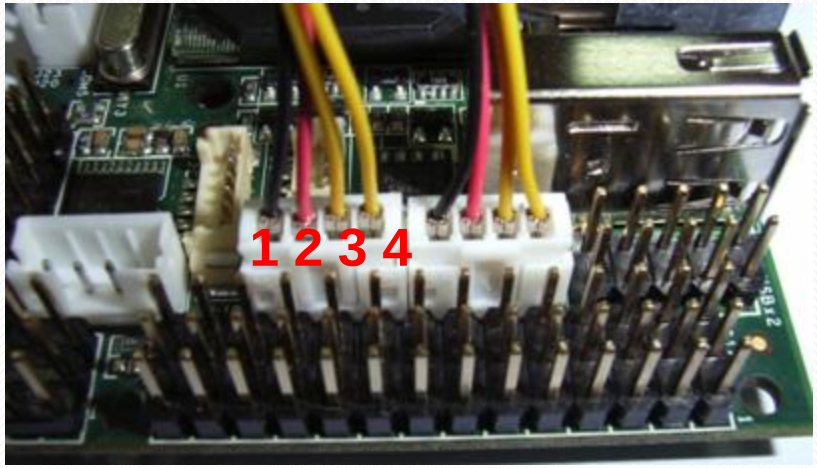


# COM 3 / Full Duplex TTL

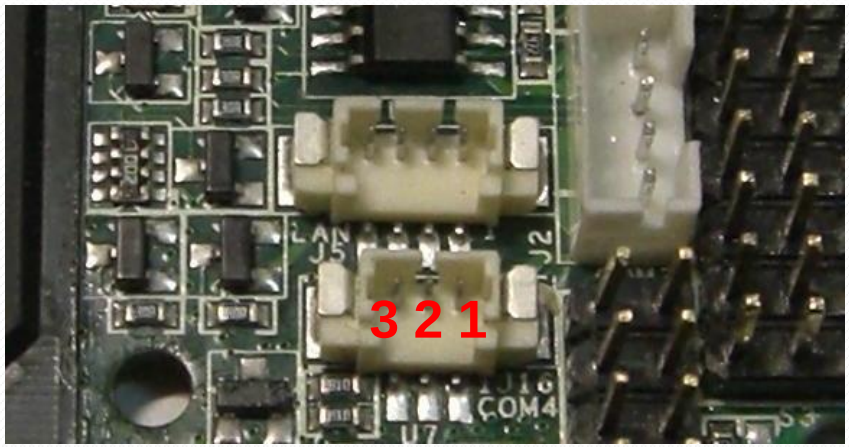
| Pin # | Signal Name | Line Color |
|---|---|---|
| 1 | GND | Black |
| 2 | Vxx | Red |
| 3 | TXD3 | Other |
| 4 | RXD3 | Other |

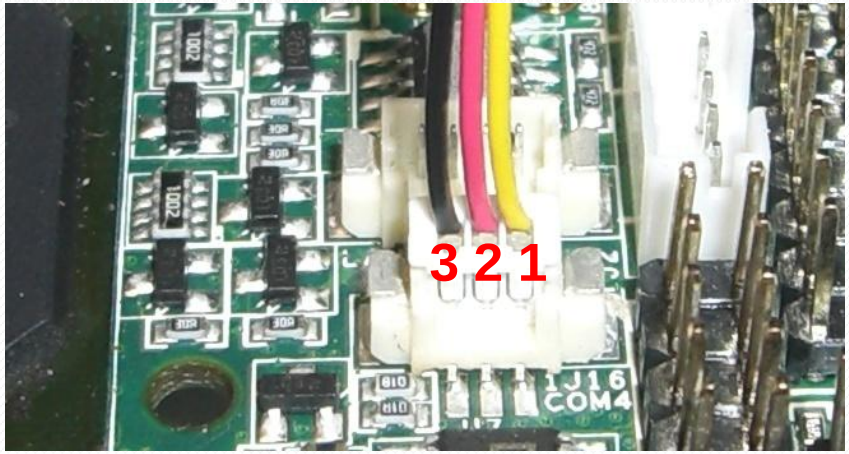


# COM 4 / Half Duplex TTL

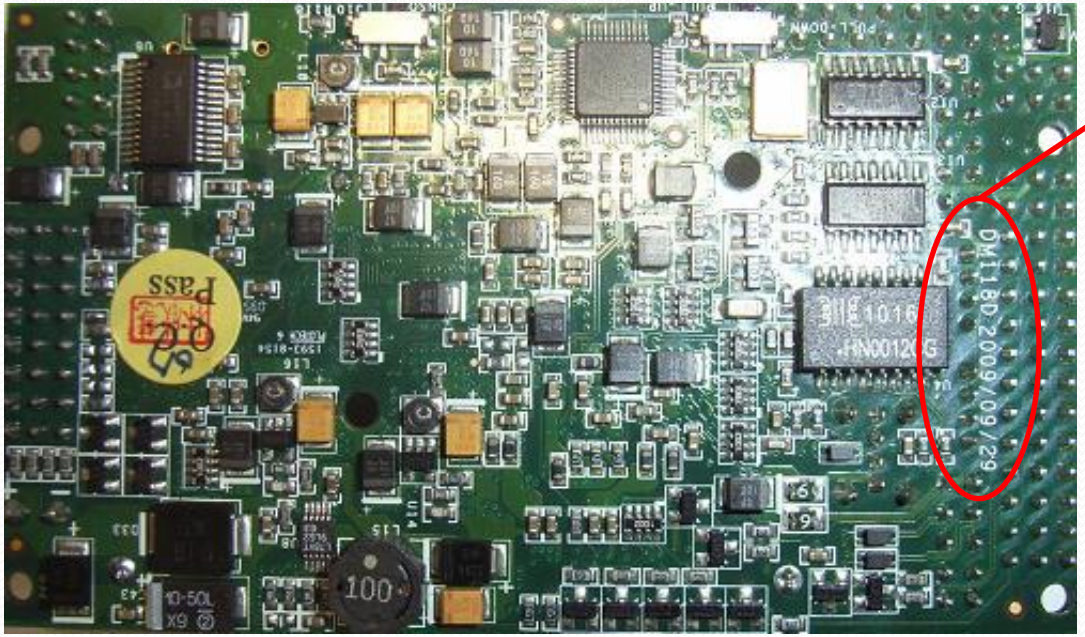
| Pin # | Signal Name | Line Color |
|---|---|---|
| 1 | GND | Other |
| 2 | Vxx | Red |
| 3 | TXRX4 | Black |



# COM 4 / Half Duplex TTL

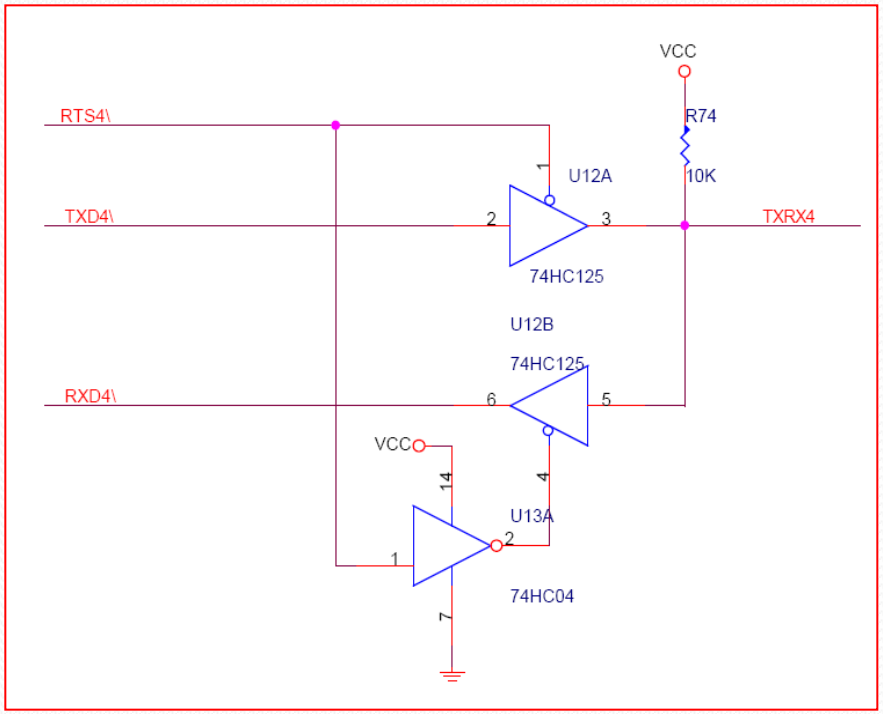
**Remarks:** COM4 has different configurations on different RB-100 models.



You can check the model no. in the bottom side of RB-100.

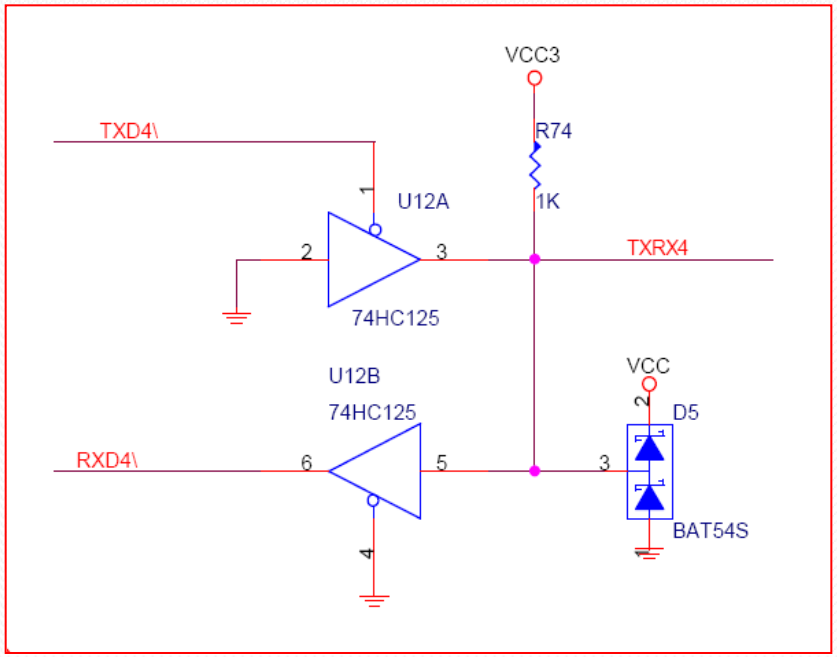
# COM 4 / Half Duplex TTL

- For older models:
  **DM118A/DM118B/DM118C**
  - COM4 is an usual industrial half-duplex port whose data-transfer direction is controlled by RTS signal of COM4.
    - RTS enabled: transfer data
    - RTS disabled: receive data



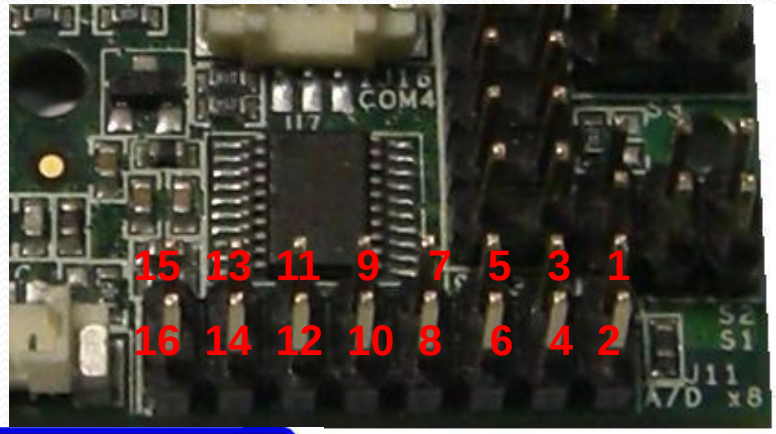
# COM 4 / Half Duplex TTL

- For the newest model:
  **DM118D**
  - COM4 is equivalent to a full-duplex port of TXD/RXD shorted.
  - It is the configuration most compatible to common serial servos, such as Bioloid AX-12 and KONDO KRS-2552HV.

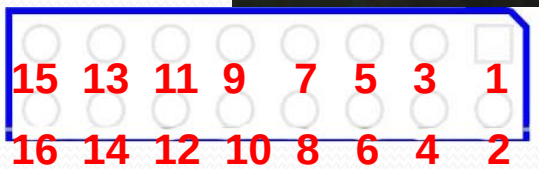


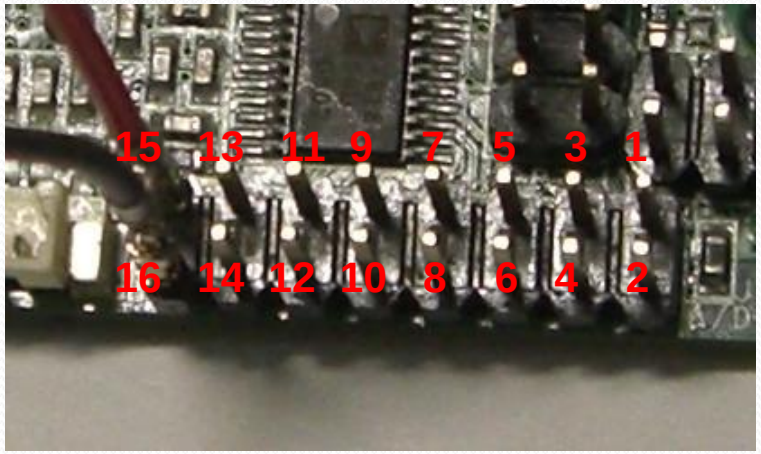
# A/D 8 Ch

| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | AD-VIN0 | 2 | ADGND |
| 3 | AD-VIN1 | 4 | ADGND |
| 5 | AD-VIN2 | 6 | ADGND |
| 7 | AD-VIN3 | 8 | ADGND |
| 9 | AD-VIN4 | 10 | ADGND |
| 11 | AD-VIN5 | 12 | ADGND |
| 13 | AD-VIN6 | 14 | ADGND |
| 15 | AD-VIN7 | 16 | ADGND |



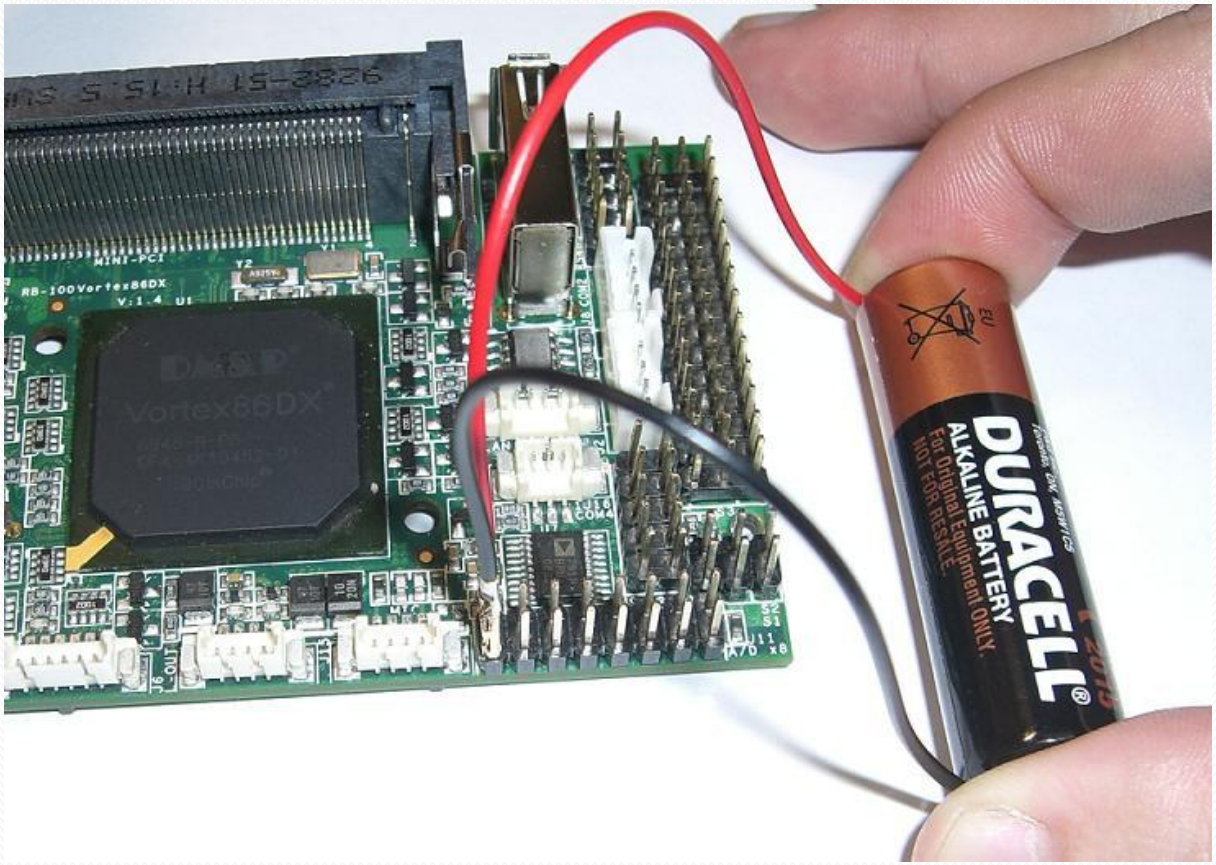

A/D 8 Ch



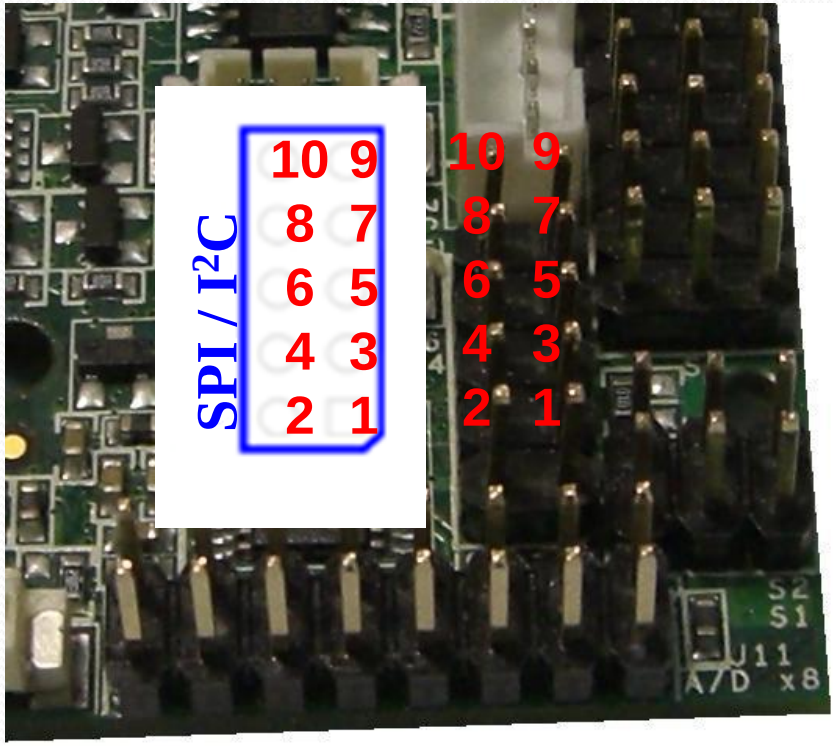
# A/D 8 Ch

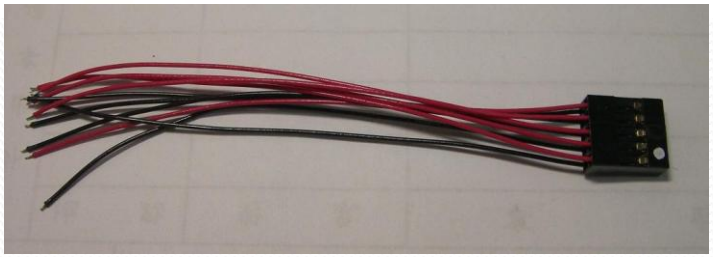
**Connection Example –** Measure battery voltage with A/D Channel7 (AD-VIN7)



# I²C / SPI

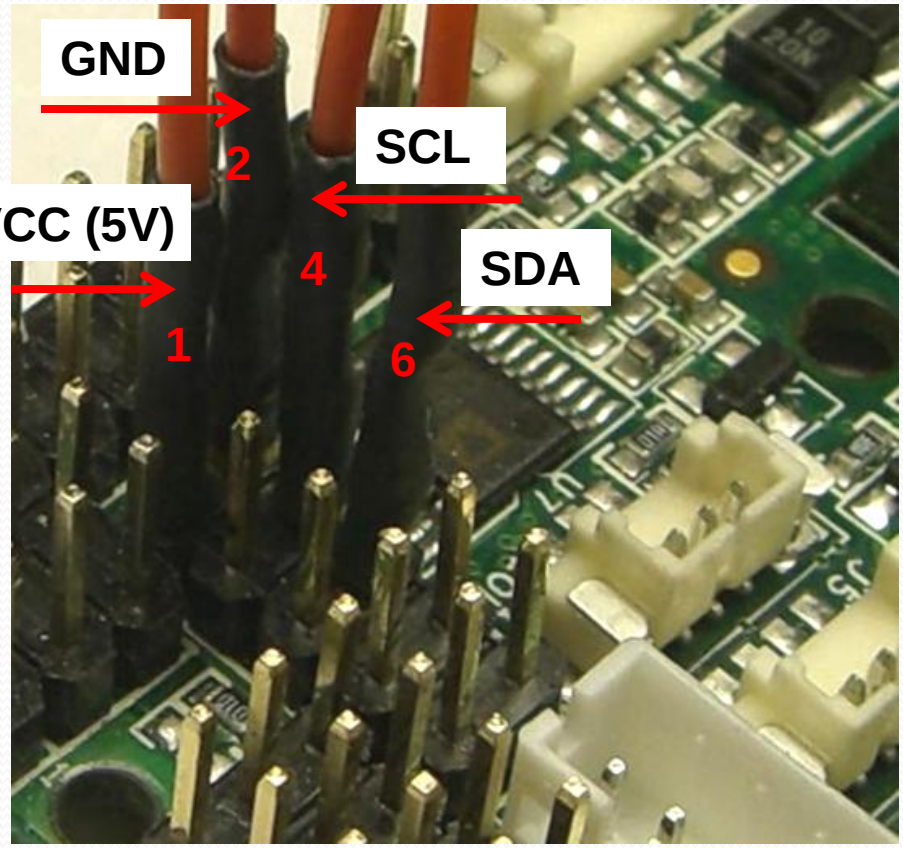
| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | GND | 2 | VCC (5V) |
| 3 | SPICLK (CPOL1, CPHA0) | 4 | I2C0_SCL |
| 5 | SPICLK (CPOL0, CPHA0) | 6 | I2C0_SDA |
| 7 | SPIDO | 8 | Reserved |
| 9 | SPIDI | 10 | SPISS |



# I²C

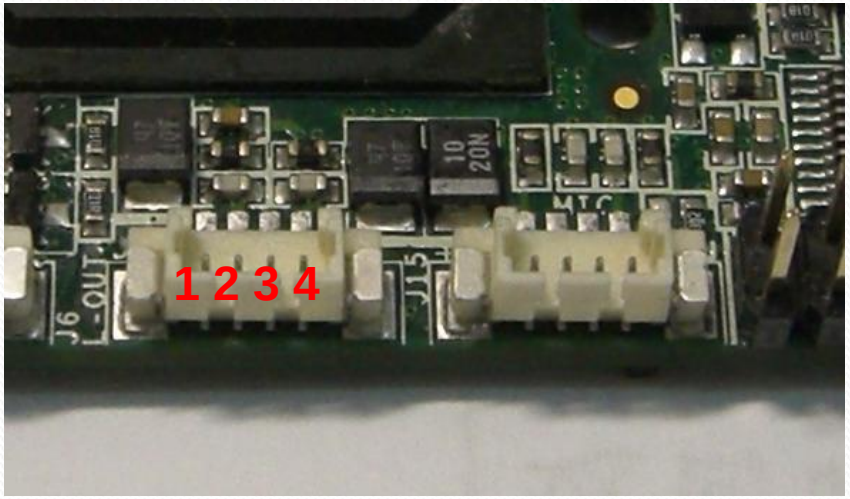
## Connection Example

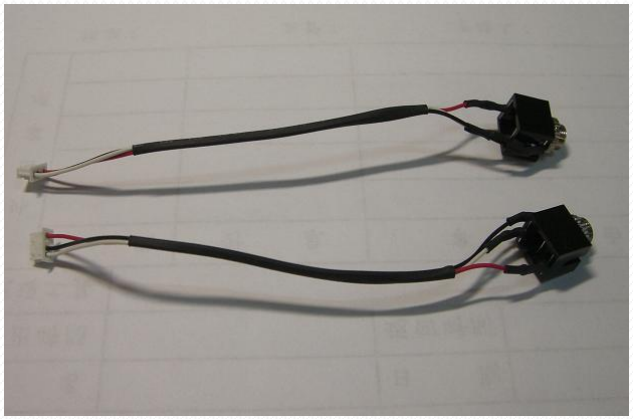


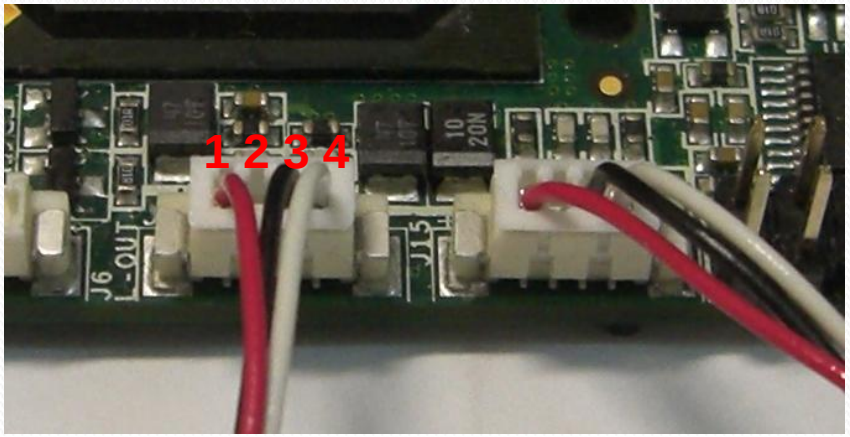
# Audio connector

## Speaker Line Out

| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | LOUTR | 2 | GND |
| 3 | GND | 4 | LOUTL |



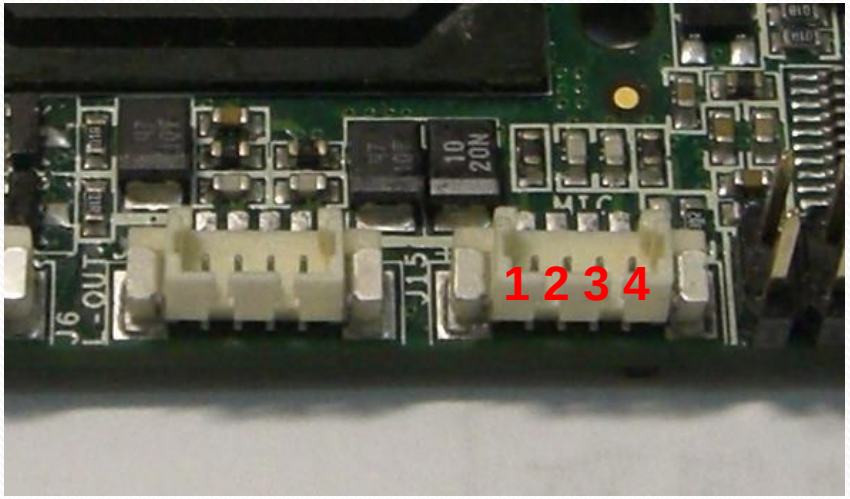



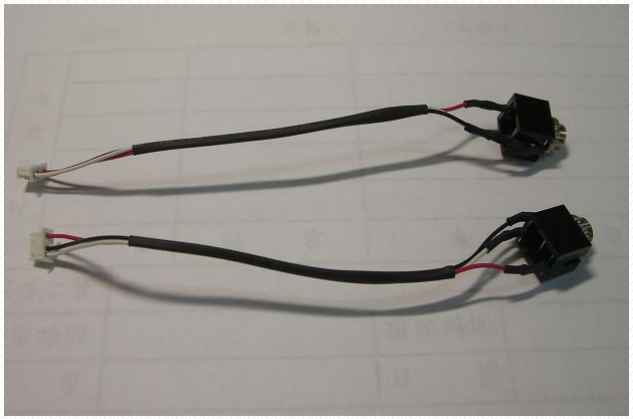


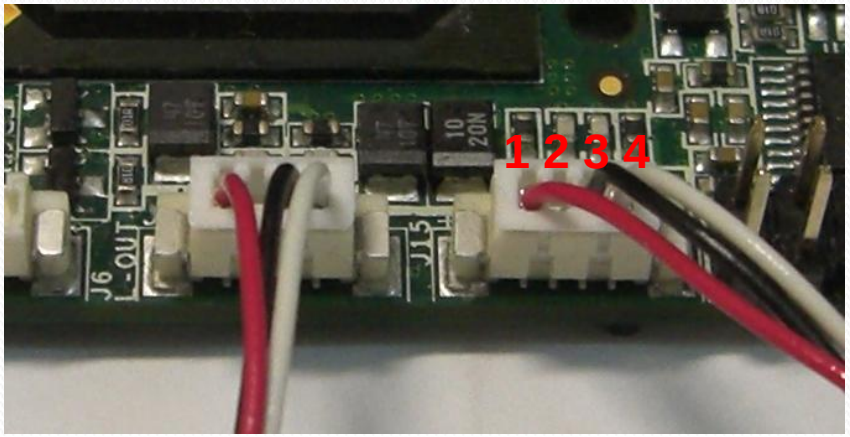
# Audio connector

## Mic in

| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | MICVREF | 2 | GND |
| 3 | GND | 4 | MIC-IN |

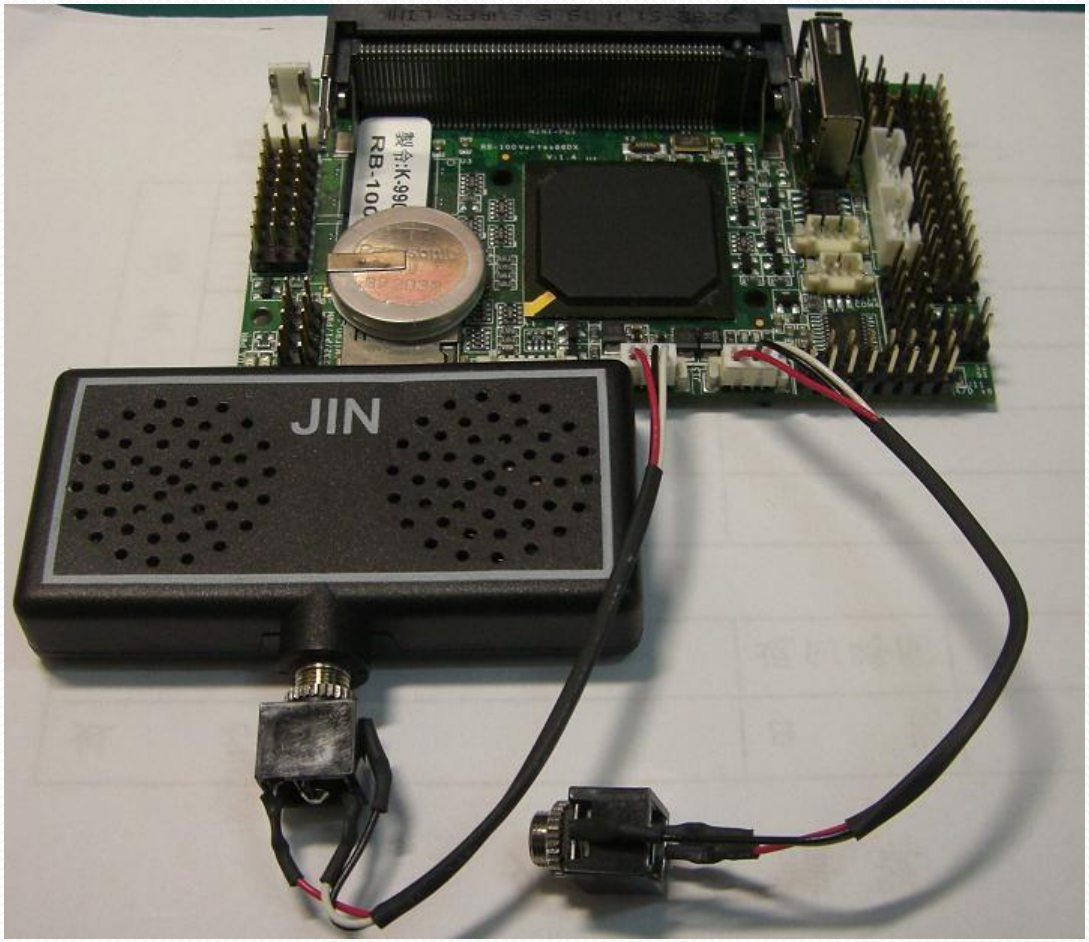




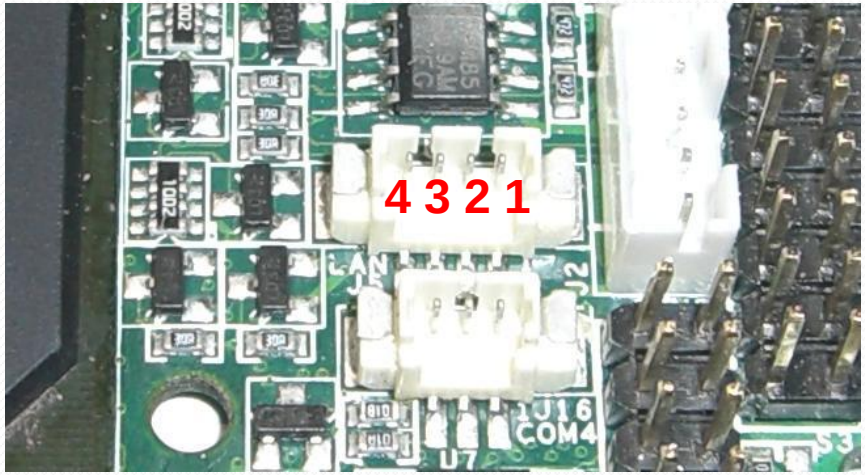
# Audio connector

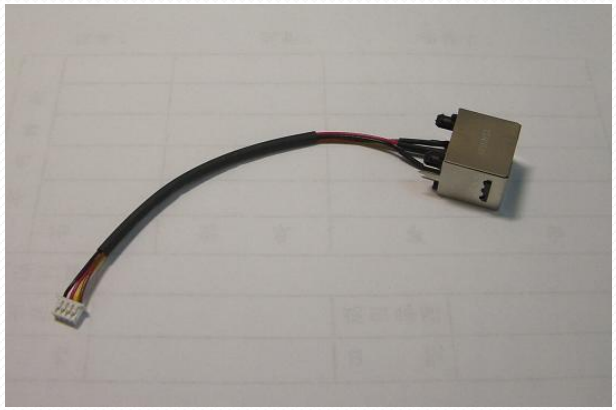
**Connection Example**



# LAN connector

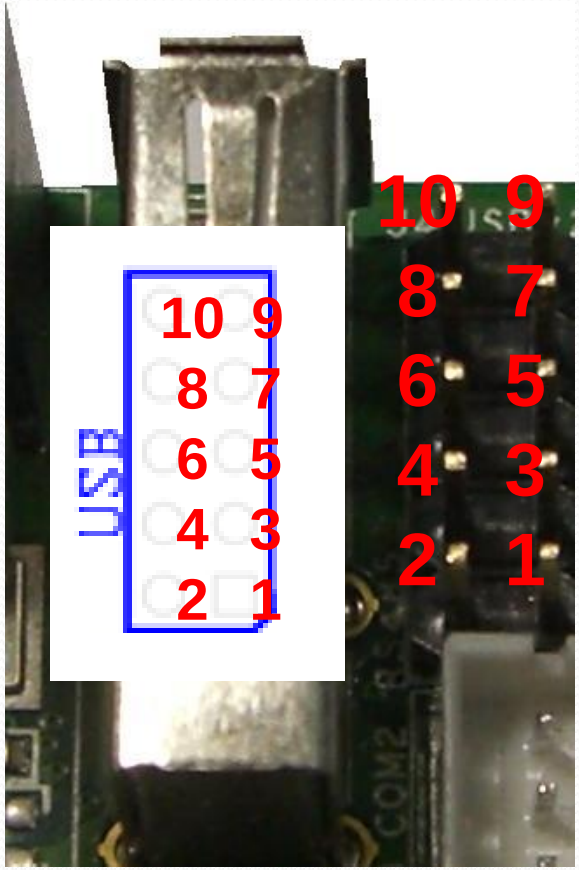
| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | LAN-TX+ | 2 | LAN-TX- |
| 3 | LAN-RX+ | 4 | LAN-RX- |

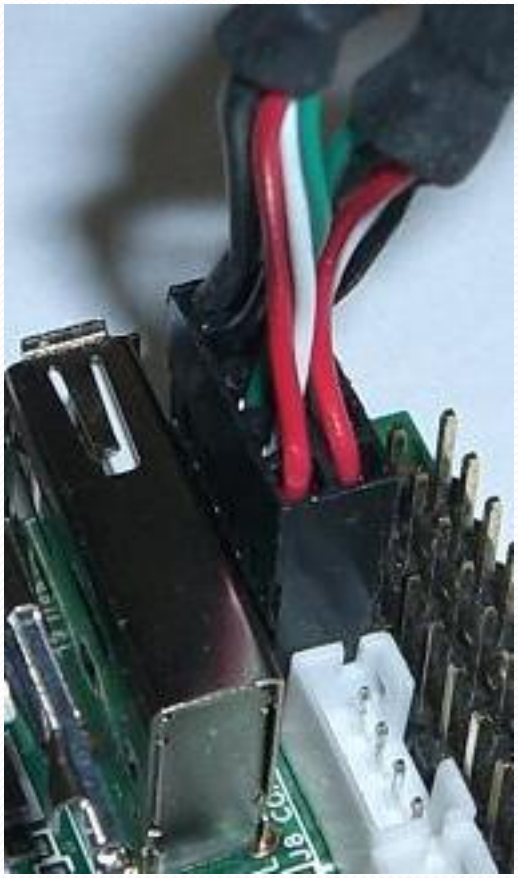


# USB

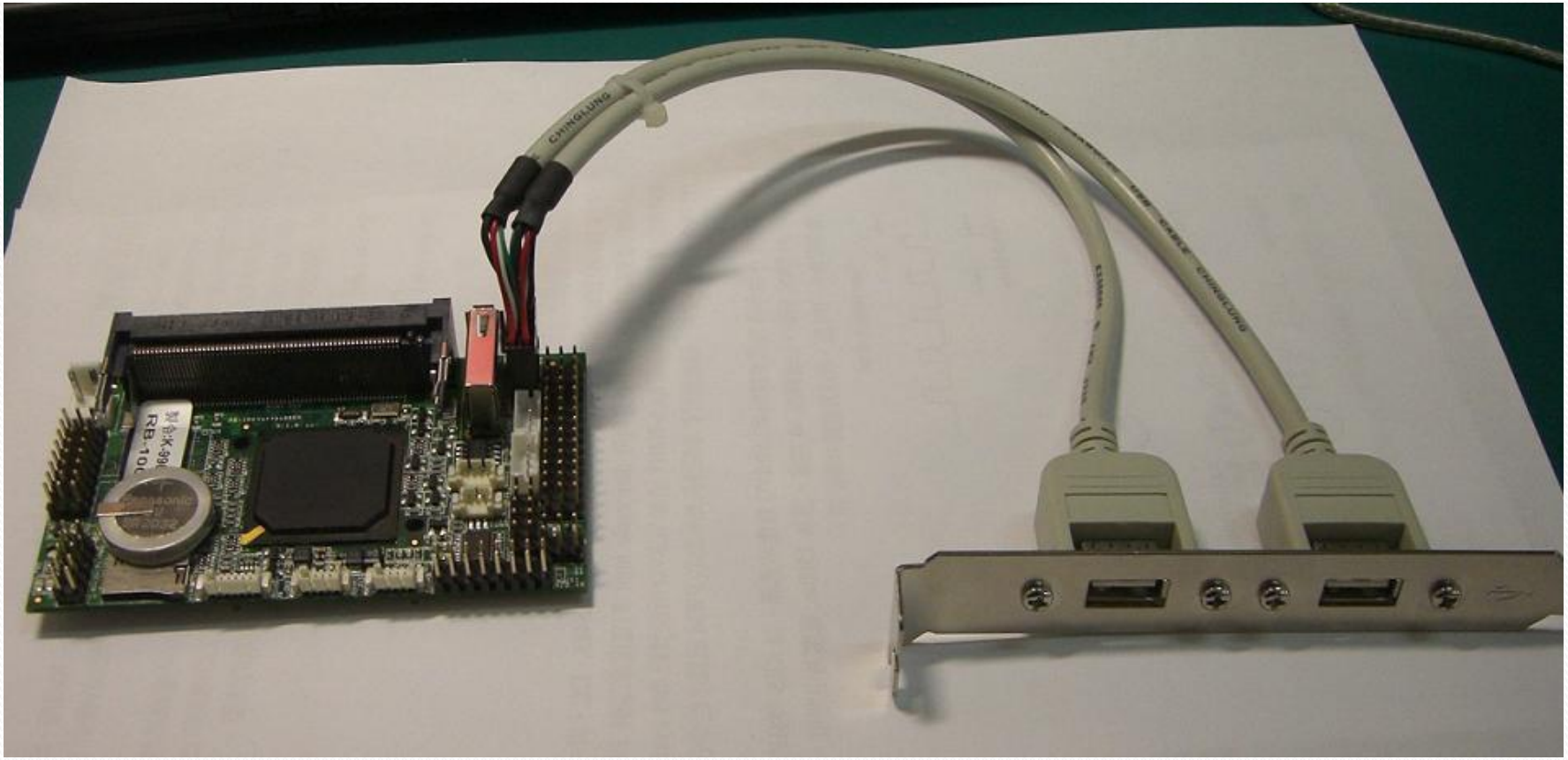
| Pin # | Signal Name | Pin # | Signal Name |
|---|---|---|---|
| 1 | VCC | 2 | VCC |
| 3 | LUSBD0- | 4 | LUSBD1- |
| 5 | LUSBD0+ | 6 | LUSBD1+ |
| 7 | GND | 8 | GND |
| 9 | GGND | 10 | GGND |



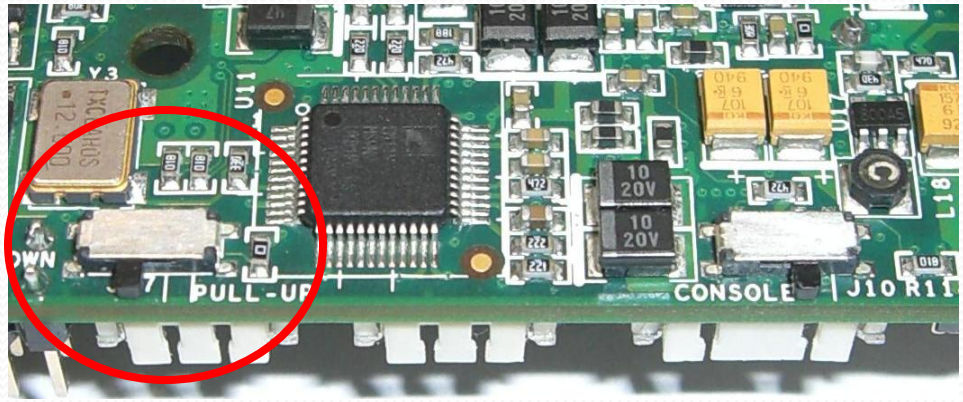
# USB

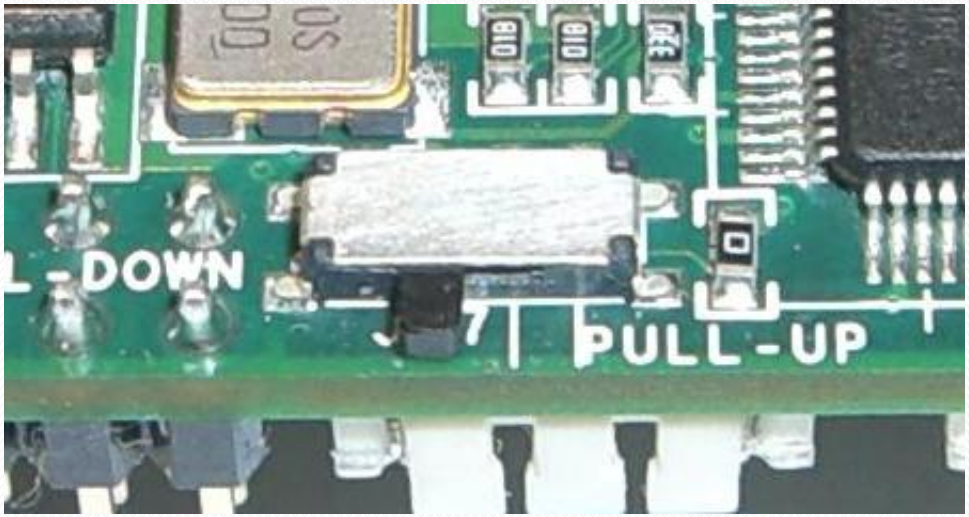
## Connection Example



# PWM Initial pull up/down switch

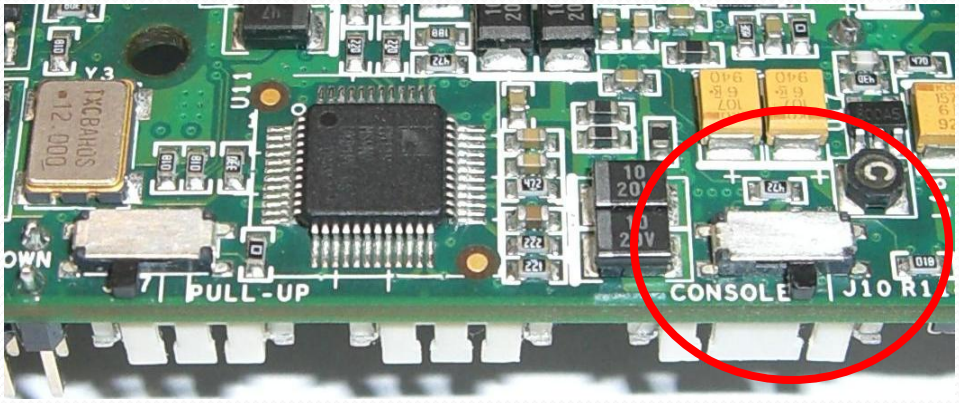
| Pin | Signal Name |
|---|---|
| Left | PWM init Pull Down |
| Right | PWM init Pull UP |

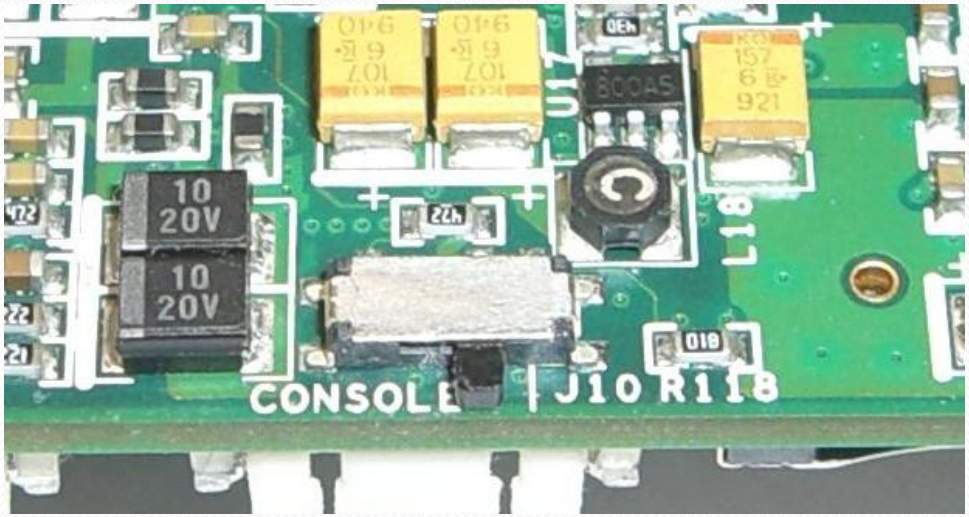


# Console Redirection switch

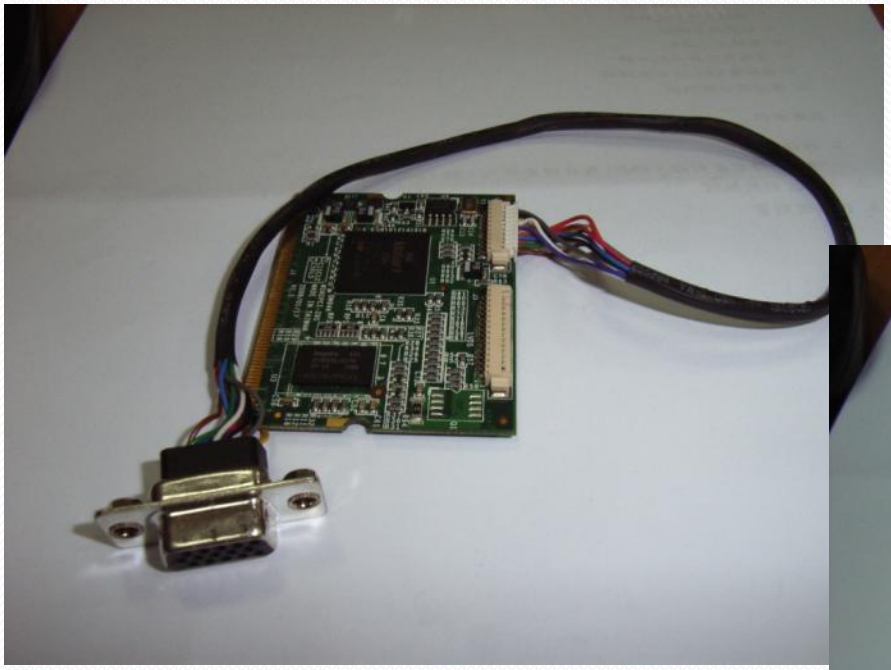
| Pin | Signal Name |
|---|---|
| Left | Console Redirection enable |
| Right | Console Redirection disable |



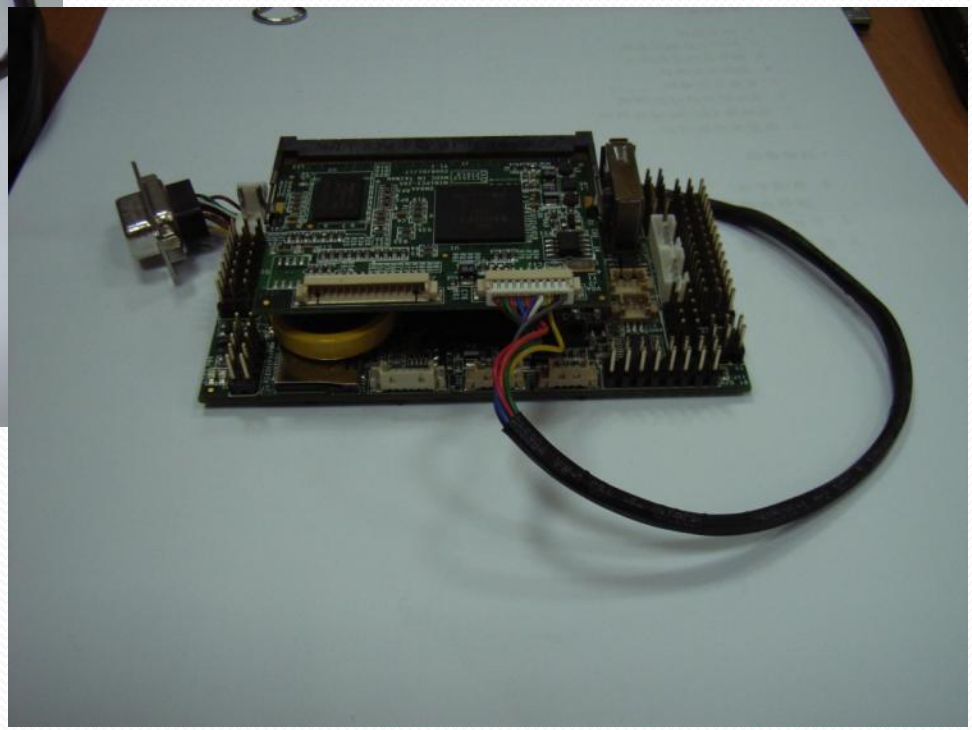



# ACCESSORY

# Mini VGA Card



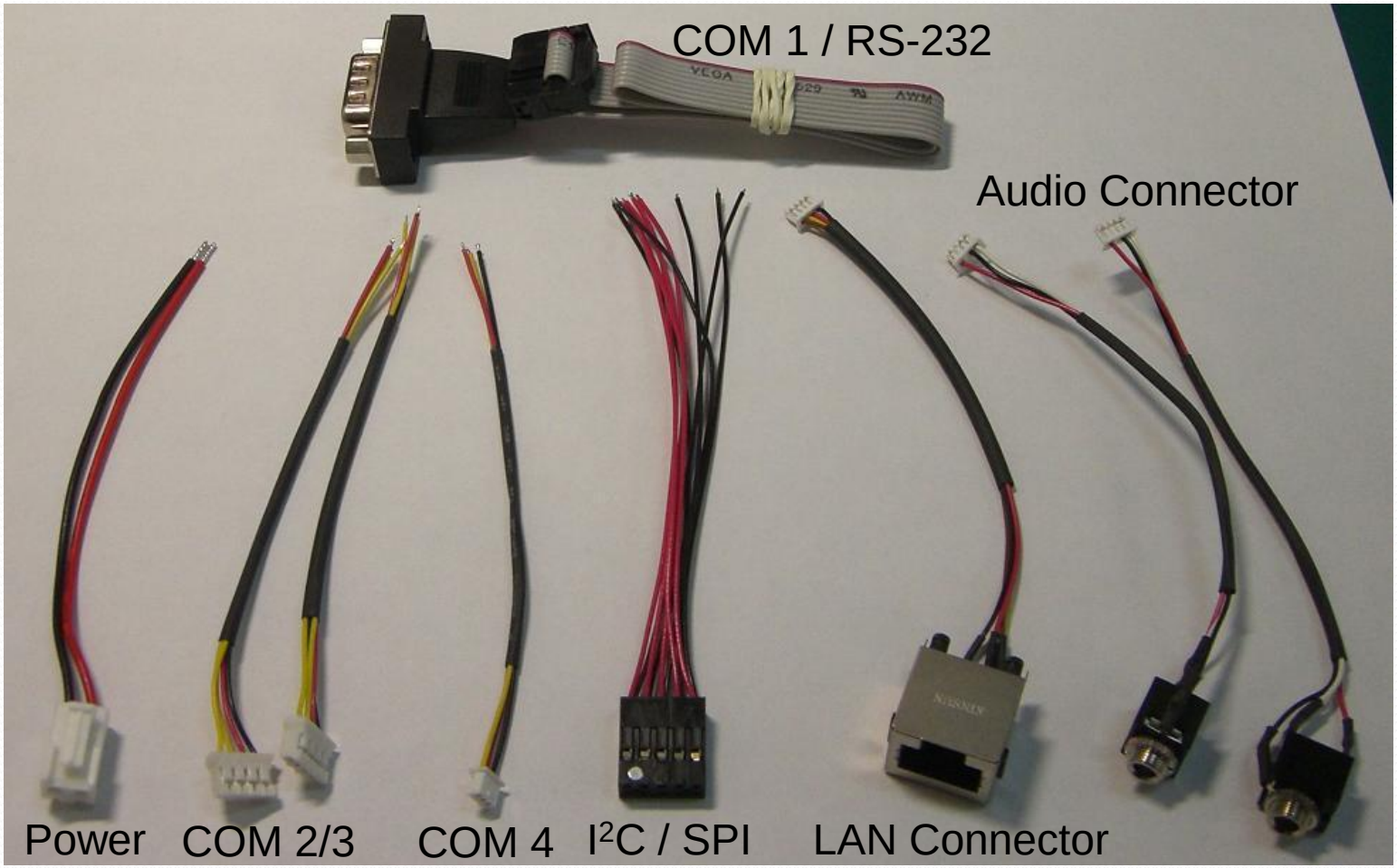
- Volari Z9S VGA Chipset with 32MB DDR2
- Up to 1600 x 1200 @16M Color
- Support Windows 98/2000/XP, Linux



# Mini PCI Wireless Card

- VIA VT6655 Chipset
- 802.11b/g

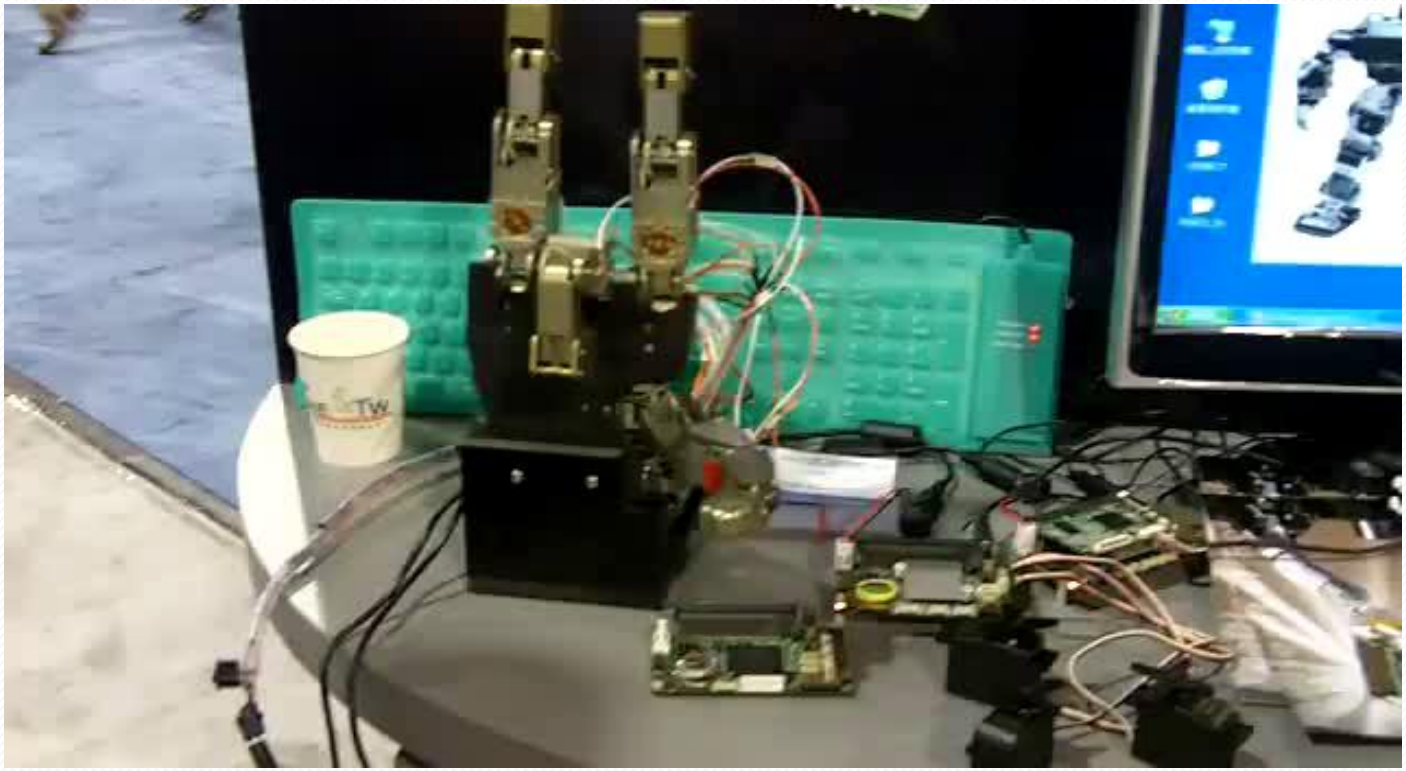
# RoBoard RB-100 Cable set



# APPLICATION

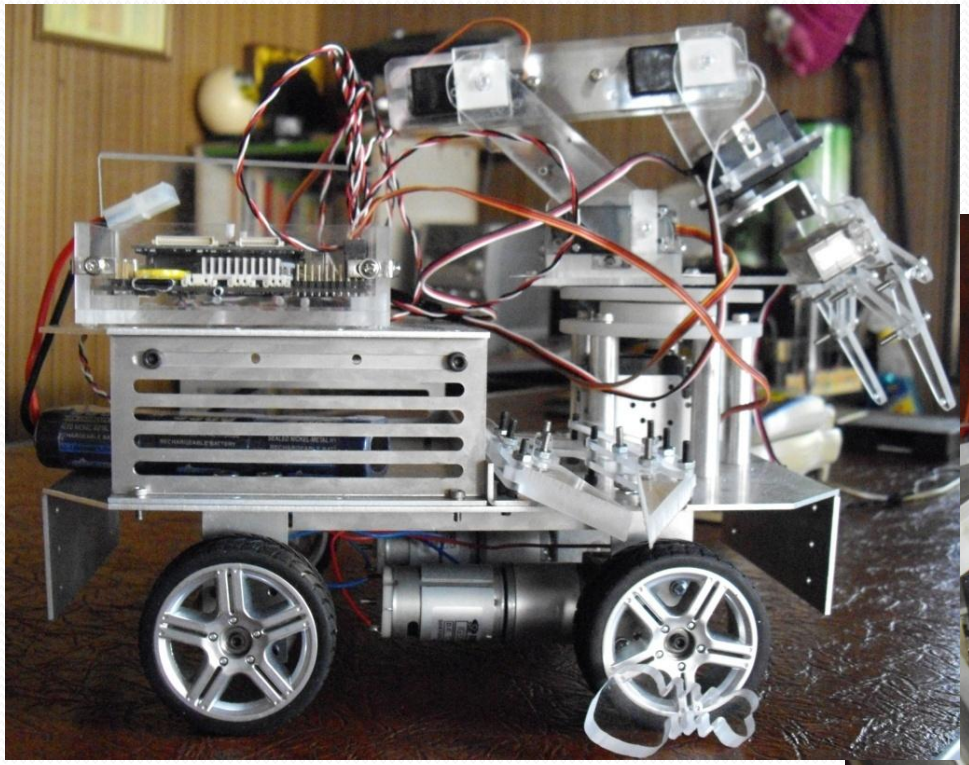
# RoBoard Booth in Computex

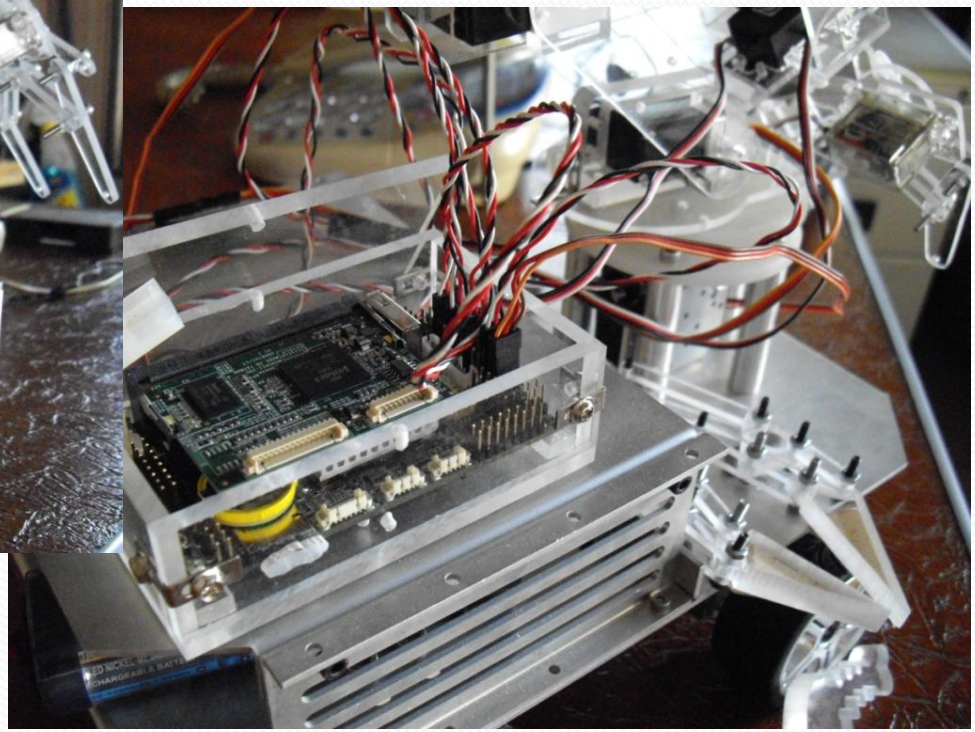
# RoBoard Application (DMP Robot Hand)



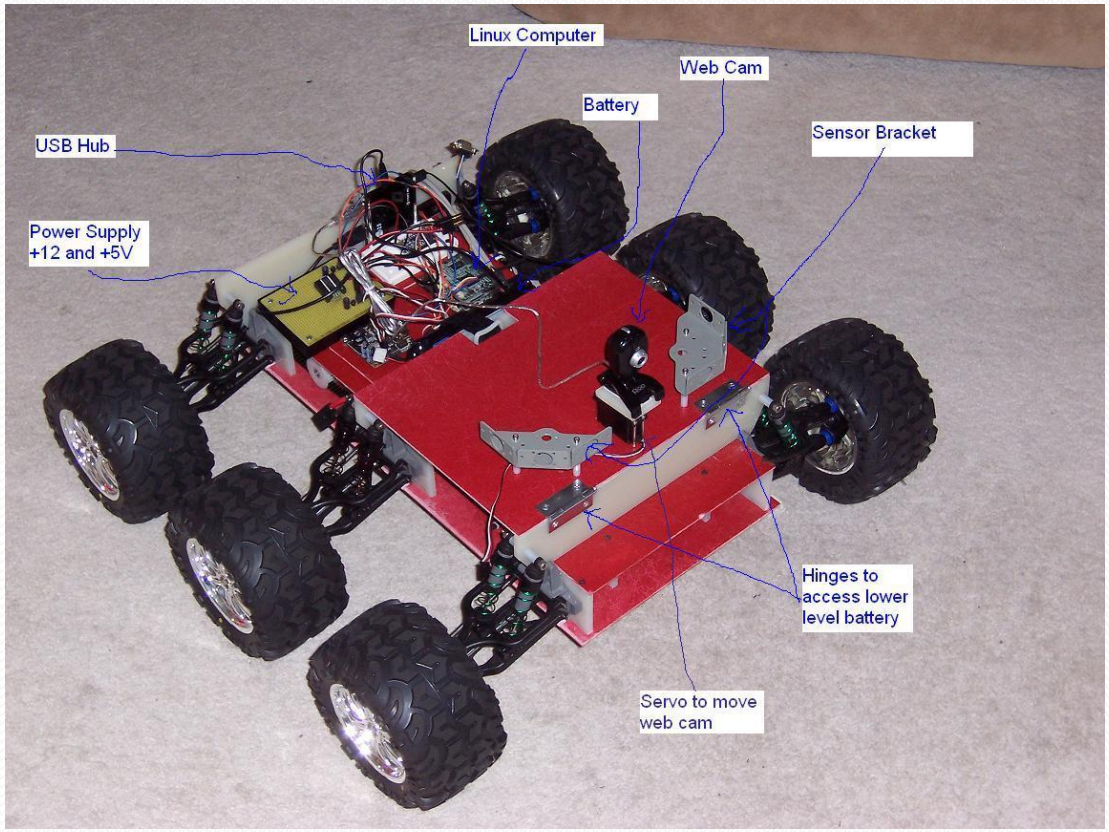
http://www.youtube.com/watch?v=Xsld8eyI_Ag

# RoBoard Application (吳明展，Taiwan)





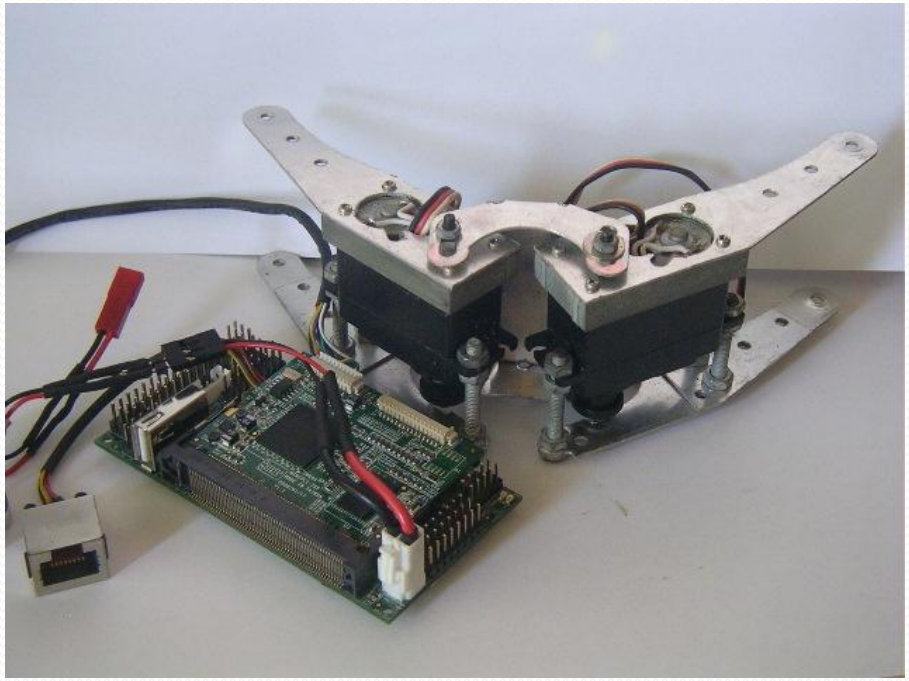
# RoBoard Application (Asbury Robotics, US)

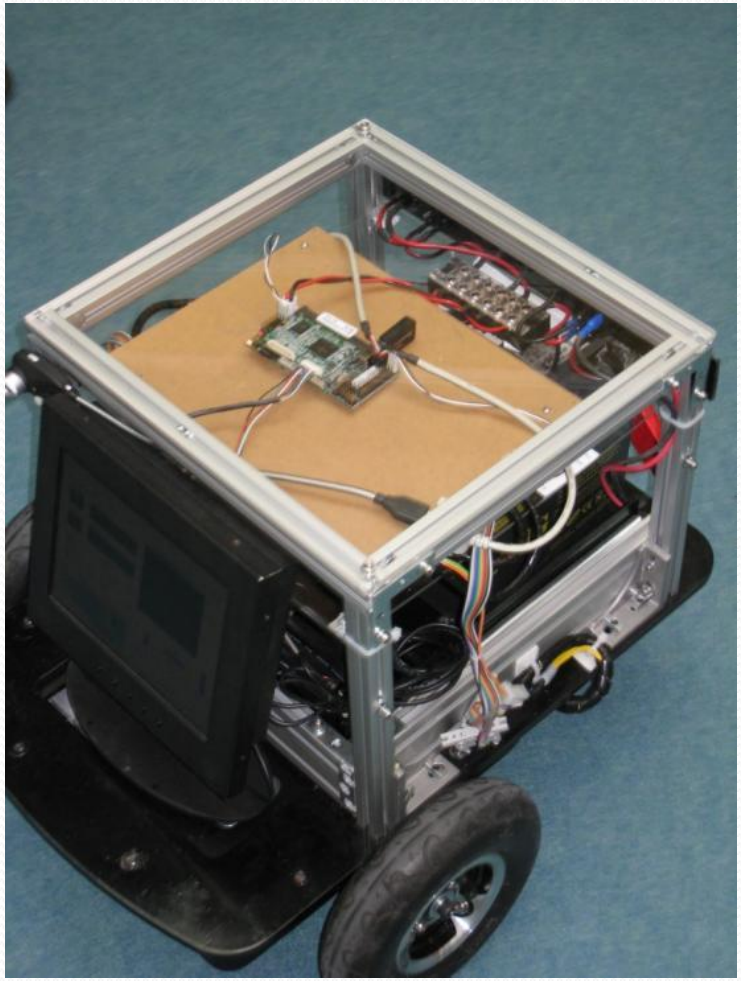



http://asburyrobotics.com/

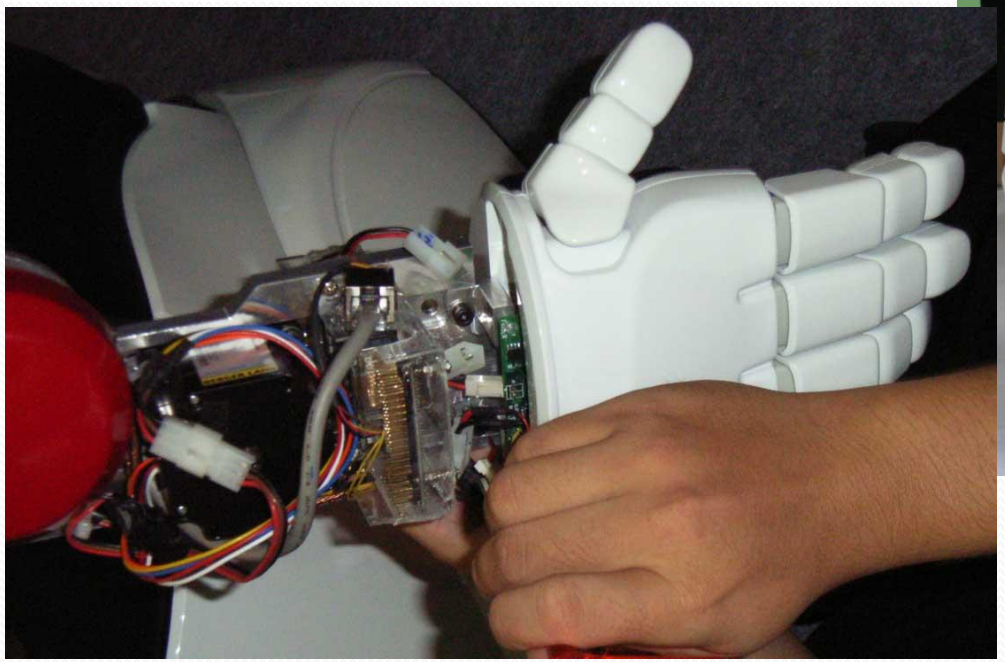
# RoBoard Application (UAV Surrogate, US)

# RoBoard Application (PMC, Taiwan)

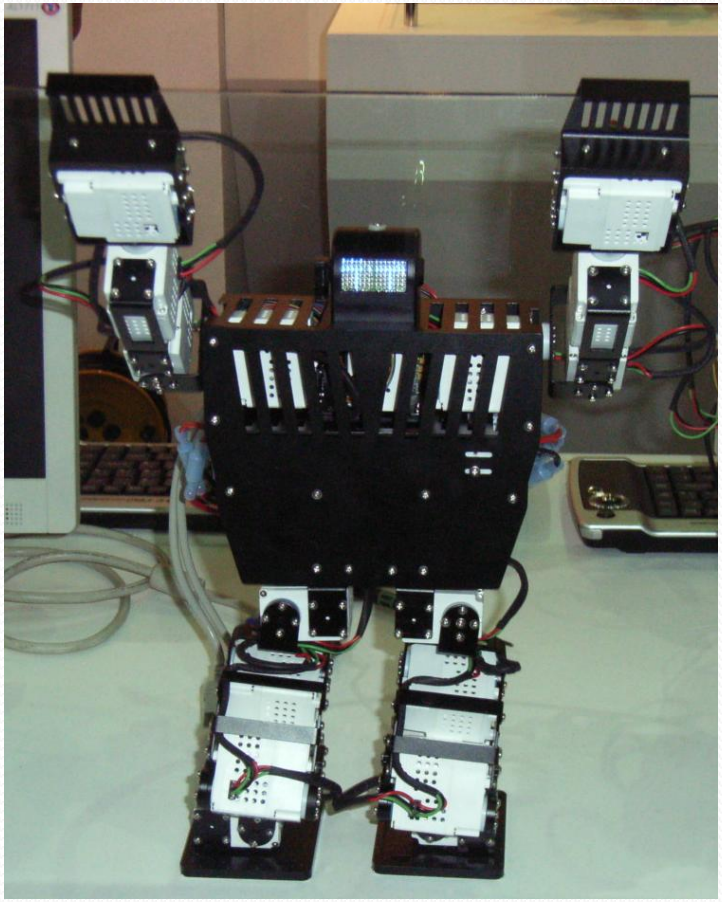


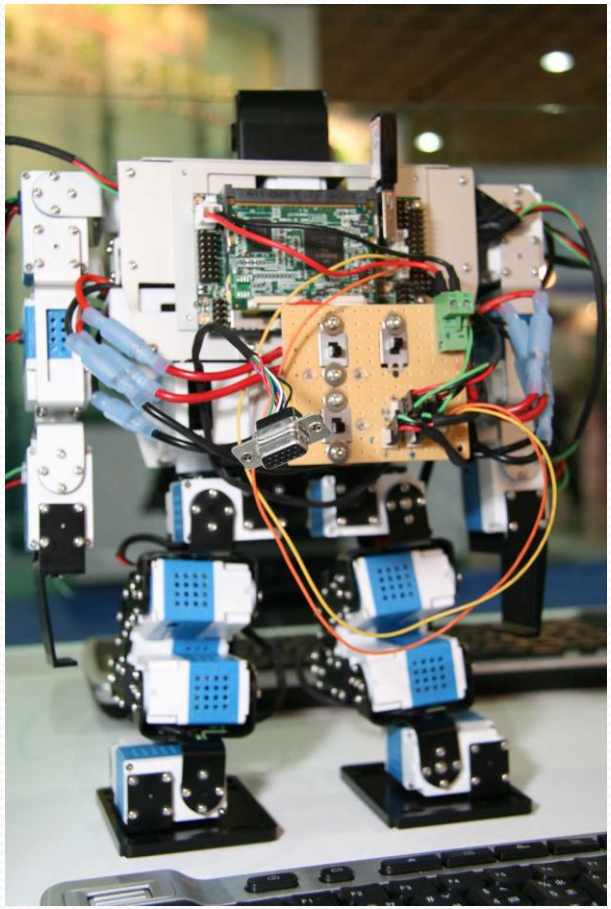


# RoBoard Application (PMC Upitor, Taiwan)

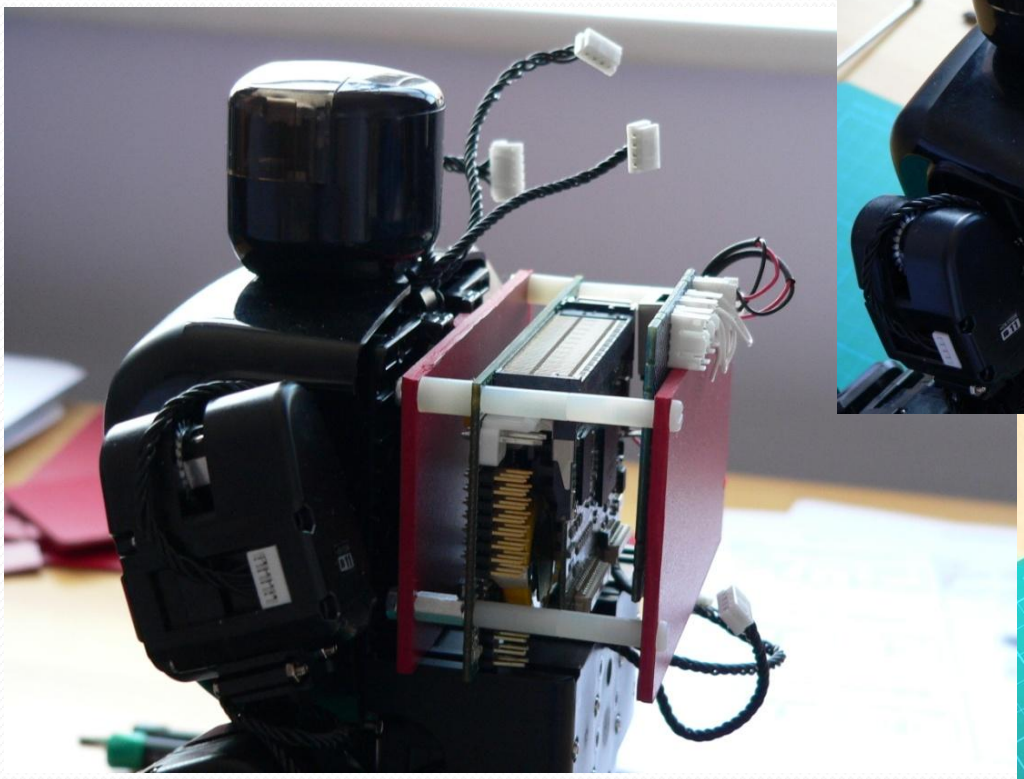


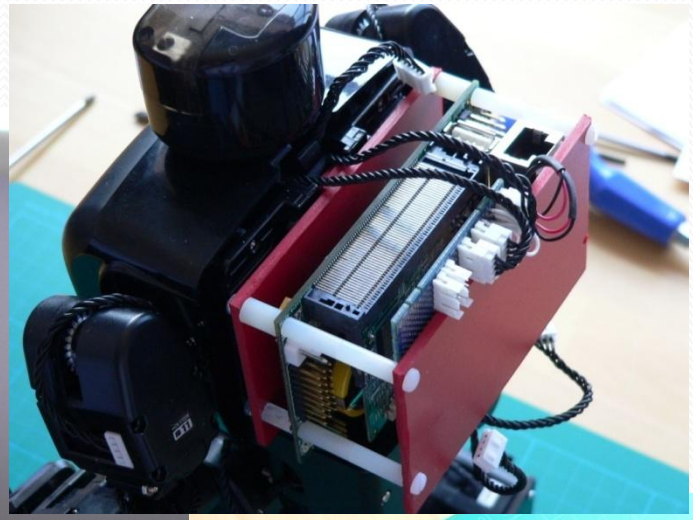
# RoBoard Application (PMC Humanoid, Taiwan)

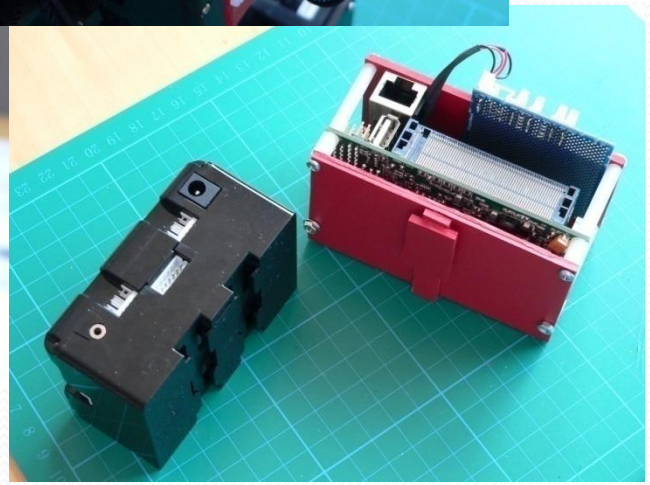




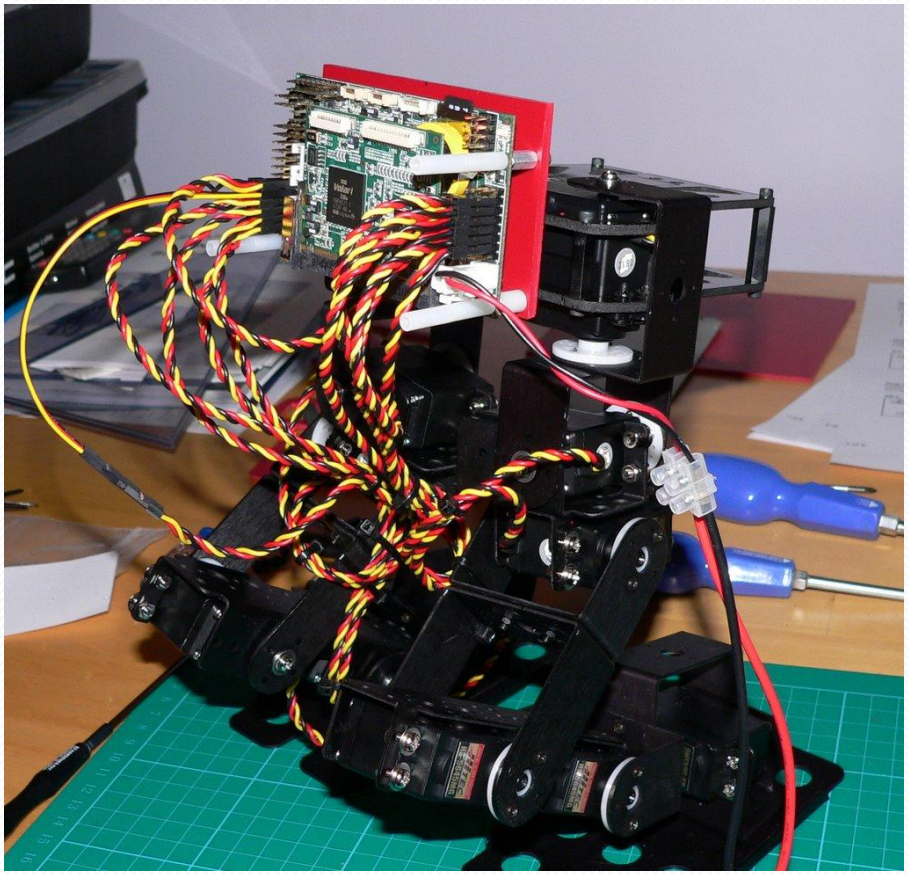
# RoBoard Application (Robobuilder, UK)

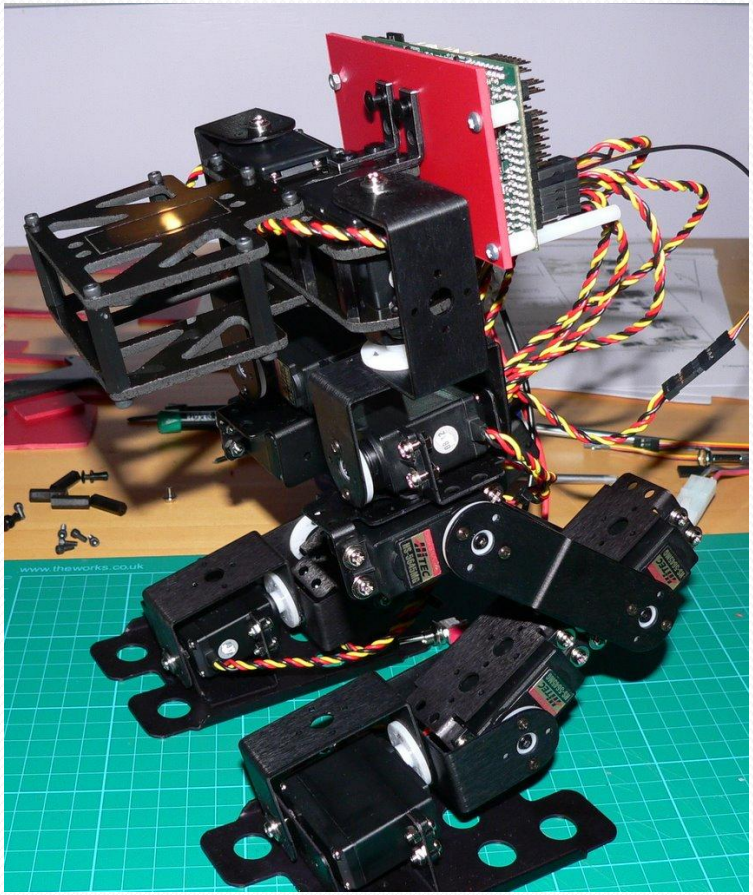




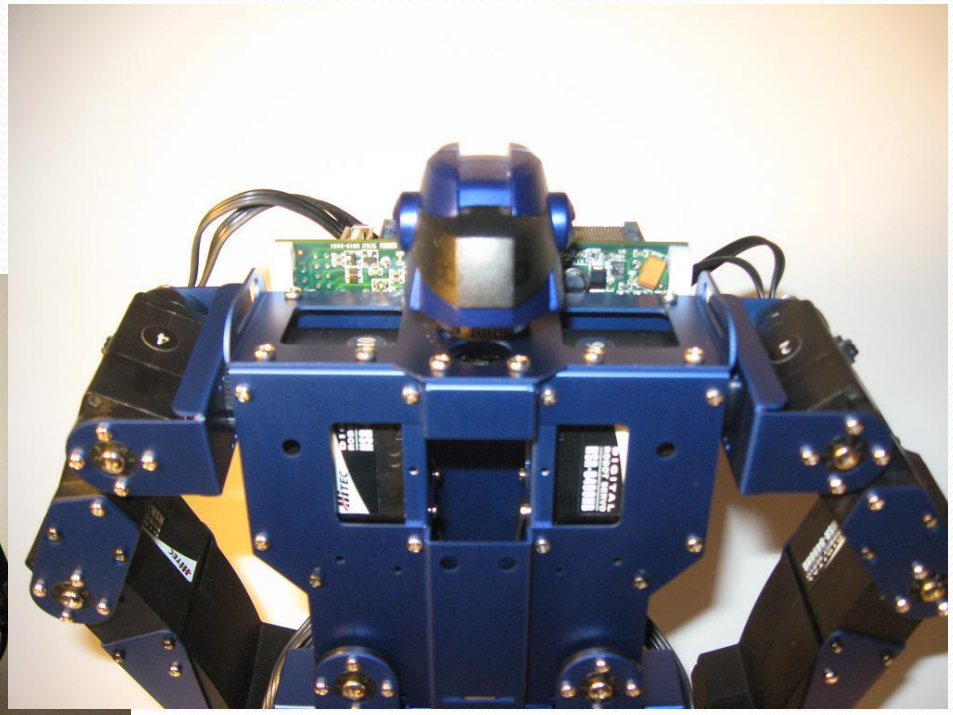


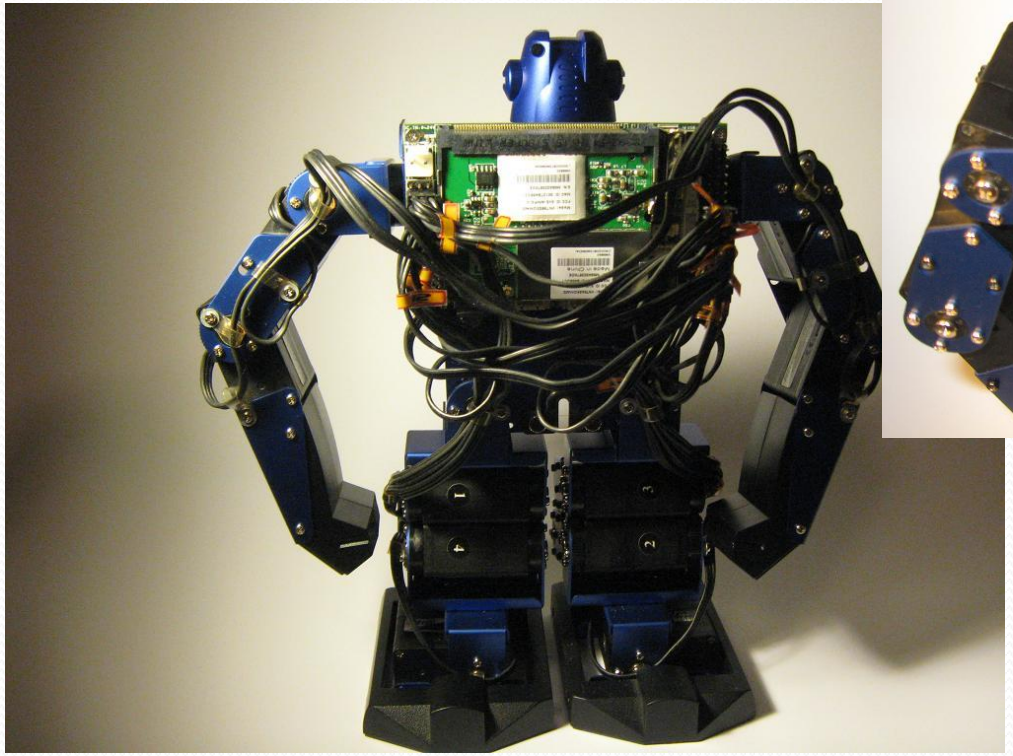
# RoBoard Application (Lynxmotion, UK)



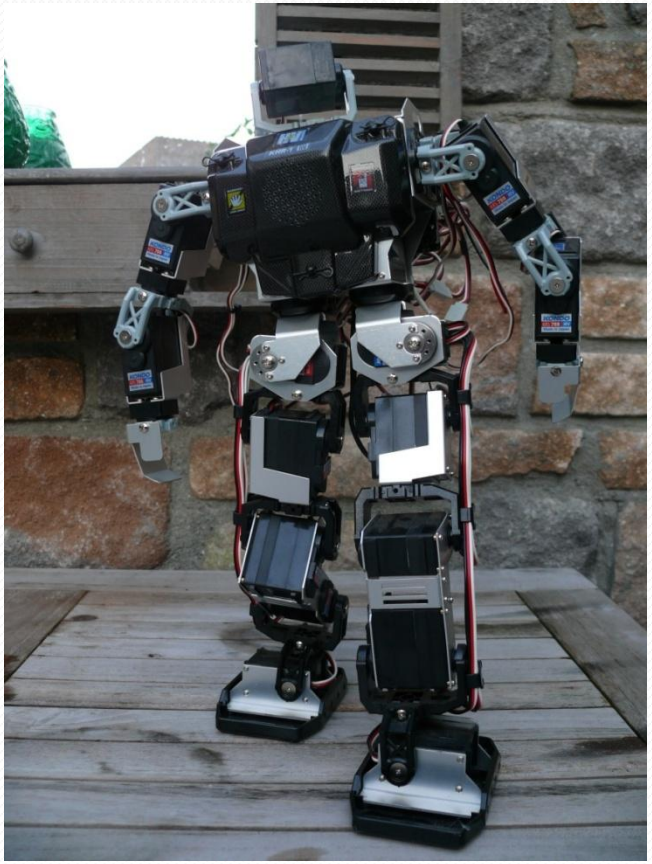


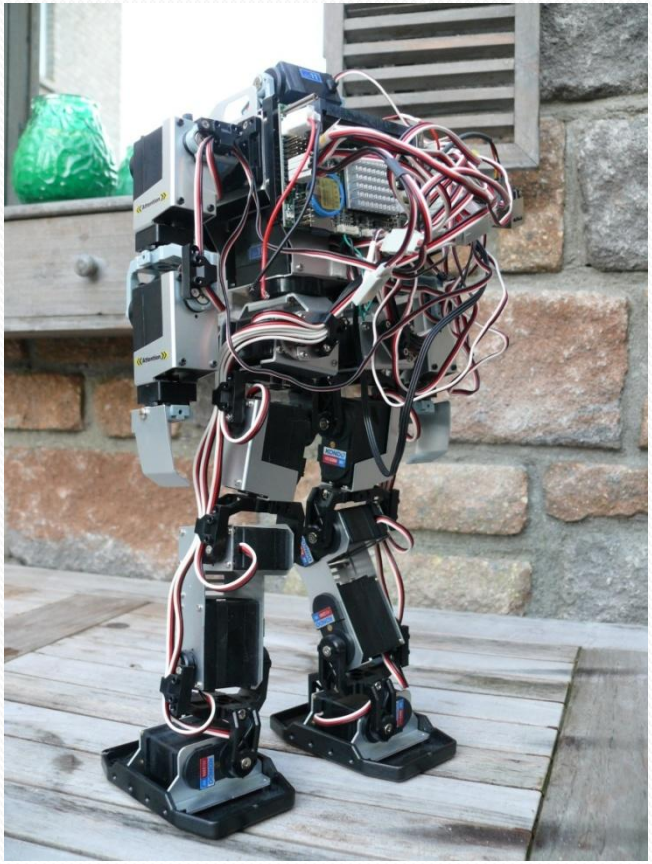
# RoBoard Application (Robonova, Virginia, US)



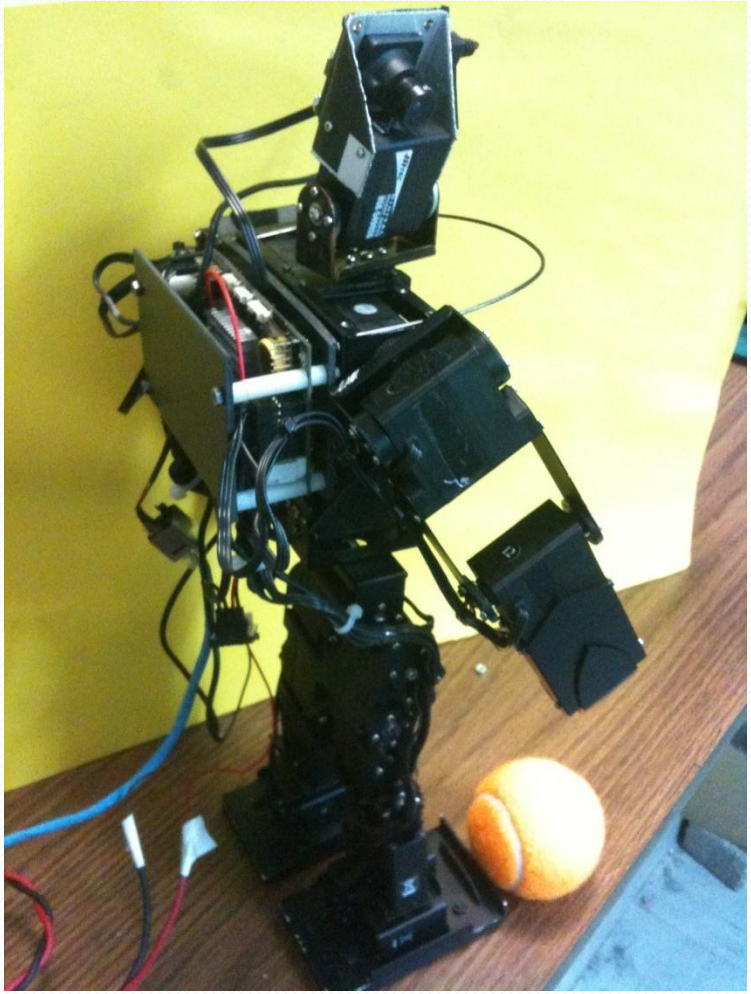


# RoBoard Application (KONDO, Netherlands)

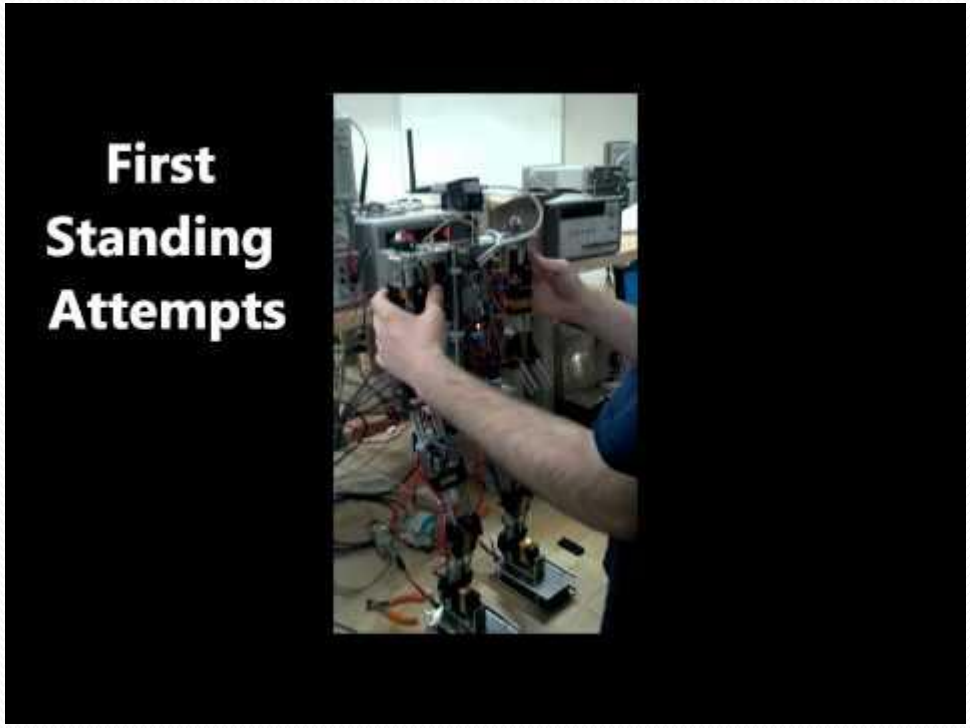


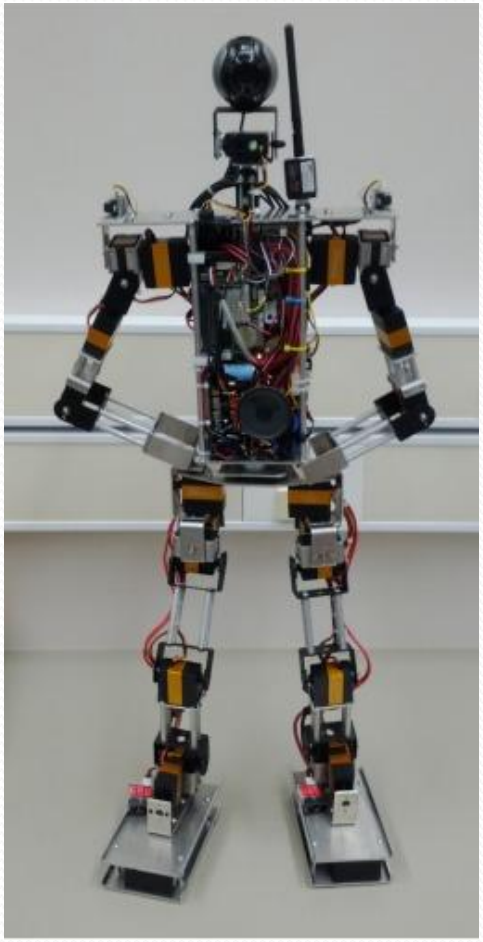


# RoBoard Application (Humanoid, Mexico)



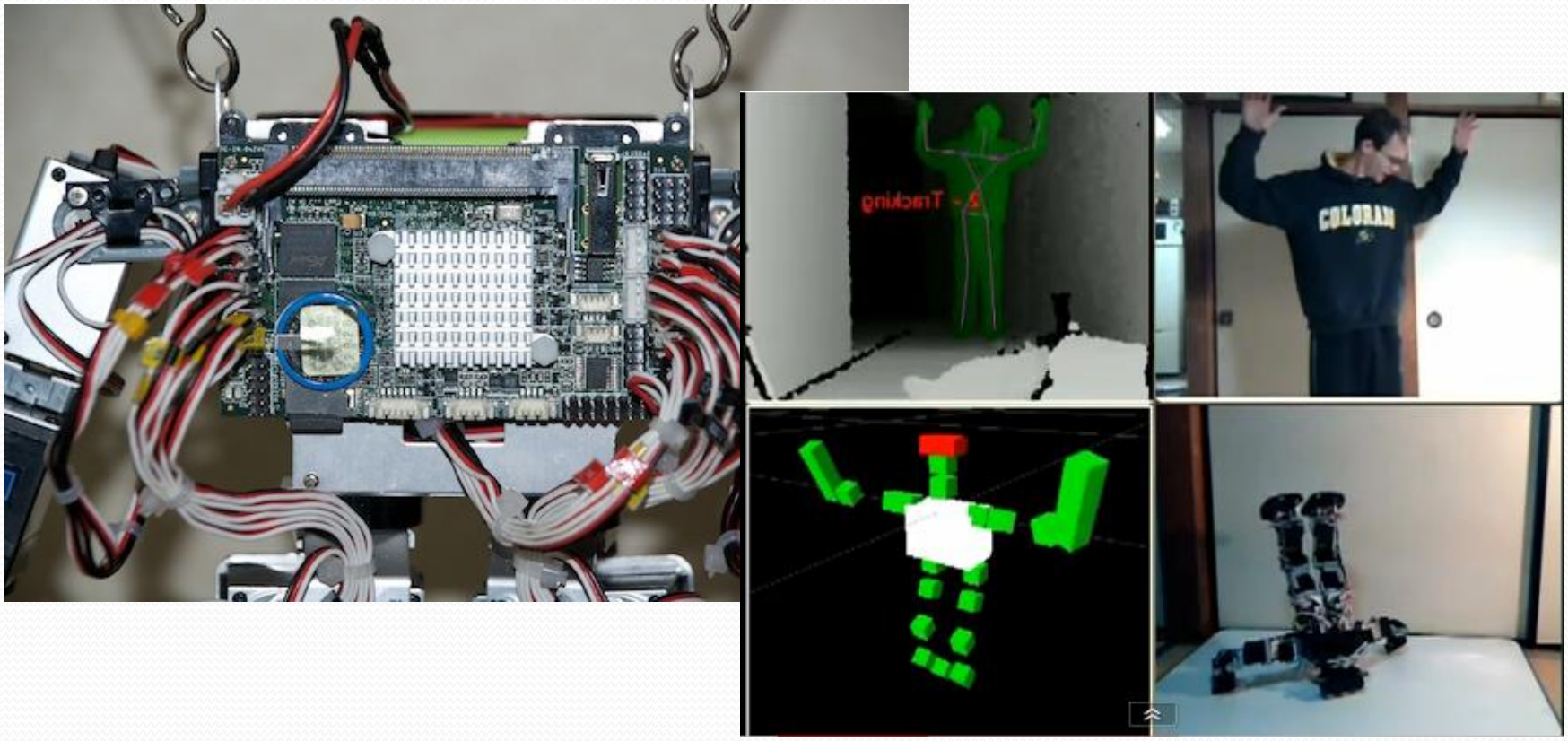
# RoBoard Application (TigerBot, RIT, USA)



http://edge.rit.edu/edge/P12202/public/Home

# RoBoard Application (Veltrobot, Kinect + ROS, Japan)




http://taylor.veltrop.com/robotics/khrhumanoidv2.php
http://www.youtube.com/watch?v=GdSfLyZl4N0

# The heart of Robotics

# THANK YOU

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http://www.roboard.com