QUADRA-602A Encoder Module Operations Manual

MAIN FEATURES

- X and Y 2-channel quadrature signal discrimination
- Two 24bit up/down counters for X and Y
- 4MHZ FSCK filtering clock input.
- Direct connection to PC USB port.
- USB powered +5v power supply and onboard +12v power supply at 150mA derived from onboard DC-DC
- Two channel TTL digital signal input
- Using LS7266R1 from LSI for excellent performance in noise filtering and fast counting.

EXPANDABLE FEATURES

- Two extra digital 0-2.5v level input
- Two extra digital 0-2.5v level output
- Eight channel 12bit single ended 0-2.5v analog input

General Description

DAQCHINA collects and selects good materials for producing field durable modules, and warrants the product to be free from workmanship in component mounting and soldering. In no event, shall DAQCHINA be liable for direct, indirect, special incidental, or consequential damages arising out of the use or inability to use the product or documentation, even if advised of the possibility of such damages. DAQCHINA will only be obligated to replace or repair the module if it proves to be defective in normal use within 1 year from the date of original purchase.

The information in this document is subject to change without prior notice in order to improve reliability, design and function and does not represent a commitment on the part of the manufacturer.

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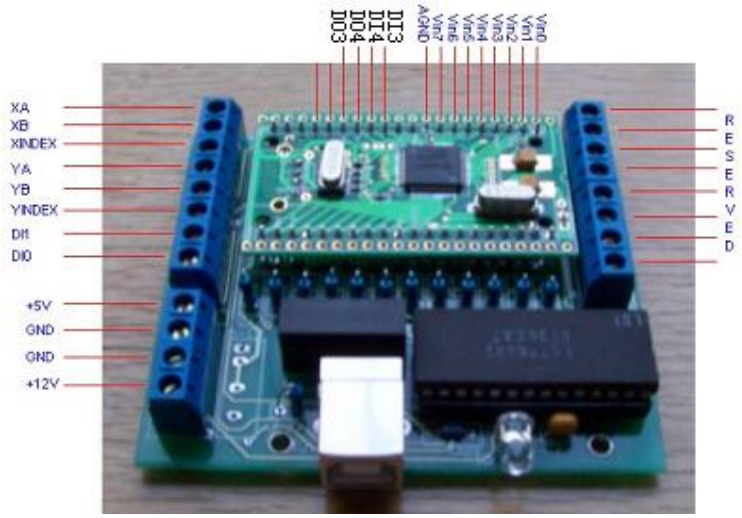
Module Specification

- USB powered +5v supply
- Onboard +12v / 150mA supply derived from +5v with DC-DC
- Total power consumption of board is less than 100mA
- Board size W80mm x H70mm
- Counting IC LS7266R1 of LSI
- LS7266R1 FSCK @ 4MHZ
- LS7266R1 Modulo N x4 quadrature mode
- LS7266R1 hardware noise filter
- Two channel digital TTL input with 180 ohm input resistor protection
- INDEX control for both X and Y channel



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- TTL single ended input for both X channel, Y channels, XINDEX and YINDEX
- Operating environment 0 to 50 degree centigrade

Note

- Quadra-602a is designed for single ended TTL input, but it is also applicable for differential input by connecting minus signals to the RESERVED screw terminal blocks on the opposite edge of the board.
- Since noises are most sensitive to LS7266, XINDEX and YINDEX is recommended wiring to GND of the board if they are not used for the application.
- If XINDEX and YINDEX have to be used and too much noises at these lines, the counter
- Quadra-602a is for Microsoft Windows.

Connecting sensors

The +12v supply from the board can only provides 150mA current, and you have to make sure the total current requirement of sensors for x and y channels are limited within 150mA. A very heavy load may cause the onboard DC-DC generating too much heat. Short circuit of the board-supplied powers is strictly not allowed.

The inputs of board are TTL compatible. A level below 0.5v is recognized as logic low, and a level beyond 2v is recognized as logic high. Though all Quadra-602a modules are input-protected with a 180-ohm resistor to avoid damage to the LS7266R1, the input signal is recommended not to exceed 5v.

As for sensors with differential RS422 level output, just use XA+, XB+, YA+, YB+, XINDEX+ and YINDEX+ for module Quadra-602a; XA-, XB-, YA-, YB-, XINDEX- and YINDEX- are not going to

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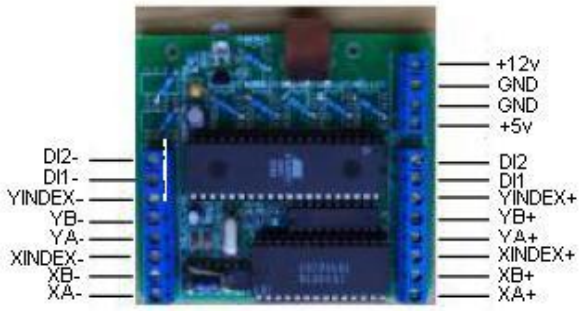
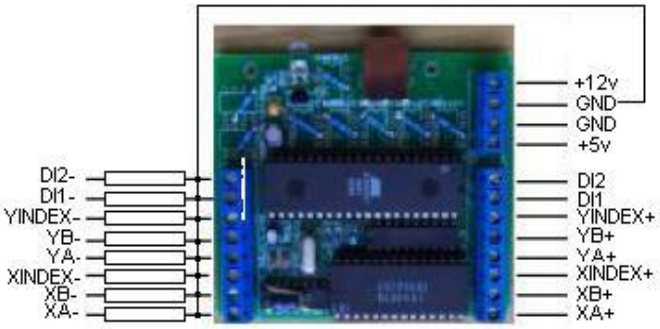
be used for Quadra-602a modules. These sensors usually give an output of positive to negative 7.5 volts in differential, which give an output of zero to positive 3.25 volts in single ended.

Below is a typical wiring for Quadra-502a modules, which is also applicable to Quadra-602a modules.



Minus signals are free from the circuit



Minus signals are terminated to ground with resistors

It is a good practice to terminate minus signals with some resistors, valued between 2.2k to 4.7k , to ground of the board. For Balluff sensors that need more stable +12v, please connect a 1000uF to 2000uF capacitor between +12v terminal and GND.

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Warning:
XINDEX and YINDEX are the input terminals of "Mark" signal of sensors, which is a pulse from high to low transit. If they are not used, always connect them to GND of the board.

Connecting Computers

Quadra-602a uses USB-a to USB-b straight cable. To communicate the board with computer, just connect USB-B connector (the square side) to the board and the USB-A connector (the flat side) to computer. When both sides connected to their socket, the "Good Link" LED will be lighted if driver is already installed. The LED will be flashing with data exchange.

Driver Installation

The driver of the board is packed in ZIP format with sub folders. After extraction of the package, a user mode DLL and two subfolders are automatically created. DAQCHINA provides board driver for Windows2000, WindowsXP, WindowsNT, Windows9x and WindowsMe.

When the board is plugged with straight USB cable to the computer, the computer will prompt finding of NEW HARDWARE. Follow steps of dialogs given by the operating system, specify the driver location, and install the driver as a standard windows device. Upon completion of installation, "DAQCHINA universal serial bus controller" will be added to the hardware device

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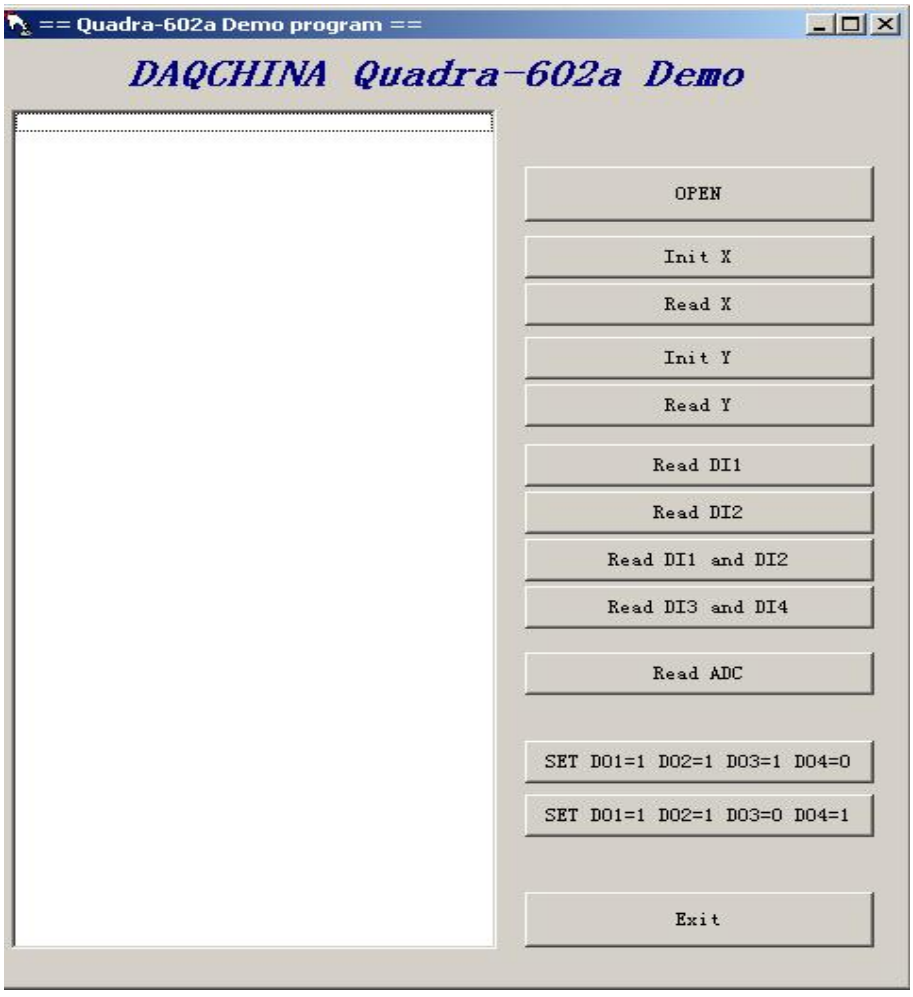
manager. UsbBusVer2.dll is a user mode DLL for your application to enable user program calling functions in the kernel mode driver. The DLL has to be copied yourself to the location of your application program, or copied it to the windows directory for calling by programs.

The Demo Program



Q602demo program is a VB6 coded program to demonstrate the functions of the board Quadra-602a. As Quadra-602a is directly USB driven with D12 chips, data acquisition speed is much higher than Quadra-502a modules. Below table is a comparison of their advantages and disadvantages for users making decisions to choice each module as per specific application requirement.

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Description	Quadra-502a	Quadra-602a
Multi-Platform and Computer	Any computer with serial communication port.	Only X86 series computers running Microsoft Windows.
5v to 12v conversion DC-DC	Packed inside data cable	Mounted on board
DI1 and DI2 pull-up	Yes	No (Connect a 4.7k resistor to +5v to pull-up)
DI3 and DI4	No	Yes
DO1 and DO2	No	Yes, but used by board itself
DO3 and DO4	No	Yes
8 channel 12bit ADCs	No	Yes
Data Acquisition Speed	Medium	High
Counters	X, Y, XINDEX and YINDEX	X, Y, XINDEX and YINDEX
Input Level	TTL compatible L0.5v-H2.0v	TTL compatible L0.5v-H2.0v
Size	80mm x 70mm	80mm x 70mm
USB Core	SPCP825 and 89C51 MCU	USB module (D12 and MSP430F133 MCU)

Note

The Quadra-602a board is recognized as a DEVICE to the WINDOWS system, therefore it has to be opened prior to any function test, and it has to be closed upon completion of all tests. Button “OPEN” is used to OPEN the device and Button “CLOSE” is used to close the device. OPEN and CLOSE share the same button but identified with its caption name.

To run the demo with sensors, click “OPEN” to open the board as a device, then click “SET DO1=1 DO2=1 DO3=1 DO4=0” or click “SET DO1=1 DO2=1 DO3=0 DO4=1” to enable the counters.

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Basic Functions

1. OPEN the board as a device
   sInt = USBDLLInit()

   returns;

0	success
non-zero	failed

   The Button “OPEN” of the demo demonstrates the function. See source code for its usage.

2. Close the board as a device
   sInt = USBDLLDone()
   returns;

0	success
non-zero	failed

   The Button “OPEN” of the demo demonstrates the function. See source code for its usage.

3. Set DO status
   tDO1=1: tDO2=1: tDO3 = 1: tDO4 = 0
   GetValue = USB_SetControl(tDO4 * 8 + tDO3 * 4 + tDO2*2 + tDO1*1)

   DO1 and DO2 are used internal by the board to control the LS7266, and they must be set to state high to enable the counters. Usage, tDO1 and tDO2 should always be 1.

4. Initialize counter X

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```
'Setup IOR Reg
    tData = &H40 + &H0 + &H2 + &H0 + &H0
    Call out7266(XCMD, tData)

    'Setup RLD Reg
    tData = &H0 + &H1 + &H4
    Call out7266(XCMD, tData)

    tData = &H4                    '4.000M
    Call out7266(XDATA, tData)

    tData = &H0 + &H6 + &H18
    Call out7266(XCMD, tData)

    tData = &H0 + &H1 + &H2
    Call out7266(XCMD, tData)

    'Setup IDR Reg
    tData = &H60 + &H1 + &H0 + &H4
    Call out7266(XCMD, tData)

    'Setup CMR Reg
    tData = &H20 + &H0 + &H6 + &H18
    Call out7266(XCMD, tData)

    'Setup PR Reg. for Modulo N Counter to 0x123456
    tData = &H56
    Call out7266(XDATA, tData)
```

```
tData = &H34
Call out7266(XDATA, tData)
tData = &H12
Call out7266(XDATA, tData)

'Transfer PR x to Counter X
tData = &H0 + &H8
Call out7266(XCMD, tData)

'Enable Counters
tData = &H40 + &H1
Call out7266(XCMD, tData)
```

The codes above are copied from the procedure of button “INITX”. It follows the instruction flow given by LSI document, which sets counter X to a value of &H123456.

5. Initialize counter Y

```
'Setup IOR Reg
tData = &H40 + &H0 + &H2 + &H0 + &H0
Call out7266(YCMD, tData)

'Setup RLD Reg
tData = &H0 + &H1 + &H4
Call out7266(YCMD, tData)

tData = &H4                    '4.000M
Call out7266(YDATA, tData)
```

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```
tData = &H0 + &H6 + &H18
Call out7266(YCMD, tData)

tData = &H0 + &H1 + &H2
Call out7266(YCMD, tData)

'Setup IDR Reg
tData = &H60 + &H1 + &H0 + &H4
Call out7266(YCMD, tData)

'Setup CMR Reg
tData = &H20 + &H0 + &H6 + &H18
Call out7266(YCMD, tData)

'Setup PR Reg. for Modulo N Counter to 0x123456
tData = &H56
Call out7266(YDATA, tData)
tData = &H34
Call out7266(YDATA, tData)
tData = &H12
Call out7266(YDATA, tData)

'Transfer PR x to Counter X
tData = &H0 + &H8
Call out7266(YCMD, tData)

'Enable Counters
tData = &H40 + &H1
```

Call out7266(YCMD, tData)

The codes above are copied from the procedure of button “INITY”. It follows the instruction flow given by LSI document, which sets counter Y to a value of &H123456.

6. Read counter X

```
tAddress = XCMD
tData = &H0 + &H1 + &H10
Call out7266(tAddress, tData)

Call in7266(XDATA)      ‘Low byte
Call in7266(XDATA)      ‘Mid byte
Call in7266(XDATA)      ‘High byte
```

It reads counter X and add each reading to the text box within the procedure of “in7266”. It has to be read by three callings of “in7266”, as the data of counter X is three-byte organized from low-byte to high-byte.

CounterX = 65536*High-byte+256*Mid-byte+Low-byte

7. Read counter Y

```
tData = &H0 + &H1 + &H10
Call out7266(YCMD, tData)

Call in7266(YDATA)      ‘Low byte
Call in7266(YDATA)      ‘Mid byte
Call in7266(YDATA)      ‘High byte
```

It reads counter Y and add each reading to the text box within the procedure of “in7266”. It has to be read by three callings of “in7266”, as the data of counter Y is three-byte

organized from low-byte to high-byte.

CounterY = 65536*High-byte+256*Mid-byte+Low-byte

8. Read DI1

```
sInt = USB_GetStatus()
sInt = sInt And 1
```

When DI1 low, sInt = 0; DI1 high, sInt = 1.

9. Read DI2

```
sInt = USB_GetStatus()
sInt = (sInt And 2) / 2
```

When DI2 low, sInt = 0; DI2 high, sInt = 1.

10. Read DI1 and DI2

```
sInt = USB_GetStatus()

DI1 = sInt and 1
DI2 = (sInt and 2)/2
```

See Read DI1 or Read DI2 for explanation of return value.

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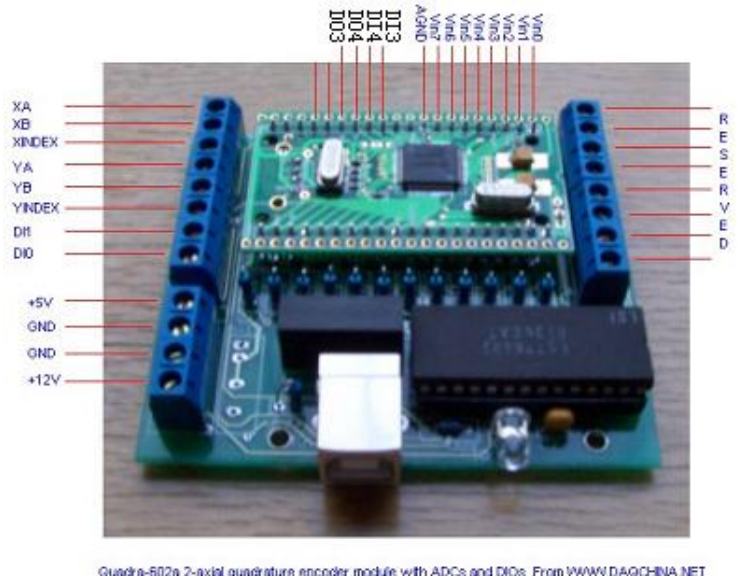
Extended Functions



Quadra-602a 2-axial quadrature encoder module with ADCs and DIOs. From WWW.DAQCHINA.NET

Quadra-602a has more functions can be expanded for special usage.

Extended functions are: DO3 and DO4, DI3 and DI4, Vin0 to Vin7.

With these new functions, the board can be used for analog to digital conversion, switch status monitoring, and triggering of relays for external controls. These functions are different from Basic functions, and therefore need to be further conditioned by users.

Electrical characteristics

DO3 and DO4 output level	Low = 0v, High = 2.5v
DI3 and DI4 input level	Low = 0v, High = 2.5v
Vin0 to Vin7	0v to 2.5v analog signal

Note

1. DI1 and DI2 are internally protected with 510 ohm resistors, which enables its intake for 0v to 5v TTL digital signals.
2. DI3 and DI4 have no resistors for protection. For TTL 0v – 5v input, please connect 510 ohm resistors between DI signals and DI3/DI4 terminal holes.

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3. DO3 and DO4 can be used as trigger signal of external equipment. It s high/low timing could be controlled by the host PC.
4. To reduce noises, connect a 47k resistor and a 1uF capacitor between each input of Vin0 to Vin7 to the AGND nearby the Vin7 terminal hole.

Sample Code

1. Read DI3 and DI4

```
sInt = USB_GetStatus()

DI3 = (sInt and 4) / 4
DI4 = (sInt and 8) / 8
```

2. Set DO3 and DO4

```
tDO1=1: tDO2=1: tDO3 = 1: tDO4 = 0
GetValue = USB_SetControl(tDO4 * 8 + tDO3 * 4 + tDO2*2 + tDO1*1)
```

As tDO1 and tDO2 used internally by the board, always set them to high state. Only tDO3 and tDO4 can be changed as per your specific requirement.

3. Acquiring analog signals

```
Dim iArr(1 To 16) As Byte
Dim sL(1 To 2) As Integer
Dim jm As Integer
Dim Low As Integer, hig As Integer
Dim Add As String, Data As String
On Error Resume Next
```

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```
If iNext = 0 Then
    iNext = 1
End If
iNe = iNe + 1
Image3.Visible = True
sInt = USB_ReadADOnce(iArr(1), sL(1))
jm = 1
Text1.AddItem "Read AD:" & iNe & "# Return:" & sInt & " Data Length:" & sL(1)
Call iRemovelist
For i = 1 To sL(1) Step 2
    Low = iArr(i)
    hig = (iArr(i + 1) And &HF) * 256
    Text1.AddItem "Channel" & jm & " " & Low + hig
    Call iRemovelist
    jm = jm + 1
Next I
```

The host PC will read 8-channels concurrently by issuing command USB_ReadADOnce, which returns an array of low and high bits to be reassembled by the program for a complete byte.

Quadra-602a and Quadra-502a are physically same in size but using different command set. LS7266 are the core counting chip for both modules, and terminal assignment are also identical to each other.

Driver for WindowsXP/NT/2K/9x/ME
http://www.daqchina.net/daqchina/download/q602adrv.zip

Demo in VB6(source code)
http://www.daqchina.net/daqchina/download/demo203.zip