

USB I/O 24 DIP R Digital I/O Module

The USB I/O 24 DIP R shown in Diagram 1 is the ROHS Compliant version of our previous USB I/O 24 DIP of which differences will be outlined in a section below. The module retains the 50 pin Dual Inline Package (DIP) and fits into a standard 50 pin 900mil wide IC Socket. This makes the USB I/O 24 DIP R ideal for rapid prototyping and development work.

The module features 24 5V level signal lines individually programmable as input or output. As the module connects to the USB port, multiple modules can be connected to a single PC by the use of a USB hub or hubs. Each module features a serial number and the PC can identify each module uniquely thereby allowing multiple modules to be connected for a single application. The outputs of the module are able to source or sink up to 30mA per I/O, up to a maximum 50mA per port, to allow for direct connection to a variety of devices.

The USB I/O 24 DIP R Module

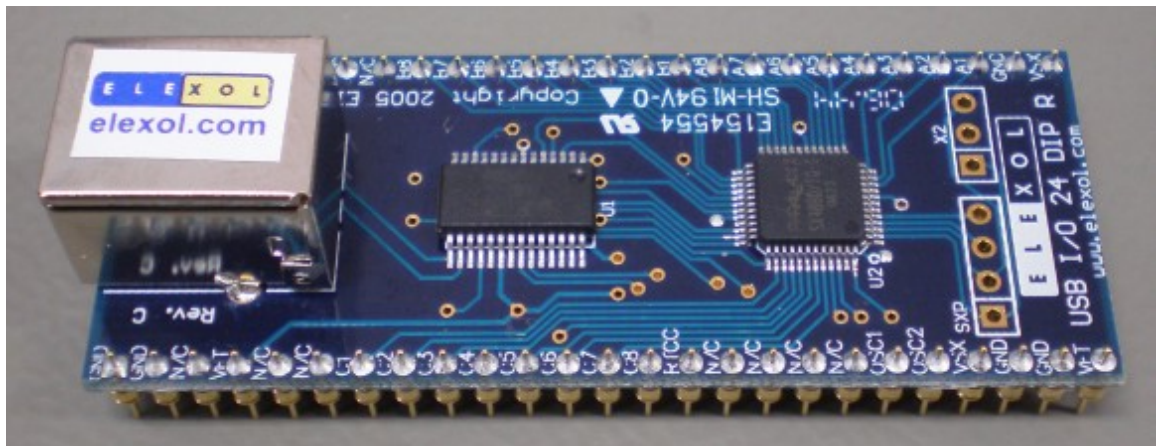


Diagram 1

MODULE FEATURES

- Single module High-Speed Digital Input / Output solution.
- Integrated Type-B USB Connector.
- On-board unique serial number in EEPROM and custom programmable FLASH microcontroller.
- Both USB Enumeration information and Micro controller can be re-programmed
- Module powered by the USB from the PC (default option) and can also be configured for Self powered.
- 50-pin Dual In-Line Package Ideal for prototyping
- Fits into a standard 50-pin 900mil IC Socket

Module Standard Firmware & Software

- Virtual COM Port driver allows access as a regular serial port.
- Optional DLL based driver available.
- Easy to program from popular languages C++, Basic, Delphi, etc.
- Simple command set for easy control of ports and data transfer

Module differences compared to previous version

The USB I/O 24 R is the next version of the USB I/O 24 MK3.

The End of life notice on the SX52 due to Non RoHS compliance / Packaging issues has forced Elexol to update the USB I/O 24 to incorporate the Parallax SX48.

The difference between the two versions are as follows

USB I/O 24 MK3

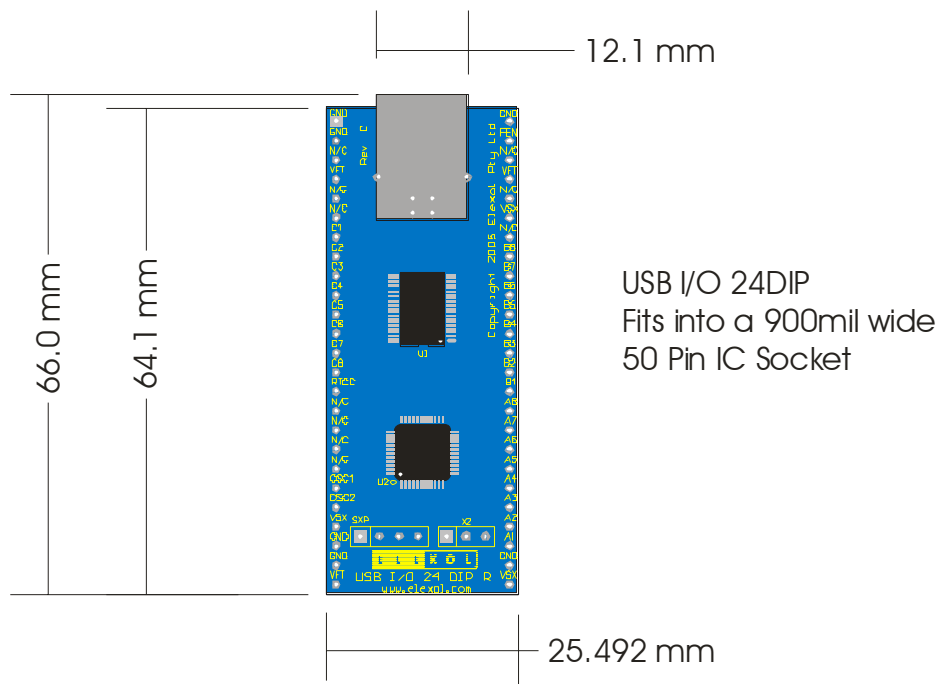
- Main Controller Ubicom SX52 (52 pin TQFP) End of Life due to Non RoHS
- USB Controller FTDI FT245BM/BL
- Mechanicals 68.6mm x 38.2mm
- Expansion Port Header
- Led Functionality to indicate data transfer
- Not RoHS

USB I/O 24 R

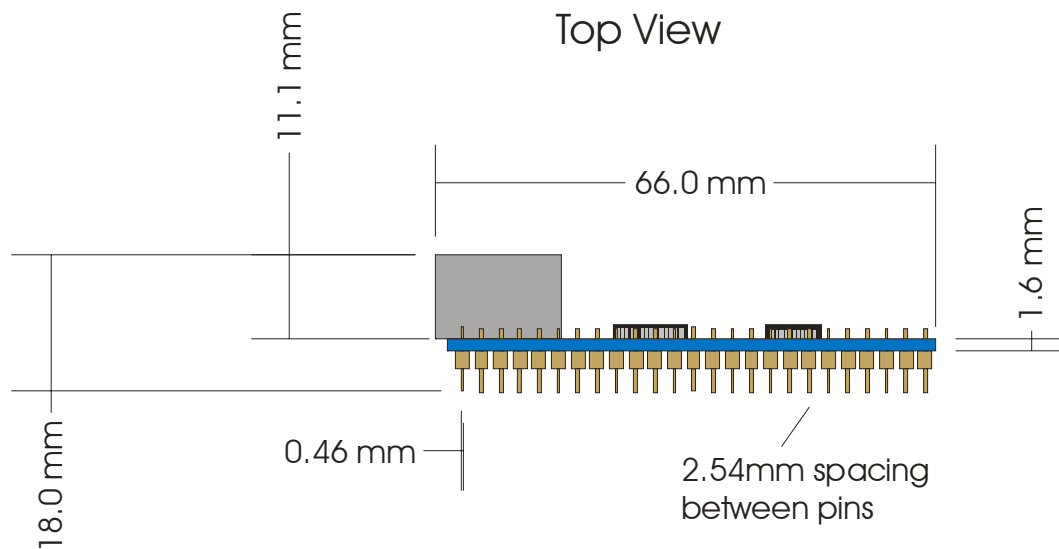
- Main Controller Parallax SX48 (48 pin TQFP) RoHS Compliant
- USB Controller FTDI FT245R (28 pin SSOP) RoHS Compliant
- Mechanicals identical to MK3
- No Expansion Port Header
- No LED functionality to indicate data transfer
- RoHS Compliant
- Firmware is identical to MK3 except identifier '?' returns USB I/O 24 R

With the exception of the loss of the expansion port header and the LED function, the USB I/O 24 R retains the same functionality as the USB I/O24 MK3.

Module Layout



Top View



Side View

Physical Dimensions

Length	65.4mm
Width	25.2mm
Height	19mm (not in IC Socket)

USB I/O 24 DIP Pin out Tables

Power Pins for the USB I/O 24 DIP

PIN #	SIGNAL	TYPE	DESCRIPTION
1	GND	PWR	Device – Ground Supply Pin
2			
23			
24			
27			
50			
3	N/C	N/C	No Connection
5			
6			
16			
17			
18			
19			
44			
46			
48			
4	VFT	PWR	+4.35 to 5V VCC supply to FT245BM when in self-powered mode. Note: In USB powered mode this pin is linked to V+ from USB ** NO External power needs to be applied when in Bus powered mode** Module is bus powered out of box.
25			
47			
22	VSX	PWR	3.3 to 5V VCC supply to SX48 when in self powered mode. Note: In USB powered mode this pin is linked to V+ from USB via FET** NO External power needs to be applied when in Bus powered mode** Module is bus powered out of box.
26			
45			

Control Pins for the USB I/O 24 DIP

PIN #	SIGNAL	TYPE	DESCRIPTION
15	RTCC	IN	Input to Real Time Clock Counter
49	PEN	OUT	Connected to P – Channel Logic Level MOSFET switch to control power to Parallax SX48 circuitry. .

SX Programming Header Pins

PIN #	SIGNAL	TYPE	DESCRIPTION
20	OSC1	IN	Crystal Oscillator Input – external clock source input
21	OSC2	OUT	Crystal Oscillator Output -
22	VSX	PWR	3.3 to 5V VCC supply to SX48 when in self powered mode. Note: In USB powered mode this pin is linked to V+ from USB via FET** NO External power needs to be applied when in Bus powered mode** Module is bus powered out of box.
23	GND	PWR	Device – Ground Supply Pin

Note: There is also a programming header located on the board called SXP

I/O Connections (PORT A, B, C)

Listed below are the connections for the I/O connections on the USB I/O 24 DIP.

PORT A (Bi-Directional Data Bus pins)

PIN #	SIGNAL	TYPE	DESCRIPTION
35	A8	I/O	Programmable I/O pin with bit value of 128
34	A7	I/O	Programmable I/O pin with bit value of 64
33	A6	I/O	Programmable I/O pin with bit value of 32
32	A5	I/O	Programmable I/O pin with bit value of 16
31	A4	I/O	Programmable I/O pin with bit value of 8
30	A3	I/O	Programmable I/O pin with bit value of 4
29	A2	I/O	Programmable I/O pin with bit value of 2
28	A1	I/O	Programmable I/O pin with bit value of 1

PORT B (Bi-Directional Data Bus pins)

PIN #	SIGNAL	TYPE	DESCRIPTION
43	B8	I/O	Programmable I/O pin with bit value of 128
42	B7	I/O	Programmable I/O pin with bit value of 64
41	B6	I/O	Programmable I/O pin with bit value of 32
40	B5	I/O	Programmable I/O pin with bit value of 16
39	B4	I/O	Programmable I/O pin with bit value of 8
38	B3	I/O	Programmable I/O pin with bit value of 4
37	B2	I/O	Programmable I/O pin with bit value of 2
36	B1	I/O	Programmable I/O pin with bit value of 1

PORT C (Bi-Directional Data Bus pins)

PIN #	SIGNAL	TYPE	DESCRIPTION
14	C8	I/O	Programmable I/O pin with bit value of 128
13	C7	I/O	Programmable I/O pin with bit value of 64
12	C6	I/O	Programmable I/O pin with bit value of 32
11	C5	I/O	Programmable I/O pin with bit value of 16
10	C4	I/O	Programmable I/O pin with bit value of 8
9	C3	I/O	Programmable I/O pin with bit value of 4
8	C2	I/O	Programmable I/O pin with bit value of 2
7	C1	I/O	Programmable I/O pin with bit value of 1

Firmware

Communication Protocol

COMMAND	DATA	FUNCTION
'?’	Responds 'USB I/O 24R'	Identify Device
'A'	1 Byte Port Data	Write to Port A
'B'	1 Byte Port Data	Write to Port B
'C'	1 Byte Port Data	Write to Port C
'a'	Responds with 1 Byte Port Data	Read from Port A
'b'	Responds with 1 Byte Port Data	Read from Port B
'c'	Responds with 1 Byte Port Data	Read from Port C
'!A'	1 Byte Port I/O Data	Write to Port A Direction Register
'!B'	1 Byte Port I/O Data	Write to Port B Direction Register
'!C'	1 Byte Port I/O Data	Write to Port C Direction Register
'H'	1 Byte specifying which I/O pin (0-23)	Set specific I/O Pin High
'L'	1 Byte specifying which I/O pin (0-23)	Set specific I/O Pin Low
'#'	Follow with Port write and binary data	Port Pull up feature for SX48
'@'	Follow with Port write and binary data	Set inputs to CMOS/ TTL level
'\$'	Follow with Port write and binary data	Set Port Schmitt trigger enables
'2'		Sets unit to Mode 2 (Enables transmit on pin change)
'1'		Sets unit to Mode 1 (Exits Mode 2)

The commands in the above table are in ASCII format. All Data is sent in Binary format.

Mode 2 Functional Changes

All reads have a port designator ('a', 'b' or 'c') before the data.

All auto sends have a port designator ('a', 'b' or 'c') before the data.

All writes to the port that change the port will results in a port data auto send.

SPI Interface

Send / Receive SPI Byte on PORT A

COMMAND	DATA	REPLY	FUNCTION
'S'	1 Byte of data sent on SPI Bus	1 Byte of data received on SPI Bus	Send / Receive SPI Byte on PORT A

Send / Receive SPI Byte on PORT B

COMMAND	DATA	REPLY	FUNCTION
'T'	1 Byte of data sent on SPI Bus	1 Byte of data received on SPI Bus	Send / Receive SPI Byte on PORT B

Send / Receive SPI Byte on PORT C

COMMAND	DATA	REPLY	FUNCTION
'U'	1 Byte of data sent on SPI Bus	1 Byte of data received on SPI Bus	Send / Receive SPI Byte on PORT C

Notes on SPI

Bit 1 is always Clock and must be set as an output from the SPI to function

Bit 2 is always Serial Data Out (MOSI) and must be set as an output from the SPI to function

Bit 3 is always Serial Data In (MISO) and must be set as an input from the SPI to function

All other port pins act as normal

Setting the port pin as high or low will set the clock as normally high or low before the SPI transaction begins.

Any of the other pins can be used as SS or CE when SPI is used.

Temperature Sensor Interface using DS18B20

Convert Start

COMMAND	DATA	REPLY	FUNCTION
'J'	1 Byte specifying which pin 0 to 23	1 Byte Status of Command	Start Conversion

Read Temperature

COMMAND	DATA	REPLY	FUNCTION
'K'	1 Byte specifying which pin 0 to 23	3 Bytes Byte 1 – Status (see below) Byte 2 – MSB of Temperature Byte 3 – LSB of Temperature	Read Temperature

Notes on the DS18B20

Status Bytes

- G Command execute normally
- C A CRC error occurred while reading the data
- N No sensor found
- E Bad pin number (only pins 0 to 23 are valid)
- S Bus Shorted (or pull up resistor missing)

The DS18B20 requires a resistor between 1K and 4.7K between the data line and the +5V rail. A DS18S20 may also be used if the higher resolution of the DS18B20 is not required.

Note: This function will not work with the 50 MHz upgrade

Reprogramming and Customising the firmware

In order to reprogram the original or any customized firmware into the USB I/O 24 you will require a SX Key programmer. These programmers are available from Parallax. For further information on these programmers visit

http://www.parallax.com/sx/programming_kits.asp

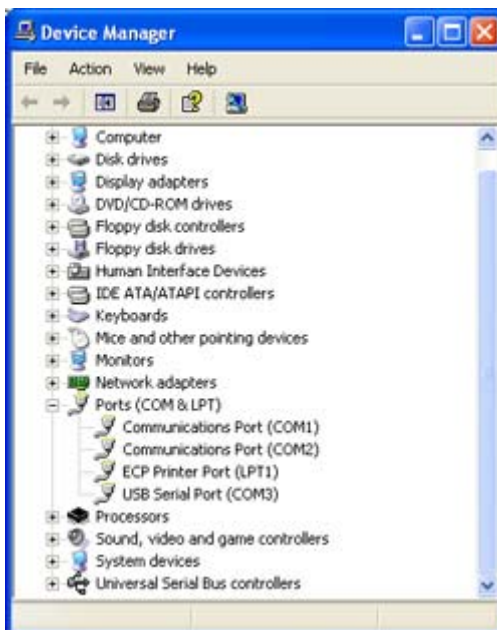
The firmware for the USB I/O 24 DIPR is available on request. Please contact

support@elexol.com

Driver Installation

Your first choice when using the USB I/O 24 DIP is whether you want to use the Virtual COM Port driver or the Direct DLL driver.

For programming simplicity the best driver is the Virtual COM Port and when installed the USB I/O 24 DIP will appear in the System Properties / Device Manager as an USB Serial Port (COMn) as follows.



The COM port number will vary depending on the number of existing COM ports on your computer and the number of USB I/O 24s or USBMODs connected to your system.

To install the Virtual Com Port drivers, download the driver from our website or the ftdichip.com website and unzip the files to a local directory. Then connect the USB I/O 24 DIP and windows will automatically ask for the driver, select to specify a location and browse to the directory where you have unzipped the files. (Use of the Non Plug & Play driver for the USB I/O 24 DIP is recommended to avoid a delay on connecting the USB I/O 24 DIP)

Once the Virtual COM Port is installed it can be programmed exactly as a regular serial COM port using the MSComm control from within VB or API calls from C or other languages. Set the COM port to the same number as appears in the Device Manager, the baud rate, stop bits, parity etc are not used as the device always runs at full speed.

The Direct DLL driver is installed in a similar manner but using the alternative download from the website.

Programming the Direct DLL driver is by call to the DLL Library functions. Please download the Direct DLL programmers guide from the FTDI website.

Programmers Reference Documentation

Programming the USB I/O 24 DIP from Visual Basic.Net using the Virtual Comm Port.

To operate the USB I/O 24 DIP from within Visual Basic.Net it's best to use the Serial Port .NET component to access the com port.

Opening the Port

If the port number is incorrect or the USB I/O 24 DIP module is not connected then VB.net will generate an error.

Try

```
With serialPort
    .PortName = ComboBox1.Text
    .BaudRate = 115200
    .Parity = IO.Ports.Parity.None
    .DataBits = 8
    .StopBits = IO.Ports.StopBits.One
End With

serialPort.Open()

Catch ex As Exception
    MsgBox(ex.ToString)
```

End Try

Setting the pins as Inputs or Outputs

Setting the Ports as Input or Output you must determine the value for the pins you want set as inputs.

To set pins I/O1, I/O2 and I/O3 as inputs and the remaining pins as outputs you simply add the bit values of the input pins $1 + 2 + 4 = 7$ and thus the value to be placed in the buffer as a Byte.

```
Dim buffer As Byte() = {&H07}

serialPort.Write("!A")
serialPort.Write(buffer, 0, 1) 'Set I/O 1,2,3 on PORT A as input
```

Writing to the Ports

To write to the Output Pins simple repeat the Above without the ! character.

The following example code sets the I/O8 pin on port B to high and the remaining pins as low.

```
Dim buffer As Byte() = {&H80}

serialPort.Write("B")
serialPort.Write(buffer, 0, 1) 'Set Output on PORT B
```

Reading from the Ports

To Read the Input Pins is a bit more complicated as we must request the data from the module, wait for it to arrive and then retrieve the data from the port. The following example reads the value from port A.

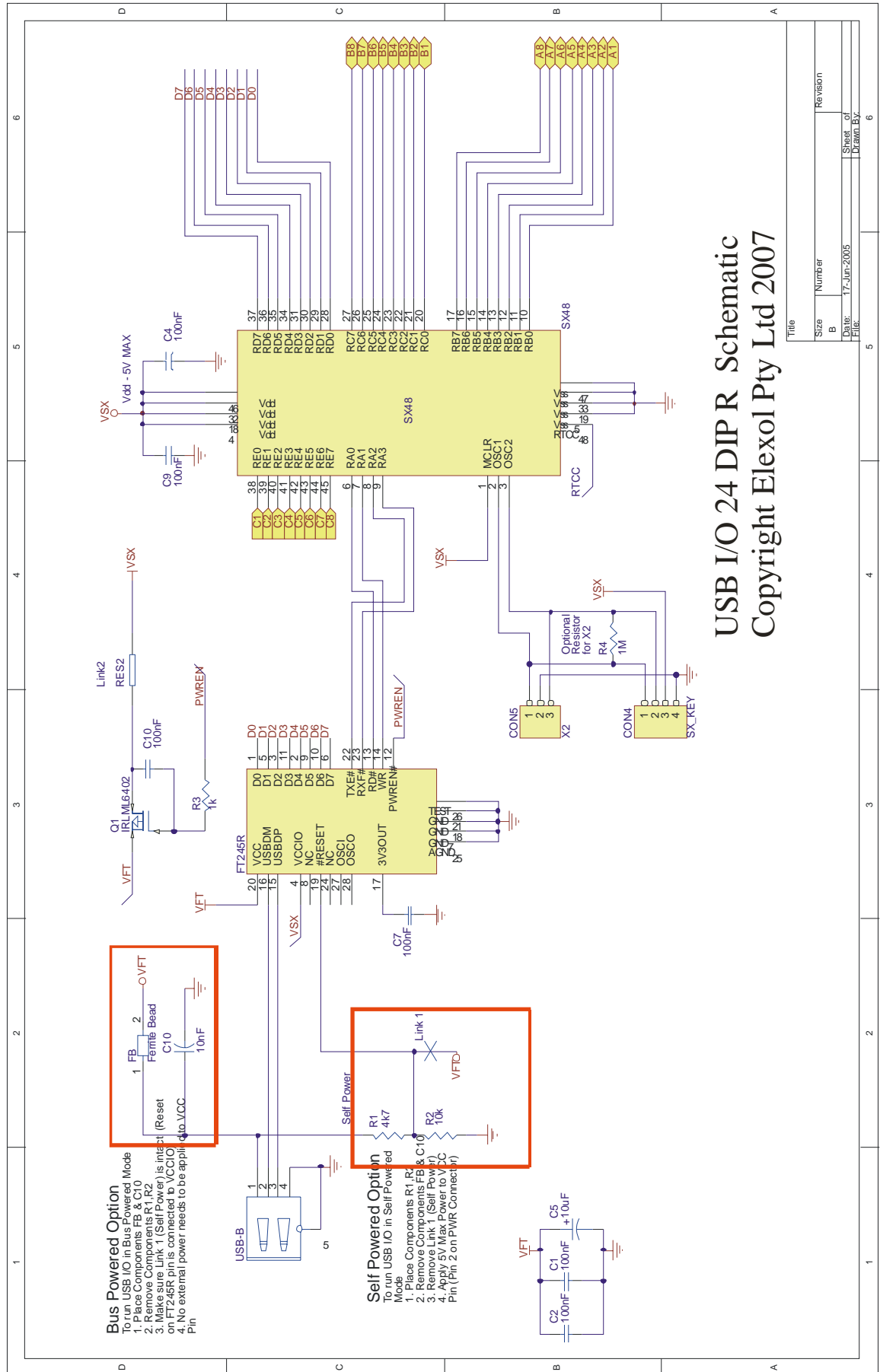
```
Dim myData As Integer
Dim ascChar As String

serialPort.Write("a")
' Wait some time for response
System.Threading.Thread.Sleep(50)

If serialPort.BytesToRead = 1 Then
    myData = serialPort.ReadByte
ElseIf serialPort.BytesToRead = 0 Then
    TextBox1.Text = "Read Timeout"
End If

'Convert Int to string to HEX
ascChar = Conversion.Hex(myData.ToString)
TextBox1.Text = ascChar
```

Schematic



USB I/O 24 DIP R Schematic
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Title		Revision	
Size	Number	Sheet of	Drawn By
B		6	
Date:	17-Jun-2005	File:	

Hardware Configurations for the USB I/O 24 DIP as per schematic

The USB I/O 24 DIP has a number of different hardware configurations that can be implemented. Each of the configurations are listed below:

Bus Powered (FTDI Chip)

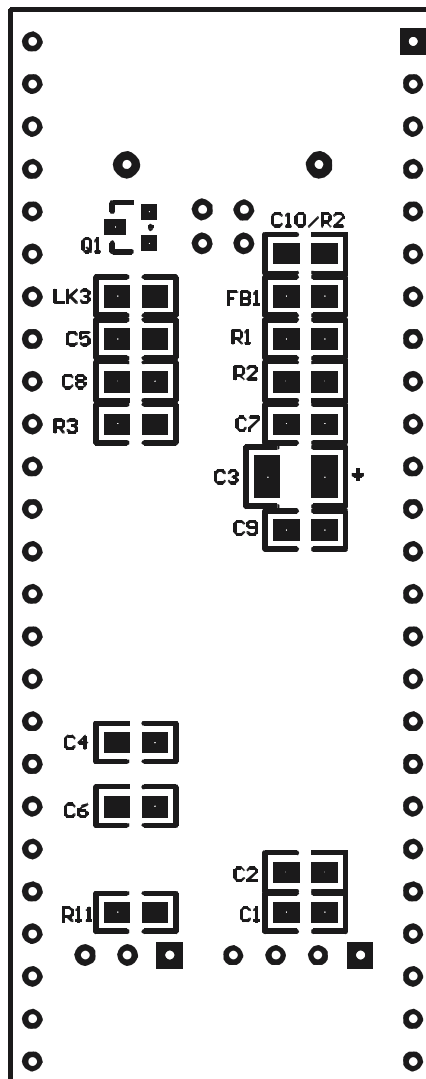
The bus powered mode draws power from the USB Bus. This option is the current configuration that is used when the USB I/O 24 DIP is sent out.

Self Powered (External power supplied to FTDI Chip)

The self-powered mode of operation draws power from its own external Power supply and doesn't draw any current from the USB Bus.

Note: The FTDI chip can only be bus powered or self powered

Component Designators for underside of board



Underside View

Self Powered Option

To run USB I/O in Self Powered mode

1. Remove Components FB & C10
2. Place components R1,R2
3. Apply 5V Max Power to VFT Pin

Where R1 = 4k7, R2 = 10k

Powering SX 48 Options

There are a number of different ways that the Parallax SX48 micro controller can be powered. These options are shown below.

Note: When the SX48 is powered from the USB this also means that the USB Bus will also power the FTDI FT245BM.

USB 5V

The SX48 draws its power from the USB Bus. This is the default setting out of the box.

External Power to SX48 (3.3V to 5V)

The SX48 draws its power from its own external power supply. Either 3.3V or 5V power can be used to power the SX48.

Absolute Maximum Ratings

Subjecting the device to conditions outside these rating will invalidate the product warranty and may cause irreparable damage the device.

Maximum Voltage on Any Pin (referenced to GND)	5.1 V DC
Minimum Voltage on Any Pin (referenced to GND)	-0.1V DC
Supply current when USB enumerating	55mA
Supply current when running with no load on I/O pins	32mA
Total Current to or from Any Single I/O Pin	30mA
Total Current to or from Any PORT (8 Single I/O make a PORT).....	50mA
Total Current in or out of all the module's I/O pins	200mA

Further Reading and Examples

More information and examples for the USB I/O 24 DIP can be found on our websites at www.elexol.com

Updated drivers and further information about the USB interface chip can be found at the FTDI website www.ftdichip.com

Information about the SX48 micro controller can be found on the PARALLAX website at www.parallax.com

Document Revision History

USB I/O 24 DIPR Datasheet V1.0– Initial document created 23rd August 2007

Technical Support and Further Information

For any questions relating to the USB I/O 24 DIP please contact us by Email:
support@elexol.com

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Product Use Limitations, Warranty and Quality Statement.

The USB I/O 24 DIP should not be used in any situation where it's failure or failure of the PC or software controlling it could cause human injury or severe damage to equipment.

This device is not designed for or intended to be used in any life critical application.

The USB I/O 24 DIP is warranted to be free from manufacture defects for a period of 12 months from the date purchase.

Subjecting the device to conditions beyond the Absolute Maximum Ratings listed above will invalidate this warranty.

The USB I/O 24 DIP is a static sensitive device, anti static procedures should be used in the handling of this device.

All USB I/O 24 DIP units are tested during manufacture and are despatched free of defects.

Elexol is committed to providing products of the highest quality. Should you experience any product quality issues with this product please contact our quality assurance manager at the above address.

Disclaimer.

This product and its documentation are provided as-is and no warranty is made or implied as to their suitability for any particular purpose.

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