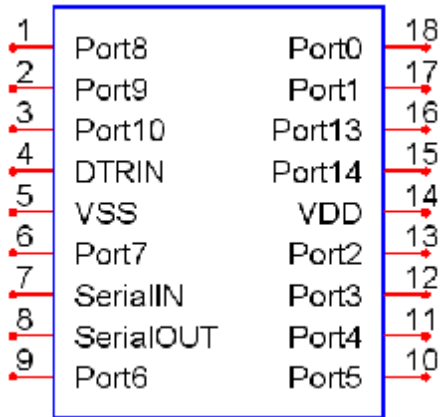




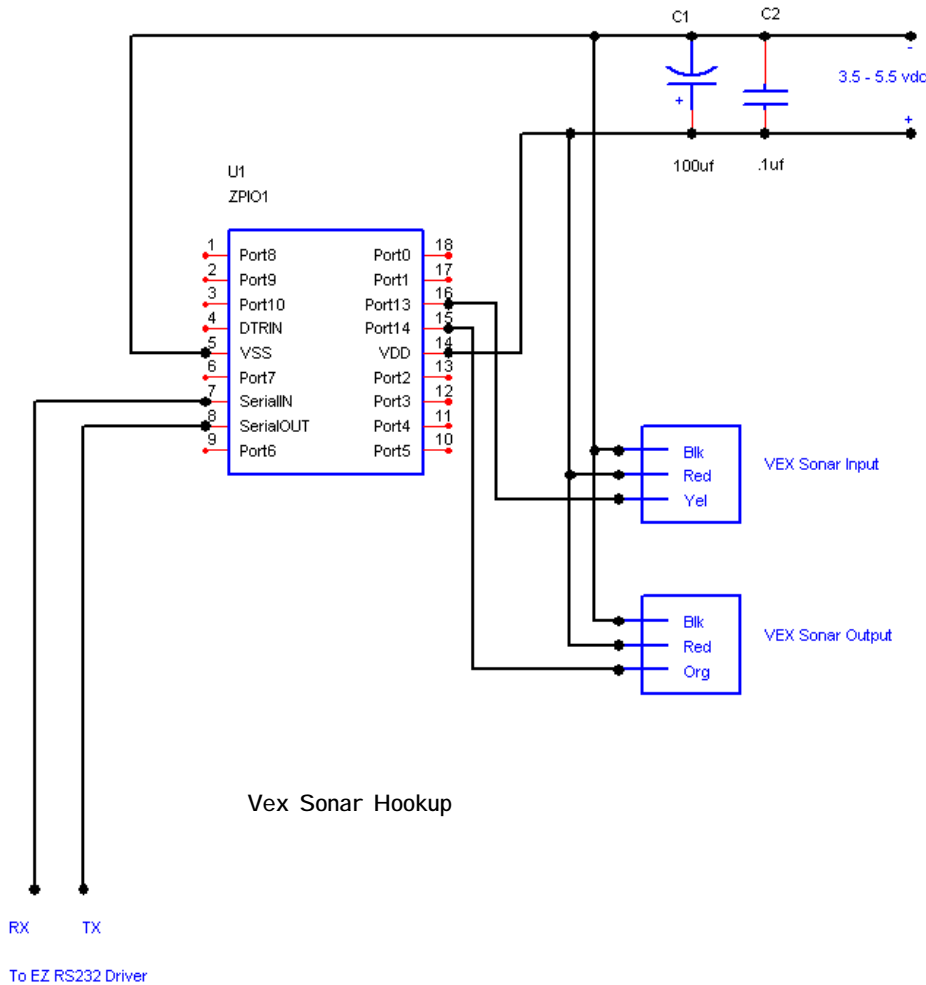
# ZPI O1 Manual



By attaching the ZPI O1 chip to a PC, Laptop or Pocket PC you can control up to 13 IO Ports.

### Features

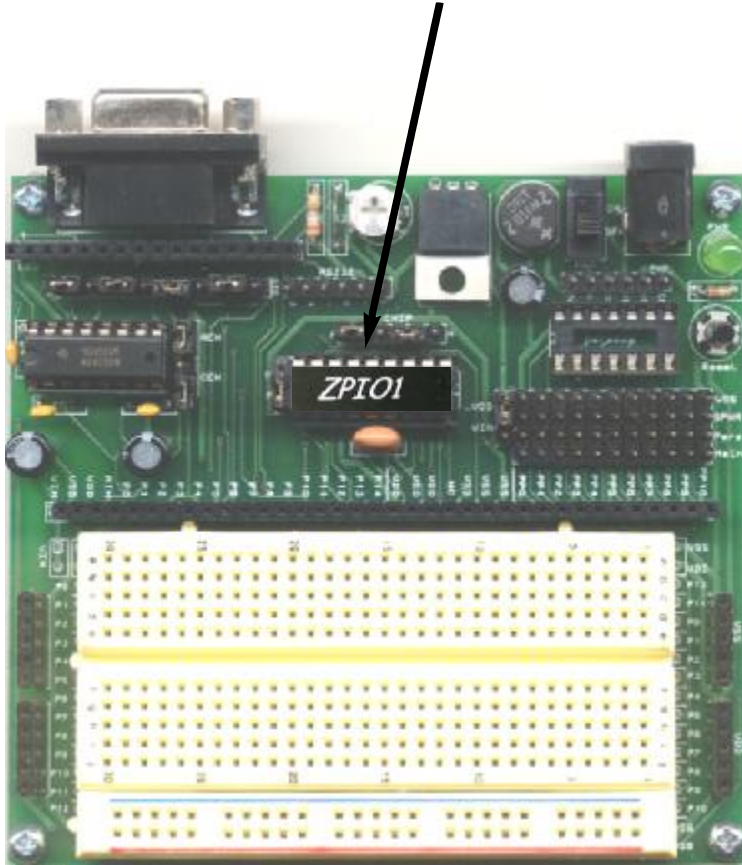
- 13 digital IO ports, input and output.
- Vex Sonar Interface.
- Pulsein on Port 0
- Pulseout on Ports 2,3,4, and 5
- Hardware PWM on Port 6
- Fast access to DTR and CTS leads.
- 19200 baud rate interface.
- Multiple chips may be connected for more ports.
- Can be connected to other ZP procs.
- Pulseout command can drive servos/



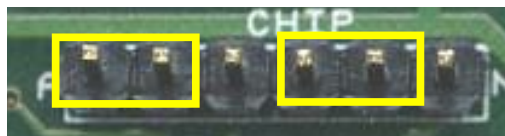
## Zeus Work Board

The ZPIO1 chip was designed to plug into the Athena Work Board Deluxe or Athena Workboard Basic. You can even use our Athena Workboard PCB.

Just plug the Zeus Proc into the socket as shown (Notch facing right).



Make sure the chip selector jumpers are set to the Athena mode as shown below.

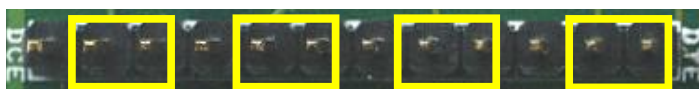


You need to set the type of PC your work board is communicating with. The default DCE is what you set for PC, Laptop and Bluetooth interface.

If you are connecting directly to a Pocket PC serial cable you will need to set the board to DTE mode. You will also need a Male to Male gender changer.



DCE (PC and Laptop)



DTE (Pocket PC, Male to Male gender changer needed)

## Workboard Connectons

Vss Gnd

Vdd5v

ATNConnected to RS232 DTR. Use ZPReadDTR() command.

P0 Input, Output, Pulsein

P1 Input, Output

P2 Input, Output, Pulseout

P3 Input, Output, Pulseout

P4 Input, Output, Pulseout

P5 Input, Output, Pulseout

P6 Input, Output, PWM

P7 Input, Output

P8 Input, Output

P9 Input, Output

P10 Input, Output Note that P10 is Open Collector and must be heald high with resistor when used as output.

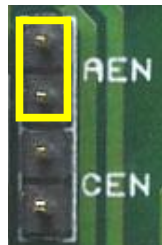
P13 Input, Output, Vex Sonar Input

P14 Input, Output, Vex Spmar Output

### DTR Port

The ATN port can be used as a very high speed output or normal speed input. If you want to use ATN as an output make sure the AEN jumper is in place as shown.

Note DTR is connected to ATN on the work-board.



ATN is connected to DTR (Default)

You then issue the following commands to set the ATN state high or low.

ZPSetDTRHigh() sets the ATN lead high

ZPSetDTRLow() sets the ATN lead low

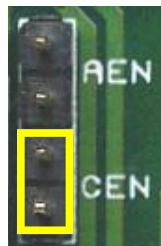
To use the ATN port as a input remove the jumper and use the ZPReadDTR() command.

The reason the ATN output port is so fast is that no serial command is issued when used as output and the DTR lead is set directly by the PC.

### CTS Port

Note that you may connect Port 10 to CTS. This makes port10 very fast for input because not serial command needs tp be issued. Just use the ZPComCTS() function to get the CTS status.

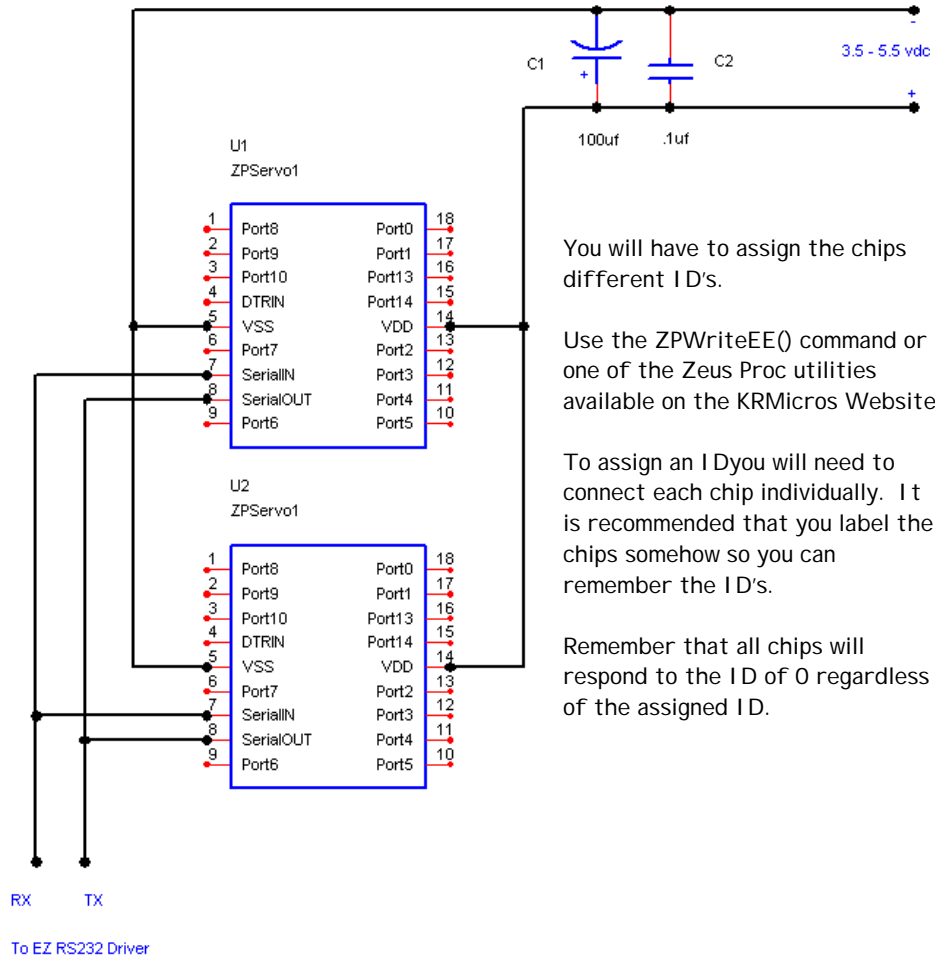
You will need to place the jumper on the CEN header as shown for this to work.



CTS is connected to IO Port 10

## Connecting Multiple Chips

You can connect upto 30 chip. Just connect all the SerialIn, SerialOut, VSS and VDD connections as shown.



You will have to assign the chips different ID's.

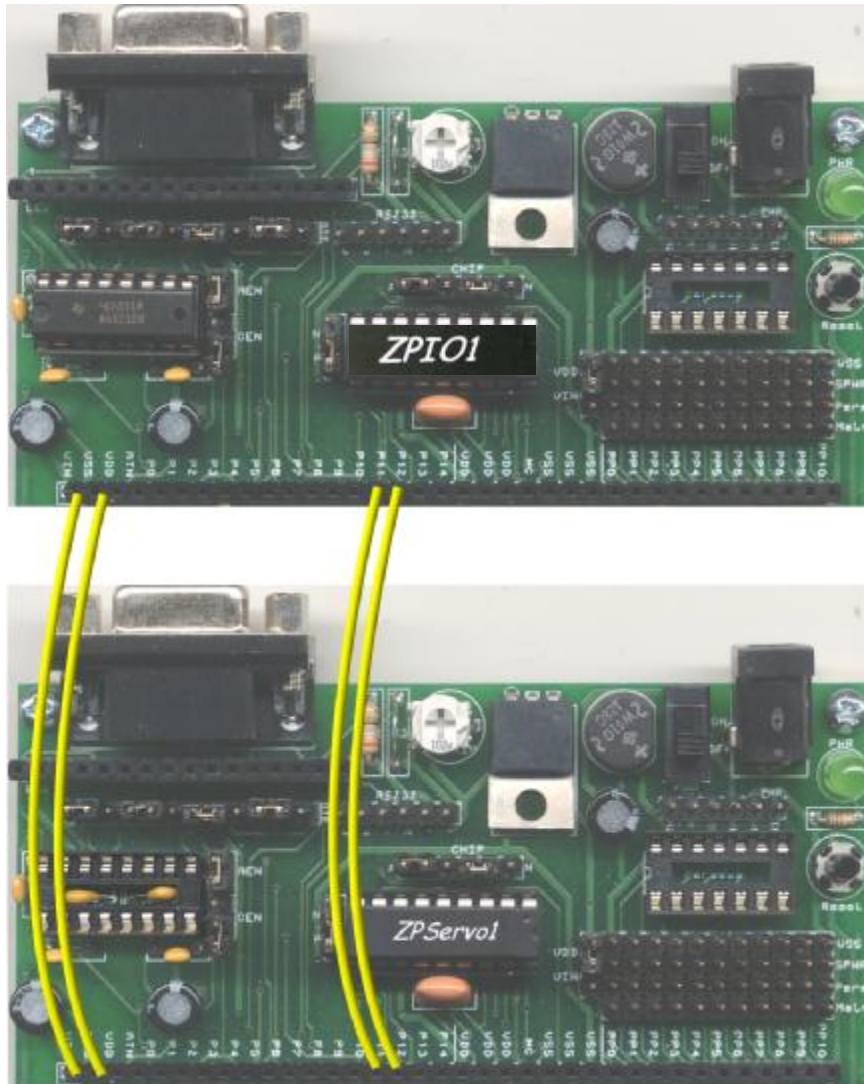
Use the ZPWriteEE() command or one of the Zeus Proc utilities available on the KRMicros Website.

To assign an ID you will need to connect each chip individually. It is recommended that you label the chips somehow so you can remember the ID's.

Remember that all chips will respond to the ID of 0 regardless of the assigned ID.

## Connecting Multiple Workboards

You connect multiple workboards the same way you do individual chips. Jumper the power connections VSS and VDD, then Jumper Ports 11 and 12 as shown.



Notice that the RS232 driver chip has been removed on the second board. Only the board connect to the PC, Laptop or Pocket PC should have the RS232 driver chip installed.

You may also wire up an additional Zeus Proc chip by using the breadboard or prototype area.

## Parts

ZPServo 1

<http://www.kronosrobotics.com/xcart/customer/product.php?productid=16482>

ZeusPro

<http://www.krmicros.com/Development/ZeusPro/ZeusPro.htm>

Athena Workboards Basic

<http://www.kronosrobotics.com/xcart/customer/product.php?productid=16473>

Athena Workboards Deluxe

<http://www.kronosrobotics.com/xcart/customer/product.php?productid=16457>

## Other Products

USB to Serial Adapter	<a href="http://www.jameco.com">www.jameco.com</a>	#387954CE
	<a href="http://www.cyberguys.com">www.cyberguys.com</a>	#104 0475
6' Serial Cable	<a href="http://www.jameco.com">www.jameco.com</a>	#199638CE
Gender Changer	<a href="http://www.jameco.com">www.jameco.com</a>	#18497CE
Bluetooth Adapter	<a href="http://www.cyberguys.com">www.cyberguys.com</a>	#202 5618
BlueTooth to RS232	<a href="http://www.expansys.com">www.expansys.com</a>	#112190

## Other Links

Be sure to visit our online forums at

<http://www.kronosrobotics.com/forums/>

## Specifications

Chip Default I D	7
Baud Rate	19200
I O Ports	13
Sink Current	25ma per port
Source Current	25ma per port
Power Supply	3.5-5.5V

EE Addresses

0 = I D

1 = Transmit hold time

2-127 Free

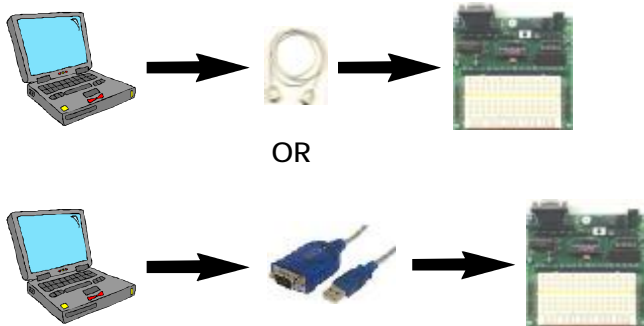
## Direct Connections

### PC Direct Connection to Workboard



To connect a PC to the workboard is very simple. All that is needed is a 9 male to female straight through cable. You will need Zeus Pro on the PC and a Zeus Proc on the workboard. If your computer does not have a serial port you will need a USB to serial adapter. (See below)

### Laptop Direct Connection to Workboard



This type connection is very similar to the PC. New laptops do not have a serial connector. In this case you will need a USB to serial adapter. Many come with cables that can be connected up to the workboard. You will need Zeus Pro on the Laptop and a Zeus Proc on the workboard.

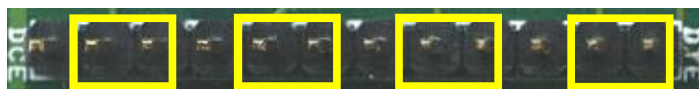
### Pocket PC Direct Connection to Workboard



In order to make a direct connection from the Pocket PC to the workboard you need a couple things. First you need a cable specifically designed for your model pocket PC. Early Pocket PC's used this cable to connect the Pocket PC to the PC.

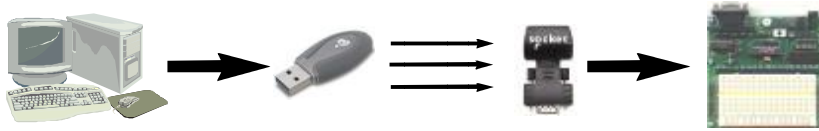
Next you will need a male to male gender changer in order to connect this cable to the workboard. A gender changer simply changes the sex of the cable to male which is needed to connect to the workboard.

The workboard also needs to be configured as a DTE device by changing the four jumpers as shown below.



## Bluetooth Connections

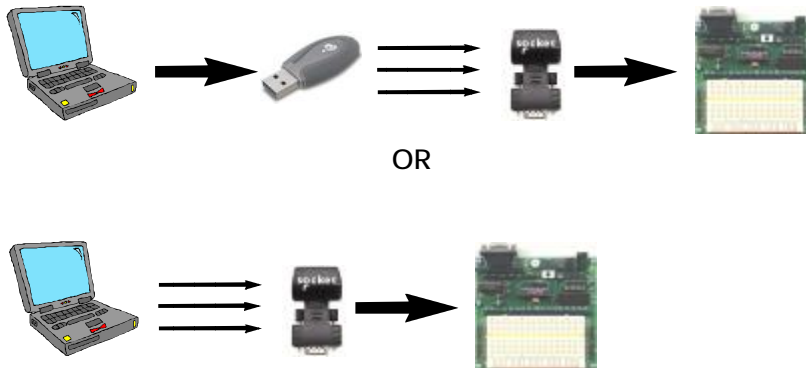
### PC Bluetooth Connection to Workboard



If you want a wireless connection from your PC to the workboard the best way to go is with Bluetooth. You will need a USB to Bluetooth adapter (Dongle) and a Bluetooth to RS232 adapter.

Warning Bluetooth can be a pain to setup and get it working. It is also prone to interference. Start with PC direct connection when working with the workboard then migrate to bluetooth and Pocket PC.

### Laptop Bluetooth Connection to Workboard



This type connection is very similar to the PC. However many laptops have built-in Bluetooth so only the Bluetooth to RS232 adapter is needed.

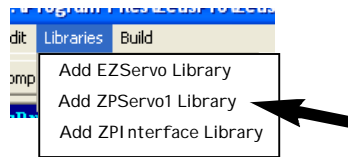
### Pocket PC Bluetooth Connection to Workboard



Many new Pocket PC's have built-in Bluetooth, this works the same as the laptop with builtin bluetooth. If your Pocket PC does not have built in Bluetooth then you will have to purchase an I O card that adds it to your Pocket PC. Other than that you may have to use a direct connection.

## ZPIO1 Command Library

To include the ZPServo1 command library select the Add ZPServo1 Library option on the Libraries Menu. Note that this option does not exist on the light versions of the software.



This will add the ZPServo1 library include file at the end of your document. The ZPServo Library automatically includes the generic Zeus Interface Library.

Once the library has been included you are free to use the following commands.

## ZPIO1 Specific Commands

### ZPInitInterface(1,1)

ZPInitInterface Channel,ComPort

*ZPInitInterface exp,exp*

#### Description

The ZPInitInterface command is required to use the ZPServo1 chip. This command sets up the comport to talk to the ZPServo chip. It sets the baudrate to 19200.

**Channel** - The Zeus communications channel 1-5 to use. Generally this is 1 unless you are using this channel for something else. If you omit the channel it will automatically use channel 1.

**ComPort** - The PC,Laptop or Pocket PC Comport that you are connecting to the ZeusProc1. You will need to consult your particular devices manual for available Comports.

### ZPPWM()

ZPPWM([Channel, I D,] Range,Period,Duty)

*ZPPWM([exp,exp,] exp,exp,exp)*

#### Description

Sets up a fire and forget signal. That is once it is set up the signal will continue until power is removed from the chip. Note that you must place port 6 in output mode.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Range** - Sets the range the PWM will perform. 0-2 is valid.

Range 0 Each unit 1us. EG 0,255,128 will give a 255us period with a 128us high time.

Range 1 Each unit 4us. EG 0,255,128 will give a 1020us period and a 512us high time.

Range 2 Each unit 16us. EG 0,255,128 will give 4080us period with a 2048us high time.

**Period** - The Period of the signal. See Range

**Duty** - This is the time the signal is high. See Range.

### ZPPulseout()

ZPPulseout([Channel, I D,] Port, Time)

*ZPPulseout([exp, exp,] exp, exp)*

#### Description

Pulse Port 2, 3, 4, or 5

If port 5 is high this command will pulse the port low. If it is low it will pulse it high. In other words the port is pulsed then returned to its original state.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Port** - The Port to pulse. Only Ports 2,3,4 and 5 are valid for the PulseOut command.

**Time** - This time in 10us units to pulse the port. There is also approximately 20us overhead for the command. A value of 10 will yield a 120us pulse.

### ZPPulsein()

ZPPulsein([Channel, I D,] State, Timeout)

*ZPPulsein([exp, exp,] exp, exp)*

#### Description

Read repeating pulse on Port 0

This command is designed to read repetitive pulses. It will wait one complete cycle before the pulse is measured to sync properly.

Returns 0 if timeout and 1-65535 for a valid reading. Each unit is approximately 20us so a value of 100 is 2000us.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**State** - This is the condition to measure. If 0 it will measure the low state. If it is 1 it will measure the high state.

**Timeout** - This is the number of tests to make before the count is terminated. It equates to about 10us per unit.

### ZPInitSonar()

ZPInitSonar([Channel, I D] )

*ZPInitSonar([exp, exp] )*

#### Description

Sets up ports 13 and 14 to interface to a VEX Sonar sensor. You need only call this command once to set up the ports.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

### ZPPingSonar()

ZPPingSonar([Channel, ID])  
ZPPingSonar([exp, exp] )

#### Description

This command sends a pulse to the VEX Sonar sensor and starts a counter that will read the amount of time it takes to get the echo.

Returns 0 if error or timeout. We don't currently have a actual number correlation for the value returned. The smaller the number the closer up to about 3 inches or so. You will need to experiment a bit. If you come up with a working formula for unit verses distance let us know and we will post it.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

## ZP Interface Commands

The following commands are available on most of the ZP processor chips. Some chips may have fewer or more IO ports. To use the commands you must include the ZPInterface library if you have not already included one of the other ZP libraries.

### IO Commands

#### ZPPortInput()

ZPPortInput([Channel, ID,] Port)  
ZPPortInput([exp, exp,] exp)

#### Description

Sets a port as a digital input. The port will read 1 or 0 when the ReadPort command is called.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Port** - Must be a valid ZeusProc1 IO port 0-10 or 13, 14. Note that Ports 11 and 12 are reserved.

### ZPReadPort()

ZPReadPort([Channel,I D,] Port)  
*ZPReadPort([exp,exp,] exp) as integer*

#### Description

Returns the state of a input port. Will return 1 or 0. Actually this command returns a 48 if the port is low and a 49 if the port is high.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Port** - Must be a valid ZeusProc1 IO port 0-10 or 13 , 14. Note that Ports 11 and 12 are reserved.

Note that ports 11 and 12 on the ZPServo1 chip will always return 0.

### ZPReadPorts()

ZPReadPorts([Channel,I D])  
*ZPReadPorts([exp,exp]) as integer*

#### Description

Returns the state of input ports 0-7. Will return 0-255 with each bit representing a given port state.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

### ZPPortOutput()

ZPPortOutput([Channel,I D,] Port)  
*ZPPortOutput([exp,exp,] exp)*

#### Description

Sets a port as an output. Once set you can use the PortHigh and PortLow to set the given port high or low.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Port** - Must be a valid ZeusProc1 IO port 0-10 or 13 , 14. Note that Ports 11 and 12 are reserved.

### ZPPortHigh()

ZPPortHigh([Channel,I D,] Port)  
*ZPPortHigh([exp,exp,] exp)*

#### Description

Sets an output port to high state.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Port** - Must be a valid ZeusProc1 IO port 0-10 or 13 , 14. Note that Ports 11 and 12 are reserved.

#### ZPPortLow()

ZPPortLow([Channel, ID,] Port)

ZPPortLow([exp,exp,] exp)

#### Description

Sets an output port to low state.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Port** - Must be a valid ZeusProc1 IO port 0-10 or 13 , 14. Note that Ports 11 and 12 are reserved.

#### SetPorts()

ZPSetPorts([Channel, ID,] Value)

ZPSetPorts([exp,exp,] exp)

#### Description

Sets the state of ports 0-7 depending on the bit in the passed 8 bit value. If bit 0 is 1 then port 0 will be set high. If bit 0 is 0 then the port will be set low.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Value** - Each bit in this parameter is mapped to a one of the ports 0-7. If the bit is high the port will be set high.

#### SetDTRHigh()

ZPSetDTRHigh([Channel, ID] )

ZPSetDTRHigh([exp,exp])

#### Description

This command sets DTR port to the high state. On the Workboard if AEN jumper is in place the

ATN port will go high.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPI nitI nterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

#### SetDTRLow()

ZPSetDTRLow([Channel, ID] )  
ZPSetDTRLow([exp,exp])

#### Description

This command sets the DTR port to the low state. On the Workboard if AEN jumper is in place the ATN port will go low.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPI nitI nterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

#### ZPReadDTR()

ZPReadDTR([Channel, ID] )  
ZPReadDTR([exp,exp]) as integer

#### Description

This command will return the state of the DTR lead on the Zeus chip.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPI nitI nterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

#### ZPReadCTS()

ZPReadCTS([Channel, ID] )  
ZPReadCTS([exp,exp]) as integer

#### Description

This command will return the state of IO port 10 on the Zeus chip. Note that this is a high speed command as no serial command needs to be sent to the Zeus chip. You must set the port to input mode and enable the CEN jumper on the workboard.

Note that CTS is inverted. If it is low it will return 1 and high will return 0.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPI nitI nterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

ID - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

## Other Commands

### ZPReadVersion()

ZPReadVersion([Channel, ID])

*ZPReadVersion([exp, exp]) as integer*

#### Description

This command will return the version of the targeted chip.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

### ZPReadID()

ZPReadID([Channel, ID])

*ZPReadID([exp, exp]) as integer*

#### Description

This command will return the ID of the targeted chip.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

### ZPReadEE()

ZPReadEE([Channel, ID], Address)

*ZPReadEE([exp, exp,] exp) as integer*

#### Description

This command will return the value of a given EEPROM address in the chip.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Address** - This is the address of the internal EEPROM located in the ZP processor. Note that not all locations will be available so refer to the spec sheet at the end of this document for valid locations.

### ZPWriteEE()

ZPWriteEE([Channel, I D], Address, Value)  
*ZPWriteEE([exp, exp,] exp, exp)*

#### Description

This command will return the value of a given EEPROM address in the chip. Warning writing to some addresses can change functionality of the chip.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

**Address** - This is the address of the internal EEPROM located in the ZP processor. Note that not all locations will be available so refer to the spec sheet at the end of this document for valid locations.

**Address** - This is the value to write to the given address.

#### ZPReset()

ZPReset([Channel, I D])  
*ZPReset([exp, exp])*

#### Description

This command will resets the chip to the startup state of the chip. Turns off all servos and sets all IO ports to input mode.

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.

#### ZPReadType()

ZPReadType([Channel, I D])  
*ZPReadType([exp, exp]) as itneger*

#### Description

This command will return a number that represents the type of chip.

Type 1 = ZPServo1

Type 2 = ZPIO1

Type 3 = ZPAtoD

Type 4 = ZPBotProc

**Channel** - The Zeus communications channel 1-5 to use. If you omit the channel it will automatically use the channel set by the last ZPInitInterface command. Note that Channel may be omitted but if included you must include all remaining parameters.

**ID** - This is the chip ID. If ID is omitted a value of 0 will be used. This ID is recognized by all chips. See the section on changing ID at the end of this document.