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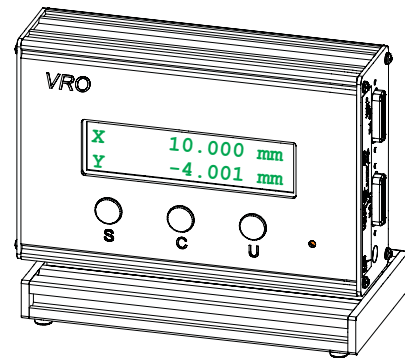
## VRO Encoder Readout Reference Manual Version 1.21

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### Introduction

The Velmex Read Out (VRO) is a compact 1 and 2 axes digital readout for linear and rotary incremental encoders. The VRO uses the latest OLED display and DSP microcontroller technology for a high performance ultra-precise digital position readout.

Designed for differential type encoders, the VRO is also fully compatible with single ended encoders.



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### Precautions

**⚠ CAUTION:**

*Readout and AC power adapter should be operating in a well ventilated area. Do not use in a wet, dirty, or explosive environment. In industrial environments, repackaging into a NEMA grade enclosure is required.*

*Do not connect or disconnect encoder while VRO is powered. Keep encoder cables a minimum of 2" (50 mm) from any power or motor control cables. Do not alter cables in any way without first consulting Velmex.*

*Only power VRO on/off by toggling AC power to power adapter. Do not connect/disconnect power plug on side of VRO to power on/off, VRO may not power-up correctly.*

**⚠ WARNING:**

**DO NOT USE POWER ADAPTER OUTDOORS OR IN WET ENVIRONMENTS**

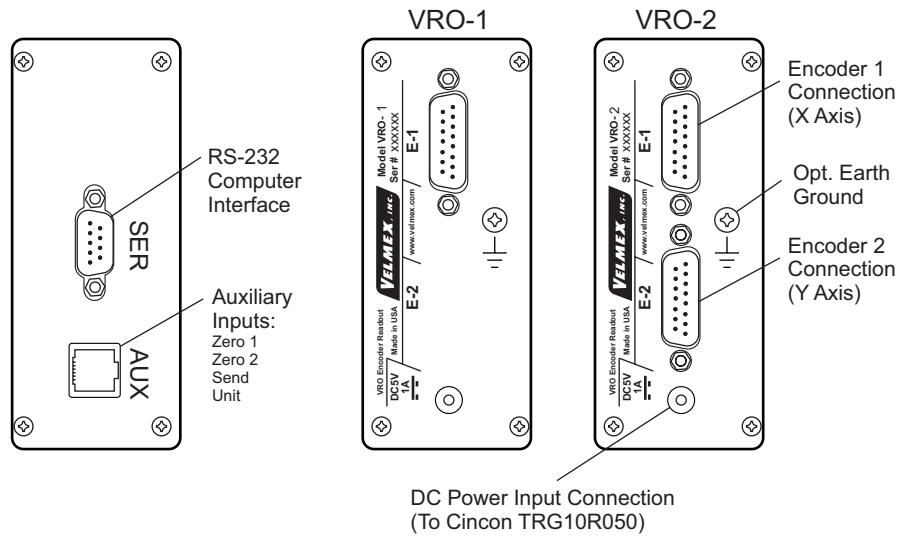
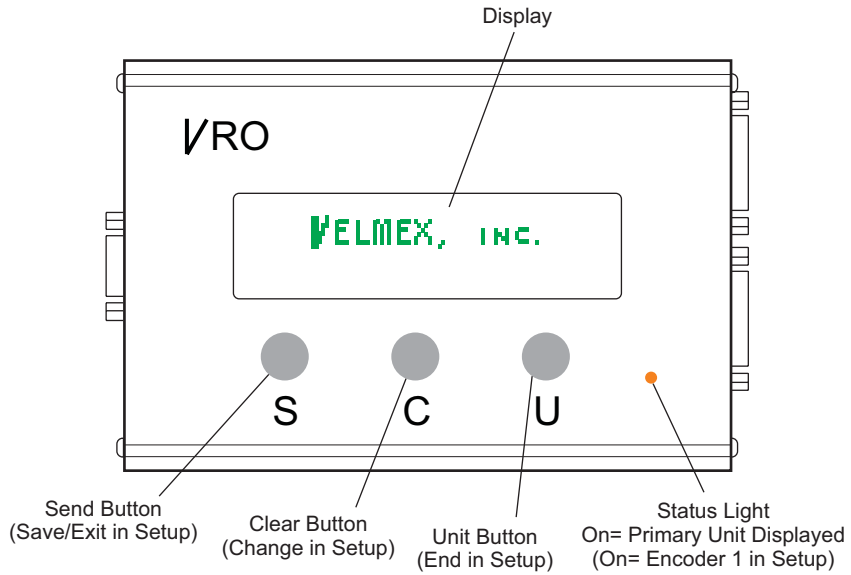
# Table of Contents

Precautions.....	1	Appendix A	
Features.....	3	Low Display Res Scaling Tables.....	35
Features (Views).....	4	Appendix B	
RS-232 Port.....	5	High Display Res Scaling Tables.....	36
Encoder Connection.....	5	Appendix C	
Remote Connection.....	5	Display Messages.....	37
Encoder Cable.....	6		
Power-up.....	7		
Setup/Encoder Type.....	8		
<i>Linear encoder</i>			
Setup/Linear Resolution.....	9		
<i>Rotary encoder</i>			
Setup/Cycles per Rev.....	10		
Setup/Device.....	11		
Setup/Lead Screw.....	12		
Setup/Rotary Table.....	13		
<i>Linear and Rotary encoders</i>			
Setup/Direction.....	14		
Setup/Display Resolution..	15		
Setup/Primary Unit.....	16		
End Encoder Setup.....	17		
Setup/Emulate.....	18		
Setup/Set Baud.....	19		
Display Mode.....	20		
Clearing count.....	20		
Send counter.....	21		
Sleep Mode.....	21		
Troubleshooting.....	21		
RS-232 Power-up.....	22		
RS-232 Front Panel Setup.	23		
RS-232 Display Mode.....	24		
RS-232 Online/Setup.....	26		
Specifications.....	31		
Dimensions.....	32		
Warranty.....	34		
Contact Information.....	34		

## Features

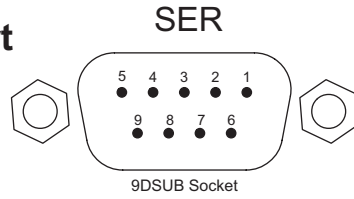
- Compatible with all 5V Incremental Encoders
- High speed differential line driver interface
- 9 digit plus decimal point, direction, axis and unit labels
- 4x quadrature decoding for highest resolution
- Easy front panel and PC configuration
- Inch/Metric selectable units
- Decimal degrees/revolutions selectable units
- Full RS-232/USB communication
- 1.6 Mhz counting rate
- Automatic memory back-up of settings
- Sleep mode
- Self diagnostics
- Encoder inputs with Schmitt triggers & digital filtering
- Input voltage monitoring
- Over voltage and over current protected
- Button “stuck” monitoring
- Data Send button with resettable totalizer of # presses
- Fractional scaling for highest accuracy
- Highly visible, wide angle viewing OLED display
- Remote Send, Clear, Unit button Inputs
- Programmable data output format
- 1 or 2 axis (VRO-1, VRO-2)
- User settable scaling, decimal place, axis and unit labels
- Pass through mode for custom display messages
- All I/Os  $\pm 15,000$  volt ESD protected
- UL/IEC category low voltage (5VDC) device
- Universal input AC Power adapter with UL, CE, TUV ratings
- 3 year Limited Warranty

# Features



# Connections

## RS-232 Port



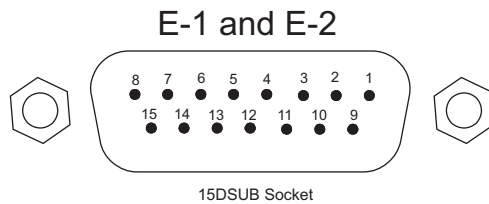
Pin Assignments:

- 1 N/C
- 2 Tx
- 3 Rx
- 5 Gnd
- 4
- 6
- 7
- 8
- 9 N/C

The RS-232 port will connect directly to a COM port of a PC with a straight through 9 pin serial cable or to a standard USB converter/cable.

N/C = No Connection

## Encoder Connection

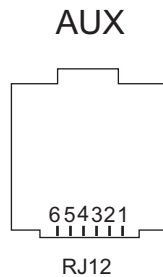


Pin Assignments:

- 1 A+
- 2 Gnd
- 3 B+
- 4 +5V
- 5 +5V@5ma
- 6 N/C
- 7 N/C
- 8 N/C
- 9 A-
- 10 N/C
- 11 B-
- 12 N/C
- 13 +5V@5ma
- 14 N/C
- 15 Gnd

N/C = No Connection

## Remote Connection



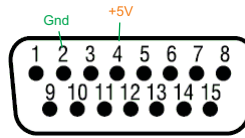
Pin Assignments:

- 1 0-1 (Zero encoder 1)
- 2 Gnd
- 3 Send (same as "S" button)
- 4 Unit (same as "U" button)
- 5 0-2 (Zero encoder 2)
- 6 Gnd

# Connections

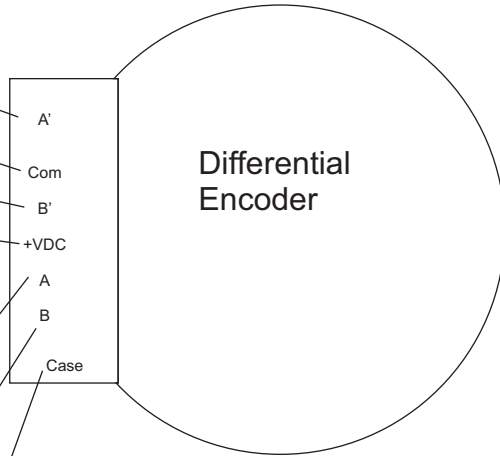
## Encoder Cable

Encoder Connector  
(Encoder/cable end shown)



15 Dsub Male

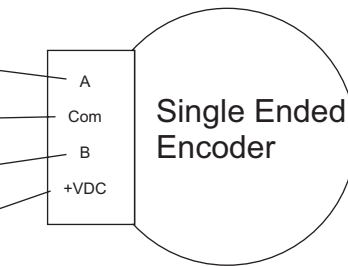
Pin	Signal
1	A+
2	Gnd
3	B+
4	+5V
5	+5 @ 5 ma
6	
7	
8	
9	A-
10	
11	B-
12	
13	+5 @ 5 ma
14	
15	Gnd
Shell	Shield



Pin	AMO	ELGO	EPC
1	green	violet	yellow
2	blue	white	black
3	brown	yellow	green
4	red	brown	white
9	yellow	green	brown
11	white	orange	red

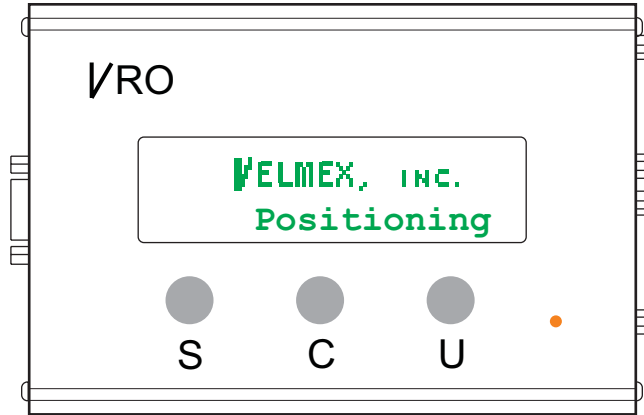
**NOTE:** To Invert direction on Differential Encoders swap A and A' or B and B' connections

Pin	Signal
1	A+
2	Gnd
3	B+
4	+5V
5	+5 @ 5 ma
6	
7	
8	
9	A-
10	
11	B-
12	
13	+5 @ 5 ma
14	
15	Gnd



**NOTE:** To Invert direction on Single Ended encoders swap A and B connections

# Power-up

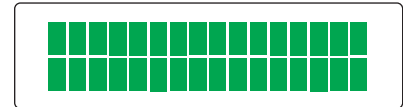


Hold "S" button down when powering\* to skip splash screen

Hold "C" button down when powering\* to skip splash & Start screen

Hold "U" button down when powering for pixel test:

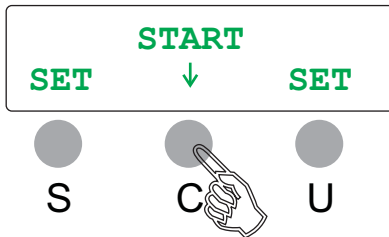
Pixel test display



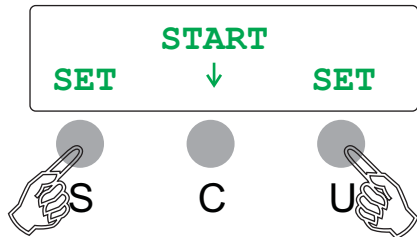
End of Power-up display



Start menu



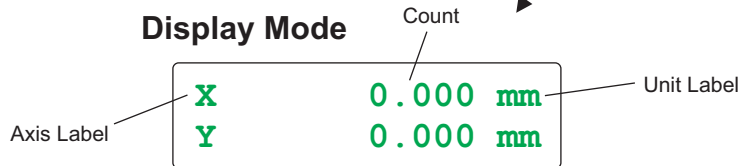
Start menu



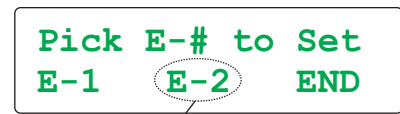
Press "C" Button for Display Mode

Hold "S" & "U" Button down > 1 second for Front Panel Setup Mode

**Display Mode**



**Front Panel Setup**



Only on VRO-2

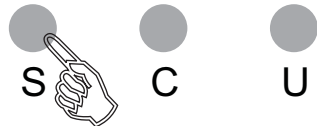
\* Holding both the "S" and "C" buttons down when powering will temporarily put a one axis (VRO-1) into a two axis mode, and a two axis (VRO-2) into a one axis mode.

# Front Panel Setup

## Encoder Set

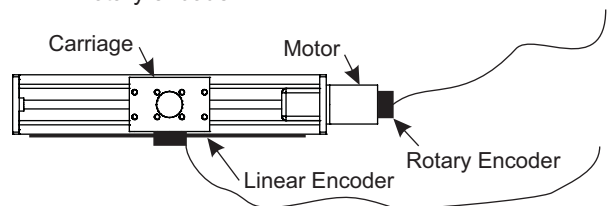
### Encoder Type

Pick E-# to Set  
E-1 E-2 END



Press "S" button to set encoder 1 or "C" for encoder 2

Follow the cable to the device to determine the type. If the cable ends at the carriage/slider of the device it's a linear encoder. If the cable originates from the back of a motor then it is a rotary encoder



Press "C" button to change encoder Type

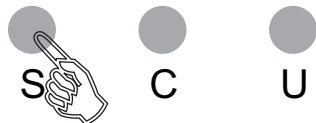
Enc Type: \_\_\_\_\_  
SAV CHG



Linear  
Rotary

Press "S" button to Save and exit this menu

Enc Type: Linear  
SAV CHG





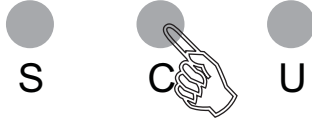
## Front Panel Setup

Encoder Type: Linear

Linear Resolution

Press "C" button to  
change Linear Resolution

Ln Res: \_\_\_\_\_  
SAV    CHG



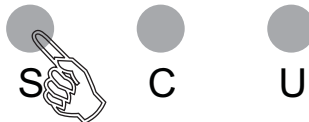
0.001 mm ← ELGO & AMO Encoders  
0.002 mm  
0.005 mm  
0.010 mm

**NOTE:** Linear Resolution must be set to match the resolution of the encoder.

The resolution is 0.001 mm for ELGO and AMO linear encoders.

Press "S" button to  
Save and exit this menu

Ln Res: 0.001 mm  
SAV    CHG



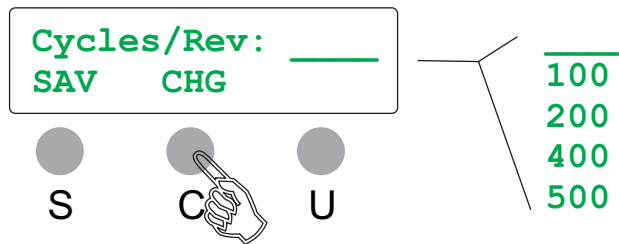
**Go to:**

"Front Panel Setup  
Encoder Type: Linear & Rotary  
Direction"

# Front Panel Setup

Encoder Type: Rotary  
Cycles / Revolution

Press "C" button to  
change Cycles/Revolution\*



\* Cycles/Revolution can be found in the part number of the encoder.

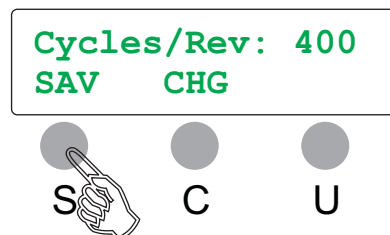
Typical ENCODER PRODUCTS part number:

Part# 15T-01SF-0400N5QHV-F00

Cycles/Rev

**Cycles/Rev** (CPR) can be determined empirically by temporarily setting CPR to "\_\_\_\_\_" and rotating the encoder exactly 1 revolution. The display will show raw counts (ct) from the encoder. Dividing this value by 4 equals the CPR.

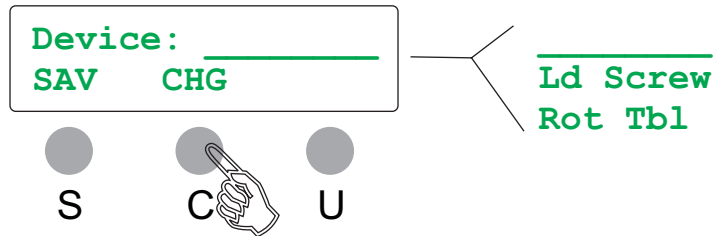
Press "S" button to  
Save and exit this menu



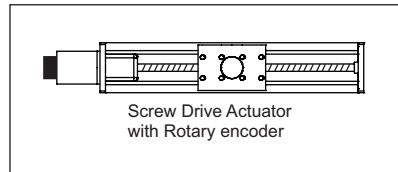
# Front Panel Setup

Encoder Type: Rotary  
Device

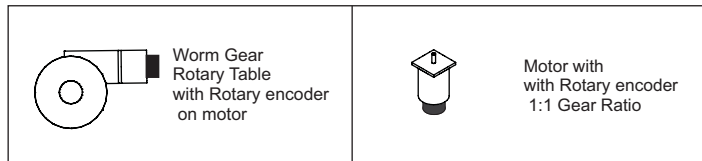
Press "C" button to  
change Device



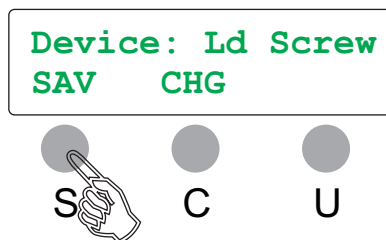
## Ld Screw



## Rot Tbl



Press "S" button to  
Save and exit this menu



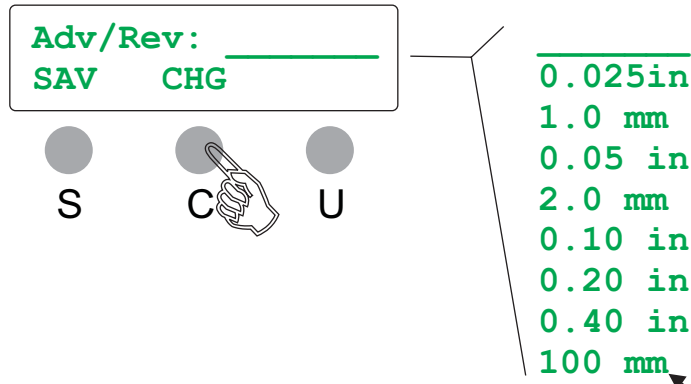
# Front Panel Setup

Encoder Type: Rotary

Device: Ld Screw

Advance/Revolution

Press "C" button to change Advance/Revolution



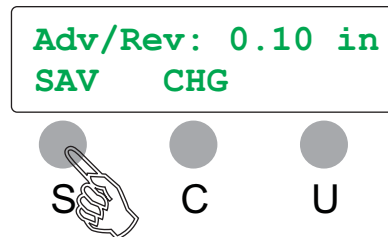
## Rotary Encoder & Lead Screw

	UniSlide*	BiSlide** XSlide***	Adv/Rev
C	P40	E25	0.025 in
K1	Q1	M01	1.0 mm
B	P20	E50	0.05 in
K2	Q2	M02	2.0 mm
W1	P10	E01	0.10 in
W2	P5	E02	0.20 in
W4	P2.5	E04	0.40 in

100 mm is for an encoder/motor mounted direct drive on the Velmex BiSlide Belt Drive (100 mm adv/turn)

\* Typical UniSlide model (where x is from above table): MA4009x-S4  
 \*\* Typical BiSlide model (where x is from above table): MN10-0100-x-21  
 \*\*\* Typical XSlide model (where x is from above table): XN10-0040-x-71

Press "S" button to Save and exit this menu



## Go to:

"Front Panel Setup  
Encoder Type: Linear & Rotary  
Direction"

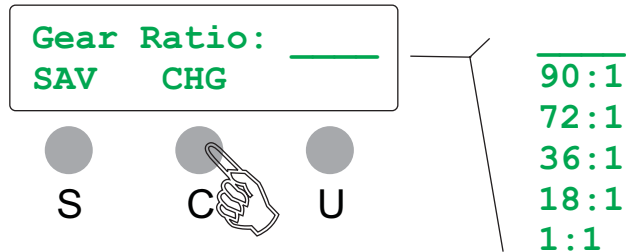
# Front Panel Setup

Encoder Type: Rotary

Device: Rotary Table

Gear Ratio

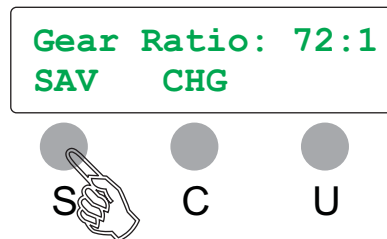
Press "C" button to  
change Gear Ratio



## Rotary Encoder & Rotary Table

Model #	Gear Ratio
B5990	90:1
B4872	72:1
B4836	36:1
B4818	18:1

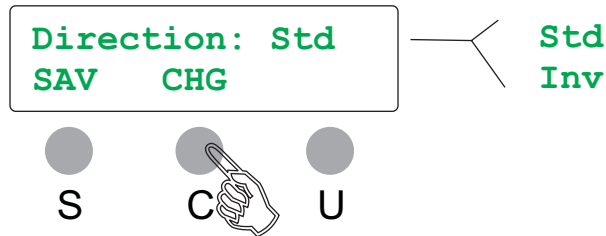
Press "S" button to  
Save and exit this menu



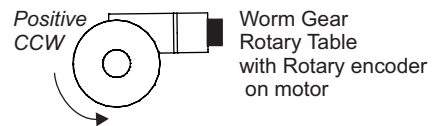
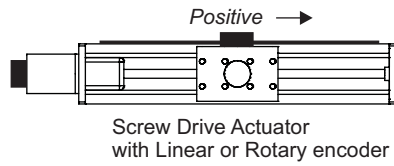
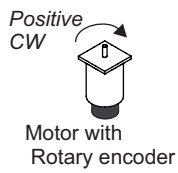
# Front Panel Setup

Encoder Type: Linear & Rotary  
Direction

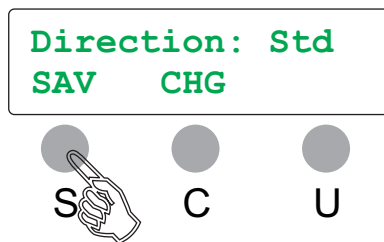
Press "C" button to  
change Direction



Direction: Std



Press "S" button to  
Save and exit this menu

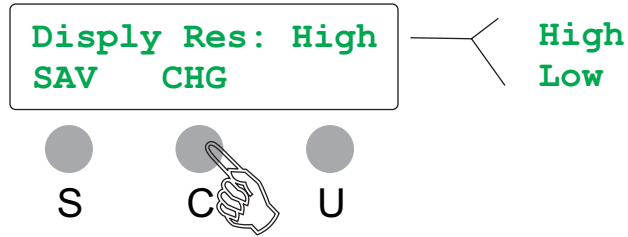


# Front Panel Setup

## Encoder Type: Linear & Rotary

### Display Resolution

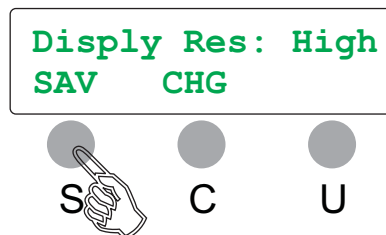
Press "C" button to  
change Display Resolution



Units	Maximum Decimal Places Displayed	
	High*	Low**
in (inches)	6	4
mm (millimeters)	4	2
o (degree)	4	2
rv (revolutions)	6	3

\* Refer to Appendix B for more information  
\*\* Refer to Appendix A for more information

Press "S" button to  
Save and exit this menu

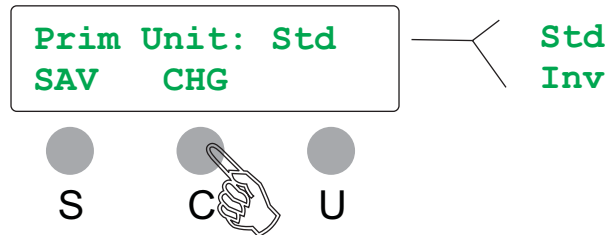


# Front Panel Setup

## Encoder Type: Linear & Rotary

### Primary Unit

Press "C" button to  
change Primary Unit



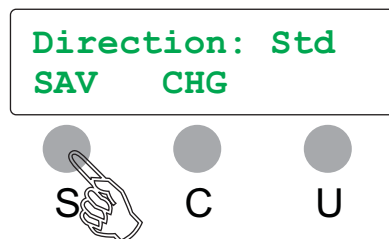
### Std Primary Units

- mm** For Linear Encoders
- mm** For Lead Screws with **x.x mm** Adv/Rev
- in** For Lead Screws with **x.xx in** Adv/Rev
- o** For Rotary Tables

### Inv Primary Units

- in** For Linear Encoders
- in** For Lead Screws with **x.x mm** Adv/Rev
- mm** For Lead Screws with **x.xx in** Adv/Rev
- rv** For Rotary Tables

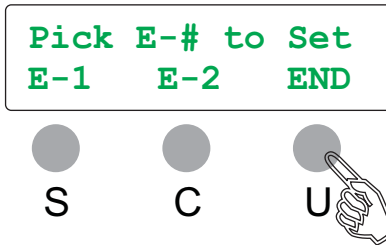
Press "S" button to  
Save and exit this menu



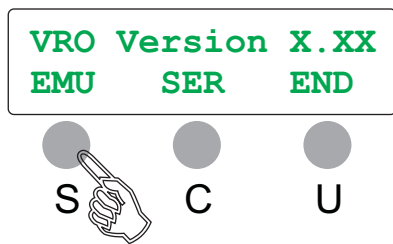


# Front Panel Setup

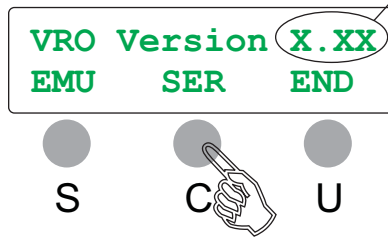
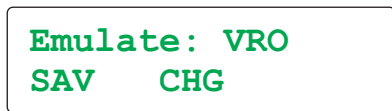
## End Encoder Set



Press "U" button to  
End encoder setting

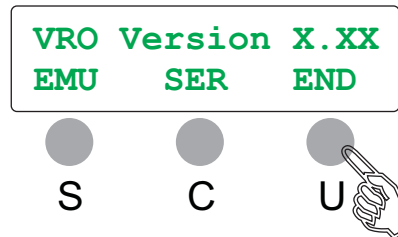
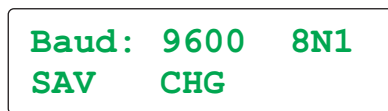


Press "S" button to  
Set Emulation mode

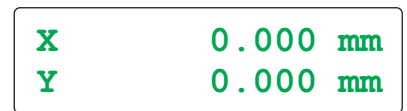


Firmware Version Number

Press "C" button to  
Set Serial port Baud rate



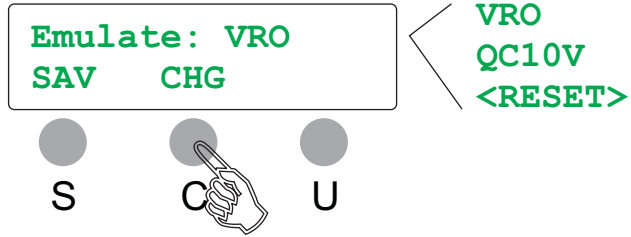
Press "U" button to  
End Setup start  
Display mode



# Front Panel Setup

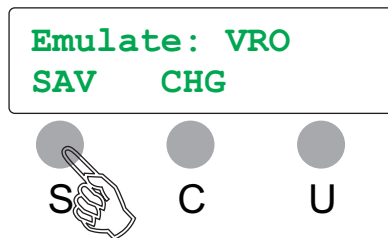
## Emulate

Press "C" button to change Emulation setting



VRO is the standard setting  
QC10V setting changes the Serial port stop bits from 1 to 2  
<RESET> setting will erase all settings saved in memory

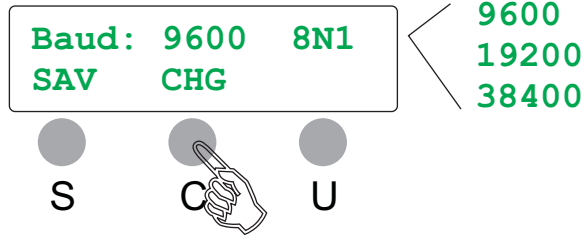
Press "S" button to  
Save and exit this menu



# Front Panel Setup

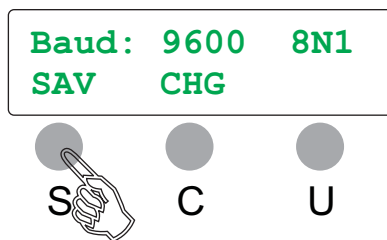
## Serial Set Baud

Press "C" button to change Baud rate setting

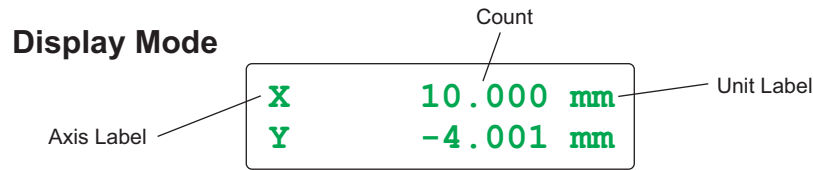


**NOTE:** Data bits are 8, Parity is None, and Stop bits is normally 1

Press "S" button to Save and exit this menu



# Display Mode



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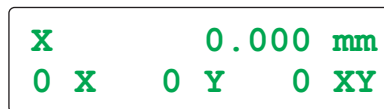
## Clearing Count (VRO-1)

Press the "C" button to zero the encoder count



## Clearing Count (VRO-2)

Press the "C" button, the second line of the display will show the zero submenu:



Press the "S" button to zero X axis, press the "C" button to zero Y axis, the "U" button to zero X & Y axes,

**NOTE:** This menu will revert back to the previous display if a button is not pressed within 2 seconds.

---

## Primary/Secondary Units

Press and release the "U" button to toggle between units.

NOTE: The status light is on for primary and off for secondary units.

### Standard Units

mm	Millimeters
in	Inches
o	Decimal Degrees
rv	Revolutions
ct	Raw Encoder Counts (default when VRO Setup not completed)

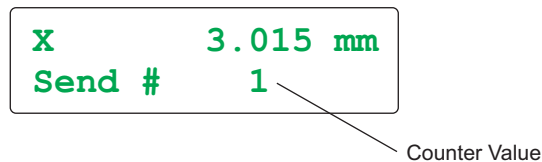
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# Display Mode

## Send Count to Host Computer

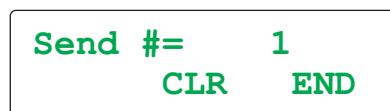
Press the "S" button to Send the display count out the Serial port.  
The status light will flash for duration of the send.  
For more information on the Send format refer to the "setO" command.

There is user resettable Send Counter that counts the number of Sends.



## Viewing & Clearing Send Counter

Hold the "U" button down and press the "S" button to display the Send Counter menu:



Press the "C" button to Clear the Send Counter, press "U" to End menu

**NOTE:** This menu will revert back to the previous display if a button is not pressed within 2 seconds.

---

## Sleep Mode

To put the VRO into Sleep mode hold the "U" button down >2 seconds until "( Sleep mode" is displayed.  
The display will blank and the status light will flash on/off continuously at a 1 second rate.  
To exit sleep press "U" button, or send any character in the Serial port.

**NOTE:** The VRO fully powers attached encoders and keeps counting while in sleep mode.

---

## Troubleshooting\*

- ◇ Status light flashing rapidly and display shows partial information or odd characters
- ✘ Power is intermittent /was interrupted, check power input connector & cycle power
  
- ◇ Status light pulsating and display shows ">5 INPUT VOLTS !"
- ✘ Power in is greater than 5.4 volts, disconnect power adapter and check it's voltage
  
- ◇ Status light pulsating and display shows "<5 INPUT VOLTS !"
- ✘ Power in is less than 4.6 volts, check power adapter voltage, and encoder load
  
- ◇ Status light pulsating and display shows "Enc Input Fail !"
- ✘ Poor encoder connection, electrical interference, or count exceeding 1.6 MHz

\* Refer to Appendix C for more display messages

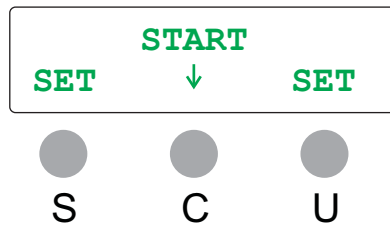
# RS-232/USB Communication

## General Command Structure

- Commands with a value after the command letter(s) need to end with a <cr> (carriage return) or comma.
- All single letter command do not need an ending <cr> or comma.
- Spaces are optional and not required between any characters.
- **All command characters are case sensitive**
- Scripts of commands can contain a comment field designated by a semicolon  
This example:  
**setO1XUC**<cr>  
is the same as this:  
**setO1XUC ;set Send Format**<cr>  
Everything from the semicolon to a <cr> is ignored by the VRO

## Power-up/Start Mode Commands

The following commands are available when the Start menu is displayed



- E** Enable On-Line/Setup mode with echo "on"
- F** Enable On-Line/Setup mode with echo "off"
- @** Simulate "C" button press

### **Status request commands:**

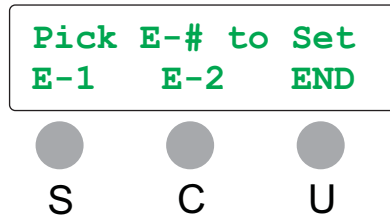
- V** Verify Readout's status, VRO sends "P" to host to indicate in Power-up mode

Refer to the "Display Mode Commands" section for more information on the "E", "F", and "V" commands

# RS-232/USB Communication

## Front Panel Setup Commands

The following commands are available when in Front Panel Setup



- ! Simulate button 1 ("S") press
- @ Simulate button 2 ("C") press
- # Simulate button 3 ("U") press

**Status request command:**

- V Verify Readout's status, VRO sends "F" to host to indicate in Front panel set-up mode

# RS-232/USB Communication

## Display Mode Commands

Display Mode Screen (VRO-1)

<b>X</b>	<b>10.000 mm</b>
----------	------------------

Display Mode Screen (VRO-2)

<b>X</b>	<b>10.000 mm</b>
<b>Y</b>	<b>-4.001 mm</b>

All commands are ASCII characters sent to the VRO through the RS-232 Serial interface. The simplest method to send commands is with terminal programs like the Velmex COSMOS Terminal or TeraTerm.

### **NOTE: All command characters are case sensitive**

Another method to send commands is with commercially available languages such as BASIC, C, LabVIEW, MATLAB, etc.

To put the VRO in the On-Line / Setup mode, the host must send either an "E", or "F". When the VRO receives an "E", or "F" the On-line screen will be displayed, Display mode commands, and Display mode button inputs will be disabled.

The "E" puts the VRO on-line with echo "on" (echoes all characters received back to the host.) The "F" puts the VRO on-line with echo "off". If you are using a terminal program to communicate to the VRO use the "E" so typed characters will be displayed. When using a software language to send commands, use the "F" so the host's input buffer will not be burdened with echoed characters from the VRO.

- E** Enable On-Line / Setup mode with echo on. The single character "E" is used to put the VRO in the On-Line mode. All characters the VRO receives will be echoed back to the host.
- F** Enable On-Line / Setup mode with echo oFF. The single character "F" is used to put the VRO in the On-Line mode. No characters will be echoed back to the host. The VRO will respond to all count and status requests.
- C** Clear/Null (zero) encoder position registers
- N** Clear/Null (zero) encoder position registers (same as "C")
- <** Clear (zero) encoder 1 position register
- >** Clear (zero) encoder 2 position register
- U** Display Primary Unit (Similar function to pressing the "U" button)
- u** Display Secondary Unit (Similar function to pressing the "U" button)
- B** Blank display (Puts VRO in Sleep mode)



# RS-232/USB Communication

## Display Mode Status Request Commands

- V** Verify Readout's status, VRO sends "D" to host to indicate in Display mode.
- 1** Send raw count encoder 1 to host. The VRO sends encoder count without scaling or unit label followed by a carriage return.
- 2** Send raw count encoder 2 to host. The VRO sends encoder count without scaling or unit label followed by a carriage return.
- X** Send displayed encoder 1 primary position to host. The VRO sends encoder count scaled with primary units followed by a carriage return.
- x** Send displayed encoder 1 secondary position to host. The VRO sends encoder count scaled with secondary units followed by a carriage return.
- Y** Send displayed encoder 2 primary position to host. The VRO sends encoder count scaled with primary units followed by a carriage return.
- y** Send displayed encoder 2 secondary position to host. The VRO sends encoder count scaled with secondary units followed by a carriage return.
- S** Send formatted display to host (same as "S" button) See "setO" command to configure format.
- #** Send count for # times "S" button pressed. The VRO sends count followed by a carriage return.

# RS-232/USB Communication

## On-Line / Setup Mode Commands

On-Line / Setup mode with echo on

On-Line / Setup  
Mode (echo)

On-Line / Setup mode with echo off

On-Line / Setup  
Mode (no echo)

**Q** Quit On-Line mode (return to Display mode)

**quit** Quit On-Line mode without backing-up changes. This is the same as the "Q" command except any settings that were updated will not be saved when the VRO is powered off.

**fpsetup** Display Front Panel setup menu. This is the same as starting the setup menu at Power-up

**lock** Disable Front Panel setup mode at power-up. The VRO will disable the Front Panel setup at the Start menu.

Start menu after "lock" command

START  
↓

**unlock** Enable Front Panel setup mode at power-up (default) This command restores setup at the Start menu that the "lock" command disabled

**I1v** Preset encoder 1 (raw) count to value "v", v= 0 to +/- 2147483647

Display value =  $((v \times \text{Multiplier}) / \text{Divisor}) / 1 \times 10^{\text{DecP}}$

$v = ((\text{Display value} \times 1 \times 10^{\text{DecP}}) / \text{Multiplier}) \times \text{Divisor}$

Where:

Multiplier = **get\*x**

Divisor = **get/x**

DecP = **getPx**

Example, set "I1" to 1600: **I1 16000 <cr>**

The "<cr>" is a carriage return character (<Enter> key on most keyboards)

A comma can be used instead of a <cr>:

**I1 16000 ,**

Spaces are optional:

**I116000,**

**I2v** Preset encoder 2 (raw) count to value "v", v= 0 to +/- 2147483647

Display value =  $((v \times \text{Multiplier}) / \text{Divisor}) / 1 \times 10^{\text{DecP}}$

$v = ((\text{Display value} \times 1 \times 10^{\text{DecP}}) / \text{Multiplier}) \times \text{Divisor}$

Where:

Multiplier = **get\*y**

Divisor = **get/y**

DecP = **getPy**

# RS-232/USB Communication

## On-Line / Setup Mode Commands

**PT[[** Start Pass-Through mode.

When the VRO is in Pass-Through mode all characters coming in the Serial port will get put directly on the display. A carriage return will advance to the start of the next line. There are 2 lines of 16 characters. Characters will automatically wrap to the next line on the 17th character.

**]** Close Pass-Through mode and maintain current screen

**]]** Close Pass-Through mode and restore "On-Line" screen

The following script will create the screen below:

```
PT[[Example of Pass<cr>  
Through Mode !
```



**Example of Pass  
Through Mode !**

# RS-232/USB Communication

## On-Line / Setup Status Request Commands

**V** Verify Readout's status, VRO sends "S" to host to indicate in Setup mode

**~** Read state of buttons/inputs (value is 8 bit binary bits 2-6) returns:  
| for no button pressed (bits 2-6=1)  
1 if "S" button down (bit 4=0)  
\ if "C" button down (bit 5=0)  
< if "U" button down (bit 6=0)  
x if 0-1 input is activated (bit 2=0)  
t if 0-2 input is activated (bit 3=0)  
, for "S" & "U" low (bit 4,6=0)  
p for 0-1 & 0-2 inputs (bit 2,3=0)

**@** Read analog converted value of input voltage (755 to 805)

**getD0** Read firmware version

**getD1** Read date code

**getD2** Read number of axes (1= 1 encoder, 2 =2 encoder)

**getD3** Read model number

**getO** Read Output format used by Send ("S" button and "S" command)

Default format for a VRO-1:

**1XUCL**<cr>

Default format for a VRO-2:

**1XUCL2YUCL**<cr>

**getQ** Read Quadrature direction setting (0= both std, 1= 1 inv, 2= 2 inv, 3= both inv)

**getAX** Read Axis label for encoder 1

**getAY** Read Axis label for encoder 2

**getUX** Read primary Unit label for encoder 1

**getUx** Read secondary Unit label for encoder 1

**getUY** Read primary Unit label for encoder 2

**getUy** Read secondary Unit label for encoder 2

**getPX** Read primary decimal Place for encoder 1

**getPx** Read secondary decimal Place for encoder 1

**getPY** Read primary decimal Place for encoder 2

**getPy** Read secondary decimal Place for encoder 2

**get\*X** Read primary Multiplier for encoder 1

**get\*x** Read secondary Multiplier for encoder 1

**get\*Y** Read primary Multiplier for encoder 2

**get\*y** Read secondary Multiplier for encoder 2

**get/X** Read primary Divisor for encoder 1

**get/x** Read secondary Divisor for encoder 1

**get/Y** Read primary Divisor for encoder 2

**get/y** Read secondary Divisor for encoder 2

# RS-232/USB Communication

## On-Line / Setup Set Commands

All "set" commands must terminate with in a carriage return character (<Enter> key on most keyboards) or a comma.

- setD0** Set VRO to default settings (all settings get cleared)
- setD1** Set Front Panel setup to defaults
- setD2** Set Scaling, Decimal Place, and Units to defaults
- setD3** Set Output format to defaults

**setOv** Set Output format used by Send, v= 1,2,X,x,Y,y,U,C,L,<space> (max 100 char.)  
When the "S" button is pressed or the "S" command is used in Display mode the VRO sends the encoder count value based on the format of the script in the "setOv" command.

These are the script characters that can used:

- 1** Axis label encoder 1
- 2** Axis label encoder 2
- X** Primary value encoder 1
- x** Secondary value encoder 1
- Y** Primary value encoder 2
- y** Secondary value encoder 2
- C** <cr> (carriage return)
- L** <lf> (line feed)
- U** Unit label for previously designated axis

Default format for a VRO-1:

**setO1XUCL**<cr>

Sends when "S" button pressed:

**X 123456.789 mm**<cr><lf>

Spaces can be put between characters to separate parameters further:

**setO 1 X UCL**<cr>

Sends when "S" button pressed:

**X 123456.789 mm**<cr><lf>

Default format for a VRO-2:

**setO1XUCL2YUCL**<cr>

Sends when "S" button pressed:

**X 123456.789 mm**<cr><lf>

**Y-987654.321 mm**<cr><lf>

**setQv** Set Quadrature counting direction (v= 0= both std, 1= 1 inv, 2= 2 inv, 3= both inv)  
Example to invert both encoder 1 and 2 direction:

**setQ3,**

# RS-232/USB Communication

## On-Line / Setup Set Commands

All "set" commands must terminate with in a carriage return character (<Enter> key on most keyboards) or a comma.

<b>setAXv</b>	Set Axis label for encoder 1, v= any ASCII character
<b>setAYv</b>	Set Axis label for encoder 2, v= any ASCII character
<b>setUXv</b>	Set primary Unit label for encoder 1, v= any 2 ASCII characters
<b>setUxv</b>	Set secondary Unit label for encoder 1, v= any 2 ASCII characters
<b>setUYv</b>	Set primary Unit label for encoder 2, v= any 2 ASCII characters
<b>setUyv</b>	Set secondary Unit label for encoder 2, v= any 2 ASCII characters

**NOTE:** When the following values are set through the Serial port, the Front panel encoder setup will be disabled.

<b>setPXv</b>	Set primary decimal Place for encoder 1, v= 0 to 8 0 disables the decimal point. Decimal place is right justified.
<b>setPxx</b>	Set secondary decimal Place for encoder 1, v= 0 to 8 0 disables the decimal point. Decimal place is right justified.
<b>setPYv</b>	Set primary decimal Place for encoder 2, v= 0 to 8 0 disables the decimal point. Decimal place is right justified.
<b>setPyv</b>	Set secondary decimal Place for encoder 2, v=0 to 8 0 disables the decimal point. Decimal place is right justified.
<b>set*Xv</b>	Set primary Multiplier for encoder 1, v= 1 to 200000
<b>set*xv</b>	Set secondary Multiplier for encoder 1, v= 1 to 200000
<b>set*Yv</b>	Set primary Multiplier for encoder 2, v= 1 to 200000
<b>set*yv</b>	Set secondary Multiplier for encoder 2, v= 1 to 200000
<b>set/Xv</b>	Set primary Divisor for encoder 1, v= 1 to 200000
<b>set/xv</b>	Set secondary Divisor for encoder 1, v= 1 to 200000
<b>set/Yv</b>	Set primary Divisor for encoder 2, v= 1 to 200000
<b>set/yv</b>	Set secondary Divisor for encoder 2, v= 1 to 200000

# Specifications

## Physical

Enclosure: Aluminum Black Anodized, IP30 rated  
Weight.(VRO-1)...1.00 lbs (459 g)  
Weight.(VRO-2)...1.06 lbs (473 g)  
Height .....4.27" (108.5 mm)  
Width .....6.87" (174.5 mm)  
Depth .....1.89" (48 mm)

### AC Power Adapter:

Weight.....0.29 lbs (130 g)  
Height .....1.8" (46 mm)  
Width .....1.4" (36 mm)  
Length .....2.8" (73 mm)

### Display:

Format.....2 Line x 16 Character  
Type.....OLED, Green  
Contrast Ratio.....2000:1 (readable in direct sunlight)  
Character Height...9 mm (0.35")  
Viewing Angle.....160 degrees  
Half-life.....50,000 hours

## Performance

Maximum displayable count:  $\pm 999,999,999$   
Maximum internal count:  $\pm 2,147,483,647$   
Maximum count rate: 1.6 MHz  
Encoder Inputs: 4x quadrature differential line receivers, Schmitt trigger with low pass digital filtering  
Maximum power output: 330 ma per encoder  
RoHS compliant

## Electrical Requirements

AC Power Adapter..... 90-264VAC 0.4A 47-63Hz  
VRO ..... 5VDC $\pm$  2% 1.0A  
Power Connector.....5.5 mm (type N) 2.5 mm ctr pin positive

### Encoder:

4.87 to 5.13 VDC, 330 ma max input  
Differential or Single Ended Interface

## Environmental

Operating Temperature .... 0°-120° F (-18°-49° C)  
Relative Humidity..... 10%-90% (noncondensing)

## Models

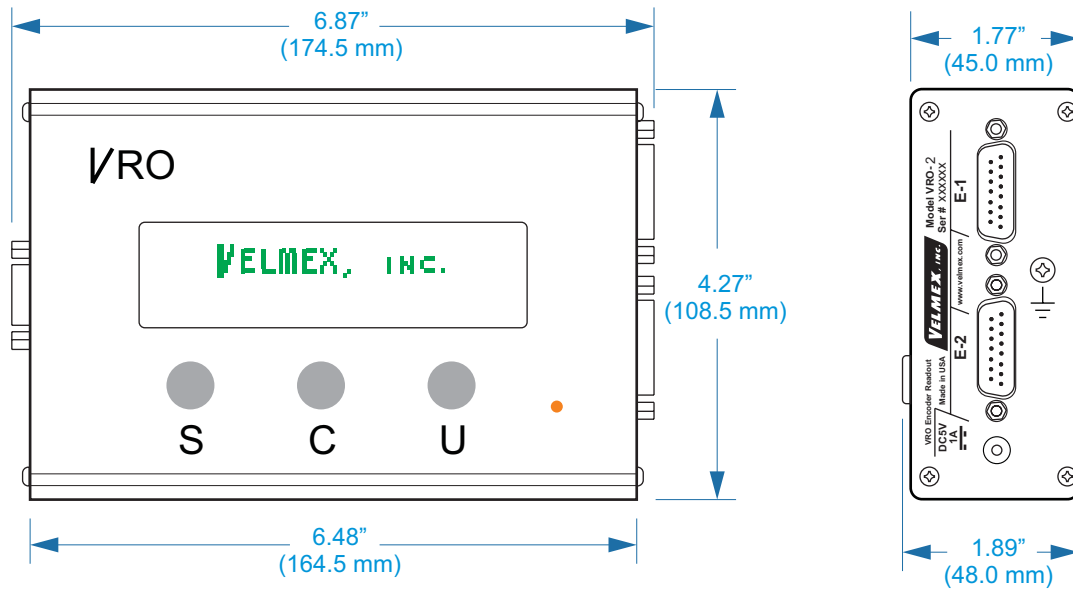
VRO-1 (one axis version)  
VRO-2 (two axis version)  
VRO-1B (one axis version with tilt base)  
VRO-2B (two axis version with tilt base)  
VRO-1H (one axis version with hinge)  
VRO-2H (two axis version with hinge)

## RS-232 Port Configuration

8 Data, No Parity, 1 Stop, 9600 baud rate default  
(19200, 38400 baud rate settable)

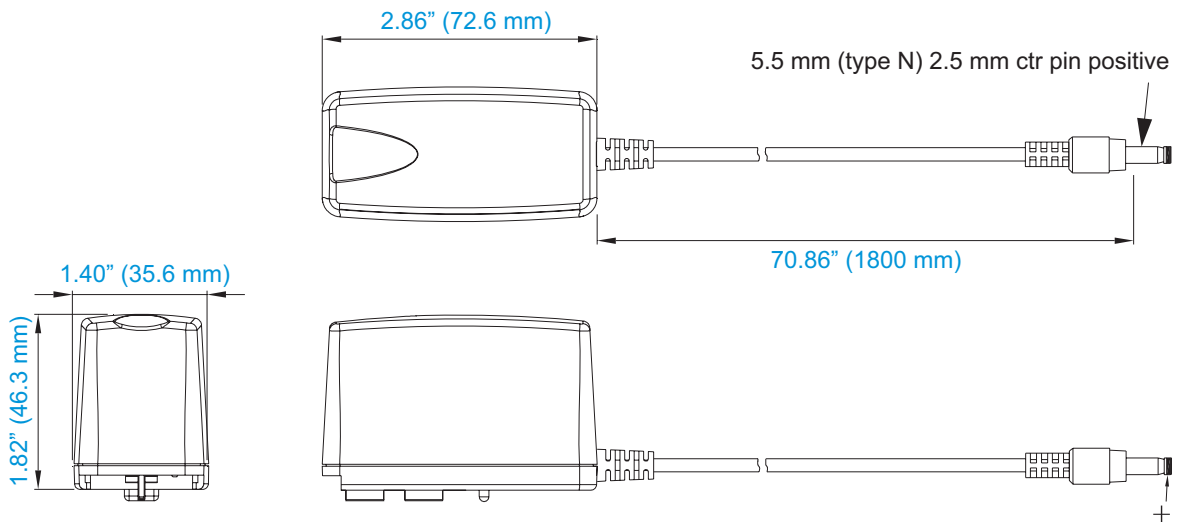
# Dimensions

## VRO-1 / VRO-2



## Power Adapter

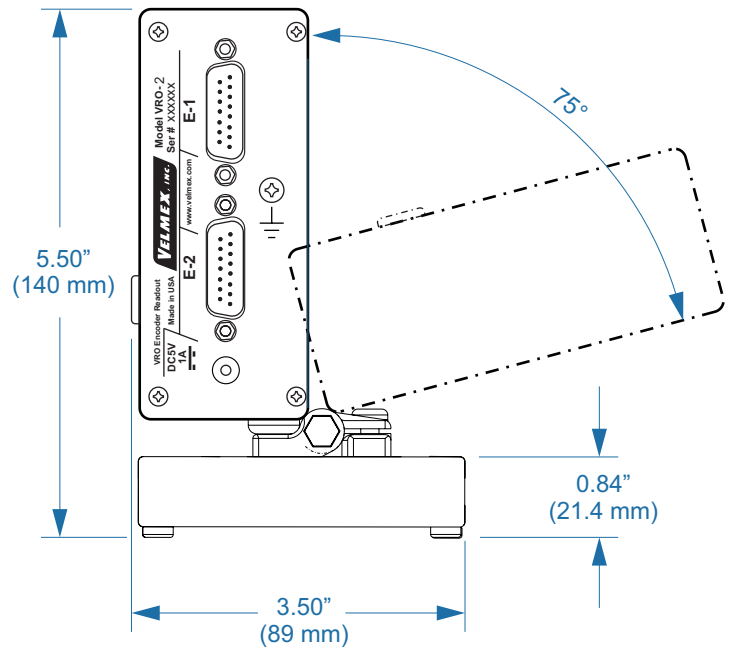
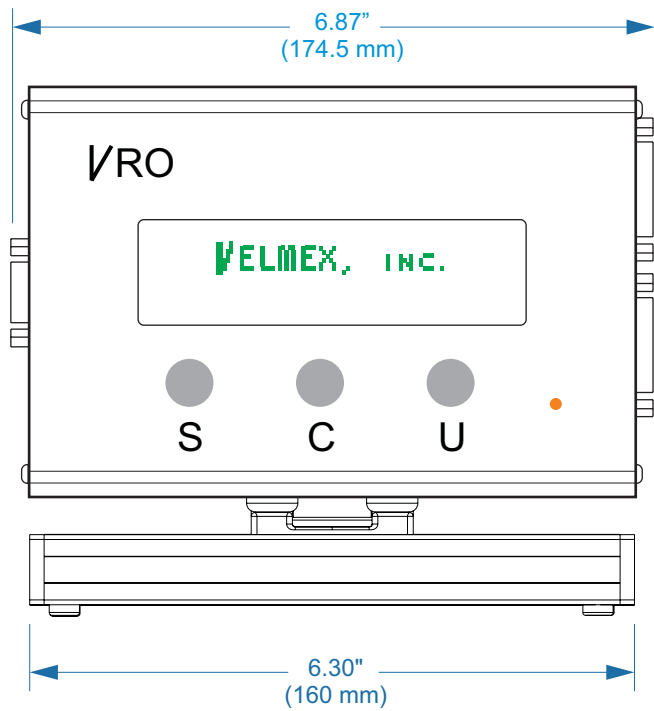
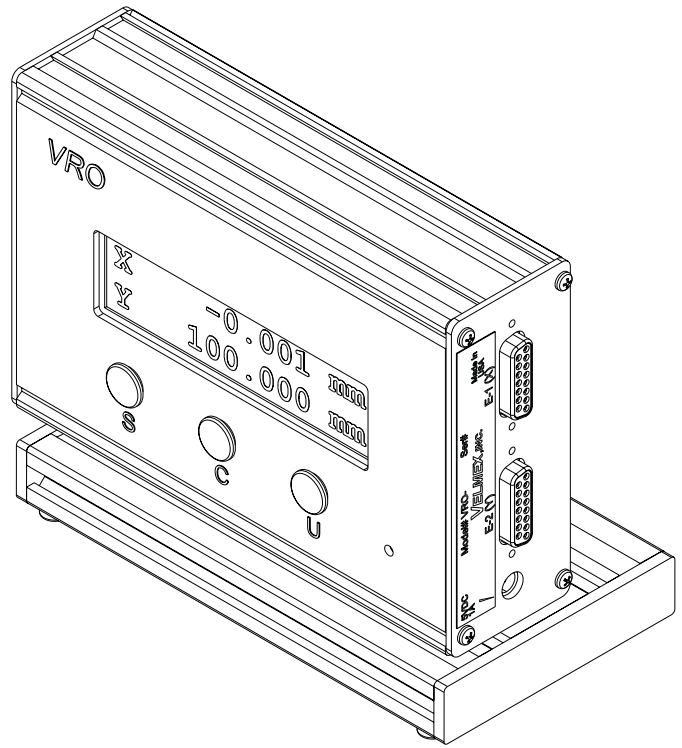
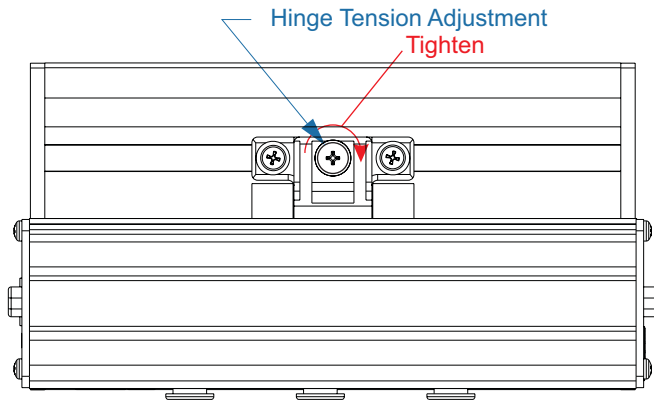
(Shown without AC Plug)





# Dimensions

## VRO-1B / VRO-2B



# Warranty

The VRO encoder readout manufactured by Velmex is warranted to be free from defects for a period of three (3) years. Velmex's obligation under this warranty does not apply to defects due, directly or indirectly, to misuse, abuse, negligence, accidents, or unauthorized repairs, alterations, or cables/connectors that require replacement due to wear. Claims must be authorized, and a return authorization number issued before a product can be returned.

The warranty does not cover items which are not manufactured or constructed by Velmex, Inc. These components are warranted by their respective manufacturer:

- 1 Year for OLED Display Module
- 1 Year for Cincon Power Adapter

Under the above warranty, Velmex will, at its option, either repair or replace a nonconforming or defective product.

The above warranty is the only warranty authorized by Velmex. Velmex shall in no event be responsible for any loss of business or profits, downtime or delay, labor, repair, or material costs, injury to person or property or any similar or dissimilar incidental or consequential loss or damage incurred by purchaser, even if Velmex has been advised of the possibility of such losses or damages.

Inasmuch as Velmex does not undertake to evaluate the suitability of any Velmex product for any particular application, the purchaser is expected to understand the operational characteristics of the product, as suggested in documentation supplied by Velmex, and to assess the suitability of Velmex products for this application.

This limited warranty give you specific legal rights which vary from State to State.

## Contact Information

*By Phone:* 585-657-6151 and 800-642-6446

*By Fax:* 585-657-6153

*Email:* [velmexcontrols@velmex.com](mailto:velmexcontrols@velmex.com)

*On the Internet:* [www.velmex.com](http://www.velmex.com) and [www.velmexcontrols.com](http://www.velmexcontrols.com)

*By mail:* Velmex, Inc.  
7550 State Route 5 & 20  
Bloomfield, NY 14469 USA

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# Appendix A LOW Display Res Scaling Tables

CPR= Cycles/rev

MAX 4 DEC PT FOR IN, MAX OF 2 DEC PT FOR MM & DG, 3 FOR RV											100 CPR Rotary							
Except these=											PRIMARY UNIT				SECONDARY UNIT			
Ld Screw	Advance/ct	Ex Count	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	Error	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display		
" "	" "	" "	" "	100	400	1	1	1	0	1 ct	" "	" "	1	1	1	0		
" 0.025in"	0.025 11	1	0.000625000	100 4X=	400	1	1	1	0	1 ct	0.001 in	0.000000000	0.001587500	1	1	0		
" 1.0 mm"	1.000 11	1	0.002500000	100 4X=	400	0.000625000	625	1000	4	0.0001 in	0.000000000	0.000984251	15875	10000	2	0.0001 in		
" 0.05 in"	0.050 11	1	0.001250000	100 4X=	400	0.000125000	125	100	4	0.001 in	0.000000000	0.003175000	3175	10000	2	0.0001 in		
" 2.0 mm"	2.000 11	1	0.005000000	100 4X=	400	0.005000000	5	10	2	0.01 mm	0.000000000	0.000196850	250	127	4	0.0002 in		
" 0.10 in"	0.100 11	1	0.002500000	100 4X=	400	0.002500000	25	10	4	0.003 in	0.000000000	0.006350000	635	1000	2	0.0001 in		
" 0.20 in"	0.200 11	1	0.005000000	100 4X=	400	0.005000000	5	1	4	0.005 in	0.000000000	0.012700000	127	100	2	0.01 mm		
" 0.40 in"	0.400 11	1	0.010000000	100 4X=	400	0.010000000	1	1	3	0.01 in	0.000000000	0.025400000	254	100	2	0.03 mm		
" 100 mm"	100.000 11	1	0.250000000	100 4X=	400	0.250000000	25	1	2	0.25 mm	0.000000000	0.009842510	12500	127	4	0.0098 in		

Increase (Revolutions)

MAX 4 DEC PT FOR IN, MAX OF 2 DEC PT FOR MM & DG, 3 FOR RV											200 CPR Rotary							
Except these=											PRIMARY UNIT				SECONDARY UNIT			
Ld Screw	Advance/ct	Ex Count	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	Error	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display		
" "	" "	" "	" "	200	800	1	1	1	0	1 ct	" "	" "	1	1	1	0		
" 0.025in"	0.025 11	1	0.000312500	200 4X=	800	0.000312500	625	2000	4	0.0001 in	0.000000000	0.000793750	15875	20000	3	0.0001 in		
" 1.0 mm"	1.000 11	1	0.001250000	200 4X=	800	0.001250000	25	200	2	0.00 mm	0.000000000	0.000492126	625	1270	4	0.0001 in		
" 0.05 in"	0.050 11	1	0.000625000	200 4X=	800	0.000625000	125	200	4	0.001 in	0.000000000	0.001587500	3175	20000	2	0.0001 in		
" 2.0 mm"	2.000 11	1	0.002500000	200 4X=	800	0.002500000	25	100	2	0.00 mm	0.000000000	0.000984251	125	127	4	0.0001 in		
" 0.10 in"	0.100 11	1	0.001250000	200 4X=	800	0.001250000	125	100	4	0.001 in	0.000000000	0.003175000	635	2000	2	0.0001 in		
" 0.20 in"	0.200 11	1	0.002500000	200 4X=	800	0.002500000	25	10	2	0.003 in	0.000000000	0.006350000	127	200	2	0.01 mm		
" 0.40 in"	0.400 11	1	0.005000000	200 4X=	800	0.005000000	5	1	4	0.005 in	0.000000000	0.012700000	127	100	2	0.01 mm		
" 100 mm"	100.000 11	1	0.125000000	200 4X=	800	0.125000000	125	10	2	0.13 mm	0.000000000	0.004921260	6250	127	4	0.0049 in		

Increase (Revolutions)

MAX 4 DEC PT FOR IN, MAX OF 2 DEC PT FOR MM & DG, 3 FOR RV											400 CPR Rotary							
Except these=											PRIMARY UNIT				SECONDARY UNIT			
Ld Screw	Advance/ct	Ex Count	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	Error	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display		
" "	" "	" "	" "	400	1600	1	1	1	0	1 ct	" "	" "	1	1	1	0		
" 0.025in"	0.025 11	1	0.000156250	400 4X=	1600	0.000156250	625	4000	4	0.0001 in	0.000000000	0.000396875	15875	40000	3	0.0001 in		
" 1.0 mm"	1.000 11	1	0.000625000	400 4X=	1600	0.000625000	25	400	2	0.00 mm	0.000000000	0.000246962	3125	12700	4	0.0001 in		
" 0.05 in"	0.050 11	1	0.000312500	400 4X=	1600	0.000312500	125	400	4	0.0001 in	0.000000000	0.000793750	3175	40000	2	0.0001 in		
" 2.0 mm"	2.000 11	1	0.001250000	400 4X=	1600	0.001250000	25	200	2	0.00 mm	0.000000000	0.000492126	625	1270	4	0.0001 in		
" 0.10 in"	0.100 11	1	0.000625000	400 4X=	1600	0.000625000	125	200	4	0.001 in	0.000000000	0.001587500	635	4000	2	0.0001 in		
" 0.20 in"	0.200 11	1	0.001250000	400 4X=	1600	0.001250000	25	20	4	0.001 in	0.000000000	0.003175000	127	400	2	0.0001 in		
" 0.40 in"	0.400 11	1	0.002500000	400 4X=	1600	0.002500000	25	10	4	0.003 in	0.000000000	0.006350000	127	200	2	0.01 mm		
" 100 mm"	100.000 11	1	0.062500000	400 4X=	1600	0.062500000	625	100	2	0.06 mm	0.000000000	0.002469630	3125	12700	2	0.00 in		

Increase (Revolutions)

MAX 4 DEC PT FOR IN, MAX OF 2 DEC PT FOR MM & DG, 3 FOR RV											500 CPR Rotary							
Except these=											PRIMARY UNIT				SECONDARY UNIT			
Ld Screw	Advance/ct	Ex Count	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	Error	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display		
" "	" "	" "	" "	500	2000	1	1	1	0	1 ct	" "	" "	1	1	1	0		
" 0.025in"	0.025 11	1	0.000125000	500 4X=	2000	0.000125000	125	1000	4	0.0001 in	0.000000000	0.000317500	15875	50000	3	0.0001 in		
" 1.0 mm"	1.000 11	1	0.000500000	500 4X=	2000	0.000500000	5	100	2	0.00 mm	0.000000000	0.000196850	25	127	4	0.0001 in		
" 0.05 in"	0.050 11	1	0.000250000	500 4X=	2000	0.000250000	25	100	4	0.001 in	0.000000000	0.000635000	3175	50000	2	0.0001 in		
" 2.0 mm"	2.000 11	1	0.001000000	500 4X=	2000	0.001000000	5	10	2	0.00 mm	0.000000000	0.000393707	50	127	4	0.0001 in		
" 0.10 in"	0.100 11	1	0.000500000	500 4X=	2000	0.000500000	5	10	4	0.001 in	0.000000000	0.000127000	127	1000	2	0.0001 in		
" 0.20 in"	0.200 11	1	0.001000000	500 4X=	2000	0.001000000	1	1	4	0.001 in	0.000000000	0.002540000	127	500	2	0.00 mm		
" 0.40 in"	0.400 11	1	0.002000000	500 4X=	2000	0.002000000	2	1	4	0.002 in	0.000000000	0.005080000	254	500	2	0.01 mm		
" 100 mm"	100.000 11	1	0.050000000	500 4X=	2000	0.050000000	5	1	2	0.05 mm	0.000000000	0.001968504	2500	127	4	0.0020 in		

Increase (Revolutions)

MAX 4 DEC PT FOR IN, MAX OF 2 DEC PT FOR MM & DG, 3 FOR RV											LINEAR							
Except these=											PRIMARY UNIT				SECONDARY UNIT			
Linear	Res	Ex Count	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	Error	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display		
" 0.001 mm"	0.001 11	1	0.001000000	" "	1	1	1	1	0	0.00 mm	0.000000000	0.000393707	50	127	4	0.0001 in		
" 0.002 mm"	0.002 11	1	0.002000000	" "	2	10	2	10	2	0.00 mm	0.000000000	0.000787415	100	127	4	0.0001 in		
" 0.005 mm"	0.005 11	1	0.005000000	" "	5	10	2	10	2	0.01 mm	0.000000000	0.001968504	250	127	4	0.0002 in		
" 0.010 mm"	0.010 11	1	0.010000000	" "	1	1	1	1	2	0.01 mm	0.000000000	0.003937014	500	127	4	0.0004 in		

# Appendix B

## HIGH Display Res Scaling Tables

CPR= Cycles/rv

MAX 6 DEC PT FOR IN & RV, MAX OF 4 DEC PT FOR MM & DEG

100 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT					Increment	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
"	"	"	"	100	400	1	1	1	0	1 ct	0.0000000000	0.0000000000	1	1	1	0	1 ct		
" 0.025in"	0.025	11	1	0.00062500	100	400	400	0.00062500	625	10	6	0.00063 in	0.0000000000	0.001587500000000000	7500.00158	15875	1000	4	0.0016 mm
" 1.0 mm"	1.000	11	1	0.00250000	100	400	400	0.00250000	25	1	4	0.0025 mm	0.0000000000	0.000098425196850394	0.0000984	12500	127	6	0.00098 in
" 0.05 in"	0.050	11	1	0.00125000	100	400	400	0.00125000	125	1	6	0.00125 in	0.0000000000	0.003175000000000000	5000.00317	3175	100	4	0.0032 mm
" 2.0 mm"	2.000	11	1	0.00500000	100	400	400	0.00500000	5	1	3	0.005 mm	0.0000000000	0.00196850393700787	0.0019685	25000	127	6	0.00197 in
" 0.10 in"	0.100	11	1	0.00250000	100	400	400	0.00250000	25	1	5	0.0025 in	0.0000000000	0.006350000000000000	0.0063500	635	10	4	0.0064 mm
" 0.20 in"	0.200	11	1	0.00500000	100	400	400	0.00500000	5	1	4	0.005 in	0.0000000000	0.012700000000000000	0.0127000	127	1	4	0.0127 mm
" 0.40 in"	0.400	11	1	0.01000000	100	400	400	0.01000000	1	1	3	0.01 in	0.0000000000	0.025400000000000000	0.0254000	254	1	4	0.0254 mm
" 100 mm"	100.000	11	1	0.25000000	100	400	400	0.25000000	25	1	2	0.25 mm	0.0000000000	0.00984252019685039370	0.009842520	12500	127	4	0.0098 in

200 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT					Increment	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
"	"	"	"	200	800	1	1	1	0	1 ct	0.0000000000	0.0000000000	1	1	1	0	1 ct		
" 0.025in"	0.025	11	1	0.00031250	200	800	800	0.00031250	625	20	6	0.00031 in	0.0000000000	0.00079375000000000000	3750.00079	15875	2000	4	0.0008 mm
" 1.0 mm"	1.000	11	1	0.00125000	200	800	800	0.00125000	25	2	4	0.0013 mm	0.0000000000	0.00049212598425197	0.0004921	6250	127	6	0.00049 in
" 0.05 in"	0.050	11	1	0.00062500	200	800	800	0.00062500	125	2	6	0.00063 in	0.0000000000	0.00158750000000000000	7500.00158	3175	200	4	0.0016 mm
" 2.0 mm"	2.000	11	1	0.00250000	200	800	800	0.00250000	25	1	4	0.0025 mm	0.0000000000	0.000098425196850394	0.0000984	12500	127	6	0.00098 in
" 0.10 in"	0.100	11	1	0.00125000	200	800	800	0.00125000	125	1	6	0.00125 in	0.0000000000	0.00317500000000000000	5000.00317	635	20	4	0.0032 mm
" 0.20 in"	0.200	11	1	0.00500000	200	800	800	0.00500000	25	1	5	0.0025 in	0.0000000000	0.00635000000000000000	0.0063500	127	2	4	0.0064 mm
" 0.40 in"	0.400	11	1	0.02500000	200	800	800	0.02500000	5	1	4	0.005 in	0.0000000000	0.01270000000000000000	0.0127000	127	1	4	0.0127 mm
" 100 mm"	100.000	11	1	0.12500000	200	800	800	0.12500000	125	1	3	0.125 mm	0.0000000000	0.004921259842519680	0.00492126	6250	127	4	0.0049 in

400 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT					Increment	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
"	"	"	"	400	1600	1	1	1	0	1 ct	0.0000000000	0.0000000000	1	1	1	0	1 ct		
" 0.025in"	0.025	11	1	0.00015625	400	1600	1600	0.00015625	625	40	6	0.00016 in	0.0000000000	0.00039687500000000000	6878.00039	15875	4000	4	0.0004 mm
" 1.0 mm"	1.000	11	1	0.00625000	400	1600	1600	0.00625000	25	4	4	0.0063 mm	0.0000000000	0.0002496299212598	0.0002496	3125	127	6	0.00025 in
" 0.05 in"	0.050	11	1	0.00031250	400	1600	1600	0.00031250	125	4	6	0.00031 in	0.0000000000	0.00079375000000000000	3750.00079	6375	400	4	0.0008 mm
" 2.0 mm"	2.000	11	1	0.00125000	400	1600	1600	0.00125000	25	2	4	0.0013 mm	0.0000000000	0.00049212598425197	0.0004921	6250	127	6	0.00049 in
" 0.10 in"	0.100	11	1	0.00062500	400	1600	1600	0.00062500	125	2	6	0.00063 in	0.0000000000	0.00158750000000000000	7500.00158	635	40	4	0.0016 mm
" 0.20 in"	0.200	11	1	0.00125000	400	1600	1600	0.00125000	25	2	6	0.00125 in	0.0000000000	0.00317500000000000000	5000.00317	127	4	4	0.0032 mm
" 0.40 in"	0.400	11	1	0.00250000	400	1600	1600	0.00250000	25	1	5	0.0025 in	0.0000000000	0.00635000000000000000	0.0063500	127	2	4	0.0064 mm
" 100 mm"	100.000	11	1	0.06250000	400	1600	1600	0.06250000	625	1	4	0.0625 mm	0.0000000000	0.00240629921259840	0.002406299	3125	127	4	0.0025 in

500 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT					Increment	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
"	"	"	"	500	2000	1	1	1	0	1 ct	0.0000000000	0.0000000000	1	1	1	0	1 ct		
" 0.025in"	0.025	11	1	0.00012500	500	2000	2000	0.00012500	125	10	6	0.00013 in	0.0000000000	0.00031750000000000000	7500.00031	15875	5000	4	0.0003 mm
" 1.0 mm"	1.000	11	1	0.00500000	500	2000	2000	0.00500000	25	1	4	0.005 mm	0.0000000000	0.00019685039370079	0.0001968	2500	127	6	0.00020 in
" 0.05 in"	0.050	11	1	0.00025000	500	2000	2000	0.00025000	25	1	6	0.00025 in	0.0000000000	0.00063500000000000000	5000.00063	3175	500	4	0.0006 mm
" 2.0 mm"	2.000	11	1	0.00100000	500	2000	2000	0.00100000	1	1	3	0.001 mm	0.0000000000	0.00039370078740158	0.0003937	5000	127	6	0.00039 in
" 0.10 in"	0.100	11	1	0.00050000	500	2000	2000	0.00050000	5	1	5	0.0005 in	0.0000000000	0.00127000000000000000	0.001270	127	10	4	0.0013 mm
" 0.20 in"	0.200	11	1	0.00100000	500	2000	2000	0.00100000	1	1	4	0.001 in	0.0000000000	0.00254000000000000000	0.0025400	127	5	4	0.0025 mm
" 0.40 in"	0.400	11	1	0.00200000	500	2000	2000	0.00200000	2	1	4	0.002 in	0.0000000000	0.00508000000000000000	0.0050800	254	5	4	0.0051 mm
" 100 mm"	100.000	11	1	0.05000000	500	2000	2000	0.05000000	5	1	2	0.05 mm	0.0000000000	0.001968503937007870	0.001968504	25000	127	5	0.00197 in

LINEAR

Linear	Res	Ex Count	Increment	PRIMARY UNIT					Increment	Exact Conv	SECONDARY UNIT								
				Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display					
" 0.001 mm"	0.001	11	1	0.00100000	1	1	1	0.001 mm	1	1	3	0.001 mm	0.0000000000	0.00039370078740158	0.0003937	5000	127	6	0.00039 in
" 0.002 mm"	0.002	11	1	0.00200000	1	1	3	0.002 mm	2	1	3	0.002 mm	0.0000000000	0.00078740157480315	0.0007874	10000	127	6	0.00079 in
" 0.005 mm"	0.005	11	1	0.00500000	1	1	3	0.005 mm	5	1	3	0.005 mm	0.0000000000	0.00196850393700787	0.0019685	25000	127	6	0.00197 in
" 0.010 mm"	0.010	11	1	0.01000000	1	1	2	0.01 mm	1	1	2	0.01 mm	0.0000000000	0.00393700787401575	0.0039370	50000	127	6	0.00394 in

## Appendix C

### Display Messages

Message	Description
<p>Release Button X Now !</p>	<p>Button "X" has been depressed for more than 2 seconds ("X" = "S", "C", "U", "0-1", "0-2") <b>NOTE:</b> "0-1" and "0-2" are the AUX inputs, Refer to the "Connections" section on page 5 for more information</p>
<p>Enc Input Fail ! &gt;1.6MHz / Noise</p>	<p>Encoder input has exceeded 1.6MHz, or electrical interference has been detected from either a poor connection or routing encoder cable near power cables</p>
<p># &gt; 10<sup>9</sup></p>	<p>Count has exceeded 999,999,999 The VRO can display max of 9 digits + decimal point (internally the VRO counts up to 2,147,483,647 before overflowing to zero)</p>
<p># &lt; 10<sup>9</sup></p>	<p>Count is less than -999,999,999 The VRO can display max of 9 digits + decimal point (internally the VRO counts down to -2,147,483,647 before underflowing to zero)</p>
<p>&gt;5 INPUT VOLTS ! Chk Power/Load</p>	<p>+5V Power input has exceeded 5.4V (Wrong voltage power supply connected to VRO)</p>
<p>&lt;5 INPUT VOLTS ! Chk Power/Load</p>	<p>Power in is less than 4.6V (Caused by an overload on the 5V when the VRO's resettable fuse goes into high impedance state, or when power input voltage too low)</p>
<p>UART ERROR ! CHK SETTINGS</p>	<p>Baud rate, or parity is not set the same between Host and the VRO</p>
<p>RAM/ROM FAIL !</p>	<p>A read/write check of ROM/RAM error has occurred</p>
<p>Not Settable ! PC set this last</p>	<p>Message when encoder setup was done from the serial port last. Front panel setup can not make changes unless the VRO is cleared (set to defaults)</p>