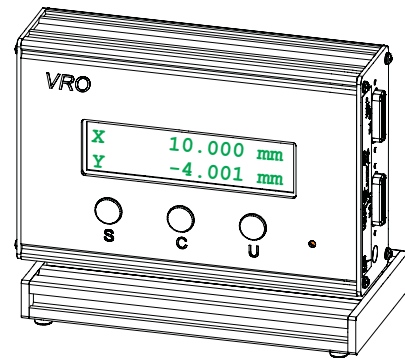

VRO Encoder Readout Reference Manual Version 1.21

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.



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

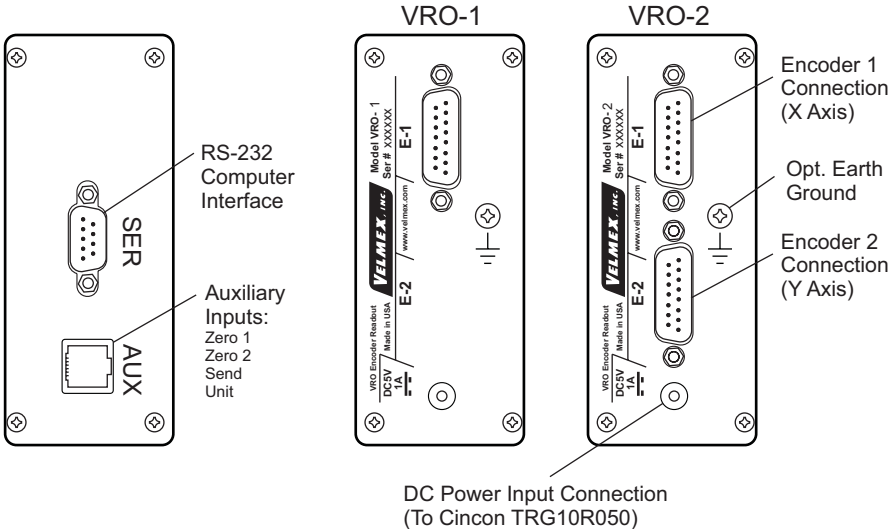
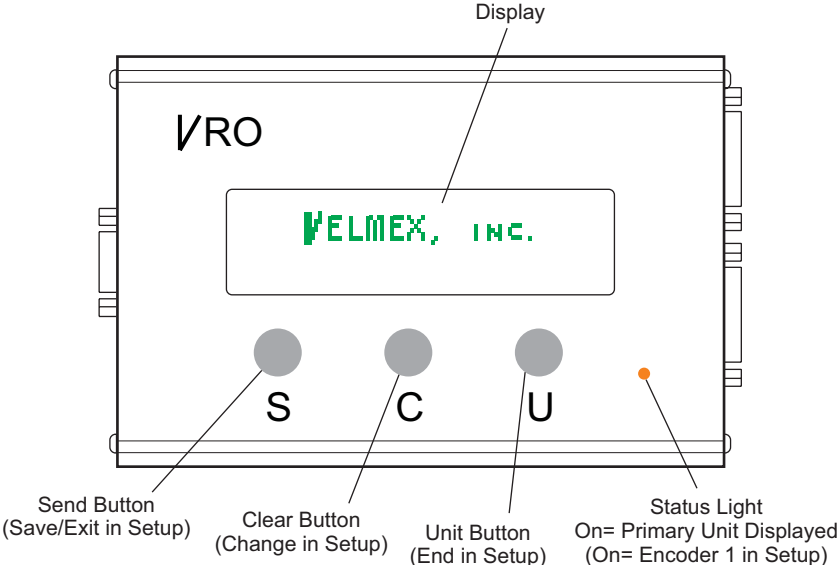
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Features

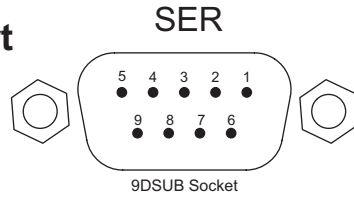
- Compatible with all 5V Incremental Encoders
- High speed differential line driver interface
- 9 digit plus decimal point, direction, axis and unit labels
- 4x quadrature decoding for highest resolution
- Easy front panel and PC configuration
- Inch/Metric selectable units
- Decimal degrees/revolutions 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



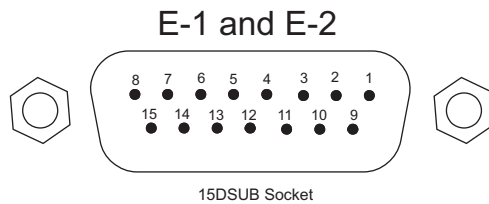
Pin Assignments:

- 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

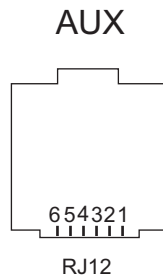


Pin Assignments:

- 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



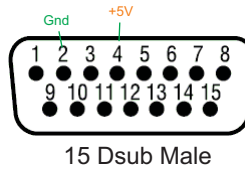
Pin Assignments:

- 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

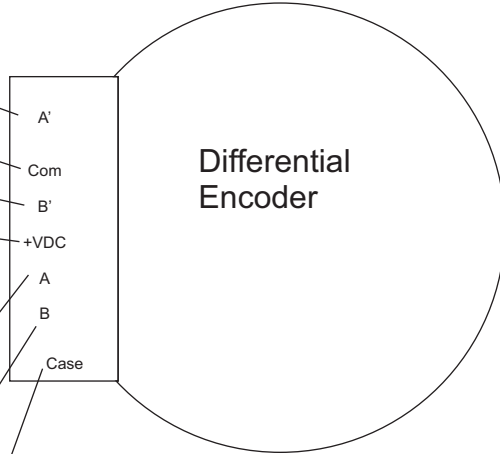
Connections

Encoder Cable

Encoder Connector
(Encoder/cable end shown)



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

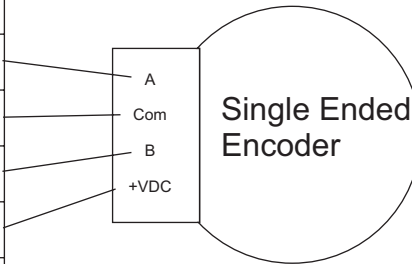


Pin	AMO	ELGO	EPC
1	green	violet	yellow
2	blue	white	black
3	brown	yellow	green
4	red	brown	white
9	yellow	green	brown
11	white	orange	red

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

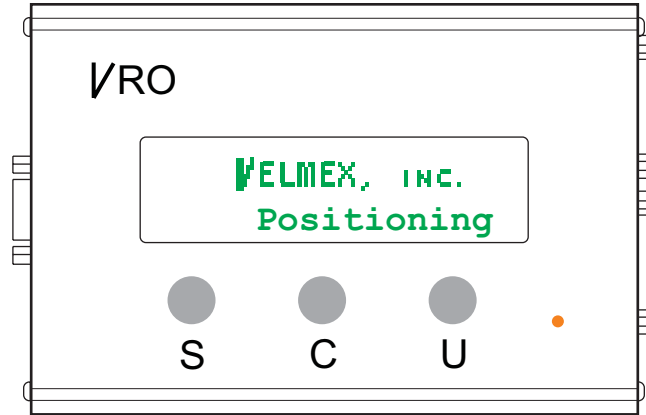
Cable Shield /bare wire

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



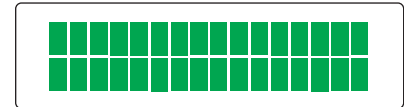
Hold "S" button down when powering* to skip splash screen

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

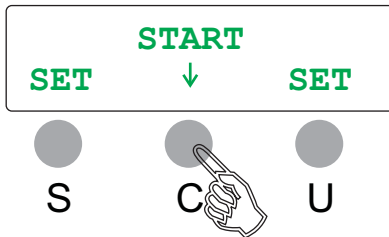
Hold "U" button down when powering for pixel test:

End of Power-up display

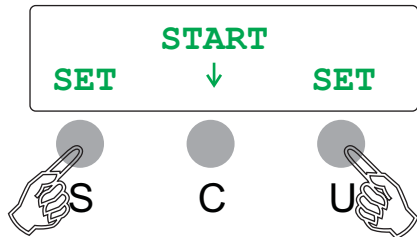
Pixel test display



Start menu



Start menu



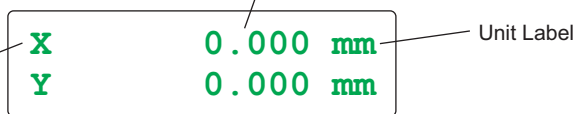
Press "C" Button for Display Mode

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

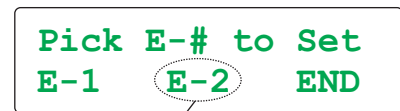
Display Mode

Count

Axis Label



Front Panel Setup



Only on VRO-2

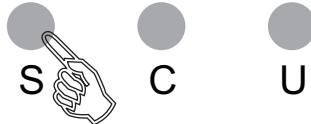
* Holding both the "S" and "C" buttons down when powering will temporarily put a one axis (VRO-1) into a two axis mode, and a two axis (VRO-2) into a one axis mode.

Front Panel Setup

Encoder Set

Encoder Type

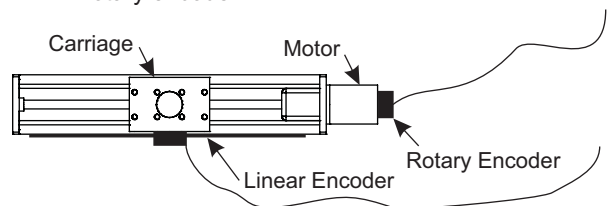
Pick E-# to Set
E-1 E-2 END



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

Press "C" button to change encoder Type

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



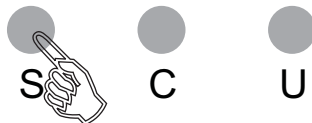
Enc Type: _____
SAV CHG



Linear
Rotary

Press "S" button to Save and exit this menu

Enc Type: Linear
SAV CHG



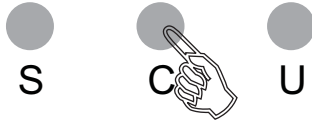
Front Panel Setup

Encoder Type: Linear

Linear Resolution

Press "C" button to
change Linear Resolution

Ln Res: _____
SAV CHG



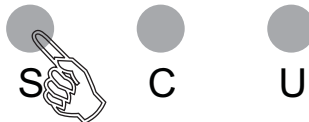
0.001 mm ← ELGO & AMO Encoders
0.002 mm
0.005 mm
0.010 mm

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



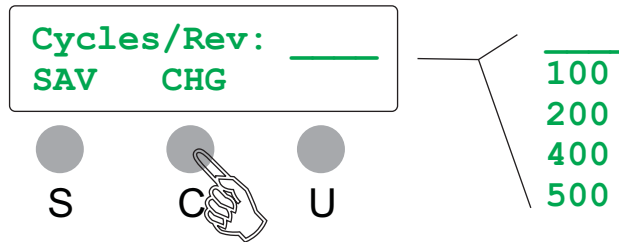
Go to:

"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.

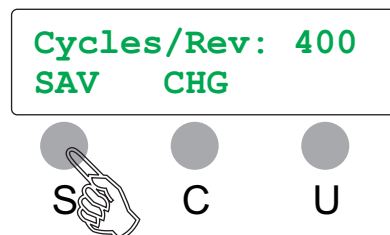
Typical ENCODER PRODUCTS part number:

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.

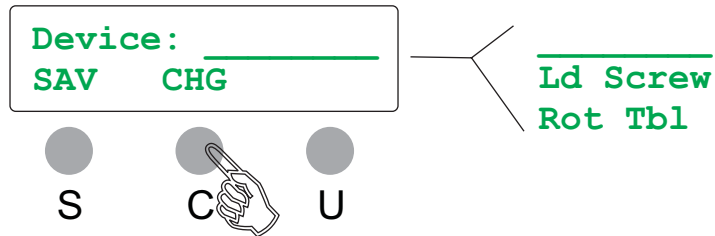
Press "S" button to
Save and exit this menu



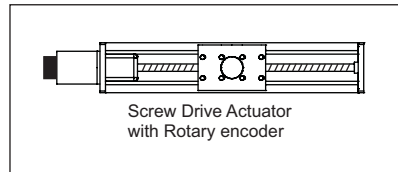
Front Panel Setup

Encoder Type: Rotary
Device

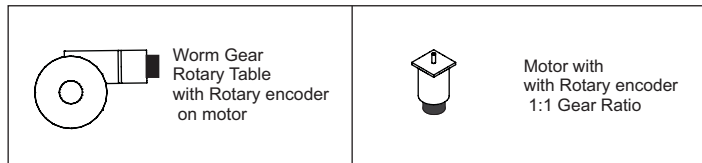
Press "C" button to
change Device



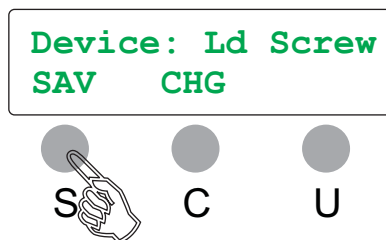
Ld Screw



Rot Tbl



Press "S" button to
Save and exit this menu



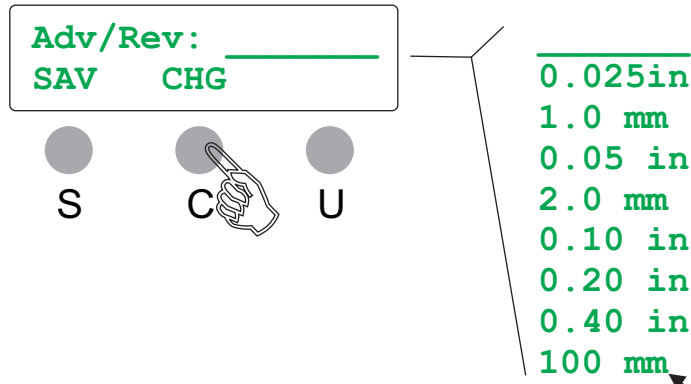
Front Panel Setup

Encoder Type: Rotary

Device: Ld Screw

Advance/Revolution

Press "C" button to change Advance/Revolution



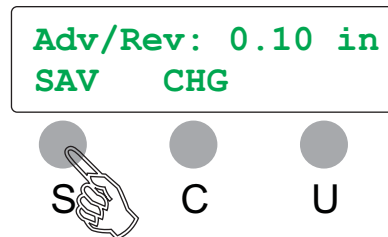
Rotary Encoder & Lead Screw

	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"

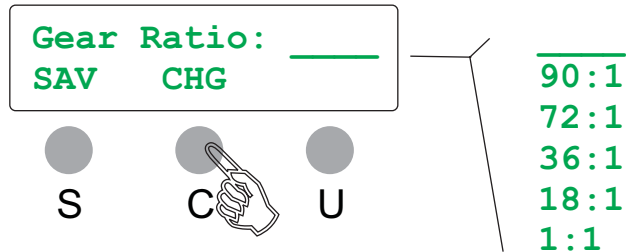
Front Panel Setup

Encoder Type: Rotary

Device: Rotary Table

Gear Ratio

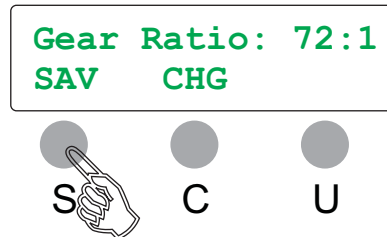
Press "C" button to
change Gear Ratio



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

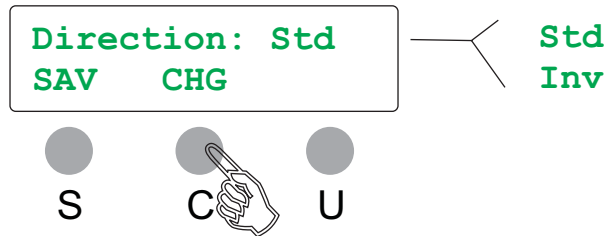


Front Panel Setup

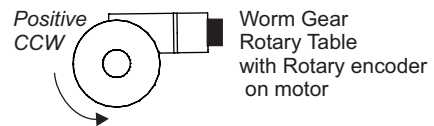
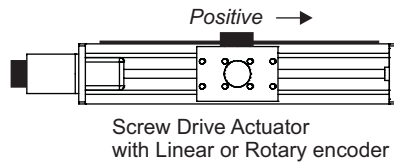
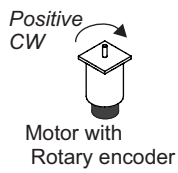
Encoder Type: Linear & Rotary

Direction

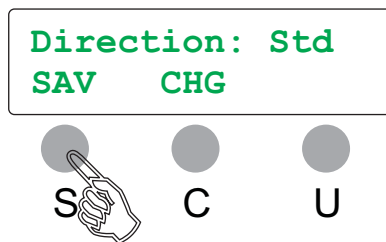
Press "C" button to change Direction



Direction: Std



Press "S" button to
Save and exit this menu

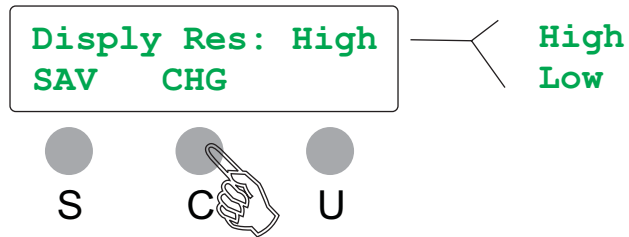


Front Panel Setup

Encoder Type: Linear & Rotary

Display Resolution

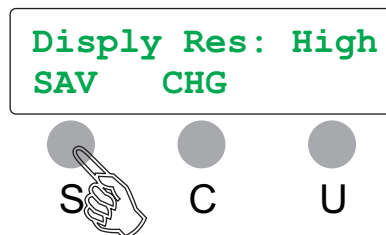
Press "C" button to
change Display Resolution



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

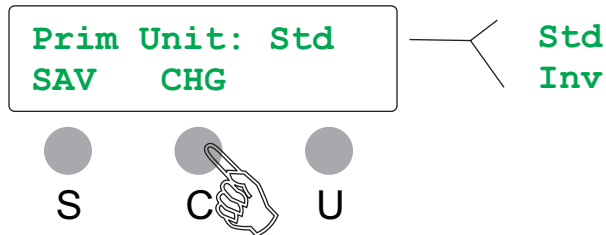


Front Panel Setup

Encoder Type: Linear & Rotary

Primary Unit

Press "C" button to
change Primary Unit



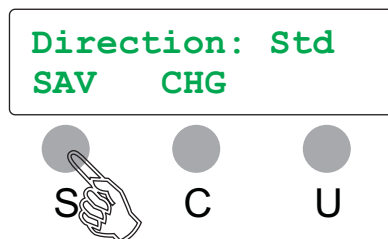
Std Primary Units

- 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

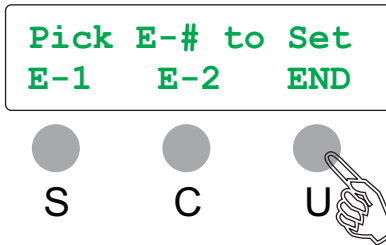
- in** For Linear Encoders
- in** For Lead Screws with **x.x mm** Adv/Rev
- mm** For Lead Screws with **x.xx in** Adv/Rev
- rv** For Rotary Tables

Press "S" button to
Save and exit this menu

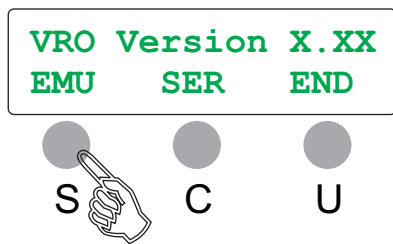


Front Panel Setup

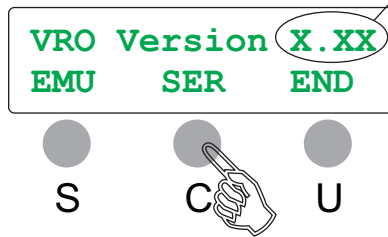
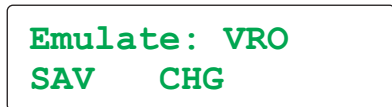
End Encoder Set



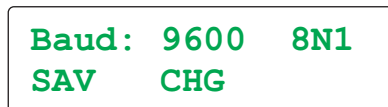
Press "U" button to
End encoder setting



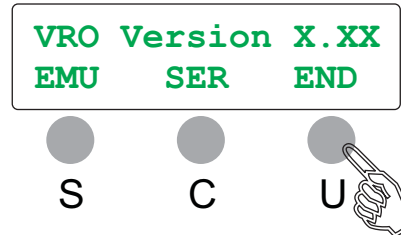
Press "S" button to
Set Emulation mode



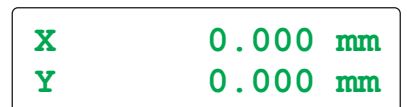
Press "C" button to
Set Serial port Baud rate



Firmware Version Number



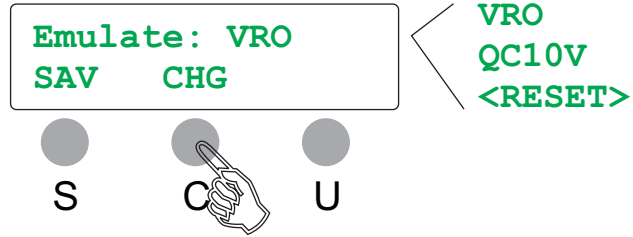
Press "U" button to
End Setup start
Display mode



Front Panel Setup

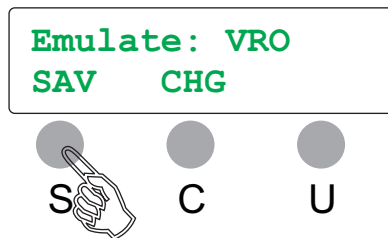
Emulate

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

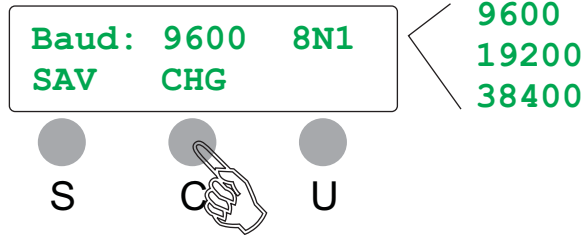
Press "S" button to Save and exit this menu



Front Panel Setup

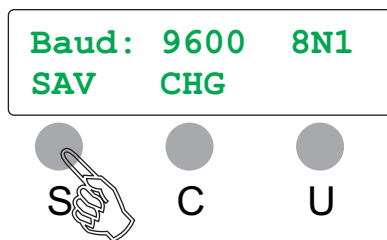
Serial Set Baud

Press "C" button to change Baud rate setting

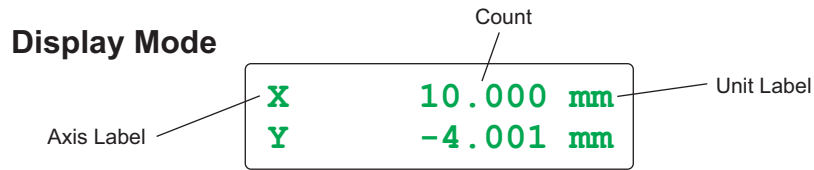


NOTE: Data bits are 8, Parity is None, and Stop bits is normally 1

Press "S" button to Save and exit this menu

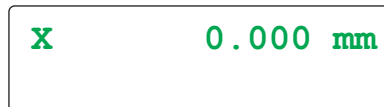


Display Mode



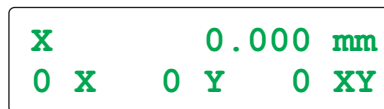
Clearing Count (VRO-1)

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

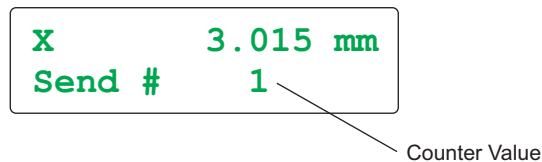
mm	Millimeters
in	Inches
o	Decimal Degrees
rv	Revolutions
ct	Raw Encoder Counts (default when VRO Setup not completed)

Display Mode

Send Count to Host Computer

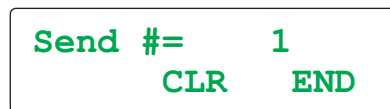
Press the "S" button to Send the display count out the Serial port.
The status light will flash for duration of the send.
For more information on the Send format refer to the "setO" command.

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

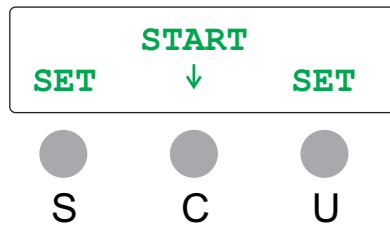
RS-232/USB Communication

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:

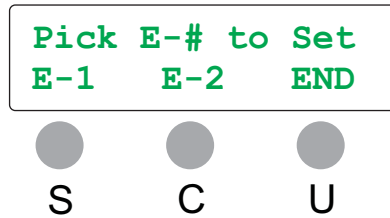
- V** Verify Readout's status, VRO sends "P" to host to indicate in Power-up mode

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)

```
X      10.000 mm
```

Display Mode Screen (VRO-2)

```
X      10.000 mm  
Y      -4.001 mm
```

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.

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

setPXv	Set primary decimal Place for encoder 1, v= 0 to 8 0 disables the decimal point. Decimal place is right justified.
setPxx	Set secondary decimal Place for encoder 1, v= 0 to 8 0 disables the decimal point. Decimal place is right justified.
setPYv	Set primary decimal Place for encoder 2, v= 0 to 8 0 disables the decimal point. Decimal place is right justified.
setPyv	Set secondary decimal Place for encoder 2, v=0 to 8 0 disables the decimal point. Decimal place is right justified.
set*Xv	Set primary Multiplier for encoder 1, v= 1 to 200000
set*xv	Set secondary Multiplier for encoder 1, v= 1 to 200000
set*Yv	Set primary Multiplier for encoder 2, v= 1 to 200000
set*yv	Set secondary Multiplier for encoder 2, v= 1 to 200000
set/Xv	Set primary Divisor for encoder 1, v= 1 to 200000
set/xv	Set secondary Divisor for encoder 1, v= 1 to 200000
set/Yv	Set primary Divisor for encoder 2, v= 1 to 200000
set/yv	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)
Height4.27" (108.5 mm)
Width6.87" (174.5 mm)
Depth1.89" (48 mm)

AC Power Adapter:

Weight.....0.29 lbs (130 g)
Height1.8" (46 mm)
Width1.4" (36 mm)
Length2.8" (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 $^{\circ}$ -120 $^{\circ}$ F (-18 $^{\circ}$ -49 $^{\circ}$ C)
Relative Humidity..... 10%-90% (noncondensing)

Models

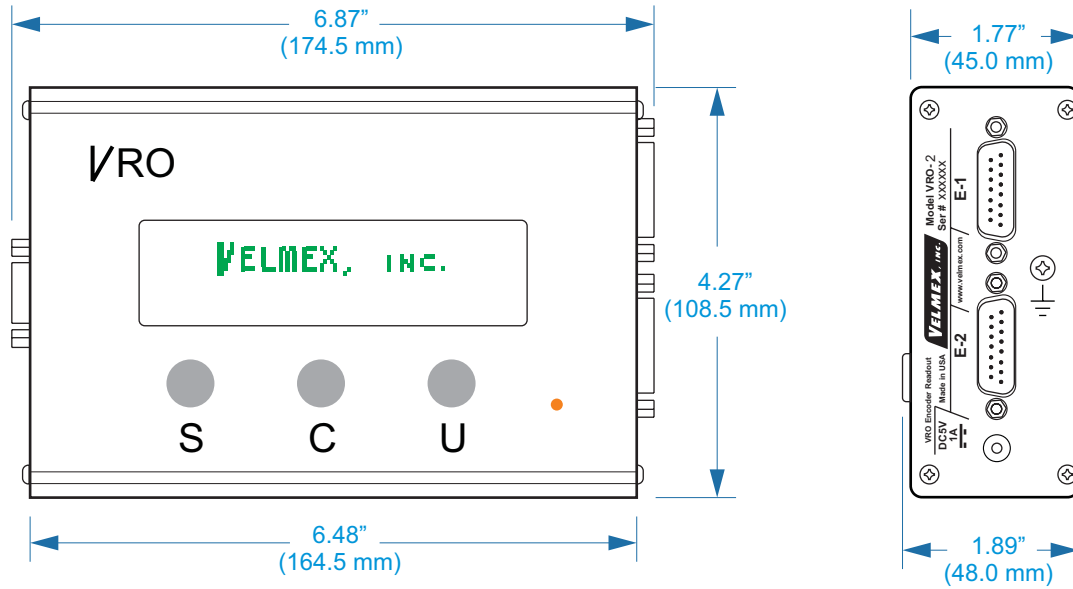
VRO-1 (one axis version)
VRO-2 (two axis version)
VRO-1B (one axis version with tilt base)
VRO-2B (two axis version with tilt base)
VRO-1H (one axis version with hinge)
VRO-2H (two axis version with hinge)

RS-232 Port Configuration

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

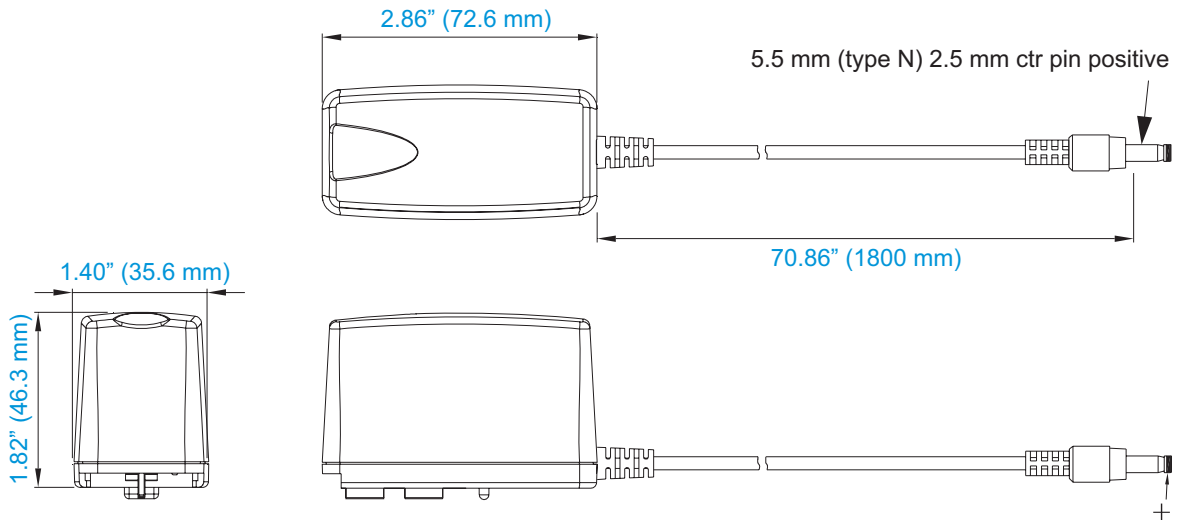
Dimensions

VRO-1 / VRO-2



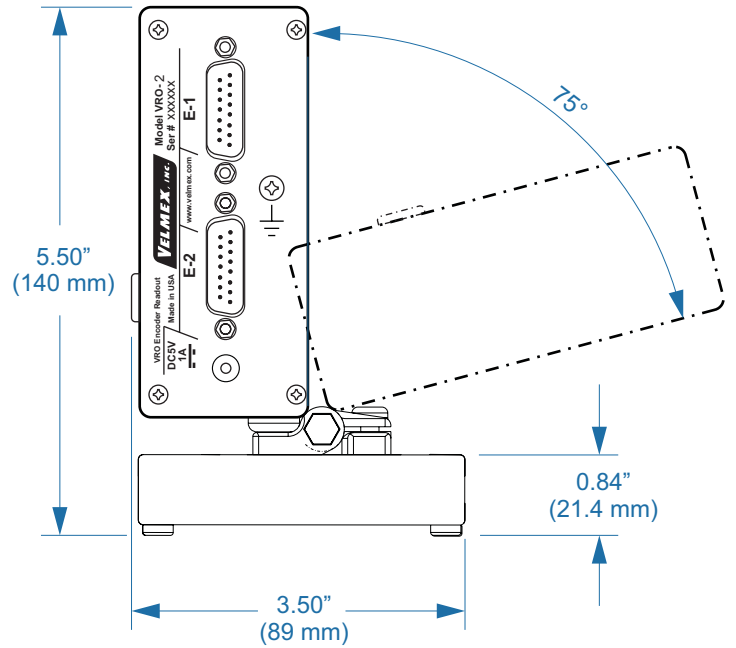
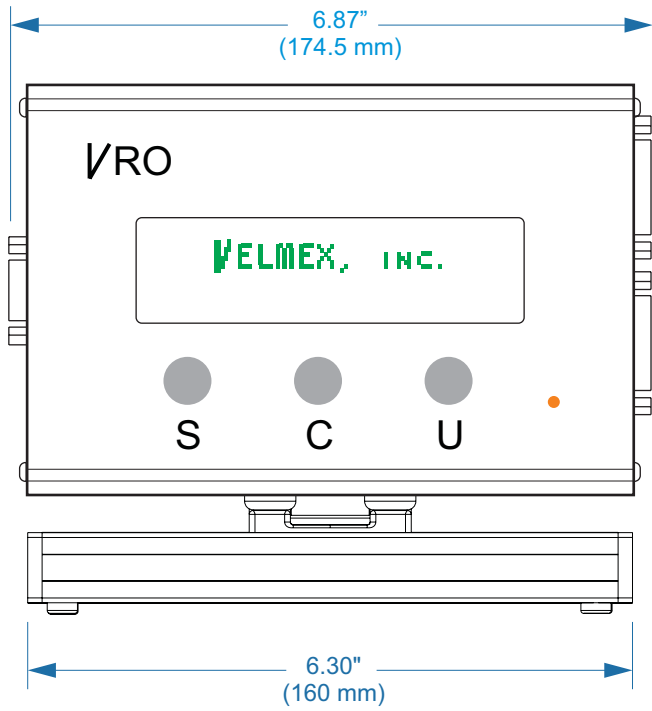
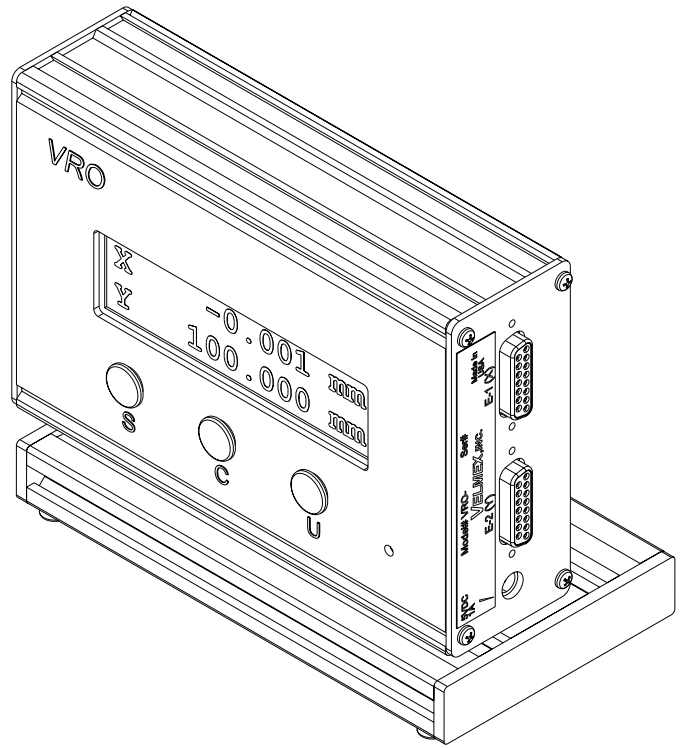
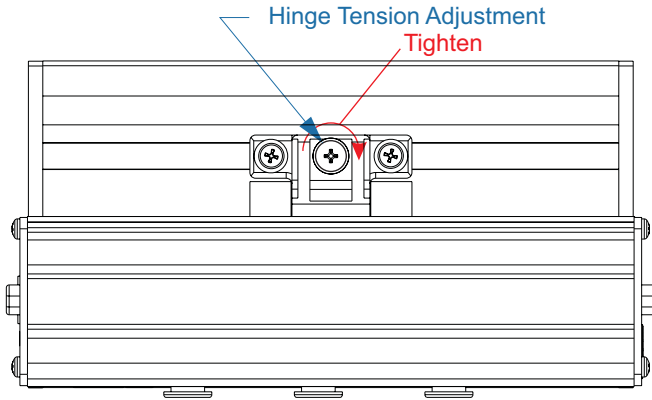
Power Adapter

(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

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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=

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT				format cell below Dec Pt	ERROR	Increment	Exact Conv	SECONDARY UNIT					
					Exact Conv	Multiplier	Divisor	Dec Pt					Display	Multiplier	Divisor	Dec Pt	Display	
" "	" "	" "	" "	100	4x=	400	1	1	0	1 ct	0.0000000000	1	1	1	0	1 ct		
"0.025in"	0.025 11	1	0.000625000	100	4x=	400	0.000625000	625	1000	4	0.0001 in	0.0000000000	0.001587500000000000	0.000015875	15875	10000	2	0.000 mm
"1.0 mm"	1.000 11	1	0.002500000	100	4x=	400	0.002500000	25	100	2	0.00 mm	0.0000000000	0.000098425196850394	0.000098425	125	127	4	0.0001 in
"0.05 in"	0.050 11	1	0.001250000	100	4x=	400	0.001250000	125	100	4	0.0001 in	0.0000000000	0.003175000000000000	0.000031750	3175	10000	2	0.000 mm
"2.0 mm"	2.000 11	1	0.005000000	100	4x=	400	0.005000000	5	10	2	0.01 mm	0.0000000000	0.000196850393700787	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	0.0003 in	0.0000000000	0.006350000000000000	0.000063500	635	1000	2	0.01 mm
"0.20 in"	0.200 11	1	0.005000000	100	4x=	400	0.005000000	5	1	4	0.0005 in	0.0000000000	0.012700000000000000	0.000127000	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	0.0000000000	0.025400000000000000	0.002540000	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	0.0000000000	0.009842519685039370	0.009842520	12500	127	4	0.0098 in

Rot Tbl	Ratio	degrees	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	format cell below Dec Pt	ERROR	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display	
"90:1"	90 11	1	0.010000000	100	4x=	400	0.010000000	1	1	0	1 ct	0.0000000000	0.00002777777777777778	1	1	1	0	1 ct
"72:1"	72 11	1	0.012500000	100	4x=	400	0.012500000	125	100	2	0.01 o	0.0000000000	0.00003472222222222222	625	1800	3	0.000 rv	
"36:1"	36 11	1	0.025000000	100	4x=	400	0.025000000	25	10	2	0.03 o	0.0000000000	0.00006944444444444444	625	900	3	0.000 rv	
"18:1"	18 11	1	0.050000000	100	4x=	400	0.050000000	5	1	2	0.05 o	0.0000000000	0.000138888888888889	125	90	3	0.000 rv	
"1:1"	1 11	1	0.900000000	100	4x=	400	0.900000000	9	1	2	0.9 o	0.0000000000	0.002500000000000000	225	90	3	0.003 rv	

200 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT				format cell below Dec Pt	ERROR	Increment	Exact Conv	SECONDARY UNIT					
					Exact Conv	Multiplier	Divisor	Dec Pt					Display	Multiplier	Divisor	Dec Pt	Display	
" "	" "	" "	" "	200	4x=	800	1	1	0	1 ct	0.0000000000	1	1	1	0	1 ct		
"0.025in"	0.025 11	1	0.000312500	200	4x=	800	0.000312500	625	2000	4	0.0000 in	0.0000000000	0.000793750000000000	500.0007937	15875	20000	3	0.001 mm
"1.0 mm"	1.000 11	1	0.001250000	200	4x=	800	0.001250000	25	200	2	0.00 mm	0.0000000000	0.000049212598425197	0.000049213	625	1270	4	0.0000 in
"0.05 in"	0.050 11	1	0.000625000	200	4x=	800	0.000625000	125	200	4	0.0001 in	0.0000000000	0.001587500000000000	0.000015875	3175	20000	2	0.000 mm
"2.0 mm"	2.000 11	1	0.002500000	200	4x=	800	0.002500000	25	100	2	0.00 mm	0.0000000000	0.000098425196850394	0.000098425	125	127	4	0.0001 in
"0.10 in"	0.100 11	1	0.001250000	200	4x=	800	0.001250000	125	100	4	0.0001 in	0.0000000000	0.003175000000000000	0.000031750	635	2000	2	0.000 mm
"0.20 in"	0.200 11	1	0.002500000	200	4x=	800	0.002500000	25	10	4	0.0003 in	0.0000000000	0.006350000000000000	0.000063500	127	200	2	0.01 mm
"0.40 in"	0.400 11	1	0.005000000	200	4x=	800	0.005000000	5	1	4	0.0005 in	0.0000000000	0.012700000000000000	0.000127000	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	0.0000000000	0.004921259842519680	0.004921260	6250	127	4	0.0049 in

Rot Tbl	Ratio	degrees	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	format cell below Dec Pt	ERROR	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display
"90:1"	90 11	1	0.005000000	200	4x=	800	0.005000000	5	10	2	0.01 o	0.0000000000	0.000138888888888889	125	9000	3	0.000 rv
"72:1"	72 11	1	0.006250000	200	4x=	800	0.006250000	125	200	2	0.01 o	0.0000000000	0.00017361111111111111	625	3600	3	0.000 rv
"36:1"	36 11	1	0.012500000	200	4x=	800	0.012500000	125	100	2	0.01 o	0.0000000000	0.00034722222222222222	625	1800	3	0.000 rv
"18:1"	18 11	1	0.025000000	200	4x=	800	0.025000000	25	10	2	0.03 o	0.0000000000	0.00069444444444444444	625	900	3	0.000 rv
"1:1"	1 11	1	0.450000000	200	4x=	800	0.450000000	45	1	2	0.45 o	0.0000000000	0.012500000000000000	225	180	3	0.001 rv

400 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT				format cell below Dec Pt	ERROR	Increment	Exact Conv	SECONDARY UNIT					
					Exact Conv	Multiplier	Divisor	Dec Pt					Display	Multiplier	Divisor	Dec Pt	Display	
" "	" "	" "	" "	400	4x=	1600	1	1	0	1 ct	0.0000000000	1	1	1	0	1 ct		
"0.025in"	0.025 11	1	0.000156250	400	4x=	1600	0.000156250	625	4000	4	0.0000 in	0.0000000000	0.000396875000000000	750.0003968	15875	40000	3	0.000 mm
"1.0 mm"	1.000 11	1	0.000625000	400	4x=	1600	0.000625000	25	400	2	0.00 mm	0.0000000000	0.00024606299212598	0.00024606	3125	12700	4	0.0000 in
"0.05 in"	0.050 11	1	0.000312500	400	4x=	1600	0.000312500	125	400	4	0.0000 in	0.0000000000	0.000079375000000000	500.0007937	3175	40000	2	0.000 mm
"2.0 mm"	2.000 11	1	0.001250000	400	4x=	1600	0.001250000	25	200	2	0.00 mm	0.0000000000	0.000049212598425197	0.000049213	625	1270	4	0.0000 in
"0.10 in"	0.100 11	1	0.000625000	400	4x=	1600	0.000625000	125	200	4	0.0001 in	0.0000000000	0.001587500000000000	0.000015875	635	4000	2	0.000 mm
"0.20 in"	0.200 11	1	0.001250000	400	4x=	1600	0.001250000	25	20	4	0.0001 in	0.0000000000	0.003175000000000000	0.000031750	127	400	2	0.000 mm
"0.40 in"	0.400 11	1	0.002500000	400	4x=	1600	0.002500000	25	10	4	0.0003 in	0.0000000000	0.006350000000000000	0.000063500	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	0.0000000000	0.002460629921259840	0.002460630	3125	12700	2	0.00 in

Rot Tbl	Ratio	degrees	Increment	CPR	Exact Conv	Multiplier	Divisor	Dec Pt	Display	format cell below Dec Pt	ERROR	Increment	Exact Conv	Multiplier	Divisor	Dec Pt	Display
"90:1"	90 11	1	0.002500000	400	4x=	1600	0.002500000	25	100	2	0.00 o	0.0000000000	0.00000694444444444444	125	18000	3	0.000 rv
"72:1"	72 11	1	0.003125000	400	4x=	1600	0.003125000	125	400	2	0.00 o	0.0000000000	0.000096805555555556	625	7200	3	0.000 rv
"36:1"	36 11	1	0.006250000	400	4x=	1600	0.006250000	125	200	2	0.01 o	0.0000000000	0.00017361111111111111	625	3600	3	0.000 rv
"18:1"	18 11	1	0.012500000	400	4x=	1600	0.012500000	125	100	2	0.01 o	0.0000000000	0.00034722222222222222	625	1800	3	0.000 rv
"1:1"	1 11	1	0.225000000	400	4x=	1600	0.225000000	225	10	2	0.23 o	0.0000000000	0.006250000000000000	1125	1800	3	0.001 rv

500 CPR Rotary

Ld Screw	Advance/ ct	Ex Count	Increment	CPR	PRIMARY UNIT				format cell below Dec Pt	ERROR	Increment	Exact Conv	SECONDARY UNIT					
					Exact Conv	Multiplier	Divisor	Dec Pt					Display	Multiplier	Divisor	Dec Pt	Display	
" "	" "	" "	" "	500	4x=	2000	1	1	0	1 ct	0.0000000000	1	1	1	0	1 ct		
"0.025in"	0.025 11	1	0.000125000	500	4x=	2000	0.000125000	125	1000	4	0.0000 in	0.0000000000	0.000317500000000000	0.00003175	15875	50000	3	0.000 mm
"1.0 mm"	1.000 11	1	0.000500000	500	4x=	2000	0.000500000	5	100	2	0.00 mm	0.0000000000	0.00019685039370079	0.00019685	25	127	4	0.0000 in
"0.05 in"	0.050 11	1	0.000250000	500	4x=	2000	0.000250000	25	100	4	0.0001 in	0.0000000000	0.000635000000000000	0.000063500	3175	50000	2	0.000 mm
"2.0 mm"	2.000 11	1	0.001000000	500	4x=	2000	0.001000000	1	10	2	0.00 mm	0.0000000000	0.00039370078740158	0.00039370	50	127	4	0.0000 in
"0.10 in"	0.100 11	1	0.000500000	500	4x=	2000	0.000500000	5	10	4	0.0001 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				
" 0.025in"	0.025 11	1	1	100	400	1	1	0	1 ct	0.0000000000	0.001587500000000000	1	1	1	0	1 ct			
" 1.0 mm"	1.000 11	1	1	0.002500000	100	400	400	0.002500000	25	1	4	0.0025 mm	0.0000000000	0.000098425196850394	0.0000984	12500	127	6	0.000098 in
" 0.05 in"	0.050 11	1	1	0.000125000	100	400	400	0.000125000	125	1	6	0.000125 in	0.0000000000	0.003175000000000000	5000.00317	3175	100	4	0.0032 mm
" 2.0 mm"	2.000 11	1	1	0.005000000	100	400	400	0.005000000	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	1	0.002500000	100	400	400	0.002500000	25	1	5	0.0025 in	0.0000000000	0.006350000000000000	000.006350	635	10	4	0.0064 mm
" 0.20 in"	0.200 11	1	1	0.005000000	100	400	400	0.005000000	5	1	4	0.005 in	0.0000000000	0.012700000000000000	00.0127000	127	1	4	0.0127 mm
" 0.40 in"	0.400 11	1	1	0.010000000	100	400	400	0.010000000	1	1	3	0.01 in	0.0000000000	0.025400000000000000	0.02540000	254	1	4	0.0254 in
" 100 mm"	100.000 11	1	1	0.250000000	100	400	400	0.250000000	25	1	2	0.25 mm	0.0000000000	0.0098425201968503970	0.009842520	12500	127	4	0.0098 in

Rot Tbl	Ratio	ct	degrees	CPR	PRIMARY UNIT					Increment (Revolutions)	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
" 90:1 "	90 11	1	1	100	400	400	1	1	0	1 ct	0.0000000000	0.0000277777777777777	1	1	1	0	1 ct		
" 72:1 "	72 11	1	1	0.010000000	100	400	400	0.010000000	1	1	2	0.01 o	0.0000000000	0.0000277777777777777	0.000027778	250	9	6	0.000028 rv
" 36:1 "	36 11	1	1	0.012500000	100	400	400	0.012500000	125	1	4	0.0125 o	0.0000000000	0.0000347222222222222	0.000034722	625	18	6	0.000035 rv
" 18:1 "	18 11	1	1	0.025000000	100	400	400	0.025000000	25	1	3	0.025 o	0.0000000000	0.0000694444444444444	0.000069444	625	9	6	0.000069 rv
" 1:1 "	1 11	1	1	0.050000000	100	400	400	0.050000000	5	1	2	0.05 o	0.0000000000	0.00138888888888889	0.001388889	1250	9	6	0.00139 rv

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				
" 0.025in"	0.025 11	1	1	200	800	800	1	1	0	1 ct	0.0000000000	0.000793750000000000	3750.00079	15875	2000	4	0.0008 mm		
" 1.0 mm"	1.000 11	1	1	0.001250000	200	800	800	0.001250000	625	20	6	0.000031 in	0.0000000000	0.00049212598425197	0.000492126	6250	127	6	0.00049 in
" 0.05 in"	0.050 11	1	1	0.000625000	200	800	800	0.000625000	125	2	6	0.000063 in	0.0000000000	0.001587500000000000	7500.00158	3175	200	4	0.0016 mm
" 2.0 mm"	2.000 11	1	1	0.002500000	200	800	800	0.002500000	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	1	0.001250000	200	800	800	0.001250000	125	1	6	0.00125 in	0.0000000000	0.003175000000000000	5000.00317	635	20	4	0.0032 mm
" 0.20 in"	0.200 11	1	1	0.005000000	200	800	800	0.005000000	25	1	5	0.0025 in	0.0000000000	0.006350000000000000	000.006350	127	2	4	0.0064 mm
" 0.40 in"	0.400 11	1	1	0.025000000	200	800	800	0.025000000	5	1	4	0.005 in	0.0000000000	0.012700000000000000	00.0127000	127	1	4	0.0127 mm
" 100 mm"	100.000 11	1	1	0.125000000	200	800	800	0.125000000	125	1	3	0.125 mm	0.0000000000	0.004921259842519680	0.00492126	6250	127	4	0.0049 in

Rot Tbl	Ratio	ct	degrees	CPR	PRIMARY UNIT					Increment (Revolutions)	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
" 90:1 "	90 11	1	1	200	800	800	1	1	0	1 ct	0.0000000000	0.0000000000	1	1	1	0	1 ct		
" 72:1 "	72 11	1	1	0.005000000	200	800	800	0.005000000	5	1	3	0.005 o	0.0000000000	0.00013888888888889	0.000138889	125	9	6	0.00014 rv
" 36:1 "	36 11	1	1	0.006250000	200	800	800	0.006250000	125	2	4	0.0063 o	0.0000000000	0.0001736111111111111	0.0001736	625	36	6	0.00017 rv
" 18:1 "	18 11	1	1	0.012500000	200	800	800	0.012500000	125	1	4	0.0125 o	0.0000000000	0.0003472222222222222	0.0003472	625	18	6	0.00035 rv
" 1:1 "	1 11	1	1	0.025000000	200	800	800	0.025000000	25	1	3	0.025 o	0.0000000000	0.0006944444444444444	0.0006944	625	9	6	0.00069 rv

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				
" 0.025in"	0.025 11	1	1	400	1600	1600	1	1	0	1 ct	0.0000000000	0.000396875000000000	6878.00039	15875	4000	4	0.0004 mm		
" 1.0 mm"	1.000 11	1	1	0.000625000	400	1600	1600	0.000625000	25	4	4	0.0006 mm	0.0000000000	0.0002462992125984	0.0002463	3125	127	6	0.00025 in
" 0.05 in"	0.050 11	1	1	0.000312500	400	1600	1600	0.000312500	125	4	6	0.00031 in	0.0000000000	0.000793750000000000	3750.00079	15875	400	4	0.0008 mm
" 2.0 mm"	2.000 11	1	1	0.001250000	400	1600	1600	0.001250000	25	2	4	0.0013 mm	0.0000000000	0.00049212598425197	0.000492126	6250	127	6	0.00049 in
" 0.10 in"	0.100 11	1	1	0.000625000	400	1600	1600	0.000625000	125	2	6	0.00063 in	0.0000000000	0.001587500000000000	7500.00158	635	40	4	0.0016 mm
" 0.20 in"	0.200 11	1	1	0.001250000	400	1600	1600	0.001250000	25	2	6	0.00125 in	0.0000000000	0.003175000000000000	5000.00317	127	4	4	0.0032 mm
" 0.40 in"	0.400 11	1	1	0.002500000	400	1600	1600	0.002500000	25	1	5	0.0025 in	0.0000000000	0.006350000000000000	000.006350	127	2	4	0.0064 mm
" 100 mm"	100.000 11	1	1	0.062500000	400	1600	1600	0.062500000	625	1	4	0.0625 mm	0.0000000000	0.002460629921259840	0.0024606	3125	127	4	0.0025 in

Rot Tbl	Ratio	ct	degrees	CPR	PRIMARY UNIT					Increment (Revolutions)	Exact Conv	SECONDARY UNIT							
					Exact Conv	Multiplier	Divisor	Dec Pt	Display			Multiplier	Divisor	Dec Pt	Display				
" 90:1 "	90 11	1	1	400	1600	1600	1	1	0	1 ct	0.0000000000	0.0000000000	1	1	1	0	1 ct		
" 72:1 "	72 11	1	1	0.002500000	400	1600	1600	0.002500000	25	1	4	0.0025 o	0.0000000000	0.0000694444444444444	0.0000694	125	18	6	0.00007 rv
" 36:1 "	36 11	1	1	0.003125000	400	1600	1600	0.003125000	125	4	4	0.0031 o	0.0000000000	0.00098685555555556	0.0009869	625	72	6	0.00009 rv
" 18:1 "	18 11	1	1	0.006250000	400	1600	1600	0.006250000	125	2	4	0.0063 o	0.0000000000	0.0001736111111111111	0.0001736	625	36	6	0.00017 rv
" 1:1 "	1 11	1	1	0.012500000	400	1600	1600	0.012500000	125	1	4	0.0125 o	0.0000000000	0.0003472222222222222	0.0003472	625	18	6	0.00035 rv

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				
" 0.025in"	0.025 11	1	1	500	2000	2000	1	1	0	1 ct	0.0000000000	0.000317500000000000	7500.00031	15875	5000	4	0.0003 mm		
" 1.0 mm"	1.000 11	1	1	0.000125000	500	2000	2000	0.000125000	125	10	6	0.00013 in	0.0000000000	0.000175000000000000	0.0001750	5000	4	0.0002 in	
" 0.05 in"	0.050 11	1	1	0.000062500	500	2000	2000	0.000062500	25	1	4	0.00006 mm	0.0000000000	0.00019685039370079	0.0001969	2500	127	6	0.00020 in
" 2.0 mm"	2.000 11	1	1	0.000250000	500	2000	2000	0.000250000	25	1	6	0.00025 in	0.0000000000	0.000635000000000000	0.0006350	3175	500	4	0.0006 mm
" 0.10 in"	0.100 11	1	1	0.001000000	500	2000	2000	0.001000000	1	1	3	0.001 mm	0.0000000000	0.00039370078740158	0.0003937	5000	127	6	0.00039 in
" 0.20 in"	0.200 11	1	1	0.000500000	500	2000	2000	0.000500000	5	1	5	0.0005 in	0.0000000000	0.001270000000000000					

Appendix C

Display Messages

Message	Description
<p style="text-align: center;">Release Button X Now !</p>	<p>Button "X" has been depressed for more than 2 seconds ("X" = "S", "C", "U", "0-1", "0-2") NOTE: "0-1" and "0-2" are the AUX inputs, Refer to the "Connections" section on page 5 for more information</p>
<p style="text-align: center;">Enc Input Fail ! >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 style="text-align: center;"># > 10⁹</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 style="text-align: center;"># < 10⁹</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 style="text-align: center;">>5 INPUT VOLTS ! Chk Power/Load</p>	<p>+5V Power input has exceeded 5.4V (Wrong voltage power supply connected to VRO)</p>
<p style="text-align: center;"><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 style="text-align: center;">UART ERROR ! CHK SETTINGS</p>	<p>Baud rate, or parity is not set the same between Host and the VRO</p>
<p style="text-align: center;">RAM/ROM FAIL !</p>	<p>A read/write check of ROM/RAM error has occurred</p>
<p style="text-align: center;">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>