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, re-packaging 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
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 ±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

**Display**

**Send Button** (Save/Exit in Setup)

**Clear Button** (Change in Setup)

**Unit Button** (End in Setup)

**Status Light**

On = Primary Unit Displayed

On = Encoder 1 in Setup

**Features**

**VRO-1**

- RS-232 Computer Interface
- Auxiliary Inputs: Zero 1, Zero 2, Send Unit

**VRO-2**

- Encoder 1 Connection (X Axis)
- Opt. Earth Ground
- Encoder 2 Connection (Y Axis)

**DC Power Input Connection** (To Cincon TRG10R050)
Connections

**RS-232 Port**

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.

**Encoder Connection**

**Remote Connection**

Pin Assignments:

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

N/C = No 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

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)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+</td>
</tr>
<tr>
<td>2</td>
<td>Gnd</td>
</tr>
<tr>
<td>3</td>
<td>B+</td>
</tr>
<tr>
<td>4</td>
<td>+5V</td>
</tr>
<tr>
<td>5</td>
<td>+5 mA</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>A-</td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>B-</td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>+5 mA</td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Gnd</td>
</tr>
</tbody>
</table>

Shell: Shield

Differential Encoder

<table>
<thead>
<tr>
<th>Pin</th>
<th>AMO</th>
<th>ELGO</th>
<th>EPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>green</td>
<td>violet</td>
<td>yellow</td>
</tr>
<tr>
<td>2</td>
<td>blue</td>
<td>white</td>
<td>black</td>
</tr>
<tr>
<td>3</td>
<td>brown</td>
<td>yellow</td>
<td>green</td>
</tr>
<tr>
<td>4</td>
<td>red</td>
<td>brown</td>
<td>white</td>
</tr>
<tr>
<td>9</td>
<td>yellow</td>
<td>green</td>
<td>brown</td>
</tr>
<tr>
<td>11</td>
<td>white</td>
<td>orange</td>
<td>red</td>
</tr>
</tbody>
</table>

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

Single Ended Encoder

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A+</td>
</tr>
<tr>
<td>2</td>
<td>Gnd</td>
</tr>
<tr>
<td>3</td>
<td>B+</td>
</tr>
<tr>
<td>4</td>
<td>+5V</td>
</tr>
<tr>
<td>5</td>
<td>+5 mA</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>A-</td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>B-</td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>+5 mA</td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Gnd</td>
</tr>
</tbody>
</table>

NOTE: To Invert direction on Single Ended encoders swap A and B connections
Power-up

Start menu

Hold “S” button down when powering* to skip splash screen

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

End of Power-up display

Pixel test display

Hold “U” button down when powering for pixel test:

Press “C” Button for Display Mode

Display Mode

Count

Unit Label

Axis Label

Front Panel Setup

Pick E-# to Set

E-1  E-2  END

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
Press “S” button to Save and exit this menu

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

Enc Type: Linear
SAV   CHG

Linear
Rotary

Carriage
Motor
Linear Encoder
Rotary Encoder
Front Panel Setup
Encoder Type: Linear
Linear Resolution

Press “C” button to change Linear Resolution

Lin Res: ________
SAV   CHG

0.001 mm
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

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*

**Typical ENCODER PRODUCTS part number:**

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

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

Cycles/Rev (CPR) can 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

Device: ________
SAV CHG

Ld Screw
Rot Tbl

Press “S” button to Save and exit this menu

Device: Ld Screw
SAV CHG
Front Panel Setup
Encoder Type: Rotary
Device: Ld Screw
Advance/Revolution

Press "C" button to change Advance/Revolution

Press "S" button to Save and exit this menu

Rotary Encoder & Lead Screw

<table>
<thead>
<tr>
<th>UniSlide*</th>
<th>BiSlide**</th>
<th>Adv/Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>P40</td>
<td>E25</td>
</tr>
<tr>
<td>K1</td>
<td>Q1</td>
<td>M01</td>
</tr>
<tr>
<td>B</td>
<td>P20</td>
<td>E50</td>
</tr>
<tr>
<td>K2</td>
<td>Q2</td>
<td>M02</td>
</tr>
<tr>
<td>W1</td>
<td>P10</td>
<td>E01</td>
</tr>
<tr>
<td>W2</td>
<td>P5</td>
<td>E02</td>
</tr>
<tr>
<td>W4</td>
<td>P2.5</td>
<td>E04</td>
</tr>
</tbody>
</table>

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

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

Gear Ratio: ____
SAV     CHG
____             90:1
72:1
36:1
18:1
1:1

Press “S” button to save and exit this menu

Rotary Encoder & Rotary Table

<table>
<thead>
<tr>
<th>Model #</th>
<th>Gear Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>B5990</td>
<td>90:1</td>
</tr>
<tr>
<td>B4872</td>
<td>72:1</td>
</tr>
<tr>
<td>B4836</td>
<td>36:1</td>
</tr>
<tr>
<td>B4818</td>
<td>18:1</td>
</tr>
</tbody>
</table>

Gear Ratio: 72:1
SAV     CHG
Front Panel Setup
Encoder Type: Linear & Rotary
Direction

Press “C” button to change Direction

Direction: Std
SAV  CHG

Std
Inv

Press “S” button to Save and exit this menu

Direction: Std
SAV  CHG

S  C  U
Front Panel Setup
Encoder Type: Linear & Rotary
Display Resolution

Press “C” button to change Display Resolution

Display Res: High
SAV  CHG

High
Low

S  C  U

<table>
<thead>
<tr>
<th>Units</th>
<th>High*</th>
<th>Low**</th>
</tr>
</thead>
<tbody>
<tr>
<td>in (inches)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>mm (millimeters)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>o (degree)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>rv (revolutions)</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

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

Press “S” button to Save and exit this menu

Display Res: High
SAV  CHG

S  C  U
Front Panel Setup
Encoder Type: Linear & Rotary
Primary Unit

Press “C” button to change Primary Unit

Press “S” button to save and exit this menu

- **Prim Unit: Std**
  - **SAV**
  - **CHG**

  **Std**

- **Inv**

**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

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

Press "U" button to
End encoder setting

Firmware Version Number

VRO Version X.XX
EMU     SER     END

S       C       U

Press "S" button to
Set Emulation mode

VRO Version X.XX
EMU     SER     END

Press "C" button to
Set Serial port Baud rate

Baud: 9600  8N1

Emulate: VRO
SAV     CHG

VRO Version X.XX
EMU     SER     END

Press "U" button to
End Setup start
Display mode

X       0.000 mm
Y       0.000 mm
Front Panel Setup

Emulate

Press “C” button to change Emulation setting

Emulate: VRO
SAV    CHG

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: 8 N 1 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

X  0.000 mm

Clearing Count (VRO-2)
Press the “C” button, the second line of the display will show the zero submenu:

X  0.000 mm
0 X 0 Y 0 XY

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
c t  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

X 3.015 mm
Send #  1

Send #=  1
CLR  END
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

```
START
SET   ↓  SET
S    C    U
```

- **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

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

S   C   U

! 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)
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

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>Quit On-Line mode (return to Display mode)</td>
</tr>
<tr>
<td>quit</td>
<td>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.</td>
</tr>
<tr>
<td>fpsetup</td>
<td>Display Front Panel setup menu. This is the same as starting the setup menu at Power-up</td>
</tr>
<tr>
<td>lock</td>
<td>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</td>
</tr>
<tr>
<td>unlock</td>
<td>Enable Front Panel setup mode at power-up (default) This command restores setup at the Start menu that the “lock” command disabled</td>
</tr>
</tbody>
</table>

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

Display value = ((v x Multiplier) / Divisor) / 1x10^DecP
v=  ((Display value x 1x10^DecP) / Multiplier) x 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 x Multiplier) / Divisor) / 1x10^DecP
v=  ((Display value x 1x10^DecP) / Multiplier) x 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)
   =  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

go  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.
setPxv    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)
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

Electrical Requirements
AC Power Adapter...... 90-264VAC  0.4A  47-63Hz
VRO ..........................5VDC± 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)

Performance
Maximum displayable count: ±999,999,999
Maximum internal count: ±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

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

Hinge Tension Adjustment
Tighten

6.87”
(174.5 mm)

5.50”
(140 mm)

6.30”
(160 mm)

3.50”
(89 mm)

0.84”
(21.4 mm)

0.84”
(21.4 mm)

75°
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
On the Internet: www.velmex.com and www.velmexcontrols.com
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7550 State Route 5 & 20
Bloomfield, NY 14469 USA

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## Appendix A

### LOW Display Res Scaling Tables

#### 100 CPR Rotary

<table>
<thead>
<tr>
<th>Rs Screw</th>
<th>Advance/Ex Count</th>
<th>Increment</th>
<th>CPR</th>
<th>Multiplier</th>
<th>Display</th>
<th>Multiplier</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0000</td>
<td>100000</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.10 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0010</td>
<td>100000</td>
<td>0.0010</td>
</tr>
<tr>
<td>0.25 mm</td>
<td>100.000</td>
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<td>1</td>
<td>100000</td>
<td>0.0025</td>
<td>100000</td>
<td>0.0025</td>
</tr>
<tr>
<td>0.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0050</td>
<td>100000</td>
<td>0.0050</td>
</tr>
<tr>
<td>0.75 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0075</td>
<td>100000</td>
<td>0.0075</td>
</tr>
<tr>
<td>1.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0100</td>
<td>100000</td>
<td>0.0100</td>
</tr>
<tr>
<td>2.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0250</td>
<td>100000</td>
<td>0.0250</td>
</tr>
<tr>
<td>5.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0500</td>
<td>100000</td>
<td>0.0500</td>
</tr>
<tr>
<td>10.00 mm</td>
<td>100.000</td>
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<td>1</td>
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<td>0.1000</td>
<td>100000</td>
<td>0.1000</td>
</tr>
</tbody>
</table>

#### 200 CPR Rotary

<table>
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<th>Rs Screw</th>
<th>Advance/Ex Count</th>
<th>Increment</th>
<th>CPR</th>
<th>Multiplier</th>
<th>Display</th>
<th>Multiplier</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0000</td>
<td>100000</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.10 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0010</td>
<td>100000</td>
<td>0.0010</td>
</tr>
<tr>
<td>0.25 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0025</td>
<td>100000</td>
<td>0.0025</td>
</tr>
<tr>
<td>0.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0050</td>
<td>100000</td>
<td>0.0050</td>
</tr>
<tr>
<td>0.75 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0075</td>
<td>100000</td>
<td>0.0075</td>
</tr>
<tr>
<td>1.00 mm</td>
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<td>1</td>
<td>100000</td>
<td>0.0100</td>
<td>100000</td>
<td>0.0100</td>
</tr>
<tr>
<td>2.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0250</td>
<td>100000</td>
<td>0.0250</td>
</tr>
<tr>
<td>5.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0500</td>
<td>100000</td>
<td>0.0500</td>
</tr>
<tr>
<td>10.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.1000</td>
<td>100000</td>
<td>0.1000</td>
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</table>

#### 400 CPR Rotary

<table>
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<th>Rs Screw</th>
<th>Advance/Ex Count</th>
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<th>CPR</th>
<th>Multiplier</th>
<th>Display</th>
<th>Multiplier</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 mm</td>
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<td>1</td>
<td>100000</td>
<td>0.0000</td>
<td>100000</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.10 mm</td>
<td>100.000</td>
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<td>1</td>
<td>100000</td>
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<td>100000</td>
<td>0.0010</td>
</tr>
<tr>
<td>0.25 mm</td>
<td>100.000</td>
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<td>1</td>
<td>100000</td>
<td>0.0025</td>
<td>100000</td>
<td>0.0025</td>
</tr>
<tr>
<td>0.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0050</td>
<td>100000</td>
<td>0.0050</td>
</tr>
<tr>
<td>0.75 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0075</td>
<td>100000</td>
<td>0.0075</td>
</tr>
<tr>
<td>1.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0100</td>
<td>100000</td>
<td>0.0100</td>
</tr>
<tr>
<td>2.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0250</td>
<td>100000</td>
<td>0.0250</td>
</tr>
<tr>
<td>5.00 mm</td>
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<td>1</td>
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<td>0.0500</td>
<td>100000</td>
<td>0.0500</td>
</tr>
<tr>
<td>10.00 mm</td>
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</table>

#### 500 CPR Rotary

<table>
<thead>
<tr>
<th>Rs Screw</th>
<th>Advance/Ex Count</th>
<th>Increment</th>
<th>CPR</th>
<th>Multiplier</th>
<th>Display</th>
<th>Multiplier</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 mm</td>
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<td>1</td>
<td>100000</td>
<td>0.0000</td>
<td>100000</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.10 mm</td>
<td>100.000</td>
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<td>1</td>
<td>100000</td>
<td>0.0010</td>
<td>100000</td>
<td>0.0010</td>
</tr>
<tr>
<td>0.25 mm</td>
<td>100.000</td>
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<td>1</td>
<td>100000</td>
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<td>100000</td>
<td>0.0025</td>
</tr>
<tr>
<td>0.50 mm</td>
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<td>1</td>
<td>100000</td>
<td>0.0050</td>
<td>100000</td>
<td>0.0050</td>
</tr>
<tr>
<td>0.75 mm</td>
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<td>100000</td>
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<td>100000</td>
<td>0.0075</td>
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<tr>
<td>1.00 mm</td>
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<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0100</td>
<td>100000</td>
<td>0.0100</td>
</tr>
<tr>
<td>2.50 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
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<td>100000</td>
<td>0.0250</td>
</tr>
<tr>
<td>5.00 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0500</td>
<td>100000</td>
<td>0.0500</td>
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<tr>
<td>10.00 mm</td>
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#### LINEAR

<table>
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<tr>
<th>Rs Screw</th>
<th>Advance/Ex Count</th>
<th>Increment</th>
<th>CPR</th>
<th>Multiplier</th>
<th>Display</th>
<th>Multiplier</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 mm</td>
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<td>1</td>
<td>100000</td>
<td>0.0000</td>
<td>100000</td>
<td>0.0000</td>
</tr>
<tr>
<td>0.10 mm</td>
<td>100.000</td>
<td>1</td>
<td>1</td>
<td>100000</td>
<td>0.0010</td>
<td>100000</td>
<td>0.0010</td>
</tr>
<tr>
<td>0.25 mm</td>
<td>100.000</td>
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<td>1</td>
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<td>0.0025</td>
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<tr>
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</tbody>
</table>
### Appendix B

#### HIGH Display Res Scaling Tables

**MAX 8 DEC PT FOR IN & RV, MAX OF 4 DEC PT FOR MM & DEG**

**100 CPR Rotary**

<table>
<thead>
<tr>
<th>CPR</th>
<th>Exact Conv</th>
<th>PRIMARY UNIT</th>
<th>SECONDARY UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.001</td>
<td>0.000001</td>
<td>0.0001</td>
<td>0.000001</td>
</tr>
<tr>
<td>0.002</td>
<td>0.000002</td>
<td>0.0002</td>
<td>0.000002</td>
</tr>
<tr>
<td>0.005</td>
<td>0.000005</td>
<td>0.0005</td>
<td>0.000005</td>
</tr>
<tr>
<td>0.010</td>
<td>0.000010</td>
<td>0.0010</td>
<td>0.000010</td>
</tr>
<tr>
<td>0.100</td>
<td>0.000100</td>
<td>0.0100</td>
<td>0.000100</td>
</tr>
<tr>
<td>1.000</td>
<td>0.001000</td>
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<td>0.001000</td>
</tr>
</tbody>
</table>

**500 CPR Rotary**

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<tr>
<th>CPR</th>
<th>Exact Conv</th>
<th>PRIMARY UNIT</th>
<th>SECONDARY UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.001</td>
<td>0.000001</td>
<td>0.0001</td>
<td>0.000001</td>
</tr>
<tr>
<td>0.002</td>
<td>0.000002</td>
<td>0.0002</td>
<td>0.000002</td>
</tr>
<tr>
<td>0.005</td>
<td>0.000005</td>
<td>0.0005</td>
<td>0.000005</td>
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<tr>
<td>0.010</td>
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<td>0.000100</td>
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<tr>
<td>1.000</td>
<td>0.001000</td>
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<td>0.001000</td>
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</table>

**400 CPR Rotary**

<table>
<thead>
<tr>
<th>CPR</th>
<th>Exact Conv</th>
<th>PRIMARY UNIT</th>
<th>SECONDARY UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.001</td>
<td>0.000001</td>
<td>0.0001</td>
<td>0.000001</td>
</tr>
<tr>
<td>0.002</td>
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<tr>
<td>0.010</td>
<td>0.000010</td>
<td>0.0010</td>
<td>0.000010</td>
</tr>
<tr>
<td>0.100</td>
<td>0.000100</td>
<td>0.0100</td>
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<tr>
<td>1.000</td>
<td>0.001000</td>
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**200 CPR Rotary**

<table>
<thead>
<tr>
<th>CPR</th>
<th>Exact Conv</th>
<th>PRIMARY UNIT</th>
<th>SECONDARY UNIT</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.001</td>
<td>0.000001</td>
<td>0.0001</td>
<td>0.000001</td>
</tr>
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<td>0.002</td>
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<tr>
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<td>0.0005</td>
<td>0.000005</td>
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<tr>
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<td>0.000010</td>
<td>0.0010</td>
<td>0.000010</td>
</tr>
<tr>
<td>0.100</td>
<td>0.000100</td>
<td>0.0100</td>
<td>0.000100</td>
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<td>1.000</td>
<td>0.001000</td>
<td>1.0000</td>
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</table>

**Linear CPR**

<table>
<thead>
<tr>
<th>Linear Res</th>
<th>Ex Co</th>
<th>CPR</th>
<th>Display</th>
<th>CPR</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.001</td>
<td>0.0001</td>
<td>0.001</td>
</tr>
<tr>
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<td>0.0002</td>
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<td>0.002</td>
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<tr>
<td>0.005</td>
<td>0.0005</td>
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</tr>
<tr>
<td>0.010</td>
<td>0.0010</td>
<td>0.0010</td>
<td>0.010</td>
<td>0.0010</td>
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</tr>
<tr>
<td>Message</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Release Button X Now !</strong></td>
<td>Button “X” has been depressed for more than 2 seconds (“X” = “S”, “C”, “U”, “0-1”, “0-2”)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> “0-1” and “0-2” are the AUX inputs, Refer to the “Connections” section on page 5 for more information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Enc Input Fail !</strong></td>
<td>Encoder input has exceeded 1.6MHz, or electrical interference has been detected from either a poor connection or routing encoder cable near power cables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>&gt;1.6MHz / Noise</strong></td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong># &gt; 10^9</strong></td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>&gt;5 INPUT VOLTS !</strong></td>
<td>+5V Power input has exceeded 5.4V (Wrong voltage power supply connected to VRO)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chk Power/Load</strong></td>
<td><strong>&lt;5 INPUT VOLTS !</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chk Power/Load</strong></td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UART ERROR !</strong></td>
<td>Baud rate, or parity is not set the same between Host and the VRO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CHK SETTINGS</strong></td>
<td><strong>RAM/ROM FAIL !</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RAM/ROM FAIL !</strong></td>
<td>A read/write check of ROM/RAM error has occurred</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Not Settable !</strong></td>
<td>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)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC set this last</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>