The REE analogue interface is designed for use with any 1 Vpp analogue readhead. It applies Automatic Offset, Balance and Gain Control (AOC, ABC, AGC) to the input signals. Accurate, constant amplitude 1 Vpp industry standard signals are then output.

A tri-coloured LED indicates input signal strength and allows ease of setup for optimum performance. If this LED is not visible when the interface is installed, a separate external setup signal can be used and a calibration cycle also helps to simplify installation.

These features result in the output signals having very low cyclic error, typically less than 50 nm. The interface is fully RoHS compliant and also caters for readheads with single or dual limit outputs.

- Compatible with all standard 1Vpp analogue output readheads
- Outputs accurate, industry standard, 1 Vpp analogue differential signals
- Low cyclic error
- Tri-colour integral set-up LED
- User selectable automatic gain control (AGC)
- Automatic offset and balance control (AOC and ABC)
- Single or dual limit capability
**Operating and electrical specifications**

**Power supply**  
5 V nominal -5% + 10%  
150 mA current consumption (interface only, when terminated with 120 Ω).  
Provision is given to feed a maximum of an additional 100 mA to the readhead.  
The interface will be fully active <300 ms after power is applied.  
Renishaw encoder systems must be powered from a 5 V dc supply complying with  
the requirements for SELV of standard EN (IEC) 60950.  
Provision is given for remote sensing via two cores of the customer’s cable.  
The interface and readhead are protected from reverse voltage and over voltage of  
up to 12 V.  
Ripple  
200 mVpp maximum @ frequency up to 500 kHz maximum

**Acceleration**  
Operating 500 m/s²  
BS EN 60068-2-7:1993  
(IEC 68-2-7:1983)

**Shock**  
non-operating  
1000 m/s², 6 ms, ½ sine  
BS EN 60068-2-27:1993  

**Vibration**  
operating  
100 m/s² max @ 55 to 2000 Hz  
BS EN 60068-2-6:1996  
(IEC 68-2-6:1995)

**Temperature**  
Storage  
-20 °C to +70 °C  
Operating  
0 °C to +55 °C

**Humidity**  
Storage  
95% maximum relative humidity (non-condensing)  
Operating  
80% maximum relative humidity (non-condensing)

**Sealing**  
IP40

**Mass**  
95 g

**EMC compliance**  
BS EN 61000  
BS EN 55011

**Connectors** (input/output)  
15-way D type socket/plug
REE interface features

Self-tuning active correction
The REE analogue interface actively corrects for input signal imperfections to optimise system accuracy. Corrections are made for the following:

**Automatic Offset Control (AOC)** – adjusts offset independently for the sine and cosine signals

**Automatic Gain Control (AGC)** – ensures consistent 1 Vpp signal amplitude

**Automatic Balance Control (ABC)** – adjusts the gain to equalise the sine and cosine signals

These correction mechanisms operate over the full working speed range of the readhead. The user can disable/enable the AGC by pressing the CALIBRATE button for greater than 3 seconds.

LED indicators
The tri-coloured SETUP LED provides visual feedback of signal strength and error condition, for setup and diagnostic use.

- **Flashing Purple** indicates high signal alarm condition  >135%
- **Purple** indicates high signal  >110% and <135%
- **Blue** indicates optimum signal  >90% and <110%
- **Green** indicates acceptable signal  >70% and <90%
- **Orange** indicates low signal  >50% and <70%
- **Red** indicates unacceptable signal  >20% and <50%
- **Flashing Red** indicates unacceptable signal alarm condition  <20%
- **Flashing Blue** indicates overspeed alarm condition
- **Flashes Off** momentarily to indicate a reference mark, up to 100 mm/s only

The **Yellow** CAL/AGC LED indicates when the REE is in a calibration routine and whether or not AGC is active

- LED on indicates AGC active
- LED off indicates AGC inactive
- LED slow flashing indicates calibration routine
- LED fast flashing indicates calibration failure

Reference mark processing
The REE analogue interface monitors the user configurable BID and DIR lines in order to control the outputting of any reference mark.

<table>
<thead>
<tr>
<th>BID line</th>
<th>DIR line</th>
<th>Reference output</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
<td>All, both directions</td>
</tr>
<tr>
<td>High</td>
<td>Low</td>
<td>All, both directions</td>
</tr>
<tr>
<td>Low</td>
<td>High</td>
<td>Forward direction only</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Reverse direction only</td>
</tr>
</tbody>
</table>

Calibration procedure
The calibration procedure is required to optimise the gain, balance and offset of the analogue input signals in the REF interface. These settings are then stored and recalled for initial use at startup.

To calibrate the system, the following sequence should be carried out:

- Prior to calibration, AGC should be off. To switch AGC on or off, the CALIBRATE button should be pressed for more than 3 seconds. When AGC is on, the CAL/AGC LED will be on and when AGC is off, the CAL/AGC LED will be off.
- Install the readhead and set up to obtain optimum (1 Vpp) signal amplitude
- Enter the calibration routine by pressing the CALIBRATE button momentarily. The calibration routine is indicated by slow flashing of the CAL/AGC LED.
- Traverse the readhead slowly past the scale until the CAL/AGC LED stops flashing. The calibration cycle is now complete.
- If calibration fails, the CAL/AGC LED will flash quickly instead of switching off. If this happens the CALIBRATE button should be pressed momentarily to exit the calibration routine. The calibration procedure should then be re-tries.
- If the unit continues to fail calibration, factory default settings should be restored by powering down, then pressing the CALIBRATE button as power is re-applied. The calibration procedure should then be repeated.

**NOTE:** To exit the calibration routine at any time, the CALIBRATE button should be pressed momentarily.
**Input signals**

REE interfaces are designed to be used with industry standard 1 Vpp readheads. Cos ($V_1$), Sin ($V_2$) and reference mark ($V_0$) differential input signals should have nominal signal amplitude of 1 Vpp developed across 120Ω input termination resistor.

One or two open collector limit switch signals, active high or active low can also be input.

15 way ‘D’ type socket

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$V_1^-$</td>
<td>Cosine -ve</td>
</tr>
<tr>
<td>2</td>
<td>$V_2^-$</td>
<td>Sine -ve</td>
</tr>
<tr>
<td>3</td>
<td>$V_0^+$</td>
<td>Reference mark +ve</td>
</tr>
<tr>
<td>4</td>
<td>5 V</td>
<td>5 V power supply</td>
</tr>
<tr>
<td>5</td>
<td>5 V</td>
<td>5 V power supply</td>
</tr>
<tr>
<td>6</td>
<td>–</td>
<td>Not connected</td>
</tr>
<tr>
<td>7</td>
<td>$V_x/V_p$</td>
<td>Setup signal/second (P) limit switch on dual limit readheads</td>
</tr>
<tr>
<td>8</td>
<td>$V_Q$</td>
<td>First (Q) limit switch</td>
</tr>
<tr>
<td>9</td>
<td>$V_1^+$</td>
<td>Cosine +ve</td>
</tr>
<tr>
<td>10</td>
<td>$V_2^+$</td>
<td>Sine +ve</td>
</tr>
<tr>
<td>11</td>
<td>$V_0^-$</td>
<td>Reference mark -ve</td>
</tr>
<tr>
<td>12</td>
<td>0 V</td>
<td>0 V power supply</td>
</tr>
<tr>
<td>13</td>
<td>0 V</td>
<td>0 V power supply</td>
</tr>
<tr>
<td>14</td>
<td>–</td>
<td>Do not connect</td>
</tr>
<tr>
<td>15</td>
<td>Inner</td>
<td>Cable’s inner shield connection to 0 V</td>
</tr>
</tbody>
</table>

**Output signals**

15 way ‘D’ type plug

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Signal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$V_1^-$</td>
<td>Cosine -ve</td>
</tr>
<tr>
<td>2</td>
<td>$V_2^-$</td>
<td>Sine -ve</td>
</tr>
<tr>
<td>3</td>
<td>$V_0^+$</td>
<td>Reference mark +ve</td>
</tr>
<tr>
<td>4</td>
<td>5 V</td>
<td>5 V power supply</td>
</tr>
<tr>
<td>5</td>
<td>5 V</td>
<td>5 V power supply</td>
</tr>
<tr>
<td>6</td>
<td>BID</td>
<td>Bi/uni-directional reference mark select</td>
</tr>
<tr>
<td>7</td>
<td>$V_x/V_p$</td>
<td>Setup signal/P limit switch on dual limit readheads</td>
</tr>
<tr>
<td>8</td>
<td>$V_Q$</td>
<td>Q limit switch</td>
</tr>
<tr>
<td>9</td>
<td>$V_1^+$</td>
<td>Cosine +ve</td>
</tr>
<tr>
<td>10</td>
<td>$V_2^+$</td>
<td>Sine +ve</td>
</tr>
<tr>
<td>11</td>
<td>$V_0^+$</td>
<td>Reference mark -ve</td>
</tr>
<tr>
<td>12</td>
<td>0 V</td>
<td>0 V power supply</td>
</tr>
<tr>
<td>13</td>
<td>0 V</td>
<td>0 V power supply</td>
</tr>
<tr>
<td>14</td>
<td>DIR</td>
<td>Direction selector for reference mark</td>
</tr>
<tr>
<td>15</td>
<td>–</td>
<td>Not connected</td>
</tr>
</tbody>
</table>
Output specifications

Analogue output signals - type REE 0000
Form - 1 Vpp differential

**Incremental**
2 channels $V_1$ and $V_2$ differential sinusoids in quadrature (90° phase shifted)

- $V_1+ - V_1-$
- $V_2+ - V_2-$

1 Vpp (nominal) with AGC active

**Reference**

- $V_0+ - V_0-$
- $V_1+ - V_1-$
- $V_2+ - V_2-$

Differential pulse $V_0$, 18° to 108°, Duration 126° (electrical), Repeatability of position (uni-directional) maintained within ±10 °C from installation temperature and for speed <250 mm/s.

**Limit**
RGH22, RGH40 and RGH41 only
Open collector output

**Single limit**
- Length of actuating magnet
- Repeatability <0.1 mm typical
- Asynchronous pulse $Q$

**Dual limit**
- $V_0$, $V_1$, $V_2$ typical
- $V_0+ - V_0-$
- $V_1+ - V_1-$
- $V_2+ - V_2-$

- Repeatability <0.1 mm typical
- Length of actuating magnet
- Asynchronous pulse $P$, $Q$

**Set-up**

- Voltage at $V_x$
- Setup signal voltage proportional to signal amplitude

**Recommended signal termination**

- $V_0$, $V_1$, $V_2$ with 120R
- $V_0+ - V_0-$
- $V_1+ - V_1-$
- $V_2+ - V_2-$

- 5 V to 25 V
- *Select R so that the maximum current does not exceed 20 mA. Alternatively use a relay or opto-isolator.

**Electrical connections**
Grounding and shielding

- 1 Vpp readhead
- Inner shield (if fitted)
- Outer shield
- Pin 15
- REE interface
- Extension cable max. 100 m
- Customer electronics
- 0 V power
- Output signals

**NOTE**: Extension cable inner shield must be connected to 0V at customer electronics only

**IMPORTANT**: The outer shield should be connected to the machine earth (Field Ground). The inner shield should be connected to 0V. Care should be taken to ensure that the inner and outer shields are insulated from each other. If the inner and outer shields are connected together, this will cause a short between 0V and earth, which could cause electrical noise issues.
EMC compliance

The REE interface conforms to the relevant harmonised European standards for electromagnetic compatibility as detailed below.

BS EN 61000   BS EN 55011

Patents

Features of Renishaw’s encoder systems and similar products are the subjects of the following patents and patent applications:

US4959542   US4974962   US4926566
EP0383901   US5088209   JP2963926
EP0388453   US5063685   JP2837483
EP0514081   US5248895   JP3202316
EP0543513   US5302820   JP5248895
US6051971   JP3676819   EP1094302
US6481115   US6588333 B1   EP1147377
EP2003-512,611   US6772531   GB2397040
CN1585685   WO 03/041905   JP2005-508,760
US2005-0079499   CN1620353   WO 03/061891
WO 2004/008076

Further information

For further information relating to the installation of REE systems, see also related readhead installation guides. These can be downloaded from our website www.renishaw.com/encoder and are also available from your local representative.

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