Equipment Health Monitoring (EHM) Systems

Detectors

DESCRIPTION
Honeywell Equipment Health Monitoring (EHM) System Detectors are designed to monitor equipment steady state physical characteristics and provide the output to generate an alarm when these characteristics deviate from pre-defined settings. The fault may then be quickly investigated and the problem corrected before it becomes so serious that a line is shut down, production is lost and costs spiral.

The EHM’s output is expressed in two ways:
- The device’s dual color LED changes from normal green to red.
- At the same time, the device's output changes state from open to closed. This output may be connected to an alarm or PLC input, allowing the alarm to be graphically shown and to generate a "system" alarm.

Ten versions of the EHM are available for potential applications requiring independent system monitoring of such physical characteristics as temperature loss or rise, vibration, fluid flow or leak, mechanical noise or wear, slope change, mechanical insertion or audible noise.

Installation is simple. The EHM detectors are ready to be attached directly to equipment and, after a quick calibration, will begin monitoring for faults immediately.

A demonstration kit, as well as accessory/replacement connector pins and cables are also available.

FEATURES
- Enhanced reliability designed to provide early warning fault detection for protection of valuable equipment
- Visual and electrical alarm output is simple to integrate and makes current equipment status easy to monitor
- Digital output means no time-consuming data collection and analysis required
- Internal monitoring circuitry means no outside design needed
- Easy installation and calibration provides quick set-up and immediate use

POTENTIAL APPLICATIONS
- Wide variety of stationary and mobile equipment health monitoring. See page two for specifics
## Equipment Health Monitoring (EHM) Systems

### SELECTION GUIDE

<table>
<thead>
<tr>
<th>Catalog Listing</th>
<th>Detector Cap Color</th>
<th>Detector Function</th>
<th>Description</th>
<th>Potential Applications</th>
</tr>
</thead>
</table>
| EHM-D-COOL      | Blue               | Temperature Loss  | Monitors steady state temperature within a range of -40 °C to 85 °C [-40 °F to 185 °F] and provides an alarm if the desired temperature measurement drops below the set point. | • Heating systems  
• Hot water supplies  
• Oil coolers  
• Air conditioning outlets  
• Exhaust venting systems  
• Chimneys |
| EHM-D-FLOW      | Brown              | Fluid Flow        | Acoustically monitors the flow of liquid in a pipe to verify that upstream components are functioning correctly. Often suitable for areas around turbid flow (valves, joints, elbows, etc.). | • Heating systems  
• Process pipes  
• Feeder pipes  
• Vessels  
• Valves |
| EHM-D-HEAT      | Red                | Temperature Rise  | Monitors steady state temperature within a range of -40 °C to 85 °C [-40 °F to 185 °F] and provides an alarm if the desired temperature measurement rises above the set point. | • Gearboxes  
• Temperature control failure  
• Electrical switchgears  
• Perishable goods cold storage  
• Equipment under test |
| EHM-D-HISS      | Black              | Fluid Leak        | Monitors for pressurized leaks in joints, vessels, seals and gaskets. Able to detect the sonic signature of leaks from several meters away from the source. | • Process equipment  
• Compressed air systems  
• Steam leaks |
| EHM-D-KNOCK     | Orange             | Mechanical Noise  | Monitors machine knocks, clicks and other spurious noises from equipment that might indicate loosening or wearing components about to fail. | • Water hammers  
• Cavitation in pumps  
• Lubrication failure  
• Machine resonance shift  
• Worn brake pads/shoes |
| EHM-D-RUMBLE    | Green              | Bearing Wear      | Monitors the high frequency and low frequency signature from bearings and rotating equipment. It is designed to detect ovoid wear before it becomes a serious issue. | • Conveyor systems  
• Marine  
• Power generation  
• Mining/quarrying  
• Rolling mills  
• Paper production |
| EHM-D-SNAP      | Black              | Mechanical Insertion | Monitors for the ‘ultrasonic’ sound of click-fit assembly components which may be more reliable than relying on audible sound, especially in noisy industrial/factory environments. | • Automotive harness assembly  
• Snap fit assembly (plastic hose, fittings, retaining rings, connectors, etc.) |
| EHM-D-SONIC     | Brown              | Audible Noise     | Monitors human acoustic noise levels. Detects increases in applications where the characteristic can be heard and other methods are not possible. | • Any audible ‘listening’ application |
| EHM-D-TILT      | Green              | Slope Change      | Monitors when an angle drifts from the set point and provides an alarm. | • Bridges  
• Temporary structures  
• Ships  
• Cranes  
• Fork lift trucks  
• Land moving equipment |
| EHM-D-VIBRATION | Yellow             | Vibration         | Monitors a steady state vibration and provides an alarm if the desired vibration measurement rises above the set point. | • Cranes  
• Conveyors  
• Wind turbines  
• Turbines  
• Compressors |
**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>10 Vdc to 32 Vdc at 20 mA typical</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 °C to 90 °C [-40 °F to 194 °F]</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-25 °C to 70 °C [-13 °F to 158 °F]</td>
</tr>
<tr>
<td>Mounting</td>
<td>(2) M4 (#6 UNF) screws or cable ties for pipes</td>
</tr>
<tr>
<td>Body material</td>
<td>nylon 66 and ABS</td>
</tr>
<tr>
<td>Output</td>
<td>• green/red LED</td>
</tr>
<tr>
<td></td>
<td>• isolated volt free contact rated at 48 V (max.) 100 mA (max.) ac or dc switching</td>
</tr>
<tr>
<td>Approvals</td>
<td>CE compliant to EN610101</td>
</tr>
<tr>
<td>Sealing</td>
<td>IP67 when installed according to instructions</td>
</tr>
</tbody>
</table>

**ACCESSORIES/REPLACEMENTS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration case</td>
<td>Includes EHM-D-KNOCK</td>
</tr>
</tbody>
</table>

**DIMENSIONS (For reference only. mm/[in])**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable</td>
<td>3 m [9.8 ft] or 6 m [19.7 ft]</td>
</tr>
<tr>
<td>Connector pins</td>
<td>1.5 [0.059] 13.36 [0.527] 0.85 [0.033] 1.22 [0.048] 5.3 [0.209] [Silver]end</td>
</tr>
</tbody>
</table>

Honeywell Sensing and Control 3

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
<table>
<thead>
<tr>
<th>Catalog Listing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHM-D-COOL</td>
<td>Temperature Loss Detector</td>
</tr>
<tr>
<td>EHM-D-FLOW</td>
<td>Fluid Flow Detector</td>
</tr>
<tr>
<td>EHM-D-HEAT</td>
<td>Temperature Rise Detector</td>
</tr>
<tr>
<td>EHM-D-HISS</td>
<td>Fluid Leak Detector</td>
</tr>
<tr>
<td>EHM-D-KNOCK</td>
<td>Mechanical Noise Detector</td>
</tr>
<tr>
<td>EHM-D-RUMBLE</td>
<td>Bearing Wear Detector</td>
</tr>
<tr>
<td>EHM-D-SNAP</td>
<td>Mechanical Insertion Detector</td>
</tr>
<tr>
<td>EHM-D-SONIC</td>
<td>Audible Noise Detector</td>
</tr>
<tr>
<td>EHM-D-TILT</td>
<td>Slope Change Detector</td>
</tr>
<tr>
<td>EHM-D-VIBRATION</td>
<td>Vibration Detector</td>
</tr>
<tr>
<td>EHM-C-003</td>
<td>Cable, 3 m [9.8 ft]</td>
</tr>
<tr>
<td>EHM-C-006</td>
<td>Cable, 6 m [19.7 ft]</td>
</tr>
<tr>
<td>EHM-D-DEMO</td>
<td>Demonstration kit (includes EHM-D-KNOCK)</td>
</tr>
</tbody>
</table>

**WARNING**

PERSONAL INJURY
DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.
**Failure to comply with these instructions could result in death or serious injury.**

WARRANTY/REMEDY
Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell’s standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer’s sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

SALES AND SERVICE
Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

**E-mail:** info.sc@honeywell.com

**Internet:** www.honeywell.com/sensing

**Phone and Fax:**
Asia Pacific  +65 6355-2828
Europe        +44 (0) 1698 481481
              +44 (0) 1698 481676 Fax
Latin America +1-305-805-8188
              +1-305-883-8257 Fax
USA/Canada    +1-800-537-6945
              +1-815-235-6847
              +1-815-235-6545 Fax
DESCRIPTION
The HG1171 Series is a six degrees of freedom (6DF) inertial measurement unit (IMU) that senses rotation rate about the roll, pitch and yaw axes (X, Y and Z axes) and acceleration along the longitudinal, lateral and vertical axes (X, Y and Z axes, see Figure 1 on page 2). This product is designed for enhanced accuracy of tracking and monitoring of vehicle/platform (up/down, left/right, forward/backward) in a hard mounted configuration.

It provides key data for automated steering and vehicle controls, freeing the operator to focus on machine functions, one of the main reasons customers use IMUs.

The HG1171 contains high performance MEMS (Micro Electromechanical Systems) rotation rate sensors (gyroscopes), whose function is based on the physical properties of the Coriolis effect, as well as enhanced precision integrated accelerometers for each axis.

High speed CAN bus (2.0 A or B) provides cost-effective, high-integrity serial data communications bus for real-time control applications operating at data rates up to 1 Mbit/s. This capability allows enhanced error detection and confinement.

KWP (Keyword Protocol) is used for self-test, health reporting, software loading and related tasks. KWP 2000 (or ISO14230) is a defined protocol for monitoring health and status of a unit on a CAN bus (primary use is for off-vehicle test equipment). It supports high speed IMU flashing for re-reprogramming.

Customization of I/O timing, CAN labels, connectors, and other parameters allows the customer to specify changes in the IMU so it more readily fits into existing architecture on vehicle.

A temperature sensor in each rotation rate sensor provides a temperature value to the processing module where the samples are filtered and compensated. This information allows the customer’s system to perform over a wide temperature range.

The tough metal housing is often ideal for demanding environments. The user may mount the product on the vehicle frame outside the cabin, anywhere an IMU is needed.

FEATURES
- 3-dimensional rotation rate and acceleration outputs (roll, pitch, yaw)
- High speed CAN bus
- Broad dynamic range
- Low noise
- High resolution
- Customizable
- Enhanced temperature performance
- Tough metal housing

POTENTIAL APPLICATIONS
Vehicle stability control systems on:
- Agricultural equipment such as tractors and harvesters to:
  - Provide motion control feedback (attitude/acceleration) for leveling cutting blades, planters, tillers and other equipment when on slopes or hills
  - Improve automated steering capabilities by providing rotational rate change data to vehicle controls
  - Smooth GPS data (position and velocity) for use in high accuracy planting/tilling
- Construction equipment such as excavators, trucks, forestry equipment, loaders and graders to:
  - Improve operator awareness relative to equipment loading and extension envelopes on cranes and material/telescopic handlers
  - Provide real time stability control in rugged and steep terrain
  - Provide active depth and angle control for graders
  - Provide motion compensation in GPS-guided automated vehicles
Table 1. General Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Minimum</th>
<th>Typical</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (normal operation)</td>
<td>+7</td>
<td>+13.5</td>
<td>+17</td>
<td>V</td>
</tr>
<tr>
<td>Over voltage (output halted)</td>
<td></td>
<td></td>
<td>+26</td>
<td>V</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td></td>
<td></td>
<td>-18</td>
<td>V</td>
</tr>
<tr>
<td>Supply current</td>
<td></td>
<td></td>
<td>+75</td>
<td>mA</td>
</tr>
<tr>
<td>Start up time</td>
<td>−</td>
<td>700</td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40 [-40]</td>
<td>20 [68]</td>
<td>85 [185]</td>
<td>°C [°F]</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 [-40]</td>
<td></td>
<td>95 [203]</td>
<td>°C [°F]</td>
</tr>
<tr>
<td>Vibration (10 Hz to 1000 Hz)</td>
<td></td>
<td></td>
<td>3.1</td>
<td>g (RMS)</td>
</tr>
<tr>
<td>Shock</td>
<td></td>
<td>100</td>
<td></td>
<td>g (half sine for 6 ms)</td>
</tr>
<tr>
<td>Humidity (1°)</td>
<td></td>
<td></td>
<td>95%</td>
<td>—</td>
</tr>
<tr>
<td>Sealing</td>
<td></td>
<td>IP62K</td>
<td></td>
<td>—</td>
</tr>
<tr>
<td>ESD (Electrostatic Discharge)</td>
<td></td>
<td></td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Connector</td>
<td></td>
<td>AMP: 3-967-616-1, keying C mating cable harness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. After exposure, including a condensing environment.
2. All exposed ports have low-pass filtering using trade-off methods which consider ESD protection, RF filtering and bandwidth. The ESD simulator waveform verification complies with ISO 10605 except for contact discharge rise time < 1 ns and air discharge rise time ≤ 20 ns.

Table 2. Rotation Rate Sensor Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>-75</td>
<td>75</td>
<td>°/s</td>
</tr>
<tr>
<td>Overload range (&lt;60 ms recovery)</td>
<td>-1000</td>
<td>1000</td>
<td>°/s</td>
</tr>
<tr>
<td>Sensitivity error</td>
<td>-4</td>
<td>4</td>
<td>%</td>
</tr>
<tr>
<td>Linearity</td>
<td>-1</td>
<td>1</td>
<td>%</td>
</tr>
<tr>
<td>Offset (total)</td>
<td>-2.5</td>
<td>2.5</td>
<td>°/s</td>
</tr>
<tr>
<td>Offset drift (over temperature range)</td>
<td>-1</td>
<td>1</td>
<td>°/s</td>
</tr>
<tr>
<td>Offset drift speed (t &gt; 3 min)</td>
<td>-0.2</td>
<td>0.2</td>
<td>°/s/min</td>
</tr>
<tr>
<td>Noise</td>
<td></td>
<td>0.2</td>
<td>°/s</td>
</tr>
<tr>
<td>Cross axis sensitivity</td>
<td></td>
<td>2</td>
<td>%</td>
</tr>
<tr>
<td>Turn on time</td>
<td></td>
<td>750</td>
<td>ms</td>
</tr>
</tbody>
</table>

Table 3. Acceleration Sensor Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>-17</td>
<td>17</td>
<td>m/s²</td>
</tr>
<tr>
<td>Overload range (&lt;60 ms recovery)</td>
<td>-100</td>
<td>100</td>
<td>m/s²</td>
</tr>
<tr>
<td>Sensitivity error</td>
<td>-5</td>
<td>5</td>
<td>%</td>
</tr>
<tr>
<td>Linearity</td>
<td>-4</td>
<td>4</td>
<td>%</td>
</tr>
<tr>
<td>Offset (total)</td>
<td>-1</td>
<td>1</td>
<td>m/s²</td>
</tr>
<tr>
<td>Offset drift (over temperature range)</td>
<td>-0.35</td>
<td>0.35</td>
<td>m/s²</td>
</tr>
<tr>
<td>Offset drift speed (over 60 °K interval)</td>
<td>-0.2</td>
<td>0.2</td>
<td>m/s²/min</td>
</tr>
<tr>
<td>Noise</td>
<td></td>
<td>0.1</td>
<td>m/s² (RMS)</td>
</tr>
<tr>
<td>Cross axis sensitivity</td>
<td></td>
<td>5</td>
<td>%</td>
</tr>
<tr>
<td>Turn on time</td>
<td></td>
<td>250</td>
<td>ms</td>
</tr>
</tbody>
</table>

Table 4. Software Resolution for Rotation Rates and Accelerations

<table>
<thead>
<tr>
<th>Bit Position</th>
<th>Number of Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Dynamic Rates</td>
<td>14</td>
</tr>
<tr>
<td>Vehicle Dynamic Lateral and Longitudinal Acceleration</td>
<td>10</td>
</tr>
<tr>
<td>Vehicle Dynamic Vertical Acceleration</td>
<td>10</td>
</tr>
</tbody>
</table>

Figure 1. Axes of Motion
Inertial Measurement Unit

Figure 2. Block Diagram

HG1171 Series 6DF IMU

Processing Module

Main Processor

Digital Input' Output

Analog to Digital Converter

CAN A

CAN Tranceiver

Power Supply Module

Reset

Watch Dog Timer

Regulated Power Supply

Supply Voltage

Customer System

Sensor Module

Accelerometers

Rotation Rate Sensors (Gyroscopes)

3 x Accelerometer

3 x Accelerometer

3 x Status

Analog to Digital Converter

Serial Peripheral Interface

Digital Input' Output

Analog to Digital Converter

Reset

Timer

Power Supply Module

Supply Voltage

Power to All Modules

Figure 3. Dimensional Drawing (For reference only: mm/[in].)

98.0 [3.86]

82.0 [3.23]

10.0 [0.39]

114.2 [4.50]

97.0 [3.82]

80.0 [3.15]

2x Ø 7.0 [0.28]

Ø 7.0 [0.28]

41.0 [1.61]

40.0 [1.57]

21.0 [0.83]
### Order Guide

<table>
<thead>
<tr>
<th>Catalog Listing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HG1171BA01</td>
<td>HG1171 Series 6DF inertial measurement unit</td>
</tr>
</tbody>
</table>

### WARNING

**PERSONAL INJURY**

Do not use these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. **Failure to comply with these instructions could result in death or serious injury.**

### MISUSE OF DOCUMENTATION

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product. **Failure to comply with these instructions could result in death or serious injury.**

### WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell’s standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer’s sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

### SALES AND SERVICE

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

- **E-mail:** info.sc@honeywell.com
- **Internet:** www.honeywell.com/sensing
- **Phone and Fax:**
  - Asia Pacific: +65 6355-2828; +65 6445-3033 Fax
  - Europe: +44 (0) 1698 481481; +44 (0) 1698 481676 Fax
  - Latin America: +1-305-805-8188; +1-305-883-8257 Fax
  - USA/Canada: +1-800-537-6945; +1-815-235-6847
    +1-815-235-6545 Fax
LLE Series
Liquid level sensors

DESCRIPTION
The enhanced series of liquid level sensors incorporates a photo-transistor trigger which provides a digital output that denotes the presence or absence of liquid.

The mode of operation is derived from the principle of total internal reflection. An LED and photo-transistor are housed within a plastic dome at the head of the device. When no liquid is present, light from the LED is internally reflected from the dome to the photo-transistor. When liquid covers the dome, the effective refractive index at the dome-liquid boundary changes, allowing some light from the LED to escape. Thus the amount of light received by the photo-transistor is reduced and the output switches, indicating the presence of liquid. This method of liquid level sensing is very fast, and almost instantaneous for water.

FEATURES
• Solid state technology
• Small size
• Digital output
• Pre-wired
• Electrically robust

BENEFITS
• Accurate, repeatable switching point
• Can be mounted in applications where space is limited
• Microprocessor compatible
• Easy to install, saving assembly time
• Reverse polarity, over voltage, short circuit and transient protection

TYPICAL APPLICATIONS
• Home appliances
• Spa baths
• Vending machines
• Food and beverage
• Medical
• Compressors
• Machine tools
• Automotive

ORDER GUIDE

<table>
<thead>
<tr>
<th>Description</th>
<th>Standard temperature</th>
<th>High temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw In, M12 Thread, Plastic</td>
<td>LLE101000</td>
<td>LLE101101</td>
</tr>
<tr>
<td>(Type 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Type 2)</td>
<td>LLE102000</td>
<td>LLE102101</td>
</tr>
<tr>
<td>(Type 3)</td>
<td>LLE103000</td>
<td>LLE103101</td>
</tr>
<tr>
<td>Push In, Plastic</td>
<td>LLE105000</td>
<td>LLE105100</td>
</tr>
<tr>
<td>(Type 5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screw In, ½ in, Metal</td>
<td>LLE205000</td>
<td>LLE205100</td>
</tr>
<tr>
<td>Nickel plated brass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel</td>
<td>LLE305000</td>
<td>LLE305100</td>
</tr>
</tbody>
</table>
## LLE Series

### TECHNICAL INFORMATION

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Plastic LLE101/102/103 Series</th>
<th>Metal LLE205/305 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation mode</td>
<td>User defined single point on/off switch</td>
<td>Output is high in air</td>
</tr>
<tr>
<td>Repeatability (mm)</td>
<td>± 1</td>
<td></td>
</tr>
<tr>
<td>Hysteresis (mm)</td>
<td>2 (dependent on liquid)</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>Rising liquid level - 50 µs</td>
<td>Falling liquid level - 1 s max (in ethanol)</td>
</tr>
<tr>
<td></td>
<td>Falling liquid level - 1 s max (in ethanol)</td>
<td>Response in other liquids dependent on viscosity</td>
</tr>
</tbody>
</table>

### Mechanical

<table>
<thead>
<tr>
<th>Mounting</th>
<th>Type 1 and 2 - mounted from outside; Type 3 and 5 - mounted from inside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Termination</td>
<td>250 mm flying leads (180 mm for metal versions)</td>
</tr>
<tr>
<td></td>
<td>Blue 0 V</td>
</tr>
<tr>
<td></td>
<td>Red +5 V to +12 V supply</td>
</tr>
<tr>
<td></td>
<td>Green Output</td>
</tr>
<tr>
<td>Material [Note 1]</td>
<td>Polysulphone</td>
</tr>
</tbody>
</table>

### Dimensions

<table>
<thead>
<tr>
<th>Plastic LLE105 Series</th>
<th>Metal LLE205/305 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dome</td>
<td></td>
</tr>
<tr>
<td>Thread</td>
<td>3.5 mm radius (includes LLE105 Series)</td>
</tr>
<tr>
<td>Hex</td>
<td>19 mm</td>
</tr>
</tbody>
</table>

### Environmental

| Operating temperature (°C)   | -25 to 80 (-13 °F to 176 °F) | -40 to 125 (-40 °F to 257 °F) |
| Storage temperature (°C)     | -30 to 85 (-22 °F to 185 °F)  | -40 to 125 (-40 °F to 257 °F)  |
| Thermal testing              | As per BS EN60068-2-33       |                                     |
| Humidity                     | As per BS EN60068-2-30       |                                     |
| Vibration                    | As per BS EN60068-2-6 Part S3: 1996 |                                    |
| Mechanical shock             | As per BS EN60068-2-27 Part 2 Ea: 1987 |                                        |
| Pressure range (bar)         | 0 to 5 (plastic housing) [Note 2] | 0 to 25 (metal housing) |
| Ambient IR light limit (940 nm) [Note 3] | 10 mW/cm² in operation |                                     |

### Electrical

<table>
<thead>
<tr>
<th>Electrical</th>
<th>Standard temperature</th>
<th>High temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage (Vcc)</td>
<td>+5 Vdc to +12 Vdc ± 5 %</td>
<td></td>
</tr>
<tr>
<td>Supply current (mA)</td>
<td>15 mA nominal @ +5 Vdc</td>
<td>5 mA nominal @ +5 Vdc</td>
</tr>
<tr>
<td>Output sink current [Note 4]</td>
<td>@ 25 °C 10 mA max.</td>
<td>@ 25 °C 40 mA max.</td>
</tr>
<tr>
<td>@ 5 Vdc supply</td>
<td>@ 80 °C 3 mA max.</td>
<td>@ 125 °C 7 mA max.</td>
</tr>
</tbody>
</table>

### Notes:

[Note 1] Material compatibility information available on request.
[Note 2] Threaded sensors only.
[Note 3] For other ambient light environments the user should test the sensor under application conditions to verify compatibility.
[Note 4] The output is intended as a TTL compatible output signal, for interfacing to logic systems. For interfacing with other types of circuitry an appropriate buffer circuit must be used.
Liquid level sensors

MOUNTING DRAWING (IN MM AND INCHES)

**LLE101000/LLE101101** (Type 1)

- 19.00 (0.75)
- 12.40 (0.49)
- 10.25 (0.40)
- 4.70 (0.19)

0.22 mm² (0.01 in²) Tinned Ends

**LLE102000/LLE102101** (Type 2)

- 19.00 (0.75)
- 12.49 (0.49)
- 4.70 (0.19)

0.22 mm² (0.01 in²) Tinned Ends

**LLE103000/LLE103101** (Type 3)

- 19.00 (0.75)
- 7.20 (0.28)
- 2.70 (0.11)
- 10.30 (0.41)

0.22 mm² (0.01 in²) Tinned Ends

**LLE105000/LLE105100** (Type 5)

- 16.12 (0.63)
- 4.1 (0.16)

0.22 mm² (0.01 in²) Tinned Ends

**LLE205000/LLE205100**

- Cable length
- 12.3 (0.49)
- 16.00 (0.63)
- 24.00 (0.94)

0.22 mm² (0.01 in²) Tinned Ends

**ELECTRICAL DIAGRAM**

- Vcc
- RED
- OUTPUT
- GREEN
- PHOTOCRISTOR
- IRED
- SCHMITT TRIGGER
- 0 V
- BLUE

Notes
1. Recommended panel hole size Ø 12.5 ±0.3 mm (0.49 ±0.01 in)
2. 'O' ring seal supplied Unassembled

LLE101000/LLE101101
LLE102000/LLE102101
LLE103000/LLE103101
LLE105000/LLE105100
LLE205000/LLE205100
LLE305000/LLE305100

Honeywell Sensing and Control
WARRANTY/REMEDY
Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. The foregoing is buyer's sole remedy and is in lieu of all warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

SALES AND SERVICE
Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

E-mail: info.sc@honeywell.com
Internet: www.honeywell.com/sensing

Phone and Fax:
Asia Pacific  +65 6355-2828
Europe        +44 (0) 1698 481481
Latin America +1-305-805-8188
USA/Canada    +1-800-537-6945

Fax:
Asia Pacific  +65 6445-3033
Europe        +44 (0) 1698 481676
Latin America +1-305-883-8257
USA/Canada    +1-815-235-6847

Automaion and Control Solutions
Sensing and Control
Honeywell
Newhouse Industrial Estate
Motherwell, ML1 5SB, UK
www.honeywell.com