

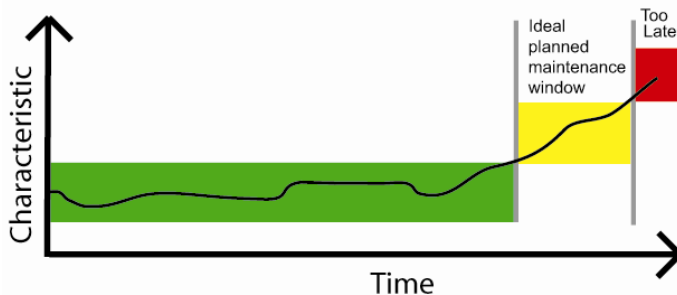
Equipment Health Monitoring (EHM) Systems

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.



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

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.

POTENTIAL APPLICATIONS

- Wide variety of stationary and mobile equipment health monitoring. See page two for specifics

Equipment Health Monitoring (EHM) Systems

SELECTION GUIDE

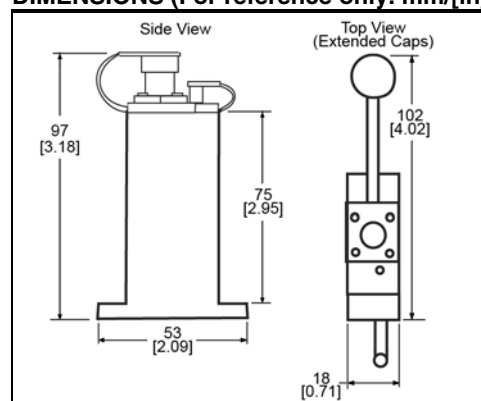
Catalog Listing	Detector Cap Color	Detector Function	Description	Potential Applications
EHM-D-COOL		Temperature Loss	Monitors steady state temperature within a range of -40 °C to 85 °C [-40 °F to 185 °F] and provides an alarm if the desired temperature measurement drops below the set point.	<ul style="list-style-type: none"> • Heating systems • Hot water supplies • Oil coolers • Air conditioning outlets • Exhaust venting systems • Chimneys
EHM-D-FLOW		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.).	<ul style="list-style-type: none"> • Heating systems • Process pipes • Feeder pipes • Vessels • Valves
EHM-D-HEAT		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.	<ul style="list-style-type: none"> • Gearboxes • Temperature control failure • Electrical switchgears • Perishable goods cold storage • Equipment under test
EHM-D-HISS		Fluid Leak	Monitors for pressurized leaks in joints, vessels, seals and gaskets. Able to detect the the sonic signature of leaks from several meters away from the source.	<ul style="list-style-type: none"> • Process equipment • Compressed air systems • Steam leaks
EHM-D-KNOCK		Mechanical Noise	Monitors machine knocks, clicks and other spurious noises from equipment that might indicate loosening or wearing components about to fail.	<ul style="list-style-type: none"> • Water hammers • Cavitation in pumps • Lubrication failure • Machine resonance shift • Worn brake pads/shoes
EHM-D-RUMBLE		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.	<ul style="list-style-type: none"> • Conveyor systems • Marine • Power generation • Mining/quarrying • Rolling mills • Paper production
EHM-D-SNAP		Mechanical Insertion	Monitors for the 'ultrasonic' sound of click-t- fit assembly components which may be more reliable than relying on audible sound, especially in noisy industrial/factory environments.	<ul style="list-style-type: none"> • Automotive harness assembly • Snap fit assembly (plastic hose, fittings, retaining rings, connectors, etc.)
EHM-D-SONIC		Audible Noise	Monitors human acoustic noise levels. Detects increases in applications where the characteristic can be heard and other methods are not possible.	<ul style="list-style-type: none"> • Any audible 'listening' application
EHM-D-TILT		Slope Change	Monitors when an angle drifts from the set point and provides an alarm.	<ul style="list-style-type: none"> • Bridges • Temporary structures • Ships • Cranes • Fork lift trucks • Land moving equipment
EHM-D-VIBRATION		Vibration	Monitors a steady state vibration and provides an alarm if the desired vibration measurement rises above the set point.	<ul style="list-style-type: none"> • Cranes • Conveyors • Wind turbines • Turbines • Compressors

Detectors

SPECIFICATIONS

Characteristic	Parameter
Power supply	10 Vdc to 32 Vdc at 20 mA typical
Storage temperature.	-40 °C to 90 °C [-40 °F to 194 °F]
Operating temperature	-25 °C to 70 °C [-13 °F to 158 °F]
Mounting	(2) M4 (#6 UNF) screws or cable ties for pipes
Body material	nylon 66 and ABS
Output	<ul style="list-style-type: none"> green/red LED isolated volt free contact rated at 48 V (max.) 100 mA (max.) ac or dc switching
Approvals	CE compliant to EN610101
Sealing	IP67 when installed according to instructions

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



ACCESSORIES/REPLACEMENTS

Item	Description
Demonstration case	Includes EHM-D-KNOCK

Item	Description (Dimensions for reference only. mm/[in])	Item	Description (Dimensions for reference only. mm/[in])
Cable	3 m [9.8 ft] or 6 m [19.7 ft]	Connector pins	

Cable drawing: Overall length L = 3 m [9.8 ft] or 6 m [19.7 ft]. Shielded section length 45.08 [1.77]. Belden 24AWG (7/32AWG) Overall shielded 2 x twisted pair (red/black; white/black) O/D 5.64. Stripped length 30.00 [11.81]. Wire diameter 8 [0.31].

Connector pins drawing: Total length 13.36 [0.526]. Silver end length 1.5 [0.059]. Inspection hole offset 5.3 [0.209]. Pin diameter 0.85 [0.033]. Pin length 1.22 [0.048].

ORDER GUIDE

Catalog Listing	Description
EHM-D-COOL	Temperature Loss Detector
EHM-D-FLOW	Fluid Flow Detector
EHM-D-HEAT	Temperature Rise Detector
EHM-D-HISS	Fluid Leak Detector
EHM-D-KNOCK	Mechanical Noise Detector
EHM-D-RUMBLE	Bearing Wear Detector
EHM-D-SNAP	Mechanical Insertion Detector
EHM-D-SONIC	Audible Noise Detector
EHM-D-TILT	Slope Change Detector
EHM-D-VIBRATION	Vibration Detector
EHM-C-003	Cable, 3 m [9.8 ft]
EHM-C-006	Cable, 6 m [19.7 ft]
EHM-D-DEMO	Demonstration kit (includes EHM-D-KNOCK)

WARNING

PERSONAL INJURY

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Automation and Control Solutions

Sensing and Control

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+1-815-235-6847
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Honeywell

HG1171 Series

6DF Inertial Measurement Unit



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.

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

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.

POTENTIAL APPLICATIONS

Vehicle stability control systems on:

- Agricultural equipment such as tractors and harvesters to:
 - Provide motion control feedback (attitude/accleration) 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

HG1171 Series

Table 1. General Specifications

Characteristic	Minimum	Typical	Maximum	Unit
Supply voltage (normal operation)	+7	+13.5	+17	V
Over voltage (output halted)	—	—	+26	V
Reverse voltage	—	—	-18	V
Supply current	—	—	+75	mA
Start up time	—	700	—	ms
Operating temperature	-40 [-40]	20 [68]	85 [185]	°C [°F]
Storage temperature	-40 [-40]	—	95 [203]	°C [°F]
Vibration (10 Hz to 1000 Hz)	—	—	3.1	g (RMS)
Shock	—	100	—	g (half sine for 6 ms)
Humidity ⁽¹⁾	—	—	95%	—
Sealing	IP62K			
ESD (Electrostatic Discharge) ⁽²⁾	Meets ISO 10605: – at ≤8 kV ESD protection for handling – at ≤15 kV protection for power			
Connector	AMP: 3-967-616-1, keying C mating cable harness			

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

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

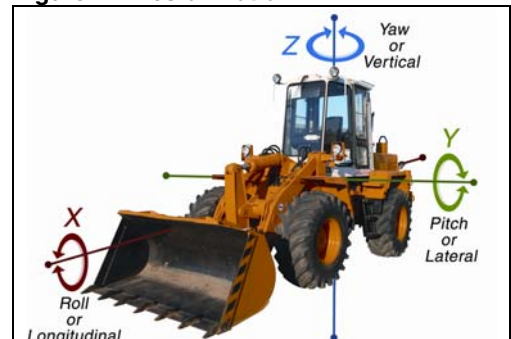
Table 3. Acceleration Sensor Specifications

Characteristic	Minimum	Maximum	Unit
Measurement range	-17	17	m/s ²
Overload range(<60 ms recovery)	-100	100	m/s ²
Sensitivity error	-5	5	%
Linearity	-4	4	%
Offset (total)	-1	1	m/s ²
Offset drift (over temperature range)	-0.35	0.35	m/s ²
Offset drift speed (over 60 °K interval)	-0.2	0.2	m/s ² /min
Noise	—	0.1	m/s ² (RMS)
Cross axis sensitivity	5	5	%
Turn on time	—	250	ms

Table 4. Software Resolution for Rotation Rates and Accelerations

Bit Position	Number of Bits
Vehicle Dynamic Rates	
34-47	14
—	—
Vehicle Dynamic Lateral and Longitudinal Acceleration	
22-31	10
—	—
Vehicle Dynamic Vertical Acceleration	
22-31	10
—	—
—	—

Figure 1. Axes of Motion



Inertial Measurement Unit

Figure 2. Block Diagram

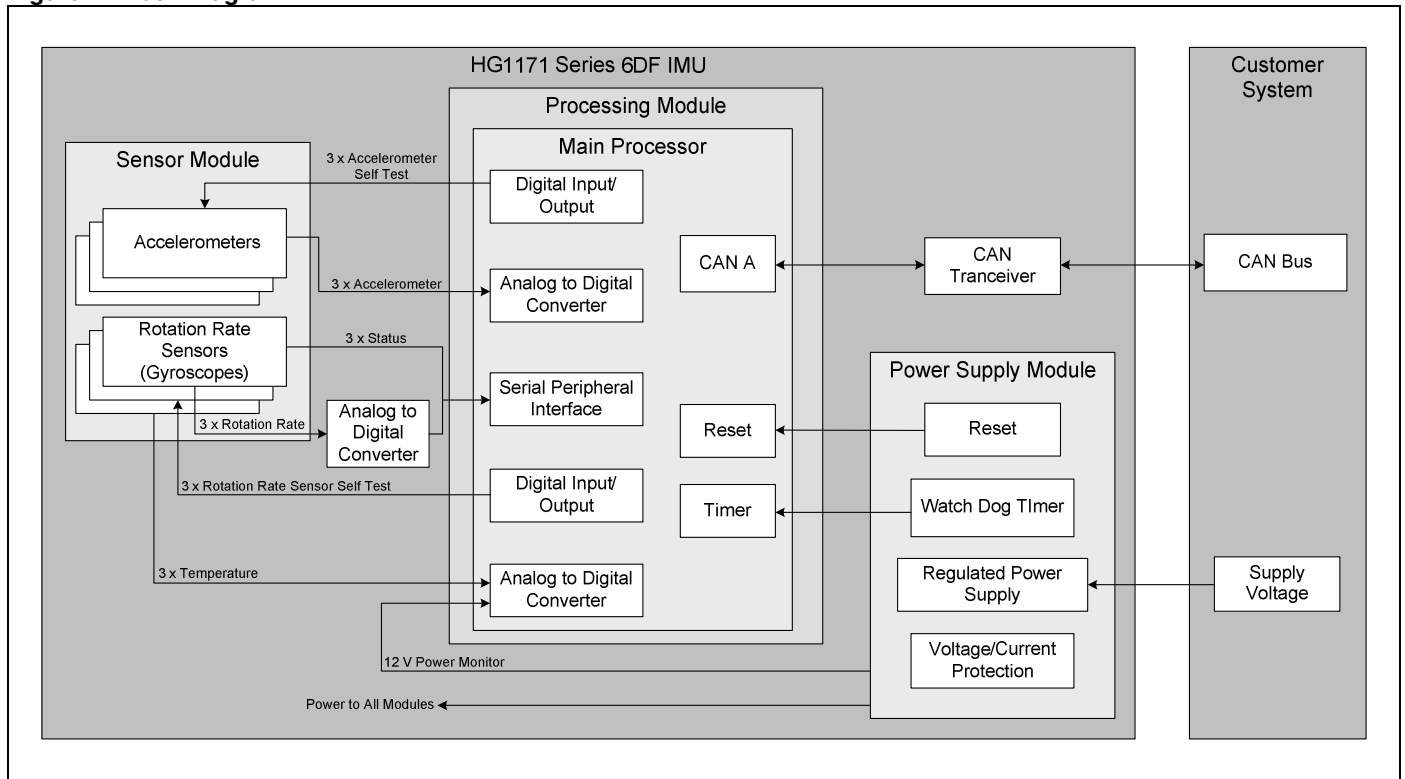
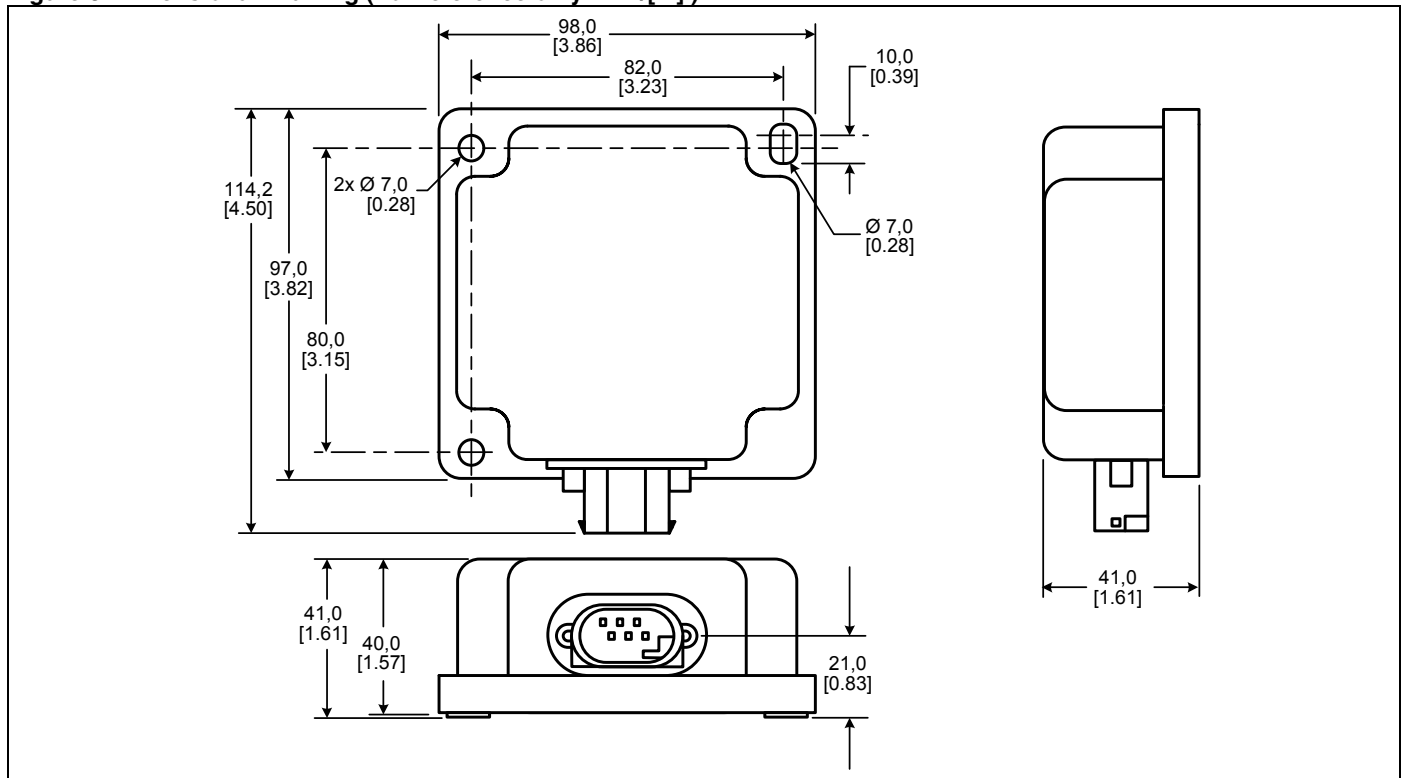


Figure 3. Dimensional Drawing (For reference only: mm/[in.]



Order Guide

Catalog Listing	Description
HG1171BA01	HG1171 Series 6DF inertial measurement unit

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Honeywell

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

Catalogue Listing			
Description		Standard temperature	High temperature
Screw In, M12 Thread, Plastic	(Type 1)	LLE101000	LLE101101
	(Type 2)	LLE102000	LLE102101
	(Type 3)	LLE103000	LLE103101
Push In, Plastic	(Type 5)	LLE105000	LLE105100
Screw In, 1/2 in, Metal	Nickel plated brass	LLE205000	LLE205100
	Stainless steel	LLE305000	LLE305100

LLE Series

TECHNICAL INFORMATION

Specifications			
Operation mode	User defined single point on/off switch (Output is high in air)		
Repeatability (mm)	± 1		
Hysteresis (mm)	2 (dependent on liquid)		
Response time	Rising liquid level - 50 µs Falling liquid level - 1 s max (in ethanol) Response in other liquids dependent on viscosity		
Mechanical			
Mounting	Type 1 and 2 - mounted from outside; Type 3 and 5 - mounted from inside		
Termination	250 mm flying leads (180 mm for metal versions)		
	Blue	0 V	
	Red	+5 V to +12 V supply	
	Green	Output	
Material [Note 1]	Polysulphone		
Dimensions	Plastic	Metal	
	LLE101/102/103 Series	LLE205/305 Series	
	Dome	3,5 mm radius (includes LLE105 Series)	
	Thread	M12x1	½ in BSPT
Hex	19 mm	24 mm (See mounting drawings on page 3)	
Environmental			
	Standard temperature	High temperature	
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/cm ² in operation		
Electrical			
	Standard temperature	High temperature	
Supply voltage (Vcc)	+5 Vdc to +12 Vdc ± 5 %		
Supply current (mA)	15 mA nominal @ +5 Vdc	5 mA nominal @ +5 Vdc	
Output sink current [Note 4]	@ 25 °C 10 mA max.	@ 25 °C 40 mA max.	
@ 5 Vdc supply	@ 80 °C 3 mA max.	@ 125 °C 7 mA max.	

Notes:

[Note 1] Material compatibility information available on request.

[Note 2] Threaded sensors only.

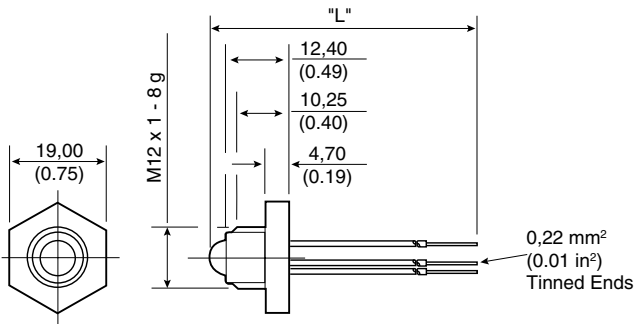
[Note 3] For other ambient light environments the user should test the sensor under application conditions to verify compatibility.

[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.

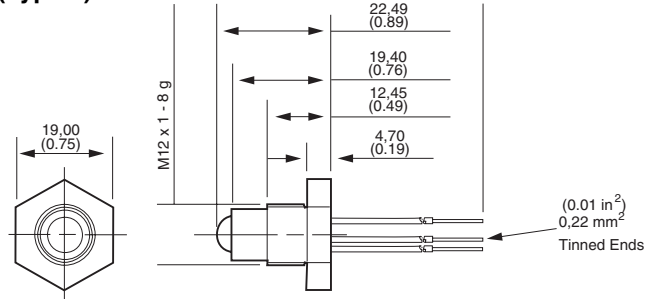
Liquid level sensors

MOUNTING DRAWING (IN MM AND INCHES)

LLE101000/LLE101101 (Type 1)



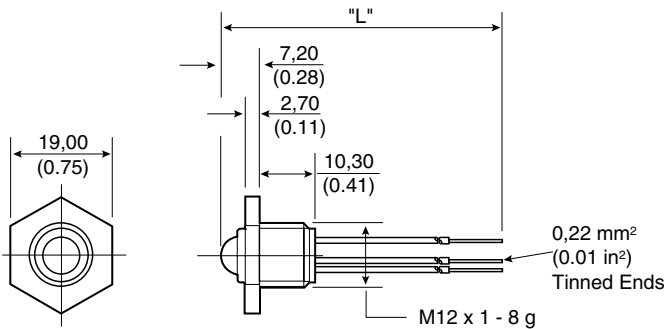
LLE102000/LLE102101 (Type 2)



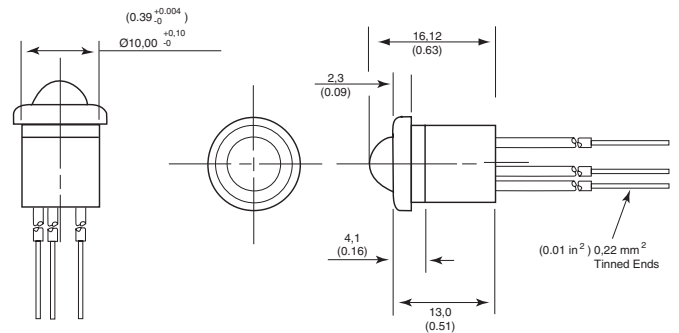
Notes

- 1 Recommended panel hole size \varnothing 12,5 \pm 0.3 mm (0.49 \pm 0.01 in)
- 2 'O' ring seal supplied Unassembled

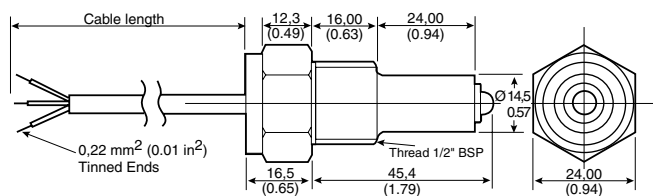
LLE103000/LLE103101 (Type 3)



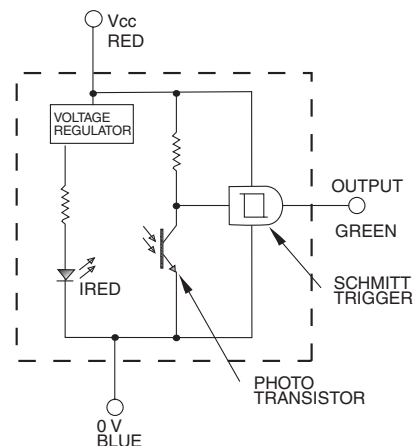
LLE105000/LLE105100 (Type 5)



LLE205000/LLE205100 LLE305000/LLE305100



ELECTRICAL DIAGRAM



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Automation and Control Solutions

Sensing and Control

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