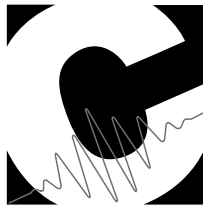
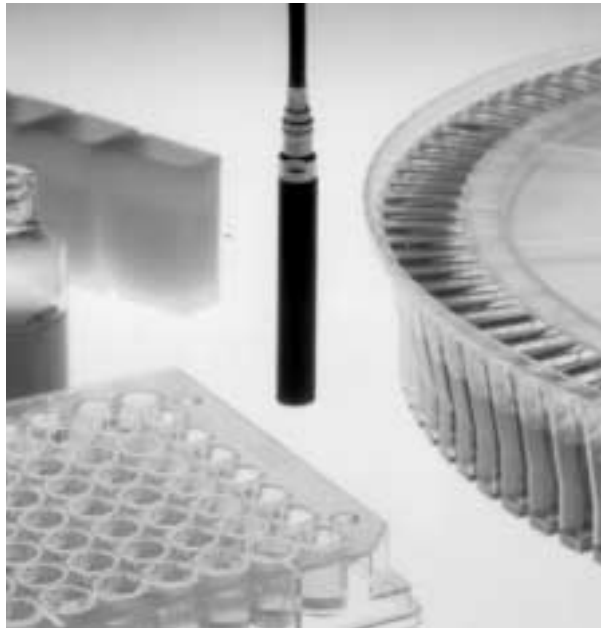


ML-102 Micro Level Measurement Systems



COSENSE INC

155 Ricefield Lane, Hauppauge, New York 11788-2007
631-231-0735 Fax: 631-231-0838

www.cosense.com



UNPACKING INSTRUCTIONS

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Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

Ultrasonic Level Measurement System (1)

Operator's Manual (1)

If you have any questions about the shipment, please call the COSENSE Customer Service Department. When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

Note:

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipping is necessary.

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SYSTEM SPECIFICATIONS

- Input Power: 24VDC (nominal) to board, optional 5VDC system
- Output: One solid state relay, RS-232 (PC compatible)
- Programmability: via RS-232, and optional handheld unit
- RS-232: 9600 baud, 8 data bits, 1 stop bit, no parity, full duplex
- Setpoints (Alarms): One solid state relay
- Operation Mode: Distance measurement, Inches or Millimeters
(contact factory for volume measurement capabilities)
- Operating Range: 0.5" to 20" (Dependent on installed sensor)
- Accuracy: $\pm 0.005"$ ($\pm 0.127\text{mm}$) or 0.1% of full scale
(temperature compensation optional) at room temperature
- Repeatability: $\pm 0.05\%$ of full scale range

SYSTEM DESCRIPTION

The Cosense model ML-102 is a state-of-the-art level measurement instrument based on the latest ultrasonic technologies. The ML-102 provides an efficient, reliable and cost-effective means of level control. The ML-102 consists of two major components: the sensor and the electronic control board.

The ML sensor is available in a variety of sizes and materials to suit virtually any application. The size of the sensor is dependent on the needed range and the material required depends on the environment in which the unit is intended to be used. Sensor materials include, but are not limited to 316SS, CPVC, Kynar and Teflon. Contact the factory for assistance in sensor selection.



PRINCIPLES OF OPERATION

In operation the electronics generate an electronic signal which is converted by the sensor to an ultrasonic burst. This burst is then transmitted through the air (or liquid) towards the target surface. When the burst reaches the surface it is reflected back to the sensor. The received echo is converted by the sensor to an electronic signal and then amplified and digitized before being sent to the microprocessor. The microprocessor uses the echo signal to calculate the transit time of the ultrasonic burst. This transit time is directly proportional to the target distance from the sensor. The microprocessor then compares the calculated values with the user programmed set-tings to provide the required control of the system.

SETUP CONSIDERATIONS

- The PC Board can be mounted in any position without detriment to its operation.
- The sensor should be mounted perpendicular to the surface it is detecting. An error of a few degrees from perpendicular will adversely affect the effective range of the unit.
- The design of the sensor mounting should be that no physical contact with the sensor face is ever encountered. While casual contact with the sensor or the sensor face has no lasting adverse effects on the sensor, contact of a forceful nature can permanently damage the sensor.
- The sensor wire should not be bent without allowing a radius of one inch or more. Bending the wire excessively can cause an internal break in the wire.
- The sensor (in through air applications) should be mounted in a plastic holder of some nature. Use of metal is not recommended.
- The board should never be mounted in a sealed enclosure without adequate ventilation. The components on the board do generate heat and need air circulation for cooling.
- Be sure when connecting the DC supply lines from the power supply to observe the connection information silkscreened onto the board and/or contained in the operating instructions. Connecting the power cable or ground to the wrong terminal on the terminal block can cause permanent damage to vital components.
- When using the Temperature Compensation option, the remote temperature sensor should be mounted / placed as close to the area that actual measurements are to be performed as possible. Mounting the sensor away from the actual measurement location can result in erroneous temperature corrections being made.



PROGRAMMING SECTION

The programming section allows the user to access the parameters which are used to control the operation of the ML-102 unit. There are two modes that the ML-102 can be used, through air and through liquid. When using the ML-102 in a through air application the user can access the parameters by sending the character "P" via the RS-232 connection followed by a carriage return (note the capital letter 'P'). When using the ML-102 in a through liquid application the user accesses the parameters by sending the character "F" via the RS-232 connection followed by a carriage return (note the capital letter 'F'). See Appendix B of this manual for the pinout of the DB-9 connector. The parameters available are, in their programming order:

- 1) Repetition Rate in Micro Seconds [200-35000 us] { 5000}
- 2) Transmit Width Usec [0.3 - 500.0] {50.0}
- 3) AGC Width Usec [1-190] { 150}
- 4) Samples [1 - 10] {10}
- 5) Output Units [M = Millimeter, I = Inch] {I}
- 6) Window Open in Inches [0.50 - 10.00] {2.00}
- 7) Window Close in Inches [1.00 - 150.00] {8.00}
- 8) Select Baud Rate [4800 9600 19200 38400] {9600}
- 9) RS232 Transmissions [E=Enabled, D=Disabled] {E}
- 10) Alarm Mode [D=Distance, A=Acceptance Band] {D}
- 11) Alarm in Inches [0.00 - 150.00] {3.00}
- 11a) Acceptance Band [0.001 - 10] {0.10}
- 12) Hysteresis in Inches [0.001 - 0.25] {0.10}
- 13) Acquisition Mode [C=Continuous, S=Software Strobe, H=Hardware Strobe] {C}
- 14) Media T/D Factor in Usec/Inch [20.00 - 200.00] {147.76} ('F' Menu parameter only)

1) REPETITION RATE

The Repetition Rate parameter controls the frequency at which readings are taken. The lower the value of the Rep Rate parameter, the more often a reading will be taken. The higher the value of the Rep Rate, the less often a reading will be taken. This parameter directly reflects the update rate of the unit.

VALID SETTINGS: from 200 to 35000 µsecs

FACTORY DEFAULT: 5000 µsecs

2) TRANSMIT WIDTH

The transmit width parameter controls the width of the pulse which is sent from the face of the sensor to the target and then reflected back. The wider the width the more signal which is then reflected back to the sensor. The width is set according to the type of sensor being used and the application.

VALID SETTINGS: from 0.3 to 500.0 µsecs

FACTORY DEFAULT: 50 µsecs

3) AGC WIDTH

The AGC width parameter controls the time at which the automatic gain is used in controlling the signals at the sensor face. The lower the value of the AGC parameter, the more signal will be seen as a receive signal from the sensor. The higher the value of the AGC parameter, the less signal will be observed at the sensor face.

VALID SETTINGS: from 1 to 190 µsecs

FACTORY DEFAULT: 150 µsecs

4) SAMPLES

The Samples parameter dictates the number of samples which will be used in the processing of data acquired. The number of samples will range from 1 to 10.

VALID SETTINGS: 1 to 10

FACTORY DEFAULT: 10

5) OUTPUT UNITS

The Output Units parameter dictates in what units the system will report the readings. Currently the choices are millimeters and inches. The millimeters setting reports readings in the format ZZX.XX. The inches setting formats its output as ZX.XX. Where X characters are always transmitted, Z characters are transmitted when non-zero.

VALID SETTINGS: M = MILLIMETERS, I = INCHES

FACTORY DEFAULT: I = INCHES

6) RECEIVE WINDOW OPEN

The Receive Window Open parameter signifies the time at which a received pulse is recognized as a return, or stop signal. Only after the Receive Window Open value and before the Receive Window Close value will a pulse be detected as a return signal and therefore be recognized as a stop signal. The Receive Window Open needs to be greater than the ringing of the sensor. If the Receive Window Open parameter is set too small then erroneous results will be reported. This has a direct correlation to the type of sensor and the setting of the Transmit Width parameter.

VALID SETTINGS: from 0.50 to 10.00 inches

FACTORY DEFAULT: 2.00 inches

7) RECEIVE WINDOW CLOSE

The Receive Window Close parameter signifies the time at which a received pulse is no longer recognized as a return, or stop signal. After the Receive Window Close value a pulse is no longer detected as a return signal and is therefore not recognized as a stop signal. The Receive Window Close needs to be greater than the maximum distance you wish to measure, otherwise erroneous results will be reported for distance.

VALID SETTINGS: from 1.00 to 150.00 inches

FACTORY DEFAULT: 10.00 inches



8) SELECT BAUD RATE

The Baud Rate is the speed at which the unit will communicate with an attached data collection device such as a computer. The selection of baud rate is determined by requirements of the receiving device and will not affect the overall speed of the Micro Level Measurement System.

VALID SETTINGS: 4800 9600 19200 38400

FACTORY DEFAULT: 9600

9) RS232 TRANSMISSION

The Micro Level Measurement System is capable of output each reading on the RS232 communications port. If it is desired to turn this feature off, then set this parameter to disabled.

VALID SETTINGS: Enabled or Disabled

FACTORY DEFAULT: Enabled

10) ALARM MODE

The output alarm can be triggered through one of two alarm modes. In Distance mode the output is turned on when the target observed exceeds the alarm set-point entered. In Acceptance Band Mode the output is turned on when a target is observed outside of the designated band.

VALID SETTINGS: Distance or Acceptance Band

FACTORY DEFAULT: Distance

11) ALARM IN INCHES

The alarm relay can be set to turn on when the measured distance exceeds the alarm point. When the measured distance does not exceed the alarm point or when there is no return echo the output will turn off.

VALID SETTINGS: from 1.00 to 150.00 inches

FACTORY DEFAULT: 3.00 inches

11A ACCEPTANCE BAND

This parameter only appears when the Alarm Mode selected is Acceptance Band. The band for the alarm relay can be set to define an area of "good" readings and any observed distance outside this area will trip the alarm.

VALID SETTINGS: from 0.001 to 10.00 inches

FACTORY DEFAULT: 0.10 inches

12) HYSTERESIS IN INCHES

The hysteresis setting prevents the output from rapidly switching when at the alarm set-point. Usually this parameter can be left at its default value.

VALID SETTINGS: from 0.001 to 0.25 inches

FACTORY DEFAULT: 0.10 inches

13) ACQUISITION MODE

The Acquisition Mode parameter selects how and when readings are to be taken. When the Mode parameter is set to Continuous then readings are performed at the rate specified by the Rep Rate parameter and all enabled outputs are written



to or updated (RS232 and relay output). When the acquisition mode parameter is set to Software Strobe, then the unit waits for a software input (command "S") to the unit to perform a reading. When the acquisition mode parameter is set to Hardware Strobe, then the unit waits for a pulse input (a "low" logic signal) on the hardware strobe terminal block to perform a reading.

VALID SETTINGS: C = CONTINUOUS, S = SOFTWARE STROBE,

H = HARDWARE STROBE

FACTORY DEFAULT: C = CONTINUOUS

14) MEDIA T/D FACTOR IN USEC/INCH

The Media T/D Factor is used for through liquid applications to enter the speed of sound in the material to be measured. This parameter is only displayed when the parameters are accessed through the 'F' menu. For through air applications using the 'P' menu this parameter is automatically set to the through air value and temperature compensated. Note the units of measure are not standard and this value needs to be calculated from known variables.

VALID SETTINGS: from 20.00 to 200.00 μ secs/inch

FACTORY DEFAULT: 147.76 μ secs/inch



STANDARD FUNCTIONS SECTION

This section will describe in detail the standard functions and applications for the features of the ML-102. The ML-102 has been designed with many years of customer requested features built-in to serve the widest range of customer applications.

Using the Alarm (Relay Output) in Distance Mode

The alarm* for the ML-102 can only be set via the RS-232 communications port. The alarm point will control the on board relay. When the observed distance is less than the alarm point, the relay will be off or de-energized (open contact). When the observed distance is more than the alarm point, the relay will be on or energized (closed contact). When the observed distance is lost echo or 0.00, the relay will be de-energized (open contact).

Using the Alarm (Relay Output) in Acceptance Band Mode

The alarm* for the ML-102 can only be set via the RS-232 communications port. The alarm point will control the on board relay. When the observed distance is less than the alarm point minus the acceptance band value or the distance is greater than the alarm point plus the acceptance band value then the relay will be on or energized (closed contact). When the observed distance is more than the alarm point minus the acceptance band value and the observed distance is less than the alarm point plus the acceptance band value then the relay will be off or de-energized (open contact). When the observed distance is lost echo or 0.00, the relay will be de-energized (open contact).

Strobe Mode vs. Continuous Output

The use of the ML-102 is accomplished in one of two ways. Continuous operation allows the unit to run continuously at the set repetition rate and outputting the results in a constant manner. Selecting one of the strobe modes allows an outside device to dictate when a reading will be taken and output. The Software Strobe is used when it is desired for the data collection computer to signal the ML-102 board when to take a reading. A software strobe is initiated when the computer sends the "S" character followed by a carriage return (note the capital "S") to the ML-102 unit.

The Hardware Strobe is used when it is desired for an external device/sensor to signal when a reading is to be taken. A hardware strobe is initiated when the external devices sends a pulse (high to low transition) to the hardware strobe terminal block on the ML-102 unit.

After either of the above strobe modes is initiated, the ML-102 then processes a single reading according to the parameters set and outputs the results as per those parameters. The ML-102 will then enter an idle mode where no updating or outputting will result until the next strobe or another valid RS-232 command is received.

* = alarm point setting will be in millimeters when *Output Units* is set to millimeters.

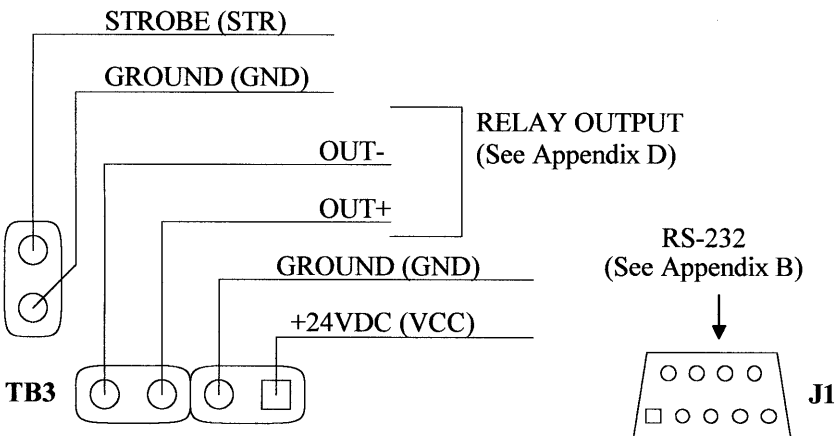


APPENDIX A-1 BOARD LAYOUT AND WIRING DIAGRAM



J2

Ultrasound and
Temperature Sensor
Connection

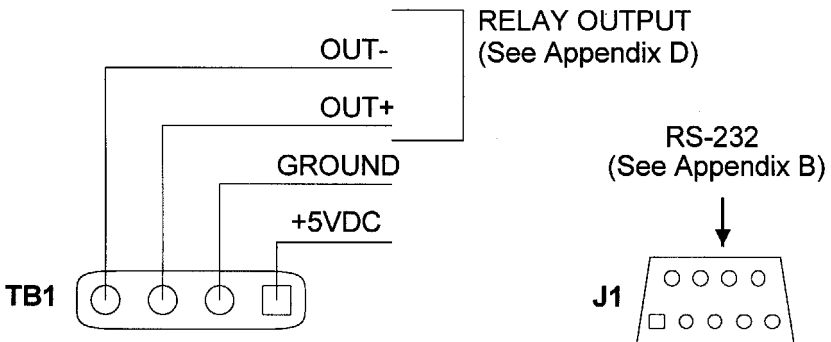


APPENDIX A-2
BOARD LAYOUT AND WIRING DIAGRAM
(5VDC SYSTEMS ONLY)



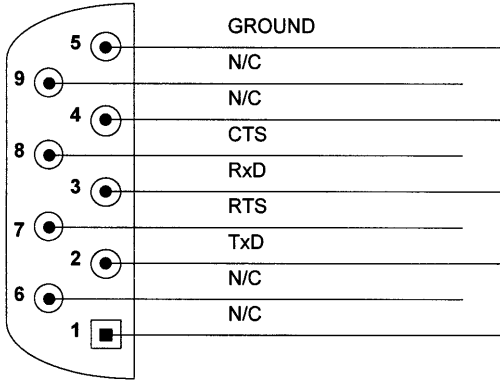
J2

Ultrasonic and
Temperature Sensor
Connection

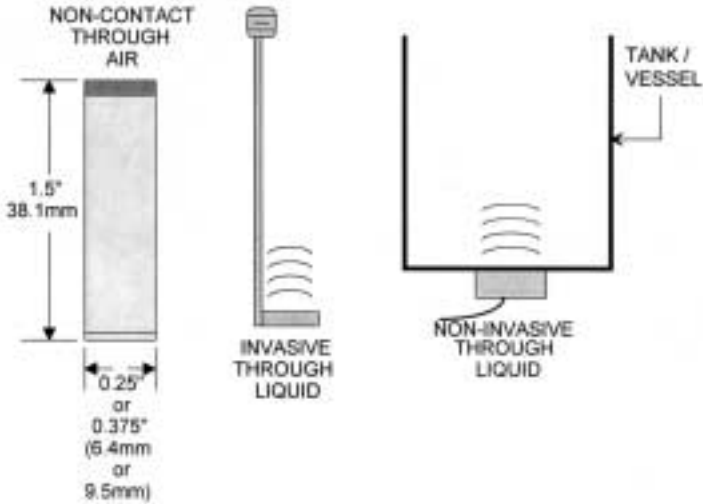




APPENDIX B
DB9 (RS232) CONNECTOR (J1)



APPENDIX C SENSORS



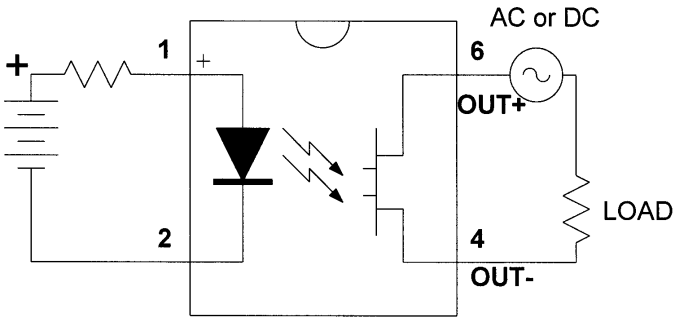
HOUSINGS w/Optional

- | | |
|------------|---------------|
| 1) Plastic | 1) Connector |
| 2) Epoxy | 2) NPT Thread |
| 3) Teflon | Specify |
| 4) 316 SS | |

Consult Factory for Part Numbers
on specific sensors.



APPENDIX D
RELAY OUTPUT



Maximum Sink Current = 140mA (AC or DC)

Photovoltaic Relay Manufacturer: International Rectifier
Manufacturer's Part Number: PVU414 or PVU414S



All components of Cosense Inc. are warranted to be free from defects in material and workmanship for a period of eighteen months from the date of shipment to the original purchaser. This warranty applies to general purchaser and to components installed, serviced and operated according to Cosense Installation Manuals. Cosense will repair or replace, at its option, F.O.B. at its plant or any other location designated, any part which proves to be defective in manufacture or workmanship.

All claims must be made within the warranty period. No claims outside of the warranty period will be honored.

Warranties are not applied to any components which have been damaged by improper installation, exposure to unusual atmospheric conditions or components which have been mis-used, misapplied, abused and/or damaged by neglect or accident. This warranty shall not apply to any components which may have been altered or repaired without the prior written consent of Cosense.

Cosense assumes no responsibility or liability for any labor, material, or back charges, without written authorization. Any products returned must be with prior written authorization.

The foregoing is in lieu of all other warranties, expressed or implied, including any warranties of merchantability and/or for fitness for particular purpose. Cosense assumes no other liabilities expressed or implied. Cosense shall not be liable for normal wear and tear, nor for direct, incidental or consequential damages. In no event shall Cosense's liability exceed the price of its product at the time of purchase.

