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LCD 3.2E™
Lightweight Chemical Detector

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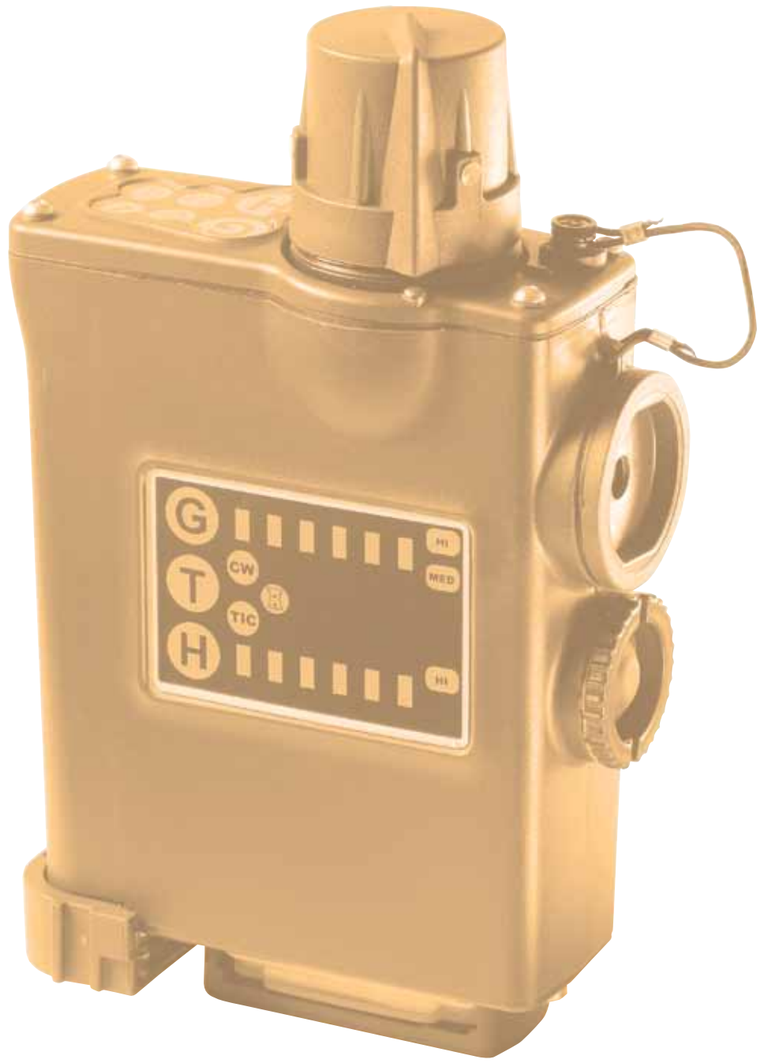


The Lightweight Chemical Detector

- Detects a range of chemical warfare agents
- Small and lightweight, 'hands-free' operation
- Uses non radioactive IMS technology
- Continuous simultaneous real-time detection of nerve and blister agents or TICs
- Up to 40 hours of operation from a single set of commercial AA-type batteries
- Audible and visual alarm
- 72 hour data logging
- Requires no routine maintenance or calibration

The LCD 3.2E Lightweight Chemical Detector is designed to provide an unobtrusive, but effective, means of detecting a range of Chemical Warfare threats and Toxic Industrial Chemicals. It can be used as a wearable detector or as a survey instrument capable of checking cargo, equipment, personnel and facilities.

Incorporating an LED display, the detector shows the operating status and gives audible and visual alarms, and hazard levels. The detector also gives an indication of accumulated dosage hazard level.

The LCD 3.2E incorporates two distinct audible tones:
Alarm/Alert: To indicate CW agent detection.
Warning: To indicate equipment fault and/or battery low/sieve pack low, different from the detection alarm.

Detection data can be recorded for up to 72 hours, which can then be downloaded to a PC for interrogation.

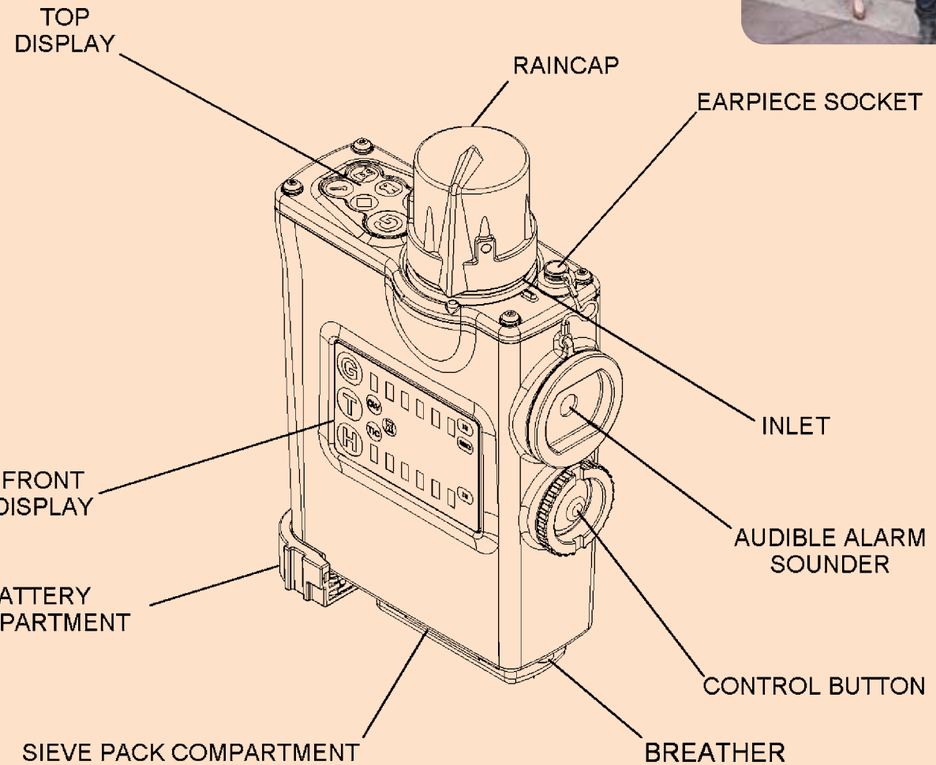
For tactical deployment all audible alarms/warnings from the sounder can be disabled by plugging in an earpiece. A dimmer control is provided to change the display intensity.

Typically operational (including warm-up & self-test) within 90 seconds of switch on; with no complex or time consuming shutdown procedures. The unit can be switched off at any time without damage or performance degradation.

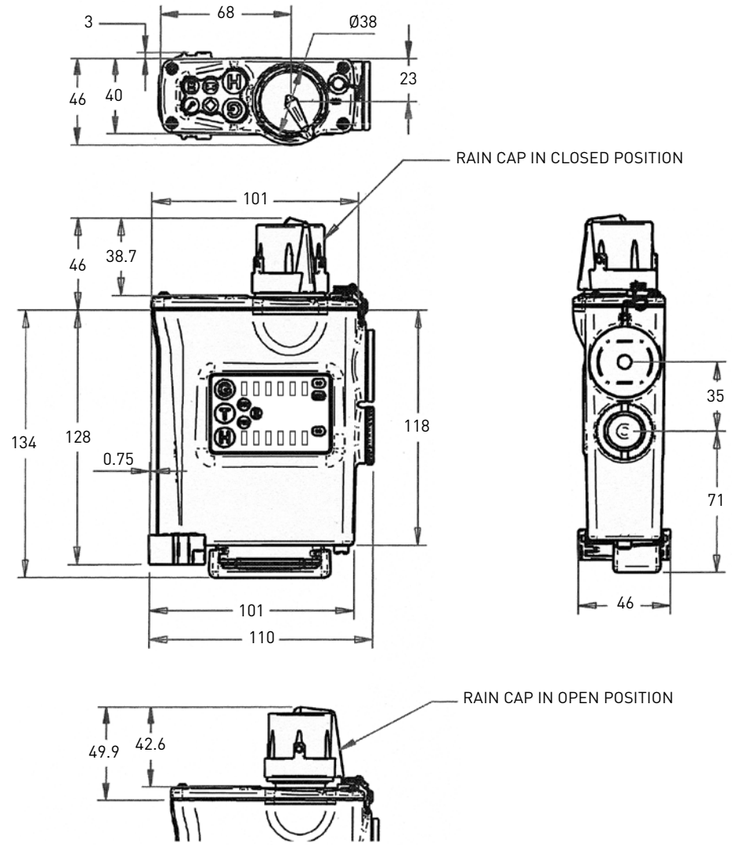
The detector is supplied with a carrying pouch, designed to be flexible, allowing personnel of different services to choose their preferred mounting location on their clothing/belt or harness. The pouch also provides a means of concealing the displays when they are not required.

PRODUCT DIMENSIONS / APPEARANCE
The unit has a volume of 492 cm3 (30 cubic inches) and a weight not exceeding 0.65kg (1.5 lb) with batteries. The physical dimensions are shown opposite.

Currently available colours are: green, black, yellow, beige or blue.



LCD 3.2E General Dimensions



All Dimensions in mm
Third Angle Projection

DETECTION CHARACTERISTICS

The LCD 3.2E samples the air continuously, for the simultaneous detection of all agents and simulants. The detection performance has been designed to meet or exceed the response times specified in the US JCAD specification, as listed in the detection characteristics tables 1, 2 & 3:

Table 1. Maximum Alert Response Time at Concentration

	Threshold Exposure Concentration (mg/m^3)	Threshold Exposure Response TimeMax (sec)	Relative Humidity (%RH) Range
VX & VXR	0.04	≤90	0 to 100
VX & VXR	0.1	≤10	0 to 100
GA, GB, GD & GF	0.1	≤10	0 to 100
HD	1	≤10	0 to 100
L	2	≤10	0 to 100
HN3	1	≤10	0 to 100
AC	22	≤10	0 to 100
CK	20	≤10	0 to 100

The unit is capable of agent identification by class; either Nerve(G), Blister(H), Blood(H) or TICs (T) and will also alarm if the accumulated dosage exceeds the Hazard Levels shown in table 2 below.

Table 2. Accumulated Dosage Alarm Thresholds

	Medium Hazard (mg/m^3) 2 minute exposure	High Hazard (mg min/m^3) 30 minute exposure
GA	≥0.5	≥1000
GB	≥0.5	≥600
GD & GF	≥0.2	≥150
VX	≥0.09	≥5
HD	N/A	≥25

CLEAR DOWN

Clear down is achieved in no more than 120 seconds after being challenged with the Threshold Exposure Concentration levels of agent listed in table 1.

When operated in the TIC mode, the unit will alarm when it detects the presence of TICs as listed in table 3.

Table 3. TICs currently in the LCD 3.2E detection library.

	Threshold Exposure Concentration (ppm)	Threshold Exposure Concentration (mg/m^3)	Threshold Exposure Response TimeMax (sec)	Relative Humidity (%RH) Range
Hydrogen Sulphide	5	7	≤90	0 to 100
Hydrogen Chloride	10	14.9	≤10	0 to 100
Hydrogen Fluoride	11	9.02	≤10	0 to 100
Hydrogen Bromide	200	660	≤10	0 to 100
Chlorine	10	29	≤10	0 to 100
Sulphur Dioxide	2	100	≤10	0 to 100
Phosgene	12	50	≤10	0 to 100

Additional TICs are available to be included upon request. This will involve additional Engineering activity and may result in a one off charge.

It is not recommended that more than 10 TICs are programmed into the unit at any one time. Any more than this may increase the probability of false alarms.

These additional TICs are generally detected at or below 1/10 IDLH (Immediate Danger to Life and Health)

TIC (Toxic industrial chemicals)	IDLH (ppm)
Carbon disulphide	500
Diborane	15
Diethyl methyl phosphonate	250
Ethylene oxide	800
Fluorine	
Formaldehyde (liquid source)	20
Nitric acid	25
Nitrogen dioxide	5
Phosphorous trichloride	25
Thionyl chloride	100
Benzene	500
Boron trichloride	25
Methyl hydrazine	20
(2,2-Thiodiethanol)	
Propylene oxide (1,2-epoxypropane)	400
Chloropicrin	2
(Trichloronitromethane)	
2 chlorovinylarsonous acid	
DA (diphenylchloroarsine)	
DC (diphenylcyanoarsine)	

ACCESSORIES

The LCD 3.2E is supplied with the following accessories as standard:

- Confidence tester to assure the User that the equipment is functioning correctly. The confidence tester uses simulants (MS and DPM) – one for each agent class G and H. The simulants are currently in service use and do not pose an unnecessary hazard.
- Standard earpiece is provided for tactical operations
- Survey nozzle is provided for use as a 'Survey' Instrument
- Unit is held in a pouch that is compatible with the in-service webbing and clothing
- Spare battery cassette

OPTIONAL ACCESSORIES

- Power and Communications Adaptor (PCA) - enables the use of external power, software upgrades, data downloads and analysis of real time data.
  - → 8-32Vdc, 110-240Vac Power input using PSU
  - → USB or RS422 data output
  - → Remote alarm connection
- Vehicle Mounting Kit - when used with the PCA enables the detector to be fitted into vehicles and other platforms allowing communications, external power supply and remote alarms.

CONSUMABLES

- The consumable sieve pack has a typical life of not less than 250 hours, dependant upon the environmental conditions.
- It should be noted that a change of consumables is not required when an agent is detected
- 4 x AA batteries for up to 40 hours of operation

CLIMATIC & ENVIRONMENTAL

The detector is capable of being stored and operated in the following climatic conditions +50°C to -32°C and 0-100% RH. Designed to withstand stresses and shocks associated with both operational use and transport by road, sea and air. The equipment has been designed to meet the requirements of MIL-STD-810F for the following aspects:

Vibration
Shock
Drop, Topple and Roll
Impact
Wheeled Vehicle Bounce
Bump
High Temp, Low Humidity
High Temperature, Low Humidity and Solar
Heating – Diurnal Cycle
Constant Low Temp
High Temperature, Humidity and Solar
Heating – Diurnal Cycle
High Temp, High Humidity
Air Pressure (Above Standard Atmospheric)
Low Pressure and Air Transportation
Dust and Sand
Mist, Fog and Low Cloud
Immersion
Driving Rain
Rapid Temp/Climatic Change

The LCD 3.2e is also designed to meet the requirements of MIL-STD-461F for Electromagnetic Compatibility (EMC) and is certified compliant with the regulations for CE Marking.

Principle of operation of the LCD 3.2E

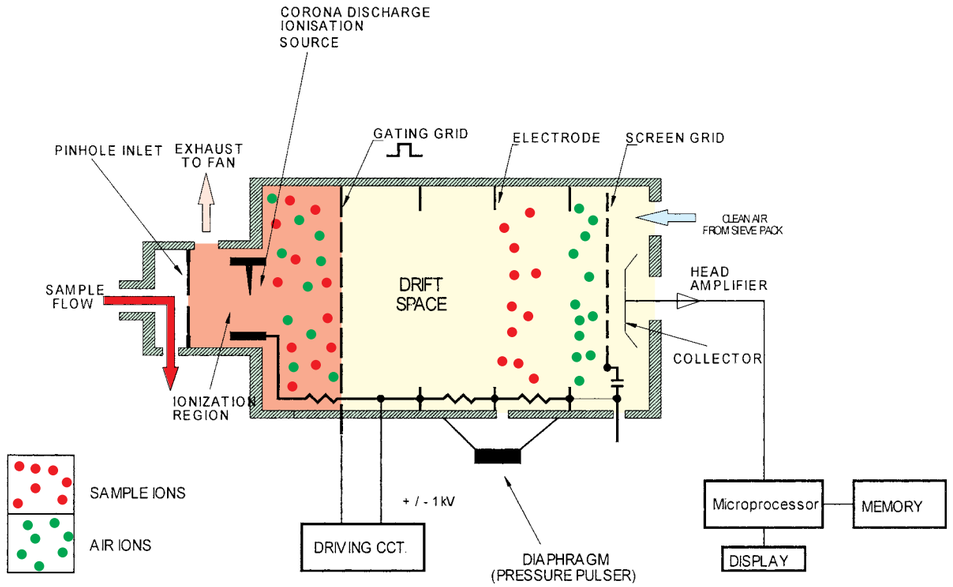


Figure 1 – Principles of Ion Mobility Spectroscopy

Principle of Operation

The LCD 3.2E uses ion mobility phenomena to respond to agent vapours, utilising the Ion Mobility Spectrometry (IMS) technique. An air sample is drawn into the sampling line by a fan; the sample then passes two pinhole inlets, one for each of the two ion mobility spectrometers. When the internal pressure is reduced by the movement of the diaphragm, an air sample is pumped from the sampling line into the spectrometers through the pinhole inlets. The movement of the diaphragm is under the control of a microprocessor. On passing through the inlets, the air samples enter the ionization sections where ions are generated by corona discharge ionisers.
Ions are then formed from both the air and agent molecules as a result of complex interchange reactions. Typically, the air ions travel faster than the agent ions. All the ions are swept towards a gating grid in each IMS cell by an electric field. The gating grids open momentarily to allow small clusters of ions to enter the two drift regions. The two drift regions operate at different electrical polarities. One drift region collects ions with a positive charge to identify Nerve Agents, whilst the other collects ions of a negative charge to identify Blister Agents and Blood/Choking Agents. The IMS cells are operated at the same time to give simultaneous nerve / blister / blood / choking detection. Ions formed from TICs can give rise to ions of either polarity.

Key Developments
At the core of the unit are the following key developments:

- Miniaturised twin IMS cell assembly
- Non-Radioactive ionisation source
- Low Power sampling and re-circulation system, incorporating:
  - → Pinhole inlet system
  - → Pulsed sample intake system
  - → Fan driven re-circulation flow
  - → Fan driven sample intake flow
- Operator replaceable sieve pack

Frequently asked questions

- **What is the storage life?**
  The storage life of the detector in its packaging is in excess of 10 years.
- **What is the storage life the detector when removed from packaging?**
  The storage life of the detector when removed from its packaging is still in excess of 10 years, although un-packaged it is more vulnerable to contamination associated with the storage environment. Smiths would recommend e-packaging for long term storage when the storage environment may contain vapours likely to contaminate the device.
- **How long can the sieve packs be stored?**
  In the tin of 10 sieve packs (as supplied) the storage life would be in excess of 10 years, as for the detector unit. Once a sieve pack is removed from the tin its storage life would be limited to 5 years, depending on the humidity of the local environment. If the tin is re-sealed after opening the remaining sieve packs should have the full storage life.
- **Should the dummy sieve pack be kept for re-use?**
  No. Once removed from the unit, the dummy sieve pack will degrade absorbing environmental contamination and should not be kept for re-use.
- **What are common false alarm materials**
  Many false alarm tests have been conducted and although in general has been shown to be very resistant to false alarms, some materials do produce false alarms but often only at very high concentrations that are unlikely to be encountered in normal usage.These include:
  - AFFF (Aqueous Fire Fighting Foam),
  - Flash Pine and other cleaning products containing high concentrations of di-propylene glycol mono-methyl ether (DPM)
  - Products containing high concentrations of Methyl Salicilate (MS)
  - Ardrox
  - Very high concentration of Signal Smokes
  - Dense smoke from burning straw and polythene.
- **Where should the detector be worn on the body, does it need to be close to the mouth and nose?**
  The LCD 3.2E should be mounted with the inlet-nozzle pointing up (to prevent rain ingress) and with the inlet in free air such that loose clothing etc, cannot obstruct the inlet. The proximity to the nose and mouth is of less importance.
- **What de-contaminants can be used?**
  The unit has been tested using the UK MOD in-service Chemical Agent De-contaminant (CAD). This is an alkaline solution of the chlorinating compound sodium dichloroisocyanurate bleach powder that is made up with water into a de-contaminant solution.

  Other de-contaminant solutions have not been tested although unless they produce a false alarm reading they should be compatible with the LCD3.2E. De-contaminants used on other IMS based CW detectors should be compatible with LCD3.2E.
- **How do you de-contaminate the pouch?**
  The pouch can be de-contaminated with Fuller's earth and by weathering, if this is not effective then the pouch should be replaced.
- **Should the detector be used as a de-masking aid?**
  Its use as a de-masking aid should be determined by local operating procedures. Smiths do not define local concept of operation for equipment, however we can advise on the performance of equipment in relation to the definition of operating procedures.
- **Can the detector be used with re-chargeable batteries?**
  It is not currently advised to use re-chargeable batteries as this would invalidate the safety case of the system. Rechargeable batteries options are currently being developed.

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