A2 Chemical Agent Alarm

—a miniature alarm for German armed forces

by MAJ Jeffrey A. Adams

A chemical agent alarm system, extremely small in size and capable of responding to nerve, blister, blood, and choking agents, is currently undergoing operational testing in the German Armed Forces. The potential for use by US forces is obvious. The system, called the A2 chemical agent alarm, was developed by Honeywell ELAC of Kiel, Germany, to replace currently fielded systems.

It consists of a basic detector for nerve, blister, blood, and choking agents, and a set of peripheral devices. The A2 alarm itself is 7.8 inches high, 5.9 inches wide, 1.2 inches thick, and weights approximately 3 pounds. An external power pack containing four lithium three-volt batteries provides 72 hours of continuous, unattended operation.

Additionally, electrical power from any source capable of providing 10 to 32 VDC can be utilized. The system functions in temperatures ranging from 4 to 122 degrees Fahrenheit and meets MILSTD 810 for shock, MILSTD 461 for EMI, and STANAG 4145 for NEMP. This article will cover alarm reaction times, mechanics of detection, operation of the system, component parts, peripheral devices, and employment options.

Reaction Times

As stated earlier, the system responds to nerve, blister, blood, and choking agents. See reaction times in chart below.

Detection

Detection is based on particle ionization and selection by means of a "dynamic screen cell." Chemical agent molecules are formed into ion clusters in the ionization detector cell. Based on different mobilities, the desired ion clusters are separated from the other ions and collected.

The ionization detector cell has four components: an ionization region where ions are created, a reaction region where ion clusters form, a selection region where ion clusters are divided by mass, and a collection region where the ion current is measured. The detector cell is configured as a set of three elements: a source electrode, the dynamic screen, and a collector electrode. It contains a 1.85 MBq Americium 241 radioactive source.

The dynamic screen serves as the selection element of the cell. It consists of two sets of screen wires that are electrically insulated from each other.

When an alternating current is placed on the elements, an alternating electrical field perpendicular to the cell axis is generated. By modulating this electric field, ions are deflected by the screen. The portion of the ions that

Agent	Concentration (mg/m3)	Reaction Time in Seconds *
GB	0.04	12
	0.40	2
	1.30	2
GD	0.01	20
	0.02	5
	1.45	2
VX (Vapor)	0.02	20
	0.04	7
	0.06	5
HD	10.00	60
AC	50.00	5
CG	10.00	5
*At 60 degrees Fahrenheit, 50% humidity		

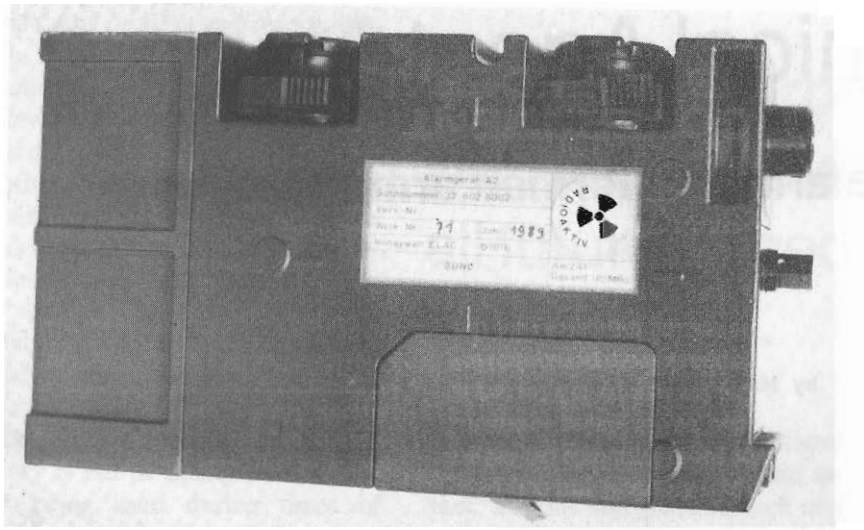

Figure 1. The A2 Chemical Agent Alarm.

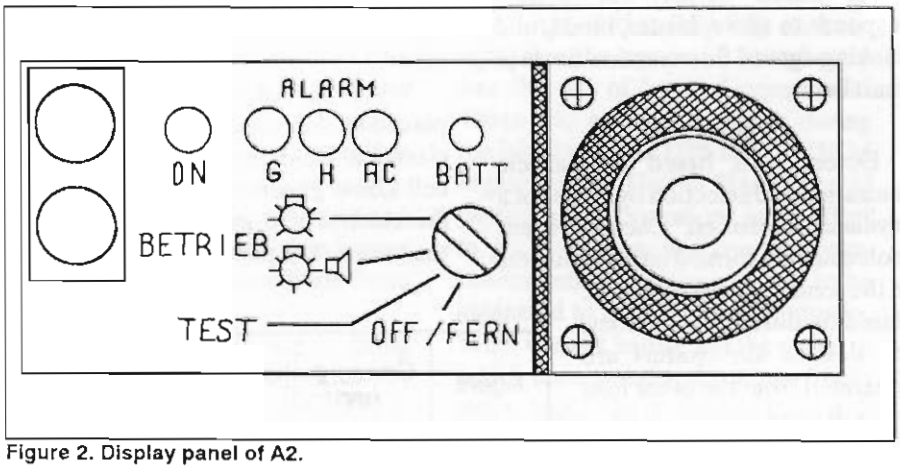

Figure 2. Display panel of A2.

make it through the electrical field is a function of ion mobility. Chemical agent ion clusters are less influenced by the electrical field than the lighter air ions.

Blood and choking agents are detected and identified through catalytic reactions in a dry electrochemical cell.

Operation of the System

The display panel from the A2 is shown in figure 2. Notice that it consists of five LEDs and a four-position rotary switch. In the field position, the alarm is turn off, but remains available for use as a remote detector with power supplied externally. Position two provides an automatic test of the alarm and display. In this position, an audible test signal sounds, and the display LEDs light up and blink.

Additionally, an automatic check is also made to verify the voltage level of the battery pack. The alarm is on line and operational in the third and fourth positions. This is indicated by periodic blinking of the first (green) LED. An automatic self test of the electrical system, including the ionization cell, runs every few minutes. Position four disconnects the acoustic alarm.

When a chemical agent is encountered, one or more red LEDs begin to blink. The type of agent is indicated by the blinking LEDs: "G" for nerve agents, including VX, "H" for blister agents, and "AC" for blood and choking agents. The alarm continues to sound and/or blink as long as the chemical agent present remains over threshold concentrations. Because of the short air path and the use of inert materials, including Teflon and gold plating, "memory effect" is not a problem. A few seconds after the alarm ends, the detector cell has purged itself and is ready for use.

Other Components

Other components of the basic alarm include the remote alarm control unit, a simulant test device, and a carrying device. The remote alarm control unit allows a separation of up to 1,000 meters between a remote alarm and the control unit Connection between the two devices is made with standard communication wire. When both devices are connected, power is supplied from the control unit.

The A2 alarm is remotely controlled, with the status and alarm signals shown on the control unit. A reusable simulant test device containing three simulants to allow function tests of the alarm is provided. The above items fit into a carrying case provided with the system. The case is approximately 14 inches by 20 inches by 6 inches. Three sets of batteries and a vehicle mount with power cable are also included.

Peripheral Devices

It should be noted that the peripheral devices are in advanced development. The devices include a central control console and test set. The central control console can serve as the central service console for up to 12 detectors. Each detector (remote

alarm) may be separated up to 1,600 meters from the central console. The control can be powered by 12/24 VDC or 110/220 VAC 50/60 Hz. This test set is designed to be used by maintenance level 3 personnel. It is connected by means of a test socket on the alarm, and uses a micro-processor to identify defective components.

Employment Options

Generally speaking, the A2 would be employed in much the same manner as currently fielded alarm systems. However, this low bulk, lightweight alarm system could be more easily carried by the individual, dismounted soldier on patrol.

The high sensitivity and short reaction time allow soldiers to rapidly take protective measures. As part of a perimeter defense system, it could be employed as one element of a chemical alarm warning array. The detector would be placed upwind and connected to the remote alarm control unit located in a command post. The alarm could be externally mounted on vehicles for use during convoy operations.

A definite application for fixed sites and permanent installations such as airfields or depots exists. Detectors could be placed at various external as well as internal locations at the installation. They could be controlled and monitored from the central control console in a command center. However, there is a problem. The system shows a tendency to malfunction when operating in areas of high humidity. The extent to which this will affect the outcome of the test has yet to be determined.

In summary, Honeywell ELAC has developed a chemical agent alarm for the German Armed Forces designed to replace currently fielded systems. It can detect nerve, blister, blood, as well as choking agents.

The alarm is so small and compact that it can be literally fit into the cargo pocket of the battle dress uniform. The potential for use by US forces is obvious. Feedback from personnel involved in the testing indicates that the system is a rugged, dependable piece of equipment well liked by the soldiers for its compact size and low weight.

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