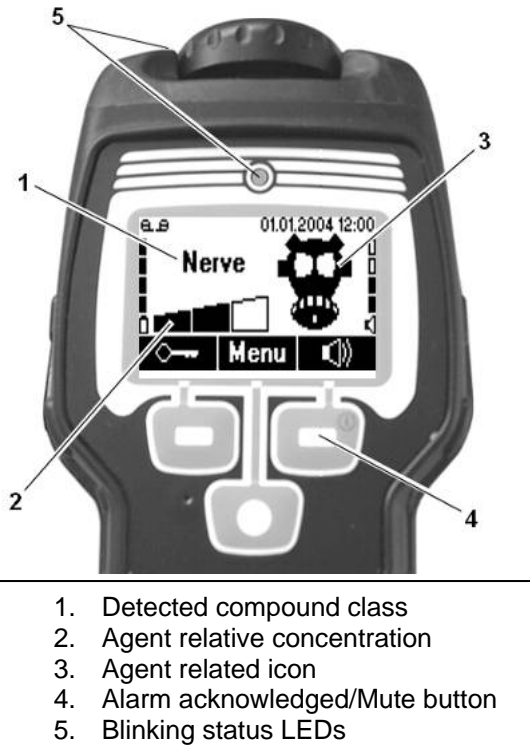


### ChemPro100i Libraries 7.2.3E



#### What is a Library?

The ChemPro100i is a multi-sensor TIC (Toxic Industrial Chemical) and CWA (Chemical Warfare Agent) classifier that uses fuzzy logic to compare what the device is seeing from its multiple sensors to saved "patterns" that result from the device being tested with the actual chemicals using both laboratory and real world exposure test scenarios. This laboratory and real world test data is used to create a detection library.

#### Why Use Libraries?

While the ChemPro100i can detect a wide variety of Chemical Warfare Agents (CWAs) and Toxic Industrial Chemicals (TICs) if all of these chemicals were to be put in one list it could lead to an unsatisfactory number of false alarms. Therefore, chemicals of interest are put into lists ("Libraries") that are use specific. For example, clues (physical, biological, etc.) at the scene will lead responders to draw conclusions about the type of threat and then

the responder can choose the correct library. If the responder reinterprets the on-scene clues the selected library in the ChemPro100i can be changed "on-the-fly."

#### Understanding the Following Charts

The ChemPro100i is a classifier, not an identifier. Its pattern recognition software will alarm for groups of chemicals but not identify a particular chemical. For example, when a ChemPro100i is presented with GB, it will display "Nerve" and the gasmask icon along with a bar graph of relative concentration. But the ChemPro100i will not identify the GB as either "GB" or "Sarin." In the case of the nerve agents, the response protocol is the same for all of the agents so the "Nerve" alarm is appropriate. Blister requires a different response protocol so it is found in another "classification" category.

#### The ChemPro100i Provides Broad Chemical Protection

The ChemPro100i detector is designed to alarm when CWAs and/or TICs are present at life threatening concentrations. The detection rate for CWAs and TICs is extremely high; however, to ensure an additional margin of safety, a generic "Chemical Hazard" alarm has been added to selected libraries at the ChemPro family of products. This "Chemical Hazard" alarm is triggered when one of the following conditions is identified:

- An individual chemical is detected which is not in the current library selected
- Environmental conditions are encountered that are not in the current library selected
- A chemical mixture is encountered

#### Special Considerations Regarding Chemical Hazard Alarm:

The Chemical Hazard Alarm is used to minimize false negative alarms. However, there is still a risk of false negative alarms (i.e. no alarm, although the specified

## TN-008: ChemPro100i Libraries 7.2.3E

chemical is present) in the following two scenarios











- (1) The ChemPro is turned on in a contaminated area. NEVER turn the ChemPro on in a contaminated environment.
- (2) The ChemPro may fail to alarm if the rate of concentration change as a function of time is greater than six minutes to the alarm level. This is a very unusual situation that is almost never encountered. Most CWA and / or TIC exposures to the ChemPro100i occur as a responder approaches a contaminated or hazardous location and the alarm limits are reached in seconds.

### **ChemPro100i Enhanced System Monitoring:**

The ChemPro100i has an additional special "Limited Performance Alarm" which monitors the responses of the entire ChemPro 100i detector. This alarm is triggered when internal "watch dog" algorithms monitoring system performance detect system wide anomalies. In the case of a "Limited Performance Alarm," please proceed to a clean environment and perform a standard sensor test as described in the manual. This will ensure the ChemPro 100i is still operating within specifications, and has not been damaged due to extreme chemical exposure.

## CWA-TIC Standard 7.2.3E

## Alarm indications and agent coverage:

Alarm indication				Agents	Low Alarm mg/m <sup>3</sup>
Text	Icon	Audio	Visible		
Nerve			Red LEDs	Sarin (GB), Tabun (GA), Soman (GD), Cyclosarin (GF), VX (including degraded VX and Russian VX)	0.1
Blister			Red LEDs	Sulphur mustard (HD)	2
				Lewisite (L)	2 <sup>(1)</sup>
				Nitrogen mustard (HN <sub>3</sub> )	5
Blood			Red LEDs	Hydrogen cyanide (AC)	50
				Cyanogen chloride (CK)	50
TIC			Red LEDs	Chlorine (CL <sub>2</sub> )	10 ppm
				Ammonia (NH <sub>3</sub> )	100 ppm
Chemical Hazard			Red LEDs	Generic alarm for chemicals in hazardous concentrations or chemical mixtures	-

**Notes:**(1) Lewisite in the absolute humidity range 0-8 g/m<sup>3</sup>**Library purpose:**











This library is designed for use as the PRIMARY library for military or first responder environments when circumstances indicate that a CWA attack has taken place or could potentially take place.

**Library meanings:**

- **Nerve:** The ChemPro100i will display “Nerve” and the gasmask icon to indicate that operators should “mask-up” because there is a nerve agent such as Sarin (GB), Tabun (GA), Soman (GD), Cyclosarin (GF), VX (including degraded VX and Russian VX) or some nerve agent precursors in the air being sampled by the ChemPro100i.
- **Blister:** The ChemPro100i will display “Blister” and the gasmask icon to indicate that operators should “mask-up” because there is a blister agents such as Sulfur mustard (HD), Lewisite (L), Nitrogen mustard (HN<sub>3</sub>) or some vesicant precursors in the air being sampled by the ChemPro100i.
- **Blood:** The ChemPro100i will display “Blood” and the gasmask icon to indicate that operators should “mask-up” because there is a blood agent such as Hydrogen cyanide (AC) or Cyanogen chloride (CK) in the air being sampled by the ChemPro100i.
- **TIC:** The ChemPro100i will display “TIC” and the skull & crossbones icon to indicate that operators should “mask-up” because there is a Toxic Industrial Chemical such as Chlorine (CL<sub>2</sub>) or Ammonia (NH<sub>3</sub>) in the air being sampled by the ChemPro100i.
- **Chemical Hazard:** The ChemPro100i will display “Chemical Hazard” and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100i do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## CWA-TIC High Sensitive 7.2.3E

### Alarm indications and agent coverage:

Alarm indication				Agents	Low Alarm mg/m <sup>3</sup>
Text	Icon	Audio	Visible		
Nerve			Red LEDs	Sarin (GB), Tabun (GA), Soman (GD), Cyclosarin (GF), VX (including degraded VX and Russian VX)	0.04
Blister			Red LEDs	Sulphur mustard (HD)	0.5
				Lewisite (L)	2 <sup>(1)</sup>
				Nitrogen mustard (HN <sub>3</sub> )	5
Blood			Red LEDs	Hydrogen cyanide (AC)	20
				Cyanogen chloride (CK)	20
TIC			Red LEDs	Chlorine (CL <sub>2</sub> )	10 ppm
				Ammonia (NH <sub>3</sub> )	100 ppm
Chemical Hazard			Red LEDs	Generic alarm for chemicals in hazardous concentrations or chemical mixtures	-

**Notes:**

(1) Lewisite in the absolute humidity range 0-8 g/m3

### Library purpose:



This library is designed for use by military or first responder environments when circumstances indicate that a CWA attack has taken place, the presence of CWAs has been established using the "CWA-TIC Standard" library but greater sensitivity is required. This library is NOT recommended without first using the "CWA-TIC Standard" library.

### Library meanings:

- **Nerve:** The ChemPro100i will display "Nerve" and the gasmask icon to indicate that operators should "mask-up" because there is a nerve agent such as Sarin (GB), Tabun (GA), Soman (GD), Cyclosarin (GF), VX (including degraded VX and Russian VX) or some nerve agent precursors in the air being sampled by the ChemPro100i.
- **Blister:** The ChemPro100i will display "Blister" and the gasmask icon to indicate that operators should "mask-up" because there is a blister agents such as Sulfur mustard (HD), Lewisite (L), Nitrogen mustard (HN<sub>3</sub>) or some vesicant precursors in the air being sampled by the ChemPro100i.
- **Blood:** The ChemPro100i will display "Blood" and the gasmask icon to indicate that operators should "mask-up" because there is a blood agent such as Hydrogen cyanide (AC) or Cyanogen chloride (CK) in the air being sampled by the ChemPro100i.
- **TIC:** The ChemPro100i will display "TIC" and the skull & crossbones icon to indicate that operators should "mask-up" because there is a Toxic Industrial Chemical such as Chlorine (CL<sub>2</sub>) or Ammonia (NH<sub>3</sub>) in the air being sampled by the ChemPro100i.
- **Chemical Hazard:** The ChemPro100i will display "Chemical Hazard" and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100i do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## First Responder 7.2.3E

### Alarm indications and agent coverage:



Alarm indication				Agents	Alarm Limit (ppm)
Text	Icon	Audio	Visible		
Toxic		●■■■■■■■	Red LEDs	Acrylonitrile	85
				Allyl alcohol	20
				Ammonia	300
				Arsine	3
				Benzene	500
				Carbon disulphide	500
				Carbon monoxide	1200
				Chlorine	10
				Cyanogen chloride	50
				Diborane	15
				Ethylene oxide	800
				Formaldehyde	20
				Hydrogen bromide	30
				Hydrogen chloride	50
				Hydrogen cyanide	50
				Hydrogen fluoride	30
				Hydrogen sulphide	100
				Methanol	6000
				Nitric acid	25
				Nitrogen dioxide	20
Phosphine	50				
Phosphorus oxychloride	0.85				
Phosphorus trichloride	25				
Sulphur dioxide	100				
Chemical Hazard		●■■■■■■■	Red LEDs	Generic alarm for chemicals in hazardous concentrations or chemical mixtures	

### Library purpose:

The "First Responder" library offers a broader list of TICs than the ITF25 list and provides an alert of a potentially toxic environment. This library should be used as the primary first-in library to alert a responder that a potential toxic threat for these chemicals may exist. The "TIC High Sensitive" or "TIC-ID" libraries may be used subsequently to further classify the unknown chemical. Benzene and Phosphorous oxychloride are not found in the "TIC High Sensitive" library while they are in this library.

## TIC-ITF25 1.3.2E

## Alarm indications and agent coverage:













Alarm indication				Agents	Alarm Limit (ppm)
Text	Icon	Audio	Visible		
Toxic		●■■■■■■■	Red LEDs	Ammonia	300
				Arsine	3
				Boron trichloride	2
				Boron trifluoride	25
				Carbon disulphide	500
				Chlorine	10
				Diborane	15
				Ethylene oxide	800
				Fluorine	25
				Formaldehyde	20
				Hydrogen bromide	30
				Hydrogen chloride	50
				Hydrogen cyanide	50
				Hydrogen fluoride	30
				Hydrogen sulphide	100
				Chemical Hazard	

**Library purpose:**

ITF-25 (International Task Force #25) is an internationally recognized listing of some of the most common and toxic TICs found in the industrial world. This library is designed to provide protection in areas where these TICs are thought to be present. This library represents most, but not all, chemicals found on the ITF-25 listing. The "TIC High Sensitive" or "TIC-ID" libraries may be used subsequently to further classify the unknown chemical.

## TIC High Sensitive 7.2.3E

## Alarm indications and agent coverage:








Alarm indication				Agents	Alarm Limit (ppm)
Text	Icon	Audio	Visible		
TIC oxidizer			Red LEDs	Chlorine (Cl <sub>2</sub> )	10
				Nitrogen dioxide (NO <sub>2</sub> )	20
TIC hydride			Red LEDs	Ammonia (NH <sub>3</sub> )	100
				Arsine (AsH <sub>3</sub> )	3
				Diborane (B <sub>2</sub> H <sub>6</sub> )	15
				Hydrogen sulphide (H <sub>2</sub> S)	100
				Phosphine (PH <sub>3</sub> )	50
TIC acidic			Red LEDs	Hydrogen bromide	30
				Hydrogen chloride (HCl)	50
				Hydrogen fluoride (HF)	30
				Nitric acid (HNO <sub>3</sub> )	25
				Phosphorous trichloride (PCl <sub>3</sub> )	25
TIC organic			Red LEDs	Acrylonitrile (C <sub>3</sub> H <sub>3</sub> N)	85
				Allyl alcohol (C <sub>3</sub> H <sub>6</sub> O)	20
				Carbon disulphide (CS <sub>2</sub> )	500
				Ethylene oxide (C <sub>2</sub> H <sub>4</sub> O)	100
				Formaldehyde (CH <sub>2</sub> O)	20
				Methanol (CH <sub>3</sub> OH)	200
TIC			Red LEDs	Carbon monoxide (CO)	300
				Cyanogen chloride, CK (CNCl)	50
				Hydrogen cyanide, AC (HCN)	20
				Sulphur dioxide (SO <sub>2</sub> )	100
Chemical Hazard			Red LEDs	Generic alarm for chemicals in hazardous concentrations or chemical mixtures	

**Library purpose:**

This library is designed to help further classify potentially unknown toxic chemical environments.

## TIC-ID 1.3.2E

### Alarm indications and agent coverage:

Alarm indication				Agents	Low Alarm mg/m <sup>3</sup> (ppm)
Text	Icon	Audio	Visible		
Ammonia		●■■■■■■■	Red LEDs	Ammonia (NH <sub>3</sub> )	190 (273)
Chlorine		●■■■■■■■	Red LEDs	Chlorine (Cl <sub>2</sub> )	8.1 (2.8)
Cyanogen chloride		●■■■■■■■	Red LEDs	Cyanogen chloride, CK (CNCl)	1.3 (0.5)
Hydrogen cyanide		●■■■■■■■	Red LEDs	Hydrogen cyanide, AC (HCN)	19 (17)
Hydrogen sulfide		●■■■■■■■	Red LEDs	Hydrogen sulfide (H <sub>2</sub> S)	57 (40.9)
Sulphur dioxide		●■■■■■■■	Red LEDs	Sulphur dioxide (SO <sub>2</sub> )	13 (5)
Chemical Hazard		●■■■■■■■	Red LEDs	Generic alarm for chemicals in hazardous concentrations or chemical mixtures	







### Library purpose:

This library is designed to help provide field identification of concentrated quantities of some common TICs in cases where the responder has very strong clues that one of these chemicals may be present. These strong clues might be a big white cloud of ammonia or a big green cloud of chlorine. This library may not do as well in complex matrices of TICs and our more "broadband" libraries like "First Responder" or "TIC-ITF25" would be recommended in these cases.



## Precursor 7.2.3E

## Alarm indications and agent coverage:

Alarm indication				Agents	Low Alarm mg/m <sup>3</sup>
Text	Icon	Audio	Visible		
Nerve precursor			Red LEDs	Dimethyl methyl phosphonate	0.1
				Di methyl phosphite	0.5
				Methyl phosphonic dichloride	0.2
				Pinacolyl alcohol	75
Vesicant precursor			Red LEDs	Thiodiglycol	0.1
Chemical Hazard			Red LEDs	Generic alarm for chemicals in hazardous concentrations or chemical mixtures	

**Library purpose:**


This library is designed to help CWA counter proliferation officials and law enforcement officials to identify the precursors typically used to produce nerve agents and vesicants.

**Library meanings**

- **Nerve precursor:** The ChemPro100i will display “Nerve Precursor” and the skull & crossbones icon to indicate that operators may be exposed to Dimethyl methyl phosphonate (DMMP), Dimethyl phosphite, Methyl phosphonic dichloride and Pinacolyl alcohol. Concentrations of nerve agents such as GA, GB, GD, GF and VX may also trigger this alarm. Alarm indication ‘Chemical Hazard’ may occur in high nerve precursor concentrations.
- **Vesicant precursor:** The ChemPro100i will display “Nerve Precursor” and the skull & crossbones icon to indicate that operators may be exposed to Thiodiglycol. Alarm indication ‘Chemical Hazard’ may also occur.
- **Chemical Hazard:** The ChemPro100i will display “Chemical Hazard” and the skull & crossbones icon to tell operators that the chemical(s) being sampled by the ChemPro100i do not match the alarm patterns in this library. But an unknown chemical(s) is present at such a level that it could represent a hazard to the user and the situation should be evaluated appropriately.

## Clan Lab 1.3.0

### Alarm indications and semi-quantitative concentration limit:

Alarm indication				Chemicals	Alarm Limit (ppm)
Text	Icon	Audio	Visible		
Chemical Detected		●■■■■■■■	Red LEDs	Acetic acid	Detectable mostly at TWA level
				Acetone	
				Ammonia	
				Benzene	
				Ethers	
				Ethyl acetate	
				Ethyl alcohol	
				Gasoline	
				Hydrogen chloride	
				Isopropyl alcohol	
				Methyl amine	
				Phosphine	
				Phosphorus trichloride	
				Stoddard solvent (white spirit)	
Toluene					

### Library purpose:



This library is designed to alert responders in clandestine methamphetamine labs (“clan lab”) that potentially toxic concentrations of chemicals typically present in clan labs may be present at levels that exceed TWA levels. This library is still considered a “prototype” library and while it can be made available, further field validation is sought.

### Library meanings

- Chemical Detected:** The ChemPro100i will display “Chemical Detected” and the skull & crossbones icon to indicate that operators may be exposed to clan lab chemicals at levels that exceed TWA (Time Weighted Average) levels.

## Overhaul 1.3.0

### Alarm indications and semi-quantitative concentration limit:

Alarm indication				Chemicals	Alarm Limit (ppm)
Text	Icon	Audio	Visible		
Mask Up			Red LEDs	Acrylonitrile	Detectable mostly at TWA level
				Ammonia	
				Benzene	
				Carbon monoxide	
				Formaldehyde	
				Hydrogen chloride	
				Hydrogen cyanide	
				Hydrogen fluoride	
				Phosgene	
				Sulphur dioxide	
Toluene					

#### Library purpose:



“Overhaul” is the process whereby firefighters enter a structure that has burned but has been put out with the purpose of confirming that the fire is completely out and to potentially identify the source of the fire. There are many potentially toxic gases in this environment. This library is designed to warn firefighters that potentially toxic gases are present during the Overhaul process and that they should don their SCBA to protect themselves. This library is still considered a “prototype” library and while it can be made available, further field validation is sought.

#### Library meanings

- **Mask Up:** The ChemPro100i will display “Mask Up” and the gasmask icon to indicate that firefighters may be exposed to chemicals from the smoldering environment at levels that exceed TWA (Time Weighted Average) levels.

## Irritant 1.3.0

### Alarm indications and semi-quantitative concentration limit:

Alarm indications				Pepper sprays	Detectability after attack (h)
Text	Icon	Audio	Visible		
Irritant			Red LEDs	Juova Law Enforcement (2% oleoresin capsicum), USA	1
				Bodyguard Defence Pepper Spray (5% OC), USA	>24
				Sabre 5.0 Law Enforcement Unit (5% OC), USA	
				First Defence Red Pepper Spray MK-4, Germany	
				First Defence Red Pepper Gel MK-4, Germany	

Saturated vapor of capsaicin can also be detected.

### Library purpose:

This library is designed to help first responders identify the presence of irritant chemicals such as pepper spray. This library is still considered a “prototype” library and while it can be made available, further field validation is sought.

### Library meanings

- **Irritant:** The ChemPro100i will display “Irritant” and the X icon to indicate the presence of irritant compounds.