



### Recommended ChemPro100i Testing Procedures

This document describes the recommended test procedures for chemical, environmental and mechanical testing of the ChemPro100i detector.

#### General

The ChemPro100i user manual and associated training materials should be followed especially regarding:

- Start-up procedures
- Testing the sensors
- Shut down procedures
- Operation conditions
- Gas library data sheets

The ChemPro100i should be confidence checked according to the user manual prior to any test procedures and at least upon every start-up. This ensures that the detector is fully operational. If the test does not pass within three trials (please provide at least 10 minutes between trials) the detector should be sent in for service and no further testing should be performed. After a confidence check or any other exposures the detector should be left to run 30 minutes in clean air before being shut down. Too early a shut-down may leave traces of chemicals on the sensor surfaces thus decreasing their lifetime. The user manual contains information about the operation conditions specified for the ChemPro100i. The manufacturer does not guarantee operation outside of this range.

#### Testing Should Mimic Usage

In general the testing methods should as closely as possible resemble real usage as far as temperature, humidity, gas matrices and expected operational concentrations. System and laboratory effects that do not take place in real use should be avoided.

#### Let Enviroics Help

Enviroics is happy to help generate a test plan and evaluate the test methods prior to testing. With our experience in developing test plans this usually makes the actual testing faster, avoids unnecessary test sessions and reduces misunderstandings. Improper testing methods might be impossible to correct after the entire test session has been completed, even if the mistake is recognized. Therefore, careful planning beforehand is important.

#### Don't Sniff Straight from the Bottle

The gas library data sheets (TN-008 for example) contain information about the detector performance. The detector does not alarm, or usually provides only a generic alarm, if the test gas is not programmed into the gas library. The specified concentrations should not be exceeded: the detector may not alarm at concentrations that are lower than the low limit. If the high limit is exceeded the detector may give a generic alarm. Sniff tests straight from the bottle typically represents abnormally high concentrations and other atmospheric anomalies like very low relative humidity (RH) and low or no Oxygen that are not seen in normal use and not necessary covered by the library. Instead of sniff tests, a proper vapor generation system should be used.

#### Chemical testing

Chemical testing should test only the desired parameters. Changing multiple parameters unintentionally should be avoided. For example when introducing the chemical vapor to the detector, the humidity, background air and the temperature should be kept constant from before sample presentation, during sample presentation and after the sample has been removed. Drastic sudden change of environmental conditions such as changing the humidity within a few seconds from 10% to 90% humidity does not usually represent a real performance in nature. Even if the detector is designed to handle these situations, it might lead to wrong conclusions at the laboratory tests.

#### Make Sure Your Test Setup Doesn't Cause Problems

The test system or environment should be clean from contaminants and system effects. Prior to testing, the system should always be tested as a blank and background files collected, and system effects caused by turning valves etc. should be checked. As an example, the ChemPro100i has been designed to operate in an open air: turning a two-way valve might shut off the air flow or reverse it for a short period of time causing the detector to enter into a flow failure mode.

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In normal operation the air supply is continuous and both the air inlet and outlet operate in a same pressure. Different air pressures to the air inlet and outlet of the ChemPro100i should be avoided. The ChemPro100i has to receive minimum of 1.3 LPM for normal operation.

EnviroNics has designed a portable vapor generation system that can be used on site in a laboratory to test multiple gases. The system allows background free and unambiguous testing of vapors. Please contact EnviroNics for the availability of this vapor generation system.

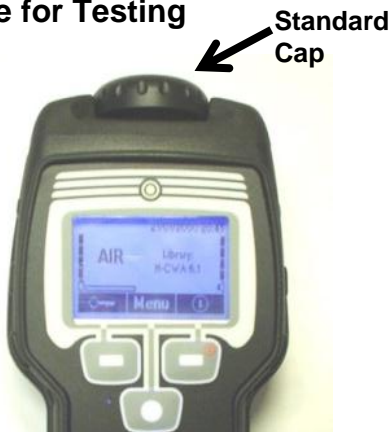
### Use Trend Mode during Testing

The detector should be kept in the Trend mode during the testing. This allows the user to see that the ChemPro100i is responding to the gas/vapor sample because the line graph will increase as concentration increases. The Trend screen will also allow the tester to verify that the previous sample has cleared from the detector before the next exposure. Repeated exposures without proper clear down time and extremely high concentrations of smoke, dust and vapors should be avoided. Even if the detector is designed to be operable in difficult conditions, performance might not be optimal immediately after extreme conditions.

### The Field Monitoring Cap is Often the Best Choice for Testing

The Standard Cap (also known as the "Storage Cap") is designed for surveillance mode. It will collect air from 180 degrees sector in front of the unit: in a real nature a chemical

cloud will surround the entire detector thus completely entering into the air cap. When testing with chemicals, typically point sources are used (bottles, drops of liquids etc.) in a monitor mode. For this purpose the Field Monitoring cap should be used, it allows for point source



Trend mode using the Field Monitoring cap

vapors to completely enter into the detector. The Standard Cap does not work properly with point sources as the sample coming in one side of the cap may be diluted by clean air on the other side of the cap unless a homogenous atmosphere is presented to all sides of this cap.

### Environmental testing

The ChemPro100i meets MIL-810-E standard for environmental effects. Typically, the standards allow using several detectors for each test and even in some cases (like shock test) for the same test sessions. The tests are rough and might influence the detector performance in a long term. Therefore, if environmental effects are tested using only one device, it is possible that test history will influence the detector performance in subsequent tests. Therefore, it is recommended that chemical testing is performed before environmental tests, and the operation is later verified with a set of chemical tests. In order to completely avoid test history influencing the results, EnviroNics recommends using a minimum of 5 units for the most demanding tests such as shock, water tightness and salt spray/dust tests, one detector in each.

Testing extreme temperatures should be performed consistently. If the evaluation point is to measure the performance or start up times at temperature extremes, the unit should be kept at that temperature all the time. Temperature shocks just prior to start up should be avoided as it may cause condensation to the detector and influence performance. As an example, the detector should not be brought into room temperature after a cold storage and started immediately since the water will condensate into the

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detector. A better way is to start the system in cold, complete the test and shut it down in the cold. The system can, however, be transported between temperature extremes once it is in operation but not before start up.

### Start the ChemPro100i in the Environment in Which Testing Will Take Place

ChemPro100i's detection algorithms take into account temperature and relative humidity (RH) in addition to the outputs of the chemical sensors. Therefore it is recommended to start and use the ChemPro100i in the same atmosphere in which it will be exposed to the test chemical(s). Large temperature, humidity and oxygen swings introduced in the testing environment may produce invalid data. For example, calibration gases typically have 0% RH. When a ChemPro100i that has been started in a room at 60% RH is shown 0% RH gas the humidity sensor in the ChemPro100i cannot react fast enough to account for the quick change. These types of extremely quick changes in RH typically don't happen in the real world.

### Oxygen required

The ChemPro100i is designed for use in environments that can sustain human life. The sensors in the ChemPro100i are oxygen dependent and a radical change from 20.9% to 0% oxygen can affect the detection algorithm.

The ChemPro100i will work in oxygen concentrations between 19.5% and 22.5%. If oxygen levels set off the oxygen alarm in a confined space monitor the environment is not suitable for use of the ChemPro100i.

During the test of a ChemPro100i a user sampled a calibration cylinder containing 50 ppm ammonia balanced with nitrogen. The ChemPro100i didn't respond to the ammonia. However, when the ammonia gas was removed from the ChemPro100i (which was in the "TIC-Confirm" library) it subsequently displayed an appropriate "ammonia" alarm. The reason for this is that calibration cylinders containing reactive gases like ammonia are often balanced with nitrogen so that the gas doesn't degrade from reaction with the oxygen in air. However, the ChemPro100i requires oxygen to operate so when the pure gas was applied it didn't receive enough oxygen. When the ammonia gas without oxygen was removed

from the ChemPro100i, oxygen from ambient air flooded the detector and there was enough residual ammonia left in the ChemPro100i for it to make an accurate analysis.

### Control the Testing Environment

Sometimes people spray chemical into the air and then they don't get a detection with the ChemPro100i. Spraying chemical into ambient air can introduce a lot of variability due to shifting air currents. When possible, it is suggested that the test concentration be controlled and the sample volume be controlled to one to five liters. One common way of testing is to inject a controlled amount of target chemical into a Tedlar bag (that has the same gas matrix, temperature and humidity as the ChemPro100i). Then the ChemPro100i can sample from this bag. Remember that the ChemPro100i draws about 1 LPM so prepare a sample volume accordingly.

### Make Sure that Datalogging is On

After testing EnviroNics can access the datalog files in the test ChemPro100i to confirm performance or address issues that appeared during testing. However, EnviroNics cannot access data that does not exist so it is imperative that the datalogging feature in the test ChemPro100i has been turned on.

### Your test day

1. Make sure that the date and the time on the ChemPro100i are set correctly.
2. Write down the time that you turned on the ChemPro100i.
3. Perform a sensor test using the supplied test stick and write down the time of the sensor test. If the ChemPro100i does not pass the sensor test DO NOT CONTINUE WITH THE TESTING and contact EnviroNics.
4. After the sensor test let the ChemPro100i completely return to baseline values before commencing testing. This is easily confirmed using the "Trend" display and waiting for the values to return at or near the baseline values. Once the device has returned to baseline time and record at least 2 minutes of "baseline" data where the device is in the

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same environmental and test conditions but without the test chemical present.

5. Note the time of your first chemical test. Using the "Trend" display apply test chemical to the ChemPro100i and confirm that the Trend increases (if it does not increase check to make sure that the test chemical is indeed present). If and when the ChemPro100i alarms on the test chemical the alarm state will appear at the top of the "Trend" display. To get additional visibility of the alarm you can page back to the main display of the ChemPro100i.
6. Allow the ChemPro100i to return to baseline values by again watching the "Trend" display.
7. It is recommended to repeat tests (steps 6 & 7 above) of new chemicals 3-5 times to get valid results even if the ChemPro100i does not alarm.
8. Make sure that the ChemPro100i used for chemical testing runs for 30 minutes to fully clear its sensors before turning it off and putting it away.