## OPERATION OF THE SINGLE POINT MONITOR

CONTENTS

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## 1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) outlines the procedure for the operation and use of the Honeywell Analytics Single Point Monitor (SPM) by U.S. Environmental Protection Agency (EPA) Environmental Response Team (ERT) personnel and their contractor's. It is useful for emergency response, perimeter/fence line monitoring, outdoor and hazardous locations and remote sample points. The use of the Chemcassette as a concentration media allows the instrument to see a variety of compounds down in the low parts per billion (ppb) ranges. ChemKeys and Chemcassettes are available for amines, diisocyanates, hydrazines, hydrides, hydrogen sulfide, mineral acids and oxidizers.

Depending on the compound being monitored, the Lower Detection Limit (LDL) is defined as the detection limit in parts per million (ppm) or parts per billion (ppb) at 4.56 milliamps (mA). Readings under 4.56 mA are considered to be non-detect.

The procedures and/or figures contained in this SOP are taken from the SPM Single Point Monitor Technical Handbook (Honeywell 2000). Some material is excerpted without change from this manual. This SOP will be used for educational and training purposes only.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives (DQOs) listed in the UFP-QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the UFP-QAPP. These changes must be documented in the final deliverable.

## 2.0 METHOD SUMMARY

The SPM is a colorimetric instrument that employs a specially-treated paper tape reel called a "Chemcassette" and an electronic key known as a "ChemKey". The Chemcassette is a tape medium onto which a known quantity of ambient air containing a suspected contaminant is passed through to create a measurable colored reaction product. The ChemKey stores set-up information and other functional information (i.e. compound[s] of concern, flow rate, alarm levels and compound concentration times) needed for accurate detection of target gases.

When the SPM is monitoring, the tape from the Chemcassette is drawn into the "Read Head" where it is exposed to a predetermined volume of ambient air. If the target gas is present, the tape responds with a color change in proportion to the concentration of the target gas present. The optics read this color change, and through an algorithm stored in the ChemKey, converts the observed color change into a concentration that is sent to the light emitting diode (LED) display. The concentration is also converted into a 4 to 20 mA analog output signal that is available using a 14-pin connector located on the left side of the SPM. The range and detection limits of the SPM are determined by the ChemKey's programming. For example a low level hydrogen sulfide ($H_2S$) key will have a range of 1 ppb at 4.56 mA to 90 ppb at full scale.

## 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

Storage requirements for the Chemcassette are defined by the manufacturer. Most Chemcassettes are stored either at less than or equal to (≤) 6 degrees Celsius (°C) in the refrigerator or less than (<) 0°C in the freezer.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Although the SPM is very accurate and reliable, it is still a monitoring instrument and is subject to interferences caused by cross-sensitivities and other environmental conditions. The SPM is best used in the 32-104° Fahrenheit (F) operating range. For dusty conditions, a particulate filter may be installed on sample lines for certain gases. Certain target compounds carry sample line restrictions. For example aromatic amines have a maximum line restriction of 6-inches (″). Hydrogen bromide (HBr) and hydrogen iodide (HI) are extremely water soluble and high relative humidity (RH) will cause sample loss due to absorption onto the sample lines. Refer to the manufacturer's technical notes and operating instructions before deploying the instrument.

5.0 EQUIPMENT/APPARATUS

The SPM comes with several different configuration options. Refer to manufacturer's operating instructions for detailed information (Honeywell Analytics 2011). The following components are required for the operation of the SPM.

- SPM, with a self-contained power supply, for eight hours of use
- Operating manual
- ChemKey and Chemcassette for specific compound(s)
- Field data sheet and/or site log book
- Teflon tubing (optional)
- Strap for carrying SPM (optional)

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURES

7.1 Monthly Checkout (or as needed)

7.1.1 Response Verification

A diagram of the operating controls and ports can be found in Figure 1, Appendix A. The verification routine checks the operating condition of the SPM optical system through use of the optical test card supplied with the instrument. The instrument must be in Monitor Mode to start this test. All ERT units have the ChemKey option, the ChemKey must be installed and turned on. Perform the verification routine as follows.

1. Open tape load lever (18) and remove Chemcassette (4) from the detector head (17).

2. Press alarm test (10). The green system status LED (9) will flash rapidly and the display will show "VERIFY."

3. Insert the test card with position #1 centered in the detector head (17). Be sure that the colored chip on the test card faces up and that the card is inserted fully into the detector head (17).

4. Close the tape load lever (18) and press alarm test key (10). The audible alarm will emit one short signal.

5. Open the tape load lever (18) and reverse the test card, centering position #2 in the detector head (17).

6. Close the tape load lever (18) and press alarm test key (10).

7. If all electronics and optical systems are operating properly, the instrument will simulate an alarm condition and activate both the audible and visual alarms. The 4-20 mA circuit will output a signal of 10.1 mA to 13.2 mA.

8. Open the tape load lever (18) and press alarm reset (11). Replace the Chemcassette (4) and re-thread the tape (7). After pressing the alarm reset button, the alarm lamp (16) does not extinguish. Wait until monitoring is resumed, then press the alarm reset button again.

9. Close the tape load level (18). The SPM will automatically begin monitoring.

10. Press the alarm reset button to turn off the alarm lamp (16).

11. Plug the end of the sample line. A fault #17 will be generated, indicating that there are no leaks between the sampling point and SPM.

    NOTE: Alarm relays will not activate during the verification routine.

12. If the system is not operating properly, the audible alarm will signal two times and the red system status LED (12) will light. If this occurs, open the tape load lever (18), press alarm reset (11) and repeat the verification procedure. If the system still indicates a malfunction, contact the manufacturer for assistance.

13. An internal timer is activated when you open the tape load lever (18) for the verification routine. If the lever is not closed within two minutes, the following will occur:

    - Red and green system status LED (12) will flash
    - Audible alarm will sound (Note that this alarm has been disabled on some units)
    - SPM display will show “FAULT 25”
    - Instrument fault relay is activated (de-energized)

Do not confuse this two-minute alarm with the proper response to the verification routine. To prevent the two-minute alarm, do not leave the tape load lever (18) open for more than two minutes.

NOTE: The two-minute alarm will also activate during Chemcassette replacement if the tape load lever (18) is left open for more than two minutes.

7.1.2 Simulating Gas Conditions

The SPM allows two different electronic simulations of gas conditions using the gross alarm simulation and the full alarm simulation. To conduct a full alarm simulation, the SPM must be in the Monitor Mode. Refer to Appendix B for detailed instructions.

7.2 Field Usage

7.2.1 Loading the ChemKey/Chemcassette

A diagram of the operating controls and ports can be found in Figure 1, Appendix A. The following steps are usually performed with the power on.

1. Open the door using the door thumb screws (23). Open the tape load lever (18).

2. Remove the center retaining screw securing the Chemcassette. Remove and discard the old Chemcassette, if applicable.

3. Install the fresh Chemcassette (4) with raised lettering facing up. Pull 30 centimeters (cm) (12") of tape (7) out of the fresh Chemcassette (4). Place the end of the tape in the slot on the Chemcassette take-up reel cover (27).

4. Thread the Chemcassette tape (7) through the detector head (17), capstan assembly (25), and over the guide posts (5 & 26).

5. Install the take-up reel cover (27). Rotate the assembled take-up reel (27) clockwise to take up any slack.

6. Install the Chemcassette center retaining screw.

7. Close the tape load lever (18).

8. The green system status LED (9) will flash slowly. AC Line (1) instruments will display “AC LINE” on the digital display (19). Battery-powered instruments will display current battery condition. Insert ChemKey into slot (32).

NOTE: The EP (Extended Play) Chemcassette will lock in position when tape outlet is at approximately the one o’clock position.

7.2.2 Start-Up Procedure

Depress the main power switch (8). The instrument will cycle on. The LEDs will light up and the alarm will beep. The SPM will then display (19) the ChemKey’s identification (ID), the units that the concentration will be reported in, the two alarm levels, the type of Chemcassette required for this ChemKey, and the status of the battery. The green system status light will remain lit and the unit is now ready to monitor.

7.2.3 Monitoring

The SPM is monitoring whenever a Chemcassette (4) is in place, the tape load lever (18) is closed, and the power switch (8) on. The green system status LED (9) will remain on. A list of common fault codes can be found in the operating manual on page 4-6.

8.0 CALCULATIONS

The SPM reports readings directly to the built in LED screen. The instrument also has a 4-20 mA analog output port that can be used for data logging. Refer to operating manual page 4-3 for 4-20 mA conversion factors.

9.0 QUALITY ASSURANCE / QUALITY CONTROL

Specific Quality Assurance/Quality Control (QA/QC) activities that apply to the implementation of these procedures will be listed in the QAPP prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All data must be documented on approved field data sheets, in a site logbook, and/or recorded electronically.

2. All instrumentation must be operated in accordance with operation instructions as supplied by the manufacturer, unless otherwise specified in the QAPP. Equipment checkout must be performed prior to operation and must be documented.

3. Records must be maintained, documenting the training of the operators that use instrumentation and equipment for the collection of environmental information.

Specific QA activities that apply to the implementation of this procedure include the following:

1. System response (optics) verification, leak test, gross alarm simulation and full alarm simulation is performed on a monthly basis and is documented on the Monthly SPM Checklist (Figure 2, Appendix A).

2. Inventory of the Chemcassette stock including the number of cassettes and their expiration date are conducted on a quarterly basis.

3. Based on the project's DQOs, a certification from the manufacturer may be required to verify the tolerance of the unit. The percent tolerance acceptance limit is plus or minus (±) 10 percent (%).

4. A field challenge test may be performed using a prepared standard for the compound of interest depending on the project's DQOs. The percent tolerance limit is typically ±25%.

5. All manufacturers' certifications will be maintained on file in the ERT Air Trailer.

6. Chemcassette-based instrument accuracy and precision is discussed in the technical note presented in Appendix C.

7. Chemcassette-life and running times are presented for each type and size of Chemcassette for the SPM in Appendix D.

10.0 DATA VALIDATION

Data verification/completeness checks must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. These data are essential to providing an accurate and complete final deliverable. The ERT contractor's Task Leader (TL) is responsible for completing the UFP-

QAPP verification checklist for each project. The data generated will be reviewed by the TL prior to distribution.

## 11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

## 12.0 REFERENCES

Honeywell Analytics. 2000. *Chemcassette-based Instrument Accuracy and Precision, T/N 971131.*
Honeywell Analytics.2001. *Chemcassette Life and Running Time, T/N 971066.*
Honeywell Analytics. 2000. *Operating Instructions for the SPM.*

## 13.0 APPENDICES

A - Figures
B - Simulating Gas Conditions
C - Technical Note Chemcassette - based Instrument Accuracy and Precision, T/N 971131, Rev 3, 3/11
D - Technical Note Chemcassette - Life and Running Time, T/N 971066, Rev 4, July 2014

APPENDIX A
Figures
SOP: ERT-PROC-2115-20
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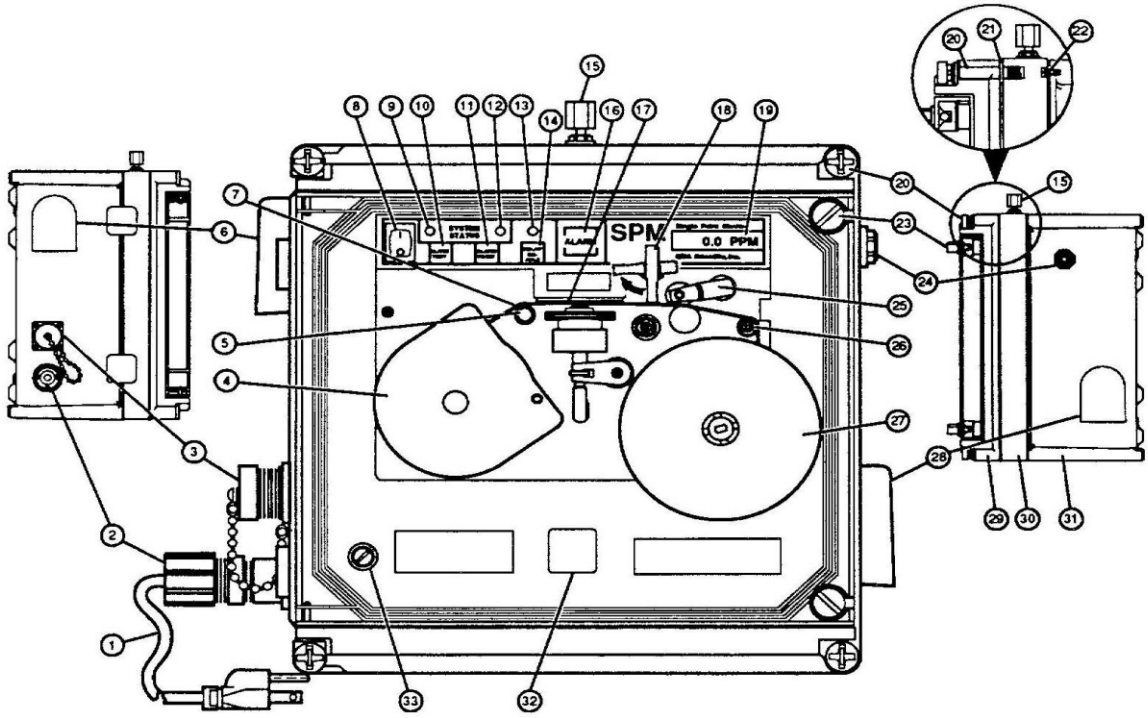
FIGURE 1. SPM Operating Controls and Ports

1. Line power cord
2. Power port
3. 14-pin circular connector
4. Chemcassette
5. Guide post
6. Vent
12. Red system status LED
13. Red relay disable LED
14. Relay disable key
15. Sample inlet port
16. Alarm lamp
17. Detector head
23. Door thumb screw
24. Exhaust port
25. Capstan assembly
26. Guide post
27. Take-up reel
28. Vent




7. Tape path
8. Main power switch
9. Green system status light
10. Alarm test key
11. Alarm reset key
18. Tape load lever
19. Digital display
20. Cover screw
21. Retaining ring
22. Collar fixing screw
29. Cover
30. Collar
31. Body
32. ChemKey slot
33. Fuse/fuse holder

NOTE: Features may vary depending on instrument options.

FIGURE 2. Monthly SPM Checklist

***Monthly Single Point Monitor (SPM) Checklist***
(Rev. 04/16)

Name: _____ Date: _____
Unit: _____ S/N: _____ EPA No: _____

**Unit Present In the Air Trailer**: **Y** **N** If no, out on WA: _____ Comment: _____

**Verifying System Response** (*Does not require a Chemcassette in the SPM.*)

1. Place any ChemKey into the ChemKey slot on the SPM, and turn the ChemKey to the monitoring position.
2. Turn on the SPM. Press **Alarm Test**. The green **System Status** LED will flash, and the display will show the message "**VERIFY**."
3. Insert the test card with the position #1 centered in the detector head. Be sure that the colored chip on the test card faces up and that the card is fully inserted into the detector head.
4. Close the tape load lever and press the **Alarm Test** key. The audible alarm will emit one short signal.
5. Open the tape load lever and reverse the test card, centering position #2 in the detector head.
6. Close the tape load lever and press the **Alarm Test** key.
7. If all the electronics and the optical system are operating properly, the instrument will simulate an alarm condition and activate both audible and visual alarms.

**AUDIBLE ALARM** **Y** **N** **VISUAL ALARM** **Y** **N**

8. Remove the test card and turn off the SPM. This concludes system response verification test.

**Leak Test** (*Requires a Chemcassette in the SPM.*)

1 Make sure that the SPM is in monitoring mode with a Chemcassette in place, the tape load lever closed, the ChemKey in position, and the power switch on.
2. Close off airflow at intake; the pump should be audibly laboring. Alarm will sound indicating *Fault 17*, Loss of Flow.

**Leak Test:** **Pass** **Fail**

3. End of Leak Test.

**Gross Alarm Simulation** (*Requires a Chemcassette in the SPM.*)

1. Make sure that the SPM is in monitoring mode with a Chemcassette in place, the tape load lever closed, the ChemKey in position, and the power switch on.
2. Press the **Alarm Test** key. The audible alarm and alarm lamp lights should activate. To reset the alarm, press the **Alarm Reset** key.

**Gross Alarm Test:** **Pass** **Fail**

**SPM Filter Annual Replacement Schedule**

| SPM Filter | Filter Replaced This Month (Y/N) | Replacement Date | Filter Replaced By |
|---|---|---|---|
| Acid Scrubber Filter | | | |
| Particulate Filter | | | |

FIGURE 2. Monthly SPM Checklist (cont'd)

**Full Alarm Simulation** (*Requires a Chemcassette in the SPM.*)

1. Make sure that the SPM is in monitoring mode with Chemcassette in place, the tape load lever closed, the ChemKey in position, and the power switch on.
2. Press and hold the **Alarm Reset** key for 2 seconds until the red **System Status** LED is flashing. The red **System Status** LED will flash until the **Alarm Test** key is pressed or the instrument ends its current sample period. To confirm that the unit is functioning properly, instructions to initiate a simulated alarm condition for four different alarm scenarios are described in the table below.

**Full Alarm Simulation Instructional Table**

| Level | Entry | Exit | Completed (Y/N) |
|---|---|---|---|
| Sub-Alarm (Unit will display concentration below Alarm Level 1) | AT | After displaying the concentration, the unit automatically returns to monitoring mode. | |
| Alarm Level 1 (1/2 TLV)* | AR, AT | AR | |
| Alarm Level 2 (TLV)* | AR, AR, AT | AR | |
| Above Scale | AR, AR, AR, AT | AR | |

AT = Alarm Test Key AR = Alarm Reset Key * Excludes Diisocyanates (5 ppb, 20 ppb).

**SPM Carrying Case Inventory Checklist**

| Item/Component | Bar Code | Present/Replaced |
|---|---|---|
| Carry Case | A05373 | |
| Battery Charger | A05746 | |
| Carry Strap | A05756 | |
| Printer (Weigh-Tronix IMP 24) B/C#11432 | A05745 | |
| Printer AC Adaptor | A05748 | |
| Paper Spool | - | |
| Printer Cable (SPM to Cable) | A05753 | |
| Instruction Manual | - | |
| Calibration Key (B/C# 7017) | A05762 | |

APPENDIX B
Simulating Gas Conditions
SOP: ERT-PROC-2115-20
October 2020

Simulating Gas Conditions

The SPM allows two different electronic simulations of gas conditions: gross alarm and full alarm simulations.

1.0 Alarm Relays. Gross alarm simulation and full alarm simulation will activate the alarm relays. All external devices connected to the alarm relays will be triggered. To disable relays, press the relay disable key (14). The relay disable LED (13) will be lighted whenever the alarm relay contacts have been disabled.

2.0 Gross Alarm Simulation. To make a gross alarm simulation, press the alarm test key (10). This test activates the audible alarm and lights the alarm lamp (16). Unless the relay disable key (14) has been pressed, the gross alarm simulation energized the alarm relay contacts. The 4-20 mA output does not change.

To reset the alarm, press the alarm reset key (11).

3.0 Full Alarm Simulation. A full alarm simulation duplicates the SPM response to four gas conditions:

- Sub-alarm Concentration
- Alarm Level 1 (½ of the Threshold Limit Value [TLV])
- Alarm Level 2 (TLV)
- Above Scale

To begin a full alarm simulation, the SPM needs to be in Monitor Mode. Press the hold the alarm reset key (11) for two seconds until the red system status LED (12) is flashing. The red system status LED will flash until the alarm test key in pressed or the instrument ends its current sample period.

For simulation of each of the four gas conditions, continue with key entries as listed in Section 4.0.

4.0 Alarm Simulation Key Entries

| Level | Entry | Exit |
|---|---|---|
| Sub-alarm | AT | After displaying concentration, the unit automatically returns to monitoring. |
| Alarm Level 1 | AR, AT | AR |
| Alarm Level 2 | AR, AR, AT | AR |
| Above Scale | AR, AR, AR, AT | AR |
| AT = Alarm Test Key (10)<br>AR = Alarm Reset Key (11) | | |

Only one simulation can be made at a time. Conclude a simulation by pressing the alarm reset key (11). This will reset the relays, but the 4-20 mA output doesn't reset until the sample period ends. The display also acts the same way. Reenter the alarm simulation routine by pressing and holding the alarm reset key (11) until the red system status LED (12) begins flashing.

When a simulation is concluded the relay contacts will reset. The 4-20 mA signal and displayed value will stay at the simulated level. When the current sample period is completed the 4-20 mA signal and displayed value will be updated to indicate the sampled gas concentration.

This section shows the SPM alarms and signals for each level of alarm simulation.

5.0 Alarm Simulation Reporting

| | Green System Status LED (9) | Red System Status LED (12) | Alarm LED (16) | Audio Signal | Display (19) |
|---|---|---|---|---|---|
| Sub-alarm | Steady On | Off | Off | Off | Concentration below alarm level 1 |
| Alarm 1 | Steady On | Off | Steady On | On | Concentration just above level 1 |
| Alarm 2 | Steady On | Off | Flashing Fast | On | Concentration between alarm level 2 and full scale |
| Above Scale | Steady On | Off | Flashing Fast | On | xxx + ppb/ppm (above full scale) |

Notes:

1. Press the alarm reset key (11) to reset all alarm indicators.
2. In actual gas condition, the display (19) will show last sampled concentration. In simulated gas condition, the display (19) will normally reset to 0 unless a concentration is detected.
3. When the unit is above scale, the display (19) will show xxx + ppb/ppm, e.g.: Arsine ($AsH_3$) above full scale is 150 + ppb; Chlorine ($Cl_2$) above full scale is 1.50 + ppm.

APPENDIX C
Technical Note-Chemcassette-based Instrument Accuracy and Precision, T/N 971131
SOP: ERT-PROC-2115-20
October 2020

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# Technical Note

## Chemcassette®-based Instrument Accuracy and Precision

971131 Rev 3 3/11

### Instrument Accuracy and Precision

In analytical chemistry, accuracy refers to the agreement of a result obtained from an instrument or technique with a true value. The closer the agreement, the more accurate the result. Unfortunately, in light of the uncertainty of "true values", accuracy often cannot be clearly determined. A meaningful indicator of an instrument's integrity is its degree of precision, or repeatability. The closer the agreement among multiple readings, the more precise the average result.

While not designed to be analytical tools, instruments for gas detection are sometimes called upon to use these same terms. For any manufacturer of gas monitoring equipment, the definition of an accuracy statement is complicated by the acknowledged absence of reliable, stable gas standards at ppm and ppb concentrations. If such standards existed, any precise (repeatable) instrument could be made as accurate as one wished by performing in-field gas calibrations and adjusting the instrument's span to read the exact result desired. Some manufacturers do not state accuracy or precision specifications. Others may state accuracy relative to full scale, which can give a much wider margin for error than one might expect at face value. For example, an accuracy statement of "±15% of scale" may sound good but may actually mean ±30 ppb at 200 ppb (full scale). However, this does not mean ±15% at 5, 10 or 20 ppb, even though these lower concentrations may be more relevant to the monitoring task.

Honeywell Analytics performs dynamic gas verifications on all Chemcassette® instruments prior to shipment. Additionally, all Chemcassettes® are batch tested, quantitatively, with gas to assure proper response when used in the field.

Our laboratories developed chemical referee methods to insure that the low-level test gas concentrations which are used for generating curves are known as accurately as possible. If available, a NIOSH Analytical Method is used as the basis for at least one of our referee methods. Comparisons are made between two or more methods to arrive at the "true" gas concentration value.

Using these chemical referee methods, our gas calibration curves are designed to read within 10% of the "true" value, on average, over the full detection range, under optimum conditions of temperature and humidity. These are designed to be very precise, having a coefficient of variation (standard deviation divided by average reading) of 5% or better.

Honeywell Analytics monitors which are designed for portability, multipoint, and multi-gas capability, including the Vertex, CM4, TLD-1 ChemKey and SPM (ChemKey and prom based) are expected to have accuracy within 20-25% of the "true" value and precision of 10% or better. In general, a humidity range of 25% to 70% RH will give optimal accuracy. However, there can be variations due to the characteristics of individual gases. Contact Honeywell Analytics for further information.

Sample data on accuracy and precision follow for a few of Honeywell Analytics' gas monitoring systems.

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# Technical Note

## Typical Accuracy and Precision Data for Honeywell Analytics Gas Monitoring Instruments

| SPM or TLD-1 for Toluene Diisocyanate (TDI) | | | | |
|---|---|---|---|---|
| "True" Gas Concentration | Average Instrument Reading | Standard Deviation | Accuracy | Precision |
| 11 ppb | 12 ppb | 1.08 | +9.1% | 9.0% |
| 21 ppb | 20 ppb | 1.02 | -4.8% | 5.1% |
| 45 ppb | 37 ppb | 1.12 | -17.8% | 3.0% |
| **CM4 or Vertex for Phosgene ($COCl_2$)** | | | | |
| "True" Gas Concentration | Average Instrument Reading | Standard Deviation | Accuracy | Precision |
| 49 ppb | 51 ppb | 2.6 | +4.1% | 4.7% |
| 98 ppb | 108 ppb | 4.4 | +10.2% | 4.1% |
| 207 ppb | 219 ppb | 6.2 | +5.8% | 2.9% |

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APPENDIX D
Technical Note - Chemcassette Life and Running Time, T/N 971066
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Juney 2020

Honeywell

# Technical Note

## Chemcassette® Life and Running Time

971066 Rev 4
July 2014

### Overview

Listed on the following page is the number of windows available on a Chemcassette.

A "window" is defined as the one sampling location on the cassette tape.

The length of time that the sampling system will remain on that one window, if not gas is present, before momentarily stopping the analysis, pulling a new window and re-initiating the time per window, is also included in the table.

Please note that the values are specific for each model instrument, Chemcassette type and Chemcassette size.

| Instrument | Chemcassette Size | Cassette Size | Windows per Tape | Time per Window (minutes) | * Days of Operation |
|---|---|---|---|---|---|
| 7100 | All Types | SP | 1200 | 10 | 8 |
| | All Types | LP | 7500 | 6 | 31 |
| TLD,SPM | Hydrides, Amines, HCN, Ozone, Fluorine | SP | 1300 | 17 | 15 |
| | All Others | SP | 1420 | 15 | 15 |
| TLD | Hydrides, Ammonia | XPT | 433 | 51 | 15 |
| | MA, Chlorine | XPT | 473 | 45 | 15 |
| SPM | Hydrides, Amines, HCN, Ozone, Fluorine | EP | 2600 | 17 | 30 |
| | All Others | EP | 2840 | 15 | 30 |
| | Hydrides, Ammonia | XPS | 2600 | 51 | 90 |
| | MA, Chlorine, Phosgene | XPS | 2840 | 45 | 90 |
| System 16 | Hydrides, Amines, HCN | SP | 1400 | 7.5 | 7 |
| | All Others | SP | 1700 | 6 | 7 |
| | Hydrides, Amines, All Others | LP | 8700 | 5.4 | 32 |
| | Hydrides | XPL | 8700 | 16.7 | 90 |
| | Phosgene | XPL | 8700 | 16.7 | 90 |
| EGM | HCN, Ozone | EGM | 1300 | 17 | 15 |
| | Sulfur Dioxide | EGM | 1420 | 15 | 15 |
| | Hydrides | EGM | 1300 | 35 | 31 |
| | All Others | EGM | 1420 | 30 | 30 |
| | Hydrides | XPE | 1300 | 105 | 90 |
| | Phosgene | XPE | 1420 | 90 | 90 |

Honeywell

# Technical Note

| | | | | | |
|---|---|---|---|---|---|
| **CM4** | Chlorine, HCN, Nitrogen Dioxide | CM4 | 1500 | 15 | 15 |
| | All Others | CM4 | 3100 | 15 | 32 |
| | Hydrides, Ammonia | XPC | 3100 | 45 | 90 |
| | Hydrides, Ammonia | XP4-C | 4133 | 45 | 120 |
| | MA, Chlorine, Phosgene | XPC | 3100 | 45 | 90 |
| | MA, Chlorine, Phosgene | XP4-C | 4133 | 45 | 120 |
| **Vertex** | Chlorine, HCN, Nitrogen Dioxide | Vertex | 1500 | 15 | 15 |
| | All Others | Vertex | 3100 | 15 | 32 |
| | Hydrides, Ammonia | XPV | 3100 | 45 | 90 |
| | Hydrides, Ammonia | XP4-V | 3711 | 51 | 120 |
| | MA, Chlorine, Phosgene | XPV | 3100 | 45 | 90 |
| | MA, Chlorine, Phosgene | XP4-V | 4133 | 46 | 120 |
| **SPM Flex** | All 14-day (p/n 1265-4xxx) | 14d | 1400 | 15 | 14 |
| | XP 14-day (1265-4xxx) | 14d | 450-500 | 45-50 | 14 |
| | Fluorine/Ox, Ozone, Sulfur Dioxide | 30d | 2700 | 17 | 30 |
| | Diisocyanates, Hydrogen Peroxide, Hydrazines | 30d | 3000 | 15 | 30 |
| | XP Chlorine, XP Mineral Acids, XP Phosgene | XP | 3000 | 45 | 90 |
| | XP Hydrides, XP Ammonia | XP | 2700 | 50 | 90 |

* Typical number of days in no gas condition.

In an application where there is a continuous presence of a target gas in low level concentration, the Chemcassette will pull a new window after every sample period. The useful life of a Chemcassette will be shortened to a time less than its normal expected running time.

In certain instances, a duty cycle can be incorporated into the instrument's software so that a sample of gas is analyzed once every 15 minutes, or whatever idle time period is programmed, therefore, eliminating rapid advancement of the paper tape.

If these are not feasible options for a particular application, the following chart may be used to estimate the usable life of a Chemcassette (by instrument model and cassette size) when continuous background levels of the target gas are present in low levels:

| Instrument | Chemcassette Size | Rate of Advancement/One Sample Period | Approximate Longevity of Chemcassette in A Typical Constant Gas Condition |
|---|---|---|---|
| **7100** | SP | 1 minute | 20 hours |
| | LP | 1 minute | 5 days |

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# Technical Note

| | | | |
|---|---|---|---|
| **TLD** | SP | 15 seconds | 5 hours |
| | XPS | 15 seconds | 1.8 hours (108 minutes) |
| **SPM** | SP | 15 seconds | 6 hours |
| | EP | 15 seconds | 10 hours |
| | XPS | 15 seconds | 10 hours |
| **System 16** | SP | 15 seconds | 5 hours |
| | LP | 15 seconds | 36 hours |
| | XPL | 15 seconds | 36 hours |
| **EGM** | EGM | 15 seconds | 5 hours |
| | CPE | 15 seconds | 5 hours |
| **CM4** | CM4 | continuous; varies depending on gas at points | 2-5 days with constant gas at all points, dependent on the gas type and concentration |
| | XPC, XP4-C | | |
| **Vertex** | Vertex | | |
| | XPV, XP4-V | | |
| **SPM Flex** | 14d | continuous; varies depending on gas type | 2-5 days with constant gas in sample, dependent on the gas type and concentration |
| | 30d | | |
| | XP | | |

Note:

The high consumption of tape can be minimized by utilizing the duty cycle option which is also available for the 7100 and the SPM. Consult your Honeywell Analytics representative.

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# Technical Note

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