



# On-Line Transformer Monitor Operation & Maintenance Guide

Model TM8

810-1652-00 Rev C

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# Introduction

The Serveron On-Line Transformer Monitor is an on-line laboratory-grade gas chromatograph. The Transformer Monitor detects and measures fault gases found in the cooling oil of power transformers. The Transformer Monitor is designed and constructed to operate under those environmental conditions typical of a power substation or generating facility.

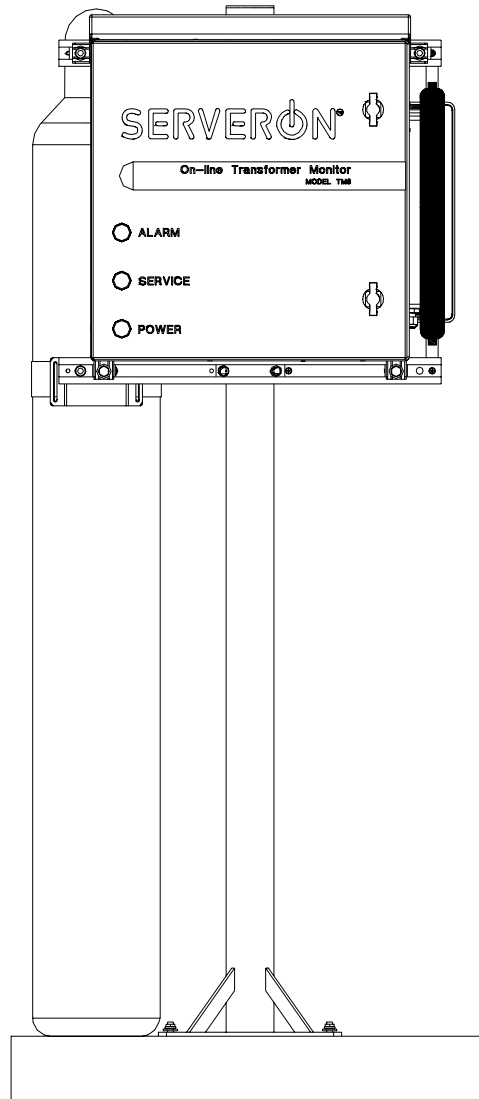


Figure 1: Serveron Transformer Monitor

# Product Symbols

The following symbols are used throughout the Transformer Monitor or accessories. They are defined by the International Electrotechnical Commission, IEC 878 and IEC 417A. It is important for safety reasons to have an understanding of their representation.


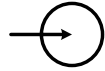
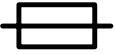




	Voltage Output
	Voltage Input
	Fuse
	High Voltage
	Caution: Refer to On-line Transformer Monitor Installation Guide and accompanying documentation.
	Protective earth (ground)
<b>V~</b>	Alternating Current and Voltage
<b>H</b>	Connect to mains live conductor (brown)
<b>L</b>	Connect to mains neutral conductor (blue)
	The <b>I</b> position indicates the power switch is ON The <b>O</b> position indicates the power switch is OFF

Table 1: Product Symbols

**WARNING** statements in this manual identify conditions or practices that could result in personal injury.

**CAUTION** statements in this manual identify conditions or practices that could result in damage to the equipment or other property.

**NOTE** statements provide additional important information.

# Operation

Once installed, the Serveron Transformer Monitor requires very little setup before operation commences. To retrieve DGA data from the Transformer Monitor, set caution/ alarm levels, sampling schedules etc. use either TM View software or the Serveron Monitoring Service. Refer to the TM View Software User's Manual or the SMS User's Guide. For more information, manuals are available for download from the Serveron web-site or by contacting Serveron directly at [support@serveron.com](mailto:support@serveron.com).

## Calibration

Each Serveron Transformer Monitor is calibrated at the factory. Following installation and commissioning, the Transformer Monitor's auto-calibration feature works once a week to automatically maintain proper calibration. Serveron recommends confirming calibration of your Transformer Monitor every six months by viewing the 'Verification PPM in Gas' graph in TM View (Graph Tools→Maintenance→Verification Data). A manual recalibration should not be required unless a new certified verification cylinder is installed, approximately once every three years. If Serveron has connectivity to the Transformer Monitor during the standard warranty period (12-months from date of install or 15-month from date of sale whichever comes first) Serveron will periodically confirm calibration of the Transformer Monitor as well.

Note: For Serveron Monitoring Service customers, upon installing a new verification cylinder fill out and return the *Verification cylinder datasheet* located near the end of this document and return it to Serveron Corporation.

## Alarm Settings

Following installation of the Transformer Monitor and after an initial 24 hour stabilization period, the gas caution and alarm levels can be set in the Transformer Monitor. These levels can be set using the TM View software which was included with your Transformer Monitor or by the Serveron Monitoring Service.

There are no universal rules regarding the values at which to set the caution and alarm levels in the Transformer Monitor. In the most general case one can disable the caution and alarm settings while the Transformer Monitor runs for approximately thirty (30) days to establish gassing trends and a baseline PPM level for each of the eight gases. After the Transformer Monitor PPM data has been established, you can use the history to set the caution and alarm levels directly or consult with the support group at Serveron Corporation ([support@serveron.com](mailto:support@serveron.com)) to determine the appropriate caution and alarm settings for your transformer.

The following guidelines may be useful for setting the initial gas caution and alarm levels. Keep in mind that these are recommendations; the appropriate caution and alarm settings for your transformer may vary from these recommendations.

## New transformers or transformers with no previous gas data:

Set the Transformer Monitor caution level to 50% and the alarm level to 100% of the low-end CAUTION ppm limits proposed by IEEE PC57.104 Draft 11, published April 21, 2004; except acetylene, as noted below.

Gas	Caution PPM	Alarm PPM	Notes:
Hydrogen	50	100	
Methane	60	120	
Acetylene	2	5	Per Draft 11
Ethylene	25	50	
Ethane	33	65	
Carbon Monoxide	175	350	
Carbon Dioxide	1750	3500	
Oxygen	baseline+10%	Baseline+20%	above initial measured PPM

Table 2: Recommended caution/alarm settings for transformers with no previous gas data

## Transformers with a stable gassing history:

Use the Transformer Monitor to measure the transformer oil for thirty (30) days in order to establish baseline levels of the eight fault gases. Set the Transformer Monitor caution/alarm levels to the measured baseline levels + value (PPM) shown below.

Gas	Caution PPM +value (PPM)	Alarm PPM +value (PPM)	Notes:
Hydrogen	+50	+100	
Methane	+60	+120	
Acetylene	+2	+5	
Ethylene	+25	+50	
Ethane	+33	+65	
Carbon Monoxide	+175	+350	
Carbon Dioxide	+1750	+3500	
Oxygen	baseline+10%	Baseline+20%	above initial measured PPM

Table 3: Recommended caution/alarm settings for transformers with a stable gassing history

## Gassing Transformers which have been degassed:

Set the caution level to 50% and the alarm level to 100% of the low-end CAUTION ppm limits proposed by IEEE PC57.104 Draft 11, published April 21, 2004; except acetylene, as noted below.

Gas	Caution PPM	Alarm PPM	Notes:
Hydrogen	50	100	
Methane	60	120	
Acetylene	2	5	Per Draft 11
Ethylene	25	50	
Ethane	33	65	
Carbon Monoxide	175	350	
Carbon Dioxide	1750	3500	
Oxygen	baseline+10%	Baseline+20%	above initial measured PPM

Table 4: Recommended caution/alarm settings for gassing transformers after degassing

## Transformers with an unstable gassing history which have not been degassed:

There are no recommendations possible for transformers in this category. In order to establish the caution and alarm levels, allow the Transformer Monitor to run for thirty (30) days to establish gassing trends and baseline measurements. After this data has been collected, you should consult with Serveron Corporation ([support@serveron.com](mailto:support@serveron.com)) to determine the appropriate caution and alarm settings for the transformer.

## Viewing Transformer Monitor Data

The Transformer Monitor data can be viewed using the supplied TM View software or the optional Serveron Monitoring Service Client software. A copy of the TM View software and user's manual can be found on the CD that shipped with the Transformer Monitor. Alternatively, the Transformer Monitor can present data to SCADA systems using DNP3 or Modbus protocols. Please contact a Serveron representative for further information regarding the Serveron Monitoring Service or to integrate the Transformer Monitor with a SCADA system

## Front panel lights (Indicators)

The Serveron Transformer Monitor has three colored lights (LED's) located on the front panel. These lights are described in the following Table as they appear on the front panel, from top to bottom.

Light	Notes:
<b>Alarm</b>	The Transformer Monitor has detected one or more gas values equal to or greater than their respective alarm settings.
<b>Service</b>	<p>The Transformer Monitor needs service. The service indicator is activated by a number of Transformer Monitor-specific parameters. For cause identification proceed as follows-</p> <p>TM View: Open TM View program and update the unit database. After updating the database open the event-log and view recorded event condition.</p> <p>Serveron Monitoring Service: Open the Serveron Monitoring Service Client program and view the event log. Contact Serveron's Technical Support group (<a href="mailto:support@serveron.com">support@serveron.com</a>).</p> <p>Note: Depending on the cause for Service, the monitor may need to perform an analysis before the blue Service LED is turned OFF.</p>
<b>Power</b>	The Transformer Monitor is ON.

Table 5: Front panel lights

## Turning On/Off the Transformer Monitor

**CAUTION:** Always ensure helium is being supplied to the analyzer. Never leave the helium inlet to the monitor exposed to atmosphere.

**CAUTION:** The Transformer Monitor is designed to operate continuously. When powering down the monitor for extended periods of time (more than 24 hours), always close the oil supply and return valves to the analyzer.

To isolate (shut off) the oil inlet and oil outlet ports, close the transformer oil supply and return valves or close the Serveron manual DGA (sample port/oil shutoff) valve as well as the Serveron oil return valve on to the bleed fixture.

The figure below is a typical example of one of these valves. There are at least two valves per installation, one for the inlet and one for the outlet. The exact location and number of these valves will vary by installation. The valve is shown in the on position in the following figure.



Figure 2: Oil shut off valve

For whatever reason, if the Transformer Monitor is consistently unable to complete its sample runs, Serveron recommends powering down the Transformer Monitor and closing the supply and return valves (described above) until the exact nature of the problem is understood and/or corrected. This will ensure no damage is caused to the Transformer Monitor.

## Manual DGA Sampling

A manual DGA sample port is installed in-line with the Transformer Monitor oil supply tubing. Serveron recommends this port for correlation of Transformer Monitor data to manual DGA data. The location of the sample port will vary by installation. The sample port provided with the monitor is a 1/4-in locking valve with a 1/4-in FNPT fitting. No special procedures are required when obtaining a manual DGA sample.



Figure 3: DGA sample port

## Operational Parameters

Please see the “Serveron On-Line Transformer Monitor Data Sheet” available online at [www.serveron.com](http://www.serveron.com).

# Maintenance

The Serveron Transformer Monitor has been designed to keep maintenance to a minimum. The following will help you determine the best service plan.

## Helium and Verification Gas

### Helium Gas

The helium gas cylinder will last greater than four (4) years based on the default four hour sampling interval. It is important that the gauge on the regulator be checked quarterly and a leak-check solution applied to fittings biannually to ensure no leaks have developed. The helium cylinder should be replaced when the pressure gauge reads less than 150psi (10.34 bar).

### Helium Dryer

The helium dryer will last greater than four (4) years based on the default four hour sampling interval. A leak-check solution should be applied to the helium dryer fittings bi-annually to ensure no leaks have developed. The helium dryer should be replaced when the helium cylinder is replaced.

## Helium Cylinder and Dryer Removal and Replacement

**WARNING:** When full, the helium cylinder is pressured to greater than 2000psi (138 bar). Helium is regulated to 80psi (5.5 bar), nominal, before entering the monitor, Always follow Compressed Gas Association (CGA) guidelines when handling and transporting compressed gases.

**CAUTION:** Use of helium other than 99.9999% pure research or chromatographic grade with less than (0.2 ppm) H<sub>2</sub>O content will VOID the Transformer Monitor warranty.

- 1)** Turn off power to the Transformer Monitor by opening the Transformer Monitor door and toggling the power switch located in the upper right hand corner to the off position.
- 2)** Turn the helium cylinder valve clockwise to the fully OFF position.
- 3)** Using a 7/16-in wrench, remove the 1/8-in helium inlet and outlet lines from the top and bottom of the helium dryer.

**WARNING:** A small amount of high-pressure helium will be released upon loosening the fitting.

- 4)** Using a suitable wrench, remove the helium regulator from the cylinder valve.

- 5) Carefully support the regulator to prevent any damage to the 1/8-in helium line or regulator.

CAUTION: It is extremely important that no water or other foreign contaminants be allowed to enter the open regulator fitting or tubing.

- 6) Remove the helium cylinder from its mounting bracket.
- 7) Remove the helium dryer from its mounting clips.
- 8) Verify the replacement cylinder meets the following specifications:
  - Chromatographic grade helium
  - 99.9999% pure/Grade (6.0)
  - Less than 0.2 ppm H<sub>2</sub>O
  - CGA-580 fitting
- 9) Position the new helium cylinder in the mounting bracket and secure the cylinder in place.
- 10) Reinstall the regulator onto the helium cylinder. *Do not use Teflon tape or pipe dope.*
- 11) Orient the gauge vertically and tighten the CGA fitting.
- 12) If necessary, reorient the helium cylinder so that the gauge on the regulator can be clearly seen.
- 13) Install the new helium dryer in the mounting clips. The dryer is not flow directional.

Note: Do not remove the helium dryer plugs at this time.

- 14) Verify the helium regulator shutoff valve is closed and slowly turn the valve located on top of the helium cylinder fully counterclockwise (open).
- 15) Slowly turn helium regulator shutoff valve counterclockwise (open) until helium begins to flow. *At this point, gas should be escaping from the stainless steel tubing.*

CAUTION: Do not open the regulator shutoff valve completely to regulate the helium flow.

- 16) Leaving the helium flowing, remove the top helium dryer plug and attach the free end of the 10-ft helium line to the top of the helium dryer.
- 17) With the helium continuing to flow reinstall the line to the bottom of the helium dryer.
- 18) Now turn the regulator shutoff valve fully counterclockwise (open).
- 19) Confirm all four helium connections and the helium regulator to helium tank connections are leak-tight by applying a leak-check solution to the fittings.

Note: The leak check is very important as even the smallest leak can substantially reduce the life of the helium cylinder.

The helium regulator outlet pressure is preset at 80psi (5.5 bar), nominal, and requires no adjustment.

## Verification Gas

The verification gas certification is three (3) years and the cylinder holds enough gas for over 10 years worth of verification runs based on a the default once a week sampling interval. It is important that the gauge on the regulator be checked quarterly and a leak-check solution applied to fittings bi-annually to insure no leaks have developed. The verification cylinder should be replaced when the high pressure gauge reads less than 25psi (1.72 bar).

**CAUTION:** Use of verification gas that does not meet Serveron specifications will VOID the Transformer Monitor warranty.

## Verification Gas Cylinder Removal and Replacement

**WARNING:** When full, the verification gas cylinder is pressured to greater than 500psi (34 bar). Verification gas is regulated to 8psi (0.5 bar), nominal, before entering the Transformer Monitor. Always follow Compressed Gas Association (CGA) guidelines when handling and transporting compressed gases.

The verification gas cylinder is used to automatically verify and calibrate the Transformer Monitor. The cylinder contains a certified NIST-traceable concentration of the eight-transformer fault gases measured by the Transformer Monitor.

- 1)** Turn off power to the Transformer Monitor by opening the Transformer Monitor door and toggling the power switch located in the upper right hand corner to the off position.
- 2)** Turn the verification cylinder tank valve to the fully off (clockwise) position.
- 3)** Using a 9/16-in wrench loosen the verification cylinder to regulator union.

**WARNING:** A small amount of high-pressure verification gas will be released upon loosening the fitting.

- 4)** While supporting the verification cylinder release the Velcro strap retaining the verification cylinder in the bracket.
- 5)** Install the new verification cylinder into the mounting bracket and secure using the Velcro strap.
- 6)** Connect the cylinder to the regulator union and tighten.
- 7)** Turn the knob on the top of the verification cylinder counterclockwise until it is fully open. The regulator requires no pressure adjustment.
- 8)** Confirm that the bottle to regulator connection is leak-tight by applying a leak-check solution to the fitting. Wipe away any excess leak-check solution.

**Note:** The leak check is very important, as even the smallest leak can substantially reduce the life of the verification cylinder.

- 9) For Serveron Monitoring Service users, please complete and return the Verification cylinder data sheet to Serveron after the Verification cylinder is replaced.

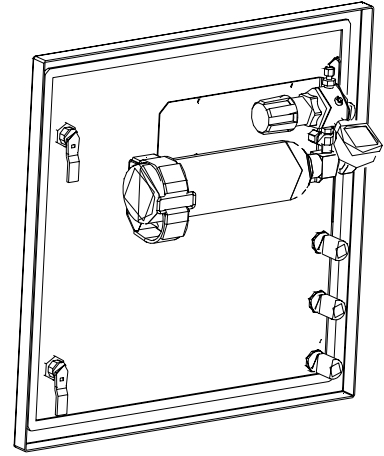


Figure 4: Installed verification cylinder

## Leak Check Fittings

After the first month of continuous use, all regulator, gas and oil fittings should be checked for leaks. A semi-annual check of these fittings is recommended following the one month initial check.

## Replacing Fuses

The Transformer Monitor has a variable input power supply capable of receiving input of 115VAC to 230VAC  $\pm 15\%$ , 50/60 Hz. Current draw is 6A max. at 115VAC and 3A max. at 230VAC. There are three 4A/250V type 3AG (T) fuses installed for the power supply (line and neutral) and the Transformer Monitor's enclosure heater (line).

**CAUTION:** Replace fuses with same type and rating only.

## Oil Filter Service

The Transformer Monitor uses two inline screen type oil filters. Under normal operation, no filter maintenance is required. If service is required, the filter consists of three main parts: the filter housing, filter screen, and the filter cap. For filter service, proceed as follows:

- 1)** Turn off power to the Transformer Monitor by opening the Transformer Monitor door and toggling the power switch located in the upper right hand corner to the off position.
- 2)** Loosen the filter cap while supporting the filter housing with an adjustable end wrench. The exact filter location will vary by installation.
- 3)** After loosening the filter cap, slowly back off the cap until transformer oil starts flowing out the purge hole located on the side of the filter cap.
- 4)** Let the oil continue to flow until a clear stream of oil void of any contaminants is visible.
- 5)** Tighten filter cap
- 6)** Turn on power to Transformer Monitor.



Figure 5: Filter assembly

## Customer Replaceable Units (CRU's)

Customer Replaceable Units (CRU's) are defined as customer replaceable parts onsite without decommissioning the analyzer.

Part Number	Description
270-0004-XX	Helium Dryer
290-0020-XX	Regulator, CAL,
290-0017-XX	Cylinder, Verification
292-0018-XX	Regulator Helium
292-0019-XX	Regulator Helium w/ Pressure Switch
370-0025-XX	LED, Front Panel, Green
370-0026-XX	LED, Front Panel, Red
370-0027-XX	LED, Front Panel, Blue
430-0032-XX	Fuse, TD, 4 Amps, 1/4" x 1 1/4"
750-0076-XX	Column Assembly
750-0084-XX	Assy, Power Supply
250-0130-XX	Filter, Oil
R750-0076-XX	Replacement Column Assembly
R750-0084-XX	Refurbished Power Supply Assy

Table 6: Customer Replaceable Units

Please contact Serveron Product Support ([www.suport@serveron.com](mailto:www.suport@serveron.com)) for removal and installation procedures.

## Cleaning Internal Cleaning

No internal cleaning of the Transformer Monitor is required; doing so may cause damage the internal components and void the warranty.

## External Cleaning

No external cleaning of the monitor is required. If external cleaning is desired, water is the only recommended cleaning solution. Direct spray of high-pressure water onto the monitor door seal, LED's, oil/helium bulkhead fittings and cable glands should be avoided.

# Return Shipping Instructions

Prior to returning parts to Serveron a Return Material Authorization (RMA) number must be obtained from Serveron technical support (Technical Support: (866) 273-7763 E-mail: [support@serveron.com](mailto:support@serveron.com)). Returned items should be shipped in the original packaging or like packaging to avoid shipping damage. If original packaging or like packaging is not available contact Serveron for shipping assistance.

**Warning:** Shipping of the Transformer Monitor without installing the internal foam support, part number (010-0038-XX) can cause damage to the monitor and void the warranty.

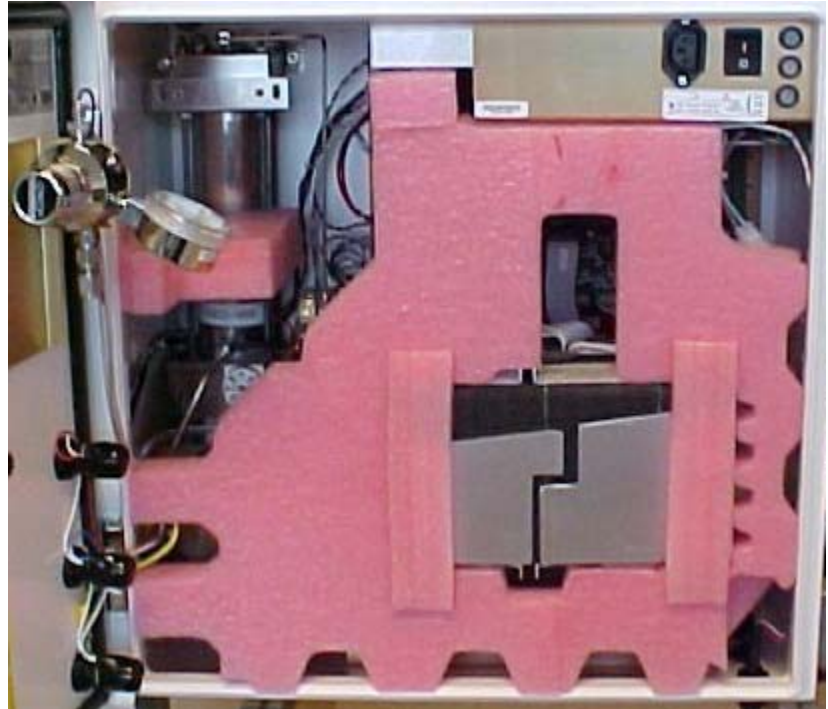


Figure 6: Internal foam support

# Forms

## Verification Cylinder Data Sheet

Upon successful installation of your verification cylinder; please complete and fax or e-mail this Verification Cylinder Data Sheet to the Serveron product support at:  
 +1 (503) 924-3290 *fax*  
 or support@serveron.com *e-mail*

Attn: Serveron Product Support

From: \_\_\_\_\_

**Customer Information**

Company: \_\_\_\_\_

Site: \_\_\_\_\_

Site Address: \_\_\_\_\_

City, State and Zip: \_\_\_\_\_

Country: \_\_\_\_\_

**Gas Cylinder Information**

Installer's Name: \_\_\_\_\_

Installation Date: \_\_\_\_\_ Transformer Monitor Serial Number: \_\_\_\_\_

Helium high pressure gauge (psig): \_\_\_\_\_

Verification high pressure gauge (psig): \_\_\_\_\_

Verification Cylinder Lot Number: \_\_\_\_\_ Verification Cylinder Manufacture Date: \_\_\_\_\_

Verification Cylinder Gas Components		Certified Concentrations
Hydrogen	H <sub>2</sub>	ppm
Oxygen	O <sub>2</sub>	ppm
Methane	CH <sub>4</sub>	ppm
Carbon Monoxide	CO	ppm
Carbon Dioxide	CO <sub>2</sub>	ppm
Ethylene	C <sub>2</sub> H <sub>4</sub>	ppm
Ethane	C <sub>2</sub> H <sub>6</sub>	ppm
Acetylene	C <sub>2</sub> H <sub>2</sub>	ppm

Table 7: Verification cylinder datasheet