



TMx Installation Guide 810-1644-04 Rev C

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# **TM8 On-Line Gas Chromatography DGA Monitor Installation Guide TMx Series**

June, 2017

810-1644-04 Rev C



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## **Contents**

<b>Product Overview .....</b>	<b>5</b>
<b>Product Symbols .....</b>	<b>6</b>
<b>Environmental Conditions .....</b>	<b>7</b>
<b>Warranty .....</b>	<b>7</b>
<b>Items Needed for Installation .....</b>	<b>8</b>
Optional Accessories.....	9
<b>Preparatory Tasks for Installation .....</b>	<b>10</b>
<b>Monitor Installation Overview .....</b>	<b>11</b>
<b>Mounting and Assembly .....</b>	<b>12</b>
Mounting the Pedestal.....	12
Assembling the Stand (Standard Installation) .....	13
Optional Oil Cooler.....	14
<b>Mounting the DGA Monitor .....</b>	<b>15</b>
Mounting to the Pedestal Stand.....	15
<b>Transformer or Wall Mounting .....</b>	<b>16</b>
Tank / Wall Mount Assembly .....	16
With Optional Oil Cooler.....	16
Without Optional Oil Cooler .....	17
<b>Oil Connections .....</b>	<b>18</b>
Oil Tubing.....	18
In-Line Oil Filter .....	19



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Oil Supply and Return Valves .....	19
Manual Sample Valve (optional) / Secondary Shut-off Valve .....	20
<b>Oil Moisture and Temperature (optional) .....</b>	<b>21</b>
Vaisala Oil Moisture / Temperature Probe.....	21
E+E Elektronik Oil Moisture / Temperature Probe.....	23
<b>Gas Connections .....</b>	<b>24</b>
Helium Cylinder / Regulator Installation.....	24
Verification Gas Cylinder Installation.....	25
<b>TMx Electrical Interface .....</b>	<b>26</b>
Power Input.....	26
Wire Termination / Grounding / Shielding.....	26
Ferrite Installation .....	26
<b>External Sensors .....</b>	<b>28</b>
Oil Moisture and Temperature Connections (optional).....	28
LoadGuide® (optional).....	29
Relays.....	29
Aux Inputs.....	30
<b>Pedestal Assembly Drawing.....</b>	<b>31</b>
Pedestal Parts List .....	32
Tank-Mount Assembly Drawing .....	33
<b>Installation Completion Checklist.....</b>	<b>34</b>



## Product Overview

The TM8 On-Line Gas Chromatography DGA Monitor from Serveron Corp. is a remotely-deployed laboratory-grade gas chromatograph which can be safely installed onto an energized or non-energized transformer. The monitor is designed to detect and measure fault gases found in an electrical power transformer's insulating oil. It is designed and constructed to resist environmental conditions relevant to a transformer substation.

Serveron offers two versions of the TMx product. The TM8 measures eight IEEE-recommended fault gases: hydrogen ( $H_2$ ), oxygen ( $O_2$ ), carbon dioxide ( $CO_2$ ), carbon monoxide (CO), methane ( $CH_4$ ), ethylene ( $C_2H_4$ ), ethane ( $C_2H_6$ ), and acetylene ( $C_2H_2$ ). The TM3 measures the three Duval Triangle fault gases: methane ( $CH_4$ ), ethylene ( $C_2H_4$ ), and acetylene ( $C_2H_2$ ). The monitor may be used on conservator or nitrogen-blanketed transformers. The sample of gas is extracted directly from the oil within the transformer.

Oil is circulated from transformer, to the monitor and then returned to the transformer through 1/4-inch O.D. stainless-steel tubing. Stainless-steel tubing is used in conjunction with compression fittings to minimize the risk of leaks. The monitor is equipped with an internal gas extraction system which removes dissolved gases from the circulating transformer oil. Helium is used as a carrier gas to help transport the extracted sample gases through the gas chromatograph.

Data is collected in the monitor each time a gas chromatograph (GC) analysis is completed. The GC analysis takes approximately 45 minutes. Once an analysis has been completed, the TM View software can be used to view the monitor's data. The monitor is set up to perform a sample analysis once every four hours by default. All data captured during an analysis is stored on compact flash memory within the monitor. The compact flash memory holds approximately (2) years of data. The TM View software will allow the end user to track the gas ppm levels over time and monitor the gas levels against user defined caution and alarm settings.

Optional LoadGuide® and Oil Moisture and Temperature sensors are available, along with 4-20mA inputs for use with other external devices. External sensor information can be correlated with fault gas information to allow a complete diagnostic overview of the transformer's condition.



## Product Symbols

The following symbols are used throughout the 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)
V~	Alternating Current and Voltage
H	Connect to mains live conductor (brown)
L	Connect to mains neutral conductor (blue)
$\frac{I}{O}$	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.



## Environmental Conditions

The TMx series is designed to operate within the following outdoor conditions:

- Altitude 4572 m
- Humidity Range 5% to 95%
- Temperature Range -50C to 55C
- Installation Category II

Please note that the altitude, humidity and temperature ranges indicated are considered extended environmental conditions from the minimum ranges required by UL 61010-1, Clause 1.4.1.

## Warranty

Serveron warrants its Goods to be free from latent defects in materials or workmanship for **12 months from the date of shipment**. Serveron will repair or replace, at Serveron's option and without cost to Buyer, any Goods furnished hereunder that are found to contain defects in materials or workmanship during that period. Serveron uses new and reconditioned parts in performing warranty repairs and building replacements. Serveron owns all Goods it has replaced and all parts removed from repaired Goods. It is Buyer's responsibility to return the Goods to Serveron for warranty coverage. This warranty does not cover items damaged in shipment or damages resulting from misuse, neglect, abuse, acts of war or acts of God. Serveron recommends only using the provided shipping material and packing inserts for transportation. **The TMx is designed for pedestal or tank mount in normal transformer operation. It is not designed to be mounted or affixed to the transformer or any other device during transportation.** Doing so is subject to void all and any warranties. Prior to returning any item (whether during the warranty period or out of warranty), Buyer must obtain a Return Material Authorization (RMA) number from Serveron Corporation by calling (800) 880-2552 Monday through Friday, 8 am to 5 pm, Pacific Time or by email at [support@serveron.com](mailto:support@serveron.com). Serveron makes no warranties, expressed or implied, other than the warranties expressly stated in this paragraph. All other warranties, expressed or implied, arising by law or otherwise, including, but not limited to, the implied warranties of title, merchantability, non-infringement and fitness for a particular purpose, are expressly disclaimed.

Serveron's product operation manuals and product installation guides describe approved accessories, options, operating materials and installation methods. Use of accessories, options, operating materials and installation methods not as described will void the warranty.



## Items Needed for Installation



**NOTE:** As each transformer is different, some items may need to be provided by the installer.

Upon receipt of your monitor, it is important to verify the contents of the shipping carton with the packing list. After inspection of the contents, please notify Serveron directly if there are any signs of damage that may have occurred in transit. (**XX** = current revision supplied).

Part #	Description
250-0130-XX	(1) In-line Oil Filter, 1/4" SS Swagelok
250-0144-XX	(2) Nut and Ferrule Set, 1/4" OD, SS
250-0238-XX	(1) Valve, Secondary Shut-off
250-0189-XX	(1) Bleed Fixture
250-0190-XX	(1) Plug, Black Iron, 2" NPT
250-0191-XX	(1) Tee, Black Iron, 2" NPT
250-0192-XX	(1) Nipple, Brass, 1/2" NPT
252-0013-XX	(3) 10-32 Nut
253-0066-XX	(2) 10-32x3/8" Screw
290-0024-XX	(1) Verification Gas Cylinder (ships separately from monitor)
292-0026-XX	(1) Helium Regulator, Dual Stage
385-0038-XX	(5) Ferrite Core, 0.40" ID x 0.735" OD
456-0022-XX	(1) Valve, Oil Return Assy.
456-0026-XX	(1) Oil Supply Port Assy.
610-0268-XX	(1) Mini USB Communication Cable
610-0185-XX	(1) Cable Adapter, Fiber Optic, ST-to-MTRJ
750-0089-XX	(1) 120" Helium Supply Line
900-0057-XX	(1) Pedestal Mount <b>OR</b>
900-0138-XX	(1) Transformer Tank Mount
910-0018-XX	(1) TM View DGA Monitor Software CD

Table 2: Items shipped





## Optional Accessories

Part #	Description
900-0082-XX	Kit, Oil Moisture and Temperature Sensor
900-0058-XX	Oil Inlet Cooler
900-0134-XX	CDMA Cellular Modem, Verizon (US Only)
900-0147-XX	GSM Cellular Modem (Int'l version – modem only, SIM card req'd)
700-0052-XX	Kit, Copper Ethernet
900-0103-XX	Internal Display
300-0004-XX	LoadGuide® Current Transformer
456-0023-XX	Valve, Manual Sample Port

Table 3: Optional Accessories



## Preparatory Tasks for Installation



**CAUTION:** Do not attempt to install your Serveron monitor until you have read and fully understand the procedures outlined in this document.

There are certain tasks that must be completed prior to the installation of the monitor. These tasks are outlined in the Site Preparation Guide (**810-1647-02**) that was sent to you upon acceptance of your order. Additionally, a copy of the guide can be downloaded from [www.qualitrolcorp.com](http://www.qualitrolcorp.com). Please review the Site Preparation Guide and ensure all items on the Site Preparation checklist below have been completed.

## Site Preparation Checklist

The following is a checklist that will help ensure that all the proper steps have been completed.

- Customer Information form filled out and returned to Serveron
- A location for mounting the monitor has been identified
- The transformer oil supply valve (oil supply port) and the transformer oil return valve (oil return port) have been selected



**NOTE:** Serveron recommends a minimum size of 1/2" for the oil supply valve

- Power is available at the installation site for the monitor
- Transformer is oil-filled
- Communication is available to the monitor (if required)
- A cylinder of chromatographic grade helium ( $\geq 99.9995\%$  pure with  $\leq 0.5$  ppm of H<sub>2</sub>O) is onsite
- A **0 to 5** Amp CT has been identified for the optional LoadGuide sensor (if required)
- All shipped items and optional accessories have been located
- Electrical conduit and enclosures have been installed (as required)
- Stainless steel tubing (**316SS, 1/4" OD, 0.035 wall thickness**), enough for each tubing run is onsite



# Monitor Installation Overview

Installation consists of the following steps:

- Pedestal Assembly and Mounting and or Tank-Mount Assembly
- Mounting the Monitor
- Gas Connections
- Wiring Connections
- Oil Connections
- External Sensors

A	Existing Xfmer valve	H	Serveron Bleed Fixture Assy
B	<i>Customer Supplied - 2" NPT Nipple</i>	I	Serveron In-line Oil filter
C	Serveron Oil Supply Valve Assy	J	Existing Xfmer valve
D	Serveron Optional Moisture / Temperature Sensor	K	<i>Customer Supplied - Helium Cylinder, 99.9995%,</i>
E	<i>Customer Supplied - 1/4" SS /316 Tubing, .035 wall</i>	L	<i>Customer Supplied - 120/230 VAC, 6A/3A</i>
F	Serveron Secondary Shut-off / Manual Sample Valve	M	Serveron Pedestal Mounting Stand
G	Serveron Oil Return Assy	N	Serveron Helium Regulator

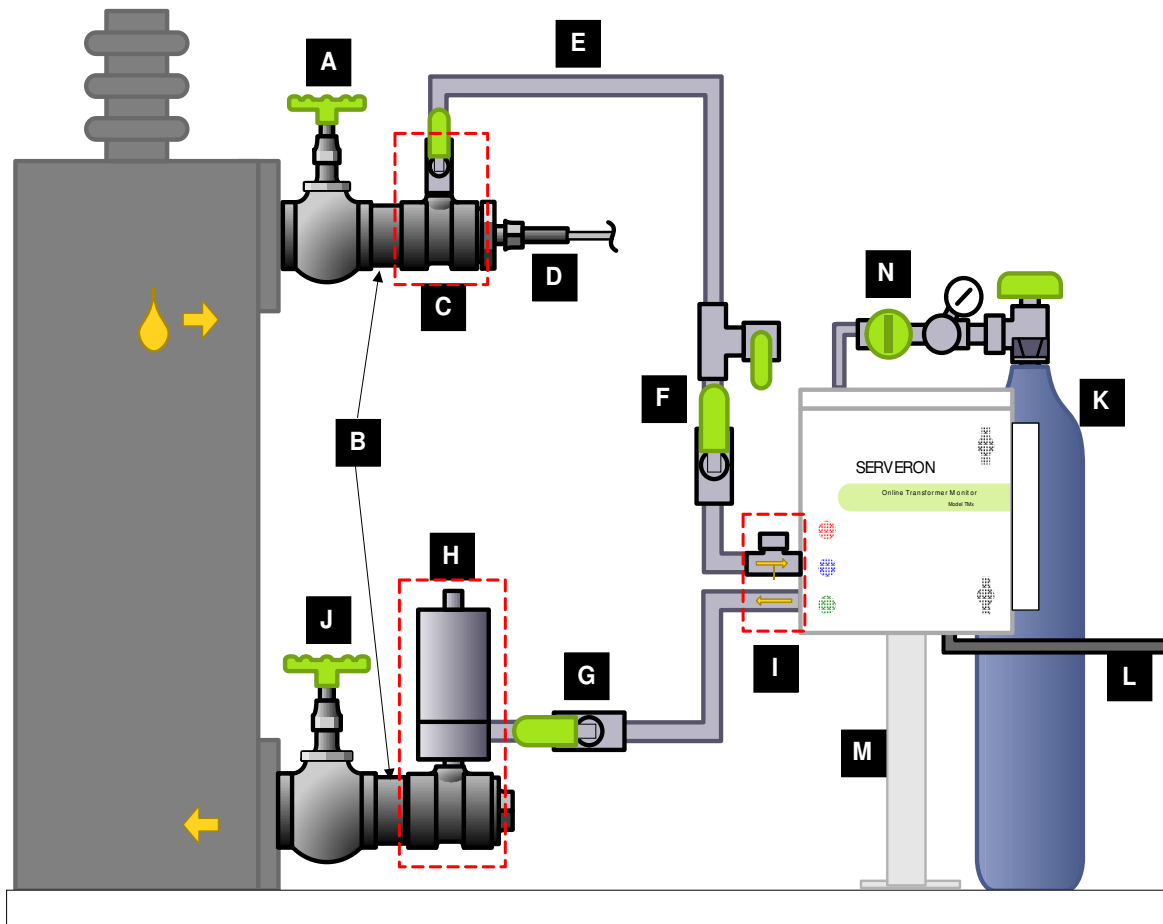


Figure 1: Installation Schematic



## Mounting and Assembly

There are two mounting options for the TMx monitor, pedestal mount or transformer tank-mount. The monitor should be located in a position where it will not interfere with transformer maintenance or access requirements. The front of the monitor must be accessible for commissioning and maintenance. There should be adequate room around the monitor to access the junction box and helium cylinder. The mounting location should also be chosen to minimize the length of supply and return tubing runs.

Items to consider when choosing a location for the monitor are:

- Location of oil supply and oil return ports
- Location of power supply
- Transformer maintenance points
- Access to the monitor
- Available concrete or grating (for pedestal mount)



**NOTE: The monitor must be mounted and operated in an upright position. Failure to do so will void the warranty.**

### Mounting the Pedestal

1. Remove the pedestal stand from the shipping container.
2. Position the stand on the transformer pad or the dedicated monitor pad. The mounting location should have been determined after reviewing the **Site Preparation Guide (810-1547-XX)**.
3. Use the stand as a template and mark the four mounting holes onto the pad. Orientation of the four mounting holes is not important.
4. Temporarily move the stand. Using a hammer drill, drill a 3/8-in x 2-in (5 cm) deep hole at each of the marked locations.
5. Insert the four 3/8-in concrete anchors supplied with the stand.
6. Reposition the stand over the four anchors and install a flat-washer, split-washer and 3/8-in nut onto each of the four anchors and tighten evenly.
7. Using a level, verify the stand-post is within  $\pm 5^\circ$  of plumb in all directions. Use 3/8-in stainless steel washers as spacers under the four corners if leveling is required.



## Assembling the Stand (Standard Installation)

1. Locate the hardware and assemble the pedestal, following the steps below and referring to the **Pedestal Assembly** drawing in the back of this guide.
2. Attach (1) unistrut (item 5) using (1) U-bolt assembly (item 4) with (2) lock washers (item 9) to the stand approx. 3-in (7.6 cm) from the top. Using a 9/16-in deep socket and a level, secure the items to the stand with (2) 3/8 nuts (item 7) without over-tightening and ensure the channel is  $\pm 5^\circ$  of plumb. (*Note: over-tightening will crush the aluminum post.*)
3. On the back side of the stand, mark from the top of the U-bolt assembly 20-in down and attach the second unistrut (item 5) using (1) U-bolt assembly (item 4) with (2) lock washers (item 9) and (2) 3/8 nuts (item 7) to post. (*Note: If the optional Oil Cooler will be installed, fully tighten the lower U-bolt nuts to the stand at this time. Otherwise, wait until the monitor is installed and secured before tightening the nuts.*)
4. Insert (2) spring nuts (item 2) in the top unistrut channel using (2) fully-threaded bolts (item 3) from the rear of channel.
5. Insert (2) spring nuts (item 2) in the bottom unistrut channel.
6. Attach helium tank support bracket and strap to the back of the lower unistrut (items 11 and 12) using (2) bolts, (2) washers and (2) nuts (items 20, 7 and 9).
7. If the optional oil cooler was purchased, proceed to the “Optional Oil Cooler” section.
8. If the oil cooler was not purchased, continue to the section, **Mounting the DGA Monitor**.



## Optional Oil Cooler

The cooler must be installed on the stand prior to mounting the monitor. If you have purchased the transformer pad mount stand, follow the instructions below. If the tank/wall mount will be used, go to the section **Tank/Wall Mount**.

1. Remove the oil cooler from its shipping container.
2. Mount the oil cooler to the upper monitor stand mounting bolts. The oil cooler will be secured using the same hardware used to secure the monitor.



**CAUTION:** If the oil cooler will not be mounted to the transformer pad mount stand, the oil cooler must still be secured by the cooler frame. Oil line fittings and oil tubing cannot support the cooler weight.

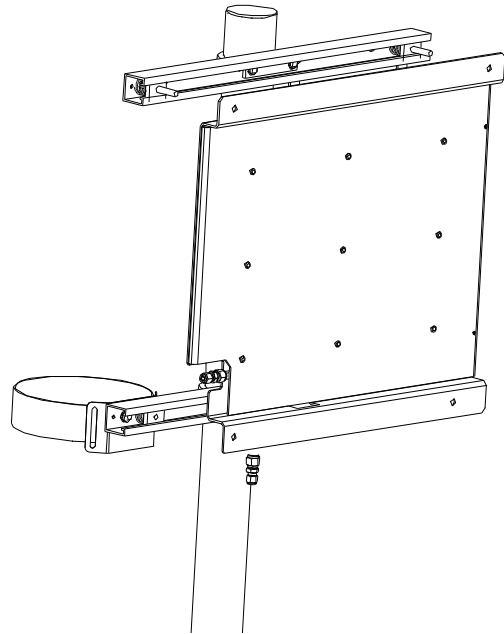


Figure 2: Oil Cooler Mounting



## Mounting the DGA Monitor



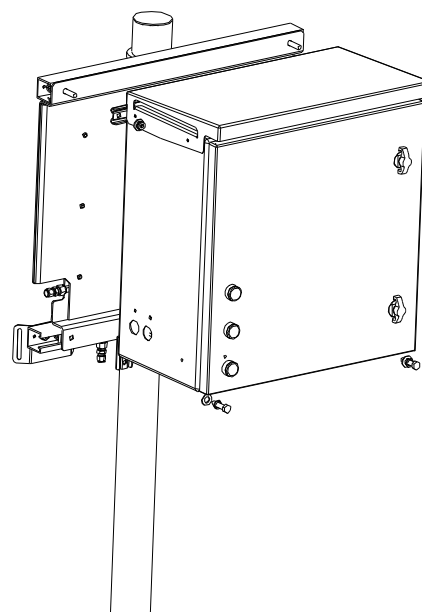
**CAUTION:** The monitor must be mounted and operated in an upright position. Failure to do so will VOID the warranty.



**WARNING:** The weight of the monitor is approximately **90 lbs (41kgs)**. Ensure there are adequate resources to lift the monitor during installation.

### Mounting to the Pedestal Stand

1. Remove the monitor from the shipping container, taking care not to damage the ambient temperature sensor or cable glands protruding from the bottom of the monitor enclosure. *Refer to the **Pedestal Assembly** drawing at the end of this guide.*
2. Attach the monitor to the upper unistrut using the (2) mounting bolts (item 3) and secure with (2) strut washers (item 21 – only if oil cooler will **NOT** be used), (2) flat washers, (2) lock washers and (2) nuts (items 8, 9 and 7) provided with the stand hardware.
3. Position the spring nuts in the lower unistrut so they are in line with the lower monitor mounting tabs. Loosely secure the monitor using (2) strut washers (item 21 – only if oil cooler will **NOT** be used), (2) bolts, (2) lock washers and (2) flat washers (items 6, 8 and 9) to the spring nuts.
4. Using a 9/16-in deep socket, tighten the lower channel on the post if not already done. *(Note: Over-tightening will crush the aluminum post.)*
5. Verify monitor is plumb and level, within  $\pm 5^\circ$  and all mounting hardware is tight.



**Figure 3: Transformer Monitor Mounting**



## Transformer or Wall Mounting

The transformer mounting kit includes the necessary hardware to mount the monitor and helium cylinder to 1 5/8" deep-channel unistrut (optional) or to mounting tabs located directly on the transformer tank.

### Tank / Wall Mount Assembly

1. If unistrut is required, mount (2) 4ft pieces approx. 40" from the ground or pad level (depending on where the helium cylinder will sit) as shown in the figure below:

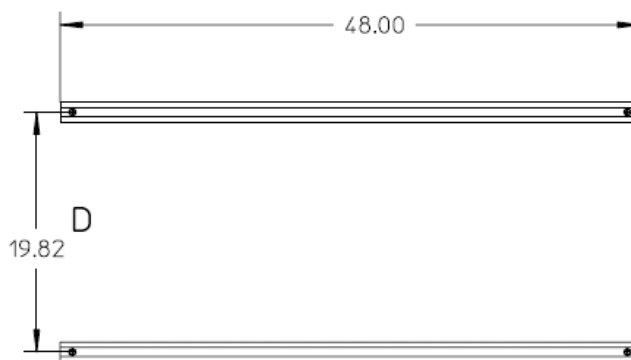


Figure 4: Unistrut Mounting

### With Optional Oil Cooler

Locate (2) 3/8" unistrut spring nuts (**item 1**) (refer to the **Tank/Wall Mount Assembly** drawing" in the back of this guide). Install one on each unistrut rung approximately 2" from the left end.

Locate and unpack the oil cooler. Position the cooler over the unistrut, aligning the mounting holes on the left with the spring nuts previously installed and mark the mounting hole positions on the right side. Set the cooler aside.

2. Install the other (2) 3/8" spring nuts in the locations identified in step 3.
3. Locate (4) 3/8" lock washers, (4) vibration dampers and the grounding strap (**items 11, 12 and 14**). Align the oil cooler over all (4) installed spring nuts. Insert a vibration damper (**item 12**) into each of the top cooler mounting holes to loosely hold it in place. Position one end of the grounding strap (**item 14**) over the lower-left mounting hole between the spring nut and the oil cooler, placing a lock washer (**item 11**) in front of, and behind the strap (**fig 6**). Use the other two vibration dampers to attach the bottom of the cooler to the unistrut. Ensure that all 4 vibration dampers are tight against the oil cooler.





## Without Optional Oil Cooler

1. Locate (4) 3/8" unistrut spring nuts (**item 1**) (refer to the **Tank/Wall Mount Assembly drawing in the back of this guide**). Install one on the upper unistrut rung approx. 2" from the left end and another one 21 1/4" to the right of the first one.
2. Install a third spring nut on the lower unistrut rung approx. 3 1/2" from the left end and another one 18 1/4" to the right of the third one.
3. Install and tighten a vibration damper (**item 12**) on each of the spring nuts on the upper unistrut.
4. Position one end of the grounding strap (**item 14**) over the lower-left spring nut, placing a lock washer (**item 11**) in front of, and behind the strap. Insert a vibration damper through the strap and the lock washers and secure to the spring nut (**fig 5**). Position the other end of the grounding strap over the end of the vibration damper. This will be held in place when the monitor is mounted. Install the last vibration damper in the lower-right spring nut.

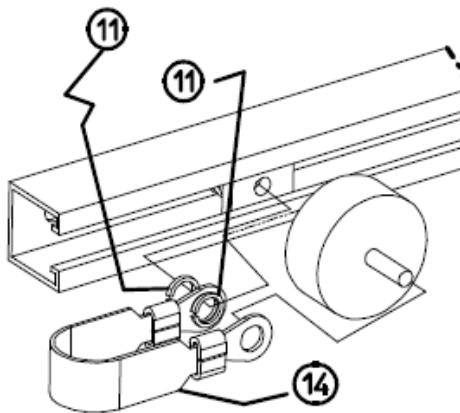


Figure 5: Grounding Strap

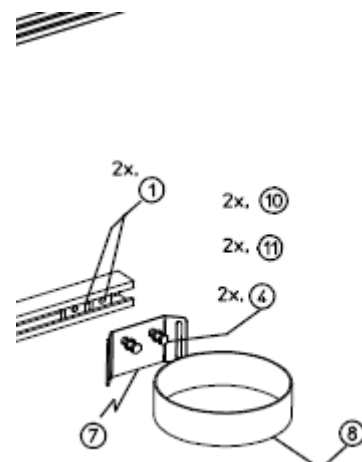


Figure 6: Helium Bracket Assembly

5. Position the monitor over the vibration dampers and secure with (4) flat washers, (4) lock washers and (4) nuts (**items 10, 11 and 9**) provided with the tank/wall-mount hardware.
6. Locate items 1, 4, 7, 8, 10 and 11 (3/8" spring nut, 3/8"x 1.5" bolts, helium support bracket, helium strap, 3/8" flat washer, 3/8" lock washer) and assemble as shown above (**fig 6**).



## Oil Connections

There are several steps that must be followed specifically when connecting the oil supply and return lines. The monitor must be connected to the transformer's main tank in two locations. The first connection supplies oil from the transformer to the monitor (Oil Supply Port). The second connection returns oil from the monitor back to the transformer (Oil Return Port). Refer to the Site Preparation Guide (810-1647-02) for recommended transformer oil connection locations.

To guard against oil leaks, Extra High Density, (1.0 SG or higher) Teflon® tape (PTFE) or Teflon paste should be applied to all pipe-thread connections prior to assembly.



**CAUTION:** The monitor must be mounted and operated in an upright position. Failure to do so will VOID the warranty.



**CAUTION:** Maximum oil inlet pressure is 45 psi (3 bar).

## Oil Tubing

### *Mineral oil*

Serveron recommends oil line installations are performed with Swagelok 1/4" OD, 0.035" wall thickness rigid tubing for all runs **less than 40ft**. For oil runs **greater than 40ft**, 3/8"OD, 0.035" wall thickness tubing should be used. Depending on the environmental conditions, heat-traced tubing may be required for the oil supply line. Flexible stainless oil lines are acceptable if the correct length is used. The inner core should be stainless steel and not Teflon.



**NOTE:** Rigid tubing is generally available in 20ft (6m) lengths. If the tubing is ordered through Serveron, 10ft (3m) lengths will be shipped. The installer is required to provide the necessary unions for the installation.

### *FR3 Oil*

Serveron recommends that installations using this oil type are performed with Swagelok 3/8" OD, 0.035" wall thickness rigid tubing for all runs **less than 30ft**. Oil runs greater than 30ft are not recommended. Depending on the environmental conditions, heat-traced tubing may be required for the oil supply and oil return lines.

The tubing runs are connected to the **Oil Supply valve** (yellow handle) and the **Oil Return valve** (black handle) at the transformer and to the **Oil In** and **Oil Out** bulkhead fittings on the monitor enclosure. Ensure that all cut tubing ends are reamed-out and that the tubing runs are routed so they are out of the way and do not restrict access to the monitor or the transformer.



## In-Line Oil Filter

One in-line oil filter (**250-0130-XX**) is supplied with the monitor to be used on the oil-supply line. The preferred mounting location is close to the monitor's **Oil In** bulkhead fitting (**fig 8**). If this location is not convenient, the filter must be mounted in a location that will allow easy access for filter inspection.

1. Identify the location for oil filter mounting.
2. Install the filter in the oil-supply line with the flow arrow oriented toward the monitor.
3. Install the filter with the cap in a vertical position.
4. Swage the two fittings onto the ¼-in oil tubing, supporting the filter housing with a wrench.



**Figure 8: In-Line Oil Filter**

## Oil Supply and Return Valves

After properly preparing all threaded portions of the oil supply and oil return/bleed fixture assemblies with Teflon® tape and pipe-thread sealant, connect them to the transformer oil supply and return valves, as described below.

1. Secure the Oil Supply Assembly (**456-0026-XX**) to the transformer supply valve, using a 2" NPT nipple, if the transformer valve is 2" NPT (**fig 9**). Ensure that the yellow-handled brass valve is facing upward.
2. Assemble the Bleed Fixture assy parts (**250-0189-XX, 250-0190-XX, 250-0191-XX and 250-0192-XX**) and secure the assembly to the transformer return valve, using a 2" NPT nipple, if the valve is 2" NPT (**fig 10**). Ensure that the bleed fixture is oriented vertically.



Figure 9: Oil Supply Assy



Figure 10: Oil Return Assy / Bleed Fixture

## Manual Sample Valve (optional) / Secondary Shut-off Valve

Included with the monitor accessories is a **Secondary Shut-off Valve** assembly (250-0238-XX - **green handle**) that should be installed in the oil supply line. As an option, a **Manual Sample Valve** (456-0023-XX – **light-green handle**) can be ordered and installed with the secondary shut-off valve as shown below (fig 11). This sampling port will allow the end user to collect manual samples from the same source that the monitor uses. The secondary valve allows the user to stop the incoming oil flow and should be closest to the monitor. Both valves should be installed together (if applicable) in a location that makes it convenient for the user to collect the sample without the need to bend over or get on a ladder.



Figure 11: Manual Sample Valve / Secondary Shut-off Valve



## Oil Moisture and Temperature (optional)

An optional sensor is available to provide measured oil moisture in percent relative saturation (%RS) and calculated moisture in parts per million (ppm), as well as oil temperature in °C. There are two versions of the oil moisture / temp sensor available, but the sensor should always be installed in the oil supply valve, wherever that valve is located on the transformer. Since there are differences in the installation and wiring for both versions, follow the instructions for the version included with your monitor.

### Vaisala Oil Moisture / Temperature Probe

This sensor assembly includes:

- Adjustable-length probe with 5m cable attached
- Transmitter unit and mounting plate
- Rain Shield
- Interface cable (20m)

Install the moisture probe as follows:

1. After installing the male nipple and the Oil Supply Assy on the transformer valve in the orientation shown below (**fig 12**), install the provided 2" NPT x 1/2" NPT reducing bushing packaged with the moisture kit, using Teflon® tape and pipe-thread sealant. If the oil supply tee is not 2" NPT, then a suitable reducing bushing must be supplied to accommodate the 1/2" NPT moisture probe fitting.
2. Install the stainless fitting into the bushing, after preparing the threads.
3. Set the proper depth of the probe by sliding it through its fitting so that the perforated end aligns with the vertical port of the tee fitting (**fig 12**). Once adjusted, insert into the end of the stainless fitting and secure with the nut.

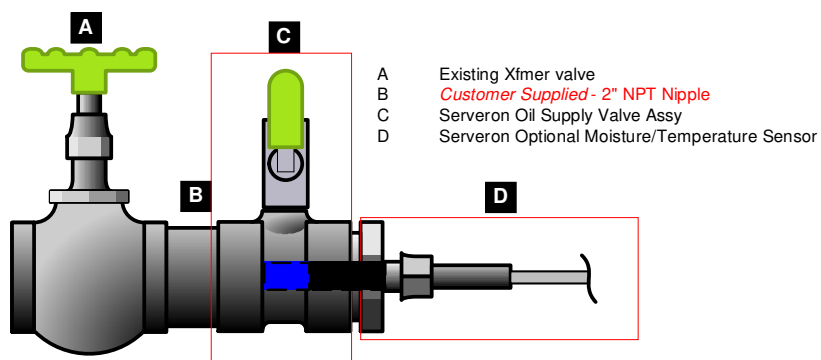


Figure 12 Moisture Probe Installation - Vaisala



**NOTE: All fittings must be stainless steel, brass or black iron. If black iron is being used, it may be beneficial to paint the valve assemblies after installation to prevent any corrosion / rust.**



The location of the transmitter unit will depend on the relative location of the oil supply valve. It should be located as close to the monitor installation (pedestal or tank-mount) as possible. The transmitter unit is secured with two 3-mm hex screws to the mounting base (**fig 13**). If the transmitter is installed in an unprotected outside environment, the rain shield **must** be installed. The base and rain shield are mounted together, then the transmitter is secured to the base. The cable between the probe and transmitter is usually secured to the stainless tubing. Once the transmitter is secured, the 20m interface cable is connected to the other port on the transmitter (**fig 14**) and is cut to length before terminating in the junction box. The wiring connections will be discussed later in this guide (**TMx Electrical Interface**).



Figure 13 Vaisala Transmitter Unit

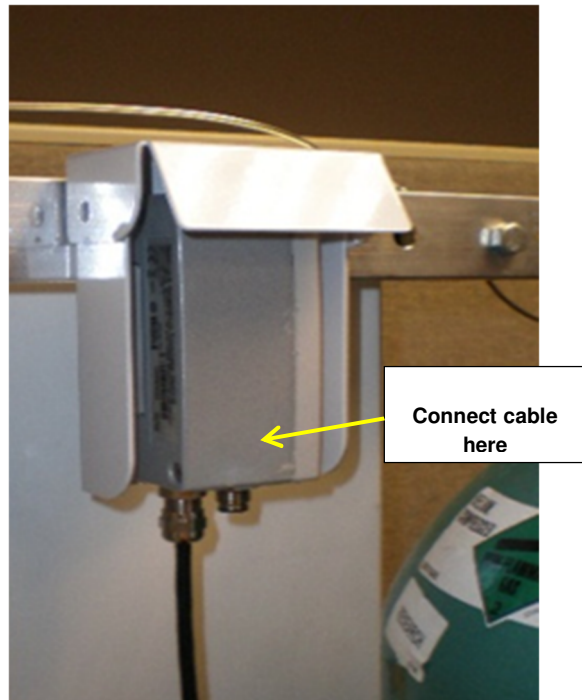


Figure 14 Installed Rain Shield





## E+E Elektronik Oil Moisture / Temperature Probe

This sensor assembly includes (fig 15):

- Non-adjustable probe
- Interface cable (10m)

Install the moisture probe as follows:

1. After installing the male nipple and the Oil Supply Assy on the transformer valve in the orientation shown (fig 12), install the provided 2" NPT x 1/2" NPT reducing bushing packaged with the moisture kit, using Teflon® tape and pipe-thread sealant. If the oil supply tee is not 2" NPT, then a suitable reducing bushing must be supplied to accommodate the 1/2" NPT moisture probe threads.
2. After preparing the probe threads with tape and sealant, install the probe into the bushing and tighten. Insert the connector of the interface cable into the end of the probe and tighten (fig 16). This cable is usually secured to the stainless tubing. The wiring connections will be discussed later in this guide (TMx Electrical Interface).



Figure 15 E+E Moisture Probe



Figure 16 E+E Probe Installed



**NOTE:** The oil temperature range for the E+E moisture probe (-40C to 120C) is different than the default TMx range for the Vaisala probe (-40C to 180C) and will require the scale for the 4-20mA temperature input to be changed in the monitor's configuration. This can be accomplished with the TM Configuration Utility software or through a CLI session in Hyperterminal or another terminal-emulation application.



## Gas Connections



**CAUTION:** The use of helium with purity less than 99.9995% or H<sub>2</sub>O content greater than 0.5-ppm will affect monitor performance and may VOID the monitor warranty.



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

### Helium Cylinder / Regulator Installation



**WARNING:** Do not leave any helium inputs exposed to the atmosphere for extended periods.



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

The helium cylinder must be securely mounted. The monitor installation kit includes a cylinder mounting bracket and strap that meets all Compressed Gas Association (CGA) cylinder restraining requirements.

A 10-ft (305 cm) section of 1/8-in O.D. stainless-steel tubing is provided to connect the helium regulator to the monitor.

1. Install the helium regulator onto the helium cylinder. **Do not** use Teflon tape or pipe dope.
2. Orient the gauge vertically and tighten the regulator fitting to the cylinder valve.
3. Orient the helium cylinder so that the gauges on the regulator can be clearly seen.



**Figure 17: Helium Regulator**

4. Install one end of the 10-ft stainless steel tubing onto the regulator. Do not over-tighten the 7/16-in. nut on the regulator. Install the other end to the helium input fitting on the right side of the monitor.
5. Verify the helium regulator shut-off valve (black knob) is closed and slowly turn the valve on top of the helium cylinder fully counterclockwise (open).
6. Open the helium regulator shutoff valve counter-clockwise.
7. Confirm all helium connections are leak-tight by applying a leak-check solution to the fittings.





## Verification Gas Cylinder Installation



**WARNING:** The verification gas cylinder is pressurized to greater than 500psi (34 bar) and is regulated to 8 psi (0.5 bar) before entering the monitor. Always follow Compressed Gas Association (CGA) guidelines when handling and transporting compressed gases.



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

The Verification Gas cylinder is used to automatically calibrate the monitor. The cylinder contains a certified, NIST-traceable concentration of the eight transformer fault-gases measured by the monitor.

1. Open the analyzer door and locate the Verification cylinder mounting bracket and regulator.
2. Install the Verification cylinder into the mounting bracket and secure using the Velcro strap.
3. Connect the cylinder to the regulator union and tighten.



**Figure 18: Installed Verification Cylinder**

4. Turn the knob on the top of the Verification cylinder counterclockwise until it is fully open.
5. Confirm that the **entire** Verification Gas regulator and gas line connection to the manifold is leak-tight by applying a leak-check solution to the fitting. Wipe away any excess leak-check solution. **Since the delivery pressure is low, it may take a few minutes to notice any foaming develop from a leak with this gas.**



## TMx Electrical Interface

The TMx enclosure includes an integrated junction box design that provides a larger terminal strip with dedicated positions for the various termination options (**fig 19**). This design eliminates the need for a separate junction box, with separate wiring harnesses, simplifying the installation.

### Power Input

The monitor has an auto-switching power supply capable of receiving input of 115VAC **or** 230VAC  $\pm 15\%$ , 50/60 Hz. Current draw is **6A** max at 115VAC and **3A** max at 230VAC. There are **two 4A/250V type 3AG (T)** fuses installed for the power supply (line and neutral) **and two 2.5A/250V type GMD** fuses for the monitor's enclosure heater (line and neutral).

Serveron recommends installing a properly-rated and marked switch or circuit breaker in close proximity as a mains voltage disconnect device.

### Wire Termination / Grounding / Shielding

**Figure 19** specifies terminal block number and function. All possible wiring options are pre-terminated on the **monitor-side** (right-side) of the terminal strip. Not all terminations will be utilized on the **end-user side** (left-side). Terminate only the connections that are required for your particular application.

- Terminals accommodate wire size **AWG #10 - #24**.
- Metallic conduit is bonded to enclosure case.
- Conduit fitting openings are  $\frac{3}{4}$  "
- Earth ground conductor is bonded to enclosure case.
- Shielded cable drain wire is grounded to case.

### Ferrite Installation

Install Ferrite Shields as shown (**fig 19**)

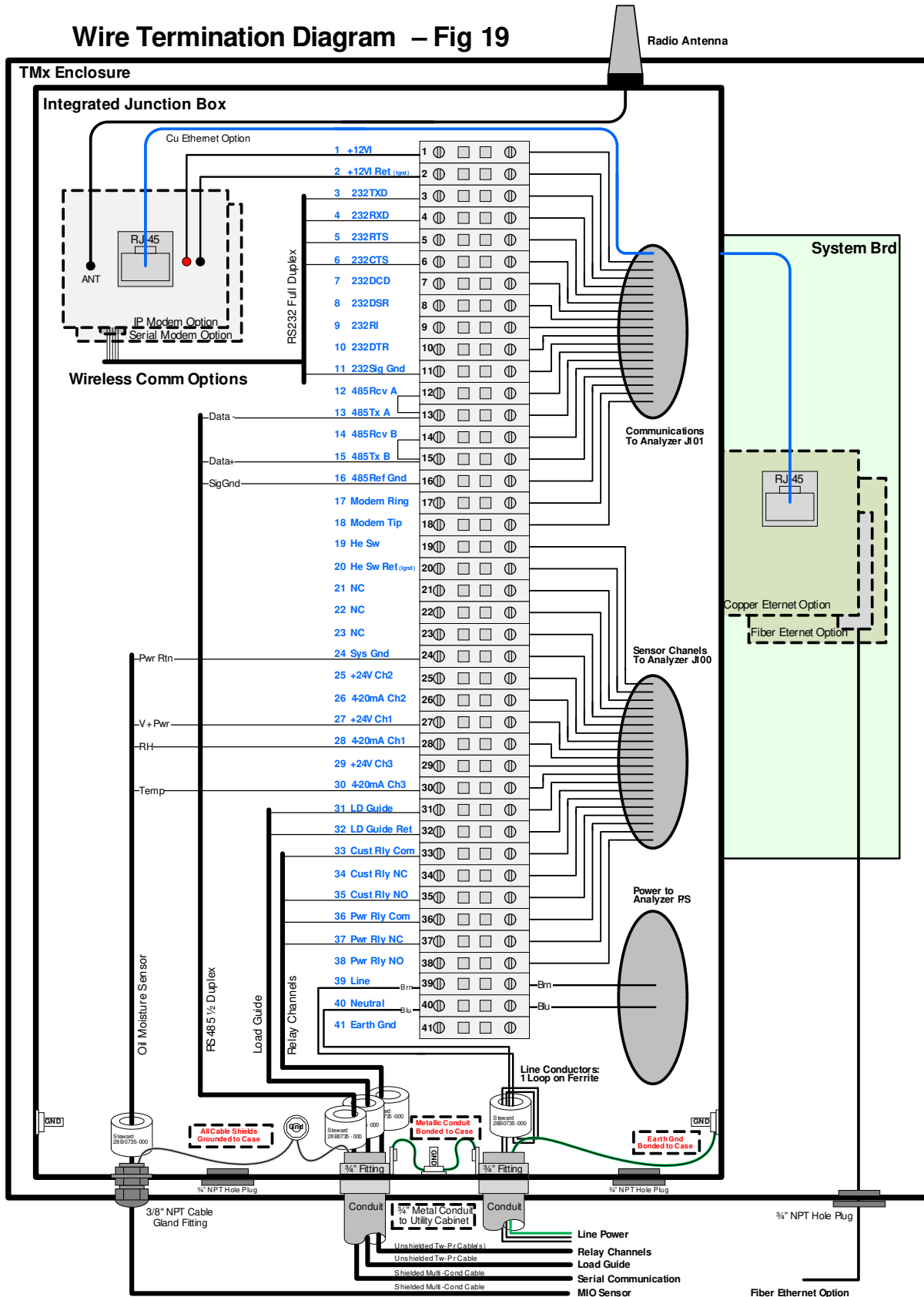
- Power conductors, wrap 1 turn around dedicated ferrite.
- Unshielded conductors (relay channels and LoadGuide®) may share a common ferrite shield.
- Shielded cables (moisture Sensor and serial communications) may share a common ferrite shield.



**NOTE:** The integrated junction box is supplied with openings that will accommodate  $\frac{3}{4}$ " conduit fittings (not included).



Wire Termination Diagram – Fig 19





## External Sensors

### Oil Moisture and Temperature Connections (optional)

The Oil Moisture and Temperature sensor can be configured for 4-20mA or RS-232 output; the recommended configuration is 4-20mA. The sensor can also be wired for **moisture only** or **moisture and temperature**. When using the 4-20mA inputs, always wire temperature to CH3 and moisture to CH1. There are two versions of the MIO sensor: **Vaisala MMT 310** and **E+E Elektronik EE364**.

Please refer to the table below and **Figure 19** for the wiring configurations.

<i>Configuration</i>	<i>MIO Sensor Signal</i>	<i>Wire Color (Vaisala)</i>	<i>Wire Color (EE364)</i>	<i>Terminal Position</i>
<b>Moisture Only</b>	Supply (-) <b>GND</b>	GREY	PINK	24
	Supply (+) <b>+24VDC</b>	PINK	RED	27
	CH 1 <b>(moisture)</b>	GRN	YEL	28
<b>Moisture+Temp</b>	Supply (-) <b>GND</b>	GREY	PINK	24
	Supply(+) <b>+24VDC</b>	PINK	RED	27
	CH 1 <b>(moisture)</b>	GRN	YEL	28
	CH 3 <b>(temp)</b>	YEL	GREY	30

**Table 4: Oil Moisture and Temperature Connections**



## LoadGuide® (optional)

If the optional LoadGuide will be used, install according to the instructions below.



**WARNING: High voltage can be induced by the LoadGuide sensor. Do not clamp the LoadGuide around the transformer CT winding until its wires have been terminated in the junction box.**

1. Locate the desired 0A to 5A CT winding identified within the transformer control panel.
2. Pull the LoadGuide leads from the transformer panel to the monitor junction box. A wire size of 22 AWG or larger can be used to extend the length of the leads.
3. Connect the black and white wires of the LoadGuide to terminal positions **31** and **32** (**fig 19**). Polarity is not significant.
4. Unscrew the white screws from the LoadGuide and remove the back plate from the device.
5. Place the clamp around the 0A to 5A tap.
6. Reinstall back plate and finger-tighten the screws.

## Relays

There are two dry-contact relays (**Programmable** and **Power**). Both relays can be wired and configured for normally-open (**NO**) or normally-closed (**NC**) operation.

**Programmable Relay** - typically configured for critical events such as high gas alarms, but can also be programmed for: gas caution alarms, service-required conditions and aux sensor alarms (**Fig 19** - terminal positions **33** and **34** or **35**)

**Power Relay** - will always report loss of AC power, if wired. It can also be configured for non-critical events such as: gas caution alarms, service-required conditions and aux sensor alarms (**Fig 19** - terminal positions **36** and **37** or **38**)

The relay contact ratings for resistive loads are:

**Max switched Power 100W or 600VA**

**Max switched Current 3A**

**Max switched Voltage 150VDC or 300VAC**



## Aux Inputs

The TMx has three 4-20mA, self-powered (24VDC) auxiliary inputs (AUX1, AUX2 and AUX3) with a common power/signal return and Sys Gnd. The inputs are scalable and can be labeled for name and units. If the moisture and temperature sensor is installed, only one spare input is available (AUX2). The AUX inputs can be configured using either the TM Configuration Utility or through Command Line Interface (CLI), in Hyperterminal or a similar application

### AUX Connections (Fig 19)

- AUX1: +24V **Ch1** (terminal position **27**) / 4-20mA **Ch1** (terminal position **28**)
- AUX2: +24V **Ch2** (terminal position **25**) / 4-20mA **Ch2** (terminal position **26**)
- AUX3: +24V **Ch3** (terminal position **29**) / 4-20mA **Ch3** (terminal position **30**)

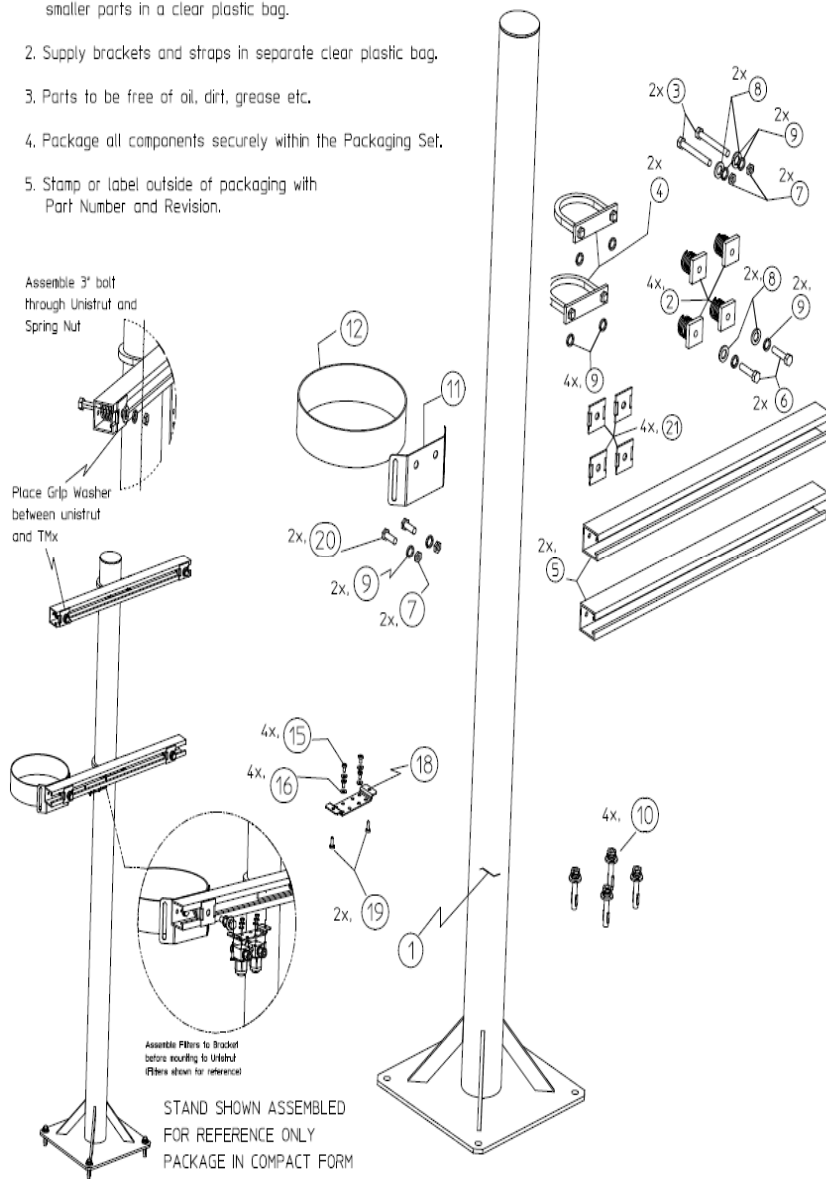


# Pedestal Assembly Drawing

**NOTE:**

1. Supply Misc hardware such as nuts, bolts, washers and smaller parts in a clear plastic bag.
2. Supply brackets and straps in separate clear plastic bag.
3. Parts to be free of oil, dirt, grease etc.
4. Package all components securely within the Packaging Set.
5. Stamp or label outside of packaging with Part Number and Revision.

REVISIONS				
REV #	REV.	DESCRIPTION	DATE	APPROVED
054	A	AS ISSUED		
058	B	ADD ITEMS 8 AND 9, QTY ON ITEMS 15 AND 16 TO 8x		
070	C	ITEM 6 TO QTY 2 FROM 4; ADD ITEM 20; ADD PAGE PIN; UPDATE NOTE 4		
096	D	ADD ITEM 21 - Grip Washer		
	E	Delete Item 13 - Straps		



1	1	140-0190-00	CMP, Stand Post
2	4	291-0011-00	Nut-Mounting w/Spring
3	2	253-0144-00	3/8 Bolts x 3\" Fully Threaded
4	2	291-0010-00	U-Bolt Assy w/Mtg Plate
5	2	291-0009-00	Unistrut-2ft
6	2	253-0071-00	3/8 Bolts x 1.5"
7	4	252-0014-00	3/8 Nut
8	4	254-0070-00	3/8 Flat Washer
9	10	254-0071-00	3/8 Lock Washer
10	4	253-0076-00	3/8 Anchor Bolts
11	1	140-0062-00	He Support Bracket
12	1	190-0001-00	Strap
13			
14			
15	4	254-0023-00	#10 Lock Washer
16	4	253-0070-00	#10-32 x 1/2 Screw
17	1	010-0047-00	Packaging Set (Not Shown)
18	1	140-0203-00	CMP, Bracket Bulkhead
19	2	253-0148-00	#10-16 x 3/4\" Self Drilling Screw
20	2	253-0151-00	3/8 Bolts x .875"
21	4	254-0094-00	Strut Washer, Grip Style

ITEM	QTY.	PART/MATERIAL-DESCRIPTION	MATL.-DWG. NO.
MATERIAL		TOLERANCES	
FINISH		UNLESS OTHERWISE NOTED:	
DO NOT SCALE DRAWING		FRACTIONS ± 0.020 ANGLES ± 0.5° DECIMALS ± 0.005 ± 0.015 ± 0.05 ± 0.15 ± 0.5	
SERVERON PROPRIETARY INFORMATION		NAME _____ DATE _____ DESCRIPTION _____ DRAWN _____ CHECKED _____ ENG. APPR. _____ MFG. APPR. _____ QUALITY _____	
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SERVERON CORPORATION. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SERVERON CORPORATION IS PROHIBITED.		SCALE 10\"/>	

Figure 20 Monitor Pedestal Assembly



## Pedestal Parts List

Item	Part Number	Item Description	QTY	UoM
1	140-0190-00	CMP, Stand Post	1	EA
2	291-0011-00	Clamping Nut w/ Spring, 3/8" - 16, ZPS	4	EA
3	253-0144-00	Screw, 3/8"-16, 3"L, Fully Threaded	2	EA
4	291-0010-00	U-bolt, 3" w/ mounting plate, Zinc	2	EA
5	291-0009-00	Strut Channel, Aluminum, 1 5/8" x 2 ft, 12 Gauge	2	EA
6	253-0071-00	Screw, HHG5, 3/8"-16, 1 1/2"L, ZPS	2	EA
7	252-0014-00	Nut, 3/8"-16, hex, ZPS	4	EA
8	254-0070-00	Washer, Flat, ZPS, 3/8", 7/16" ID, 1" OD, 5/64" Thick	4	EA
9	254-0071-00	Washer, SL, ZPS, 3/8", 0.385" ID, 0.680" OD, 0.094" Thick	10	EA
10	253-0076-00	Screw, AW, 3/8"D, 3"L, 18-8 SS	4	EA
11	140-0062-00	CMP, TG, Mounting Bracket for Helium Tank	1	EA
12	190-0001-00	Strap, Nylon Webbing, 3 Ft, 2"w	1	EA
15	254-0023-00	#10 Lock washer	8	EA
16	253-0070-00	10-32 x 1/2" Screw	8	EA
18	140-0203-00	CMP, Bulkhead Bracket	1	EA
19	253-0148-00	Screw, #10-16 x 3/4" Pan Pozi, Self Drilling	2	EA
20	253-0151-00	Screw, HHC, 3/8" - 16 by 7/8" L, 18-8, SS	2	EA
21	254-0094-00	Washer, Grip Style, 3/8", Galvanized Steel	4	EA

Table 5: Pedestal Parts List





**NOTE:** Your pedestal kit may include additional hardware that is not referenced or required for the monitor installation, and may be discarded.

## Tank-Mount Assembly Drawing

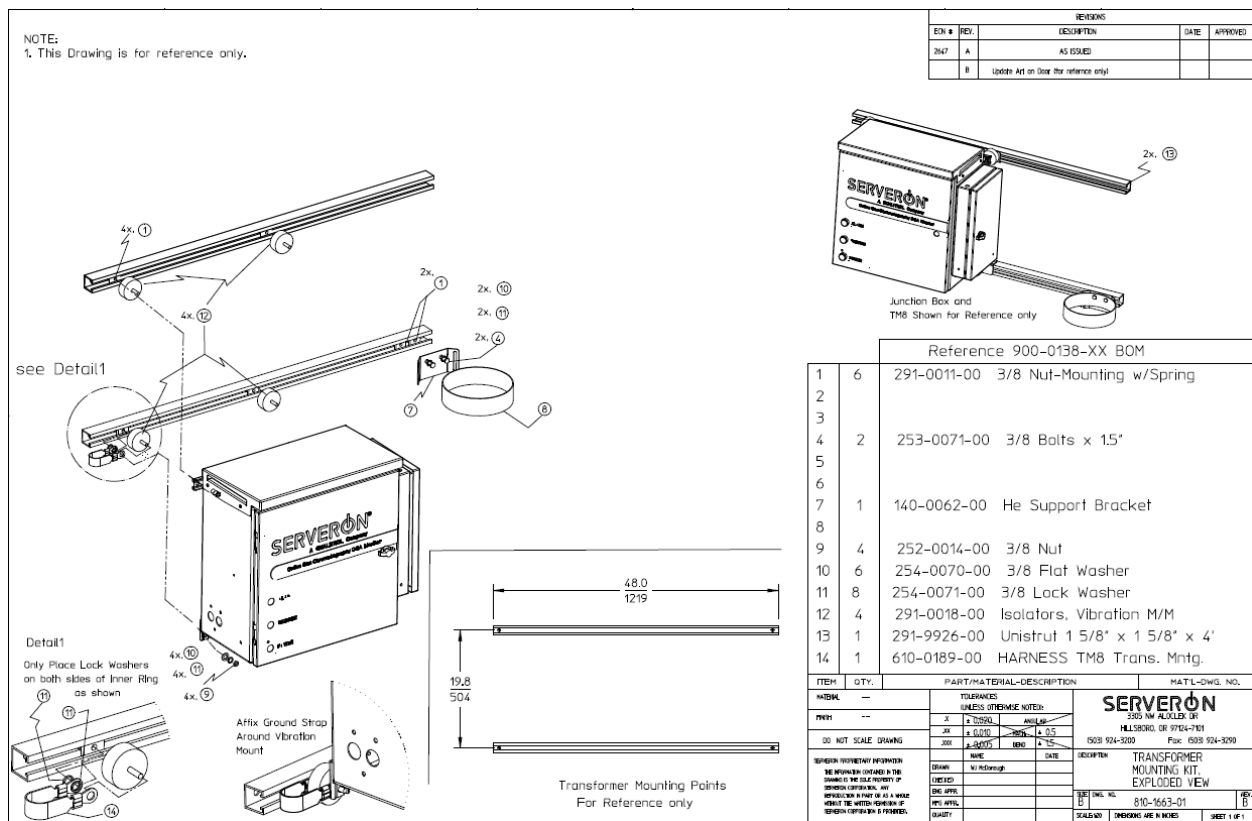


Figure 21: Monitor Tank-Mount Assembly



**NOTE:** Your tank-mount kit may include additional hardware that is not referenced or required for the monitor installation, and may be discarded.



## Installation Completion Checklist

The following steps should be completed *prior* to monitor commissioning:

- Monitor securely mounted on pedestal or tank-mount (with or without optional oil cooler)
- Helium cylinder securely mounted
- Helium regulator installed
- Helium system leak-checked
- Verification cylinder securely mounted
- Verification cylinder system leak-checked
- All oil tubing installed, valve assemblies installed and **closed**
- All compression fittings securely tightened and leak-checked
- All cabling securely routed and safely out of the way
- Any additional electrical conduit and or enclosures installed, and grounded
- Sensor connections (oil moisture / temp) installed, if required
- Communication interfaces installed, if required
- Power connections established (power is **OFF** in the analyzer)



**CAUTION: DO NOT apply power to the analyzer! Power will be applied as part of the commissioning procedure.**



## **Serveron® Field Services**

Serveron provides on-site commissioning, start-up and comprehensive maintenance contracts to all customers worldwide. To further improve reliability, an extended warranty is available on selected products commissioned by Serveron.

## **Serveron® Educational Services**

Serveron professional training (designed to achieve hands-on performance based objectives) prepares operations, maintenance, and engineering personnel to install, test, configure, operate and maintain Serveron products.

## **Serveron® Accelerated Delivery**

Serveron provides accelerated delivery on many products and services including replacements, spare parts and repairs.

## **About Serveron®**

Serveron transformer condition assessment and management tools are critical to utilities in improving grid reliability while optimizing the management and economics of their asset base. We are a leader in on-line DGA monitoring of power transformers with solutions across the entire power transformer fleet. Serveron is a QUALITROL Company.

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