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1. OVERVIEW

This guide covers all aspects of the TRANSFIX installation, including items required prior to the installation date. The following tasks will be covered: plumbing, mounting, tubing, communications, power, tools, supplies and items to purchase checklist. This manual must be read in its entirety prior to installation in order to prepare the site and to obtain the equipment necessary for installation of the TRANSFIX unit.

To ensure a successful installation of the TRANSFIX, careful planning and proper execution of the tasks outlined in this document are essential. This document outlines items to be considered when planning and preparing for the installation of the TRANSFIX. In addition, the GE technical support representative will need specific information in order to provide recommendations for a trouble free installation. If GE is to do the installation, the installation will not be scheduled until all pre-installation assessment work outlined in this document has been completed by both the customer and GE.

The TRANSFIX can be safely connected to an energized or non energized transformer. It is intended that this document is to be used along with the TRANSFIX Installation Record.

2. SYMBOLS USED

The following symbols are used in TRANSFIX and in this document:

![Caution, risk of electric shock.]

3. FEATURES

The TRANSFIX is an On-Line Transformer Insulating Oil Dissolved Gas and Moisture monitoring System for the measurement of the key gases used for transformer diagnostics. These gases are: Hydrogen, Methane, Ethane, Ethylene, Carbon Monoxide, Carbon Dioxide, Oxygen and Acetylene. The TRANSFIX will also measure moisture in oil and transformer load current. The TRANSFIX extracts gas from the oil in the transformer and analyzes it using Photo Acoustic Spectroscopy techniques. The results are stored within the instrument and available for download into a PC.

Key Features

- TRANSFIX utilizes dynamic headspace sampling to extract target gases from the oil sample.
- No consumables such as carrier gases are required.
- Accurate results are available in one hour, no need to wait several hours for gas equilibrium through a membrane.
- Requires virtually no maintenance.
- Uses highly accurate and stable Photo Acoustic Spectrographic technology.
- Full embedded microprocessor with non-volatile internal memory storage for 10,000 records (at least one year of measurement data at one hour sample interval).
- Stainless steel outdoor rated NEMA 4X, IP55 enclosure connected to the transformer by robust stainless steel tubing.
- Manual oil sampling port provided on the TRANSFIX.
- All gas sensing is carried out within the TRANSFIX, no external gas sensors.
- Transformer load tracking available.
- One red and one yellow user configurable sunlight visible alarm LED arrays on the exterior of the enclosure, and six user configurable relay contacts, based on absolute gas and moisture values.
- One green power and one blue service LED array.
- Communication options include: Ethernet, RS-232, Cellular Modem (GSM or CDMA), PSTN Modem, Leased Line Modem, RS-485. Other options are available.
- USB connection provided for commissioning and service and local data download

4. TRANSFORMER CRITERIA

The transformer should meet the following criteria:

- The transformer contains mineral type oils (paraffinic or naphthenic) that meet the requirements of IEC 60296, BS EN 60296, VDE 0370 or ASTM D 3487.
- The transformer oil must be certified PCB free.
- The temperature of the oil at the outlet valve of the transformer is never less than -10°C and never exceeds 120°C.
- The transformer is at atmospheric pressure or above. (see below)
- There are separate return and supply valves available to connect the TRANSFIX to the transformer.
- The ambient temperature in the area where the TRANSFIX resides never reaches less than -40°C and never exceeds 55°C.

**NOTE**

*If the transformer is nitrogen blanketed, check the pressure/vacuum gauge. If the pressure is positive, then the TRANSFIX unit can be installed. If the pressure is negative, a vacuum exists within the transformer. If there is a vacuum in the transformer, air will be drawn into the transformer when a valve is opened. Air bubbles could be damaging to the transformer if the transformer is energized.*

**Do not install a TRANSFIX unit on a transformer that is under vacuum while the transformer is energized.**

5. PLUMBING

The TRANSFIX removes oil from the transformer, extracts the gases, analyzes the gases, and returns the oil to the transformer. The locations from which the oil is removed and to which it is returned are important for the accurate analysis of the gases within the transformer. Refer to Figures 1, 2 and 3.

The oil is removed from one valve of the transformer (supply valve), and returned through another (return valve). The location of supply valve should produce an oil sample that is a well-mixed representation of the transformer oil.

The following pages contain points to consider when choosing where to connect the oil circuit from the transformer to the TRANSFIX.

**Discussion of the transformer valves (refer to figure 3):**

**Fill Valve:**

This valve should not be used as an oil supply valve if the transformer is nitrogen blanketed. There is no guarantee that there will always be oil at this position. However, it is acceptable to return oil through this valve.
Drain valve:
The drain valve may be used as an oil supply or oil return valve. However, it is particularly useful to return the oil to the transformer through this valve as it is near ground level, providing an easily accessible point to bleed the air from the oil lines during the installation.

Oil sampling port
A manual oil sampling port is provided and installed within the TRANSFIX and can be used for obtaining manual oil samples for analysis.

Figure 1. Schematic Representation of the installation

Figure 2. Examples of possible oil line configurations
(Three of many possible configurations)
Ancillary Valves:
Some transformers come with an array of ancillary valves and ports of various kinds. These valves can be a good choice to connect the TRANSFIX to the transformer, although it is important to know how these valves route inside the transformer.

Ensure that the valve chosen to return oil is not internally piped to another location within the transformer such as the headspace or in the internal windings.

Cooling Loop Valves:
The TRANSFIX should only be supplied with oil from a cooling loop valve if there are no other valves available. Do not return oil to the cooling loop unless it is absolutely clear that the cooling is not directed flow and that there are no other alternative valves to which to connect the TRANSFIX.

Figure 3. Possible valve locations on a transformer

All transformers have different valve configurations; the supply and return valves on the transformer will need to be adapted to ¼-inch NPT (FEMALE) to fit properly to the ¼-inch male fittings supplied with the TRANSFIX. Listed below are points to consider when choosing how to properly prepare the oil supply and return valves.

OIL SUPPLY

- The oil is typically taken from a valve midway up on the transformer or from an active cooling loop. It is necessary to ensure that the oil is taken from a location where the oil is well mixed and in the active flow of transformer oil. The oil temperature at this location should not exceed 120°C or be lower than -10°C.

- The valve separation between the oil supply valve and oil return valve should be at least 12” (30 cm), to prevent mixing of the de-gassed oil with the transformer oil being sampled.
o Fittings must be provided to adapt the oil supply valve to a ¼-inch NPT (FEMALE) fitting, using fittings and adaptors made from stainless steel, brass or black iron. **Do not** use galvanized steel, copper or plastic fittings as these materials can negatively affect the gas concentrations in the sample line.

o If the oil supply valve is located more than 6 feet (1.82 m) above the base of the transformer, it is recommended that an additional ¼-inch ball valve be placed in the oil supply line within easy reach while standing, and in an easily visible location. This valve can be used to conveniently shut off the oil supply if required.

**Oil Return**

o The oil is typically returned to a valve lower on the transformer, which can be the transformer drain valve. Do not return the oil into a cooling loop or in a location that leads directly to a critical location within the transformer such as a cooling loop that is designed for directed cooling.

o The oil returning to the transformer **must** be returned through the GE supplied Return Assembly. This assembly incorporates a check valve, a ball valve and a port that facilitates bleeding the system of air during the installation process. The bleed port must be oriented up so that air can be drawn from it. The assembly can be reconfigured to fit the transformer valve and adaptor. This assembly must be adapted from ¼” NPT (FEMALE) to the valve on the transformer.

o If the oil return valve is located more than 6 feet (1.82 m) above the base of the transformer, it is recommended that an additional ¼-inch ball valve be placed in the line within easy reach while standing, and in an easily visible location. This valve may be used to conveniently shut off the oil return if needed.

o It is important to ensure that the return configuration eliminates any air pockets that may be built into the fixture. For example, the use of a Tee on the return valve with the ¼” NPT fitting facing upwards will eliminate any air pocket and drilling a ¼” NPT hole in a valve blanking plate should be offset to the top to eliminate the air pocket it could possibly create.

**6. MOUNTING THE TRANSFIX**

Care should be taken when deciding where and how to mount the TRANSFIX to ensure a proper installation and a level and secure mounting configuration. The following items should be taken into consideration:

o The TRANSFIX should **NEVER** be mounted directly to the transformer without first consulting GE Technical support. The TRANSFIX can be directly mounted on the tank, but only with GE approval of the mounting and anti-vibration arrangement.

o The location for the TRANSFIX should allow easy access to the transformer oil supply and return valves, so that tubing lengths can be kept to a minimum, particularly in extreme conditions of heat or cold. The supply and the return tubing run between the Transformer and the TRANSFIX unit should not exceed 60m (127’) total length.

o The TRANSFIX will normally be mounted on the TRANSFIX mounting stand (see Appendix 4), which can be purchased from GE. If the TRANSFIX mounting stand has not been purchased along with the TRANSFIX, a structurally sound, weather-resistant mounting device that will support the weight (172 lbs/ 78 kg) of the TRANSFIX **must** be provided. See Appendix 3 for a dimensioned drawing of the TRANSFIX. The mounting stand must also be designed to be securely fastened to a flat mounting surface.
The TRANSFIX must be mounted on a flat surface, within 5 degrees of plumb and level on both axes, which is capable of supporting the combined weight of the TRANSFIX and the mounting frame. See Appendix 5 for details of the TRANSFIX mounting stand footprint dimensions.

If a new concrete pad is required, GE recommends that it be at least 61cm (24") wide by 122 cm (48") long and 9cm (3 1/2") thick with #3 (10mm) steel reinforcing bar around the perimeter. (Grounded and bonded per local practice and code.)

The TRANSFIX must not be mounted so that it interferes with the regular maintenance of the transformer.

The TRANSFIX should not be mounted where it will interfere with the airflow of the transformer's cooling system.

The airflow to the vent areas on the bottom and sides of the TRANSFIX must not be blocked or restricted in any way.

At least 75cm (2.5 feet) must be kept clear directly in front of the TRANSFIX. The front door of the TRANSFIX opens for access during the installation, maintenance and operation of the TRANSFIX.

7. TUBING

Stainless steel tubing is used to connect the TRANSFIX to the transformer. The amount of tubing required is based on the location of the TRANSFIX in relation to the valves on the transformer. Stainless steel is the only material that should be used; the use of any other tubing material will invalidate the results of the analysis and void the warranty of the TRANSFIX. See appendix 6 for a full discussion of the tubing.

It is recommended that each section of tubing between the transformer and the TRANSFIX should be installed as one continuous piece. It is important to use as few fittings as possible to reduce restriction and minimize the risk of oil leaks.

Listed below are points to consider when choosing where to route the tubing to the TRANSFIX and estimating how much tubing will be required:

- The route must not interfere with the regular maintenance of the transformer. The tubing should not be routed so that it could be stepped on, tripped over or damaged by activities near the transformer.

- The route should be selected to allow the tubing to be secured to existing structures. It is important that the tubing is adequately secured to the structure of the transformer or ancillary structure, by use of appropriate mounting hardware and fasteners. Swagelok or Ham-Let offers several options of mounting and tube securing devices.

- When measuring the routes chosen for the tubing between the transformer oil supply and return valves and the TRANSFIX, corners, bends and other obstacles that may add to the overall length must be taken into consideration.

- The rigid tubing is typically supplied in 20-foot (6m) lengths (see Appendix 6). If the length of either tubing path exceeds 20' or 6m, ¼-inch stainless steel compression unions will need to be provided along with the tubing. The required amount of tubing, in accordance with the specification in Appendix 6, must be on site the day of the installation.
Bending the rigid tubing is a complicated procedure and sometimes there is a change to the proposed route when the actual installation takes place. It is advisable to order a quantity of tubing about 20% above the estimated requirement.

Flexible tubing is also available, but is more expensive than rigid tubing, and must be ordered in custom lengths.

If the supplied shut off valves are mounted to transformer valves that are 6’ (1.82 m) or more above the ground, an additional ¼-inch stainless steel compression ball valve should be installed in the ¼” tubing at an easy to reach location. This valve should be located not more than 6 feet (1.82 m) above the ground. This will facilitate turning off the oil flow if needed without having to climb to reach the valve. One additional ¼-inch stainless steel compression ball valve is included in the installation kit with the TRANSFIX.

If the oil temperature can fall below -10°, a heat trace may be fitted to the oil pipe to increase the oil temperature before it enters the TRANSFIX unit. An additional power supply and control module for the heat trace is available from GE.

8. COMMUNICATIONS

The TRANSFIX has various communication options available:

A USB slave connection allows serial communications with an external computer. This connection is available on the panel inside the TRANSFIX unit.

There is an Ethernet connection using MODBUS/TCP protocol. This connection is available on the circuit board inside the inner door.

Up to two further communications channels are available. Modules may be selected from the table below, subject to the following restriction: a maximum of one DNP3.0 module may be fitted. The options listed are available at the time of printing – other options may become available. Contact GE Technical Support for further information.

The TRANSFIX can accept multiple masters, and simultaneous communication over several channels is possible. It can support simultaneous communication with three masters over the Ethernet connection plus one master on each of the serial connections and the USB connection.

<table>
<thead>
<tr>
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<th>Carrier</th>
<th>Protocol</th>
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<tr>
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<td></td>
<td>MODBUS/RTU</td>
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<tr>
<td>USB</td>
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<td></td>
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<tr>
<td>Channel A*</td>
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<tr>
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</table>

*Channel A is disabled when DNP3 over Ethernet is selected
9. POWER

- The TRANSFIX contains a power supply that can accommodate 115V or 230VAC 50/60 Hz Single Phase (factory set); the unit draws approximately 8 Amps max. A 10-15A circuit meeting these requirements needs to be available for the TRANSFIX at the time of installation.

- Disconnection from the supply is achieved through the modular fuseholders mounted adjacent to the mains inlet terminals (see figure 5).

- Ensure that mains power to the TRANSFIX unit is connected to a circuit that is continually on to ensure the continuous operation of the unit.

10. EXTERNAL SENSORS

A transformer load sensor is provided in the TRANSFIX Installation Kit, to measure and record the transformer load. The transformer load sensor is a split core current sensor that can be installed unobtrusively around a CT line receiving a feed from the main bushing (usually located within the control cabinet of the transformer). It should be possible to locate a suitable current transformer with a 0-5A secondary circuit on which to mount the sensor. The sensor is supplied with 2.5 m (100") of cable, and may be spliced to the required length to connect to the TRANSFIX with up to a total of 10 meters of 20ga twisted pair cable. Longer cable lengths are possible depending upon the quality of the cable. The load sensor connects to terminals 33 and 34 (see Appendix 7). These are the bottom two terminals on the left hand side of the system board.

11. CONNECTIONS TO THE TRANSFIX

All wires and cables leading into or out of the TRANSFIX are made through four ½” (13mm) conduit connectors on the bottom of the instrument. One is for the mains wires, one is for the heat trace supply (if fitted) and the other two are for communications and sensors. Heat Trace is only required if the oil temperature can fall below -10°C. Unused conduit connectors should be sealed. Conduit connectors may be replaced if necessary. The communications and sensor connections within the instrument are made to screw connections on terminal strips.

12. PRE-INSTALLATION PROCEDURE

The appendices to this document contain drawings, forms and checklists that comprise the information needed to plan and support the installation. The information requested in the forms should be provided to GE as soon as possible and a minimum of four weeks prior to the actual installation date to ensure a timely and trouble free installation and commissioning, unless prior arrangements have been made with the GE Installation Group.

13. MOUNTING STAND INSTALLATION

If the GE-manufactured mounting stand has not been purchased, a stand must be constructed as outlined in Section 5.

It is important that the TRANSFIX should be installed in a secure manner. The GE-manufactured mounting stand must be secured to the mounting surface as follows:

- The stand is shipped with TRANSFIX mounted in the top portion of the stand for ease of handling. Remove the hardware holding the stand together, then remove the top section which is fitted into the larger stand base. See Appendix 4 for drawing of the stand with the TRANSFIX unit mounted.
14. MOUNTING THE TRANSFIX TO THE STAND

The TRANSFIX weighs 78kg, (172lbs), so it is important to take precautions prior to lifting the TRANSFIX onto the mounting stand. GE recommends that three able persons are used to mount the TRANSFIX to the Mounting Stand; two persons to lift the TRANSFIX and top stand into place and one to fasten the mounting stand together. The following steps are recommended for mounting the TRANSFIX to the Mounting Stand.

- Have all hardware needed to join the two parts of the stand ready and within reach.
- Be sure the Mounting Stand lower portion is adequately secured to the mounting surface in the desired position, and within five degrees of level and plumb.
- The person who will fasten the hardware to the TRANSFIX stand should have the mounting hardware conveniently within reach.

Figure 4. TRANSFIX unit mounted on stand

- At least two able persons will be needed to lift the TRANSFIX, and the person who will attach the hardware should guide them into position. (Be sure to lift the TRANSFIX by the upper stand and do not lift by the vents, cooler, door, etc as this could damage the unit).
- Position the top stand over the bottom stand, then fasten them together with the bolts, nuts and washers supplied and secure them adequately.
It is also acceptable to carefully lay the mounting stand on its back and place the TRANSFIX on the stand while on the ground, then securely fasten and carefully lift the stand and TRANSFIX upright and connect it to the mounting surface with appropriate hardware.

15. ELECTRICAL CONNECTIONS

The TRANSFIX contains a power supply which can accommodate 115 or 230V (-10%/+15%) VAC 47-63Hz. The TRANSFIX operates using 8A max Single Phase.

- Use a 10 - 15A circuit meeting these requirements.
- Be sure the circuit selected is “on” continually to provide continuous uninterrupted power to the TRANSFIX.
- Ensure that the ON/OFF switch is in the OFF position. Open the front panel on the right-hand-side of the TRANSFIX unit by turning the ¼-turn fasteners anticlockwise.

![Figure 5. Location of mains supply and heat trace terminals.](image)

Route the mains supply cable through the front right cable gland on the bottom of the instrument and the front grommet in the stainless steel enclosure. Remove the outer sheath of the cable for approximately 50mm (2”) and connect the cables to the terminals as shown in figure 5.
The outer sheath of the mains supply cable should continue into the equipment as far as possible so that reinforced insulation is maintained between the operator and mains supply.

The mains supply should be connected so that the protective earth wire should be the last wire to take the strain and break free in the event of the cord being pulled.

Tighten the cable gland to secure the cable.

Attach a Wurth 74271132 ferrite to the mains supply cable as close as possible to the cable gland (see figure 6).

Disconnection from the supply is achieved through the modular fuseholders mounted adjacent to the mains inlet terminals (see figure 5).

If the heat trace is to be used, connect the heat trace supply cable through the rear cable gland and grommet in a similar fashion (figure 5). Heat Trace is only required if the oil temperature can fall below -10°C. The heat trace terminals are protected by a 10Amp fuse (10A 500V (gG), 10x38mm).

Ensure that the selector switch for the heater supply voltage is set to the correct supply voltage 115V or 230V (Figure 7). The switch is situated on the circuit board on the back wall of the enclosure.

Disconnect the power supply at the incoming fuses before accessing the board.

The TRANSFIX has a ¼" (6mm) bonding lug located on the bottom of the

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Figure 6. Ferrite fitted to mains supply cable

Figure 7. Switch for Power Supplies
enclosure on the right-hand side. This should be connected to earth ground per local practice and code (see figure 8).

![Transfix Casing](image)

**Figure 8. Earth Terminal on bottom of enclosure**

- The mounting stand should also be connected to earth ground per local practice and code.

**NOTE:** If the TRANSFIX is powered up in cold conditions (less than -10°C), the unit will perform a Cold Start sequence. The internal heaters will be switched on. The main DC power supply will not switch on. Once the TRANSFIX unit has warmed itself up to -10°C, the DC power supplies will be switched on. See TRANSFIX User Guide (40-0097-01) for more details.

**NOTE:** After the DC power supplies have switched on, the internal temperature of the TRANSFIX may take several hours to come up to working temperature before a measurement cycle will begin.

The TRANSFIX uses a lithium coin cell battery. The lithium coin cell battery is a long-life battery and may never need to be replaced. The battery is accessed behind the front panel, which can be opened by turning the ¼-turn screws. If battery replacement is necessary, save the TRANSFIX data, as it will be lost when the power is off and the battery is removed. Switch off the TRANSFIX while it is in Standby. Slide the battery out of its cover (see figure below). Replace with a new battery in the same polarity. Dispose of the used battery in accordance with local regulations. Switch the TRANSFIX on again. Battery Type: Lithium Coin Cell, CR2450 3V 620mAh.

**CAUTION:** There is a danger of a new battery exploding if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Do not dispose of the battery in a fire or with household waste. Contact your local waste disposal agency for the address of the nearest battery deposit site.

Perchlorate material - special handling may apply. See www.dtsc.ca.gov/hazardouswaste/perchlorate
16. CONNECTION TO OIL SUPPLY VALVE

See Section 5 for a discussion of valve selection.

- Inspect the valve on the transformer chosen for the oil supply line. Identify the materials needed to adapt the oil supply valve to a ¼-inch NPT female fitting. Select fittings and adaptors made from Stainless Steel, Brass or black iron. **Do not** use galvanized steel, copper or plastic fittings as these materials can negatively affect the gas concentrations in the sample line.

- All pipe fittings should be installed with Teflon tape and/or other quality pipe thread sealant applied to the male threads and adequately tightened to prevent leaks.

17. CONNECTION TO OIL RETURN VALVE

See Section 5 for a discussion of valve selection.

- The return line to the transformer must be returned through the Return Assembly supplied in the Installation Kit (see figures 9-12). This assembly incorporates a check valve and port that facilitates bleeding the system of air during the installation process. The bleed port must be oriented up so that air can be drawn from the top. The assembly can be reconfigured to fit the transformer valve and adaptor. This assembly must be adapted from ¼”-inch NPT (FEMALE) to the valve on the transformer.

![Figure 9. Bleed Assembly on Flange-type Oil Return Valve](image)

If a flange type valve is to be used to return the oil, and the flange will be drilled and tapped to ¼” NPT female, the drilled hole should be offset to the top of the internal valve diameter to prevent an air pocket from being trapped behind the flange. See figure 10.
Figure 10. Flange example

Figure 11. Bleed Assembly on threaded type Oil Return Valve

- See figure 11 for proper arrangement of the supplied return assembly.
GE highly recommends that all threaded pipe fittings are wrapped tightly with two wraps of PTFE tape. (Large pipe fittings may require three wraps). A light coating of PTFE paste is then applied over the taped threads. Both of these items are included in the installation kit.

18. FITTING STAINLESS STEEL TUBING

The stainless steel tubing should be fitted between the transformer and the TRANSFIX unit as follows:

- Ensure the supply line is connected to the OIL IN port on the TRANSFIX, which is the bulkhead fitting at the bottom of the TRANSFIX closest to the right-hand-side when viewed from the front. This line will route to the transformer supply valve.

- The return line will connect to the OIL OUT port of the TRANSFIX, which is the bulkhead fitting at the bottom of the TRANSFIX located closest to the left-hand side when viewed from the front. This line will then route to the return assembly at the transformer valve.

- Ensure all tubing is adequately and properly secured to the transformer or other available structures as necessary.

- All **tube** fittings (compression) must be installed without any type of thread sealant applied.

- Ensure that the stainless steel tubing is clean and de-burred before installing the tube fittings.

- Tighten tube fittings per the instructions below: (As outlined in Swagelok or Ham-Let Documentation)
1. Insert tubing into the Swagelok or Ham-Let tube fitting.

2. Make sure that the tubing rests firmly on the shoulder of the tube fitting body and that the nut is finger-tight.

3. Mark the nut with a fine tipped permanent marker at the 6 o'clock position.

4. While holding fitting body steady, tighten the nut 1 1/4 turns to the 9 o'clock position.

**DO NOT** open the valves on the transformer or the stainless steel tubing until commissioning the TRANSFIX unit.

19. TERMINAL BLOCK

The TRANSFIX unit has screw terminals to provide connections to the alarms, telephone, and Transformer Load sensor. These are located on the back of the front panel (see Appendix 7). Communications modules and optional analogue inputs are also located on this circuit board. All communications and sensors wires and cables leading into or out of the TRANSFIX are made through one of the two 1” (25mm) left-hand-side cable glands on the bottom of the monitor. There are cable tie bases on the inner side of the front panel to allow the cables to be secured.

*NOTE: After the TRANSFIX has been in operation, there may be hot components within the inner compartments. Care should be taken that all items have cooled down before carrying out any work within the inner compartments, including inside the front panel.*

**Alarm Connections**

The TRANSFIX has six user configurable alarm relays plus a power indication relay. These relay outputs are available on the terminal strip (see Appendix 7). Alarm1 operates the Service lamp. Three connections are provided to each relay: **N/O** Normally Open, **N/C** Normally Closed and **COM** Common. Each alarm relay can handle a maximum of 5A @ 250VAC, 200mA @ 125VDC or 5A @ 30VDC (see App. 7).

**By using the TRANSCONNECT software the user can program the TRANSFIX to alarm on many different combinations of results. A caution or alarm state will activate a chosen relay which will open or close the contacts and can also activate the front panel LED’s.** Refer to the TRANSCONNECT user guide for more information on setting alarms.
The Relay **SERVICE** and the blue Service LED are energized when an error condition is detected by the TRANSFIX during a sample run by internal error checking. The Service LED will be switched off again after the next sample run if the error condition is no longer present.

- The Relay **WATCHDOG POWER** is energized anytime the TRANSFIX Unit is connected to mains power and the Processor within the TRANSFIX unit is operating.

**Accessory Power**

+12VDC and +24VDC at 0.7A to supply accessories such as wireless modems and protocol converters is supplied power supply circuit board on the back wall of the enclosure (see Figure 13).

![Accessory Power Terminals 12V and 24V](image_url)
Appendix 1 Installation Tools and Supplies

Listed below are the tools and supplies needed to complete the installation of the TRANSFIX. If GE performs the installation, the GE installation engineer will provide these tools.

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>9/16” Combination wrench (Must be 9/16” Imperial)</td>
</tr>
<tr>
<td>1</td>
<td>30cm (12”) Adjustable wrench</td>
</tr>
<tr>
<td>1</td>
<td>35-40cm (14”) Pipe Wrench</td>
</tr>
<tr>
<td>1</td>
<td>1/8” flat blade screwdriver</td>
</tr>
<tr>
<td>1</td>
<td>1/4” flat blade screwdriver</td>
</tr>
<tr>
<td>1</td>
<td>#2 Phillips screwdriver</td>
</tr>
<tr>
<td>1</td>
<td>¼” Tubing Bender</td>
</tr>
<tr>
<td>1</td>
<td>¼” Tubing Cutter</td>
</tr>
<tr>
<td>1</td>
<td>¼” Tubing De-burring Tool</td>
</tr>
<tr>
<td>1</td>
<td>Non metallic Tape Measure</td>
</tr>
<tr>
<td>1</td>
<td>Level capable of indicating plumb and level within 5 degrees</td>
</tr>
<tr>
<td>1</td>
<td>Permanent Marker (fine tip)</td>
</tr>
<tr>
<td>1</td>
<td>22-14 Gauge wire cutter/stripper</td>
</tr>
<tr>
<td>1</td>
<td>Small diagonal cutting pliers</td>
</tr>
<tr>
<td>1</td>
<td>Quality vacuum pump with approximately 3’ of clear ¼” tubing fitted with a ¼” compression fitting at the end of the tubing.</td>
</tr>
<tr>
<td>1 roll</td>
<td>12mm (½”) width Teflon pipe sealing tape or Teflon pipe compound</td>
</tr>
<tr>
<td>1 roll</td>
<td>20mm (¾”) width Teflon tape</td>
</tr>
<tr>
<td>25</td>
<td>30cm (12”) Nylon UV resistant cable ties</td>
</tr>
<tr>
<td>25</td>
<td>20cm (8”) Stainless steel cable ties</td>
</tr>
<tr>
<td>1</td>
<td>Laptop computer meeting the requirements outlined below</td>
</tr>
</tbody>
</table>

The following items need to be on site to secure the mounting stand, to tighten 2” pipe fittings (if used) and to complete the installation. Due to size and weight restrictions, GE is unable to bring these items to the site and they should be provided by the customer.

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12mm (1/2”) capacity hammer drill with 9.5mm (3/8”) masonry bit</td>
</tr>
<tr>
<td>1</td>
<td>36” pipe wrench if large fittings are used to provide oil to the TRANSFIX</td>
</tr>
<tr>
<td>1</td>
<td>Ladder or scaffolding to obtain access to valves (if needed)</td>
</tr>
<tr>
<td>1</td>
<td>Small bucket to contain the oil during the bleed process</td>
</tr>
<tr>
<td>1</td>
<td>Bunch Absorbent rags</td>
</tr>
</tbody>
</table>

Cleaner; to clean the unit and any oil that may have been spilled during the commissioning process.
Appendix 2 Items that the customer must supply

These items **must** be on site at the time of installation

- Parts needed to fabricate a mounting stand, if the TRANSFIX mounting stand has not been purchased (Section 5)
- Correct number of 20-foot or 6m lengths of stainless steel tubing (Section 6)
- Proper fittings to adapt the transformer Supply valve to ¼” NPT (FEMALE) (Section 4)
- Proper fittings to adapt the transformer Return valve to ¼” NPT (FEMALE) (Section 4)
- ¼-inch compression ball valve, if required (Section 4)
- ¼-inch stainless steel compression unions, if the length of either tubing path exceeds 20 feet (Section 6)
- Prepared, flat mounting surface (Section 5)
- Communications option tested and located at the installation site. (Section 7)
- Circuit capable of –115 or 230V (-10%/+15%) VAC 50/60Hz. 15A max Single Phase (Section 8)
- Preferred conduit and wire to make the connections within the TRANSFIX (Section 11)
- Tools and supplies needed to complete the installation. (Appendix 1)
- Laptop computer, if required (Appendix 1)
Appendix 3 Transfix Dimensions

TRANSFIX weight 78kg, (172lbs)
All dimensions in mm, tolerance +/−5mm
Appendix 4 TRANSFIX Mounting Stand Dimensions

All dimensions in mm, tolerance +/-5mm

Appendix 5 Transfix mounting stand footprint dimensions
Appendix 6 Tubing Specification and Ordering Information

**Specification:**

<table>
<thead>
<tr>
<th>Rigid Tubing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼-inch X 0.035 wall T316 seamless stainless steel tubing (6.35 mm O.D. X 0.889 mm wall) (ASTM A269/A213)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flexible Tubing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼-inch ID Low-Pressure, 316 Stainless Steel braid over Stainless Steel Metal Flexible Hose with welded ¼” compression fittings on each end.</td>
</tr>
</tbody>
</table>

**Example Supplier Order Information:**

<table>
<thead>
<tr>
<th>Rigid Tubing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube OD: 1/4 in.</td>
</tr>
<tr>
<td>Tube Wall Thickness: 0.035 in</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flexible Tubing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swagelok FL series of Flexible SS hose is acceptable. It must be ordered in custom lengths from Swagelok well in advance of the installation. An example part number of a custom of an 8 meter hose from Swagelok would be FL4TA4TA4-800cm. See the Swagelok website or local Swagelok representative.</td>
</tr>
</tbody>
</table>

**Warning:**

Stainless steel is the only material that should be used; the use of any other tubing material will cause reliability issues or inaccurate results and **VOID** the warranty of the TRANSFIX.  
(See the discussion on the next page.)

**Tubing Unions:**

Used to connect two pieces of the above ¼” tubing together.  
Swagelok: SS-400-6 Stainless Union, 1/4 inch OD.  
Ham-Let: 762L SS 1/4 Stainless Union, 1/4 inch OD

**Shut Off Valve:**

If the oil supply or return valve is located more than 6 feet (1.82 m) above the base of the transformer, place a Swagelok: SS-4P4T Stainless Plug Valve, 1/4 inch Tube fitting or a Ham-Let: H800MSSL Stainless Plug Valve, 1/4 inch tube fitting as directed in this procedure.

**6mm Tubing Adaptors:**

If ¼” tubing is not available, 6mm Stainless Steel tubing may be used, if this is the case, the maximum tubing run is reduced to 15m and ¼” to 6mm tubing adaptors **MUST** be used.

The adaptors should be Swagelok: SS-6M0-R-4 Stainless Reducer, 6 mm OD - 1/4 inch OD or Ham-Let: 767LT SS Stainless Reducer, 6 mm OD – 1/4 inch OD. At least eight of these are required for the installation.

**Use of 6mm tubing without the above adaptors will void the warranty.**
DO NOT USE COPPER TUBING:

GE does not support using Copper tubing for the installation of its transformer analysis products. The reasons for this are outlined below:

**Flow Rate:**
The solid, seamless stainless steel tubing that GE specifies is 316 Stainless Steel, 1/4" diameter with a 0.035" wall thickness, most 1/4" copper tubing has a thicker wall thickness which reduces the flow rate. If it does have a 0.035" wall it is too fragile to place in the field. Bends in standard soft copper tubing crush and deform more and thus reduce the flow much more in copper tubing than in properly bent Stainless steel tubing.

**Physical Damage and Connection reliability:**
GE has two overriding primary design and installation rules for the Transformer products of which TRANSFIX is one:

- Rule One is to NEVER let oil out of the customer's transformer during operation.
- Rule Two is to NEVER let air into the customer's transformer during operation.

Copper tubing in general is too soft to create a reliable long term seal at the connections in the vibratory environment of a transformer. The connections will eventually leak. We therefore cannot insure that the installation will remain leak free. The softness of copper tubing also makes it prone to damage after the installation. It can easily get kinked, pinched and even torn from the connection by maintenance and service activities near the transformer.

**Compounds in the transformer oil that react with copper:**
Transformer oils contain compounds that can react with copper. One notable compound is Acetylene which when it comes in contact with copper forms copper acetylide. This creates two problems, copper acetylide is a highly explosive compound and for regulatory and health and safety reasons, our equipment or installations cannot create these compounds. The second issue is that this reaction will change the chemical makeup of the oil before it reaches the sensor in the TRANSFIX. This will cause the TRANSFIX to measure acetylene and possibly other gasses inaccurately. While it is true that a transformer has a huge amount of copper inside of it, the job of our test equipment and its installation is to accurately measure the gasses in the oil of the transformer without affecting the oil being measured, the use of copper tubing does not allow this.

For these reasons, GE will not guarantee or perform warranty work on a TRANSFIX unit that has been installed using copper tubing or any other tubing than the stainless steel specified above.
Appendix 7 TERMINAL CONNECTION BOARD

Terminal 1

Terminal 3

Terminal 9

Terminal 15

Ethernet - MODBUS TCP/IP

Ethernet - DNP3

Hinged side

Terminal 27

Optional Module 1

Optional Module 2

Module 1

Module 2
### PSTN interface

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TIP</td>
<td>PSTN interface</td>
</tr>
<tr>
<td>2</td>
<td>RING</td>
<td></td>
</tr>
</tbody>
</table>

### Digital Outputs

<table>
<thead>
<tr>
<th>Spacer</th>
<th>NO</th>
<th>Service Alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COM</td>
<td>Watchdog Alarm</td>
</tr>
<tr>
<td></td>
<td>NC</td>
<td>Alarm 2</td>
</tr>
<tr>
<td>Spacer</td>
<td>NO</td>
<td>Alarm 3</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>Alarm 4</td>
</tr>
<tr>
<td></td>
<td>NC</td>
<td>Alarm 5</td>
</tr>
<tr>
<td>Spacer</td>
<td>NO</td>
<td>Alarm 6</td>
</tr>
<tr>
<td></td>
<td>COM</td>
<td>Alarm 7</td>
</tr>
</tbody>
</table>

*Alarm Relay Max Ratings: 5A @ 250VAC, 200mA @ 125VDC or 5A @ 30VDC.*

### Digital Inputs

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>DIG IN 1+</td>
<td>Digital Input channel 1, positive</td>
</tr>
<tr>
<td>28</td>
<td>DIG IN 1-</td>
<td>Digital Input channel 1, negative</td>
</tr>
<tr>
<td>29</td>
<td>DIG IN 2+</td>
<td>Digital Input channel 2, positive</td>
</tr>
<tr>
<td>30</td>
<td>DIG IN 2-</td>
<td>Digital Input channel 2, negative</td>
</tr>
<tr>
<td>31</td>
<td>DIG IN 3+</td>
<td>Digital Input channel 3, positive</td>
</tr>
<tr>
<td>32</td>
<td>DIG IN 3-</td>
<td>Digital Input channel 3, negative</td>
</tr>
<tr>
<td>Spacer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Analog Inputs

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>ANALOG IN A</td>
<td>Analog input - Load sensor, positive</td>
</tr>
<tr>
<td>34</td>
<td>ANALOG IN B</td>
<td>Analog input - Load sensor, negative</td>
</tr>
<tr>
<td>Spacer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIGITAL INPUTS**

Digital inputs are DCD inputs with maximum voltage level 12V. The switching voltage inputs level is approximately 2.5V. The three digital channels are separate from each other.

Digital inputs are not available through PERCEPTION software but can be read through the Modbus protocol.

**OPTIONAL COMMUNICATIONS MODULES**

The following drawing details the connections for RS232 and RS485 connections including DNP3.0.
To comply with EMC requirements a Wurth 74271112 ferrite has to be fitted when making connections to the RS232 or RS485 modules using connector P1. See below for example placement on the RS 485 cable, similar placement should be used for the RS 232 cable.

**OPTIONAL ANALOGUE INPUTS**

The circuit board is provided with one load sensor input as standard (terminals 33 and 34 above). There is space to add up to 5 additional analogue input modules. The terminals for the module types currently available are shown below:

**Load sensor**

![Load sensor module diagram]

C \( \text{A}_{\text{IN}+} \)
D \( \text{A}_{\text{IN}-} \)

**4 – 20 mA with optional 24V supply**

![4-20mA module diagram]

24V B C GND

4-20mA module

**PT100 3-wire or 4-wire**

![PT100 module diagram]

A B C D E

PT100 module

**A** Terminal 1
B Terminal 2
C Terminal 3
D Terminal 4

**3-wire**

E Screen of sensor cable

**4-wire**

A Terminal 1
B Terminal 2
C Terminal 3
D Spacer
CUSTOMER CONTACT AND SITE INFORMATION

Company: ________________________________
Address: ________________________________
City, State and Postcode (Zip): ________________________________
Country: ________________________________
Phone: ________________________________

Installation Site Name: ________________________________
Site Address: ________________________________
City, State: ________________________________
Postcode (Zip): ________________________________
Country: ________________________________

Primary Corporate Contact:
Name: ________________________________ Title: ________________________________
Address: ________________________________
City, State and Postcode (Zip): ________________________________
Country: ________________________________
Phone: ________________________________ Mobile#: ________________________________
Email address: ________________________________
Secondary Contact Name: ________________________________ Mobile#: ________________________________

Primary Site Contact:
Name: ________________________________ Title: ________________________________
Address: ________________________________
City, State and Postcode (Zip): ________________________________
Country: ________________________________
Phone: ________________________________ Mobile#: ________________________________
Email address: ________________________________
Secondary Contact Name: ________________________________ Mobile#: ________________________________

Map to Site:
Please attach a detailed map on how to get to the Site or GPS coordinates.
Transformer Information

Make: ___________________________  Year: _____  Years in Service: _____

Type:
- Conservator ☐
- Nitrogen Blanketed ☐
- Other: ____________________________

MVA Rating: ____________________________

CT ratio: ______

Condition of Desiccant: ____________________________

Attach several photos showing of the transformer and surrounding area ☐

Attach all available DGA data ☐

Total Dissolved Gas: __________ ppm (Sum of all measured gases)

Please describe any major maintenance that has been required:
Such as rebuild, vacuum degassing, filtering .... (Attach separately if necessary.)
________________________
________________________
________________________
________________________

Transformer Oil

Oil Capacity: ________ gallons (_____ liters)

Manufacturer: ______________________  Type: ______________________

Certified PCB free:  Yes ☐  No ☐

Temperature range at oil supply valve:  High _______ °C  Low _______ °C

Temperature range at oil return valve:  High _______ °C  Low _______ °C

Transformer Nitrogen Blanket (if applicable)

How frequently does the nitrogen bottle need to be changed?
_________ Years  _______ Months

Headspace pressure: ________ psi (kPa, bar)
PRE-INSTALLATION PHOTOS

Take Digital Photos of the following areas of the installation.

Valves/Plumbing:
- Proposed Return Valve location
- Proposed Supply Valve location
- Alternative Return Valve location
- Alternative Supply Valve location
- Secondary Shut-Off Valve location (if needed)
- ¼” Stainless Steel Oil Tubing Routing (Supply & Return).

Proposed Monitor location:
- Overview from Front
- Overview from Left Side
- Overview from Back
- Overview from Right Side

Proposed Cables routing and connection locations:
- Communication Cable Routing (include terminations).
- Power Cable Routing (include terminations).

Transformer:
- Nameplate Photo
- Oil Temperature Gauge
- Oil Level Gauge
- Control Panel w/ Door Open
- Overview of each side
- Cooling Loop(s)
- Conservator with close-ups of gauges
- Pumps
- Desiccant

Additional Photos:
- Any additional devices used in conjunction with the Installation, such as; Junction Boxes, Telephone Line Sharing Devices, Alternative Communication Devices, etc...
- Overall site photos
- Any other useful photographs