GE
Digital Energy

Kelman TRANSFIX™ Family Installation Manual

Transformer Oil
Dissolved Gas and Moisture Monitor

imagination at work

Contents

NOTE: New document reference: TRANSFIXFAMILYIM replaces 40-0095

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1. OVERVIEW

This manual can be used for the installation of any of the following Kelman TRANSFIX family products:

- TRANSFIX 1.6
- MULTITRANS
- TAPTRANS

TRANSFIX family products are on-line DGA (Dissolved Gas Analysis) and moisture monitoring systems for the measurement of key gases used in transformer diagnostics. Differences between the products are always qualified by the use of the respective product name and operational details can be found in the respective product user guides.
This manual details the installation requirements and procedure, including important *pre-installation* tasks to be considered when planning and preparing for the installation. It also examines topics, such as plumbing, tubing and mounting among other tasks and requirements - including tools, supplies and items to purchase.

This manual must be read in its entirety *prior* to installation so as to prepare the site and obtain the necessary equipment. It is intended that this manual be used along with the Installation Record (see Appendix I).

To ensure success, careful planning and proper execution of the tasks outlined in this manual are essential. 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 perform the installation, the installation will *not* be scheduled until all *pre-installation* tasks outlined in this manual are complete (as performed by the customer and GE).
TRANSFIX family products can be safely connected to an energised or non-energised transformer, although all installation personnel must be made aware if working in an energized environment and should observe suitable health and safety practices, especially when working with conductive materials such as stainless steel installation tubing. If either of the oil supply or return valves to be utilized bring personnel within restricted approach boundaries then the transformer must be de-energized and isolated before such work is performed.

2. STORAGE

For long-term storage (exceeding 1 week) customers are requested to store TRANSFIX family products in a fully enclosed building, protected from weather conditions and free from damp and extremes in ambient temperature above 30 °C or below 2 °C.
For short-term storage of less than 1 week, it is acceptable to store the products in the open air provided they are protected from wet weather and direct sunlight exposure by a suitable customer-provided waterproof covering and also provided that outside temperatures do not exceed 45 °C or fall below 0 °C.
Unless specifically requested by a customer, the palletised package of a new unopened TRANSFIX and MULTITRANS includes the top section of the steel mounting stand so as to provide mechanical support for stacking. In this case, unopened packages can be stacked up to 3 pallets high provided no other items are stacked on top.

NOTE: TAPTRANS packages do not include a mounting stand top section, so are unsuitable for stacking.

NOTE: Customers are fully responsible for ensuring that stacked pallets are stable and, if necessary, providing additional external support. Any damage to the TRANSFIX family products caused by poor customer storage or handling will not be covered under the GE warranty.

3. PRE-INSTALLATION REQUIREMENTS

The appendices to this manual contain additional information, such as drawings, forms and checklists that need to be reviewed and completed *prior* to the installation (see Appendix A – I). This relates to materials and facilities that need to be ordered, acquired and in place well in advance of the scheduled installation date. Confirmation of this needs to reach GE as soon as possible, at a minimum four weeks prior to the installation date, unless prior arrangements have been made with the GE Installation Group. This aids in planning and supporting the installation thereby ensuring a trouble-free commissioning process.

4. SAFETY SYMBOLS

The following symbols are used on the TRANSFIX family products and in this document:

General Warning or Caution. Refer to the Installation Manual / User Guide to prevent injury or damage to the equipment.

Electrical Hazard. Risk of electric shock.

Primary Protective Earth connection.

Hot surfaces may be present.

This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including amendment 1, or a later version of the same standard incorporating the same level of testing requirements.

5. SAFETY WARNINGS

If the equipment is installed or used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

If working at height, third parties must have received appropriate training for working at height prior to work commencing. This includes, but is not limited to "Working at height training".

If working at a height greater than 4 feet or at a height greater than that stipulated by national or site regulatory requirements, it is the responsibility of the installer to ensure that planned work complies with those requirements. They shall also ensure that any third-party equipment is suitable and safe before commencing work.

Once installed, the TRANSFIX family products may have more than one source of supply. Disconnect all supplies at their source before accessing the cabinet for servicing. Follow the site lockout-tagout (LOTO) procedure.

6. TECHNICAL SPECIFICATION

PARAMETER	VALUE/MEETS
GAS MEASURED	**MEASUREMENT RANGE (PPM) AND ACCURACY**
Hydrogen (H_2)	5 – 5,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Methane (CH_4)	2 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Ethane (C_2H_6)	2 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Ethylene (C_2H_4)	2 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Acetylene (C_2H_2)	0.5 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Carbon Monoxide (CO)	2 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Carbon Dioxide (CO_2)	20 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) *1
Oxygen (O_2)	100 – 50,000 Accuracy ± 10% or ± LDL (whichever is greater) *1
Nitrogen (N_2) (Available on free-breathing transformers only)	10,000 - 100,000 ppm Accuracy ± 15% or ± LDL (whichever is greater) *1
Moisture (H_2O)	0 – 100% RS (given in ppm)
ENVIRONMENTAL	
External temperature range	-40 °C to 55 °C
Oil temperature range	-20 °C to 120 °C *2
Altitude	Up to 2000 m
Atmospheric pressure	Up to 1050 mbar
Operating humidity	10 – 95% RH non-condensing
Enclosure	IP55
Weight	72 kg (159 lb) TRANSFIX 1.6 88 kg (194 lb) TAPTRANS 76.5 kg (169 lb) MULTITRANS
POWER REQUIREMENTS	115/230 V AC (factory set), 50/60 Hz, 8 A Max
Single phase Alarm Relays: NO and NC provided	5 A 250 V AC, 200 mA 125 V DC, 4 A 30 V DC
Fuses *3	10 A 500 V (Cooper Bussmann BAF), 10x38 mm
MEASUREMENT FREQUENCY	Variable – Once per hour to once every 4 weeks

1 NOTE: Accuracy quoted based on accuracy of detectors during calibration.

2 NOTE: Based on testing carried out using VOLTESSO™ 35 mineral oil over a ¼ in. pipe run of 10 metres or less from oil supply or return valve to monitor connection point, and on transformer oil supply valve volumes of 200ml or less. For oil temperatures colder than -20 °C, GE recommends the use of heat trace cabling on piping.

3 NOTE: Use only the approved and recommended fuse to ensure continued fire protection and compliance.

7. TYPE TESTS

Category	Standard	Class/Level	Test
EMC Emissions – EN 61326-1:2006	CISPR 11	A	Radiated & Conducted Emissions
	FCC Part 15	Meets the requirements of A	Radiated & Conducted Emissions
	EN 61000-3-2	A	Harmonic Current Emissions Limits
EMC Immunity – EN 61326-1:2006	EN 61000-4-2	IV	Electrostatic Discharge
	EN 61000-4-3	III	Electromagnetic Field Immunity
	EN 61000-4-4	III	Electrical Fast Transients
	EN 61000-4-5	III	Surge Immunity
	EN 61000-4-6	III	Conducted RF Immunity
	EN 61000-4-8	IV & V	Magnetic Field Immunity
	IEC 61000-4-9	X	Pulsed Magnetic Field Immunity
	IEC 61000-4-10	X	Damped Oscillatory Magnetic Field Immunity
	EN 61000-4-11	III	Voltage Dips & Interruptions
	IEC 61000-4-12	X 2.5 kV & 1kV	Oscillatory Wave
	IEC 61000-4-18	X	Damped Oscillatory Wave
	EN 61000-3-3	Pst 10 min, Plt 120 min	Voltage fluctuations & flicker
	EN 60255-5	5 kV, 2 kV & 500 V DC	Impulse, Dielectric & Insulation resistance testing
Environmental	IEC 60068-2-1	-40 °C	Cold
	IEC 60068-2-2	55 °C	Dry Heat
	IEC 60068-2-6	10 – 150 Hz, 0.5g operation 10 – 150 Hz, 0.5g endurance	Vibration
	IEC 60068-2-30	55 °C, 95% RH	Damp Heat
	EN 60529	IP55	Degree of Protection
Safety	IEC 61010-1		2010
	EN 61010-1		2010
	UL 61010-1		2nd Edition
	CSA C22.2 No 61010-1		This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or later version of the same standard incorporating the same level of testing requirements

8. FEATURES

TRANSFIX family products are on-line DGA and moisture monitoring systems that measure all the fault gases used for transformer diagnostics. These gases are: **hydrogen, methane, ethane, ethylene, carbon monoxide, carbon dioxide** and **acetylene**. In addition they also measure **oxygen** and **nitrogen**.

TRANSFIX family products extract gas from the transformer oil and analyze it using advanced Photo-acoustic Spectroscopy techniques. TRANSFIX family products also measure moisture in the oil and the transformer load current. All these results are stored within the product, but can be downloaded to a PC for analysis.

In addition, the MULTITRANS version has the facility to measure oil from three separate oil tanks, for example, three transformer tanks operating in a single phase bank. The TAPTRANS version has the facility to measure oil from the transformer main tank and on-load tap changer (OLTC), including both separate diverter tank and selector tank where one exists.

Key Features

- Utilizes dynamic headspace sampling to extract target gases from the oil sample.
- No consumables, such as carrier gases are required.
- Accurate results are available as often as once per hour.
- Minimal maintenance.
- Uses highly accurate and stable *Photo-acoustic Spectrographic* technology.
- Fully embedded microprocessor with non-volatile internal memory storage for 10,000 records.
- Stainless steel outdoor-rated IP55 enclosure connected to the transformer by robust stainless steel tubing.
- Manual oil sampling port provided.
- All gas sensing is carried out internally – no external gas sensors.
- Transformer load tracking is available.
- Six user-configurable relay contacts based on absolute gas and moisture values.
- Two user-configurable sunlight-visible alarm LED arrays on the exterior of the enclosure – one red for alarm, one yellow for caution.
- Two standard sunlight-visible LED arrays – green for power, blue for service.
- Communication options include: Ethernet, RS-232, Cellular modem (GSM/GPRS), PSTN modem, RS-485, Fiber Optic along with other options.
- Internal USB connection provided for commissioning and service, or local data download.

9. TRANSFORMER CRITERIA

The transformer shall 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 -20 °C and never exceeds 120 °C.
- The transformer oil is at atmospheric pressure or above (see points below).
- There are separate return and supply valves available for connection.
- The ambient temperature in the area where the TRANSFIX family product resides must never fall below –40 °C and never exceed 55 °C.
- The minimum ambient temperature during installation shall be -20 °C.

If the transformer is nitrogen blanketed, check the pressure/vacuum gauge. If the pressure is positive, then the TRANSFIX family product can be installed. If the pressure is negative, a vacuum exists within 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 family product on a transformer that is under vacuum while the transformer is energized.

10. PLUMBING

TRANSFIX family products remove oil from the transformer, extract the gases, analyze the gases and then return 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 (see Figure 1-2).

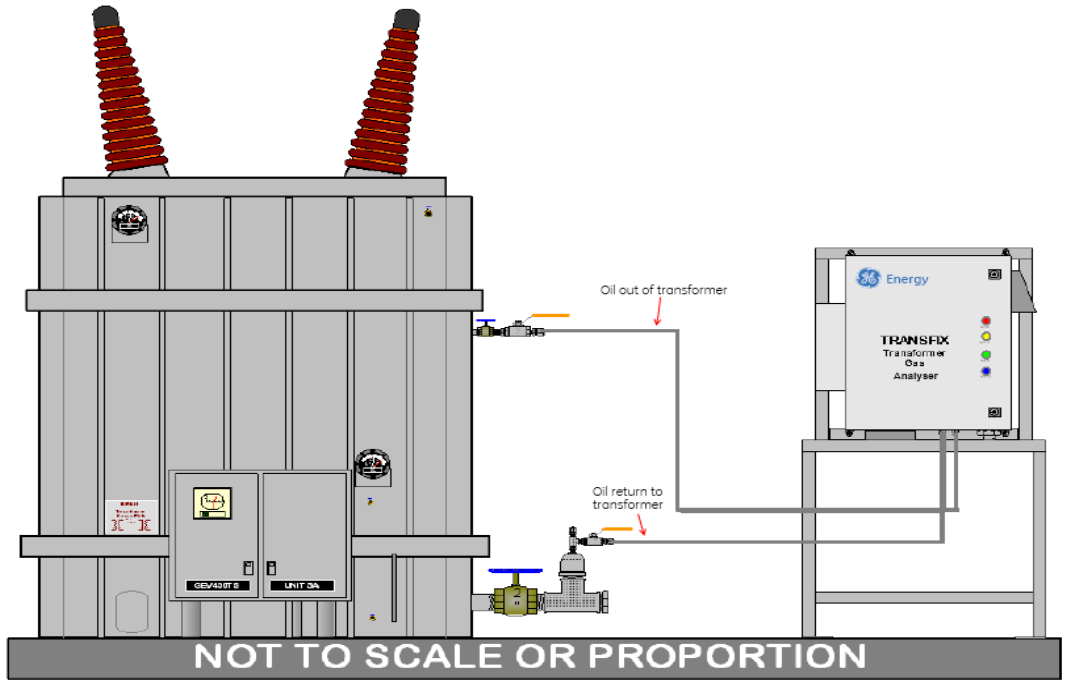

Figure 1: Schematic representation of an installation

The oil is removed from one valve of the transformer (the supply valve) and returned via another (the return valve). The location of the 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 family product.

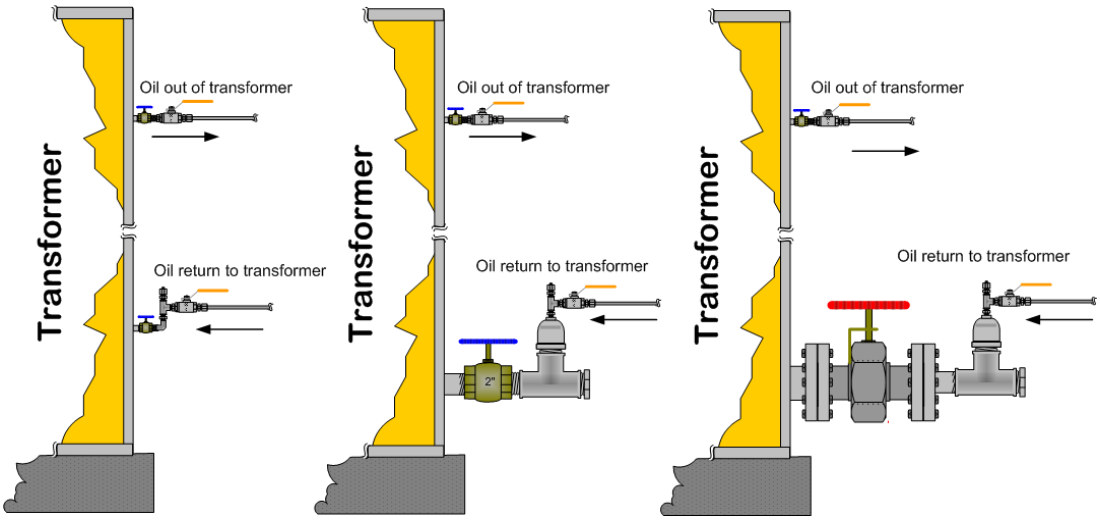

Figure 2: Examples of possible line configurations (three of many)

Transformer valves and ports

Figure 3 shows the location of the following valves:

Fill Valve

If the transformer is nitrogen blanketed, the fill valve or any other valve at the top of the transformer should *not* be used as an oil supply valve because 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 because 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 resides within TRANSFIX family products and can be used for obtaining manual oil samples for analysis.

Ancillary Valves

Some transformers have an array of ancillary valves and ports. These valves can be a good choice to connect TRANSFIX family products 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 the internal windings.

Cooling Loop Valves

TRANSFIX family products should only be supplied with oil from a cooling loop valve if there are no other valves available.

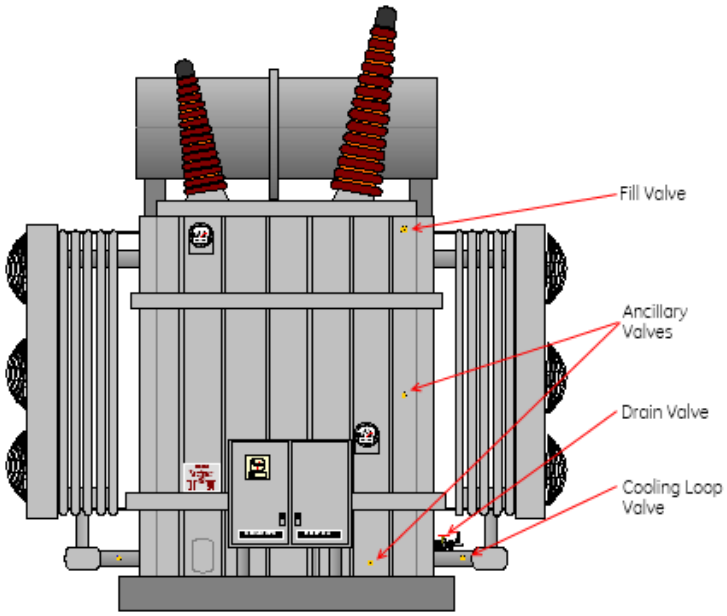

Figure 3: Possible valve locations of a transformer

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 in which to connect the TRANSFIX family product.

All transformers have different valve configurations. The supply and return valves on the transformer will need to be adapted to a ¼ in. female NPT fitting to properly fit the ¼ in. NPT male fitting on the TRANSFIX family product. When choosing how to prepare the oil supply and return valves, consider these points:

Oil Supply

- 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 -20 °C.
- The distance between the oil supply valve and oil return valve should be at least 30 cm (12 in.) to prevent mixing of the de-gassed oil with the transformer oil being sampled.
- Fittings must be provided to adapt the oil supply valve to a ¼ in. female NPT 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.
- If the oil supply valve is located more than 1.82 m (6 ft) above the base of the transformer, it is recommended that an additional ¼ in. ball valve be placed in the oil supply line within easy reach while standing, and in an easily accessible and visible location. This valve can be used to conveniently shut off the oil supply, if required.

Oil Return

- The oil is typically returned to a valve lower on the transformer, such as the transformer drain valve.

  

  Do not return the oil to a location that leads directly to a critical location within the transformer, such as a cooling loop designed for directed cooling.
- The oil returning to the transformer *must* be via the "Return Assembly" provided in the TRANSFIX family product's installation kit. 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, but must first be adapted from a ¼ in. female NPT fitting.
- If the oil return valve is located more than 1.82 m (6 ft) above the base of the transformer, it is recommended that an additional ¼ in. ball valve be placed in the oil return line within easy reach while standing, and in an easily accessible and visible location. This valve can be used to conveniently shut off the oil return, if required.
- It is important to ensure that the configuration of the Return Assembly eliminates any pre-existing air pockets. This is achieved by the use of a Tee on the return valve with the bleed port facing upwards. To reduce the possibility of air pockets behind the flange, the position of the ¼ in. NPT hole must be drilled near to the top of the flange offset from the centre.

11. MOUNTING

When considering where and how to mount TRANSFIX family products, observe the following points to ensure an appropriate mounting configuration:

The location for TRANSFIX family products should allow easy access to the transformer oil supply and return valves, so that tubing runs can be kept to a minimum. The supply and return tubing runs between each transformer valve and the TRANSFIX family product connection point should *not* exceed 30 m (98 ft) in length, or 60 m (196 ft) in total length for the complete oil circuit. ***NOTE: This avoids putting stress on the internal pump and also avoids the possibility of oil cavitation.***

TRANSFIX family products should normally be mounted on the mounting stand (see Appendix E), which can be purchased from GE. If not purchased, a structurally sound weather-resistant mounting that supports the 80 kg (177 lb) of the TRANSFIX 1.6 / MULTITRANS, or the 90 kg (199 lb) of the TAPTRANS must be available (see Appendix E for dimensions). It must also be designed to be securely fastened to a flat mounting surface. Additional reinforcement and/or dampening may be necessary if local conditions (environmental or otherwise) could expose the TRANSFIX family product to potential external forces or vibration.

TRANSFIX family products 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 family product and its 20 kg (45 lb) mounting frame. (See Appendix F for mounting stand footprint dimensions.)

If a new concrete pad is required, GE recommends that it be at least 61 cm (24 in.) wide by 122 cm (48 in.) long and 9 cm (3 ½ in.) thick with a #3 (10 mm) steel reinforcing bar around the perimeter. (Earth bonded as per local or site practice and code.)

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

TRANSFIX family products must 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 TRANSFIX family products must not be blocked or restricted in any way.

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

It is acceptable to mount TRANSFIX family products to the body of a transformer, which is exhibiting normal operational levels of vibration, provided that

- care is taken to ensure a level and secure mounting configuration;
- the product is mounted within 5 degrees of plumb and level on both axes;
- the product is mounted in such a way as to support the total weight of the unit;
- the product is mounted to an area of the tank body with minimum vibration, such as close to a corner or the stiffeners;
- guidance on inlet and outlet oil supply lengths and configuration is followed.

  If mounting to the body of a transformer, GE's recommendation is to do so with the top half of the GE-supplied mounting stand. If there is concern about extreme vibration on a transformer, GE strongly advises against mounting TRANSFIX family products to the body of a transformer. Furthermore, should damage occur to the product that is attributable to the mounting arrangement and/or excessive transformer vibration, such damage will not be covered under warranty. Care should be taken at all times to ensure that damage does not occur to the transformer or the TRANSFIX family product during installation.

12. TUBING

Stainless steel tubing is used to connect TRANSFIX family products to the transformer. The amount of tubing required is based on the location of the TRANSFIX family product 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 would invalidate the results of the analysis and void the warranty of the TRANSFIX family product. (See Appendix C for a full discussion of the tubing.)

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

Consider these points when choosing *where* to route the tubing and estimating *how much* tubing is 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 be adequately secured to the structure of the transformer or ancillary structure with appropriate mounting hardware and fasteners. (Swagelok or Ham-Let offer several options for mounting and securing tubing.)
- When measuring the routes chosen for the tubing between TRANSFIX family products and the transformer oil supply and return valves – corners, bends and other obstacles may add to the overall length and must therefore be taken in to consideration.
- The rigid tubing is typically supplied in 6 m (20 ft) lengths (See Appendix C). If the length of either tubing path exceeds 6 m (20 ft), ¼ in. stainless steel compression unions will need to be provided along with the additional tubing. The required amount of tubing, in accordance with the specification in Appendix C, must be on site on the day of the installation.
- Bending the rigid tubing is a complicated procedure and if there is a change to the proposed route during the installation it could require extra tubing. For this reason, it is advisable to order about 20% more tubing than the initial required estimate.

- 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 1.82 m (6 ft) or more above the ground, an additional ¼ in. stainless steel compression ball valve should be installed on the ¼ in. tubing at an easy to reach and visible location. This valve should be located not more than 1.82 m (6 ft) above the ground. This will facilitate turning off the oil flow, if needed, without having to climb to reach the valve. One additional ¼ in. stainless steel compression ball valve is included in the TRANSFIX family product's installation kit.

- If the oil temperature can fall below -20 °C, a heat trace may be fitted to the oil pipe to increase the oil temperature before it enters the TRANSFIX family product. ***NOTE: The heat trace shall be installed in accordance with the manufacturer's instructions and local wiring regulations.***

13. POWER

The following power requirements must be observed:

Standard TRANSFIX family products contain a power supply that can accommodate 115/230 V AC 50/60 Hz single phase (factory set) and draws 8 amps maximum. A 10 A to 15 A circuit meeting these requirements must be available at the time of installation. The installation must be done in accordance with local wiring regulations.

Disconnection is through an external circuit breaker or switch that must be installed on the mains supply line near the unit. The switch or circuit breaker must be installed in accordance with local wiring regulations.

Ensure that the mains power of the TRANSFIX family product is connected to a circuit that is continually on to ensure its continuous operation.

14. CONNECTIONS

All wires and cables leading to or from the TRANSFIX family product are made through four conduit connectors on the bottom of the unit. The 25 mm conduit connector is for the mains wires, one of the 20 mm conduit connectors is for the heat trace supply (if fitted) and the other two 20 mm conduit connectors are for communications and sensors. Heat trace is only required if the oil temperature can fall below -20 °C. Unused conduit connectors shall be sealed. Conduit connectors may be replaced, if necessary. Terminal connections are provided on the System board for terminating the communication and sensor wires and cables.

15. MOUNTING STAND INSTALLATION

It is important that TRANSFIX family products are installed securely. For this reason, GE offers an optional mounting stand. If the GE-manufactured mounting stand has not been purchased, a stand must be constructed as outlined in Section 11. If the mounting stand is purchased with the unit, the unit is supplied attached to the top stand and slotted between the legs of the bottom stand for additional protection and ease of handling. ***NOTE: TRANSFIX and MULTITRANS ship attached to a top stand.***
The GE-manufactured mounting stand shall be secured to the mounting surface as follows:

- The mounting stand shall be placed upright on a suitable mounting surface e.g. a flat concrete pad (see Section 10 for details).
- Use the mounting stand (recommended) or the dimensions from the mounting stand footprint drawing (see Appendix F) to mark at least one hole for each of the four mounting tab points.
- Use M8 threaded fasteners with a recommended minimum length of 80 mm for the concrete pad (or other suitable concrete anchors) to secure the mounting stand to the mounting surface.
- Ensure that the stand is within 5 degrees of level and plumb. If necessary, use shims under the mounting stand feet to level the stand.

See Appendix E for a drawing of the stand with a mounted TRANSFIX family product.

16. MOUNTING A TRANSFIX FAMILY PRODUCT TO THE STAND

The TRANSFIX and MULTITRANS versions are shipped secured to a top stand. The net weight of TRANSFIX is 72 kg (159 lb), MULTITRANS is 76.5 kg (169 lb) and TAPTRANS is 88 kg (194 lb), so it is important to take precautions prior to lifting. The unit shall be lifted into position using sufficient personnel or mechanical means in accordance with local regulations and company policies. Every TRANSFIX family product must be installed on an appropriate mounting structure, such as the optional but recommended mounting stand. The following steps are recommended for mounting TRANSFIX family products to a mounting stand (if purchased):

- Have all hardware needed to join the two parts of the stand ready and within reach (the supplied M8 60 mm bolts).
- Ensure the bottom mounting stand is secured to the mounting surface in the desired position using appropriate hardware, and within 5 degrees of level and plumb.
- Ensure that the top stand is securely fitted to the TRANSFIX family product.
- Lift the TRANSFIX family product (attached to the top stand) while an additional person helps position it over the now secured bottom mounting stand, such that the bolt holes on both the top and bottom stands are aligned.

  NOTE: The TRANSFIX family product must be lifted by the top stand or main enclosure casing — not by the door, vents, or cooler etc., as this could damage the unit.

- Then attach together using the supplied bolts, nuts and washers, and secure sufficiently such that the complete assembly is level and stable.

Figure 4: TRANSFIX mounted on a stand

Alternatively, for new units (*not* previously commissioned) it is acceptable to carefully lay the bottom mounting stand on its back and join the TRANSFIX family product to it while on the ground. Then securely attach both ends of the mounting stand (in the same manner as above), before carefully lifting the complete assembly upright and securing it to the mounting surface using appropriate hardware (see Section 15).

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17. ELECTRICAL CONNECTIONS

This section outlines electrical connections and power-related aspects that must be observed.

TRANSFIX family products contain a power supply that can accommodate 115/230 V AC (-10%/+15%) 47 to 63 Hz operating using 8 A maximum single phase.

Ensure that the ON/OFF switch is in the OFF position *and* that the TRANSFIX family product is disconnected from the mains supply *before* commencing any work. Disconnection from the mains supply is achieved through the external switch or circuit breaker; *not* by the TRANSFIX family product's ON/OFF switch.

The external switch or breaker shall be installed on the mains supply line. The switch or breaker shall be rated at 10 A min 250 V AC min. The switch or breaker shall be approved to IEC60947-1 or IEC60947-3, or to a standard required by local wiring regulations. The switch or breaker shall be identified as the disconnect device for the TRANSFIX family product and should be located where it is visible from the unit and easily accessible.

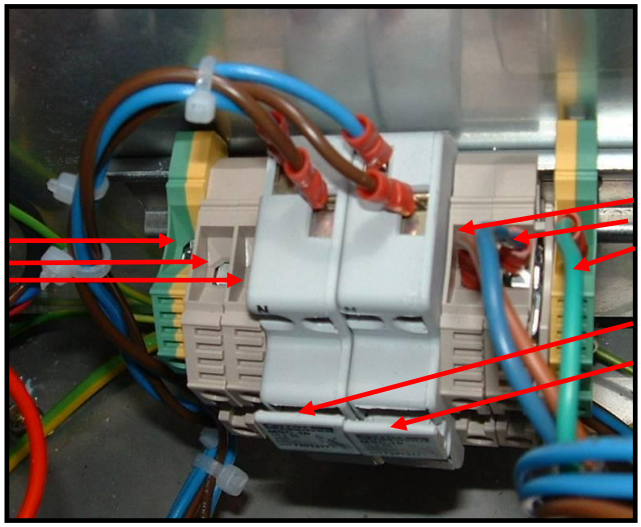


Figure 5: Location of mains supply and heat trace terminals

Figure 6: Protective cover

Figure 5 shows the location of the power supply terminals, heat trace supply terminals (if fitted) and modular fuse holders for the mains supply and heat trace supply. To ensure a safe connection to the power supply, follow these steps:

Disconnect the power supply to the TRANSFIX family product at the external switch or circuit breaker before accessing any internal components.

Open the front panel on the right-hand-side of the TRANSFIX family product by turning the ¼-turn fasteners anticlockwise.

Route the mains supply cable through the 25 mm cable gland on the bottom of the unit.

The outer sheath of the mains supply cable shall continue into the equipment as far as possible, so that reinforced insulation is maintained between the operator and mains supply.

The mains supply shall be connected so that the protective earth wire shall 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 and fit the protective cover (see Figure 6) over the AC connection block.

NOTE: The protective cover is a safety feature designed to protect the connection block from a buildup of dust.

TRANSFIX family products have an M8 earth stud located on the bottom of the enclosure on the right-hand side. To ensure continued safety and EMC compliance, this must be connected to earth ground in accordance with local wiring regulations and using at least 6 mm^2 (10 AWG) wiring (see Figure 7).

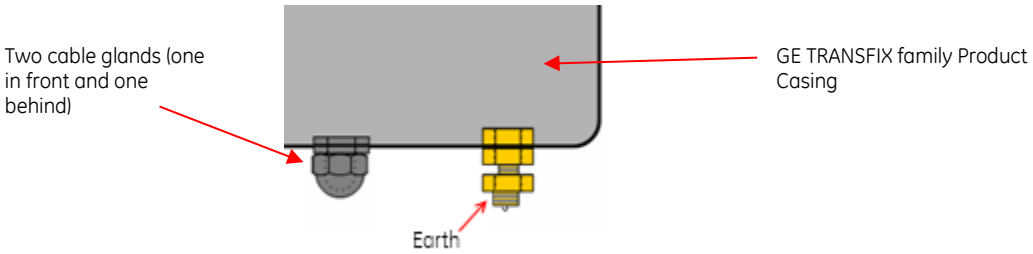


Figure 7: Earth terminal on bottom of enclosure

If heat trace is to be used, please refer to Appendix H.

Ensure that the selector switch for the heater supply voltage is set to the correct supply voltage, either 115 V or 230 V (see Figure 8). The switch is situated on the circuit board on the back wall of the enclosure.

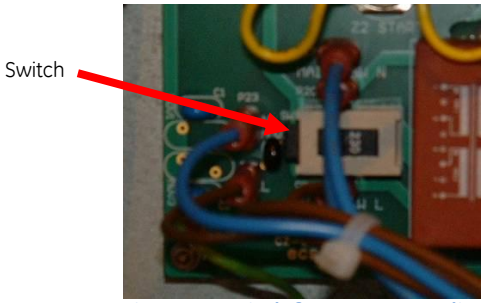


Figure 8: Switch for power supplies

Cold start

If TRANSFIX family products are powered up in cold conditions (less than -10 °C), the unit will perform a cold-start sequence: This causes the internal heaters to turn on while the main DC power supply remains off. Once the working temperature reaches -10 °C, the DC power supply is restored. See the relevant product user guide for more details.

NOTE: Once the DC power supply resumes, the internal temperature of the TRANSFIX family product may take several hours to reach working temperature before a measurement cycle can begin.

Battery

TRANSFIX family products use a non-rechargeable lithium coin cell battery (Panasonic CR2450 3 V 620 mAh). In the event that the battery needs to be replaced, data from the TRANSFIX family product must be backed up. Failure to do so may result in historical data loss. The following steps describe how to change the battery:

1. Back up the TRANSFIX family product's data – contact your GE representative.
2. Open the inner door to locate the battery on the system board.
3. Slide the battery out of its housing (see Figure 9).
4. Replace with a new Panasonic CR2450 3 V 620 mAh coin cell.
5. Close the inner door.

There is a danger of a new battery exploding if installed incorrectly.

Dispose of the used battery in accordance with local regulations — not 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.ov/hazardouswaste/perchlorate/

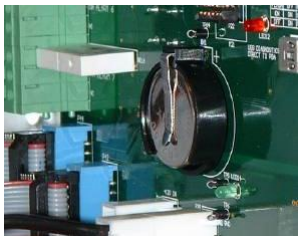


Figure 9: Coin cell battery

18. CONNECTION TO OIL SUPPLY VALVE

Oil is typically taken from a valve midway up on the transformer or from an active cooling loop (see Section 10 for a discussion of valve selection). Oil must be taken from a location where the oil is well mixed and in the active flow of the transformer oil. The temperature of the oil at this location should not exceed 120 °C or be lower than -20 °C. ***NOTE: The distance from the oil return valve should be at least 30 cm (12 in.).***

These points must be observed when connecting to the oil supply valve:

- Locate the valve on the transformer chosen for the oil supply line. Identify the items needed to adapt the oil supply valve to a ¼ in. female NPT 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 tight and all threaded pipe fittings tightly wrapped with PTFE tape with a light coating of PTFE paste or other quality pipe thread sealant applied over the taped male threads to prevent leaks. Both of these items are included in the TRANSFIX family product's installation kit. ***NOTE: GE recommends two wraps of PTFE tape or three wraps for large pipe fittings.***

19. CONNECTION TO OIL RETURN VALVE

Oil is usually returned to a valve lower on the transformer; typically this is the transformer drain valve. ***NOTE: The distance from the oil supply valve should be at least 30 cm (12 in.).***

Do not return the oil into a high pressure area on the transformer, such as a cooling loop.

The following points must be observed when connecting to the oil return valve (see Section 10 for a discussion of valve selection):

- The return line to the transformer must be via the Return Assembly (see Figures 10-13). 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 a ¼ in. female NPT fitting to the valve on the transformer.

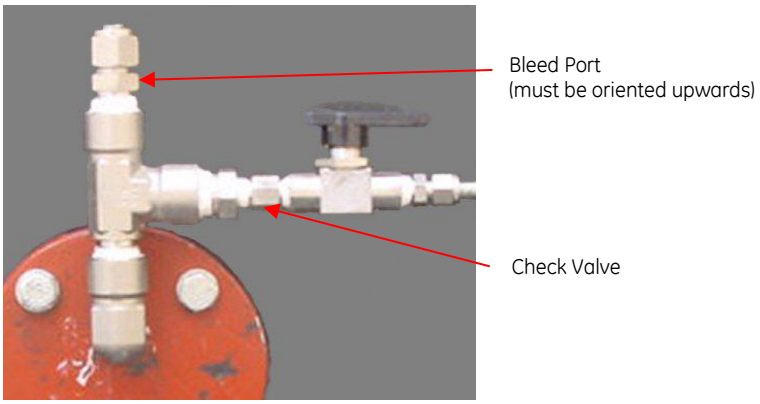


Figure 10: Bleed assembly on flange-type oil return valve

- If a flange-type valve is to be used to return the oil and the flange is drilled and tapped to a ¼ in. female NPT fitting, then 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).

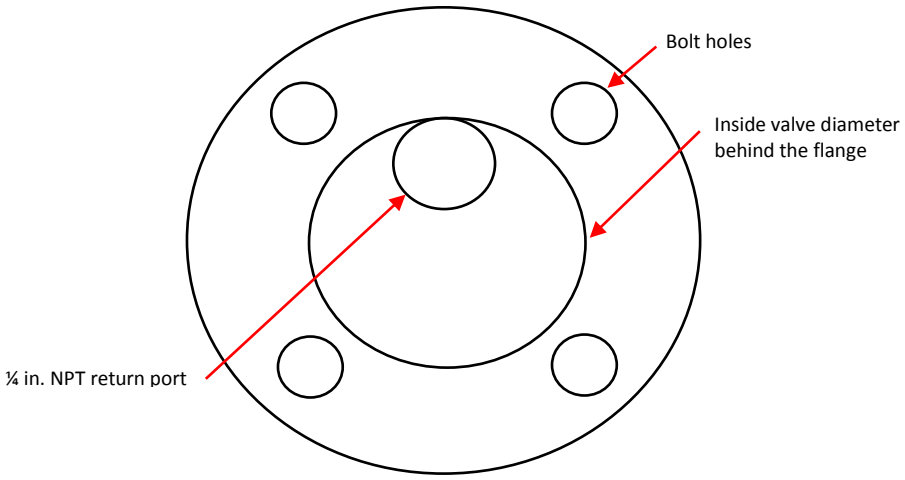


Figure 11: Flange example

Figure 12: Bleed assembly on threaded-type oil return valve

- Figure 13 depicts the proper arrangement of the Return Assembly.

Check valve – the arrow must point toward the transformer.

Elbow is only used if the ¼ in. female NPT fitting face is vertical; it is *not* used if the ¼ in. female NPT fitting face is horizontal.

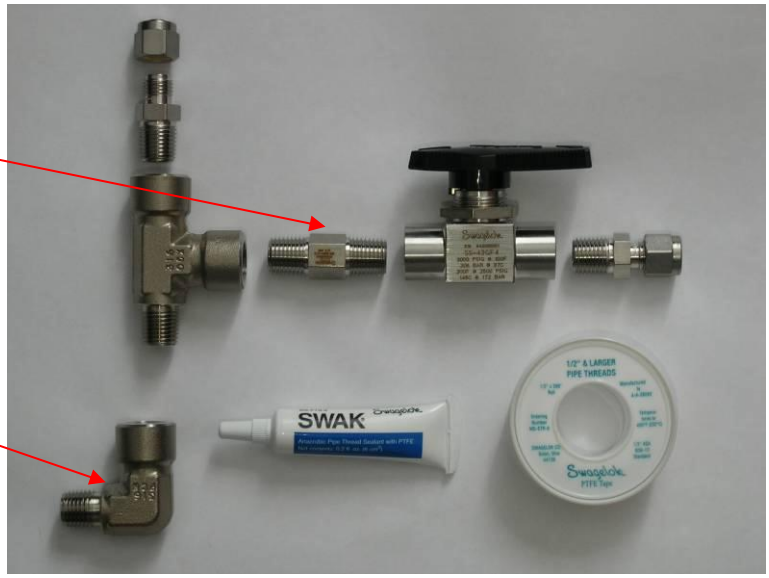


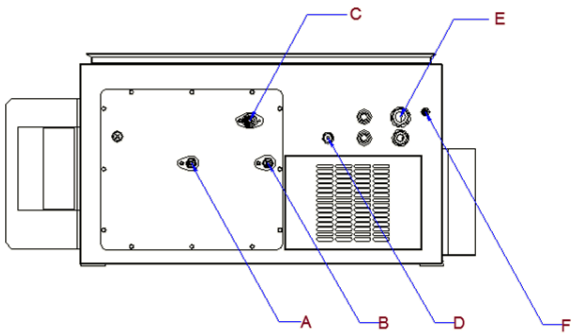
Figure 13: Return Assembly kit

- All pipe fittings should be adequately tightened and all threaded pipe fittings wrapped tightly with PTFE tape with a light coating of PTFE paste or other quality pipe thread sealant applied over the taped male threads to prevent leaks. Both of these items are included in the TRANSFIX family product's installation kit. ***NOTE: GE recommends two wraps of PTFE tape or three wraps for large pipe fittings.***

20. FITTING TUBING

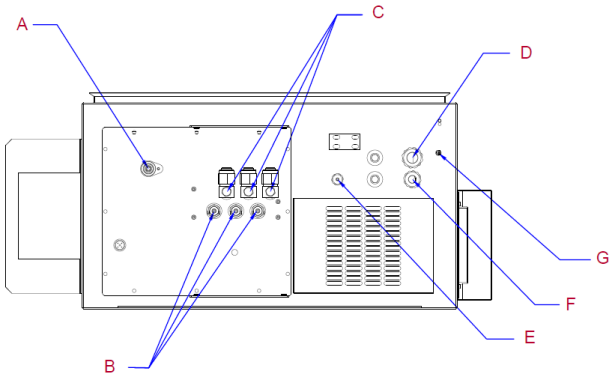
The stainless steel tubing should be fitted between the transformer and the TRANSFIX family product as follows, ensuring that

- The supply line is connected to the OIL IN port on the TRANSFIX family product (this is the bulkhead fitting at the bottom of the product that is located closest to the right-hand-side when viewed from the front). This line will route to the transformer supply valve.
- The return line is connected to the OIL OUT port on the TRANSFIX family product (this is the bulkhead fitting at the bottom of the product that is located closest to the left-hand side when viewed from the front). This line will route to the Return Assembly on the transformer valve.
- All stainless steel tubing is clean and de-burred before attaching the tube fittings.
- All tubing is properly secured to the transformer or other suitable structures.
- All tube fittings are sufficiently tight and tightened as per the fitting instructions below (also outlined in the relevant Swagelok or Ham-Let documentation).



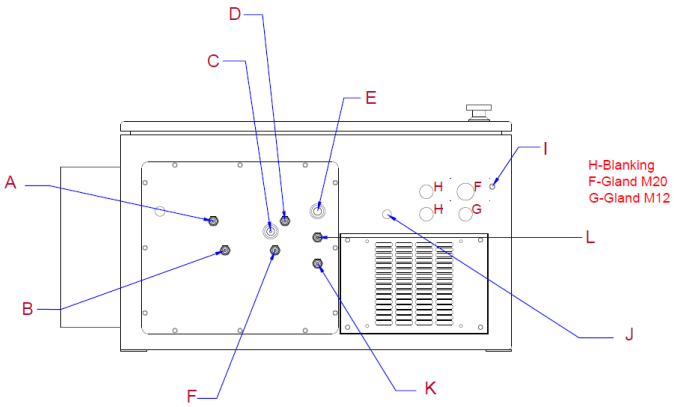
A. Oil-out
B. Oil-in
C. Manual sampling port
D. Ambient temperature sensor
E. Power-in (gland)
F. M8 earth connection point

Figure 14: TRANSFIX 1.6 oil connections bottom view



A. Manual sampling port
B. Oil-out ports (circuits 1, 2, 3)
C. Oil-in ports (circuits 1, 2, 3) with filters
D. Power cable gland
E. Ambient temperature sensor
F. Communications cables gland
G. M8 earth connection point

Figure 15: MULTITRANS oil connections bottom view



A. Out "C" selector
B. Out "A" main
C. Manual DGA "A/C"
D. In "C" selector
E. Manual DGA "B"
F. In "A" main
I. M8 earth connection point
J. Ambient temperature sensor
K. Out "B" diverter
L. In "B" diverter

Figure 16: TAPTRANS oil connections bottom view

Fitting instructions

1. Insert one end of the tubing into the Swagelok or Ham-Let fitting body.

2. Ensure that the tubing rests firmly on the shoulder of the 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 the fitting body steady, tighten the nut 1 and a 1/4 turns to the 9 o'clock position.

Do not use any type of thread sealant on compression-type tube fittings.

Do not open the valves on the transformer or the stainless steel tubing until commissioning the TRANSFIX family product. The commissioning procedure must be followed to prevent air bubbles from entering the transformer (see the relevant TRANSFIX family version Commissioning Guide).

21. SYSTEM BOARD

TRANSFIX family products provide connections for the alarms, PSTN, serial communications and transformer load sensor. These screw terminal connections are located on the System board at the back of the front panel (see Appendix G). Communications modules and optional analogue inputs are also located here. All cabling, communications and sensor wiring that lead into or out of the TRANSFIX family product are made through the two left-hand-side 20 mm cable glands on the bottom of the unit. There are also cable tie bases on the inner side of the front panel for securing the cables.

NOTE: After the TRANSFIX family product has been in operation, components may get hot within the inner compartments and inside the front panel. Care should be taken that all items have cooled sufficiently before carrying out any work.

Alarm Connections

TRANSFIX family products have six user-configurable alarms, a service relay, a watchdog power indication relay and four corresponding front panel LEDs. Relay outputs are located along the terminal strip on the System board (see Appendix G). 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 5 A at 250 V AC, 200 mA at 125 V DC or 4 A at 30 V DC (see Appendix G).

- Using the TRANSCONNECT software, the user can set the alarm on many different combinations of results. If alarm or caution states are met, this triggers the respective relays and that in turn opens or closes the contacts, and also energizes the relevant yellow (caution) or red (alarm) LEDs accordingly. (See the TRANSCONNECT user guide for more information on setting alarms).
- The service relay and the blue (service) LED are energized if an error condition is detected by internal error checking. If during the next measurement run the error condition is no longer present, the blue (service) LED is switched off.
- The power indication relay and the green (power) LED are energized anytime the TRANSFIX family product is connected to the mains power.

Accessory Power (AC board)

There are additional power points to connect +12 V DC or +24 V DC at 0.7 A accessories, such as wireless modems or protocol converters. These are available on the AC board on the back wall of the enclosure (see Figure 17.

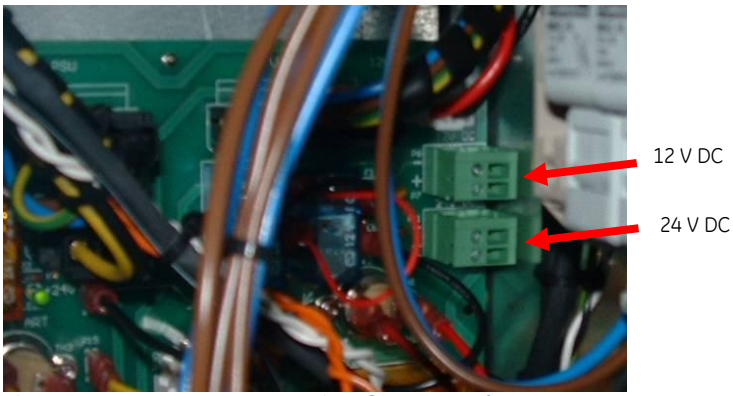


Figure 17: Accessory power points for 12 V and 24 V

22. EXTERNAL SENSORS

A transformer load sensor is provided in the TRANSFIX family product's 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 secondary wiring (usually located within the marshaling / control cabinet of the transformer).
It should be possible to locate a suitable current transformer with a 0 A – 5 A secondary circuit on which to mount the sensor. The sensor is supplied with 2.5 m (100 in.) of cable and may be spliced to the required length to connect to the TRANSFIX family product with up to a total of 10 m (32 ft) of 20 AWG twisted pair cable. Longer cable lengths are possible depending upon the quality of the cable. The load sensor connects to the bottom two terminals on the left-hand side of the System board – terminals 33 and 34 (see Appendix G).

23. COMMUNICATIONS

TRANSFIX family products have 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 family product.
- An Ethernet connection using the MODBUS/TCP protocol. This connection is available on the circuit board inside the inner door.
- Up to two further communications channels are available. However, if a DNP3 module is fitted (one maximum) this limits the available communication channels to one.

TRANSFIX family products support simultaneous communication on several channels – up to three masters over Ethernet, and one master on each of the serial connections (including the USB connection).

CHANNEL	CARRIER	PROTOCOL				
		MODBUS/ RTU	MODBUS/ TCP	MODBUS/ ASCII	DNP3.0	IEC61850
USB	USB	-	-	✓	-	-
CHANNEL A*	RS-232 Isolated	✓	-	✓	✓	✓
	RS-485 2-wire	✓	-	✓	✓	✓
	RS-485 4-wire	✓	-	✓	✓	✓
	PSTN	-	-	✓	-	-
	GSM/GPRS	-	-	✓	-	-
	CDMA	-	-	✓	-	-
CHANNEL B	RS-232 Isolated	✓	-	✓	✓	✓
	RS-485 2-wire	✓	-	✓	✓	✓
	RS-485 4-wire	✓	-	✓	✓	✓
	PSTN	-	-	✓	-	-
	GSM/GPRS	-	-	✓	-	-
	CDMA	-	-	✓	-	-
ETHERNET	Ethernet	-	✓	-	-	-
DNP3	Ethernet	-	-	-	✓	-

Note: Channel A is disabled when DNP3 over Ethernet is selected.

The options listed above are available at the time of printing – other options may become available. (Contact GE Technical Support for further information.)

Electromagnetic Compatibility (EMC) requirements

To ensure continued EMC compliance, a Wurth 74271221S ferrite (supplied) must be fitted to make connection with an RS-232 and/or RS-485 module using connector P1 (see Figure 18). The communications cable must be looped twice through the ferrite as shown.

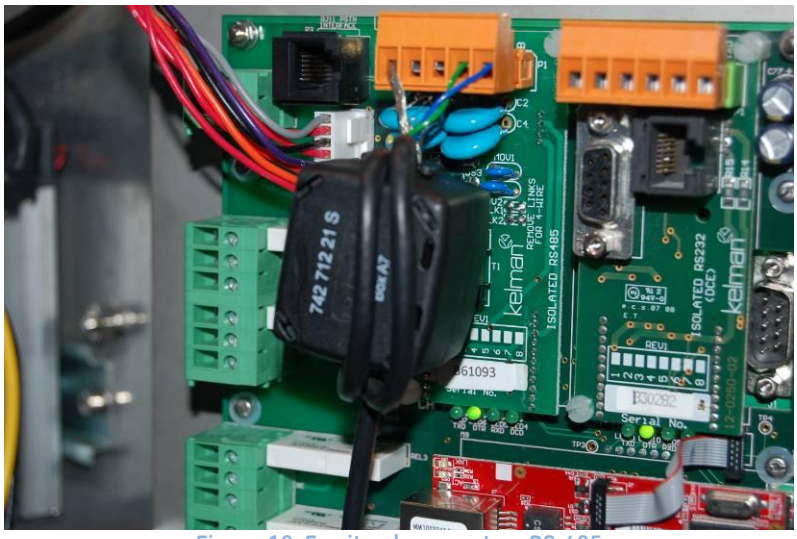


Figure 18: Ferrite placement on RS-485

APPENDIX A – INSTALLATION TOOLS AND SUPPLIES

The tools and supplies for a TRANSFIX family product installation are listed below. If GE performs the installation, the GE installation engineer will provide these items:

GE-supplied Items

Qty	Description
2	$^{9}/_{16}$ in. Combination wrench (must be imperial $^{9}/_{16}$ in.)
1	30 cm (12 in.) Adjustable wrench
1	35 – 40 cm (14 in.) Pipe wrench
1	$^{1}/_{8}$ flat blade screwdriver
1	¼ in. flat blade screwdriver
1	#2 Phillips screwdriver
1	¼ in. Tubing bender
1	¼ in. Tubing cutter
1	¼ in. Tubing de-burring tool
1	Non-metallic tape measure
1	Level capable of indicating plumb and level within 5 degrees
1	Permanent marker (fine tip)
1	22 – 14 Gauge wire cutter/stripper
1	Small diagonal cutting pliers
1	Quality vacuum pump with approximately 3 ft of clear ¼ in. tubing fitted with a ¼ in. compression fitting at the end of the tubing
1 roll	12 mm (½ in.) width PTFE pipe sealing tape or PTFE pipe compound
1 roll	20 mm (¾ in.) width PTFE tape
25	30 cm (12 in.) Nylon UV-resistant cable ties
25	20 cm (8 in.) Stainless steel cable ties
1	Laptop computer to run the TRANSFIX family commissioning tool and TRANSCOM software for downloading and interpreting the results of the gas analysis. Minimum specification: Windows® 2000 or Windows® XP operating system, PII 400 MHz processor, 128 MB of RAM and 1.2 GB hard drive space, 28.8 Kbps modem or faster and USB 1.1 or faster.

Customer-supplied Items

The following tools and supplies are needed on site to secure the mounting stand, tighten the 2 in. pipe fittings (if used) and complete the installation. GE is unable to bring the following items due to size and weight restrictions, so the customer should provide them.

Qty	Description
1	12 mm (½ in.) capacity hammer drill with 9.5 mm ($^{3}/_{8}$ in.) masonry bit
1	36 in. pipe wrench if large fittings are used to provide oil to the TRANSFIX family product
1	Scaffolding, lift or approved platform to obtain access to valves (if needed)
1	Small bucket to contain the oil during the bleed process
1	Absorbent cloths
12	M8 threaded fasteners with a recommended minimum length of 80 mm for the concrete pad

APPENDIX B – CUSTOMER CHECKLIST

The following checklist details items that the customer must acquire prior to the installation:

- ❑ Parts needed to fabricate a mounting stand (if the TRANSFIX family product's mounting stand has not been purchased – see Section 11).
- ❑ The required number of stainless steel tubing lengths of 6 m (20 ft) each (see Section 12).
- ❑ Fittings to adapt the transformer Supply valve to a ¼ in. female NPT fitting (see Section 10).
- ❑ Fittings to adapt the transformer return valve to a ¼ in. female NPT fitting (see Section 10).
- ❑ ¼ in. compression ball valve, if required (see Section 10).
- ❑ ¼ in. stainless steel compression unions (if the length of either tubing path exceeds 6 m (20 ft) – see Section 12).
- ❑ Prepared, flat mounting surface (see Section 11).
- ❑ Communications option tested and located at the installation site (see Section 23).
- ❑ Circuit capable of 115/230 V AC (-10%/+15%), 50/60 Hz with suitable overcurrent protection as per local regulations (see Section 13). If heat trace cable is used, the current capability of the circuit will have to be sufficient for both the TRANSFIX family product and the heat trace cable.
- ❑ Preferred conduit and wire to make the connections within the TRANSFIX family product (see Section 17).
- ❑ Tools and supplies needed to complete the installation (see Appendix A).

APPENDIX C– TUBING SPECIFICATION AND ORDERING DETAILS

Specifications:

Rigid Tubing
¼ in. OD X 0.035 in. wall T316 seamless stainless steel tubing (6.35 mm OD X 0.889 mm wall) (ASTM A269 / A213).

Flexible Tubing
¼ in. ID low pressure, 316 stainless steel braid over stainless steel metal flexible hose with welded ¼ in. compression fittings on each end.

Order Information:

E.g. *Swagelok*
Rigid Tubing:
Tube OD: ¼ in.
Tube Wall Thickness: 0.035 in.

Flexible Tubing
Swagelok FL series of Flexible SS hose is acceptable. It must be ordered in custom lengths from Swagelok well in advance of the installation. For example, a custom 8 meter hose from Swagelok would have a part number *FL4TA4TA4-800 cm* (see the Swagelok website www.swagelok.com or your local Swagelok representative).

Do not use copper tubing (See Tubing Material topic below).

Tubing Unions
Tubing Unions connect two pieces of the above ¼ in. tubing together. GE recommend:
Swagelok: *SS-400-6 Stainless Union, ¼ in. OD*
Ham-Let: *762L SS 1/4 Stainless Union, ¼ in. OD*

Shut Off Valve
If the oil supply or return valve is located more than 6 ft (1.82 m) above the base of the transformer, use a Swagelok tube fitting (*SS-4P4T Stainless Plug Valve, ¼ in.*) or a Ham-Let tube fitting *(H800MSSL Stainless Plug Valve, ¼ in.)* as directed in this procedure.

6 mm Tubing Adaptors
If ¼ in. tubing is not available, 6 mm stainless steel tubing may be used, but the maximum tubing run may be reduced, and ¼ in. to 6 mm tubing adaptors *must* be used. Consult with GE Technical Support. The adaptors should be Swagelok (*SS-6M0-R-4 Stainless Reducer, 6 mm OD – ¼ in. OD*) or Ham-Let (*767LT SS Stainless Reducer, 6 mm OD – ¼ in. OD*). At least eight of these are required for the installation.

Do not use 6 mm tubing *without* the above adaptors. To do so would void the warranty.

Tubing Material

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 family product**.** GE does *not* support the use of 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 in. OD with a 0.035 in. thick wall. Most 1/4 in. copper tubing has a greater wall thickness which reduces the flow rate rendering it too fragile to place in the field. Bends in standard soft copper tubing crush and deform more easily, which can reduce the flow rate than would otherwise be the case with properly bent stainless steel tubing.

Connection reliability and physical damage

GE has two overriding primary design and installation principles:

- ⚠ Never let oil out of the customer's transformer during operation.
- ⚠ 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. The softness of copper tubing also make 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 reacts with copper to form copper acetylide. This creates two related problems:

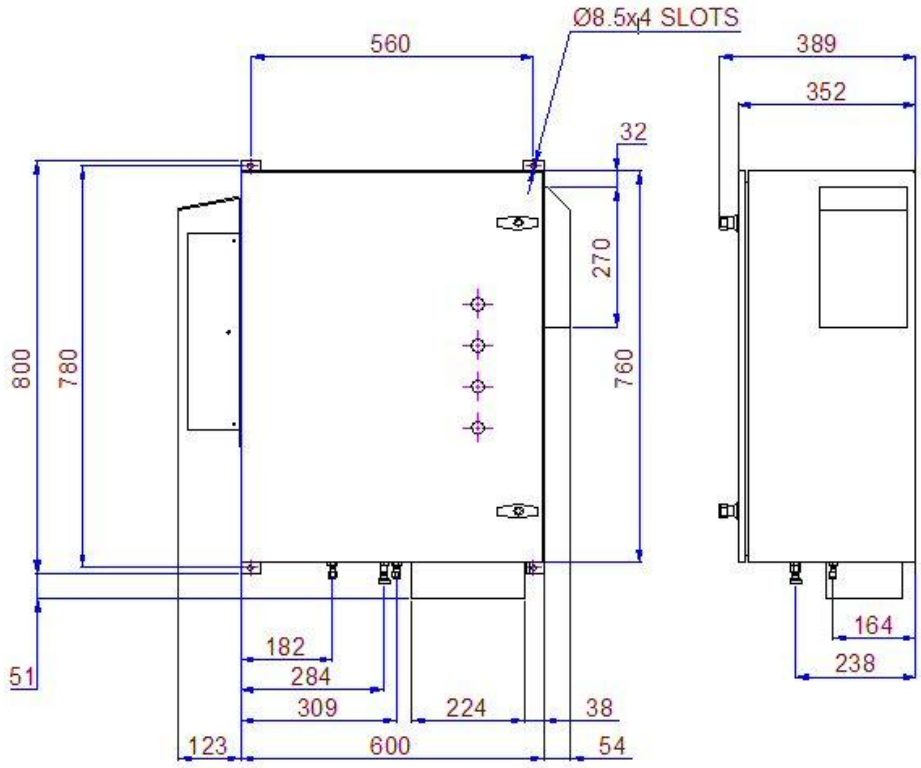
- Copper acetylide is a highly explosive compound and for regulatory and health and safety reasons, our equipment or installations cannot create these compounds.
- The reaction changes the chemical makeup of the oil before it reaches the sensor in the TRANSFIX family product. This causes the TRANSFIX FAMILY product to measure acetylene and possibly other gasses inaccurately.

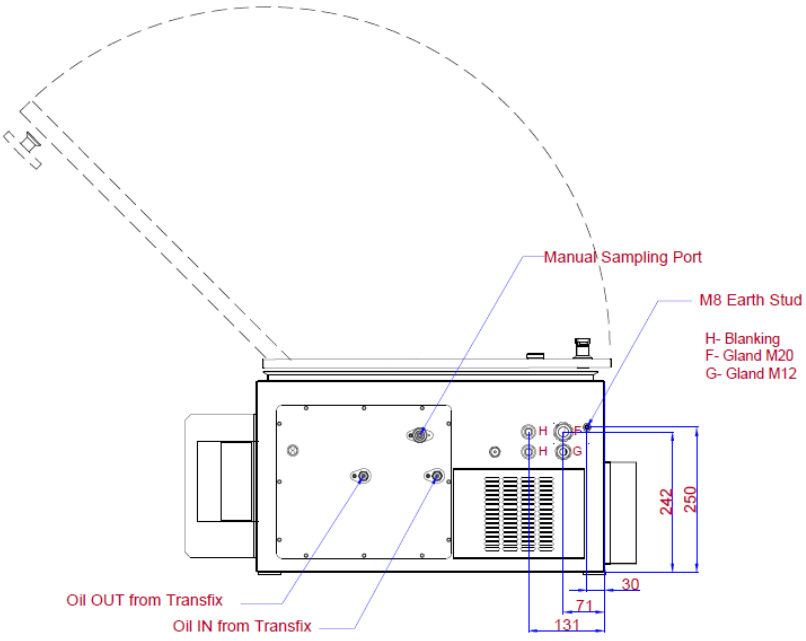
Although a transformer already contains copper, the job of our test equipment and its installation is to accurately measure the gasses in the oil of the transformer without affecting the oil being measured.

GE will not guarantee or perform warranty work on a TRANSFIX family product that has been installed using copper tubing or any other tubing, other than stainless steel, as specified above.

APPENDIX D– TRANSFIX FAMILY PRODUCT DIMENSIONS

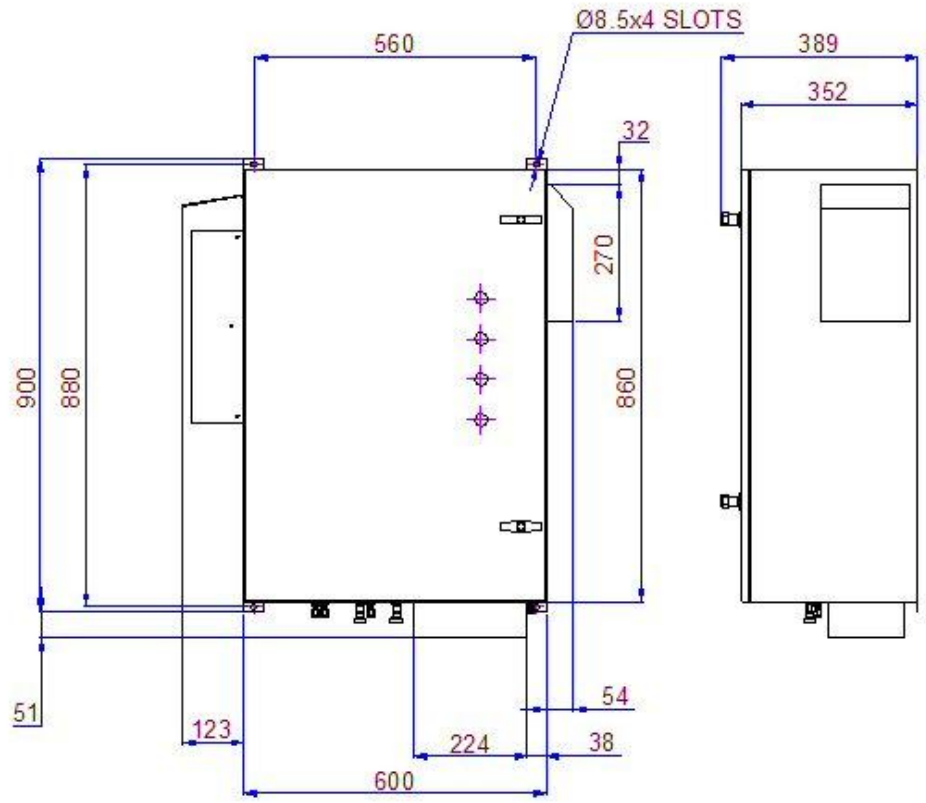
I. TRANSFIX 1.6 dimensions

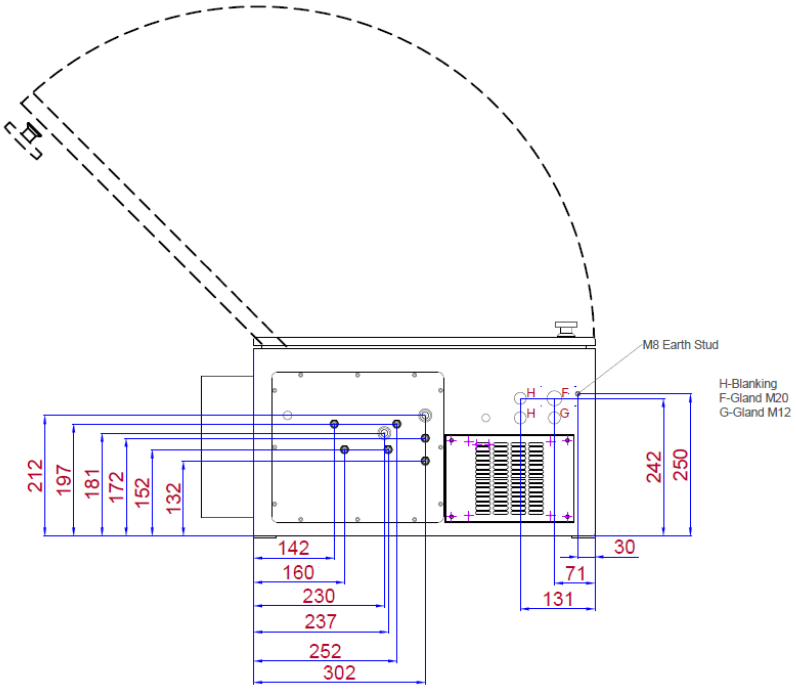




TRANSFIX 1.6 weight is 72 kg (159 lb).
All dimensions in millimetres (mm). Tolerance is ±5 mm.

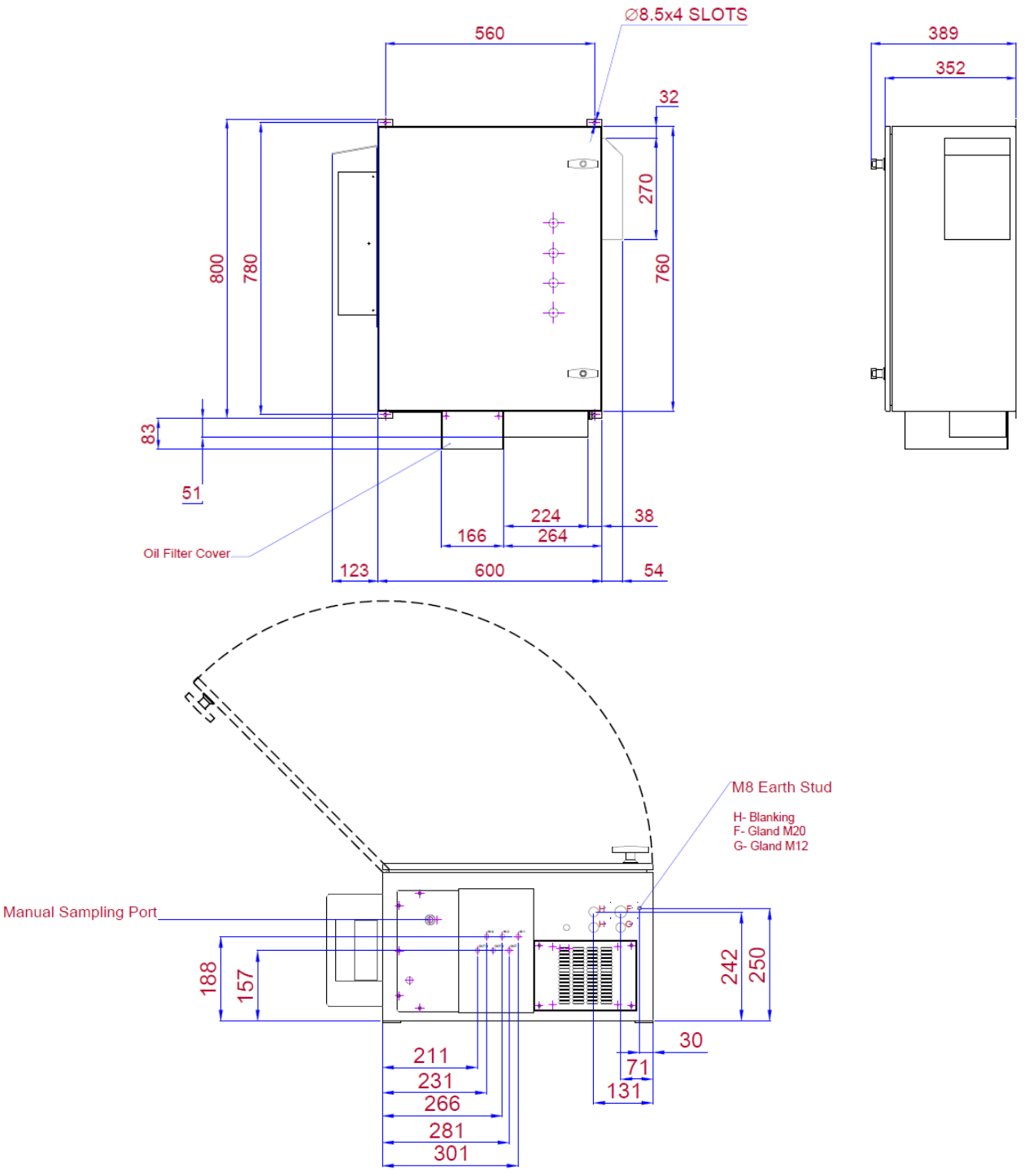
II. **TAPTRANS** dimensions





TAPTRANS weight is 88 kg (194 lb).
All dimensions in millimetres (mm). Tolerance is ± 5 mm.

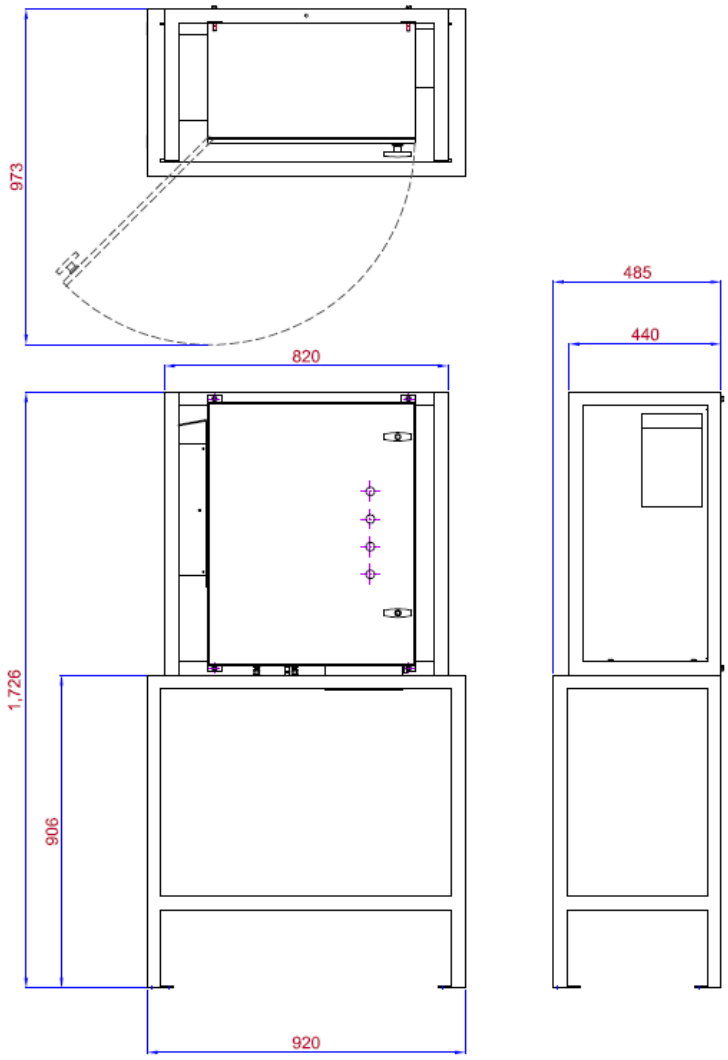
III. **MULTITRANS** dimensions



MULTITRANS weight is 76.5 kg (169 lb).
All dimensions in millimetres (mm). Tolerance is ± 5 mm.

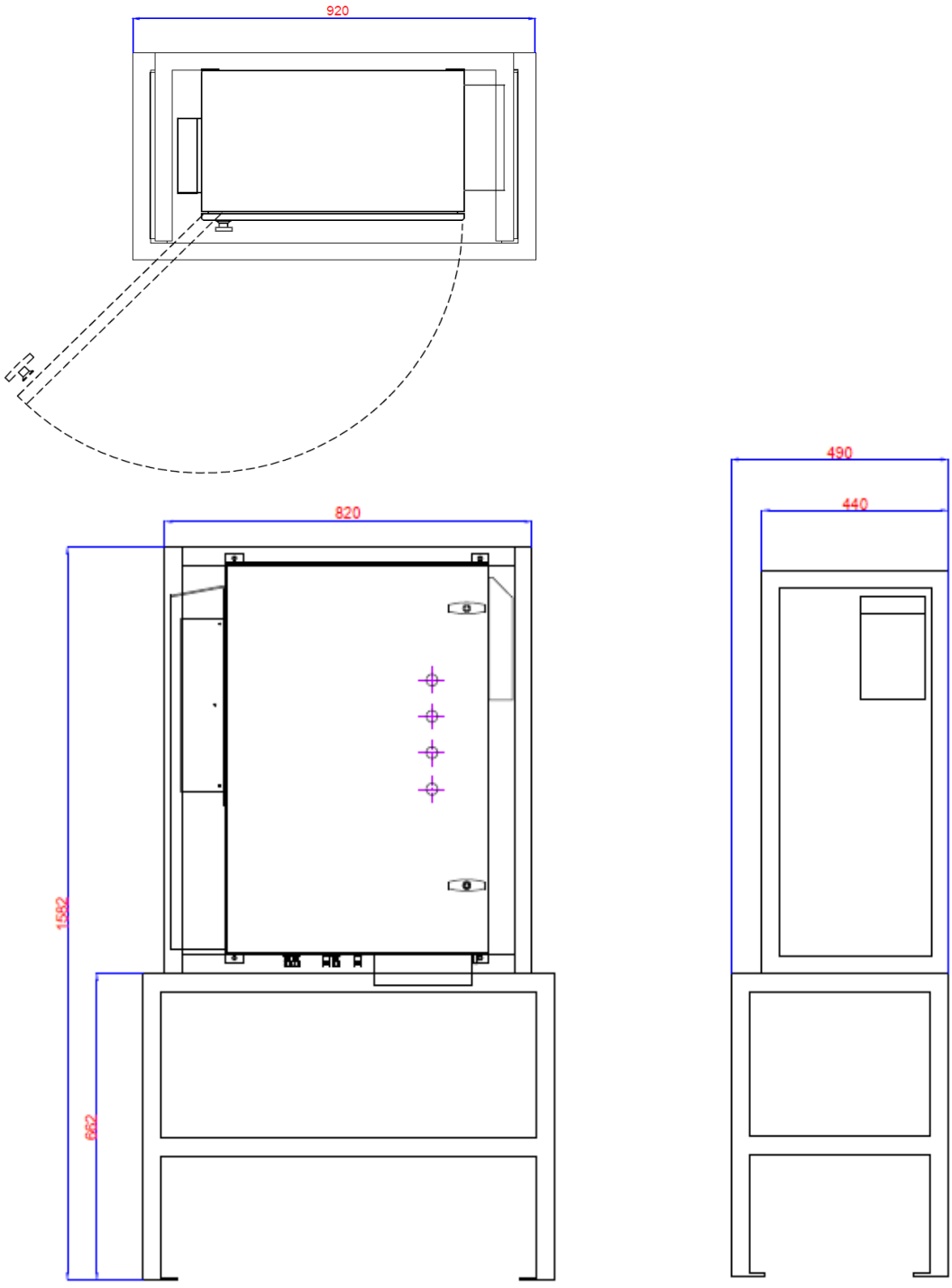
APPENDIX E – MOUNTING STAND DIMENSIONS

I. TRANSFIX 1.6 & MULTITRANS mounting stand dimensions



Mounting stand weight is 12.5 kg (28 lb)
All dimensions in millimetres (mm). Tolerance is ± 5 mm.

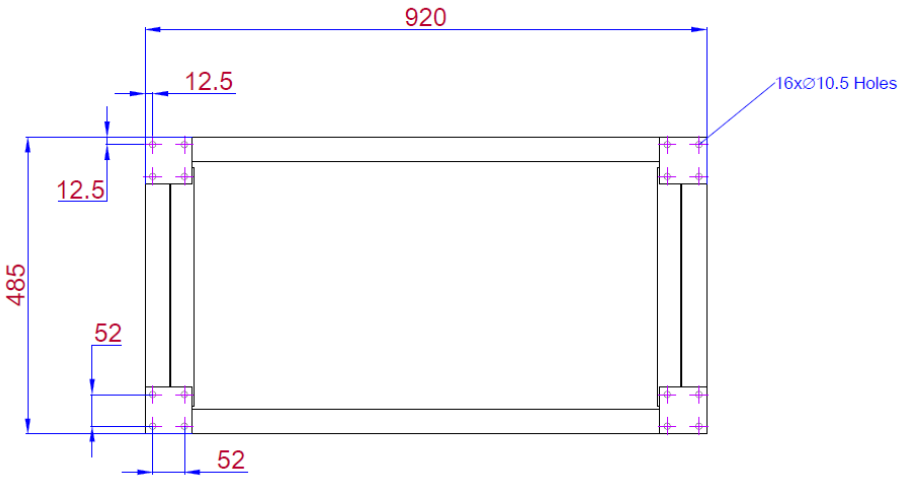
II. TAPTRANS mounting stand dimensions



Mounting stand weight is 16 kg (36 lb)
All dimensions in millimetres (mm). Tolerance is ± 5 mm.

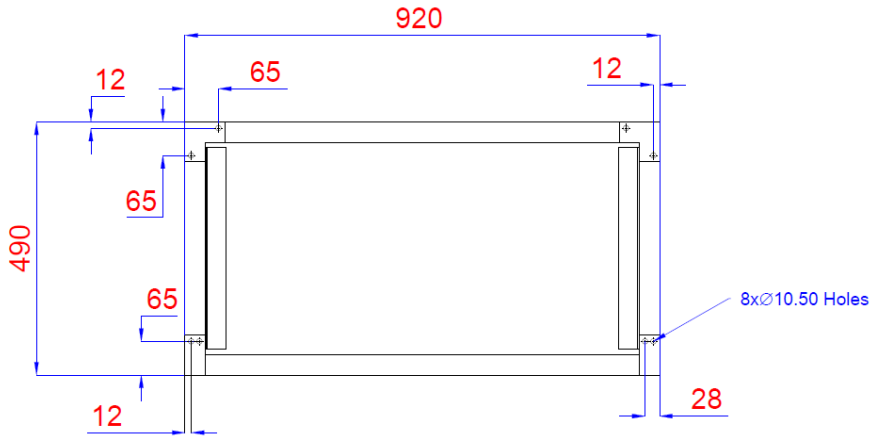
APPENDIX F – FOOTPRINT DIMENSIONS

I. TRANSFIX 1.6 & MULTITRANS mounting stand footprint dimensions



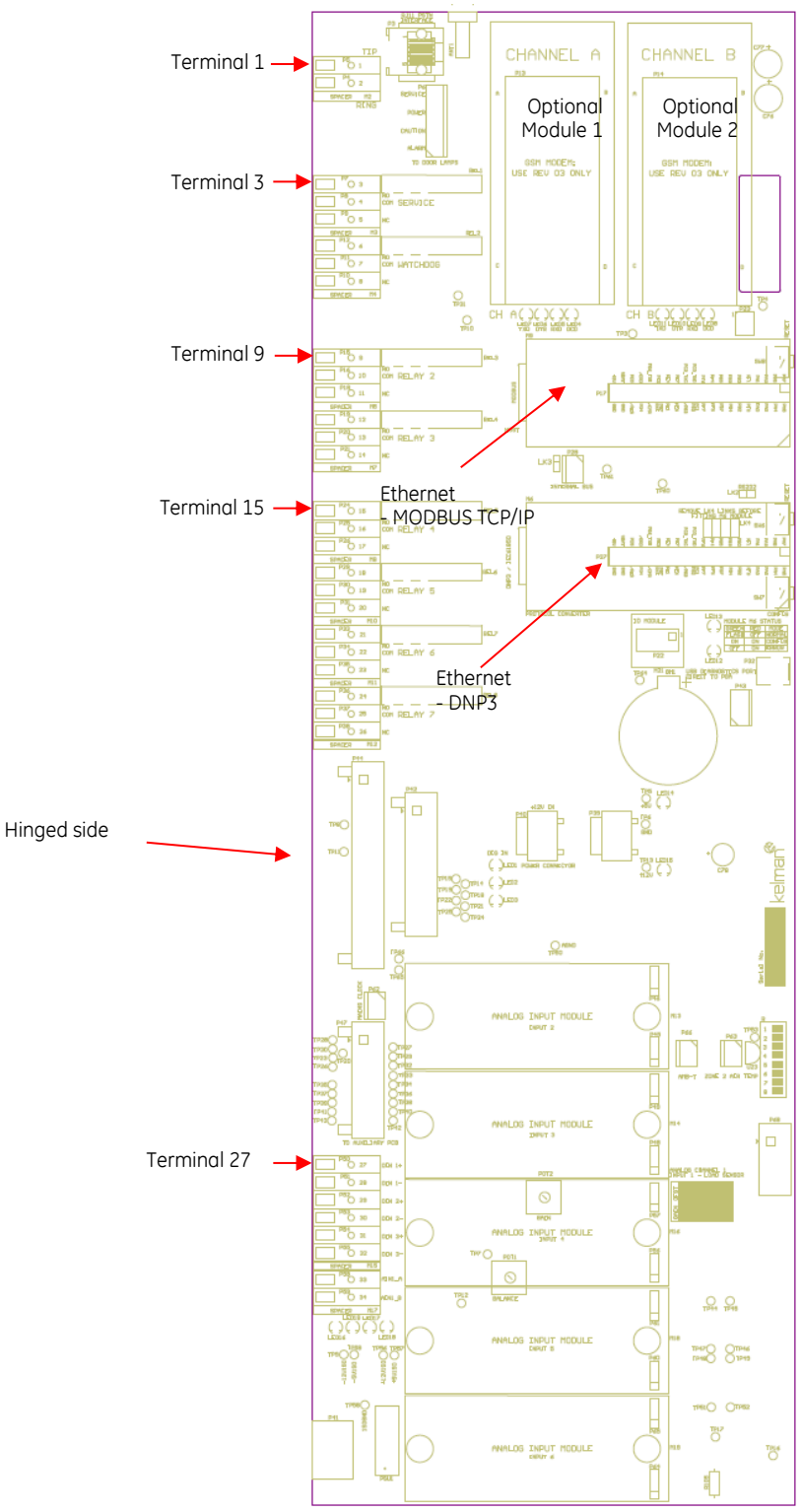
All dimensions in millimetres (mm). Tolerance is ± 5 mm.

II. TAPTRANS mounting stand footprint dimensions



All dimensions in millimetres (mm). Tolerance is ± 5 mm.

APPENDIX G– SYSTEM BOARD



PSTN interface

Terminal	Signal	Description
1	TIP	PSTN interface
2	RING	

Digital outputs

Spacer		
3	NO	Service Alarm
4	COM	
5	NC	
Spacer		
6	NO	Watchdog Alarm
7	COM	
8	NC	
Spacer		
9	NO	Alarm 2
10	COM	
11	NC	
Spacer		
12	NO	Alarm 3
13	COM	
14	NC	
Spacer		
15	NO	Alarm 4
16	COM	
17	NC	
Spacer		
18	NO	Alarm 5
19	COM	
20	NC	
Spacer		
21	NO	Alarm 6
22	COM	
23	NC	
Spacer		
24	NO	Alarm 7
25	COM	
26	NC	
Spacer		

Alarm Relay Max Ratings: 5 A at 250 V AC, 200 mA at 125 V DC or 4 A at 30 V DC.

Digital inputs

Terminal	Signal	Description
27	DIG IN 1+	Digital Input channel 1, positive
28	DIG IN 1-	Digital Input channel 1, negative
29	DIG IN 2+	Digital Input channel 2, positive
30	DIG IN 2-	Digital Input channel 2, negative
31	DIG IN 3+	Digital Input channel 3, positive

32	DIG IN 3-	Digital Input channel 3, negative
Spacer		

Digital inputs have a maximum voltage level of 12 V. The switching voltage input level is approximately 2.5 V. 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.

Analog inputs

TERMINAL	SIGNAL	DESCRIPTION
33	ANALOG IN A	Analog input - Load sensor, positive
34	ANALOG IN B	Analog input - Load sensor, negative
Spacer		

Optional communications modules

Figure 19 illustrates the connections for the RS-232 and RS-485 connections, including DNP3.

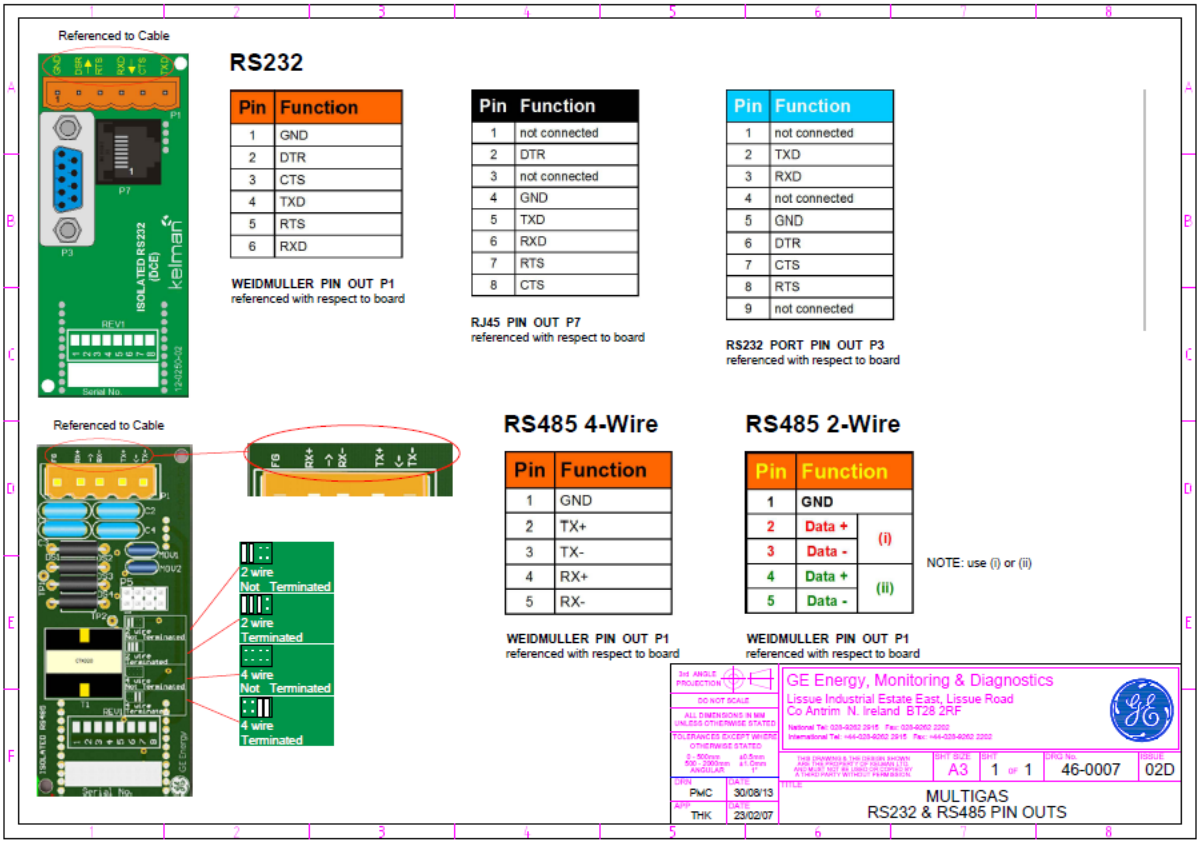
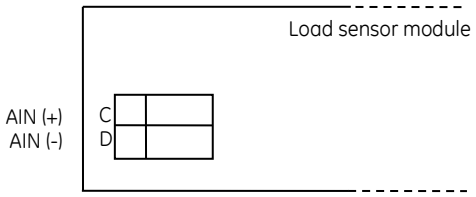


Figure 19: RS-232 & RS-485 connections

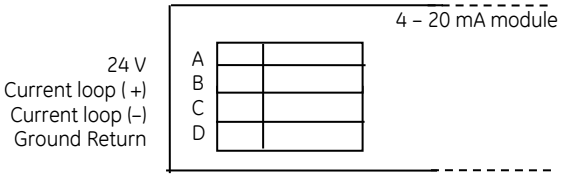
Optional analogue inputs

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 module

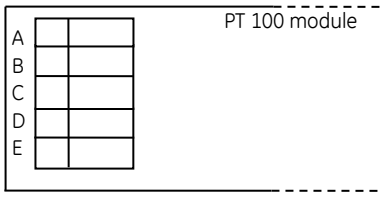


4 – 20 mA module (with optional 24 V supply)



PT 100 module

	4-wire	3-wire
A	Terminal 1	Terminal 1
B	Terminal 2	Terminal 2
C	Terminal 3	Terminal 3
D	Terminal 4	NC
E	Screen of sensor cable	Screen of sensor cable



APPENDIX H– HEAT TRACE CABLE

It is recommended that heat trace cable be used on the tubing, if the oil temperature in the tubing can reach temperatures below -20 °C.
The customer is responsible for supplying the heat trace cable, which must be installed by a qualified electrician. GE Service Personnel are available to advise the customer and work with the company's electrician to install the heat trace cable.

Installation Requirements

- Installation of heat trace cable must be done by a qualified electrician familiar with local wiring regulations.
- The heat trace cable selected shall have all necessary safety approvals required by local wiring regulations. The heat trace cable rating shall be suitable for the voltage of the power source, the temperature rating required, and the size of tubing it is to be installed on.
- Heat trace cable must be installed in accordance with the manufacturer's instructions and local wiring regulations. Particular attention should be paid to requirements for circuit protection and power supply.
- If heat trace cable is ordered as an option, terminal blocks can be provided for the connection of the power supply cable to the heat trace cable, where this connection is permitted by local wiring requirements.
- The optional heat trace cable connections within the TRANSFIX family products are protected by a 10 A normal blow fuse. The rating of the heat trace cable used should not exceed 8 A.
- If the optional heat trace cable connections within the TRANSFIX family products are used, ensure that the power supply cable and circuit protection are suitable for the 8 A rating of the unit plus the current rating of the length of heat trace cable and its accessories that are used in the installation.
- The heat trace cable shall be controlled by a thermostat to prevent continuous operation.

APPENDIX I – INSTALLATION RECORD

Customer Contact and Site Details

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: _____

Site Map

Please attach a detailed map or GPS coordinates on how to locate the site.

Transformer Details

Make: _____ Year: _____ Years in Service: _____

Type:

Conservator ❒ Nitrogen Blanketed ❒ Other: _____

MVA Rating: _____

CT ratio: _____

Condition of Desiccant: _____

Attach several photos showing the transformer and surrounding area ❒

Attach all available DGA data ❒

Total Dissolved Gas: _____ ppm (sum of all measured gases)

Please describe (or attach separately) details of any major maintenance actions, such as a rebuild, vacuum degassing or filtering etc.

_____

_____

_____

_____

Transformer Oil

Oil Capacity: _____ (in gallons) _____ (in litres)

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 Photographs

It is recommended that photographs of the installation site be taken in advance of the installation in order to properly assess the site, aid in planning the installation and contribute to the Short Duration Safety Plan. The following areas should be photographed:

VALVES / PLUMBING:

- ☐ Proposed Supply valve location
- ☐ Proposed Return valve location
- ☐ Alternative Supply valve location
- ☐ Alternative Return valve location
- ☐ Secondary Shut-Off valve location (if needed)
- ☐ Oil supply & return routing (the ¼ in. stainless steel tubing)

PROPOSED TRANSFIX FAMILY PRODUCT LOCATION:

- ☐ Overview from front
- ☐ Overview from left side
- ☐ Overview from back
- ☐ Overview from right side

PROPOSED CABLE 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 with door open
- ☐ Overview of each side
- ☐ Cooling loop(s)
- ☐ Conservator with close-ups of gauges
- ☐ Pumps
- ☐ Desiccant
- ☐ Nitrogen Cylinder / Regulator gauges (if transformer is nitrogen-blanketed) (both Output & Cylinder psig)

ADDITIONAL PHOTOGRAPHS:

- ☐ 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 photos

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GEDigitalEnergy.com

GE imagination at work