

GE
Grid Solutions

Kelman TAPTRANS™ User Guide

Transformer Oil
Dissolved Gas and Moisture Monitor



Contents

1	Introduction	5
1.1	Product Overview	5
1.2	Manual Scope	5
2	Safety	6
2.1	Symbols	6
2.2	Warnings	6
2.3	Hazardous Substances	7
3	Technical Specification	8
4	Compliance	9
5	Power	10
5.1	Introduction	10
5.2	Cold Start	10
5.3	Battery	11
5.4	Power-Down Procedure	12
6	LCD Panel	13
6.1	LCD Notifications	13
6.1.1	Startup	13
6.1.2	Manual Measurements	15
6.1.3	Manual Oil Sampling	16
6.1.4	Further System Specifications	17
6.2	Error Notification	19
6.2.1	Error Codes	20
7	Manual Oil Sampling	21
7.1	Sampling Arrangement	21
7.2	Sampling Process	22
8	Air Filter Cleaning	24
9	Oil Filter Cleaning	26
10	Communications	27
11	Modbus Protocol	27
12	Service Logs	27
13	Technical Support	27
Appendix A	Time Sync Implementation	28
Contact & Copyright Details	30

Table of Figures

Figure 5—1: Power switch.....	10
Figure 5—2: LED indicator lights & fuse holder.....	10
Figure 5—3: Coin cell battery.....	11
Figure 5—4: Standby mode.....	12
Figure 5—5: Power switch.....	12
Figure 5—6: Operation mode.....	12
Figure 6—1: Inside view.....	13
Figure 6—2: Boot.....	14
Figure 6—3: Version.....	14
Figure 6—4: Standby mode.....	14
Figure 6—5: Three sources.....	14
Figure 6—6: Peripheral scheduler.....	15
Figure 6—7: Start a manual measurement.....	15
Figure 6—8: Oil switching.....	15
Figure 6—9: Stop a measurement.....	16
Figure 6—10: Measurement data.....	16
Figure 6—11: Measurement in progress.....	16
Figure 6—12: Standby mode.....	16
Figure 6—13: Countdown & Purge.....	17
Figure 6—14: Take sample & Standby.....	17
Figure 6—15: Communication channels.....	17
Figure 6—16: Networking.....	18
Figure 6—17: GSM / GPRS modem.....	18
Figure 6—18: LCD error format.....	19
Figure 6—19: LCD error example.....	19
Figure 7—1: Oil filters and sampling ports (front view).....	21
Figure 7—2: Valve orientation.....	21
Figure 7—3: Sampling assembly.....	21
Figure 7—4: Luer fitting on assembly.....	21
Figure 7—5: Manual oil sampling flowchart.....	22
Figure 8—1: Air filter.....	24
Figure 8—2: Metallic hood.....	25
Figure 9—1: Oil filter.....	26

List of Tables

Table 3—1: Technical specification.....	8
Table 4—1: Type tests.....	9
Table 5—1: External LED status indicators.....	10
Table 6—1: Errors.....	20
Table A—1: Timing.....	28
Table A—2: UNIX time registers.....	28

Table A—3: Access flags.....	29
Table A—4: Modifier flags.....	29

1 INTRODUCTION

1.1 Product Overview

The TAPTRANS™ (herein referred to as the product) is an on-line DGA (Dissolved Gas Analysis) system for transformer diagnostics. It is designed to monitor the transformer and OLTC (On Load Tap Changer), including the Main, Selector and Diverter tanks. The product measures the following key fault gases in the transformer oil: **hydrogen, methane, ethane, ethylene, carbon monoxide, carbon dioxide** and **acetylene**. In addition the product also measures **oxygen, nitrogen** as well as moisture in the oil and the transformer load current. Such data provides insight on transformer condition criteria, such as developing faults, paper degradation and electrical arcing. Once installed, operation is straightforward. All results are stored within the product, but can be downloaded to a PC for analysis.

The key features and characteristics are summarised as follows:

- Utilises 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.
- 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 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 and Fibre Optic. Other options may be available on request.
- Internal USB connection provided for commissioning and service, or local data download.

*Note: The only recommended maintenance is periodic cleaning of the air filters, in-line oil filter and battery replacement.

1.2 Manual Scope

This guide outlines the use of the LCD panel, manual DGA sampling function and general maintenance activities.

2 SAFETY

2.1 Symbols

The following symbols are used in this manual and/or on this product:



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



Electrical Hazard. Risk of electric shock.



Primary Protective Earth connection.



Hot surfaces may be present.

2.2 Warnings

The following warnings must be observed:



The minimum ambient temperature for installation and service activities is -10°C .



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 user to ensure that planned work complies with those requirements.



The user shall also ensure that any third-party equipment, such as an approved platform, scaffold or lift is suitable and safe before commencing work. **Ladders or improvised platforms do not meet GE service engineer requirements.**



Once installed, this product 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.



Disconnection from the supply is achieved through the external circuit breaker or switch.



Ensure all power sources, including relays, are de-energised as stipulated by lockout-tagout (LOTO) requirements before removing inner covers.



The product is operated with the door shut under normal use. The door shall be kept locked and should only be opened for service access by suitably qualified and authorised service personnel. During service access, hazardous voltages are accessible.



Only GE-trained and certified personnel may commission GE products. Commissioning tasks include making any connections and/or performing any work within the enclosure, or performing tasks such as purging the oil circuit between the transformer and the product, and/or all first start-up procedures relating to equipment or firmware/software.



The product provides IP55 level water spray protection. It is possible for a water deluge system to exceed IP55 thresholds depending on the location, pressure and direction of the water jets. Therefore should customers require testing a water deluge system in the area in which the product is installed, GE recommends powering down the product and draping it with a suitable waterproof covering.

2.3 Hazardous Substances

The gases measured in the product are extracted from the oil and expelled to the atmosphere. These gases are at concentrations that are nonflammable, nontoxic and quickly diluted in the surrounding atmosphere. The expelled gases are not hazardous to health or life.

3 TECHNICAL SPECIFICATION

The product meets the following technical specification as outlined in Table 3—1.

Table 3—1: 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 ₂ H ₆)	2 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) * ¹
Ethylene (C ₂ H ₄)	2 – 50,000 Accuracy ± 5% or ± LDL (whichever is greater) * ¹
Acetylene (C ₂ H 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 ₂ O)	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	88 kg (194 lb)
POWER REQUIREMENTS	110 / 230 V AC* ³ (factory set), 50/60 Hz, 8 A Max
Single phase Alarm Relays: NO and NC provided	3 A 250 V AC, 150 mA 300 V DC* ⁴ , 200 mA 125 V DC, 3 A 30 V DC
Fuses * ⁵	10 A 500 V (Cooper Bussmann BAF), 10x38 mm
MEASUREMENT FREQUENCY	Variable – Once per hour to once every 4 weeks

*¹ Note: Accuracy quoted is the accuracy of detectors during calibration; gas-in-oil measurement accuracy may also be affected by sampling and/or oil type.

*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 product 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: Voltage ranges:

Set Voltage (V AC)	Minimum I/P Voltage (V AC)	Maximum I/P Voltage (V AC)
110	100	121
230	207	253

*⁴ Note: Maximum DC breaking capacity for a resistive load.

*⁵ Note: Use only the approved and recommended fuse to ensure continued fire protection and compliance.

4 COMPLIANCE

The product is designed to meet the following type tests as listed in Table 4—1:

Table 4—1: 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, 0.5 g operation 10 – 150 Hz, 0.5 g 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		2012

5 POWER

5.1 Introduction

The product is powered up by pressing the Power switch located inside the product towards the bottom right-hand side (see Figure 5—1). The mains fuse holder for the product is shown in Figure 5—2.



Figure 5—1: Power switch

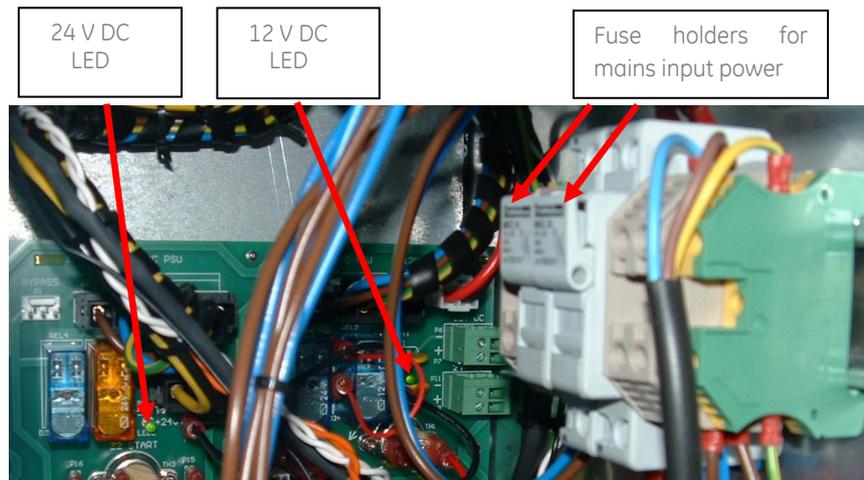


Figure 5—2: LED indicator lights & fuse holder

The product uses four external sunlight-visible LEDs on the front door. Each LED has two states – 'Off' (-) or 'On' as outlined in Table 5—1.

Table 5—1: External LED status indicators

Mode	Alarm (red) LED	Caution (yellow) LED	Power (green) LED	Service (blue) LED
Power Off	-	-	-	-
Normal	-	-	On	-
Alarm	On	-	On	-
Caution	-	On	On	-
Service	-	-	On	On

5.2 Cold Start

If the product is powered up in cold conditions (less than $-10\text{ }^{\circ}\text{C}$), the product initiates the following cold-start sequence before a measurement can commence. The internal heater in zone 1 automatically switches on to increase the internal temperature to within the PGA operational temperature range. The system does not fully power up until the working temperature in zone 1 reaches $-10\text{ }^{\circ}\text{C}$, after which the system becomes operational. Lights for the system power supplies are situated on the circuit board at the rear as shown in Figure 5—2.

Note: Once the DC power supply resumes, the internal temperature of the product may take several hours to reach working temperature before a measurement cycle commences.

5.3 Battery

The product uses a non-rechargeable lithium coin cell battery (Panasonic CR2450 3 V 620 mAh) as shown in Figure 5–3. In the event that the battery needs to be replaced, data from the product must be backed up. Failure to do so may result in historical data loss.

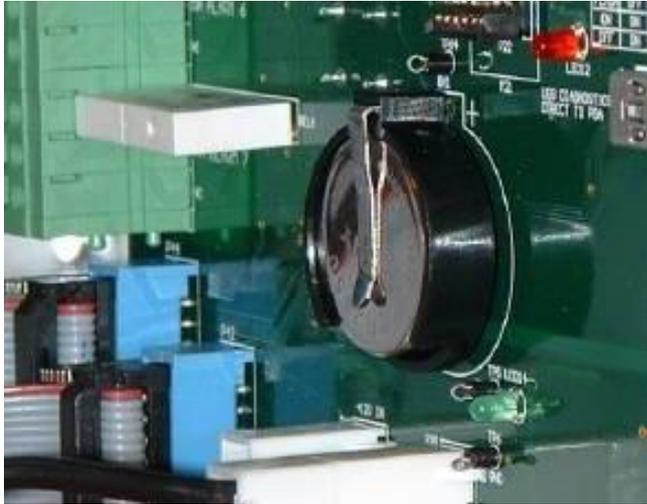


Figure 5–3: Coin cell battery



The following steps describe how to change the battery:

1. Back up the product data – contact your GE representative.
2. Open the inner door to locate the battery on the system board (as shown in Figure 5–3).
3. Slide the battery out of its housing.
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.gov/hazardouswaste/perchlorate/

5.4 Power-Down Procedure

If the transformer is to be shut down or the product needs to be shut down, perform the following steps:

1. Open the door of the product and observe the operating mode on the LCD panel.
2. If the product is in Standby mode as shown in Figure 5—4, perform the following steps:
 - Turn the switch on the inner door to the 'Off' position as shown in Figure 5—5.
 - Turn the external switch or circuit breaker to the 'Off' position.
 - Turn the transformer oil valves that connect to the input and output of the product to the 'Off' position.



Figure 5—4: Standby mode



Figure 5—5: Power switch

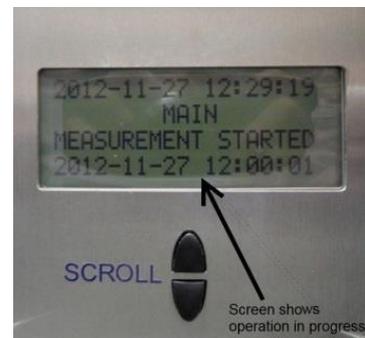


Figure 5—6: Operation mode

3. If for example, as shown in Figure 5—6 the product is in Operation mode, perform the following steps:
 - Press the red **Stop** button (Figure 5—4) or use the TRANSCONNECT software to stop an active measurement. The LCD reads "OIL DRAINING". This process may take several minutes.
 - When the product returns to Standby mode as shown in Figure 5—4, turn the switch on the inner door to the 'Off' position as shown in Figure 5—5.
 - Turn the external switch or circuit breaker to the 'Off' position.
 - Turn the transformer oil valves that connect to the input and output of the product to the 'Off' position.

When the product is to be powered up again, first turn the transformer oil valves that connect to the input and output of the product to the 'On' position. Then turn on the external switch or circuit breaker. Finally turn the switch on the inner door to the 'On' position. The product will be ready to resume taking scheduled readings.

6 LCD PANEL

The LCD panel is located on the inner cover and is visible when the door is open as shown in Figure 6–1.

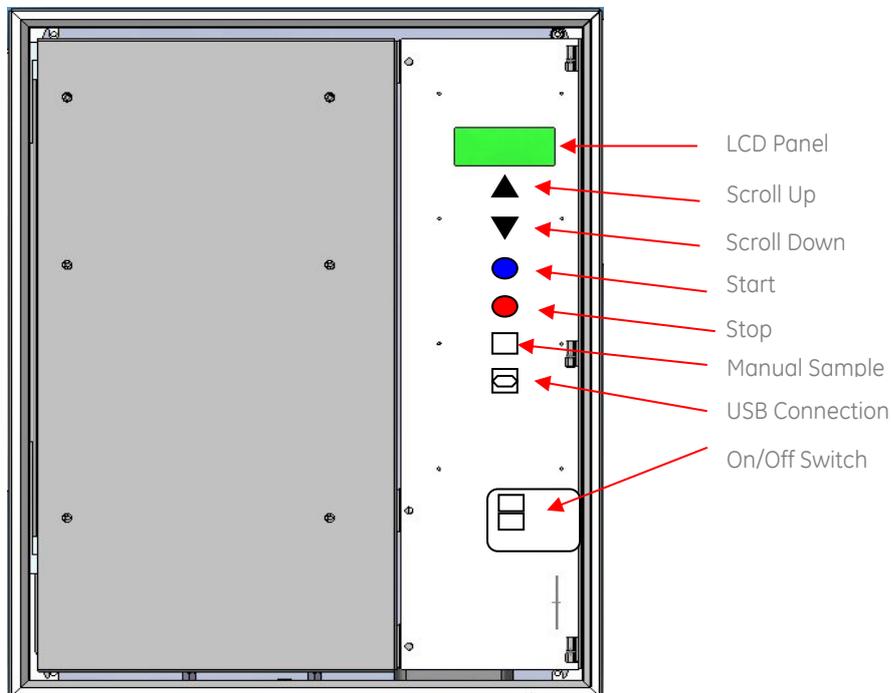


Figure 6–1: Inside view

During an analysis, the LCD panel shows the serial number of the product and the operational state. The last measurement results with date and time stamps can be obtained by using the black **scroll** buttons to page up or down through the details (see Section 6.1 for examples). By default, automatic paging is turned off.

6.1 LCD Notifications

The section outlines some examples of the notifications and data pages rendered on the LCD panel for a standard environment using factory settings. It illustrates typical information that a user is likely to see during normal operation. This can vary depending on the operational environment, firmware version and how the product is configured.

6.1.1 Startup

6.1.1.1 Boot

The Boot notice displays after power up or reset and progresses through a code checking sequence as shown in Figure 6–2. If boot problems occur, the product raises an error. Contact the Customer Service Centre.

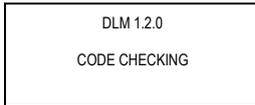


Figure 6—2: Boot

6.1.1.2 Version

If the boot sequence is successful, a Version notice reflects the product name, serial number, firmware version and PGA version as shown in Figure 6—3. Use the black **scroll** buttons at any time to page through the various notifications and data pages, including existing measurement results.

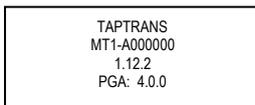


Figure 6—3: Version

6.1.1.3 Standby

A notification indicates the operational mode as shown in Figure 6—5. Standby mode is the initial operational mode. If scheduled measurements are configured, they will occur automatically at the scheduled time (see Section 6.1.2.4). If there are no scheduled measurements, the Scheduler Disabled notice displays.

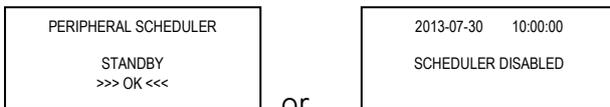


Figure 6—4: Standby mode

Use the black **scroll** buttons at any time to page through any data pages for the three sources.

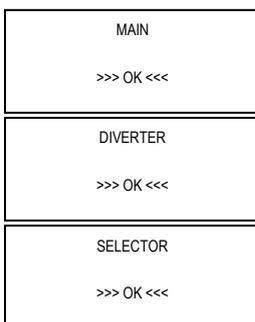


Figure 6—5: Three sources

6.1.1.4 Peripheral Scheduler

A notification lists all peripheral connections as shown in Figure 6—6. If the peripheral scheduler is enabled, all analogue inputs are listed with corresponding null values. The product has analogue inputs AIn1 to AIn6, but corresponding values for these appear

after peripheral(s) are connected. By default, a newly shipped product has no connected peripherals, but a configured installation may have a load sensor connected.



Figure 6—6: Peripheral scheduler

6.1.2 Manual Measurements

6.1.2.1 Start a Manual Measurement

Use the blue **Start** button to initiate a manual measurement on the main tank. The timer automatically counts down from 10 seconds and then indicates the start of a manual measurement as shown in Figure 6—7. *Note: If the selected oil tank is different from the previous oil tank, an oil switching notice also displays as outlined in Section 6.1.2.2.*

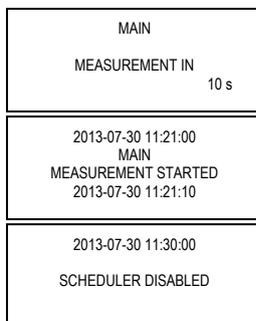


Figure 6—7: Start a manual measurement

6.1.2.2 Oil Switching

If the current oil tank (the one last measured) is different from the selected oil tank to measure, the product first needs to switch between oil tanks before a measurement can begin. Figure 6—8 indicates switching from one tank to another.

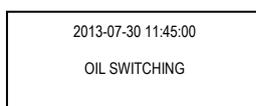
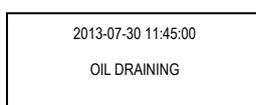


Figure 6—8: Oil switching

6.1.2.3 Stop a Measurement

Use the red **Stop** button to abort an active measurement. After any remaining oil in the headspace drains, the product returns to Standby as shown in Figure 6—9.



2013-07-30 12:00:00
STANDBY

Figure 6—9: Stop a measurement

6.1.2.4 Measurement Data

Use the black **scroll** buttons at any time to page through the notices and see the measurement data. For example, data for the Main tank is shown in Figure 6—10. Similar pages display for each oil tank in turn (Diverter and Selector tanks). The product can also be configured to automatically page through the results of the last analysis for each oil tank. *Note: If nitrogen measurement is not enabled, the nitrogen and total gas concentration is omitted.*

<p>MAIN</p> <p>LAST MEASUREMENT</p> <p>2013-07-30 12:48:10</p>	<p>MAIN</p> <p>C2H4 5000.0ppm</p> <p>C2H2 2345.0ppm</p> <p>TDCG 26390.0ppm</p>	<p>MAIN</p> <p>H2O 1040.0ppm</p> <p>CO 222.0ppm</p> <p>CO2 234.0ppm</p>	<p>MAIN</p> <p>O2 4190.0ppm</p>
<p>MAIN</p> <p>H2 15170.0 ppm</p> <p>CH4 333.0 ppm</p> <p>C2H6 3320.0ppm</p>			
<p>MAIN</p> <p>Amb Temp -0.1 °C</p> <p>Oil Temp +38.3 °C</p> <p>Oil Press +97.1 kPa</p>			
<p>MAIN</p> <p>AIN 1 -1.111xxx</p>			
<p>MAIN</p> <p>NEXT MEASUREMENT</p> <p>2013-07-30 16:48</p>			

Figure 6—10: Measurement data

6.1.3 Manual Oil Sampling

Use the white **Manual Sample** button to initiate the manual oil sampling process. If the white **Manual Sample** button is pressed during a measurement, the notice shown in Figure 6—11 displays.

<p>MANUAL DGA PREVENTED</p> <p>MEASUREMENT IN PROGRESS</p>
--

Figure 6—11: Measurement in progress

Wait until the current measurement process is complete or stop the current measurement process (See Section 6.1.2.3). The system returns to Standby as shown in Figure 6—12.

2013-07-30 12:00:00
STANDBY

Figure 6—12: Standby mode

A single press of the white **Manual Sample** button during Standby, selects the current oil tank for sampling. Subsequent presses of the button are used to toggle through and select a different oil tank from the three available – Main, Diverter or Selector tanks. Once a tank is displayed, the timer automatically counts down from 10 seconds and if the white button is not pressed again, the listed tank is selected for manual oil sampling. After the count down an oil purge is performed as shown in Figure 6–13.

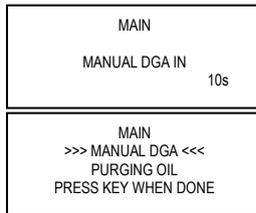


Figure 6–13: Countdown & Purge

Note: The oil must be purged for a suitable period of time dependent on the installation. See the ‘Sampling Process’ in Section 7.2.

The system prompts the user to take the manual oil sample and then returns to Standby mode when complete as shown in Figure 6–14.



Figure 6–14: Take sample & Standby

6.1.4 Further System Specifications

6.1.4.1 Communications Channels

The product has two serial communications channels. For example, default configuration details are shown in Figure 6–15, such as the interface, protocol, baud rate, modbus address and parity error-checking format:

ChA RTU	1	RS232
	19200	0
ChB: ASC	1	GSMGPRS
	57600	0

Figure 6–15: Communication channels

6.1.4.2 Networking

If Ethernet is enabled and a RJ-45 connection made, relevant network details are shown. For security reasons, all network details are hidden by default as shown in Figure 6–16, but these can be software enabled.

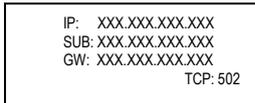


Figure 6—16: Networking

6.1.4.3 Other System Details

Additional notifications reflect the configuration of the product. For example, if a GSM/GPRS modem is fitted, additional page(s) as shown in Figure 6—17 reflect the communications provider, signal strength and any problems.



Figure 6—17: GSM / GPRS modem

Notes:

- a) Actual product values depend on the installation at any moment in time.
- b) Actual parameter format can vary e.g. O₂ or Oxygen.
- c) See Section 6.2 for a list of defined error codes.
- d) System Failure mode limits functionality. Contact the Customer Service Centre.

6.2 Error Notification

The LCD panel lists the last detected errors using a sequence of double-digit codes. A 00 state code denotes the absence of errors, whereas a non-zero state code denotes one or more errors. See Section 6.2.1 for a list of the error codes. The error format is shown in Figure 6—18. The top line is used to indicate the state within the measurement process at which the error occurred, where uppercase 'XX' denotes the Oxygen sensor error state (if the Oxygen sensor is enabled) and uppercase 'YY' the PGA error state. The bottom line denotes specific error codes within that state, where the lowercase 'xx' code relates to the specific Oxygen sensor error and all the remaining 'yy' codes relate to specific PGA errors. *Note: The Customer Service Centre requires both the state code(s) and error code(s) in order to interpret any error.*

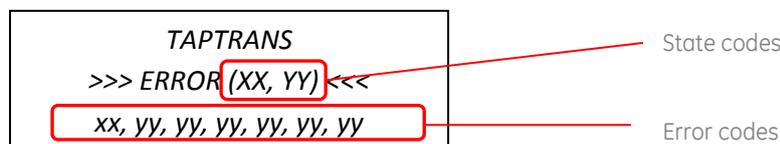


Figure 6—18: LCD error format

For example, Figure 6—19 shows the product with one PGA error. The first code on the top line reads 00 which means no reported errors from the Oxygen sensor. The next code reads 02 which means a reported PGA error in the oil purging state. If there are no Oxygen sensor errors, the first error code on the bottom line always reads 00. The next code reads 18 which means that the PGA has detected that the oil pressure is too low.

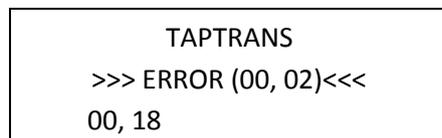


Figure 6—19: LCD error example

Note: If the Oxygen sensor is not enabled, no Oxygen sensor state or error codes display.

Note: If there is no PGA error, the PGA error state in the top line always reads 00.

6.2.1 Error Codes

The LCD panel error codes are listed in Table 6—1. All the service alarm error codes are accompanied by illumination of the blue Service light that is visible on the front door of the product.

Note: Error codes are offset by 1 from the MODBUS register bit numbers.

Note: This information relates to firmware PGA 4.0.81 for TAPTRANS.

Table 6—1: Errors

Code	Error	Note
	PGA Connection Error	
	Timeout	
01	PGA power supply voltage too low	
02	PGA chopper frequency outside range	
03	PGA IR-source outside range	
04	Gas flow lower than limit	
05	Background noise/vibration too high	
06	Microphone test failed	
07	Not level sensor 1 pulses (level)	
08	Not level sensor 3 (drain)	
09	Fill level shows Oil	
10	Over Fill shows Oil	
11	PGA Air temperature outside limits	
12	Bad communication with control PCB	
13	Gas leak test: Pump pressure too low	
14	Gas leak test: Pressure decay too high	
15	Unusual ambient gas measurements	
16	Oil temperature too low	
17	Oil temperature too high	
18	Oil pressure too low	Check that all oil supply valves are open.
19	Oil pressure too high	Check that all oil return valves are open.
20	Oil pump tacho count too high	
21	Oil pump pressure too low	
22	Oil pump speed out of range	
23	Manual oil sampling switch	
24	Oil pump tacho count too low	
25	Oil pump not turning	
26	-	Not used.
27	Temperature Sensor(s) 1 disconnected	
28	Temperature Sensor(s) 2 disconnected	
29	Drain level shows oil	
30	Conditioned oil temperature outside limits	

7 MANUAL OIL SAMPLING

A manual oil sample can be taken via the following arrangement.



Before commencing work, ensure the use of suitable protective gloves, such as nitrile rubber.

7.1 Sampling Arrangement

The product has one manual oil sampling port fitted to the base. This consists of a quick-connect body and a captive body-protector fitting as shown in Figure 7—1. The product ensures that there is fresh oil at the sampling point when the sampling process takes place.



Figure 7—1: Oil filters and sampling ports (front view)

A male quick-connect fitting and valve assembly is provided in the product installation kit. GE also recommends the use of a 50-mL gastight syringe with Luer lock termination.

Note: The manual oil sampling arrangement and the quick-connect sampling port must not be cleaned with any type of solvent as this could affect results for subsequent oil samples.

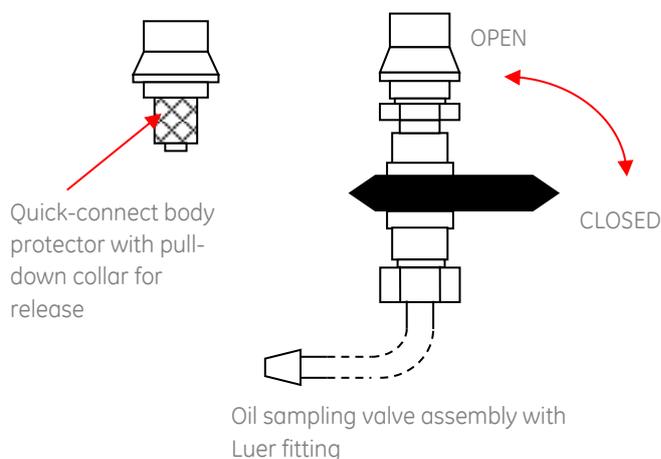


Figure 7—2: Valve orientation



Figure 7—3: Sampling assembly



Figure 7—4: Luer fitting on assembly

7.2 Sampling Process

Open the door of the product and observe the operating mode on the LCD panel. The flowchart shown in Figure 7–5 and the accompanying steps summarise the process to obtain a manual oil sample.

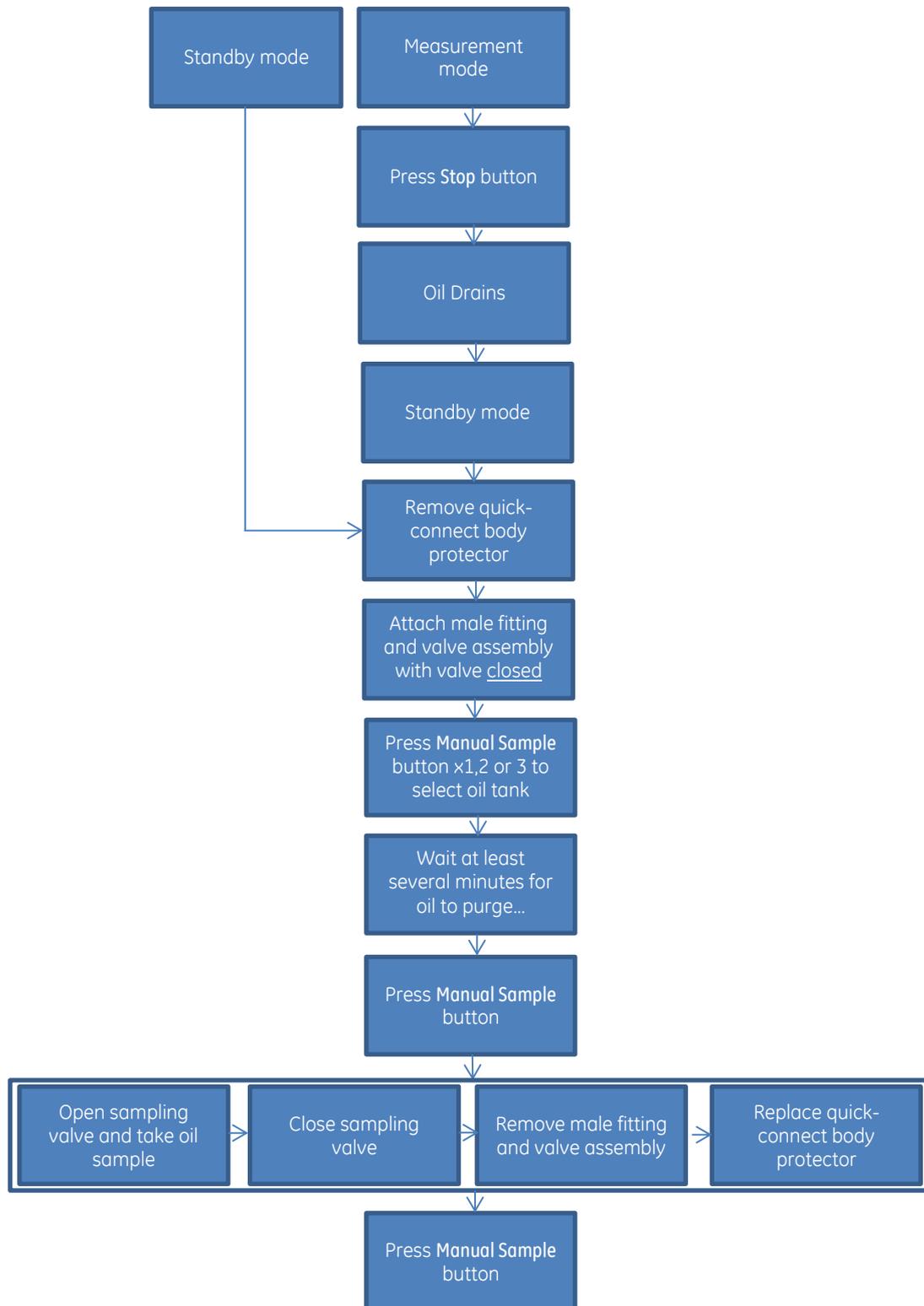


Figure 7–5: Manual oil sampling flowchart

1. If the product is in Standby mode, proceed to step 3. If the product is in Measurement mode, manual sampling is prevented.
2. Press the red **Stop** button to stop the measurement process. The display reads "OIL DRAINING". If there is oil in the headspace, the draining process may take several minutes. The product returns to Standby mode.
3. When the product is in Standby mode, remove the quick-connect body protector by pulling the collar down.
4. Fit the male quick-connect fitting and valve assembly to the correct quick-connect body on the base of the product as shown in Section 7.1. Ensure that the valve is closed to prevent oil leakage.
5. Press the white **Manual Sample** button. The display reads "MANUAL DGA IN: 10s". Subsequent presses of the white button are used to toggle through and select the required oil tank to sample. Once a tank name is displayed, the timer automatically counts down from 10 seconds, and if the white button is not pressed again, the displayed tank is selected for manual sampling. *Note: If the product has to first switch oil tanks from the last measured tank to the selected tank, an "OIL SWITCHING" notice displays.*
6. An oil line purging process starts. The display reads "MANUAL DGA PURGING OIL PRESS KEY WHEN DONE".
To ensure accurate results, oil must be adequately purged before sampling begins. This brings fresh oil from the transformer to the manual oil sampling port. Typically this means waiting approximately 5–10 minutes, but the recommended wait time can vary depending on the installation (longer tubing and lower temperatures can increase the purge duration). Consult with Technical Support.
7. Press the white **Manual Sample** button. The display reads "{oil tank name} MANUAL DGA TAKE OIL SAMPLE PRESS KEY WHEN DONE". *Note: This indicates that the oil sampling process can begin.*
8. Remove the Luer fitting cap, connect the oil sampling equipment e.g. syringe, and perform the oil sampling according to your standard process and procedures.
9. When finished sampling, close the valve and disconnect the oil sampling equipment.
10. Remove the male fitting and valve assembly, and replace the body protector fitting on the quick-connect body.
11. Press the white **Manual Sample** button to return the product to Standby mode. *Note: If left in Manual Sampling mode, the product reverts to Standby mode after one hour. Measurement then begins at the next scheduled measurement time.*
To start a measurement immediately, press the blue **Start** button and then select the oil tank to measure.

To take a manual sample from another oil tank, press the white **Manual Sample** button again. If a measurement has started since the previous sample, first press the red **Stop** button.

See Section 6.1 for example notifications from the LCD panel.

8 AIR FILTER CLEANING

The product draws air from the bottom and expels it on the right-hand side. The intake air is filtered to remove the largest particles, so depending on environmental conditions the air filter may need occasional cleaning. The outlet filter may also require attention. A higher temperature in zone two can be an indication that such action is required.

To clean the air intake filter:

1. ⚠ First isolate the product through the external circuit breaker or external switch *before* opening the inner door on the right. Isolate any other power sources to the system board relays and apply LOTO. *Note: Remove the AC cover to gain access to the filter assembly.*
2. If a cable-tie is fitted to the filter holder, first carefully remove it. Remove the filter holder by pulling off the black snap-off cover to the filter.
3. If the filter mat is just dusty, clean it with dry compressed air or by beating it against a hard clean surface.
4. If the filter mat is oily, clean it with mild detergent and water, and then dry it thoroughly.
5. Replace the filter mat and snap the cover back in place. *Note: The cable tie only secures the filter holder during shipping so there is no requirement to replace.*
6. Close the inner door and re-energise the product.



Figure 8—1: Air filter

To clean the air outlet filter:

1. Slide up and remove the metallic hood on the right-hand side of the product casing to reveal the black fan / filter assembly. *Note: Use a rubber mallet to assist with removing the hood.*
2. If a cable-tie is fitted to the filter holder, first carefully remove it. Remove the filter holder by pulling off the black snap-off cover to the filter.
3. If the filter mat is just dusty, clean it with dry compressed air or by beating it against a hard clean surface.
4. If the filter mat is oily, clean it with mild detergent and water, and then dry it thoroughly.
5. Replace the filter mat and snap the cover back in place. *Note: The cable tie only secures the filter holder during shipping so there is no requirement to replace.*
6. Replace the metallic hood over the filter assembly and re-energise the product.



Figure 8—2: Metallic hood

9 OIL FILTER CLEANING

The oil is filtered to prevent particles from entering the product or being returned to the transformer. Therefore this filter may need occasional cleaning.

Note: A non-critical error in the product data file, such as error code 18 or 20 can be suggestive of such action.

See Figure 7—1 to view the oil filter connections at the bottom of the product. Figure 9—1 shows a typical oil filter used in the product.



Figure 9—1: Oil filter



Before removing the filter housing, first isolate the product through the external switch or circuit breaker and ensure that the oil supply valve is closed.

To clean the oil filter:

1. If a measurement is in progress, press the red **Stop** button. This will abort the measurement process and return the product to Standby mode. Power off the product at the external switch or circuit breaker once it is in Standby mode.
2.  Remove the 1 in. nut that secures the filter housing using a suitable wrench. Care must be taken because there is also a spring behind the filter. *Note: A little oil may leak out.*
3. Remove the filter and clean it using a brush and compressed air. Then replace the filter back into its housing and re-secure the housing.
4. Replace the nut, but use a second wrench to hold the filter housing in place while the nut is tightened to 65 N.m with a torque wrench.
5. Re-energise the product and it will automatically begin measuring at the next scheduled time.

Note:  The compression nuts on either side may need to be loosened slightly to position the filter at a more convenient angle, but must be re-tightened afterwards.

10 COMMUNICATIONS

See the Communications section of the TRANSFIX-family Installation Manual (MA-001) for available communication options.

11 MODBUS PROTOCOL

See document 32-0245 for details of the Modbus protocol for all TRANSFIX family products.

12 SERVICE LOGS

Service logs can be obtained by using either the Kelman Download utility or the Perception transformer monitoring software v1.12 or later. See the 'Downloading service logs' section in the Perception User Guide.

13 TECHNICAL SUPPORT

For technical support, please contact the GE Customer Service Center. Available 24 hours a day, 365 days a year.

+1-800-361-3652 toll free (US/Canada)

+1-514-339-2801 (worldwide)

ge4service@ge.com

Appendix A Time Sync Implementation

The product has a time-sync feature that allows users to synchronize the clock. This Appendix explains the data format options for the “time sync” and its implementation.

A.1 Time Format

Under the standard Modbus® register list, the timing is defined in Table A—1.

Table A—1: Timing

Register	Permissions	Group Size	Description	Data Format
1200	R/W	4*	UTC Clock: Years	YYYY (BCD)
1201			UTC Clock: Months, days	MMDD (BCD)
1202			UTC Clock: Hours, minutes	HHMM (BCD)
1203			UTC Clock: Seconds, Day of week (0-6, 0 Sunday)	SSWW (BCD)

This R/W (read/write) register is in BCD format (Binary Coded Decimal). Some systems are not compatible with this data format. *The time registers can be written separately in 5 seconds interval in any order. This feature is available starting TransfixHost v1.12.4.

A.2 UNIX® Epoch register

A UNIX Epoch register was added to the host board firmware (v1.12.2) to make systems integration easier in cases of system incompatibility. Both register formats (BCD & UNIX) will be maintained in future firmware versions and both affect the same single clock. The details of the UNIX time registers are listed in Table A—2.

Table A—2: UNIX time registers

Register	Access Flags	Version	Storage Class	Effect After	Name	Description	Data Format
1197	rg2,wg2	1.12.2	RAM	immediately	RTC_UNIX_TIME	Current Time UTC in UNIX format	32-bit integer
1198							

These registers are readable and writable, but should be written together as a single 32 bit value.

A.2.1 UNIX Time Format

The number of seconds from the UNIX epoch time of 1st Jan 1970 00:00.

A.2.2 UNIX Time Example

For reference, the time on a device is reported in TransConnect as 12 Aug 2011 11:56:00 BST and the corresponding value in the registers mentioned above is 13146616.

When testing, please check that you are reading registers 1197-1198 (assuming addresses start at 999 +1) and decoding an unsigned 32 bit big endian number. The epoch time is in UTC. This matches the device time. An online converter e.g. <http://www.epochconverter.com/> can be used to verify.

A.2.3 Register Access Control

The product registers are protected with access flags. The register map details the relevant access flags for each register. Each register may have one or more access flags, separated by commas. Table A–3 lists the supported access flags:

Table A–3: Access flags

Flag	Access	Description
r	Read	Read access to a single register
rgN	Read group	Read access to a group of length N (Nmax = 120)
w	Write	Write access to a single register
wgN	Write group	Write access to a group of length N (Nmax = 120)

Access flags may be modified with the addition of the modifier flags listed in Table A–4.

Table A–4: Modifier flags

Flag	Access	Description
u	User	Only accessible if the master is authorised with user access
c	Config	Only accessible if master is authorised as config (commissioning) user
f	Factory	Only accessible if master is authorised as factory (service) user

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