



# GRIDSCAN 5000

High-Precision Monitoring for Transformers with Continuous Hydrogen and temperature Measurement

Manual



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## INTRODUCTION

H2scan's GRIDSCAN 5000 is a state-of-the-art monitor that integrates multiple sensors into a single device, enabling advanced predictive diagnostics and continuous monitoring of electrical transformers.

With its patented solid-state technology, the GRIDSCAN 5000 provides accurate hydrogen (H<sub>2</sub>) and temperature measurements, for early detection of dielectric faults and prevention of catastrophic events.

The solution allows a **significant reduction in operating costs (OPEX)**, eliminating the need for periodic calibration and minimizing maintenance interventions.

#### **KEY TECHNICAL DIFFERENTIALS**

#### 1. High Precision Hydrogen Sensor

- Measurement range: 25 to 5000 ppm
- Accuracy: ± 20% of reading or ± 25 ppm, whichever is greater
- Repeatability: ± 10% of reading or ± 25 ppm
- Response Time: < 60 minutes after contacting H<sub>2</sub>
- Low cross-interference: less than 2% sensitivity to CO, CO<sub>2</sub> and hydrocarbons
- Patented solid-state technology: no consumables or recalibration required
- **PT100 Sensor**: RTD Type -40 TO 105°C = <1°C

## ROBUSTNESS AND OPERATION IN EXTREME ENVIRONMENTS

- **Operating temperature:** -40°C to 70°C
- Submersion resistance: IP68 (immersion in water up to 7.6 meters for 14 days)
- **Compatible with insulating oils:** mineral, silicone, natural ester and synthetic
- Marine resistance: IEC 60068-2-11 compliant (salt spray)
- **Operating pressure at sensor:** 0.1 to 2 bar absolute (1.45 to 30 psi)
- **Operating altitude:** up to 3000 meters above sea level



## COMMUNICATION AND INTEGRATION

- Output Protocol: RS-485, Modbus RTU
- EHMI and SCADA compatible
- Dynamic data storage
- Flexible connectivity: choice of wired or wireless communication

## MECHANICAL AND ELECTRICAL SPECIFICATIONS

- Dimensions: 15.1 x 3.9.8 x 3.9 cm (5.94 x 1.56 x 1.56 in)
- Weight: 0.387 kg (0.85 lb)
- Supply voltage: 12 to 48 VDC
- Maximum consumption: 10W

## TECHNICAL DATA OPERATING CONDITIONS

Parameter	Value			Units		
	Minimum	Nominal	Maximum			
Environment – Insulating Liquid						
Multinational	-40		105	C°		
Survival	-40		135	C°		
Rate of change			24	°C / hour		
Pressure	0.1 (10000)		10 (1000000)	Bar (Pa)		
Environment – Environment						
Operating Temperature	-40	25	70	C°		
Storage Temperature	-40		85	C°		
Ingress Protection	IP68; 25 feet of water for 14 days (IEC 60529)					
Humidity	0 to 100% relative humidity, condensation					
Corrosion resistance	C5M Marine Class Classification; salt water condensation (IEC 60068-2-11 and DIN EN ISO 12944)					
Mechanic						
Vibration	3-axis sine, wideband and random (IEC 60068-2-6 table C.2, IEC 60068-2-64 paragraph A.2, category No. 2, IEC 61373:2010					
Shock	30g, 18ms shock duration (IEC 60068-2-27)					
Weight	0.85 pounds (387 grams) (387 grams)					
Electric						
Voltage input	12	24	52.8	VDC		
Power Consumption			10	W		

Table 1 – Operating Conditions

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## TECHNICAL DATA HYDROGEN MEASUREMENT

PARAMETER	VALUE			
Oil Range	25–5000 ppm			
Gas Range	25–5000 ppm			
*Response Time, T90	<60 minutes			
Accuracy	±20% of reading or ±25 ppm, whichever is greater			
Repeatability	±10% of reading or ±15 ppm, whichever is greater			
Cross-sensitivity	Less than 2% cross-sensitivity to other gases (CO, CO2, hydrocarbons)			
Calibration Range	No periodic calibration is required			

Note: Once hydrogen reaches the sensor, the sensor will respond in 60 minutes or less.

## Table 2 - Hydrogen measurement specification

## GETTING TO KNOW GDSCAN 5000



Fig 1 – Getting to know the GDSCAN 5000

- 1. 3/4" Female to 1" NPT Adapter
- 2. Bleed Valve
- 3. H2SCAN 5000
- 4. Electrical Connections



## INSTALLATION RECOMMENDATION

The following precautions should be followed to ensure that the sensor assembly is not damaged during handling.

- Make sure nothing comes into contact with the sensor end of the device
- The red protective cover should remain in place until the time of installation.
- Place a wrench in the metal casing closest to the threaded end when tightening. The GRIDSCAN 5000 is designed to handle torque throughout the sensor assembly enclosure.
- Use standard torque for a 3/4" NPT connection, which is approximately 50 ft-lbs. Do not overtighten.
- When installed in liquid, the monitor should be mounted horizontally, as illustrated in Figure 3. The Vertical or horizontal mounting is acceptable in a gas-only location.



Fig 3 – Installation in Oil recommended by GDSCAN 5000



## TECHNICAL MANUAL GRIDSCAN 5000

## TYPICAL INSTALLATION LOCATIONS



Fig 4 – Typical installation locations

Note: <u>When installed in liquid, the monitor should be mounted horizontally, as illustrated in Figure 3. The</u> <u>Vertical or horizontal mounting is acceptable in a gas-only location.</u> Note 2: <u>When installed in oil, provide media to bleed all air from the pipe connections between the sensor and the oil tank.</u>

## MECHANICAL INSTALLATION

Connect the sensor to a 3/4"-14 NPT fitting on the oil tank. Adapter bushings for larger ID fittings can be used, however, do not use adapters for smaller ID fittings or pipes. In oil, the sensor should be mounted in a horizontal position to prevent air bubbles from forming around the sensing element. Vertical or horizontal mounting is acceptable in gas.



Fig 5 - Installation and Assembly

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CONNECTION DIAGRAM

All electrical connections of the GRIDSCAN<sup>®</sup> 5000 are supplied via a single four(4) pin M12 connector. The key location (notch) and pin numbers are shown in the table below:

450	ENTRY	SIGNAL NAME	YARN COLOR
$\checkmark$	1	DC Power 12-48 Vdc	Brown
	2	Grounding DC 12-48 Vdc	White
	3	RS-485+	Blue
4	4	RS-485 Data -	Black



Fig 6 – Connection diagram

A properly rated cable assembly is required for most field applications. Cable recommendations are:

- M12 4-pin female molded connector
- IP68-rated, for substation environments
- AWG 4/18 wire.
- Armoured cable is recommended (grounded only at one end)



## COLLECTING FLUID THROUGH THE GDSCAN 5000

- 1. Make sure all fittings are tight and all threads are sealed with Teflon<sup>®</sup> tape or a suitable pipe thread sealant.
- 2. Make sure all valves and plugs are initially closed.
- 3. Place a suitable container under the air bleed assembly to catch any oil. Open the valve or plug on the air bleed assembly.
- 4. Slowly open the main transformer valve just enough to see a small stream of oil flow into the oil container. When there is no air seen in the stream, close the valve or plug of the air bleed assembly.
- 5. Open the transformer valve fully. Check for leaks.

## ATTENTION:

- 1. Fluid can exit the bleed hole quickly. Be prepared to close the transformer valve immediately.
- 2. Do not fully remove the bleed screw or a geyser will occur.



Fig 7 – Bleed valve

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BENEFITS FOR ENGINEERING AND MAINTENANCE

- 1. Real-Time Monitoring
  - Provides continuous data on key transformer operating parameters
  - Predictive analytics enable failure anticipation and strategic maintenance planning

## 2. Maintenance-free technology

- Hydrogen sensor with 10-year warranty free of consumables and calibration
- Rapid deployment and simplified integration
- 3. Dielectric and Operational Fault Detection
  - Early indication of failures associated with leaks, overheating and dielectric degradation
  - Reduced OPEX with optimized maintenance

## 4. Advanced Connectivity

- EHMI and SCADA compatible for remote management
- Robust industrial protocols ensure reliable integration

## EXAMPLE APPLICATION WITH EHMI



Fig 8 – Application Example

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## BENEFITS OF INTEGRATING WITH EHMI AND MONITRAFO

The **GRIDSCAN 5000**, combined with **EHMI - IoT** and the **MONITRAFO platform**, offers the most complete solution for **monitoring transformers and critical assets**. The integration of the systems allows **for greater predictability, operational efficiency, and cost reduction**, ensuring safety and performance in real time.

The **GRIDSCAN 5000** and **EHMI** - **IoT** form a robust and efficient ecosystem for **monitoring transformers and electrical assets**. With the integration of the **MONITRAFO** platform, users have access to a complete solution for **acquisition**, **processing**, **and analysis of operational data**, ensuring greater reliability and efficiency in asset management.

#### **Monitored Parameters:**

- Hydrogen (H<sub>2</sub>): First dielectric fault gas, essential for internal overheat monitoring.
- Humidity: Critical monitoring of insulating oil degradation and prevention of internal shorts.
- Pressure: Indicates operational variations and can detect structural leaks.
- Temperature: Allows you to predict thermal failures and overloads.

**EHMI** uses **MQTT protocol** and integrates advanced tools such as **Artificial Intelligence**, **Machine Learning**, **Database**, **Programmable Functions**, **Automatic Calculations and Notifications**. In the event of a loss of connection, the data is stored locally and later sent to the server.

With the MONITRAFO platform, users can set up custom designs, track measurements in real-time, and access detailed reports of monitored quantities, triggers, alarms, and predictive maintenance. Monitoring can be done via **internet browser or MONITRAFO app**, available for Android and iOS.

When integrated with the **MONITRAFO** platform, EHMI - IOT offers a complete ecosystem for monitoring and managing electrical assets, significantly expanding its functionalities:

- Efficient Monitoring: Access to advanced monitoring, diagnosis, and fault prevention tools directly from the cloud, allowing flexibility and operation from anywhere with internet access.
- **Real-Time Alerts:** Immediate notifications of faults and alarms via SMS, WhatsApp, and email, ensuring quick responses to critical events.
- **Reports with Artificial Intelligence:** Generation of detailed reports with accurate diagnoses, assisting in preventive maintenance and identifying potential problems before they become critical.
- Interactive Dashboards: Personalized visualization of projects through modes such as Dashboard, Overview and Map, facilitating the identification of active events and the efficient management of monitored assets.
- **Event Announcer:** Real-time notification to the entire team of substation incidents, promoting effective collaboration and ongoing equipment maintenance.
- **Maintenance Schedule:** Periodic maintenance recommendations generated by IEDs and artificial intelligence, ensuring the best performance and extending the useful life of sensors and electrical assets.
- **Team Communication:** Integration and facilitated communication between team members through notifications and chat on the platform, optimizing maintenance management and maintaining a history of actions.
- API and Integrations: Support for various programming languages and integration with ERP systems and IoT platforms, such as SAP, Oracle, Totvs, AWS, Google Cloud, Azure and IBM Watson, providing flexibility and versatility in meeting the specific needs of users.



ACCESSORIES



3/4" NTP male Street T

## Aerial Bleed Set:



3/4" NTP Female to 1" NPT

## **Oil Bushing Adapters, Valve**



3/16" Compressed air vent pipe



1" NPT to 3/4" NPT Bushing adapter



2" NPT to 3/4" NPT Bushing adapter

## **Oil Bushing Adapters, DN Type Valve**





DN25 to 3/4" NPT Filter Adapter



DN50 to 3/4" NPT Filter Adapter



DN25 to 1" NPT Filter Adapter



DN50 to 1" NPT Filter Adapter

## **Grounding and Conduit Adapters**



Grounding Adapter (wire connection #14 AWG to #8 AWG)



Conduit Gland Adapter (for use with 1/2" conduit)



## COMMISSIONING

After plugging in the cable and turning on the power supply, the sensor performs a power-up sequence that can last up to 16 hours. The following operations are performed during the boot sequence:

- Connected system self-test
- Restoring non-volatile memory configuration settings
- Start measuring oil and hydrogen temperature
- The self-calibration sequence is performed to stabilize the sensor as needed (the sensor may show the initial value before the self-calibration is completed)

Before putting the sensor into operation, perform the following steps:

- 1. Connect the sensor to power for at least 5 minutes to recharge the supercapacitor, which may have discharged if the sensor has been out of power for several months.
- 2. Reset the date/time according to the steps in section 7.2.16.
- 3. Turn the power off and on to eliminate any errors.

After a short power outage, approximate hydrogen readings will be reported by the sensor within 30 minutes of power being restored. In new installations and after long power outages, the sensor can take up to 16 hours to stabilize and report accurate hydrogen readings.

#### CONFIGURATION

The GRIDSCAN<sup>®</sup> 5000 only provides data to the SCADA. No alarm setpoints can be implemented on the GRIDSCAN<sup>®</sup> 5000. Configure the GRIDSCAN<sup>®</sup> 5000 in a Modbus supervisory system.

The Modbus 111, bit 15 status record will indicate ready when the first valid hydrogen measurement is available. After the boot sequence is complete, the measured and calculated values will be available in the Modbus records.

Default Communication Settings:

- RS-485, half duplex, 19200 baud, 8 data bits, 1 or 2 stop bits, no parity.
- The default Modbus ID is 1.

During normal operation, the sensor will measure oil temperature (approximately once per hour) to provide temperaturecompensated dissolved gas readings. The unit will periodically undergo an internal self-calibration check (reference cycle). These are automatic activities that don't require any user interaction





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## CERTIFICATIONS AND COMPLIANCE

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The **GRIDSCAN 5000** meets stringent international standards for electrical safety and electromagnetic compatibility, among others, according to the following standards:

- IEC 60068-2-2 & EN 50155 Section 13.4.4IEC 60068-2-11 & DIN EN ISO 12944
- ➢ IEC 60529
- IEC 60068-2-6 Table C.2
- IEC 60068-2-64 paragraph A.2, category no. 2
- IEC 60068-2-27
- FCC Part 15
- EN 55011 Class A Group 1
- EN 61000-4-2, 61000-4-3, 61000-4-4, 61000-4-6 and 61000-4-8
- > ANSI/UL/IEC/EN 61010-1
- ➢ EN 61326-1
- FM 6520 [oil version only]

#### SPECIFICATION FOR ORDER

Code: CJ-0085

Name: GRIDSCAN 5000 MONITORING KIT

Items Included in the Kit:

1 x GRIDSCAN 5000 Sensor (Hydrogen) 1 3/4" to 1" NPT Female Adapter

3/4 to 1 NPT Female Adapter

10 meters of RS485 4-wire connection cable with circular connector (external use).

**Optional:** 

Code: PA-1161

Name: EHMI – HUMAN-MACHINE INTERFACE with IoT and Gateway for Protocol Conversion



## WARRANTY TERM

The **GDSCAN 5000** Electron has a warranty period of two years from the date of sale recorded on the invoice, with coverage for any manufacturing defects that make it unsuitable or unsuitable for the applications it is intended for.

#### Disclaimer of Warranty

The warranty does not cover transportation expenses for technical assistance, freight and insurance for shipment of a product with evidence of defect or malfunction. The following events are also not covered: Natural wear and tear of parts due to continuous and frequent use, damage to the outside caused by falls or improper packaging; attempt to repair/break a seal with damage caused by persons not authorized by Electron and in disagreement with the instructions that are part of the technical description.

#### Loss of Warranty

The product will automatically lose its warranty when:

• The instructions for use and assembly contained in this manual and the installation procedures contained in the NBR 5410 Standard are not observed;

- Subjected to conditions outside the limits specified in the respective technical descriptions;
- Violated or repaired by a person other than Electron's technical team;
- The damage is caused by a fall or impact;
- Infiltration of water or any other liquid occurs;
- Overload occurs that causes degradation of the components and parts of the product.

#### Use of the warranty

To enjoy this warranty, the customer must send the product to Electron along with a copy of the purchase invoice properly packaged so that there is no damage in transport. For an emergency service, it is recommended to send as much information as possible, regarding the defect detected. This will be analyzed and subjected to full functional tests.

The analysis of the product and its eventual maintenance will only be carried out by the technical team at the headquarters of Electron do Brasil.