Edgetech Instruments

OxyTrans

Loop Powered Two Wire
Oxygen Transmitter
OPERATORS MANUAL

Edgetech Instruments

399 River Road
Hudson, MA 01749
978-310-7760 Fax: 978-310-7767
www.edgetechinstruments.com
H2O@edgetechinstruments.com

Rev. A April 2009

Edgetech Instruments

OxyTrans

QUICK STARTUP GUIDE

NOTE: **Please view addendum for Electrical Connections for explosion-proofed OxyTrans.**

STARTUP

1. Using the supplied Mounting Kit, mount the OxyTrans in position to measure the desired gas.

   Caution: The cell must be mounted vertically with Digital Display at the top.

2. Connect input and output tubing. See Manual for proper tubing materials. Shutoff valves should be installed on both sides of the sensor.

3. Connect loop power supply, using cable supplied.

4. Connect data acquisition system or other series load if required.

5. Allow sufficient equilibration time before recording data.

Edgetech Instruments

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

2.0 EDGETECH INSTRUMENTS INC.'S COMMITMENT TO QUALITY

To Our Customers:

Thank you for purchasing one of our products. At Edgetech Instruments Inc., it is our policy to provide cost-effective products and support services that meet or exceed you requirements, to deliver them on time, and to continuously look for ways to improve both. We all take great pride in the products we manufacture.

We want you to be entirely satisfied with your instrument. The information contained in this manual will get you started. It tells you what you need to get your equipment up and running, and introduces its many features.

We always enjoy hearing from the people who use our products. Your experience with our products is an invaluable source of information that we can use to continuously improve what we manufacture. We encourage you to contact or visit us to discuss any issues whatsoever that relate to our products or your application.

The Employees of Edgetech Instruments Inc.

3.0 INTRODUCTION

3.1 GENERAL DESCRIPTION

The Edgetech Instruments Inc. OxyTrans 2-wire 4 to 20 mA Loop Powered Oxygen Transmitter consists of two sub-systems:

1. The Analyzer Unit, which is an electro-chemical fuel sensor designed for measuring oxygen.

2. The Electronics Unit, which provides sensor signal conditioning, digital display, and electrical analog outputs.

The gas to be measured is transported to the sensor membrane of the Micro Fuel sensor. This sensor is an electro-chemical and galvanic cell that transforms the oxygen in the measured gas into an electrical current.

The Electronics Unit measures this electrical signal, providing visual and electrical information to the operator, directly in either parts-per-million of oxygen (ppm O_2), or as a percentage of the total measured gas (%O_2).

3.2 MICRO FUEL SENSOR

The oxygen sensor is a sealed plastic disposable electrochemical sensor. The active components are a cathode and an anode, which are immersed in a 15% aqueous KOH electrolyte solution. When oxygen in the sample gas is sensed by the membrane, the cell converts the resulting chemical reaction into an electrical current change. Its action is similar to that of a battery, with one important difference. In a battery, all reactants are stored within the cell. In the oxygen sensor, one of the reactants, oxygen, comes from outside the device as a constituent of the sample gas being analyzed.

3.3 THE EFFECT OF PRESSURE

In order to determine the amount of oxygen present in the gas sample, it is necessary that the gas diffuse into the cell under constant pressure, by Dalton's Law. If the total pressure increases during a measurement, the rate that oxygen reaches the cathode through the diffusing membrane will also increase. The electron transfer, and therefore the resulting measured output current, will increase even though the oxygen concentration in the sample has not changed.

Therefore, it is important that the sample pressure at the fuel cell remain constant during measurements.

3.4 CALIBRATION CHARACTERISTICS

Since the total pressure of the sample gas at the input of the measuring cell is constant, a convenient characteristic of the cell is that the current produced in an external circuit is directly proportional to the rate at which oxygen molecules reach the cathode, and this rate is directly proportional to the concentration of oxygen in the gaseous mixture. In other words it has a linear characteristic curve, as shown in Figure 3-1. An advantage is that measuring circuits do not have to compensate for nonlinearities.

In addition, since there is zero output in the absence of oxygen, the characteristic curve has close to an absolute zero (within ± 1 ppm oxygen). In practical application, zeroing is still used to compensate for the combined zero offsets of the cell and the electronics. The electronics is zeroed automatically when the instrument power is turned on.

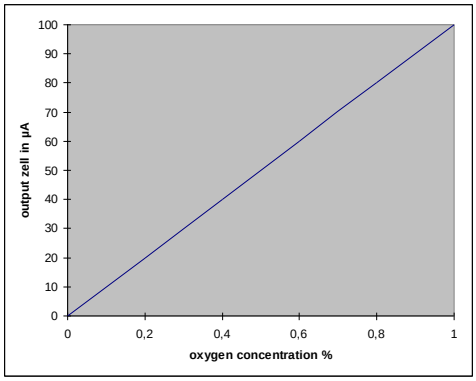


Figure 3-1 Characteristic Input/Output Curve for the Oxygen Cell

3.5 STANDARD FACTORY CONFIGURATIONS

The Edgetech Instruments Inc. OxyTrans series of transmitters are available in a number of convenient configurations. These include both vertical and horizontal mounts, so that the digital display may be viewed either from the top or from the front. Intrinsically Safe barriers are also available if required.

A number of standard ranges are available. These include:

RANGE	PARTS-PER-MILLION	PERCENT OXYGEN
0 to 10	X	
0 to 100	X	
0 to 1000	X	
0 to 10,000	X	
0 to 1		X
0 to 25		X

Table 3-1 Standard Factory Ranges

3.6 OPTIONS AND ACCESSORIES

Other standard configurations include a Panel Mount unit with optional safety barriers. A Portable unit is available in a carrying case with a built-in sampling system, including a flow meter, flow adjustment valve, sintered filter, vacuum pump, and power supply. Also available is an Explosion-Proof (ATEX approved) version. A unit with electrical interface compatible with the Hart Protocol is a standard option. Additional ranges are available on special order. Some ranges provided in the past include 0 to 20,000 ppm, 0 to 50,000 ppm, and 0 to 100% O_2. See Figure 3-2 below.

Figure 3-2a Explosion-Proof Unit

Figure 3-2b Vertical Mount

Figure 3-2c Horizontal Mount

Figure 3-2d Portable Unit

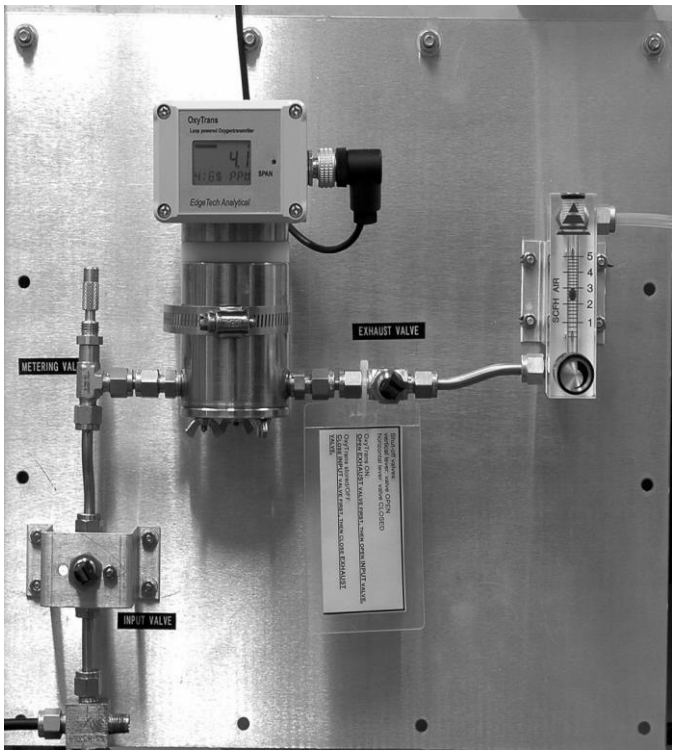


Figure 3-2e Panel Mount Unit

4.0 INSTALLATION

The installation of the transmitter is very simple. However, it must be done with care to ensure successful operation and data collection. Select a mounting location that will allow convenient viewing of the built-in Digital Display.

Note: The cylindrical portion of the cell must be mounted vertically for proper operation, with the display at the top. Both horizontal and vertical digital displays are available. The correct one should be carefully selected.

4.1 MOUNTING

A Mounting Kit, shown in Figure 4-1, is provided for easy installation. It includes the mounting hardware, and also an interconnecting cable and extra compression fitting nuts.

Figure 4-1 Mounting Kit

First, screw the supplied Mounting Plate securely to a wall or other vertical surface, using two No. 10 screws. Hole centers are 1-1/16 inch (27mm) apart. Then, run the large stainless steel pipe clamp through the slots in the sides of the Mounting Plate. Insert the OxyTrans transmitter as shown in Figure 4-2. Tighten the screw, locking the cell housing in place. Do not over-tighten.

4.2 PLUMBING

For low percentages of oxygen in the sample gas, proper selection and installation of tubing is critical for successful measurements.

Recommendations for trace O_2 measurements:

1. Use only stainless steel tubing.

2. If there is a possibility that the tubing is contaminated, it should be cleaned before installation.

3. The entire plumbing system should be leak-checked after installation.

4. After the plumbing installation has been completed, the system may have to be operated overnight to purge it.

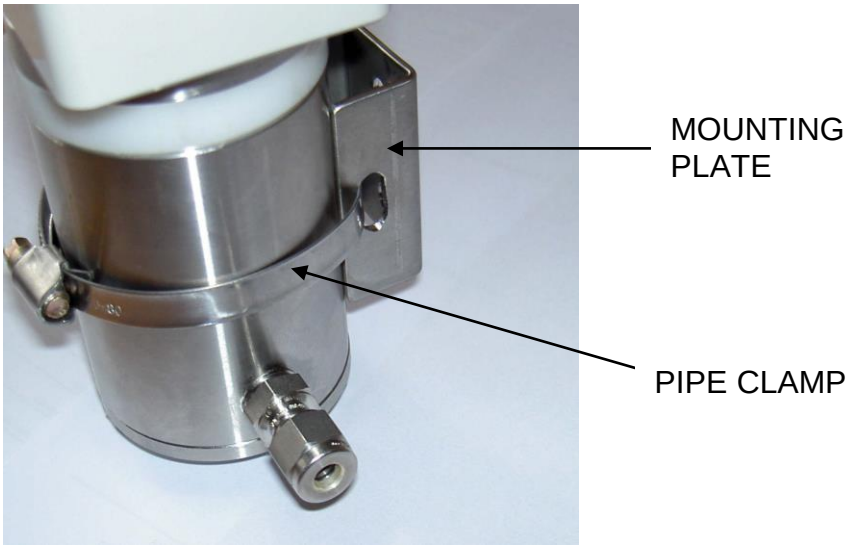


Figure 4-2 Mounting the Transmitter

A good stainless steel sintered filter or a borosilicate glass filter can increase the length of maintenance-free operation if the gas contains dust particles or other impurities.

Install shut-off valves on both sides of the sensor so that it may be isolated from the system when not being used. This ensures a longer cell life.

For higher Oxygen concentrations, some plastic materials such as Tygon™ are acceptable. Do not use soft PVC tubing.

Adjust the flow rate between 1-2 SCFH (0.5 to 1 L/min).

4.3 ELECTRICAL CONNECTIONS

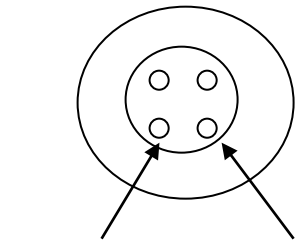
The system provides a loop-powered 4 to 20 mA output signal, corresponding to the oxygen measurement range specified. “Loop powered” means that the OxyTrans is powered by the current loop itself. The OxyTrans, power supply, and the (optional) signal-conditioning device used to measure the 4 to 20 mA signal are all connected in a series loop, so that the same current flows through

all. The loop power supply voltage should be between 10 and 36 VDC. See Figure 4-3 below for OxyTrans connections.

Figure 4-3 Electrical Connections

Pin 4:	**+**	**RED**
Pin 3:	**–**	**BLUE**

Output: 4 – 20 mA
Load: 0 to 500 Ohms



PIN 3 (-) **PIN 4 (+)**

The electrical interface cable supplied is approximately 57 inches (22 cm) long. It is color coded for easy installation. The positive side (Pin 4) is red, and the return side (Pin 3) is blue. The pin numbers are marked on the connector on the body of the OxyTran, in case you wish to fabricate your own cables.

After applying power to the loop, you will see a value on the display. Allow sufficient time for the entire system to equilibrate before attempting to record valid data. Equilibration time is longer for low concentrations of oxygen than it is for higher concentrations.

5.0 OPERATION

Operation of the OxyTrans is very simple. Open the shut-off valves on the upstream and downstream sides of the sensor. For most models, there are no switches or other controls. The operator simply has to be sure that the gas flow rate is within the specified range (1 to 2 SCFH, or 0.5 to 1 L/min.), and that new readings have completely equilibrated before data is taken.

5.1 DIGITAL DISPLAY

The Digital Display shows you the current oxygen value. A bar graph at the top symbolizes the analog output signal. See Figure 5-1.

Figure 5-1 Digital Display

5.2 ANALOG OUTPUT

The 4 to 20 mA electrical output will follow the changes in value of the measured Oxygen, just as the digital display does. It may be remotely measured with a series DC milliammeter, or used to drive a process controller or data acquisition system.

MAINTENANCE

6.1 CALIBRATION

Although the OxyTrans comes Factory-calibrated, you may wish to recalibrate the unit at some time. Calibration of the OxyTrans is very simple. A calibration gas with a known Oxygen value is required.

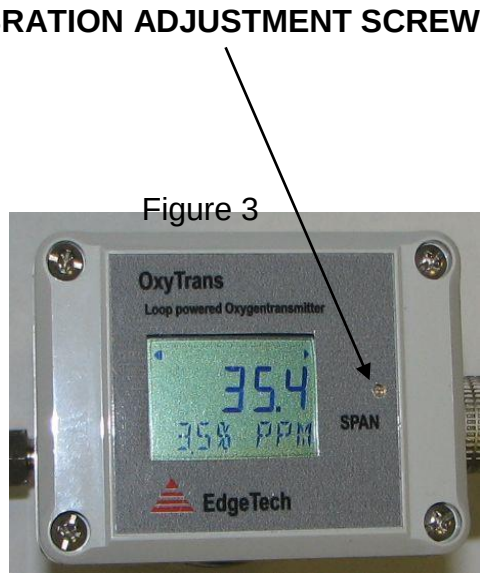


Figure 3

Figure 6-1 Calibration Adjustment

Notes:

1. **Select a calibration gas that is equivalent to your measurement range. For example, if you have the 0 to 100 ppm unit, select a gas with an Oxygen value of approximately 40 – 50 ppm O_2 in N_2.**

2. **Be sure that line pressure remains constant during the calibration.**

3. **If you have the 0 to 25% Oxygen range, air may be used for the calibrating gas. Air consists of approximately 21% Oxygen.**

4. **Be sure to wait until complete equilibration before calibrating the unit. If the Oxygen concentration is very low, or if the sampling system is large, waiting a long time may be required.**

To calibrate the OxyTrans:

1. Locate the Calibration adjustment screw. See Figure 6-1.

2. Connect the calibration gas to the compression fitting. For low ranges, do not leave the downstream fitting open to room air. We recommend that you use a few feet of tubing on the downstream side, to keep room air from entering the cell.

3. After complete equilibration (see Note 4 above), the Digital Display will show the current Oxygen value.

4. Once the value is stable, adjust the Calibration screw with a small screwdriver until the Digital Display shows the correct value.

6.2 WHAT TO DO WHEN OUT OF SERVICE

If the OxyTran is not going to be used for a period of 12 hours or more, Step 1 below should be followed. To put it back into operation, see Steps 2 and 3 below:

1. Make sure that the shut-off valves on the upstream and downstream sides of the measurement cell are closed, isolating the cell. No oxygen from the outside air or from the gas pipeline should be in contact with the measurement cell. This will increase the cell life.

2. After restarting the equipment, purge the sampling system with dry nitrogen before using it for O_2 measurements.

3. If the system has not been used for a long time, recalibrate against an Oxygen standard gas.

6.3 TROUBLESHOOTING

If the OxyTrans displays incorrect or erratic readings of the Oxygen concentration in the measured gas:

Possible Causes May Be:

1. Inaccurate calibration.

2. Leakage in the sampling system.

3. Atmospheric Oxygen may be diffusing in through the downstream port.

4. Unstable system pressure.

5. Defective Oxygen Cell.

Possible Solutions May Be:

1. Turn the analyzer off, and then back on again. Now proceed to carefully calibrate the analyzer.

2. Check the complete sampling system for leaks, and be sure that everything is tight.

3. Increase the flow rate and/or add downstream tubing in order to dilute or minimize the introduction of oxygen from the room back into the sensor.

4. Be sure that the measurement gas pressure is stable. Changes in the operating pressure will cause measurement value variations. The cell is designed to measure Oxygen at atmospheric pressure. There should be nothing downstream that could restrict gas flow and increase cell pressure.

   Caution: The measurement cell could be destroyed if the maximum pressure rating is exceeded.

   If necessary, use a non-adjustable pressure reducer on the measurement gas inlet.

5. If none of these steps correct the problem, than replace the sensor.

6.4 CELL REPLACEMENT

The sensor used in this analyzer uses electrolytes which contain toxic substances, mainly lead and potassium hydroxide. These can be harmful if touched, swallowed, or inhaled. Avoid contact with any fluid or powder in or around the unit. What may appear to be plain water could contain one of these toxic substances. In case of eye contact, immediately flush eyes with water for at least 15 minutes. Call physician. (A Material Safety Data Sheet is available from the Factory.)

CAUTION: Do not disturb the integrity of the cell package until the cell is to actually be used. If the cell package is punctured and air is permitted to enter, the cell may require an excessively long time to reach zero after installation, possibly as long as one to two weeks!

6.4.1 WHEN TO REPLACE A CELL

The ageing characteristic of the Oxygen measurement cell shows an almost constant output throughout its useful life. Near the end of its life it falls off sharply, reaching zero output at the end.

Before replacing the cell:

a. Check your calibration gas to make sure it is within specifications.

b. Check for leaks both upstream and downstream of the cell, where oxygen may be leaking into the system.

c. Are you trying to measure trace quantities of Oxygen with a large sampling system that has a large amount of surface area? The response time of the system in this case may be very slow.

d. Has the power supply and the entire electrical system been checked?

If there are no leaks and the calibration gas is known to good, but you still get no response, replace the cell.

6.4.2 STORING AND HANDLING OF REPLACEMENT CELLS

To have a replacement cell available when it is needed, we recommend that one spare cell be purchased 9-10 months after installing the OxyTrans, or shortly before the end of the cell's one year warranty period.

Note: Do not stockpile cells. The warranty period starts on the day of shipment.

The spare cell should be carefully stored at room temperature, in an area that is not subject to large variations in ambient temperature, and not subject to rough handling.

6.4.3 REMOVING THE MEASUREMENT CELL

The Oxygen cell is built into the cell housing. To take out a defective or unusable cell, proceed as follows:

1. Shut off the unit.

2. Unscrew the wing nut from the cell block.

3. Carefully remove the bottom of the cell block that contains the cell.

4. Take the cell carefully from the bottom. Do not touch the sensor surface.

5. Correctly dispose of old cells according to proper disposal regulations. A Material Safety Data Sheet (MSDS) is available from the Factory.

6.4.4 INSERTION OF A NEW MEASUREMENT CELL

Caution: Do NOT touch the sensor membrane. The surface has a small Teflon® membrane which can be destroyed by contact. The sensor will have to be replaced if the membrane surface is destroyed.

For installation of the new cell, proceed as follows:

1. Shut off the unit.

2. Take the new cell out of the package.

3. Unscrew the wing nut from the cell block. Be careful that you don't shift or destroy the O-Ring.

4. Carefully place the cell at the center of the cell block bottom. The sensor membrane wall will be below.

5. Press the cell together with the cell bottom in the cell block. The contact surface will be on the top. Screw the wing nut back on securely.

Note: The cover will fit correctly only in one direction.

6. Restart the equipment and purge the sampling system with dry nitrogen immediately.

6.4.5 CELL WARRANTY

Warranty period begins on the date of shipment. The customer should purchase only one spare cell. Do not attempt to stockpile spare cells.

Note: These cells are not designed for applications where CO_2 is a major component in the sample.

However, concentrations of 1,000 ppm or less of CO_2 will not adversely affect the cell performance. Consult us for available options for either intermittent or continuous CO_2 exposure.

If a cell was working satisfactorily, but ceases to function before the warranty period expires, the customer will receive credit toward the purchase of a new cell.

If you have a warranty claim, you must return the cell in question to the factory for evaluation. If it is determined that failure is due to faulty workmanship or material, the cell will be replaced at no cost to you.

Note: If there is evidence of damage due to tampering or mishandling, the cell warranty will be null and void.

6.4.6 CLEANING THE MEASUREMENT CELL HOUSING

If you have a reason to clean the cell housing, this may be done very carefully with a lint-free clean cloth. Be cautious not to damage or break the gold colored spring contacts inside.

Note: If there is heavy contamination inside the cell housing, send the unit to the Factory for cleaning. The electronics will have to be removed and then remounted.

7.0 SPECIFICATIONS

Measurement Range:	0-10; 0-100; 0-1000; 0-10000 ppm O_2 0-1; 0-25 % O_2
Calibration Accuracy:	With calibration gas (example: 80 ppm O_2 in N_2) +/- 2% FS at constant temperature +/- 5% FS over full temperature range (at 0 -10ppm +/- 1ppm)
Resolution:	0.1 ppm
Response time:	To 90 % of FS at 25°C 0-10 ppm < 45 s 0-100 ppm < 30 s 0-1000 ppm < 10 s
Operating Temperature:	0 - 50°C
Sample Pressure:	0.1 - 1 bar
Output signal:	4 -20 mADC isolated
Display:	LCD Digital Dispay
Loop Power Supply:	10 - 36 VDC
Oxygen sensor:	Chemical Cell
Expected Sensor Life:	>2 years
Size: (H x W x D)	6.3 x 4.7 x 2.6 inches (160 x 120 x 65mm)
Weight:	3lbs (1.4 kg)

8.0 APPENDIX

8.1 Warranty Statement

8.2 Oxygen Cell Housing Drawing

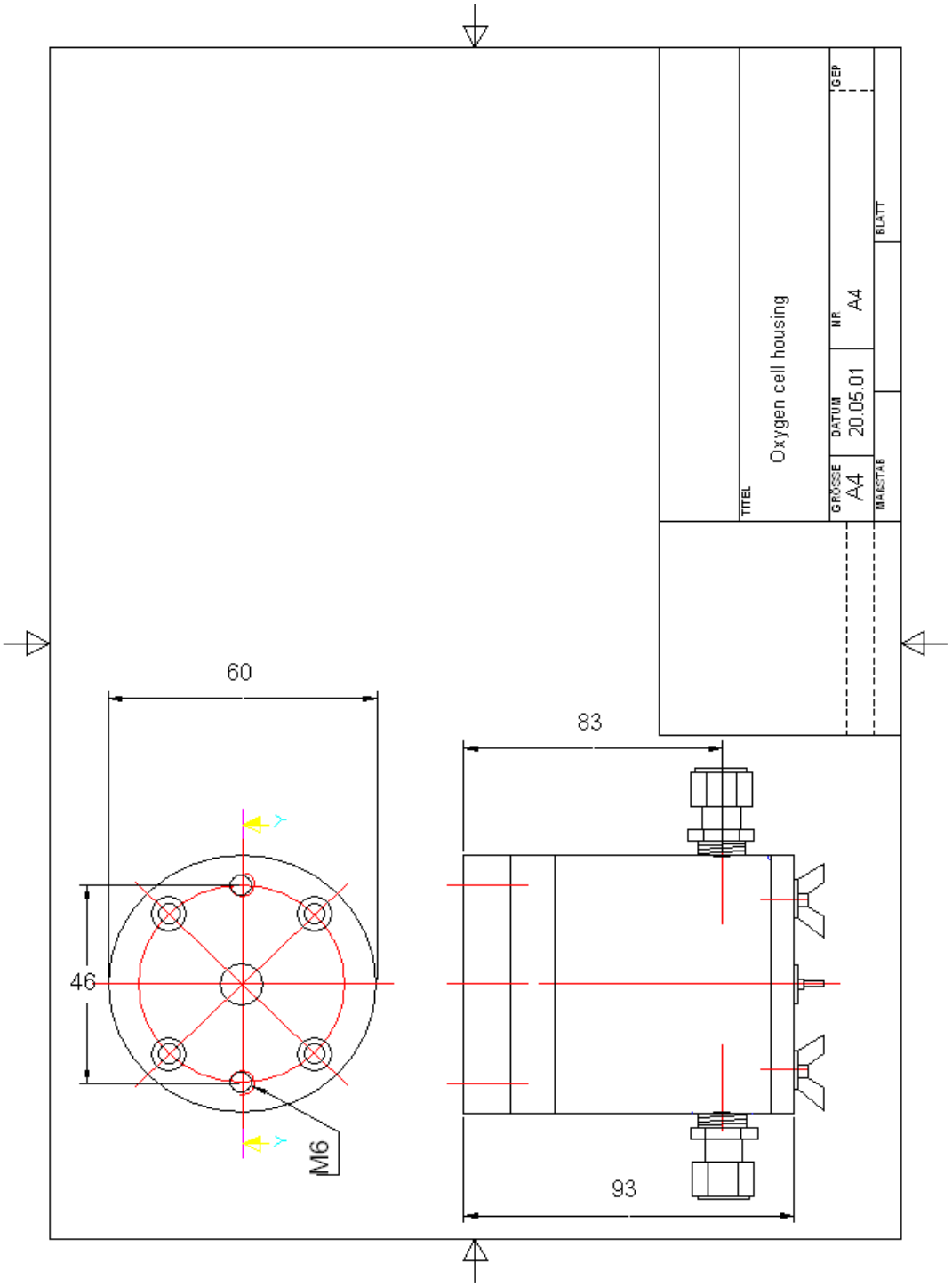
8.3 Intrinsically Safe Barrier for Panel Mount (Optional)

8.1 WARRANTY STATEMENT

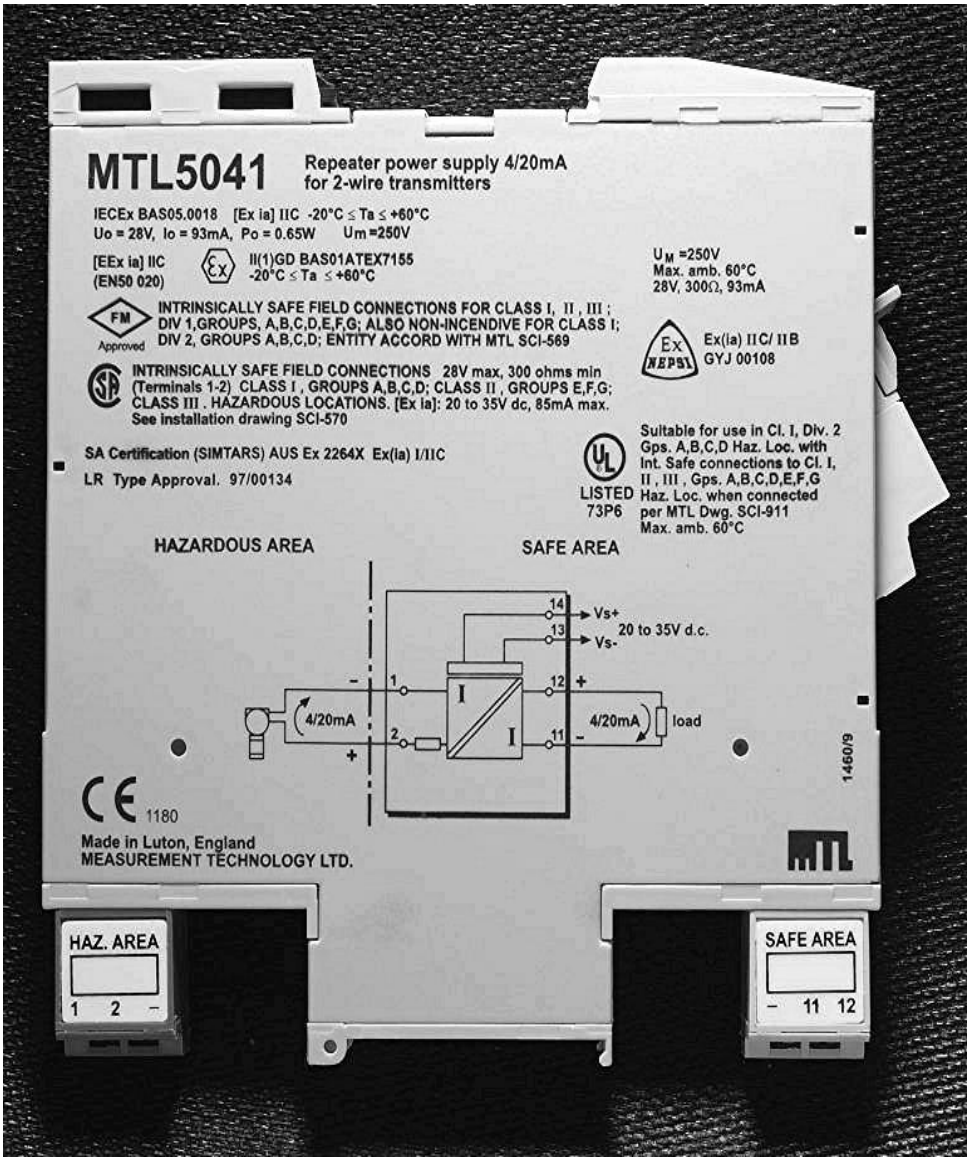
All equipment manufactured by Edgetech Instruments Inc. is warranted against defective components and workmanship for repair at their plant in Massachusetts, free of charge, for a period of twelve months. Malfunction due to improper use is not covered in this warranty and Edgetech Instruments Inc. disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose and there is no warranty of merchantability. This warranty applies only if (i) the items are used solely under the operating conditions and in the manner recommended in the instruction manual, specifications, or other literature; (ii) the items have not been misused or abused in any manner or repairs attempted thereon; (iii) written notice of the failure within the warranty period is forwarded to Edgetech Instruments Inc. and the directions received for properly identifying items returned under warranty are followed; and (iv) the return notice authorizes Edgetech Instruments Inc. to examine and disassemble returned products to the extent Edgetech Instruments Inc. deems necessary to ascertain the cause for failure. The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Edgetech Instruments Inc. does not assume any other obligation or liability in connection with the sale or use of said products.

Equipment not manufactured by Edgetech Instruments Inc. is supported only to the extent of the original manufacturer’s warranties

8.2 OXYGEN CELL HOUSING DRAWING



8.3 INTRINSICALLY SAFE BARRIER FOR PANEL MOUNT (OPTIONAL)



NOTES