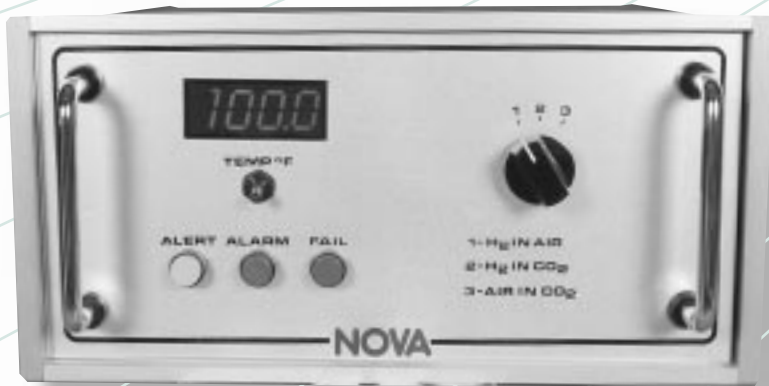


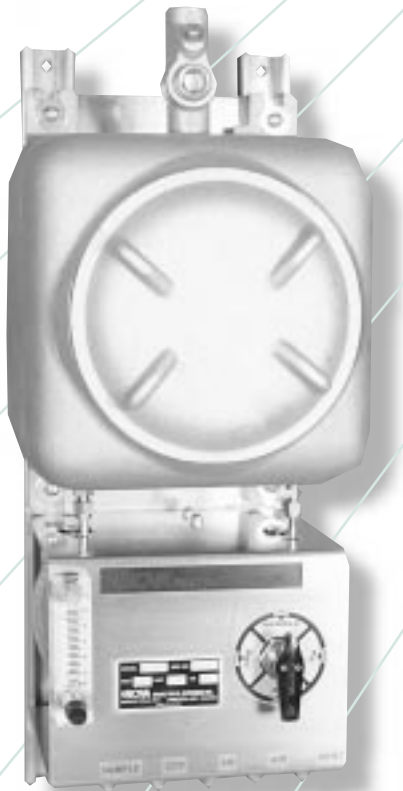
# NOVA MODEL 436

TRI-GAS ANALYZER FOR HYDROGEN PURITY AND PURGE  
MONITORING FOR HYDROGEN COOLED POWER GENERATORS

## FEATURES



436PM GENERAL PURPOSE CONTROL CABINET



436N7 GAS DETECTOR ENCLOSURE

- One analyzer monitors all 3 gases for purity or purging:
  - 0-100% Hydrogen in Air
  - 0-100% Hydrogen in CO<sub>2</sub>
  - 0-100% Air in CO<sub>2</sub>
- Digital readout
- Explosionproof gas detector cabinet
- 4-20ma output for 85-100% H<sub>2</sub>
- Fast response
- Very stable
- Detector cannot burn out even with no sample flow
- 2 levels of low H<sub>2</sub> purity alarm
- Detector failure alarm
- Available with general purpose or explosionproof control cabinet

# DESCRIPTION

Most power generating plants use hydrogen gas to cool the electrical windings within the power generator. This improves operating efficiencies by lowering the losses due to the resistance of the windings. This is commonly known as windage losses.

In order to control these losses and keep efficiencies high, the hydrogen purity must be maintained. Even a slight contamination of the hydrogen by oil vapor, water or air will increase the windage losses in the generator.

As an example, a 1% reduction in hydrogen purity creates a 12% increase in windage loss. A decrease in purity from 99% to 92% can reduce generator output by as much as 2100 KW.

Obviously, this reduction in generator efficiency results in higher fuel costs and replacement power requirements. For example, assuming a replacement power cost of 5 cents per KW/HR, each additional 100 KW of windage loss (assuming 80% capacity factor) costs a utility plant more than \$350,000.00 per year.

The other factor to consider of course is safety. Hydrogen/Air mixtures of less than 74% are explosive, so the Nova 436 helps

ensure that the purity level never drops to this point by providing alarm contact closures at two levels.

The Nova Model 436 Tri-Gas Analyzer is designed specifically for monitoring hydrogen purity in a power generator or synchronous converter and to monitor the purging procedure during shut down.

The analyzer can measure the following gases by switch selection:

Range 1: 0-100% Hydrogen in Air

Range 2: 0-100% Hydrogen in CO<sub>2</sub>

Range 3: 0-100% Air in CO<sub>2</sub>

The Model 436PMN7 analyzer is divided into 2 sections. The *Control Section* contains the amplifiers as well as the digital readout meter, alarms, range switches and power supply.

The *Gas Detector Section* contains the thermalconductivity cell, a five way selector valve, gas pressure regulator and temperature control.

A length of cable connects the two cabinets.

A 4-20ma output and two alarms are provided for the range of 85-100% hydrogen in air.

The 436 can be provided in several configurations. The 436PMN7 is the most popular. It has an explosionproof gas detector cabinet and a general purpose rated, panel mounted control cabinet.

The 436N7 has both an explosionproof gas detector cabinet and explosionproof control cabinet.

The 436N4 Gas detector and controls are all housed in one, non explosionproof NEMA 4 wall mounted cabinet.

All explosionproof enclosures are UL/CSA/FM approved for CL 1 Div I, Groups B, C, D areas.



# OPERATION

A temperature controlled thermalconductivity (T/C) cell is located in the gas analysis cabinet and is connected in series with the pressure regulator, flowmeter and selector valve.

The five way selector valve can choose between sample, hydrogen, CO<sub>2</sub> or air for calibration purposes. Whichever gas has been selected flows through the T/C cell.

The cell has a sealed air reference and can measure all 3 gas ranges by switch selection on the front panel of the control cabinet.

In the T/C measuring cell, the unknown gas concentration is determined by the rate of heat transfer from a heated thermister surrounded with sample gas, with respect to a similar, matched thermister surrounded by a reference gas (air).

The thermisters are mounted in an aluminum block which allows the sample gas to flow through it. The thermisters are connected to a wheatstone bridge measuring circuit which allows a small electrical current to flow through them which also heats them.

This circuit can readily detect any change in resistance of the

measuring thermister which would result from a change in gas thermalconductivity. This change in resistance unbalances the wheatstone bridge and causes a small output millivoltage. This output is then amplified and shown on the front panel digital meter as percent gas concentration.

The thermalconductivity of a gas is its ability to conduct heat away from a heated object at a rate greater or less than air. It is this physical characteristic which is utilized in a T/C cell. As an example, hydrogen conducts heat away faster than air and CO<sub>2</sub> is slower than air.

The output of the T/C Cell for H<sub>2</sub> in CO<sub>2</sub> or air in CO<sub>2</sub> is nearly linear over these two ranges, deviating no more than 2% at 50%. The output of the H<sub>2</sub> in air range is linear within 0.4% over its 0-100% range.

The output of the cell for whichever range has been selected is amplified then displayed on the digital meter. If Range 1 has been selected, then the amplifier output also goes to the alarm and 4-20ma output circuits. The alarm and output circuits are disabled in Range 2 and 3.

The temperature controller for the T/C cell is located in the control cabinet. A switch on the front panel will allow the digital meter to display gas concentration or cell temperature.

If there is a possibility of oil vapor existing in the hydrogen sample gas, then the addition of a Deltech Model 110R oil vapor absorber filter is highly recommended. Without this filter, oil vapor will contaminate the T/C cell. The Deltech filter is available through Nova.



# SPECIFICATIONS

DESCRIPTION	
<b>Ranges:</b>	0-100% Hydrogen in Air 0-100% Hydrogen in CO <sub>2</sub> 0-100% Air in CO <sub>2</sub>
<b>Method of Detection:</b>	Temperature controlled thermalconductivity (T/C) cell cannot be burned out due to loss of flow or changing gases.
<b>436PM Analyzer Configuration:</b>	Separated into two enclosures: Explosionproof gas detector cabinet is wall mounted and houses selector valve, flowmeter, pressure regulator, temperature control and T/C cell. Control cabinet is panel mounted and houses all electronics. General purpose classification.
<b>436N7 Analyzer Configuration:</b>	All components housed in explosionproof enclosures suitable for CL 1 Div 1 GRP BCD areas. UL/FM/CSA certified.
<b>Readout:</b>	LED digital
<b>Readout Resolution:</b>	± .1% of gas measured
<b>Accuracy and Repeatability:</b>	± 1% F.S. except in 85-100% H <sub>2</sub> in Air range which is within 0.2% absolute H <sub>2</sub>
<b>Linearity:</b>	± 0.4% of F.S. on H <sub>2</sub> in Air range. ± 2% of F.S. in H <sub>2</sub> or Air in CO <sub>2</sub> ranges
<b>Output:</b>	4-20ma for 85% to 100% Hydrogen in Air
<b>Operating Temperature Range:</b>	0-50°C
<b>Drift:</b>	H <sub>2</sub> in CO <sub>2</sub> or Air in CO <sub>2</sub> 1% of F.S. per week maximum drift 0-100% H <sub>2</sub> in Air range is ± .2% per week
<b>Alarms:</b>	Dual alarms are provided for low Hydrogen purity. Fail alarm also provided as standard. Alarms have front panel light for each alarm and SPST (normally energized) relay with 5A rating at 250VAC non inductive load. Alarm set points are field adjustable.
<b>Speed of Response:</b>	10-15 seconds to 90% step change – not including sample transport time.
<b>Warm Up:</b>	10 minutes to full accuracy
<b>Size:</b>	436PM control cabinet: 11-1/4" W x 5-3/8" H x 10-1/4" D Cutout dimension: 11-1/8" W x 5-3/8" H Gas detector cabinet: 23" H x 10" W x 7" D 436N7 enclosure approx. 16" W x 15" H x 10" D 436N4 enclosure approx. 18" H x 16" W x 10" D
<b>Sample and Cal Gas Pressure Ranges:</b>	1 - 40 PSI (2 - 80 KPA)
<b>Power:</b>	115VAC 50/60Hz. Other voltages available

*Nova reserves the right to specification changes which may occur with advances in design without prior notice.*

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