

HOW THE ELECTROLYTIC PRINCIPLE ADDS VALUE

Industrial Gas

Electronic Gas

Natural Gas

Medical & Aviation

Aerospace & Military

Glove Box

Specialty Gases

I. What Does the Electrolytic Principle Buy You?

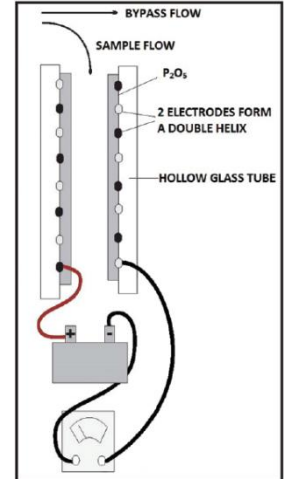
- **Freedom from Calibration:** When your analyzer is based on fundamental rules of science, like the electrolytic principle, there is no need for calibration! Consider the savings, right there, on time, labor, and materials, like calibration gases.
- **Freedom from Drift:** We hear all the time about analyzers that purchasers love for their low up-front cost, but that create costly headaches in the field. That's because drift-prone equipment calls for frequent calibration, leading to a high Cost-of-Ownership and process interruption. Such factors do not always go into engineering and purchasing decisions, unfortunately. But, they are a source of chronic pain, down-time, and expense in actual use.
- **Greater Safety:** Oftentimes, technicians' roles are high turnover, potentially resulting in folks who may lack both experience and, sometimes, adequate training. This increases the chance of hazardous errors when they are moving and handling calibration gases. Not only that, but more and more facilities are in remote locations where trained technicians are just plain hard to find. More, frequent calibrations interfere with automating gas plant operation, which many gas producers now seek.
- **Confidence in Your Gas:** Whether you are a maker or user of industrial, natural, or specialty gases, there is, frankly speaking, great comfort in knowing that your gas is certified by reliable, repeatable, and precise technology that is proven and validated by the world's leading metrology labs. At MEECO, we are honored serve the most

demanding and sensitive applications, including medical gas, semiconductor manufacturing, and space research.

II. How Does It Work?

Principle of Operation:

Based on Faraday's Law of Electrolysis, MEECO's technology electrolyzes moisture at fractional parts-per-million or parts-per-billion (ppm or ppb). As the gas flows into the analyzer, 100% of the sample moisture is absorbed by a phosphorus pentoxide (P_2O_5) film that covers two spirally-wound electrodes embedded inside a hollow glass tube (the cell). By applying an electrical potential (voltage) to the electrodes, each absorbed water molecule is split, generating a finite current. This current is precise and proportional to the amount of electrolyzed water. With a known flow rate and known cell volume, this provides a direct measurement of the water vapor present in the sample gas.



III. How Do I Know It's Working?

Use our handy Delta Flow Test:

Requirement: Nitrogen or other inert sample gas, with a stable moisture concentration higher than the analyzer's low detection limit. **Ideally, the moisture concentration will be close to the middle of the analyzer's operating range.**

Five easy steps:

- Step 1:** Wait until moisture reading stabilizes. Then, record concentration at 100% of standard gas flow.
- Step 2:** Reduce the gas flow to 50% of the standard flow and record concentration once reading stabilizes. **NOTE:** For analyzers with Mass Flow Controllers, use "SERVICE MODE" to adjust the flow rate.
- Step 3:** Subtract the Value of Step 2 from Step 1.
- Step 4:** Multiply the Value of Step 3 x 2.
- Step 5:** Divide the Value of Step 4 by the Value of Step 1 and multiply by 100 to get the Delta Flow Factor, which should be equal to or greater than **90%**.

Example:

Step 1: 112.9 ppmV @ 100 sccm flow rate

Step 2: 58.4 ppmV @ 50 sccm flow rate

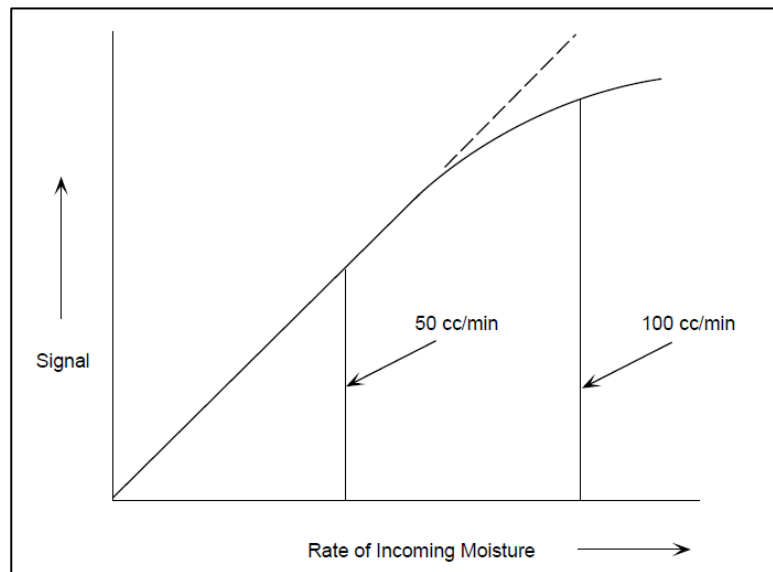
Step 3: 112.9 ppmV – 58.4 ppmV = 54.5 ppmV

Step 4: 54.5ppmVx2=109ppmV

Step 5: 109 ppmV / 112.9 ppmV x 100 = 96.5%

Delta Flow Diagnostics:

Over-range -> Cell Saturation and Possibility of Wash-out. If the electrolytic cell is hit by moisture beyond its upper measurement range, it can saturate the thin phosphoric acid film and, thus, fail to absorb and electrolyze properly. In such a case, as shown in **Figure 1** (pictured right), the electrolysis signal is no longer proportional to the level of incoming moisture. The response curve flattens and continues toward a saturation value for very high concentrations. Here, the reading at 100 cc/minute is too low while the 50 cc/minute reading is not affected. Thus, 100 cc/minute reading will NOT be twice the 50 cc/minute reading.



**Figure 1
Delta Flow**

Had the test been conducted at a lower concentration within the operating range, the 100 cc/minute reading would be approximately twice the 50 cc/minute reading, based on the linear scope of response.

IV. How Often Do I Need to Calibrate My Cell?

When the cell is factory-qualified, a certificate of calibration is issued, with a full two-year life. The cell is also covered under a two-year warranty when it is operated within

its range in accordance with proper procedures. (Please reference your operator manual.)

V. Our Most Widely Used Cells*:

CELL (SQUARE BODY)	ANALYZER	APPLICATION
AHLR	AquaVolt+	Hydrogen & Inert Gas
AILR	AquaVolt+	Inert Gas Only
AOLR	AquaVolt+	Oxygen, CO ₂ & Inert Gas
AOLR-I	AquaVolt+	Inert Gas
RILR	Tracer 2	Inert Gas Only
RTLRL	Tracer 2	Oxygen, Hydrogen & Inert Gas
RILR ♥ Cell	Tracer 2	Inert Gas Only
RTLRL ♥ Cell	Tracer 2	Oxygen, Hydrogen & Inert Gas
CELL (ROUND BODY)	ANALYZERS	APPLICATION
AP	Industrial	Sweet Natural Gas
AP 10CC	Industrial	Sweet Natural Gas
APO	Industrial	Oxygen & Inert Gas
APO 10CC	Industrial	Oxygen & Inert Gas
APO-I	Industrial	Air & Inert Gas
APR	Natural Gas	Sour Natural Gas & Inert Gas
APR 10CC	Natural Gas	Sour Natural Gas & Inert Gas
APRH	Industrial	Hydrogen & Inert Gas
APRH 10CC	Industrial	Hydrogen & Inert Gas
Cl2	Industrial	Chlorine Gas
HSPR	Industrial	Refrigerant Gas

Gas Type	Tracer 2 Cell Range
Oxygen	0 - 1200 ppb
Hydrogen	0 - 500 ppb
Inerts	0 - 2000 ppb

*Please consult factory or your local MEECO representative for special applications.