

ANALYZER SOLUTIONS FOR **YOUR** PROCESS!

PRELIMINARY LITERATURE

## Model 3050-TE for Cryo-Recovery Plants

### A TOTAL SOLUTION FOR INDUSTRIAL PPBV MOISTURE ANALYSIS

**Quartz Crystal Microbalance Technology: Accurate. Reliable. Verifiable. Responsive.**

**INCREASE RECOVERY EFFICIENCY AND MINIMIZE DOWNTIME THROUGH BETTER DRYER OUTLET MONITORING**

### A TOTAL SOLUTION PROVIDES ASSURANCE

At AMETEK Process Instruments, we know how difficult it is to perform part per billion moisture (PPBv) analysis. After all, we manufacture analyzers that are accurate, sensitive, and responsive at a single PPBv moisture. With this knowledge and ability, we have adapted our PPBv Quartz Crystal Microbalance technology into a Zone 1 / Division 1 industrial package suited for natural gas processing.

The Model 3050-TE solution is specifically designed to monitor the PPBv moisture content of the natural gas feeding turbo-expanders and other cryogenic processes. The Model 3050-TE measures moisture concentration directly, in PPBv because at these concentrations and process pressures, it is physically impossible to have or to calculate a moisture dew point. (How is it possible to have a moisture dew point not only far below the freezing point of water but also below the temperature at which the natural gas will liquefy? Because of this physical reality, the only meaningful term is the true moisture concentration.)

When attempting PPBv moisture analysis, proper selection of sample wetted components and their use is ultra critical. If you use the wrong sample tubing, or if it is too long, or if it is not properly heat traced, the minute changes in process moisture concentration will never reach the analyzer for measurement.

To ensure a successful and easy installation, the 3050-TE is an integrated solution package for your turbo-expander process. It includes all of the sample-handling components from the sample tap to the analyzer. We provide this total package because we know what to do, and more importantly what not to do, in order to achieve high-performance, PPBv moisture analysis.

While proper selection and use of sample handling components is crucial for PPBv analysis, it is useless if the analyzer they connect with cannot provide the sensitivity, accuracy, and speed of response necessary for this application. This is why 3050-TE is based upon Quartz Crystal Microbalance (QCM) technology.

### THE QUARTZ CRYSTAL SENSOR

The heart of the 3050-TE analyzer is a quartz-crystal microbalance (QCM) sensor and sampling system developed by AMETEK specifically for highly accurate moisture measurements. The sensor consists of a pair of electrodes that support the QCM sensor. When voltage is applied to the sensor, a very stable oscillation occurs.

The faces of the oscillator are covered with a hygroscopic polymer. As the amount of moisture sorbed onto the polymer varies, the mass of the QCM changes, producing a corresponding change in the frequency of oscillation. This change is directly related to the moisture concentration of the surrounding gas.



### QUARTZ CRYSTAL MICROBALANCE - THE SAFEST CHOICE

#### DRAMATICALLY BETTER ACCURACY

Consider the basic accuracy specification of the 3050-TE:  $\pm 10$ ppb or  $\pm 10\%$  *of reading* (whichever is greater), from 20 to 10,000 ppb by volume. In the table on the right, we've compared this to the accuracy of a humidity analyzer that is typically listed as dew point. The typical specification is  $\pm 3^\circ\text{C}$  dew point for gases drier than  $-65^\circ\text{C}$  dew point. The data for

One of a family of innovative process analyzer solutions from AMETEK Process Instruments.

**AMETEK**  
PROCESS INSTRUMENTS

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the aluminum oxide analyzer is based upon the specifications of a newly calibrated probe. The aluminum oxide's calibration drift, temperature instability and other sources of error are not typically taken into account by the probe manufacturer's accuracy specification. The aluminum oxide's slow speed of response is another issue.

analyzer out for re-calibration. This means that you will forever eliminate those costly, routine maintenance projects that are associated with aluminum oxide humidity sensors. But don't take our word about the analyzer's stability; ask the analyzer itself! Every 3050-TE comes equipped with an internal, verification system that consists of both zero and span challenges, which are created from the actual sample gas.

**BUILT-IN VERIFICATION CAPABILITY**

With the built-in zero module and the internal moisture generator, the 3050-TE gives you data you can have confidence in. On a programmed schedule, or whenever you feel it's necessary, you can route your process gas through the 3050-TE's internal zero gas generator and its internal moisture generator, giving you a zero reference and a span calibration

standard based upon the actual process gas. The 3050-TE automatically zeroes itself and compares its moisture measurement with the NIST-traceable known value of the internal moisture generator. If necessary, the analyzer can make small corrections to its calibration automatically. If a

Actual PPBv Moisture	3050-TE Accuracy	Aluminum Oxide Accuracy <sup>(1)</sup>
50	±10 PPBv	+38 PPBv / -22.2 PPBv
100	±10% of reading	+71.8%/-42.9% of reading
500	±10% of reading	+62.7%/-39.5% of reading
1,000	±10% of reading	+59.6%/-38.2% of reading
10,000	±10% of reading	+30.9%/-24.0% of reading

<sup>(1)</sup> Based upon accuracy of ±3 degrees C below -65C dew point. Dew Point conversions referenced to 14.7 psia.

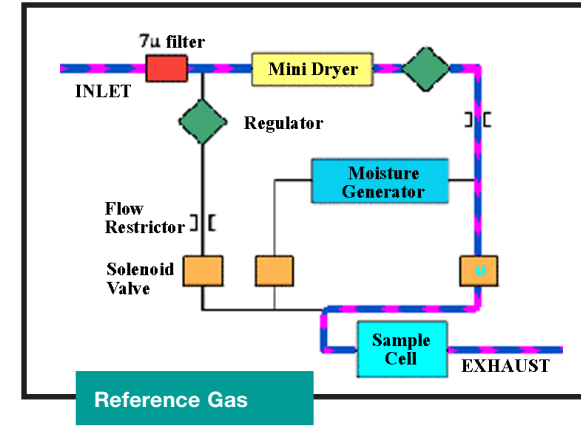
**LONG TERM STABILITY  
REDUCES MAINTENANCE COSTS**

The 3050-TE analyzer is inherently more stable due to its quartz crystal microbalance technology. The stability of the vibrating quartz crystal means that you never need to send the

**GAIN PEACE OF MIND THROUGH ACTIVE FEEDBACK**

The Model 3050-TE is an active device. It is constantly monitoring itself for its frequency of oscillation, sample flow, sample pressure, operating temperature, ambient temperature, and other telling parameters. In addition, the QCM sensor is continually challenged with increasing and decreasing moisture levels due to the non-equilibrium nature of its operation. Through this continuous system of active feedback, the 3050-TE keeps you confident in its performance. Remember if at any time you doubt the analyzer's readings you can use the built-in verification function.

The 3050-TE is simply the best analyzer available for your cryogenic turbo-expander process. Make the decision to protect your process, your revenue, and your peace of mind today.



severe calibration problem exists, the analyzer will provide an alarm. With the 3050-TE, you will always be confident that the analyzer is responsive to the moisture present in the sample gas.

**PERFORMANCE SPECIFICATIONS\***

**System Components:** 3050-TE analyzer, Heated sample probe (pipe thread or flange), 3 meters of special, heat-traced sample line

**Technology:** Quartz Crystal Microbalance

**Range:** Calibrated from 0.01 to 100 parts per million by volume (ppmv)

**Accuracy:** ±10 ppbv or ±10% of the reading, whichever is greater, from 10-10,000 ppbv

**Reproducibility:** ±5 ppbv or ±5% of the reading, whichever is greater

**Limits of Detection:** 0.01 ppmv (10 ppbv)

**Moisture Generator:** 1000 ppbv nominal; calibration is NIST-traceable

**QCM Response Time:** 80% of a step change in either direction in less than 10 minutes

**Sensitivity:** 5 ppb or 1% of reading, whichever is greater

**Allowable Inlet Pressure:** 7 to 200 Barg (100 to 3000 psig) (with pressure-reducing sample probe providing 3.45 Barg (50 psig) maximum pressure to the analyzer))

**Exhaust Pressure:** 0 to 1 Barg (0 to 15 psig)

**Sample Gas Temperature:** 0 to 100°C (32 to 212 °F); analyzer performance is immune to changes in sample gas temperature

**Gas Flow Requirements:** Approximately 1.0 slpm

**Outputs:** Isolated 4 to 20 mA analog signal, keyboard selectable; 12 bit (0.025%) resolution, RS-232 and RS-485 serial communication ports

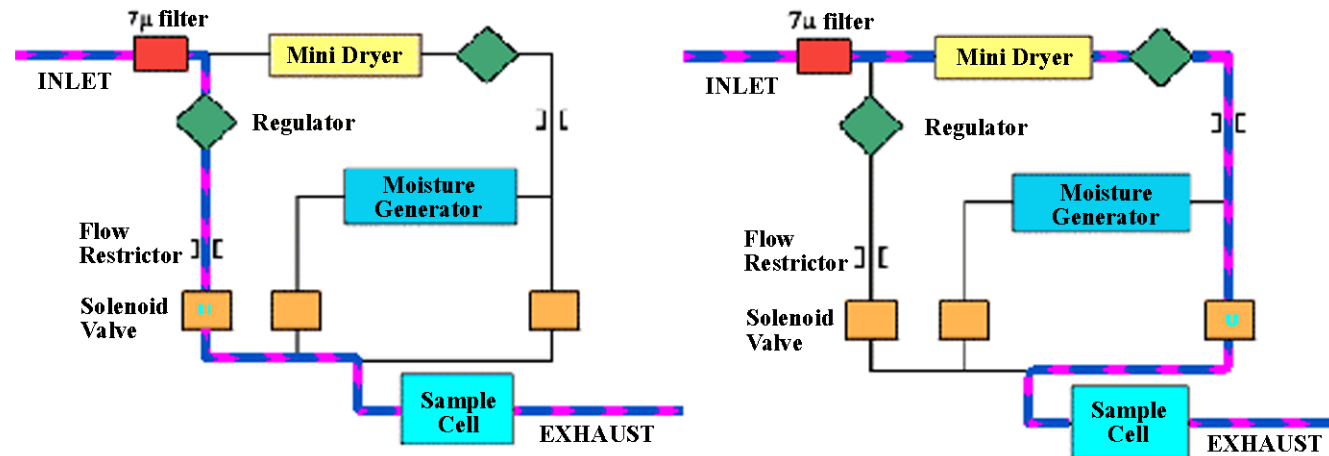
**Alarms:** Two contact closures; system and data invalid alarm

**Ambient Temperature Limits:** - 40 to +60° C (-40 to 140° F)

**Voltage / Power requirements:** 115 ±10% VAC, 50/60 Hz, 400W max  
230 ±10% VAC, 50/60 Hz, 400W max

**Approvals and Certifications:** UL/CSA/CE Class I, Division 1, Groups B,C,D, T6  
GENELEC Zone 1 IIC T6

**NON-EQUILIBRIUM OPERATING THEORY OF QCM**



The analyzer systematically cycles between the actual process gas and a dried reference gas. During the process gas cycle (above left), moisture molecules accumulate on the surface of the QCM sensor. During the reference gas cycle (above right), these water molecules are swept off the surface of the sensor by the dry gas flow. Since there is no waiting for equilibrium, the system provides a measurement of moisture concentration every cycle.

The number of water molecules that accumulate on the surface of the sensor is a function of the difference in moisture between the process gas and reference gas. The analyzer compares the process gas with the known, dry reference as opposed to trying to measure an absolute value that only occurs once equilibrium has been achieved. When a high moisture event occurs, the 3050-TE responds quickly to alert you to the problem. After the high moisture event passes, the non-equilibrium nature of the 3050-TE means that no long dry down period is ever needed before you will get accurate low ppbv measurements.

\*Specifications are preliminary and subject to change.