



## ***Diamond-tipped and conventional probes for industrial at-line and on-line process applications***

Models DPR-240 and DMD-370 are ATR immersion probes providing the high optical transmission and robust reliability required for industrial monitoring applications. The key to the performance of these probes is the use of separate metallic lightguides to direct mid-infrared radiation to and from the ATR sensing element. This dual-light-guide design provides high optical transmission, eliminating the need for a liquid nitrogen cooled IR detector - an important consideration for industrial monitoring applications. Additional considerations contributing to high accuracy and repeatability are the use of a fixed number of ATR reflections and of a precisely controlled range of incidence angles for each probe.

### **DPR-240 Versatile Probe for Diverse Applications**

The DPR-240 is a robust ATR probe employing a two reflection conical ATR element in conjunction with nearly collimated IR radiation coupled to and from the element by means of a pair of gold coated lightguides. This combination assures that all optical rays strike the sample interfacing surface at 45 deg. (+, -1 deg.), providing a very high degree of response linearity (photometric accuracy) and repeatability. The ATR element can be easily interchanged in the field. The selection of standard element materials includes ZnSe, ZnS, AMTIR-1, silicon, and cubic zirconia (three reflections), allowing the

probe characteristics to be altered as application requirements change.

### **DMD-370 Diamond-tipped Probe for Aggressive Chemistries**

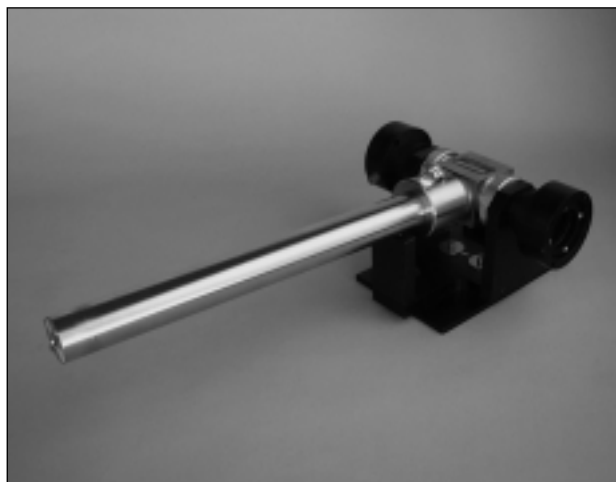
The DMD-370 provides excellent transmission throughout the mid-IR fingerprint region combined with the ability to stand up to strong acids and bases and many other aggressive chemistries. In addition, a high degree of photometric accuracy and repeatability are provided by the proprietary optical design (Patent pending) which restricts the angular range of the optical rays striking the diamond/analyte interface and insures that each ray experiences exactly three reflections.

### **Spectrometer Interfacing**

Three different standard interfaces are available for coupling either a DPR-240 or a DMD-370 to an FTIR spectrometer. Model DSR-370XY enables the probe to be coupled directly to the sample compartment of a conventional FTIR spectrometer. The suffixes X and Y are used to specify the spectrometer make and model. Model DSX-370 interfaces to Axiom's AXM-601 outboard sample module. This provides a high degree of flexibility in placement of the probe by allowing various

# **DPR-240/DMD-370**

## **HIGH TRANSMISSION ATR IMMERSION PROBES**



### **Features:**

- High sensitivity without requiring a cooled detector
- Diamond element for excellent corrosion resistance (DMD-370)
- Interchangeable ATR elements to meet diverse needs (DPR-240)
- Proprietary optical designs for maximum photometric accuracy
- Robust construction for maximum reliability

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4,835,389  
5,051,551

Additional Patent Pending (DMD-370)

combinations of Axiom mirror and conduit modules to be used between the sample module and the spectrometer. Finally, model DSD-370XY couples the probe to a dedicated process FTIR spectrometer employing dual input and output beam ports.

### Sample Interfacing

DPR-240 and DMD-370 probes can be interfaced to either a batch reaction vessel or a process pipe by means of a variety of optional pipe flanges and fittings. In addition, Axiom offers flow fixtures (models DPF-240 and DMF-370) for use in extractive sampling.

### Axiom's Comprehensive Immersion Probe Product Line

Axiom Analytical pioneered the field of in-situ IR reaction monitoring with the introduction of the first ATR immersion probes in 1989. Since then, the company's immersion probe product lines have continued to expand to include ATR, transmission, and diffuse reflectance probes tailored to all spectral regions (UV through mid-IR, Raman) and virtually all applications. The DPR-240 and DMD-370 continue this tradition, providing unmatched performance along with the robust construction and chemical resistance needed to stand up to the harshest process conditions.

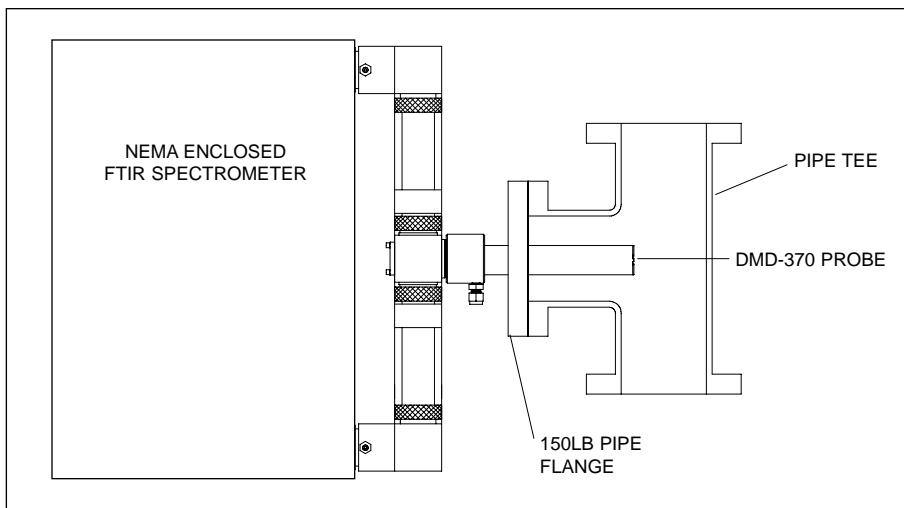


Figure 1: Two port NEMA enclosed FTIR spectrometer with a DMD-370 probe flange mounted to a process pipe tee.

### DPR-240/DMD-370 Specifications

|                       | <u>DPR-240</u>         | <u>DMD-370</u>                             |
|-----------------------|------------------------|--|
| Probe Diameter:       | 28.6 mm                | 32 mm                                      |
| Immersion Depth:      | 20 cm                  | 15 or 30 cm                                |
| ATR Reflections:      | 2                      | 3  |
| Angle of Incidence:   | 45°                    | 45°  |
| Nominal Transmission: | 20 %                   | 18 %                                       |
| Maximum Temperature:  | 280°C                  | 200°C (Continuous)<br>280°C (Intermittent) |
| Maximum Pressure:     | See table below        | 30 bar                                     |
| Wetted Metal:         | 316 Stainless Steel    | Hastelloy C-276                            |
| Seal Type:            | Energized, filled PTFE | Energized, filled PTFE                     |

### DPR-240 ATR Elements

| Material  | Spectral Cutoff       | Hardness (KNOOP) | Attacked By                    | Max Pressure |
|-----------|-----------------------|------------------|--------------------------------|--------------|
| ZnSe      | 600 cm <sup>-1</sup>  | 120              | Acids, oxidizers               | 30 bar       |
| ZnS (CVD) | 950 cm <sup>-1</sup>  | 250              | Strong oxidizers, some acids   | 30 bar       |
| AMTIR-1   | 850 cm <sup>-1</sup>  | 170              | Strong alkalis                 | 10 bar       |
| Ge        | 700 cm <sup>-1</sup>  | 780              | Hot sulphuric acid, aqua regia | 25 bar       |
| Silicon   | 1150 cm <sup>-1</sup> | 1500             | HF, HNO <sub>3</sub> , NaOH    | 30 bar       |