

VARIABLE RADIUS MIRROR (VRM)



HIGHLIGHTS

- Adaptive surface allows control of beam divergence and focus spot size.
- II-VI's highest reflectivity MMR-A coating provides minimal power loss.
- Radius ranges (i.e., 3 m concave to plano; plano to 3 m convex; 6 m concave to 6 m convex; 1.2 m convex - 1.6 m convex).
- Mirror may use either water or air pressure to control radius.
- Pressure ranges may vary between 3 and 11 bar, depending on the radius range required.
- Custom mirrors designed to specifications.

TYPICAL SPECIFICATIONS

Substrate:	Copper
Standard Mirror Diameter:	57.1 mm, 79.0 mm
Usable Clear Aperture:	35 mm, 50 mm
Radius Range*:	6 MCC - 6 MCX 3 MCC - PO PO - 3 MCX 1.2 MCX - 1.6 MCX
Pressure Range:	3 to 11 bar
Water Flow Rate:	~1 liter/minute
Angle of Incidence:	Near normal
Reflectivity with MMR-A Type Coating:	> 99.8%
Pointing Stability:	≤ 30 arc seconds

*Customized radius range available.

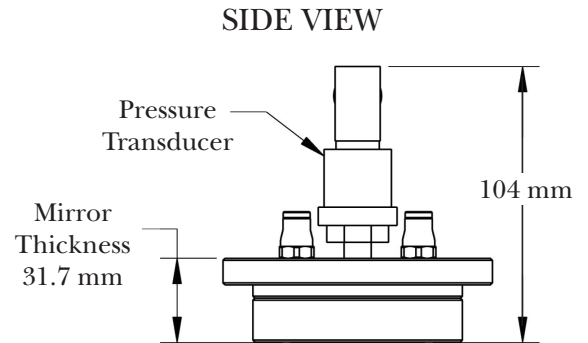
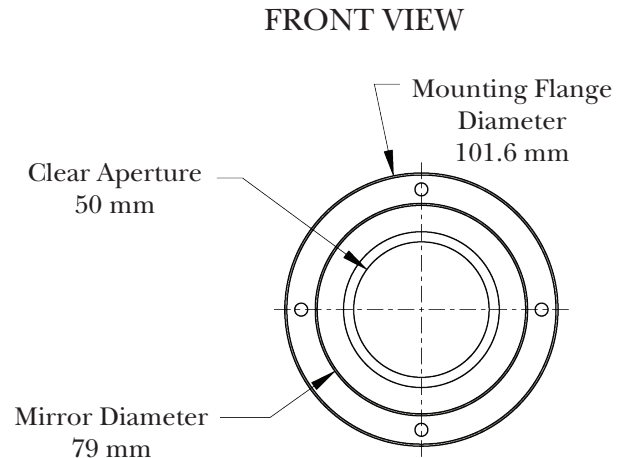
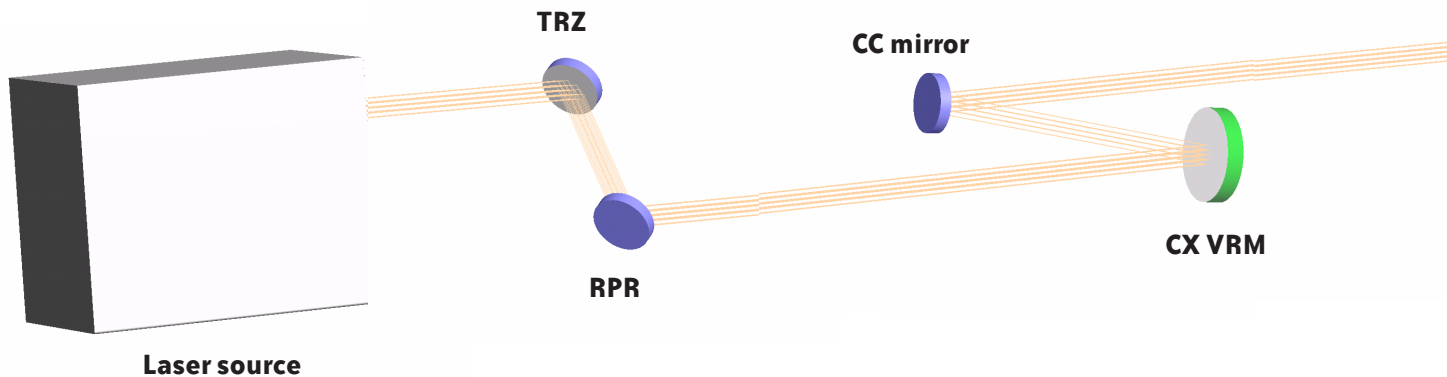
APPLICATIONS

The II-VI Variable Radius Mirror (VRM) allows users to dynamically change their beam characteristics on the fly. By controlling the radius of curvature of the VRM with water pressure, users can adjust the divergence of the laser beam.

The VRM allows focus depth control for adjustment during material piercing, and optimum speed during cutting. It also allows manufacturers of flying optics systems to compensate for focal length variations across the working table. This is especially important with large working tables, where laser beam divergence changes at the lens as the optical path moves across the work area.

The VRM is designed to be used at near normal angle of incidence. Many laser cutting systems use two mirrors as telescope optics. The telescope is made of one convex and one concave mirror. Replacing one of these mirrors with a VRM allows all of the benefits listed above.

Beam Delivery System Example



PRESSURE CONTROL

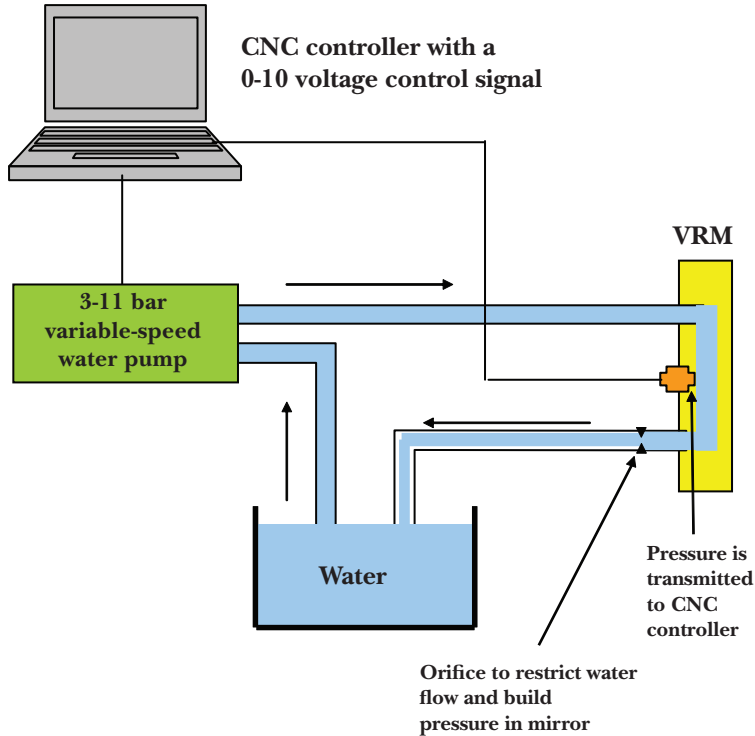
There are at least two ways to control the pressure in the VRM and, as a result, control the radius of the mirror surface. The key component can be either a variable-speed pump or a proportional control valve. Both of these items are driven by an amplifier. Input to the amplifier is typically a 0 to 10 volt signal. The amplifier can be run open ended or in a closed-loop system. Typical response plots are shown at the right bottom of the page.

CUSTOM DESIGNS

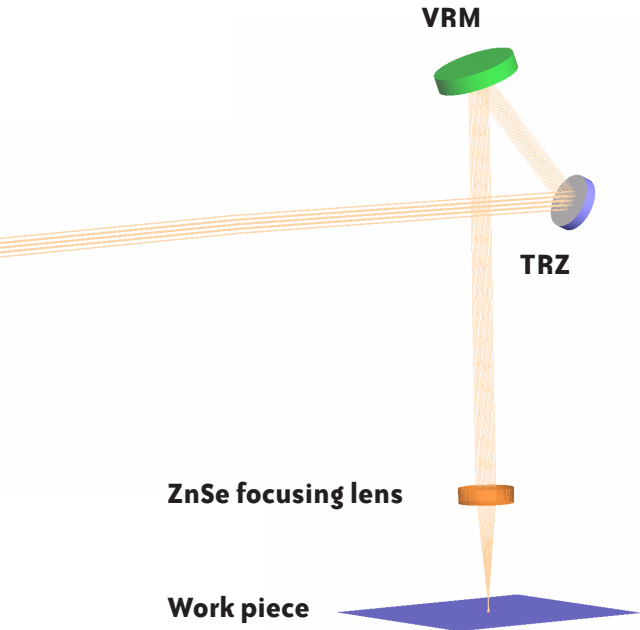
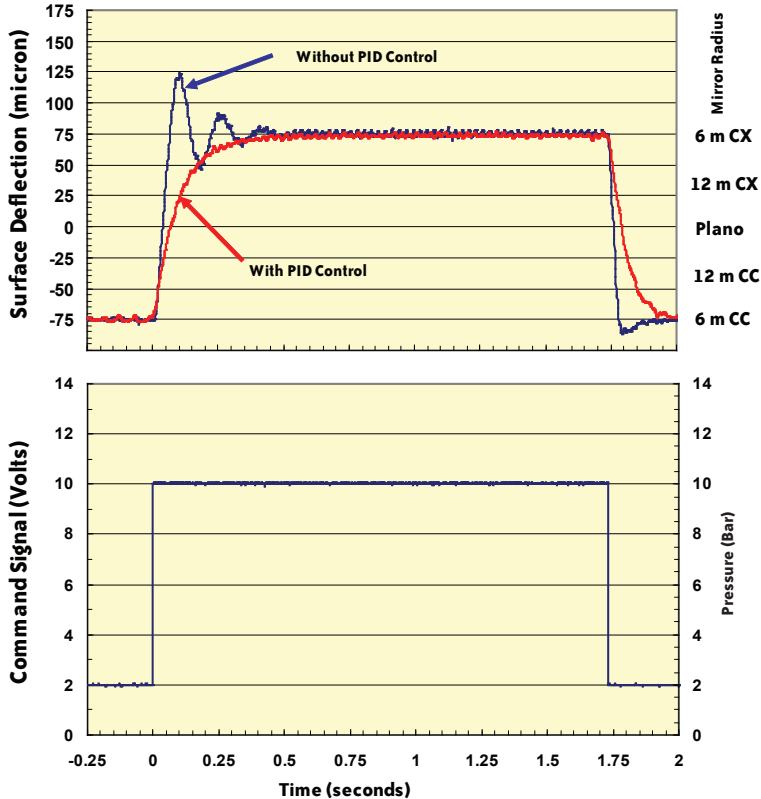
II-VI has the engineering capability to design adaptive mirrors for any beam delivery system. Using proprietary design techniques, II-VI can accurately model the shape of a VRM and predict how it will deform under pressure. The shape of the mirror is optimized to match the pressure-radius curve defined by the customer.

Water Pressure System Example

The drawing below shows the closed-loop system that uses a pressure transducer to measure the pressure in the mirror cavity. This signal is fed back to the CNC controller.



Typical Step Response for Variable Radius Mirror





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