

## DATA SHEET

### Head up display combiners

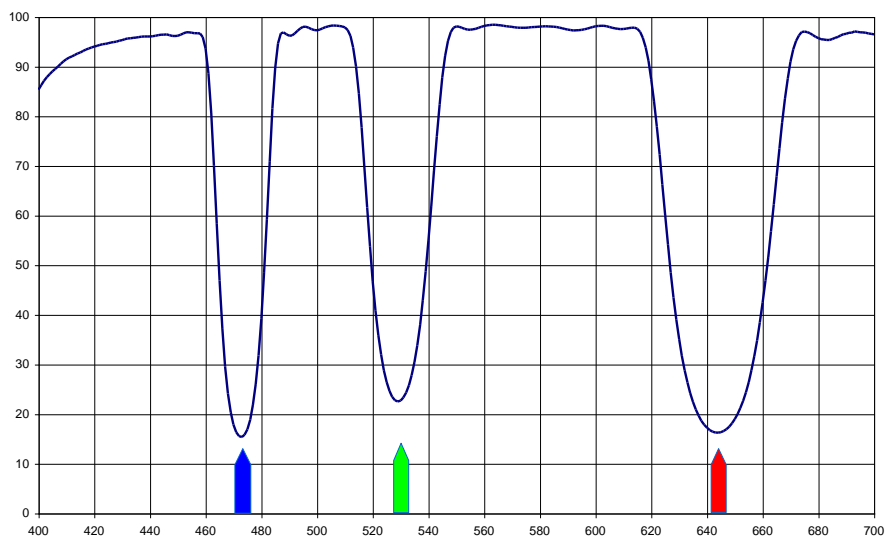
A Head-up Display (HUD) provides the ability to project information onto a transparent screen in a way that it appears to be floating in space as a virtual image. With suitable optics, the virtual image is combined with the view of the real world seen through the screen so that both images appear to be at the same distance. HUD's were originally developed for aircraft cockpits, so that flight information can be seen by the pilot without him having to refocus his eyes and look down at flight instruments, and this principle is now being used for other applications including automotive.

For aircraft in bright cloud or sunlight conditions, the display must be sufficiently visible to contrast with the background sky. The advent of near monochromatic green phosphors led to the development of HUD's with increased display brightness. With this comes the possibility of using narrow bandwidth reflective 'notch' filters, whose peak reflection is centred at the same wavelength as the phosphor. As only a narrow portion of the visible spectrum is reflected, most of the outside world spectrum is transmitted, only losing a narrow portion of the green spectrum. A powerful and efficient method for generating colour selective reflection coatings for HUD combiners is by rugate filter technology.

Orion Photonics has perfected techniques for the design and manufacture of rugate coatings for head-up displays which provides high visible transmission while maintaining up to 80% reflection of the display. The technology exhibits major advances over other HUD combiner technologies in terms of display brightness, photopic transmission, weight, ruggedness, insensitivity to head movement, and freedom from flare.

Rugate technology has also been applied for displays with more than one colour and Orion has pioneered the manufacture of HUD combiners for military avionics using double and triple notch rugate filters. Manufacture is by plasma assisted deposition providing coatings that are extremely rugged and insensitive to temperature and humidity variations.

Transmission measurement of triple notch rugate combiner



Photopic transmission = 79%  
Photopic reflection = 66%  
Colour shift = 0.008