Blue laser measurement

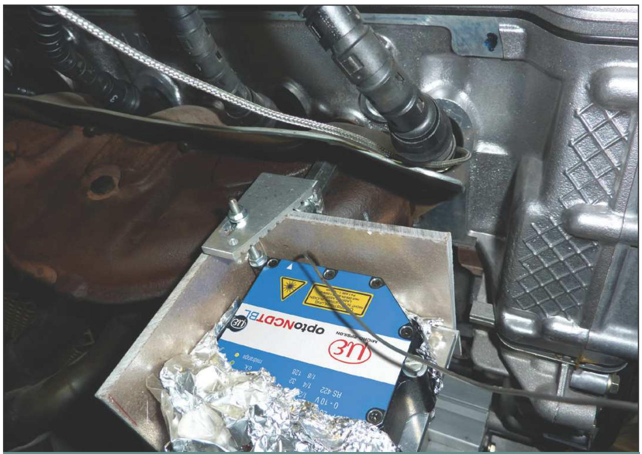
Blue-violet laser light is resistant to much of the infrared interference that plagues red laser measuring techniques, and can play a vital role in observing displacement in engine design

For many years, laser triangulation has been one of the most favored technologies for measuring displacement. From the very early days, a red laser light was used as the receiving element as that wavelength had the highest sensitivity. For many objects, however, the red-colored laser was subject to certain limitations. In these instances, the different wavelength blue-violet lasers enable the measurement of very particular applications, such as vibrations on an engine manifold.

Unlike red laser sensors that operate at a wavelength of 670nm, the wavelength of a blue laser is at the opposite end of the visible light spectrum, at 405nm. This wavelength is therefore very close to ultraviolet (UV) light. CCD elements are more sensitive in the infrared range than in the UV range. This is why conventional sensors that use a red laser light operate close to the infrared spectrum, which starts at 780nm. This approach works reliably on most target objects.

However, for some measurement tasks, conventional red laser sensors cannot be used. Various objects, such as glowing hot metal, emit a high proportion of infrared radiation, which interferes with a sensor that is set to red. At a temperature of approximately 700°C, good measurement results become very difficult to achieve. In contrast, a blue laser provides maximum distance from infrared, meaning that any infrared radiation does not interfere with the sensor. This technique is now being demonstrated in Micro-Epsilon's optoNCDT BlueLaser series.

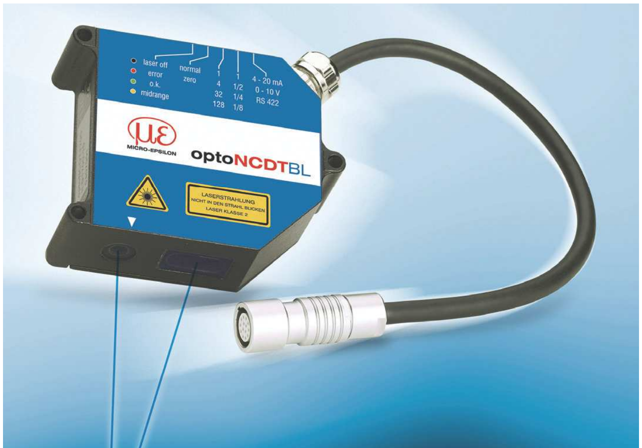
The light emitted by conventional red lasers penetrates the target object. The extent of this penetration depends on the material of the measurement object, and is particularly strong in organic objects. With a red laser, the light penetrates deeply into the surface of the measuring object and is then scattered due to its wavelength. As no clear image point on the surface is generated, it is not possible to define an exact displacement. In contrast, blue laser light does not penetrate the measuring object as deeply, due to its reduced wavelength. The blue laser generates a minimal laser point on the surface and therefore offers more stable, precise measurements on target objects.



A blue laser sensor installed for vibration measurement on an engine manifold

Triangulation sensors that use blue laser technology are completely redesigned. The sensors are equipped with new high-end lenses ideal for short wavelengths, new intelligent laser controls and innovative evaluation algorithms.

Optimizing the processes within an internal combustion engine is becoming increasingly important nowadays. A whole series of measurements is vital for engine management purposes. The temperature of the exhaust gas is recorded using a thermocouple within the manifold. To check the way it is attached, it is necessary to examine its propensity to vibrate, as well as the mechanical rigidity of the structure. This is an application where the blue laser comes to the fore. The high temperatures in the flow of exhaust gas leads to the thermocouple self-fluorescing (becoming red hot). Due to the short wavelength of the blue-violet laser employed, the light emitted from the thermocouple does not dazzle the sensor, as the long-wavelength intrinsic incandescence is a long way off the 405nm wavelength of the blue-violet laser, and is effectively blocked by the high-quality interference filters used. A narrow slit provides the free space needed for the optics. The high ambient temperatures are reduced effectively for test operation by means of a protective plate, while a blower ensures clean optical conditions and the cooling required. The vibrations expected can be accurately recorded, thanks to the sensor's fast sampling frequency (2.5kHz) and can be easily evaluated via an interface to a PC.



The optoNCDT 1700BL blue laser sensor is unaffected by infrared interference generated by red-hot objects, and provides a more reliable measurement method