

# Two Sensors in one

## Non-contact thickness measurement of non-transparent components

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**With the CHRcodile 2 DPS dual-channel sensor Precitec Optronik offers a stand-alone solution that enables non-contact thickness measurement of non-transparent components in both inline and offline production processes. Utilizing the geometry of the structure, the thickness of an object is calculated internally in the CHRcodile 2 DPS using the distance data to the two surfaces and provided directly to the user as a measurement signal.**

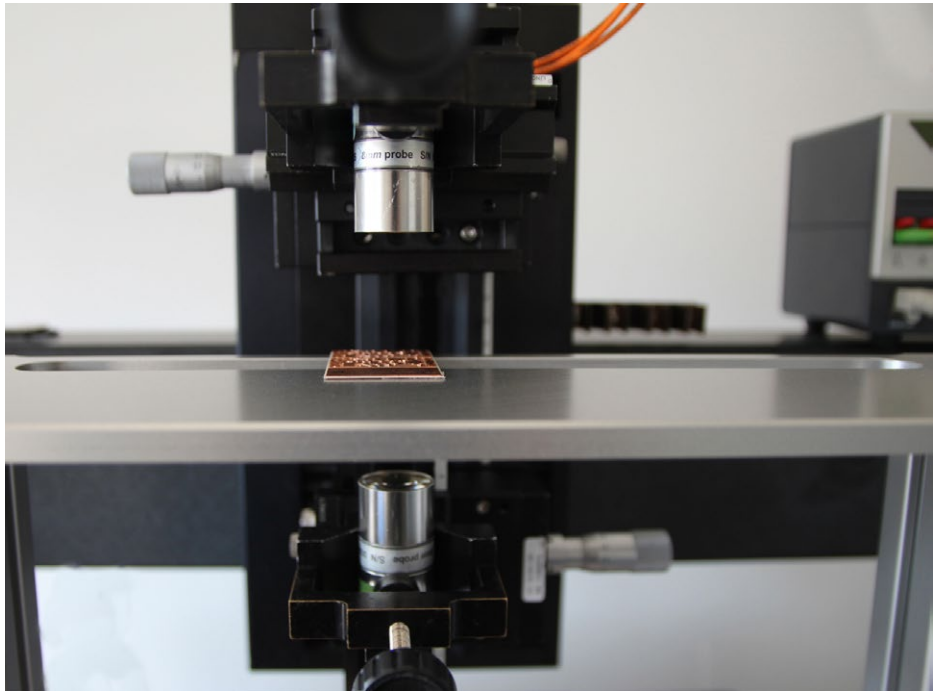


Figure 1: The thickness of a non-transparent object is measured with the CHRcodile 2 DPS and two measuring heads. The thickness value is shown on the controller's display, but can also be retrieved via a network connection.

### Non-contact chromatic- confocal measurement

When white light is focused with a dispersive lens system, it is spectrally split along the optical axis. The chromatic-confocal CHRcodile sensors from Precitec Optronik utilize this effect. From the wavelength of the light reflected back from a surface, the distance to it can be determined with high precision, opening up a wide range of applications for profilometry. In transparent multilayer systems the thicknesses of the individual layers can also be determined from the different distance signals to each interface, taking into account the refractive index (Fig. 1). Measurements are possible on many different surfaces and materials from specular to rough, light to dark, and flat to oblique – with very precise lateral resolution down to less than two micrometers with axial resolution down to a few

nanometers. Precitec Optronik's broad product portfolio includes tailored solutions for a wide range of accuracy or measurement range requirements and they are always contactless and shadowless.

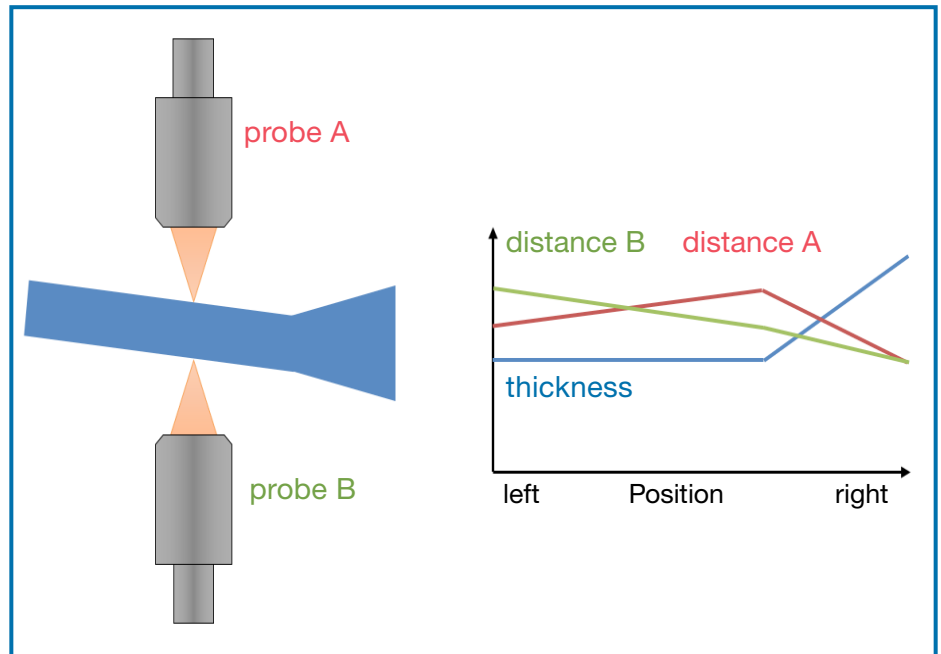
The CHRcodile sensors are robust, maintenance-free and designed for continuous operation, e.g. in production processes. The ability to automatically adjust the light intensity, ensures a high flexibility of the measurement system.

During a single measurement run, highly reflective and less reflective areas are both scanned with the optimal settings.

The lens system (hereafter referred to as the measuring head) and the controller are separate components. The light is transported between them via flexible glass fiber. The two-part design thus ensures maximum flexibility. The measuring head requires very little space and can thus be

installed in narrow measuring machines with little available installation space or on moving robot arms, while the controller is positioned in the control cabinet, for example, and thus remains protected from vibrations or thermal changes.

Fig. 2 An object with initially constant thickness is measured with the CHRocodile 2 DPS. If one surface moves away from the measuring head, the distance value will increase. If the surface comes closer to the measuring head, the measured value will decrease (red and green curve). The internal calculation includes the geometry of the structure and directly outputs the thickness profile (blue curve).



## Thickness measurement of an opaque object

If the thickness of an opaque object is to be determined, two measuring heads are required, one from each side (Fig. 2). By referencing with a test standard of known thickness, the thickness of the object can be obtained from the data on the distances to the two surfaces. This principle is not affected by displacements or vibrations of the object. If it comes closer to one measuring head, it moves away from the other; the calculation of the thickness is not affected. This makes the system highly suitable for inline applications where, for example, a passing strip (as an object) cannot be guided or only guided to a limited extent, or for roll-to-roll applications with high web speeds. The CHRocodile 2 DPS sensor can measure at up to 10 kHz, which means that even large or fast-moving objects can be closely scanned.

### 2-in-1 solution

The CHRocodile 2 DPS product combines two sensors into one by having the controller supply light to both measuring heads, spectrally analyze the reflected back light, and synchronize the two measurements. This ensures that even during fast measurement runs or web speeds, the two measurement values used for thickness calculations are generated at the same location. The light intensity is automatically adjusted for each of the two measuring heads individually so that the controller reacts independently and

for each measuring channel individually to areas with different surface properties.

The calculation of the thickness of a non-transparent object and the referencing with the test standard are performed automatically in the device and the resulting thickness value is output directly for the user in an uncomplicated manner. Thus, the CHRocodile 2 DPS represents a user-friendly and cost-effective stand-alone solution, especially in comparison to the currently established solution based on two individual sensors.

### Simultaneous acquisition of thickness and shape data

The thickness information is available in addition to the distance information. Thus, the shape of a component can be determined as well as its thickness. In multilayer systems consisting of (several) transparent layers and one non-transparent layer, this information can be combined to obtain the most comprehensive picture possible of the shape and individual layer thicknesses of an object.

### Step height measurement

Another possible application is the instantaneous determination of a step height without the time-consuming acquisition of a complete profile of the step. If both measuring heads are oriented in the same direction, the height difference between two locations on a surface can be determined. This is interesting, for example, for continuous inline control of the thickness of

a coating or to determine the thickness of an object that cannot be reached from the bottom for geometrical reasons. For example, the thickness of a wafer on a chuck table can be determined by measuring the step height between the wafer surface and the chuck table. The internal calculation and referencing can be easily adjusted to this situation so that the CHRcodile 2 DPS directly outputs the calculated step height without further post-processing.

Thickness information can also be included in this application so that composite objects with transparent layers can also be measured here.

### **Flexibly adaptable modular system**

All chromatic-confocal measuring heads from the Precitec product portfolio can be operated with the CHRcodile 2 DPS. The measuring heads used on the two channels do not have to be of the same type. This allows the measurement setup to be individually adapted to each specific measurement situation.

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