SWISS PHOTONICS
Image Processing by TRUMPF

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TRUMPF – Products and Applications
Sheet metal processing and laser processing
VisionLine uses the same platform for different TRUMPF products

welding OEM package

marking OEM & systems

welding with laser systems:
- TLC3000
- TLS5005
- TLC7000
- TruLaser Weld
VisionLine for marking
Keeping an eye on everything with TRUMPF image processing
Different camera configuration with focusing unit

**A On-axis with focusing unit**
Ideal for high precision

The field of view of the camera depends on the lens size. The standard field of view is 7x10mm. Each point in the marker field can be approached quickly (10m/s) and precisely (<1μm).

**B Off-axis**
Ideal for large field of view

The off-axis camera overlooks the entire marking area. Drift effects from the laser and scanner are not compensated. The camera resolution is 60μm per pixel.

**C On-Axis with focusing unit & off-axis**
Best of both

The off-axis camera is used for rough search with the subsequent fine search via the off-axis camera. The two cameras can be called sequentially.

**VisionLine Hardware**

The camera adapter is mounted between the laser source and the scanner. The modular principle allows you to use the same adapter for different types of lasers.

**Vision focusing unit**

The camera adapter is equipped with a focusing unit. The VFU can focus the on-axis camera on a volume (x,y,z) equal to the volume reachable by the laser focus. The laser and the camera has its own focusing unit so the focus can be adapted independent.

Panel PC with VisionLine software
VisionLine’s standard pattern library

The VisionLine software defines unique jobs. Each job defines the scanner position (x,y,z), the camera settings (gain, exposure) and the image processing function for each camera.

The modular principle allows a wide variety of use cases to be covered.
Position correction use case

A The components to be labelled are roughly fixed

B Position recognition e.g. over edges or specific features such as holes

C The content to be marked is moved to the detected position

D Finally the material is marked

The complicated fixation of the objects is no longer necessary. Fixations can be made faster, more flexibly and more cost-effectively.

The image processing software compensates the inaccuracy of the fixations.

…the marking content is lasered in the correct place.
**Code reading and grading use case**

**A** After the laser marking process

Most products in the automotive and medical industries contain a machine readable code.

**B** Read or verify code

Grading results

Processing statistics for reading and grading

**C** Postprocessing

The code content is evaluated, for example via a target-is comparison or written into a database.

**Code marked** = **Code read**

Customized Grading by ISO 1545 or ISO 29158:2011

Full norm grading depends on the lighting constellation.
Modelfinder use case

A Off-Axis camera observes complete marking field

B Locate each part with model finder functionality

C Accurate position detection of each part

D Finally marking material

The objects to be recognized are learned.

The algorithm recognizes the learned object and marks it if it matches the specification.

For even more accurate detection, the object is measured in detail using the on-axis camera.

The parts are marked one after the other in the right place. The productivity is greatly increased. Further integration with automatic feed and removal of the parts is possible.
Hairpin welding in electromobility
New application for laser processes.

The coil in the electric motor is manufactured using the Hairpin technology.
Hairpin welding in electromobility

The hairpin ends of an electric motor stator are welded by the laser. The VisionLine system recognizes the midpoint of every hairpin pair. The image processing also recognizes malposition of the pins.

The laser welds the hairpins together. The laser beam is directed to each center via the beam deflection unit (scanner).
Reliable hairpin welding with image processing VisionLine
Everything in view during welding
Outlook: Use of deep learning in quality assurance

Good / bad rating with hotspot display

As part of a training phase, the deep learning algorithms are taught.

With the training set the new pictures are qualified.

Good welds are different from bad welds. A failure of a welding site leads to the failure of the electric motor!

Bildquellen: mit freundlicher Unterstützung der Grob-Werke GmbH & Co. KG