

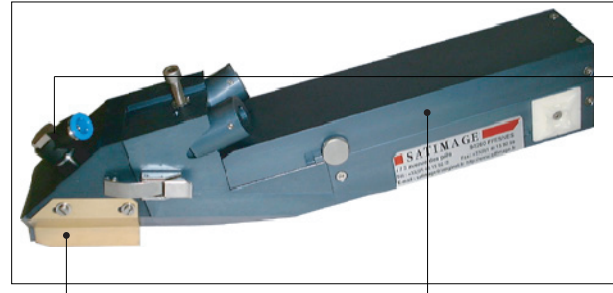
WeldInspector

General presentation

- On-board Vision system for laser butt-welding machines.
- Control of the actual spot trajectory.
- Quality control of the welded seam.
- Prevention against process drifts.
- Discards the non conformants parts.
- Designed to work in harsh environments.
- Allows the user to tolerate isolated defects.

WeldInspector is an on-board vision system. **WeldInspector** works attached to the rear of a blank butt-welding laser head, CO2 or YaG.

WeldInspector serves two purposes: it can perform on the spot a full Geometrical Inspection, and it also provides continuously the Quality Control of the welded parts.



Nose
The "nose" (front part) of the sensor is changed in seconds without any tool.

Housing
Very robust Aluminium housing, protects the optics and camera.

Air outlet
The "nose" of the measuring head is pressurized in order to avoid any pollution, reducing periodic servicing to virtually nothing

WeldInspector's Geometrical Inspection consists in checking the laser spot trajectory relative to the actual shape of the joint. The Geometrical Inspection will detect and measure any bad condition of the spot trajectory - including lateral offsets. The Geometrical Inspection will also detect any straightness defect of the blanks before welding. **WeldInspector's** Geometrical Inspection can be operated very rapidly: its operation sums up to performing a normal welding cycle. **WeldInspector's** Geometrical Inspection allows the user to adjust the position of the laser spot with respect to the joint, rigorously, rapidly, and with no risk of mistake. This feature increases the productivity of the welding machine, and smoothes the quality of the parts which are produced.

In normal operation, **WeldInspector** performs the Quality Control of the welded parts. **WeldInspector** checks 100% of each welded seam, and discards the parts which display any defect on a welded seam. The Quality Control helps preventing the drifts of the process, and prevents against defects of accidental origin.

Satimage's product line

Satimage's Machine Vision systems include two kinds of solutions.

- ▶ **Generic Measuring Machines.** They provide, in real time and with a high accuracy, some defined physical measurement. Numerous applications.
- ▶ **Dedicated Systems.** Designed up to the finest details with the help and for the purposes of their users. Devoted to some specific manufacturing process.

WeldInspector is one of the Satimage's Trade Solutions dedicated to laser butt-welding. **WeldInspector** operates a combination of two Vision technologies: dimensional measurement and surface inspection. **WeldInspector's** engine for dimensional measurements has a ± 10 microns accuracy.

Basic features

- ▶ **Video recording of the welding cycle** (in Geometrical Inspection mode).
- ▶ **Video archiving** (used for process tracking).
- ▶ **Continuous monitoring of the width** of the melted zone.
- ▶ **Continuous monitoring of the regularity** of the melted zone.
- ▶ **Surface defects detection:** beads, holes, depressed zones.
- ▶ Communication with the PLC (**for ejection of defective parts**).
- ▶ Allows the user **to disable the Quality Control** on the beginning or end of the seam.
- ▶ Manufactured according to a **modular design** which reduces the delay of unavailability and the cost of the repairs in the case of collision.
- ▶ Powerful **anti-pollution system** which suppresses any periodic servicing.

- Video recording of the welding cycle.
- Geometrical control of the melted zone.
- Detection of the surface defects.

- Bavurex
- Brillo
- Diffuso
- FireVision
- KitNum
- Profilo
- Recta
- SeamInspector
- Slots
- WeldInspector**



Operation of WeldInspector

In Quality Control mode



In normal operation, the operator is not involved. **WeldInspector** knows automatically (through the communications with the PLC) which part model is being manufactured. For each model, **WeldInspector** knows the welding parameters and the tolerances.

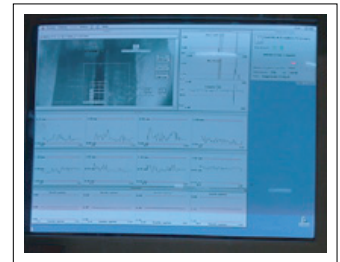
The operator should take an action if repeated defects occur. The User's Guide suggests how to address the problem, based on the kind of defect which is reported by **WeldInspector**. Practically, the shapes of the plots displayed by **WeldInspector** usually "tell" what the origin of the problem is.

Entering the parameters for a new model is done through standard, explicit, dialog boxes.

In Geometrical Inspection mode

The operator programs a welding cycle with reduced laser power (5 - 10% of the nominal power). The operator then switches **WeldInspector** into Geometrical Inspection mode, and launches a welding cycle.

WeldInspector records on the hard disk the "movie" of the welding cycle. Once the cycle is over, the operator views the movie.



The images show, at a high magnification (x 20), two thin lines: the joint and the laser spot burnt track. The quantitative information that **WeldInspector** displays provides instantly the value of the gap between the two lines. This robust piece of information will allow the operator to adjust the offsets of the seam tracking system if there is one, or to adjust directly the offsets of the laser head trajectory if there is no seam tracking system.

The operator will proceed to additional checks using the movie: viewing the full video will evidence any excessive gap between the blanks and any shape defect, and will certainly help preventing any unexpected event which could result in adverse effects on the welding.



The operator keeps informed in real time about how the welding cycle is going, via a specific information window that gets refreshed continuously.

Performances

Common data:

- ▶ **On-screen magnification** x 20
- ▶ **Field of inspection** on each video frame, WeldInspector checks a portion of the seam which is 7 mm long.
- ▶ **Rate of inspection** WeldInspector processes 60 video frames per second.
- ▶ **Smallest defect detected** 0.1 to 0.5 mm, depending on the user's setting of the control strictness.
- ▶ **Accuracy of the measurements of dimensions and positions** ± 1/100 mm
- ▶ **Overall size of the housing** l x L x H = 50 x 220 x 80
- ▶ **Maximum welding speed** 25 m/mn. At speeds lower than 12 m/mn, WeldInspector will perform a redundant control.

WeldInspector handles all usual coatings, galvanized, zinc electroplated, organic, and non coated steels.

Quantities monitored:

in Geometrical Inspection mode: position of the middle of the laser track - position of the middle of the joint - width of the joint (gap)

in Quality Control: width of the melted zone - variability of the width of the melted zone - position of the middle of the welded seam.

Architecture

- ▶ **Housing:** includes the (digital) video camera and the Illuminating Optics. The Measuring Head is fixed on the laser head, just behind the spot.
- ▶ **Optics:** the Light Source is connected to the Measuring Head through a fiber optics. The Light Source is fixed, either on a fixed support, or on the moving trolley.
- ▶ **Video:** 100% digital video camera, standard: FireWire (IEEE 1394)
- ▶ **Computer:** keyboard, mouse and monitor.