

Smart Cameras in Robot Control Applications

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www.vision-comp.com

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Introduction

- Cost, effectiveness, speed, size, reliability
- Miniature Smart camera architecture
- High end, high speed smart camera architecture
- Smart camera advantages in robot applications
- Application examples

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Miniature smart camera

- Integrating

- ◆ Image sensor
- ◆ Processor
- ◆ Lighting
- ◆ Simple user interface
- ◆ Lens and IP67 housing

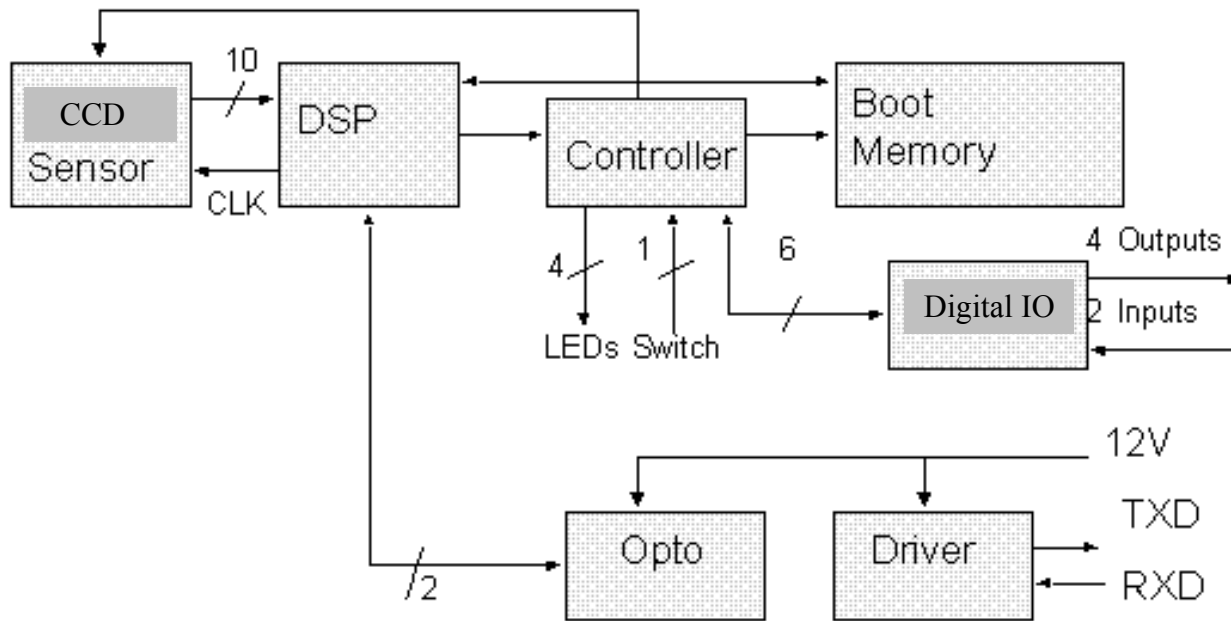


- Significantly lower cost, higher performance
- Smaller size, less power consumption, less weight
- Setting new standard for performance and integration density

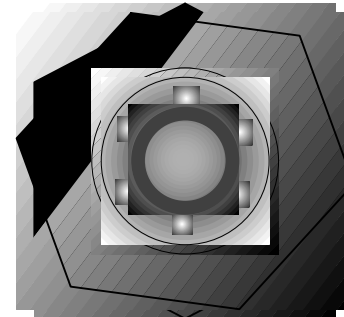
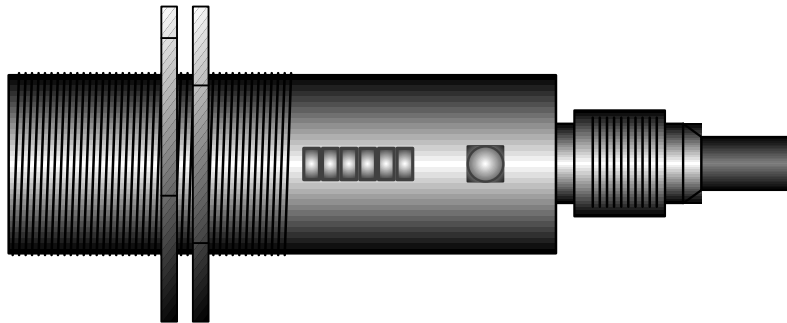
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Miniature Smart Sensor architecture



Low Cost Smart Camera



Able to read 7-10 ECC 200 codes/sec.

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CCD sensor

- Sensor: Sony 1/4"
- Resolution: 640 x 480 pixels 8/10 bit
- Frame rate: 50-200 frames/sec with binning
- Shutter: 20 usec – 4 sec frame by frame
- Picture: full frame, trigger, async reset
- Sensor next to DSP processor



Hardware components

- 75 MHz DSP, 375 MIPS
- On-chip memory, DRAM for images
- Flash EPROM for program storage
- PLC compatible digital I/Os
- Simple operator interface
- JPEG image output



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Integrated illumination and optics



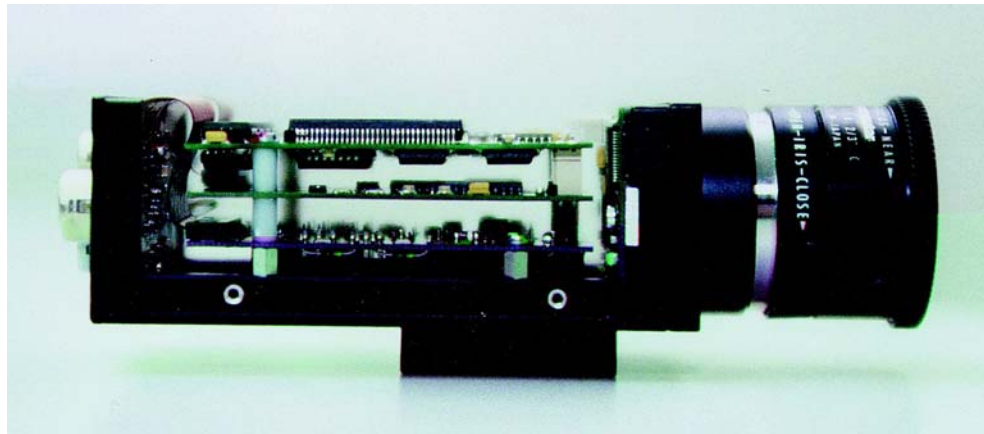
- Built-in program controlled ring LEDs
- Strobe control
- Four LEDs for FOV and focus adjustment
- Simple setup and operation
- Vibration, shock resistant
- Waterproof, durable aluminum housing



Software components

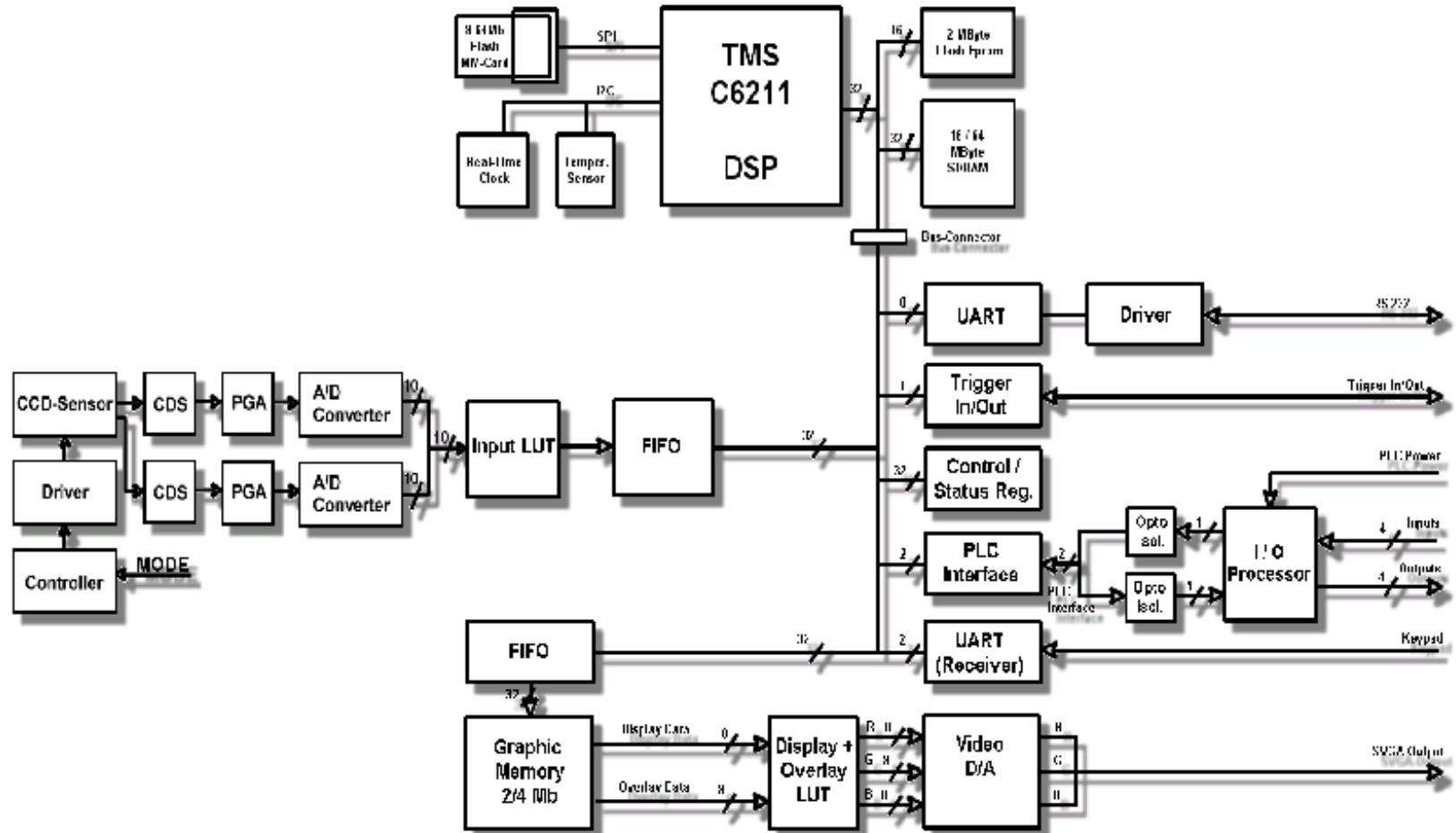
- Real time operating system in the smart camera
- Flexible Cross development environment
- Image processing, machine vision library
- Emulator, simulator
- Application software – third party software
- Robot communication protocols

High performance 32 bit Smart Camera



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High Performance Industrial Smart Camera

- Performance: up to 30-40 parts/sec
- Modular architecture
- Multitasking, parallel execution
- Exposure, read-out, UI in parallel
- Programmable gain and offset
- Crash proof file system
- Built-in Fast Ethernet/TCP/IP stack

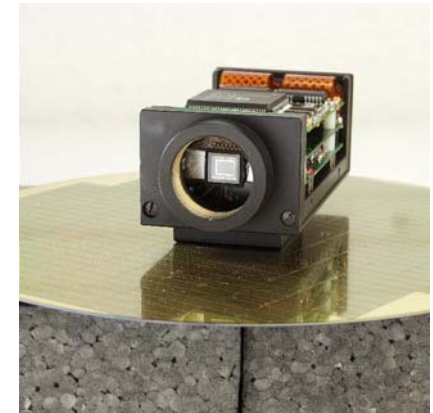


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High-performance intelligent camera

- 800x600 pixel-identical 8/10 bit A/D at the CCD
- 54 full frames/sec, dual channel 800x600
- 110 full frames/sec 640x480
- 32 bit DSP processor
- Up to 64 Mbytes SDRAM
- SVGA output with 8 bit color overlay
- Size 100x50x35 mm 300 gr
- Shutter 30 usec up-to 20 sec



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Smart camera advantages

- Low power design : few watts; small size
- No moving parts, no fans, compact, higher integration, significantly less parts
- Reproduction for a long time
- Code transferability
- DSP processors designed for image processing
- One supplier - versus several
- Small embedded, modular fast image processing

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Smart camera advantages

- Compact, self-contained units without a lot of baggage
- Simple maintenance, replace or repair of one part from one supplier
- Higher reliability
- Less parts, less cables
- Simpler
- Longer product life cycle
- Industrial design, easier to integrate

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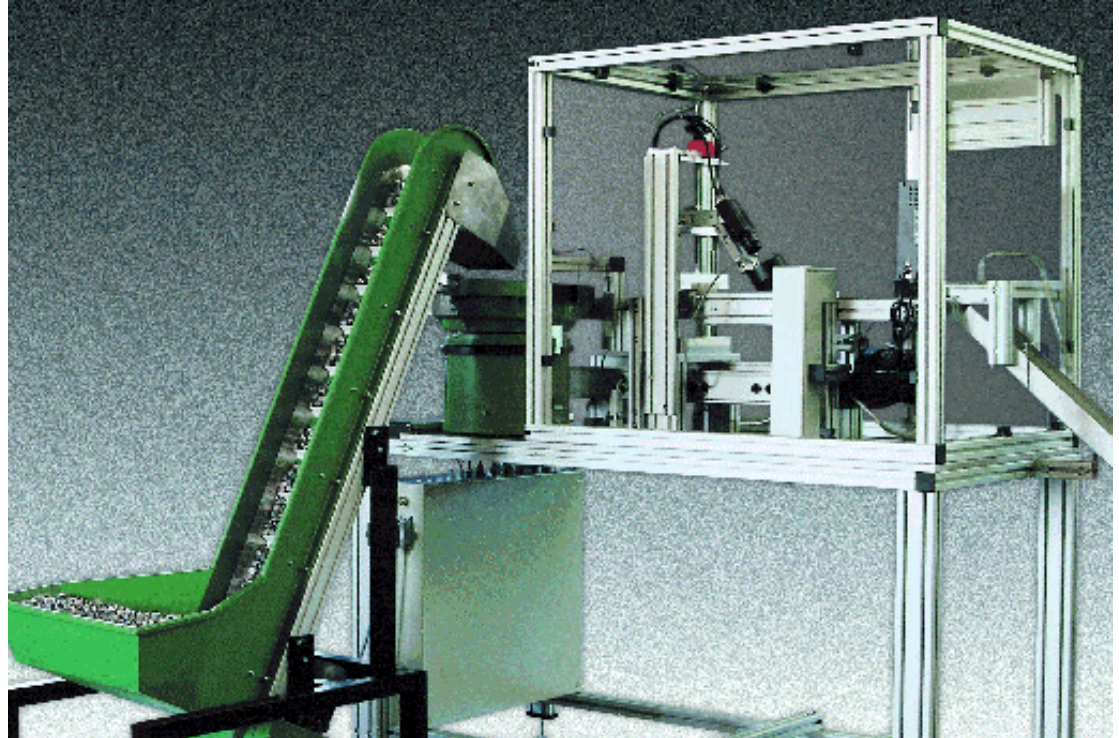
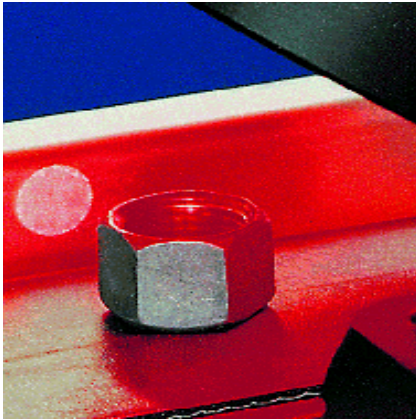
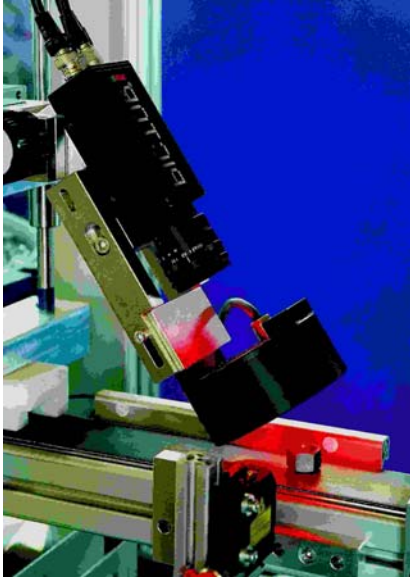
Diverse applications

- Metrology, gauging, 2D 3D and Color measurement
- Robot Guidance
- Surface analyses
- Identification, inspection
- Motion analyses
- Sorting, packaging
- Surveillance and security video systems
- Embedded systems

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Part Inspection



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Sorting, feeding parts with correct orientation



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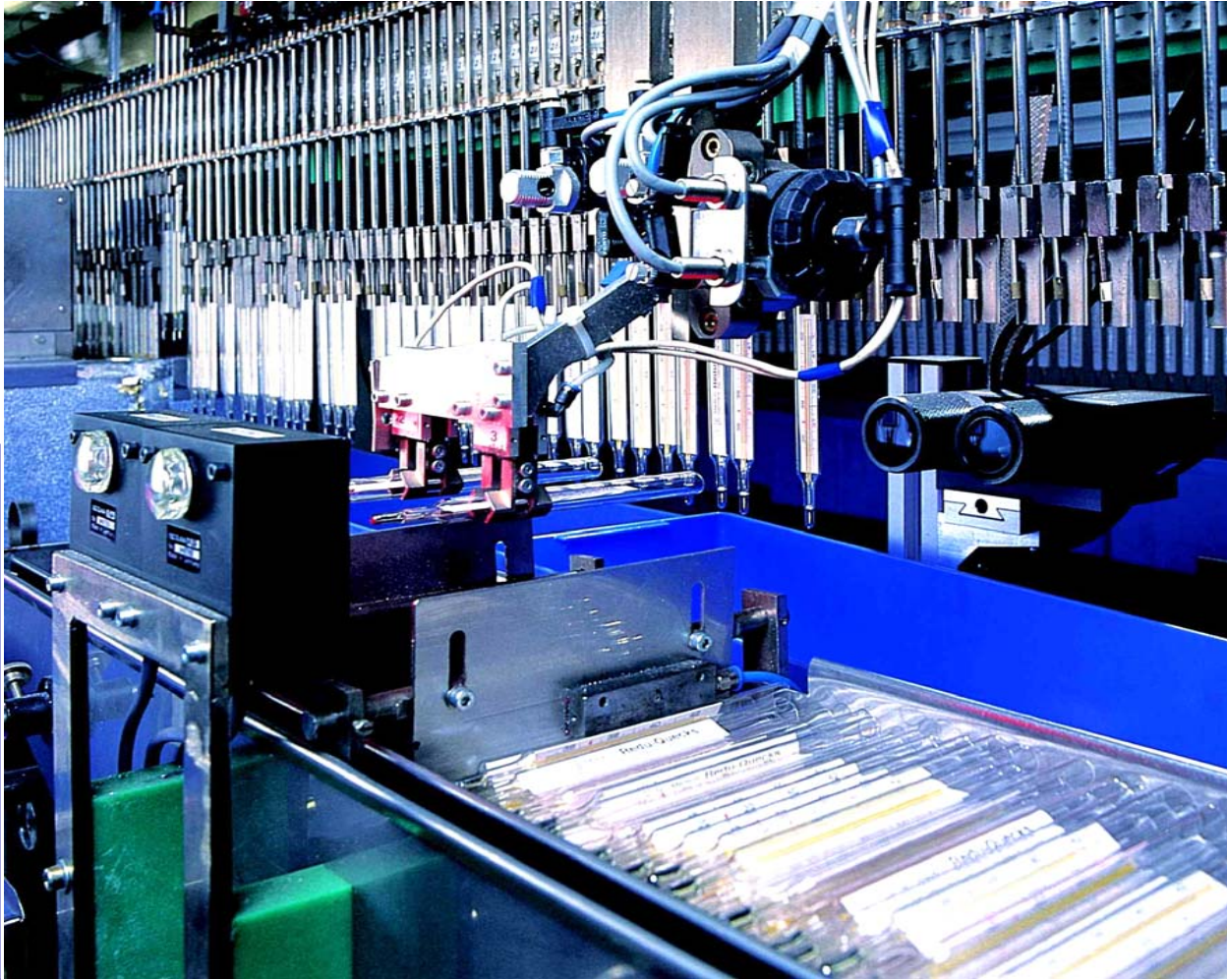
Robot Palletizer



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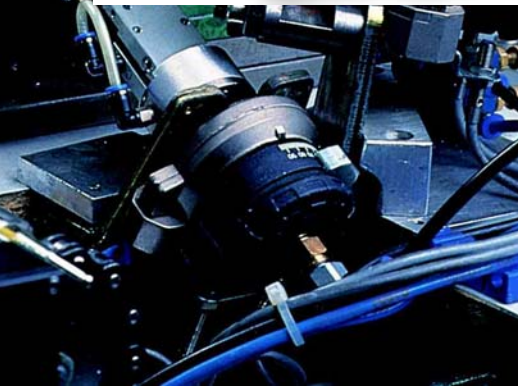
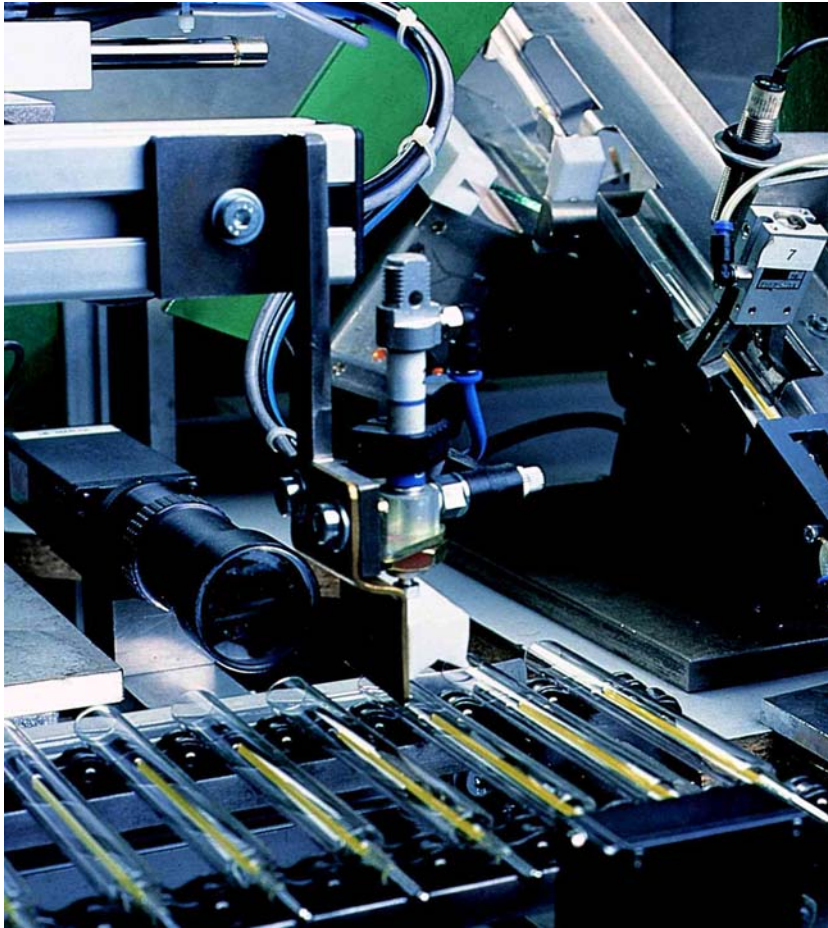
Calibration of thermometers



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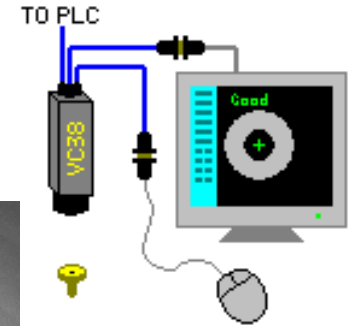
Mounting of thermometer scales



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Metal Inserts Inspection



Edge
.600 3mm brass
88441153

Start
Stop
Inspect
Trigger
Param
Set Type
Can Set
Of1 Sav
<- ->
Par Ins
x X
% Res

X = 235
Y = 300
Int = 107

Ver 24-Jun-02

Edge 0.008
Diam 0.087 **Min 0.086, Max 0.087** **Roughness 9**

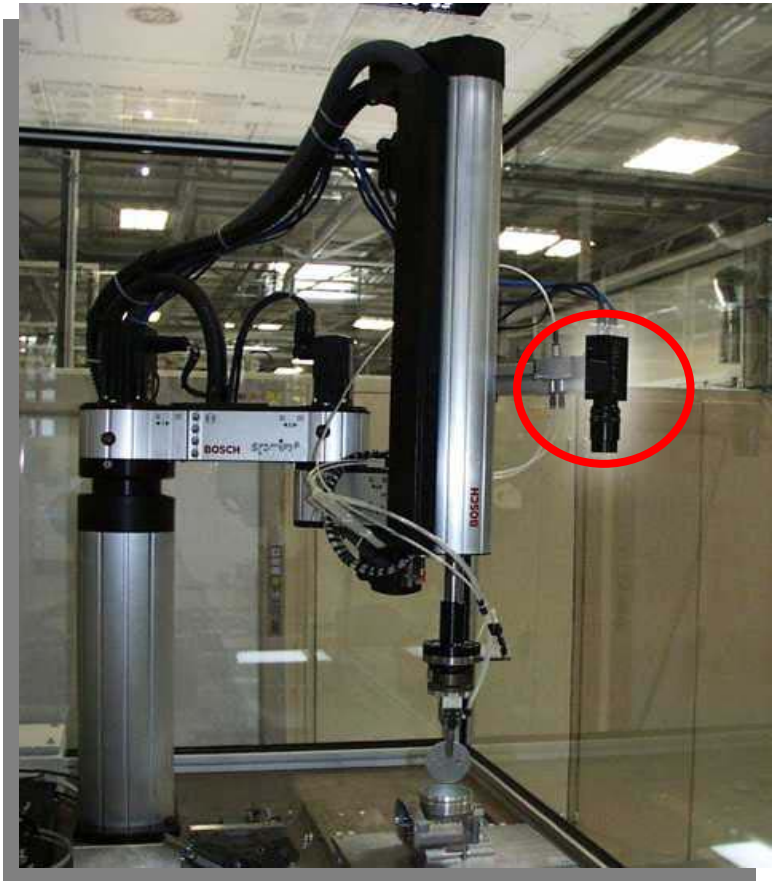


Courtesy of
Ross Microsystems Inc.



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Robot Eye controls carburetor assembly



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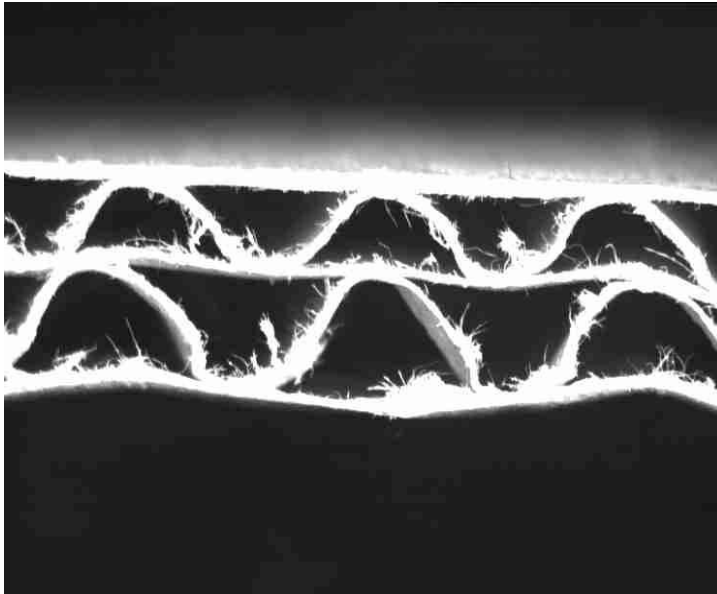
Measurement and assembly



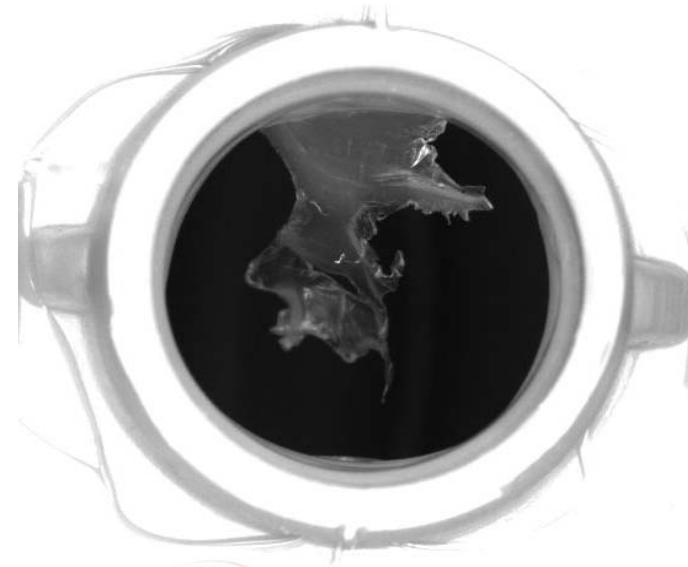
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Control and inspection example



Courtesy of AIT



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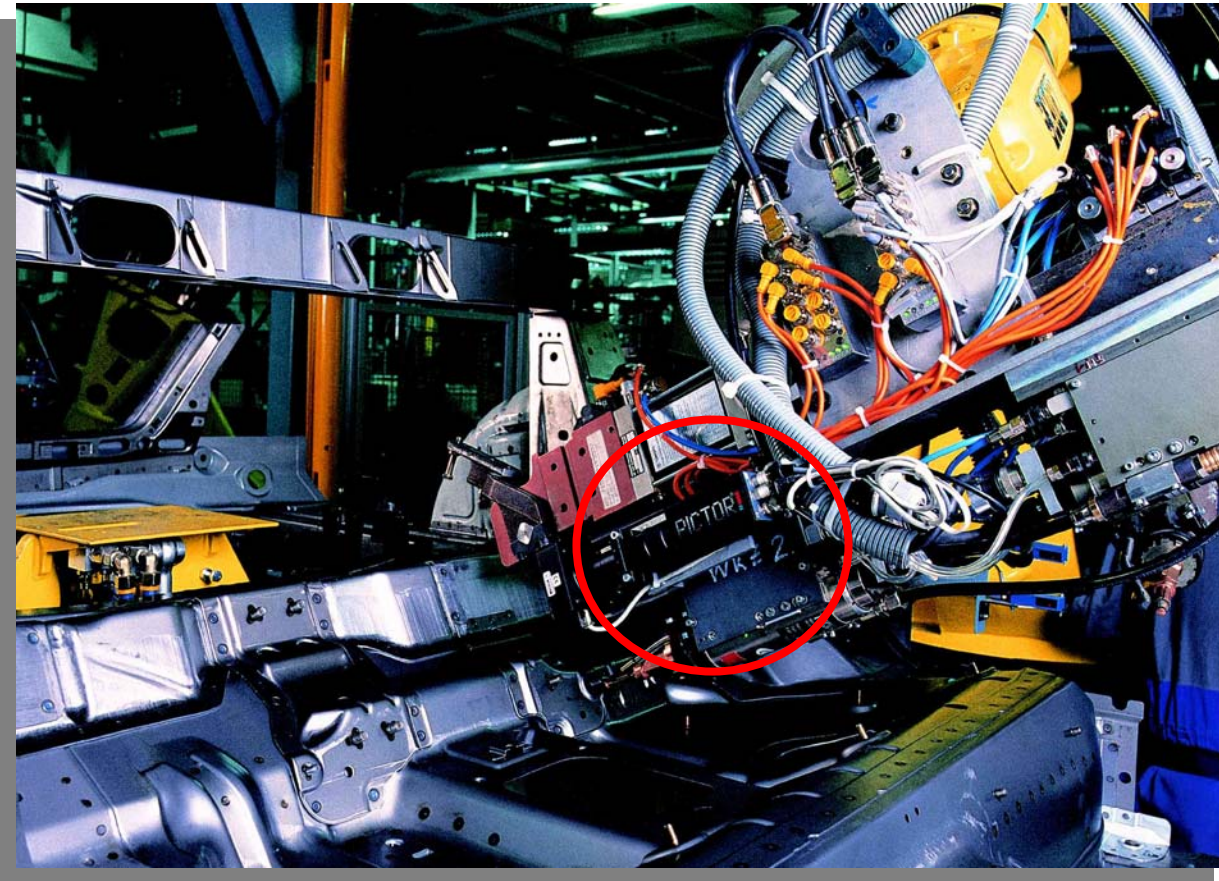
Assembly line



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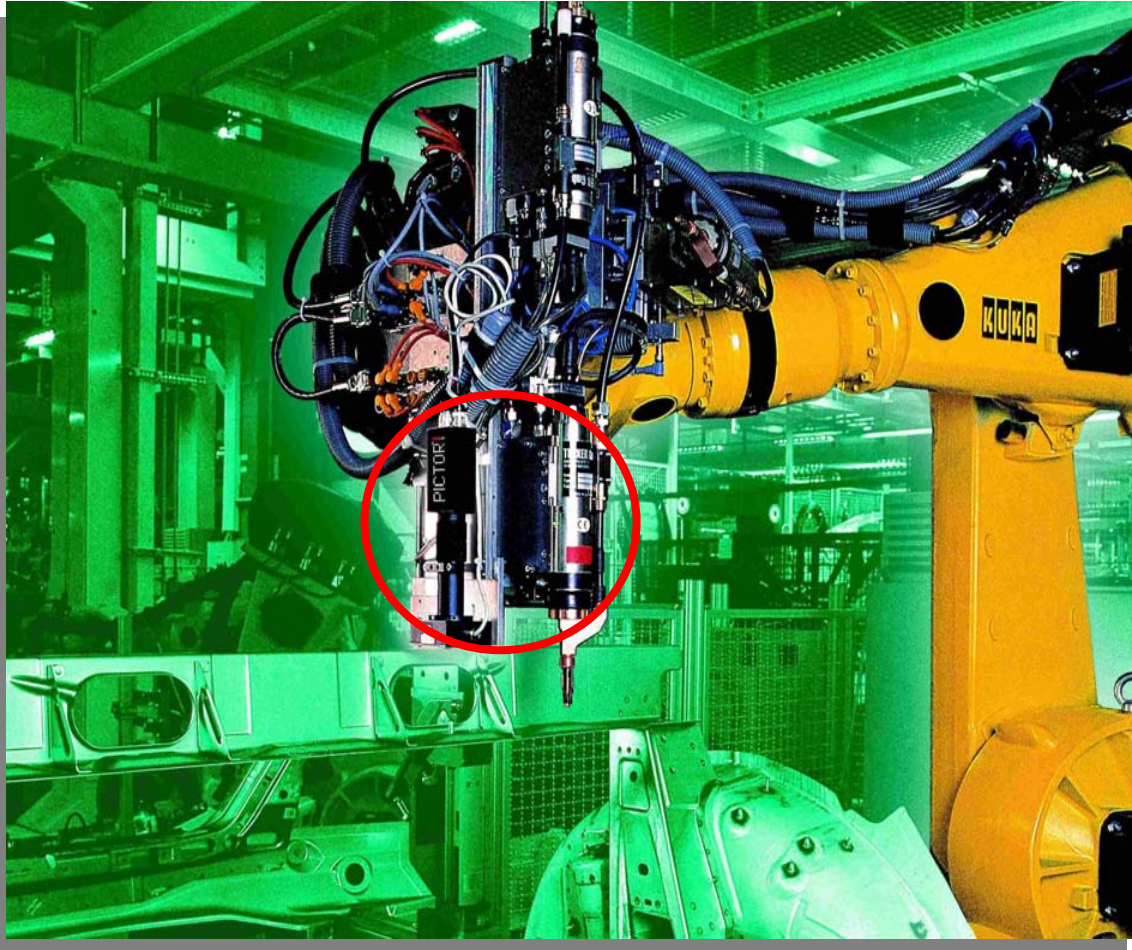
Weld seam inspection



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Welding robot



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Filling control



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