

# Supervision system for automatic assembly line

## The goals

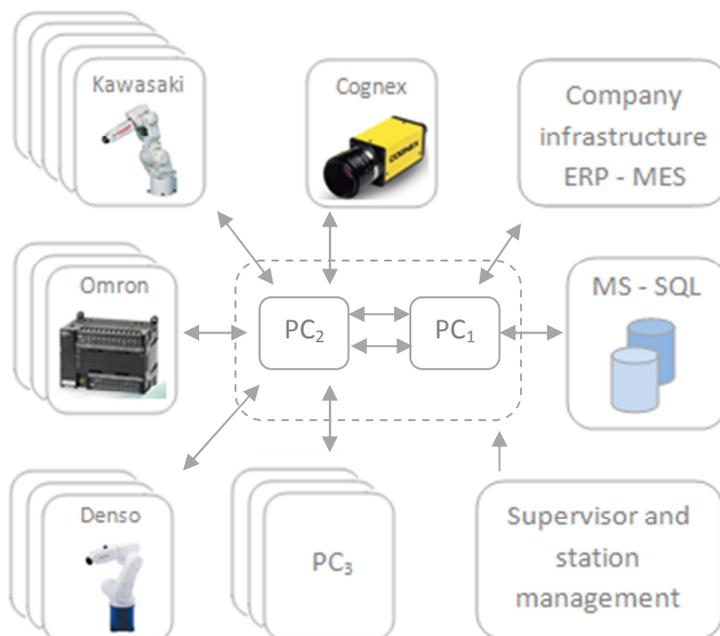
Cavagna Group decided to carry out a **completely automated, high-tech assembly and testing line** for valves.

**This kind of forward-looking project made precision, rapidity and reliability essential matters** and required a particular attention in designing and planning, since it was designed to **work fully robotized 24 hours a day**, as well as in absence of direct supervision.

In order to reach such a hi-tech aim, Cavagna arranged a highly advanced production line formed by 20 units for guaranteeing several operations at the same time, like assembling, testing and packaging. The work line is composed of the following 20 stations:

- 5 Denso robots
- 7 Kawasaki robots
- 1 Cognex camera
- 4 Omron PLCs
- 3 PCs

The following diagram shows connections and interconnections between these devices:



**The Cavagna Group, founded in 1949**, is a world leading manufacturer of equipment and fittings for compressed gases, gas storage and control.

The Group relies on seven vertically integrated production units in Italy and eight other spread on the five continents: thanks to this powerful arrangement, it deals with more than 124 countries worldwide. Cavagna Group products are acknowledged by most recognized national and international standard agencies and its experience and reliability have led to cooperate with major Oil Companies, producers of compressed gases containers and gas appliance OEMs. Each division of the group is specialized in a specific market segment.

[www.cavagnagroup.com](http://www.cavagnagroup.com)

**Cavagna Group s.p.a.**

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This working solution has been structured in order to be rapid and organized: **valves are produced in lots** according to customers' needs and, between the end of previous operations and the beginning of following ones, **the system must be enabled to be equipped and to start working in the fastest time.**

**The entire line must be manageable by a single monitoring station**, from which users can select job orders, monitor working stations and receive real-time data, production statistics, alarms and notifications. **Fastness is therefore a word key**, since it's of prime importance for Cavagna that the solution succeed in interfacing with the company information system for:

- Managing job orders;
- Getting parameters of valves manufacturing;
- Interacting with already existent quality control systems;
- Accessing data storage databases for products traceability;
- Updating systems of statistical analysis.

Last, but not least, **this solution requires versatility** in the form of a software for supervision and control **that easily allows future additions**, like different types of working stations (for example different brand PLCs or robots). Versatility, anyway, is not only a fundamental matter while adding new elements but also, more often, **in case of substitution** of an existing stations: **changing hardware must be easily manageable and has to require the least changes on related software components.**



In this picture we see Denso robots during a work session

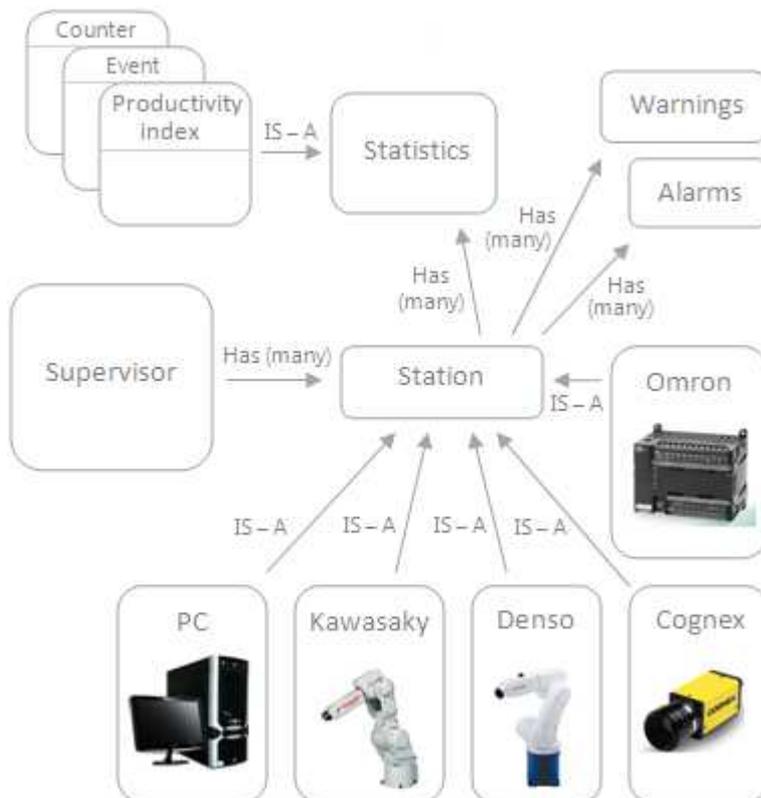


This photograph illustrates a batch of valves and a section of the assembly line.

### The solution

T4SM has designed a customized solution for getting complete control and supervision on the assembly line. The result, after an intensive and careful analysis, is a supervisor system realized in LabVIEW that interacts with client programs (these too developed with LabVIEW) handling communication with the other physical devices.

T4SM succeeded in defining a single standard interface for all the working stations and in delegating every specific communication procedure to other clients. The following section of UML diagram shows the designed solution:

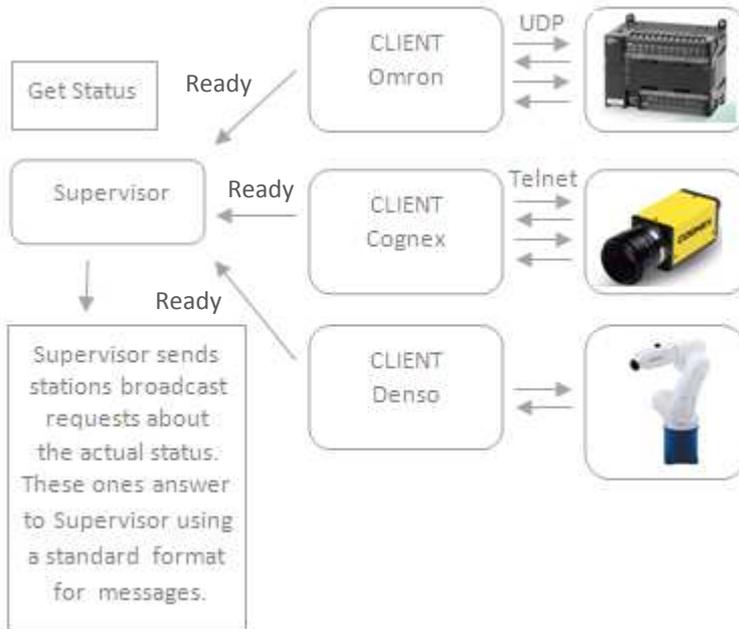


LabVIEW OOP programming has considerably helped in building a standard communication architecture between supervisor and clients. As far as it concerns clients-station connection, specific modalities of data exchange among working stations and clients have been included right in the client, so that the supervisor can

### Resources

- LabVIEW
- OOP programming
- SQL-Server
- Third party toolkit:
  - SCCT (Smartphone & Cross-Platform Communication Toolkit)
  - Imaginglab for Denso
  - Imaginglab for Kawasaki

use a single modality of communication with all of the devices. The next diagram shows an example of what has just been explained:



The entire communication among supervisor and clients has been managed by the SCCT (Smartphone & Cross-Platform communication Toolkit) library, which has greatly simplified system development thanks to broadcasting and peer to peer functionalities. Moreover, SCCT has also allowed to exchange both clusters and LabVIEW-defined objects among applications, gaining as a matter of fact a considerable amount of time during development of communication between different applications.

The supervisor has been successfully integrated with Cavagna's ERP systems through a MS-SQL database and data exchanging files, guaranteeing to the customer a complete integration of production line with all of the other systems already in action.

Statistics management has been performed with parametric modules which enable Cavagna's technicians to create and modify all the statistics regarding either single stations or their work modules, as well as to create custom statistics for the working line by means of formulas definable by users.



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