

Industrial robots and their integration with vision systems

State of the art and future trends

DAY 1

Dott. Ing.Fabio Tampalini, Ph.D.

Senior Technical Manager

DENSO @K.L.A.IN robotics srl

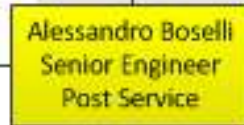
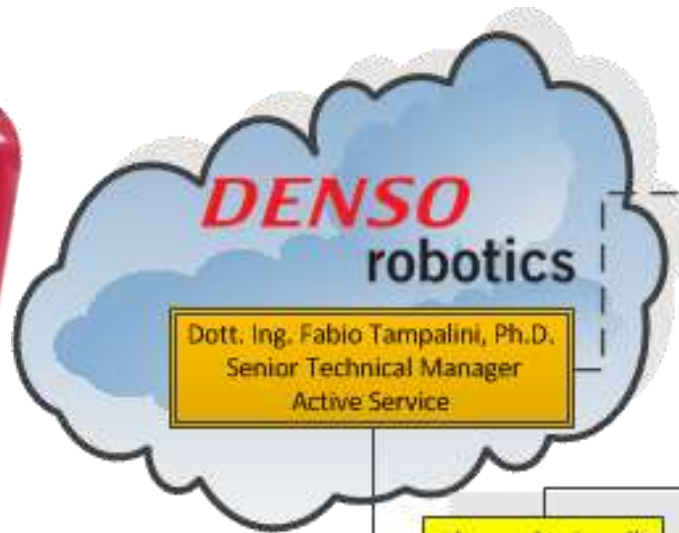


- Introduction
 - K.L.A.IN. robotics
 - DENSO
- Software instruments
 - Presentation
 - Examples
- Conclusion and Q&A

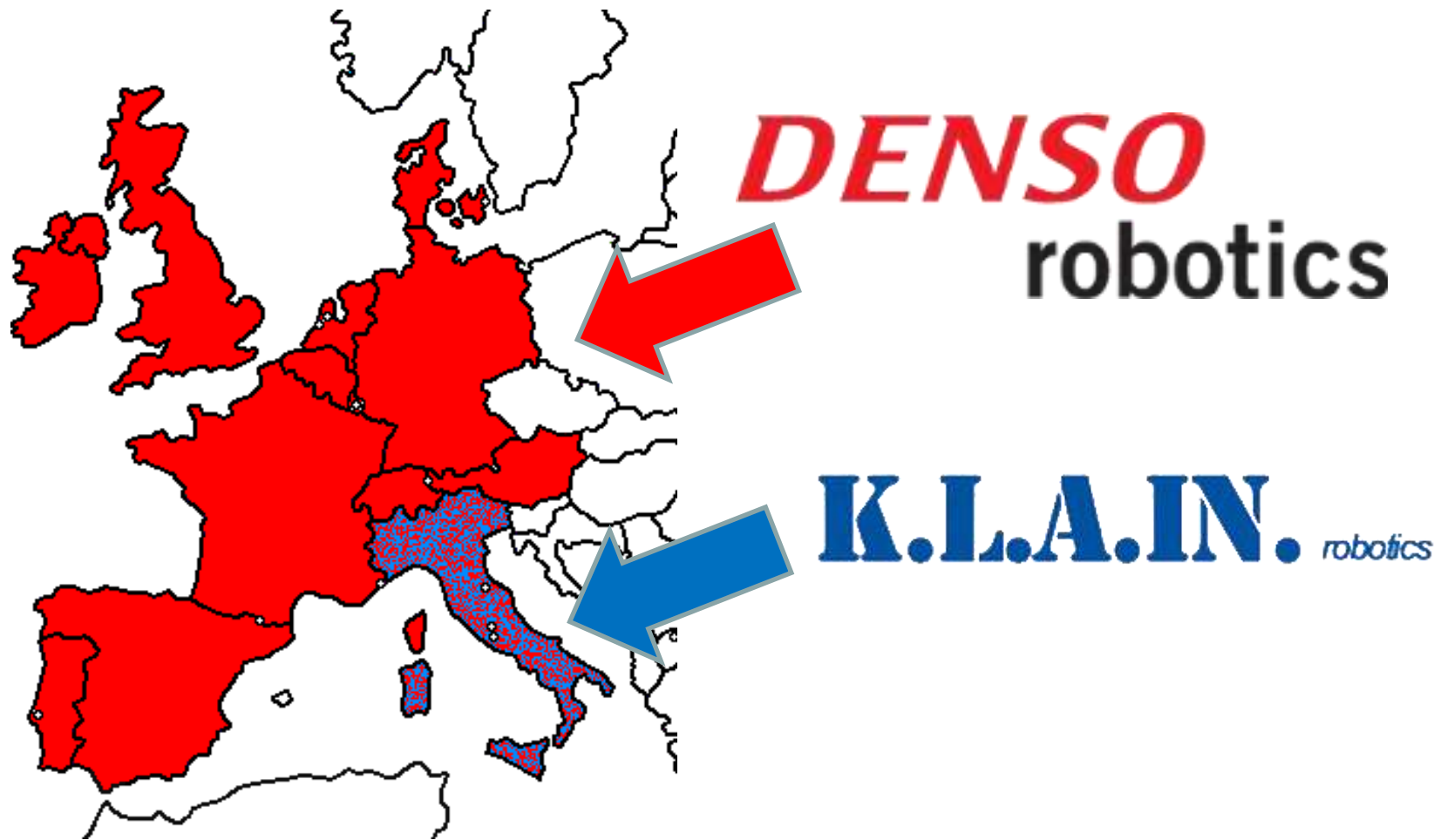
K.L.A.IN. Robotics srl

K.L.A.IN. robotics





K.L.A.I.N. robotics s.r.l.
 Sede Leg.: Via F.lli Porcellaga, 3 - 25122 Brescia
 Sede Amm./Op.: Via Cacciamali, 67 - 25125 Brescia
 PARTITA I.V.A. n° 03219670985
 Tel. 030.35.82.154 - Fax 030.26.59.911





- K.L.A.I.N.robotics, located in **Brescia**, is distributor for the **Italian market** and for **Switzerland Italian market** of two ranges of robots, which are complementary in the world of Factory Automation, and Mechatronics components.
- **Denso**, renowned Japanese producer, is the leader in the market of small assembly industrial robots , with SCARA Robot and Anthropomorphic; and **Hyundai**, renowned Korean producer, with Anthropomorphic robots up to 500 kg payload, specialized in welding, handling, enslavement.
- Our business is principally based on two fronts:
 - **The first is the distribution of components for the Factory Automation to Systems Integrators specialized**, operating in the realization of Assembly Lines and Special Machines of Handling and enslavement of operating machines in general, in fields such as cosmetic, medical the pharmaceutical, food, electronics, fashion, eyewear, quality control with or without imaging, plastic molding, etc. ..
 - **The second is the Active Service**, both with Training dedicated to the use of mechatronics products, as well as activities and support to customers or potential customers in the process of selection and / or development projects, or in the start-up of products already installed, in addition to verification of cycle times with simulations in the development Software.



HYUNDAI

HEAVY INDUSTRIES CO., LTD.

Model												
	HA006	HA010L	HA020	HH030L	HH050	HR050P	YS080	YS100	HH100SL	HH130L	HS150L	
Payload	6 kg	10 kg	20 kg	30 kg	50 kg	50 kg	80 kg	100 kg	100 kg	130 kg	150 kg	
Max. Reach	1,394 mm	1,986 mm	1,765 mm	2,535 mm	2,239 mm	2,041 mm	2,239 mm	1,701 mm	3,507 mm	3,082 mm	3,082 mm	
Degree of freedom	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	3 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	

												
HP160	HS165D	HS165C	HS165	HS165S	HS200	HS200S	HX200L	HX300	HX300L	HX400	HX400S	HX500
160 kg	165 kg	165 kg	165 kg	165 kg	200 kg	200 kg	200 kg	300 kg	300 kg	400 kg	400 kg	500 kg
3,128 mm	1,355 mm	866 mm	2,666 mm	3,090 mm	2,666 mm	3,090 mm	3,056 mm	2,573 mm	3,056 mm	2,573 mm	3,106 mm	2,573 mm
4 Axes	6 Axes	5 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes	6 Axes

DENSO Robotics

„Company & Product Introduction“



June 2011



Founded

16 Dec. ,1949

Net sales (April 1st, 2010 – March 31st, 2011)

Consolidated

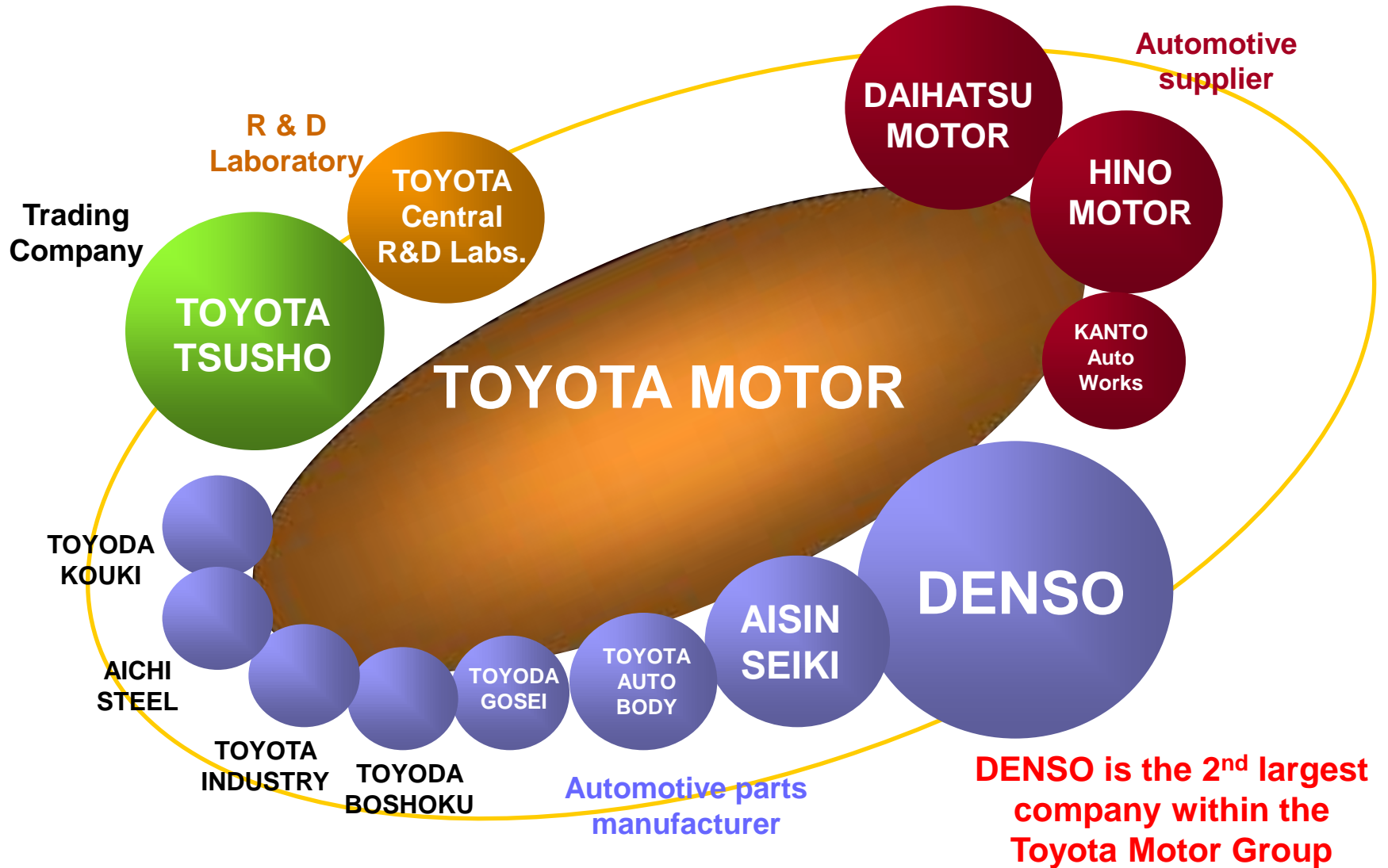
37.7 bill. \$



Employees (March 31st, 2011)

Consolidated

Around 120 000



Engine Related Products

Engine management system,
Electronically-controlled diesel system,
Starter, Alternator, Radiator, etc.

Climate Control Products

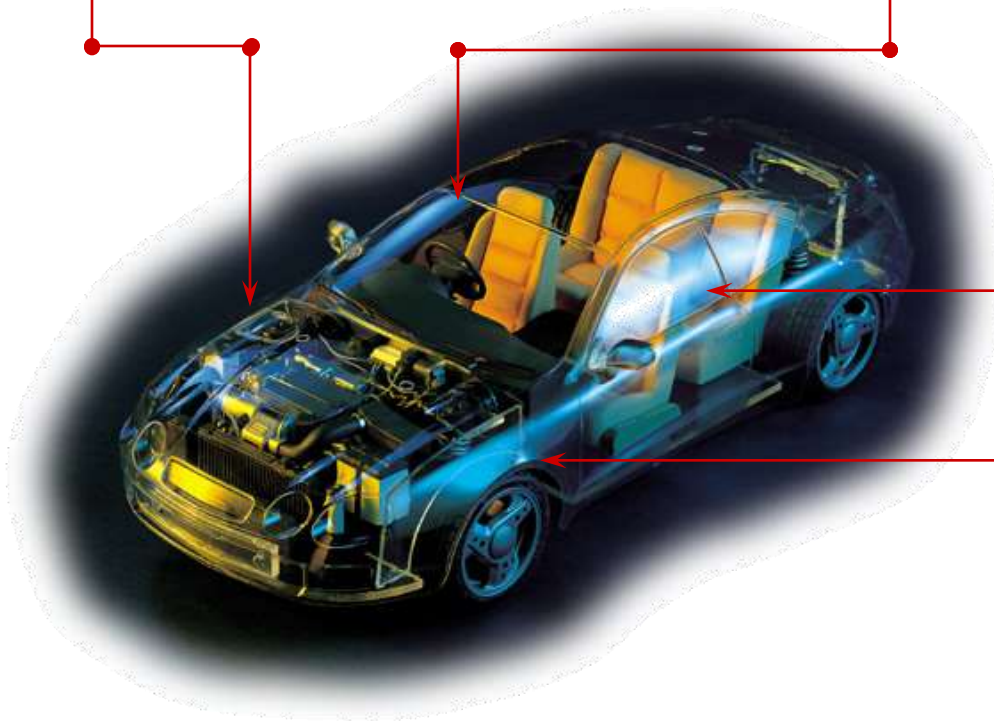
Automatic air conditioner, Car heater,
Rear cooling unit, Compressor,
Sensors, etc.

Body Electronics Products

Instrument cluster, Windshield wiper
Remote keyless entry system,
IC flasher, Horn, etc.

Driving Control and Safety

Antilock braking system, Traction control system,
Cruise control system, Airbag sensing system,
Vehicle stability control, etc.



DENSO EUROPE B.V.

Weesp, Netherlands (30 minutes away from Amsterdam Airport)

- **Administration**
- **F & A**
- **Logistic**
- **Warehouse**
 - Robots
 - Accessories
 - Spare parts
- **Repair Center**
 - Repair
 - Maintenance

EUROPE – FOCUS



DENSO Robotics

Moerfelden-Walldorf, Germany

(20 minutes away from Frankfurt Airport)

EUROPE – FOCUS

- Management / Marketing
- Sales Europe
- Order Handling
- SW + Application support
- Service & Support Hotline
- Application Laboratory
- Training
- ORiN2 Development & Support Center
- Stock for lease robots



Dealers in:

- Spain (CONTAVAL)
- Italy (Klain Robotics)
- Denmark and Sweden (AVN)
- Finland (EID Tech) EUROPE – FOCUS
- Benelux (ROBA)
- UK and Ireland (AA Robotics)
- Turkey (iRob)
- Switzerland (Bachofen)



Middle East:

- Israel (PROBO-TEC)

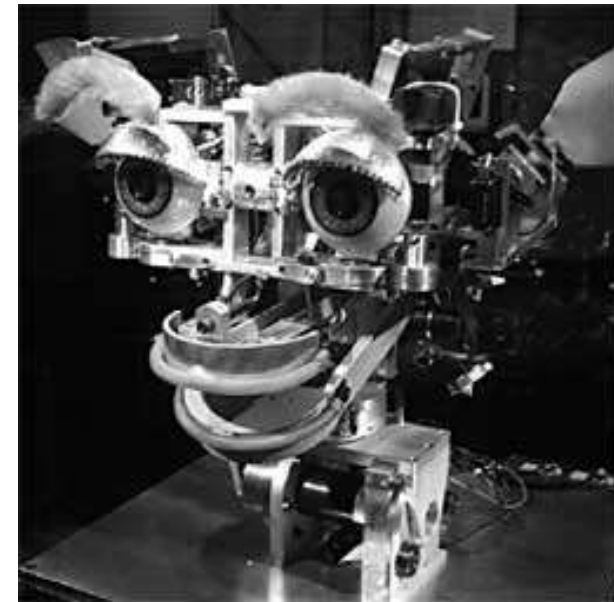


Middle East (Israel)

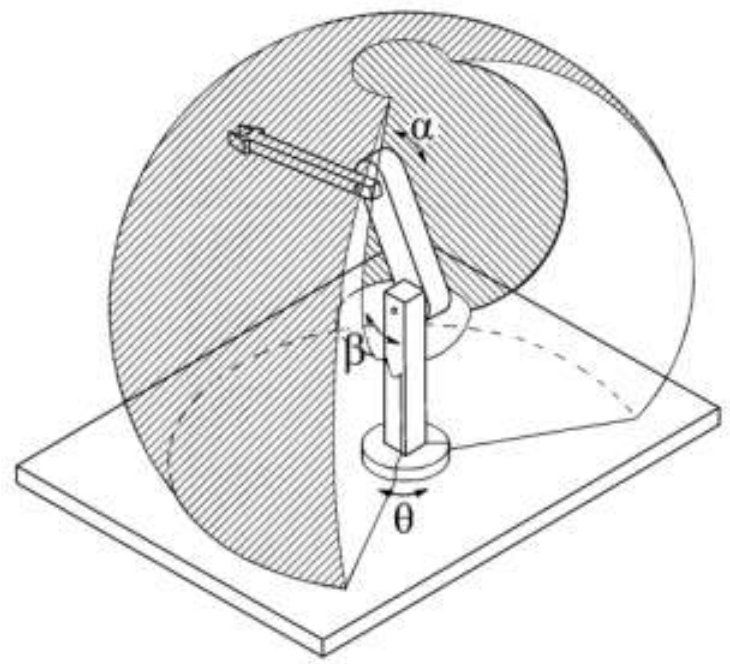
Direct Sales in:

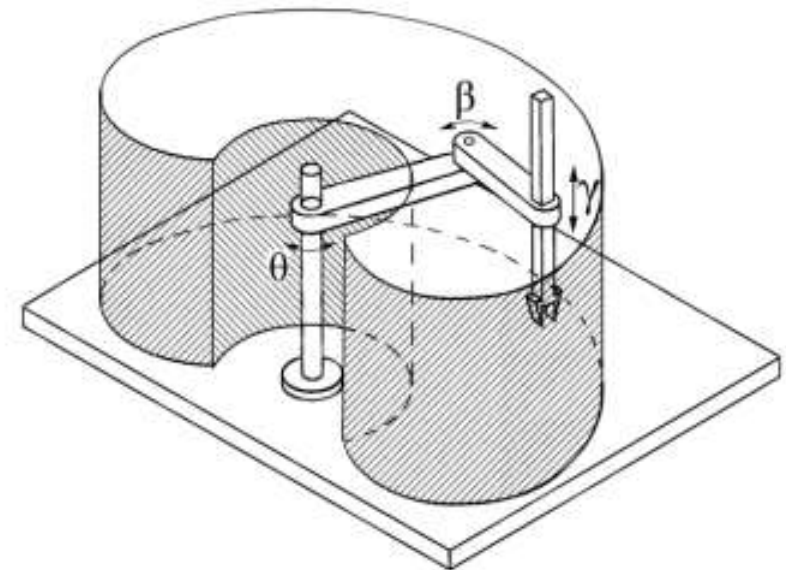
- Germany (Sales Office), Austria, and rest of Europe

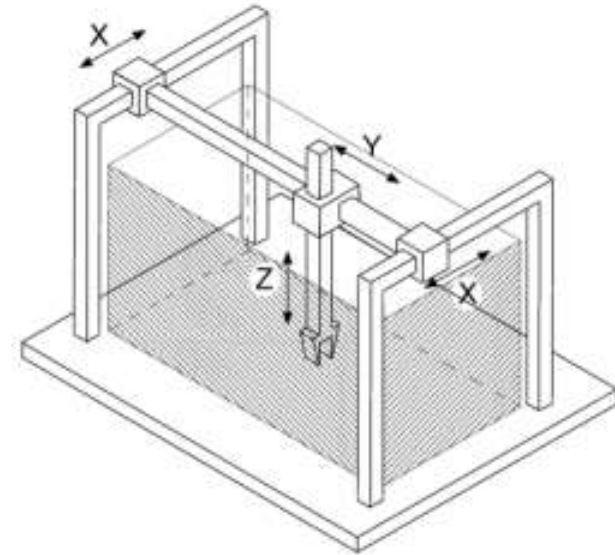
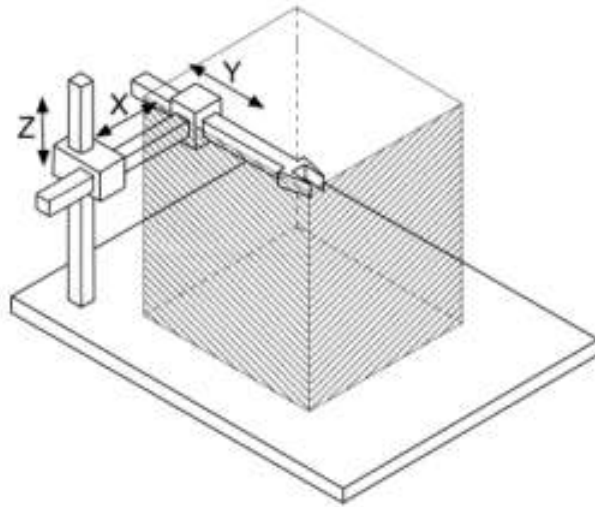










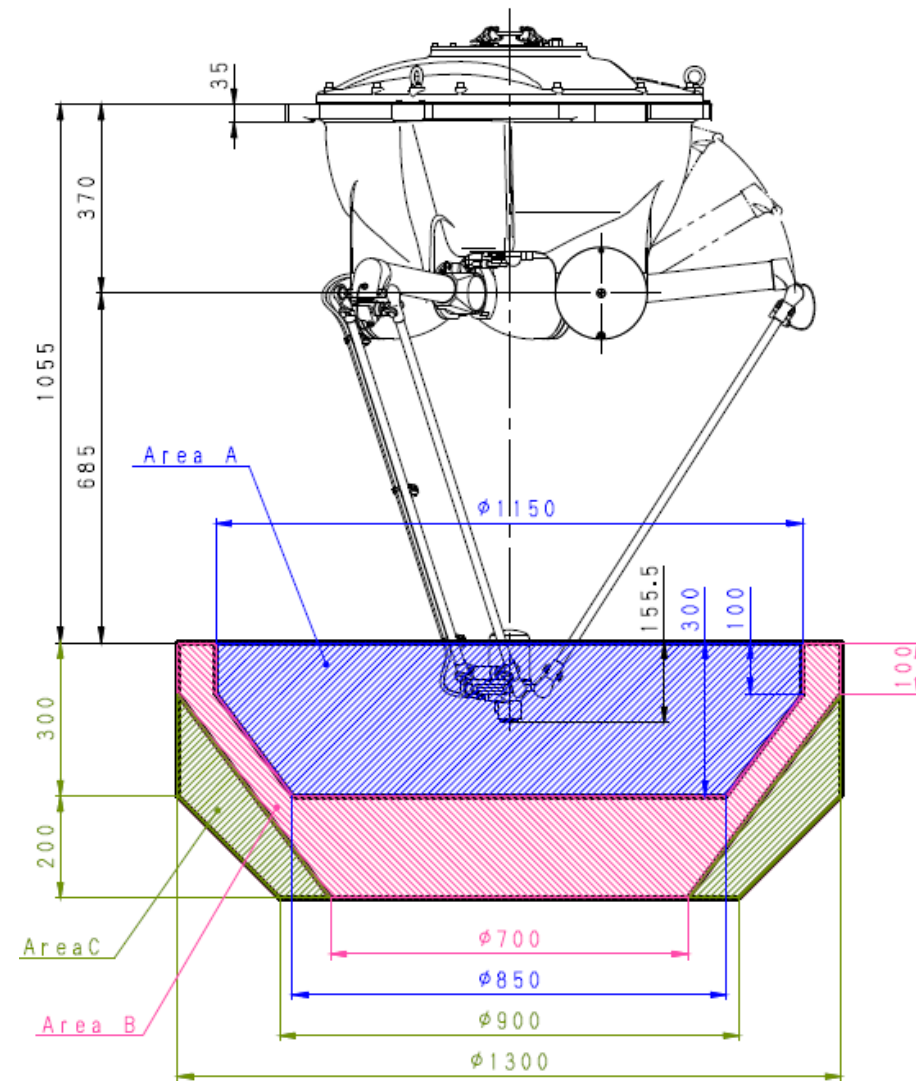


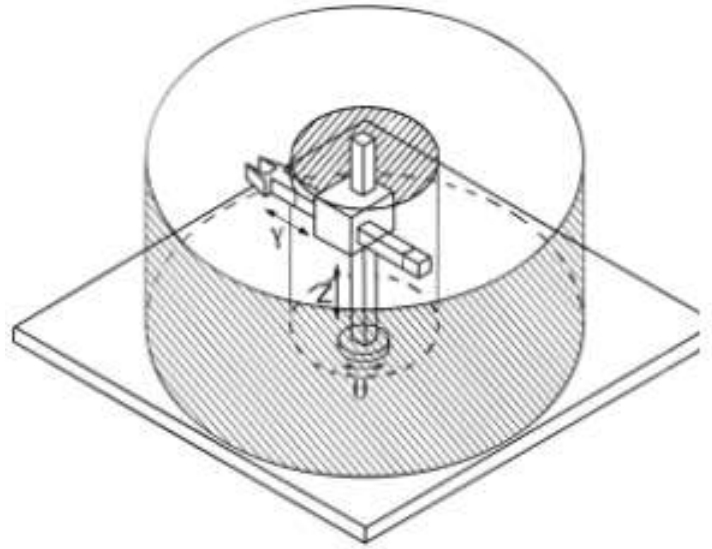
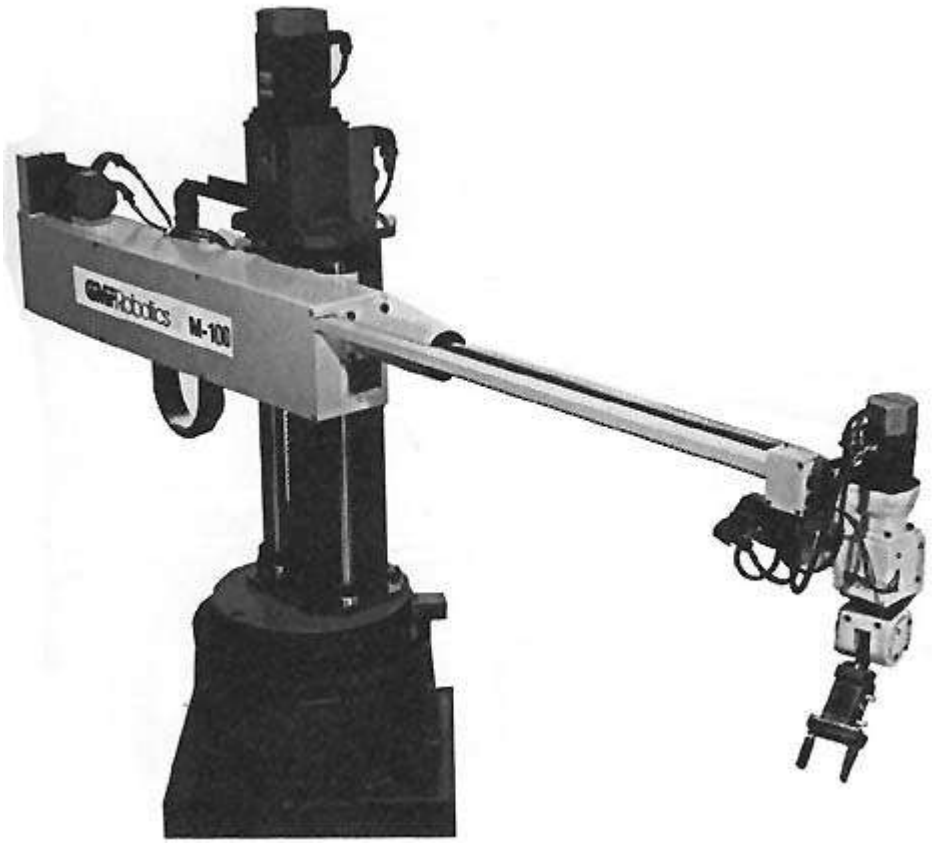
Cartesian Coordinate Robots

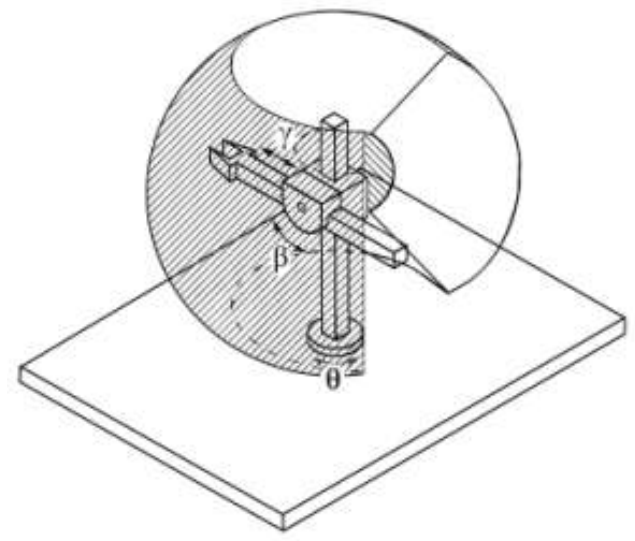
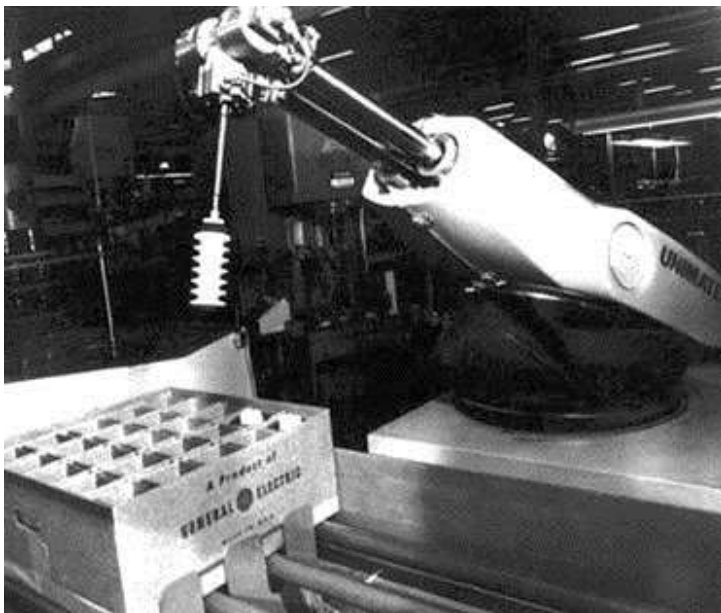
XYC4-G Series

Compact size cartesian coordinate robots!
Various choice for user's needs
due to wide variations.





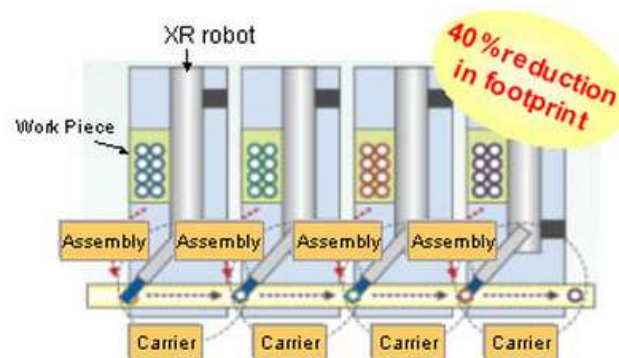






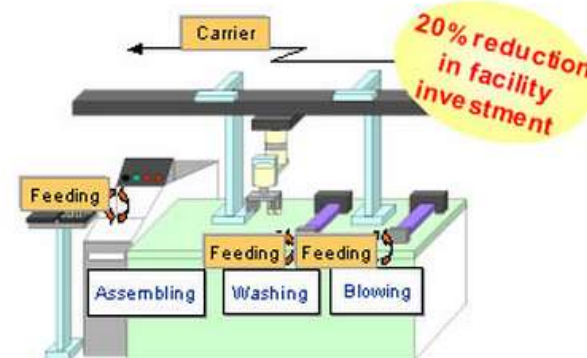
■ Applications

<Assembling & Handling>



- **Compact**
Reduced width of equipment and shortened production lines
- **Lower Investment**
Eliminate additional devices to lower cost

<Feeding & Carrier>



- **Compact**
Reduced width with ceiling mountable structure
- **Flexibility**
Programmable and flexible in feeding/ conveying movements

■ High speed

17% faster than our conventional Cartesian robots with combined move of coordinated slide and swivel motions.



6-AXIS ROBOTS /

Ideal for:

- Assembly
- Inspection
- Matching
- Material handling
- Machine tending
- Packaging
- Palletizing
- Electrostatic welding
- Bespoke applications

Industries:

Our robots are employable in a wide variety of industries including pharmaceutical, medical and food.

Available in Protection Classes:

- Standard
- Dust & Splash Proof (IP65)
- Protected (IP67)
- Clean Room Class 10 & 100
- Hydrogen Peroxide-resistant (H₂O₂) for aseptic environments
- UL Specifications (for the USA and Canada)

Main features:

- Payloads up to 10 kg
- Arm reach up to 1300 mm
- Max. Comp. Speed up to 11 000 mm/s
- Mounting in floor, ceiling and wall

4-AXIS ROBOTS /

Ideal for:

- Pick & place
- Assembly
- Packaging
- Dispensing
- Inspection
- Material removal
- Material handling
- Bespoke applications

Industries:

Our robots are employable in a wide variety of industries including pharmaceutical, medical and food.

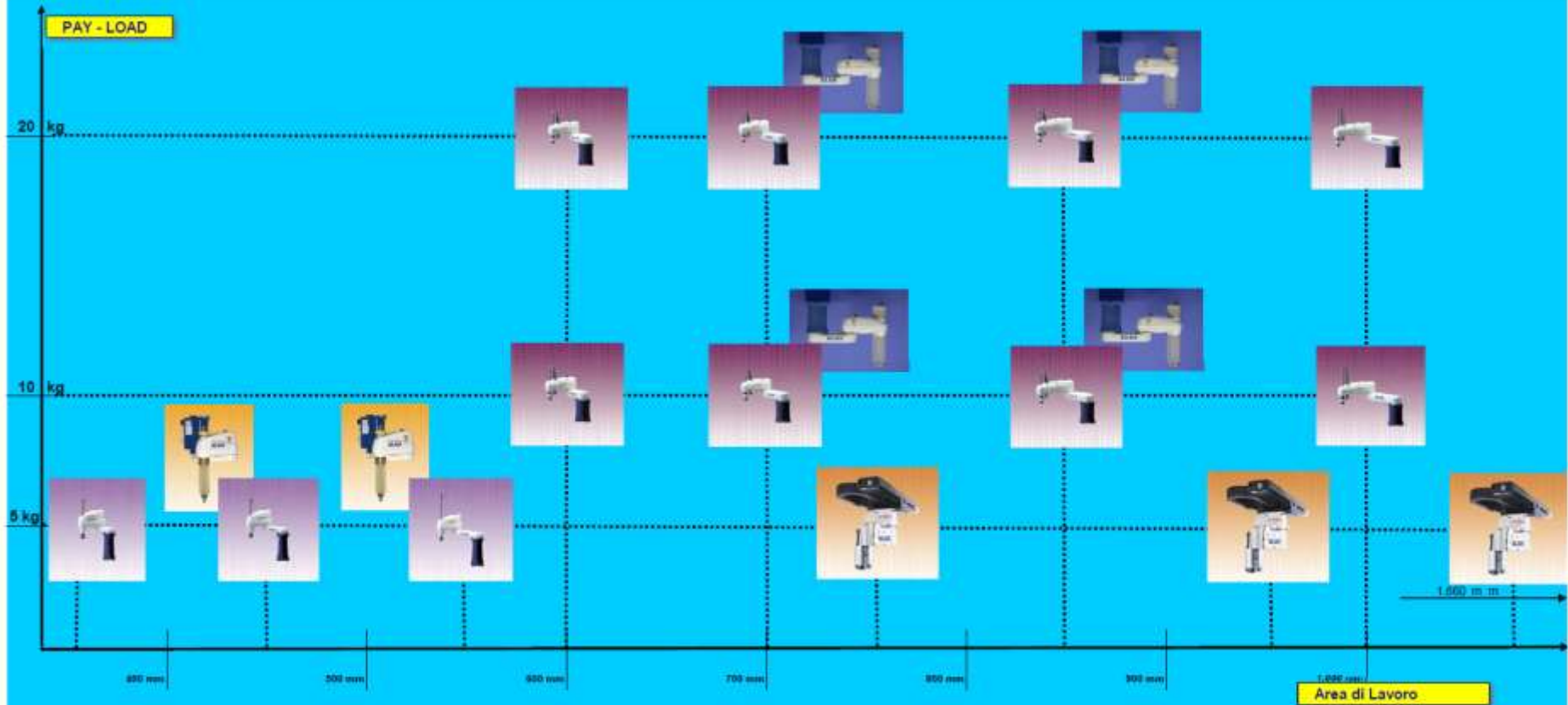
Available in Protection Classes:

- Standard
- Dust & Splash Proof (IP65)
- Clean Room Class 10
- UL Specifications (for the USA and Canada)

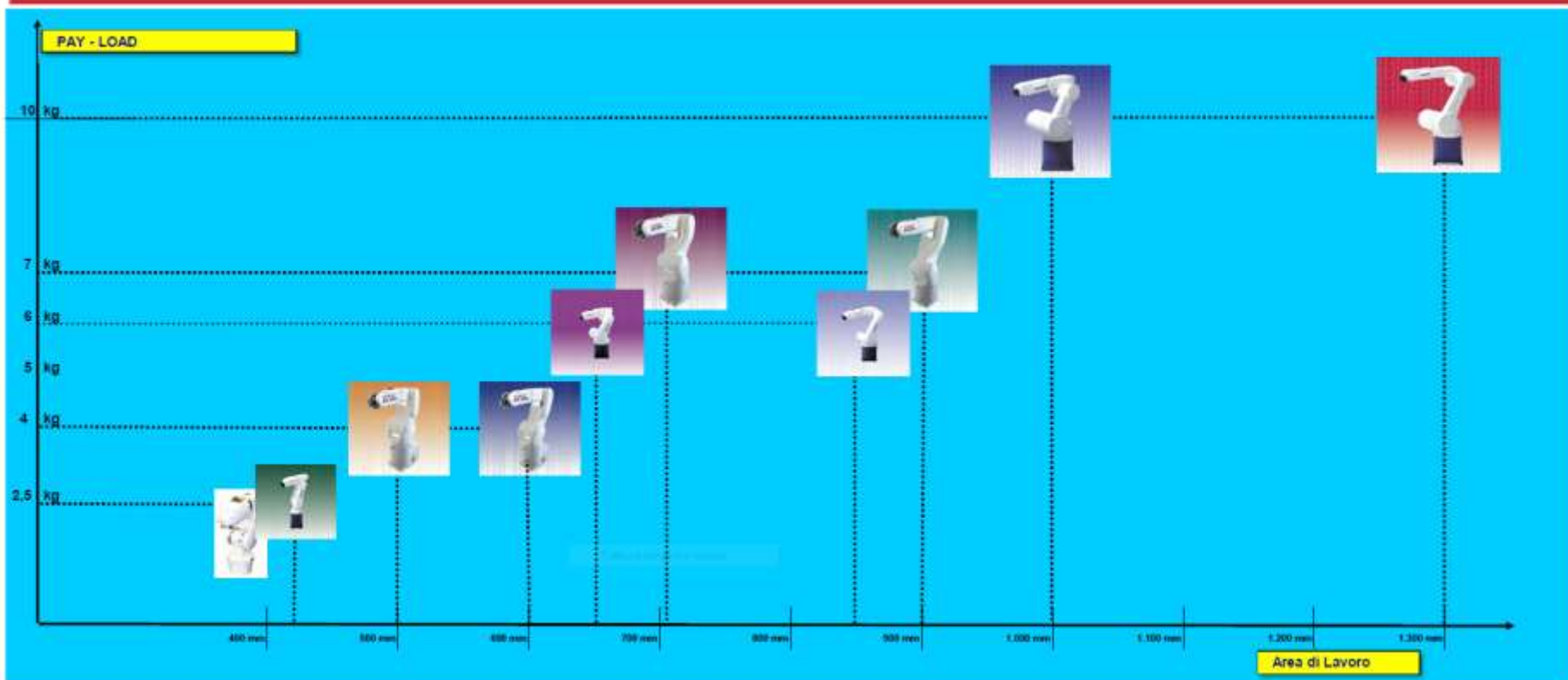
Main features:

- Payloads up to 20 kg
- Arm reach up to 1000 mm
- Max. Comp. Speed up to 11 500 mm/s
- Mounting in floor and ceiling

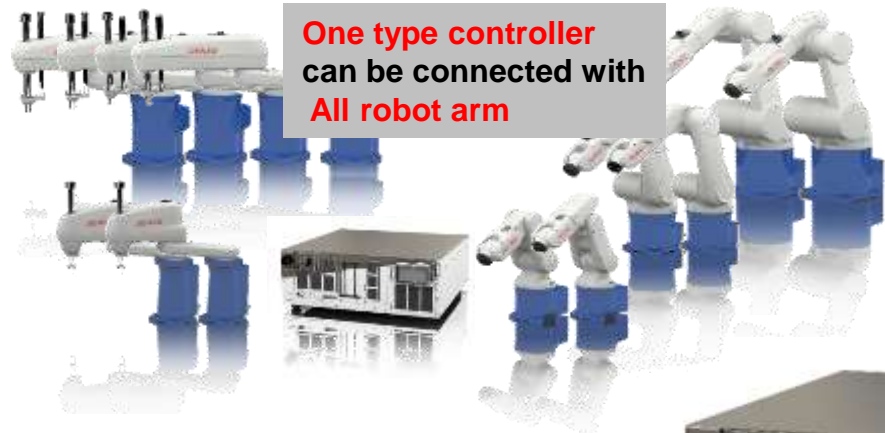
GAMMA ROBOT SCARA DENSO



GAMMA ROBOT ANTROPOMORFI DENSO



Maintainability



One type controller can be connected with All robot arm

Extendibility

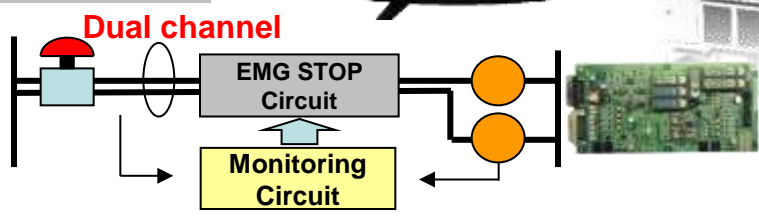
Standard:	Option:
Mini I/O 16 / 16	Extension I/O board 40(80) / 48(96)
Hand I/O 8 / 8	RS-232C +2ch
1 x Ethernet (100 Base)	Profibus Slave 256 / 256
2 x USB	DeviceNet Slave 256 / 256
1 x RS-232C	DeviceNet Master 1024 / 1024
	DeviceNet Master & Slave
	Conveyor tracking



MODE Select KEY



Safety Circuit



Lock out



Panel Designer for Windows



Display 7.5 inch
Dust & Splash proof IP65

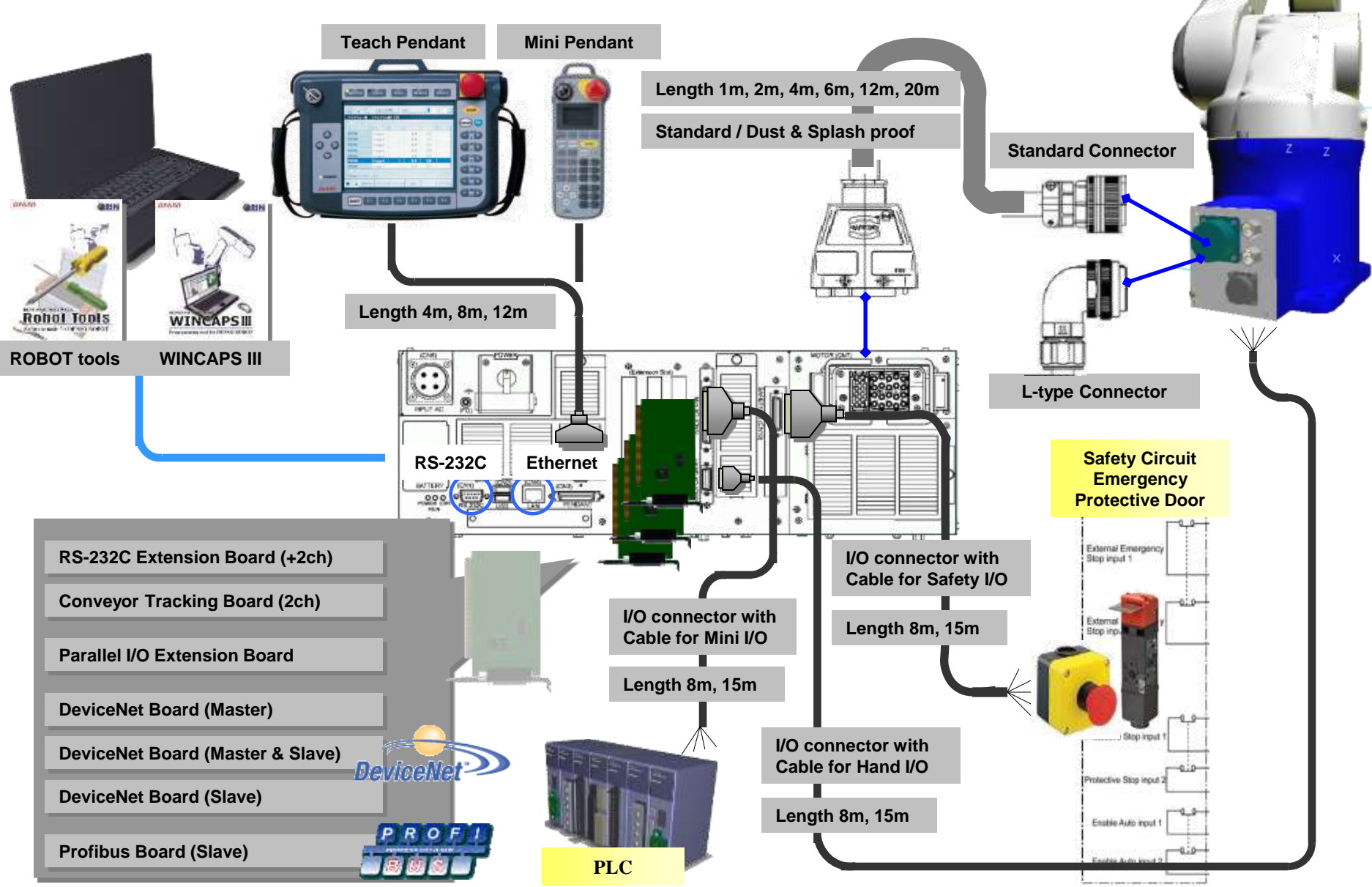
Safety

Usability

- [DENSO Automatica 2012 - RC8](#)

Instruments





- **Simulation and Development (PC-based solutions)**
 - **WINCAPS III.** DENSO's offline programming, monitoring and simulation software
 - **ORiN2.** Middleware to program our robots and other devices such as PLCs, HMIs, servo motors, etc. with high-level programming languages such as C++, C#, VB, among others.
 - **b-CAP.** Control protocol incumbent of any platform or programming language to program DENSO robots and peripheral devices using a PC, PLC or other device which incorporates Ethernet TCP/IP or UDP
 - **ORiN Vision.** Extensive vision library designed exclusively for ORiN2
 - **HALCON Extension Package.** For experienced HALCON users (powerful software for machine vision) for programming vision and robotics applications

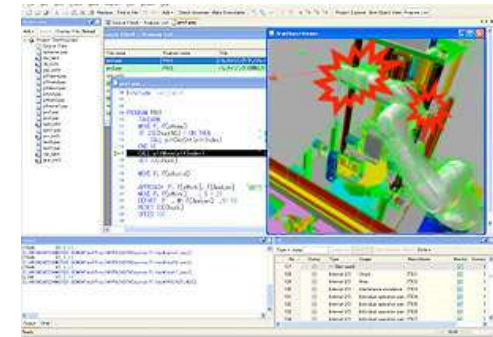
- **Software Tools**

- **e.vision.** Configuration tool for setting up vision and robotics applications with Anyfeeds from Flex Factory. This software is intended for non-experienced users of computer vision.
- **Robot Tools.** Suite of utility tools that enables the optimum maintenance and operation of DENSO robots

- **Third-party Software**
 - **3DCreate.** Powerful software for simulation complete factory layouts and robotics applications
 - **ROSY.** Tool for achieving advanced levels of precision in DENSO robots for special applications



- Program robot from offline PC without operating robot
- Lay out automation workcells in virtual environment
- Determine obstacle clearances, detect collisions, verify reach and cycle times
- Monitor workcell operation from remote location
- DENSO's WINCAPS III offline programming software enables users to conveniently program a robot from a remote PC without operating the robot.
- CAD drawings can be imported in standard VRML and DirectX formats, and variables can be easily entered or changed. A 3-D simulation feature allows layout of automation workcells in a virtual environment. Users can verify reach, determine obstacle clearances, detect collisions, troubleshoot and debug programs, and determine cycle time. The software also allows remote monitoring of workcell operations via 3 D simulation, realtime I/O status indicators and detailed control logs. A panel-design feature allows customization of the Teaching Pendant display.



Program Editor

```

01 subover.pac
02 release_3d.pac
03 reject_line.pac
04 analyze.pac
05
06 *****
07
08 #TITLE "Reject_Line"
09 PROGRAM Reject_Line
10
11 #INCLUDE "fmi.jp"
12
13 TAKEARM 0 keep=0
14
15 MOVE P_@E Rec_Pos, speed = Speed_Load
16
17 open the gripper
18 SET IO(NOZZLE)
19
20 Wait for 200 ms
21 DELAY 200
22
23 close the gripper
24 RESET IO(NOZZLE)
25
26 END
  
```

Robot position

J1: 4 | -38.7°

J2: 4 | 30.7°

J3: 4 | 112.7°

J4: 4 | 84.4°

J5: 4 | -47.6°

J6: 4 | 85.7°

Arm Player Plus

```

01 *****
02
03 #TITLE "Example"
04 PROGRAM Example
05
06 DEWIDG GRP = GRP02(ARM) (AZEL)
07 PR = AN_POSITION1
08 PR = AN_POSITION2
09 DT = AN_ROTATION1
10 AN = VALMAG01
11 AN = VALMAG02
12 AZ = VALMAG03
13 PR = VALMAG04
14 DT = GRP
15
16 TISSAM 0 keep=0
17
18 PR = 0.7145
19 MOVE P_@E PR_Pos, speed = Speed_Full_View
20
21 MOVE P_@E PR_Pos, speed = Speed_Full_View
22
23 DEWIDG GRP PR, speed = Speed_Full_View
24
25 END
  
```

Arms 3D View

Type	X	Y	Z	RX	RY	RZ	FG
Type-F	108.85	-200.36	234.98	126.54	1.63	-17.67	1

Program Manager

No	Program name	File name	Title
5	Move_to_full_view_right	move_to_full_view_right.pac	Move_t
6	Read_Next_Task	read_next_task.pac	Read_t
7	MOVE_TO_NEAR_VIEW	move_to_near_view.pac	Move_t
8	DrivePick	drive2id.pac	DriveCF

Variable List

Jump	Smart View	Get Position	Move			
No	X	Y	Z	RX	RY	RZ
2	239.7626	12.48975	308.595	156.3279	-28.99125	.7147
3	-0.015	0.187	-0.076	0	0	0
4	211.3616	-309.344	167.0395	-178.9197	0.5689448	.7383

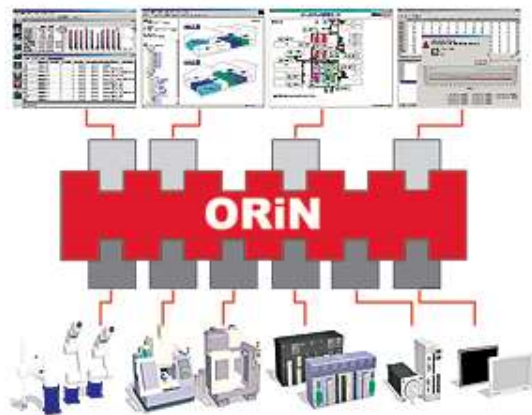
I/O Manager

Jump	State	Type	Usage	Macro
0	●	System input	Stop stop (all tasks)	SN1
1	●	System input	Strobe signal	SN2
2	●	System input	Data area bit 0	SN3

- [DENSO HS pick and place simulation 2.35 sec.avi](#)
- [DENSO Robotics - 3-D simulation software](#)
- [Academic Robot \(EN\) - HD version](#)

ORiN (Open Robot/Resource Interface Network) connects devices and application software to a network via independent interfaces. Applications can be easily created for devices from any manufacturer.

- Allows PC control of robots and peripheral devices
- Speeds up and reduces cost of development and integration
- Simplifies operation and maintenance
- Enables communication among devices from different vendors
- Allows overall system monitoring
- Uses common programming languages (Visual Basic® 6.0, Visual Basic® 2005, Visual C++ 6.0®, Visual C++ 2005®, Java, VBScript)

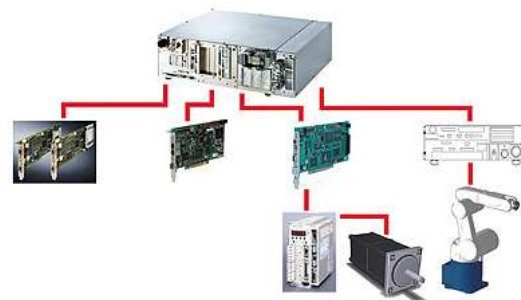


TYPICAL APPLICATIONS



Proprietary Tool (Bundle package)

For offline programming, data logging, variable monitoring, etc.



Semi-Embedded System (SDK or Runtime package)

For direct PC control of robot and peripheral devices via custom applications



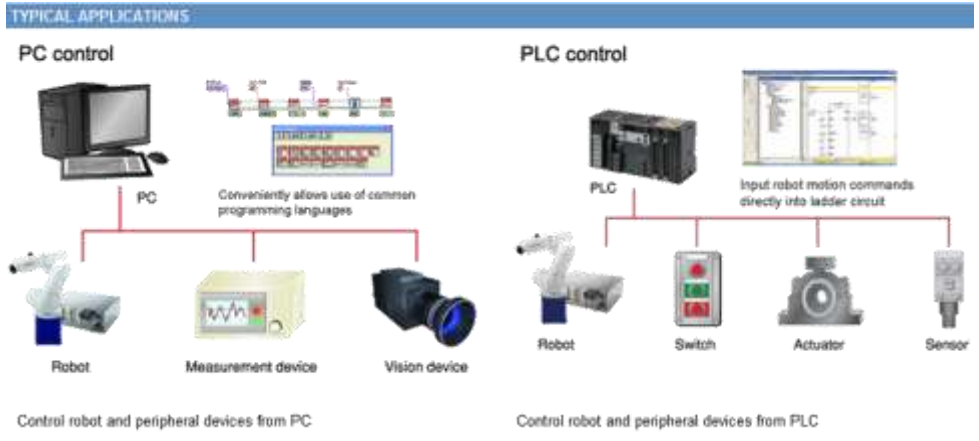
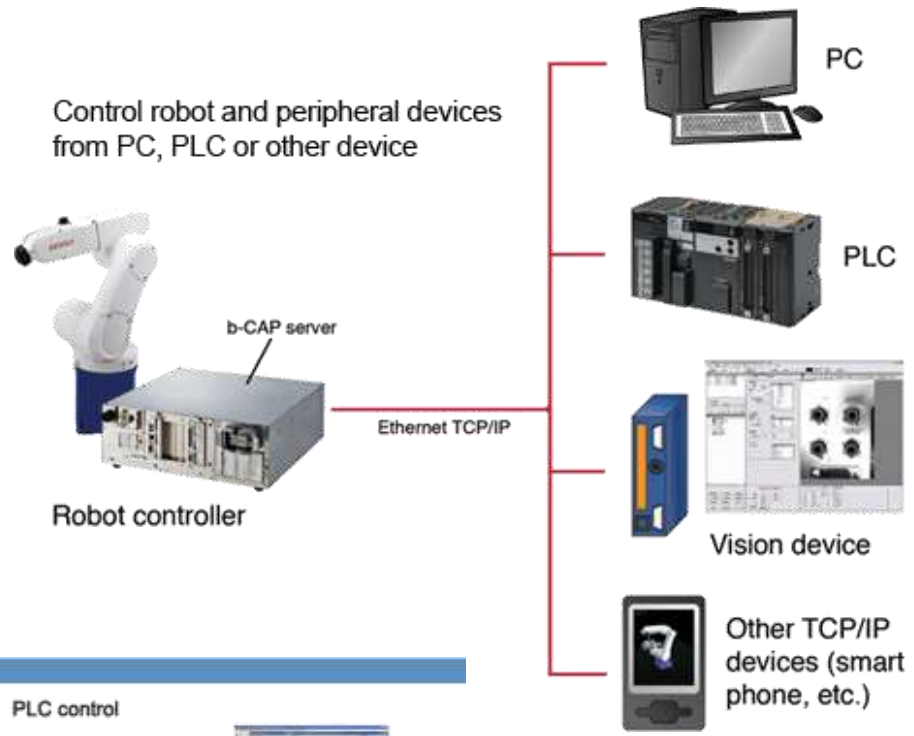
Open System (SDK or Runtime package)

For large-scale monitoring of factory automation systems



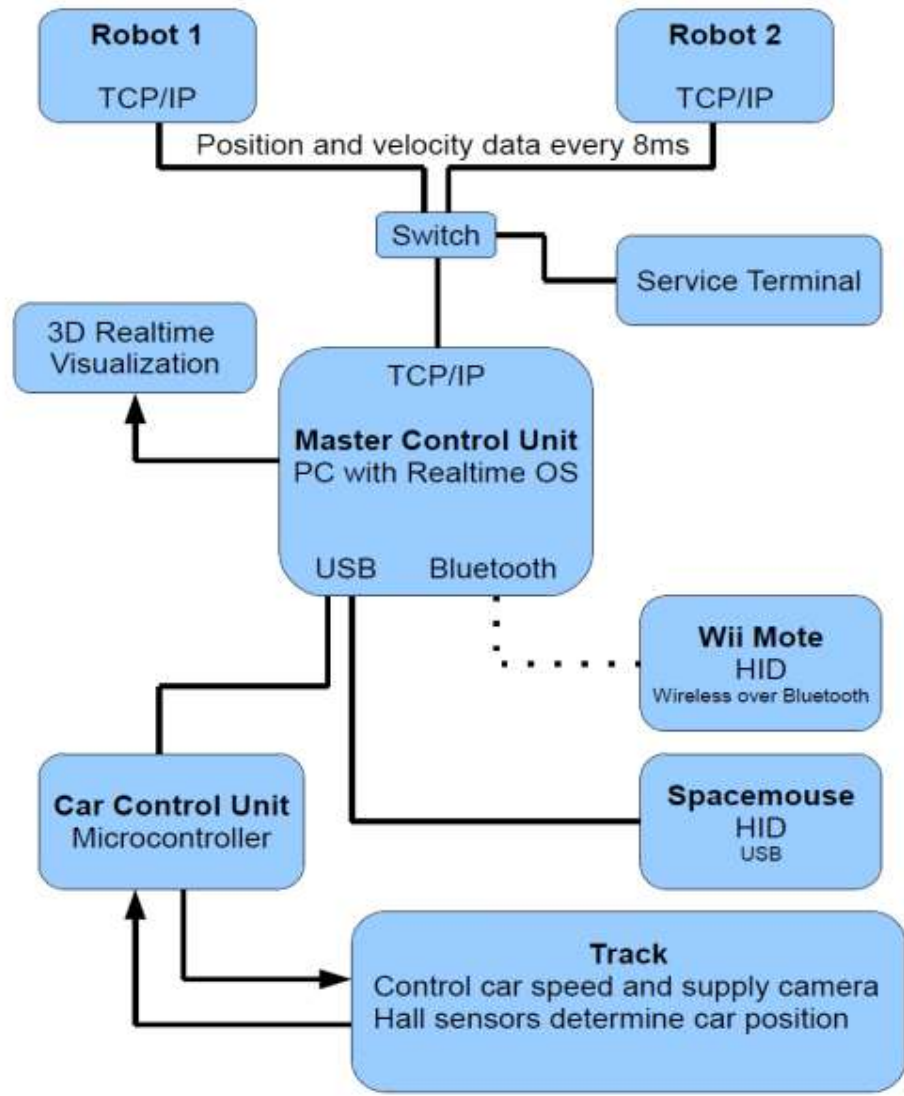
- [DENSO WincapsIII meets LabView on ORiN2](#)
- [Academic Robot \(ITA\) - HD version](#)

- Convenient, direct control of robot and peripheral devices by PC, PLC or other devices using Ethernet TCP/IP instead of Teaching Pendant and PAC (DENSO programming language)
- Use of familiar interface and common programming languages reduces development time and cost
- New server mode enables higher-speed communication between the robot and control device



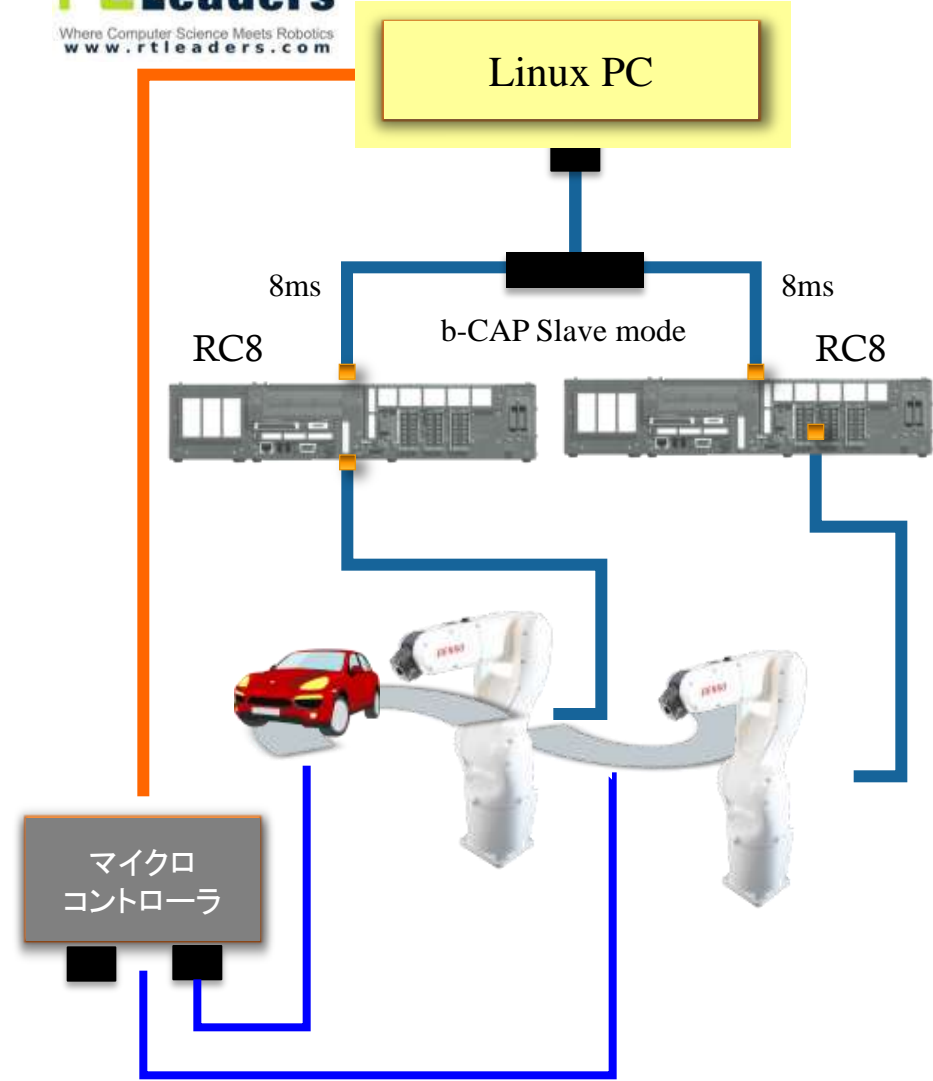
国際ロボット展 2011





RT Leaders
Where Computer Science Meets Robotics
www.rtleaders.com

Linux PCが2台のロボットの軌道生成を作る



レール下面に取付けたセンサーが車の位置、速度をPCへ送信

- DENSO Robotics - Robots lay out slot-car track

- ORiN Vision is the extensive vision library designed exclusively for ORiN2 middleware. The library allows you to directly program robot vision applications with standard high-level languages including C++, C# and VB among others.
- ORiN Vision provides many functions for image capturing, image processing (like edge detection, filters, etc.), image analysis (like blob analysis, finding contours, etc.), image interpretation and also for robot and camera calibration. Because it combines ORiN2 and OpenCV the library allows you to directly program DENSO robots and vision applications with standard high-level languages including C++, C# and VB among others through only one interface.
- **Key advantages:**
 - Built-in processing functions use the OpenCV standard
 - High-level image processing functionality
 - The system is hardware independent allowing you to connect to any off-the-shelf camera regardless of interface (analogue, USB, IEE 2394, etc.)
 - Fast and efficient procedures result in short development times



THE FLEXIBLE STANDARD SOLUTION



ORiN VISION VISION LIBRARY FOR ORiN 2

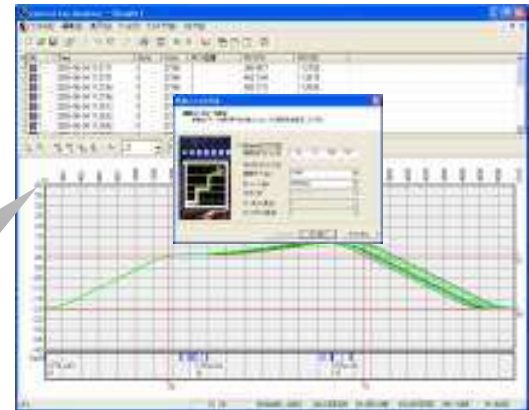
AMBIENTE DI SVILUPPO	Adeguati linguaggi di programmazione (VB, C++, C#, etc.)
OPEN CV	Facile sviluppo di applicazioni di Robot Vision
COMPATIBILE	Con qualsiasi tipo di telecamera (analog / USB / IEEE1394, etc.)
ALL'OPERATORE	Non sono necessarie particolari conoscenze su operazioni Robot Vision
BREVI TEMPI	Di sviluppo

www.densorobot.com

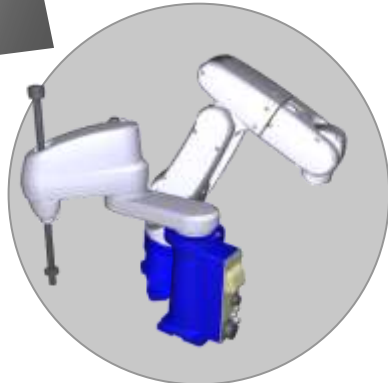
- HALCON software provides an integrated development environment (IDE) for machine vision and has become one of the worldwide industry standards.
- The HALCON Extension Package offers a complete and powerful solution with more than 1400 commands for operations including blob analysis, morphology, pattern matching, measuring, identification and 3D vision.
- Because HALCON is so widely used and highly regarded, DENSO has created a comprehensive, dedicated extension package to enable HALCON and DENSO users to conveniently program DENSO robots and control their vision applications through the same simple graphical interface.
- This integrated development environment, which is called HDevelop, is intended for engineers with a thorough knowledge of machine vision. With our DENSO extension package for HALCON users can program our robots easily.
- **Key advantages:**
 - DENSO robots can be programmed directly using one clear and practical interface
 - The DENSO extension package is conveniently and seamlessly incorporated into the HALCON integrated development environment, HDevelop
 - No previous experience of robotic programming is required



Virtual TP

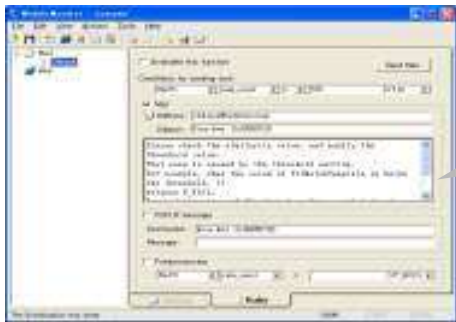


Control Log Analyzer

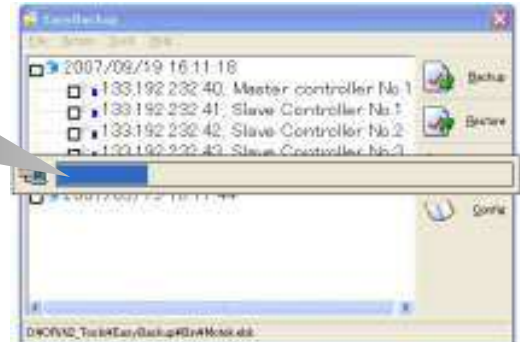


DENSO Robot

Support software for robot
operation and maintenance



Mobile Monitor

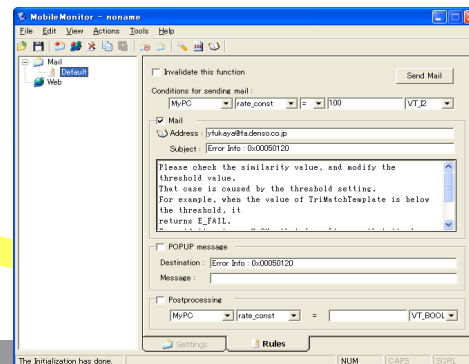
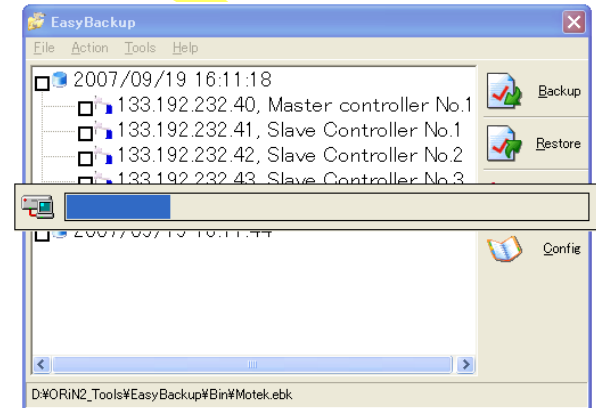
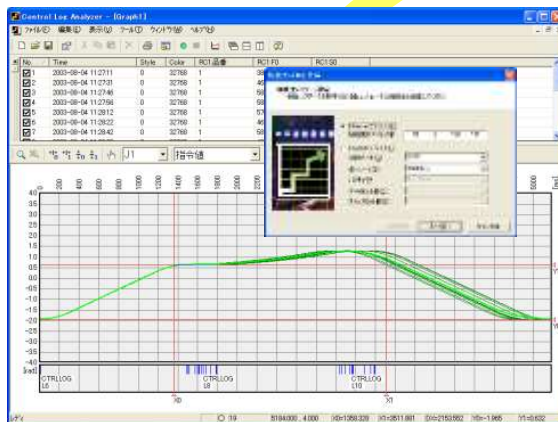
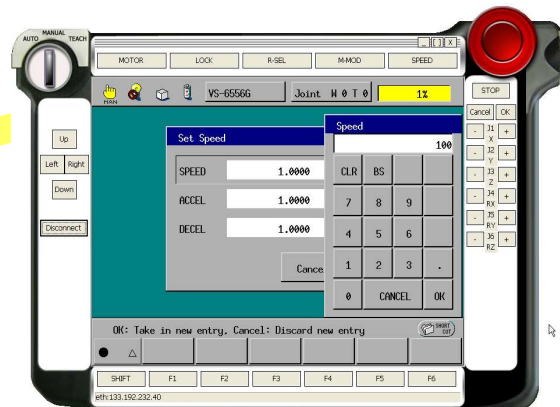


Easy Backup

Strumenti di diagnostica e assistenza per Robot DENSO

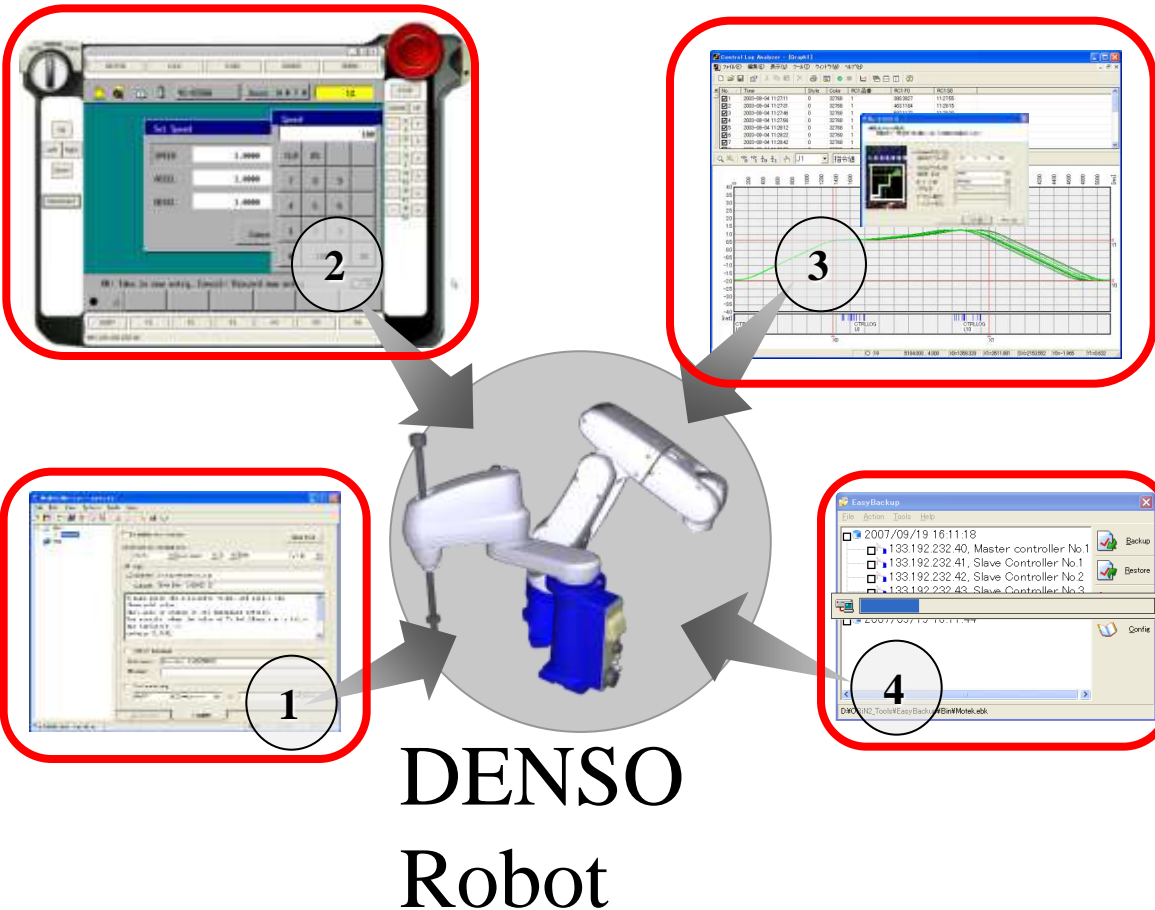
Robot Tools

- Strumenti di sistema per ORiN2 -



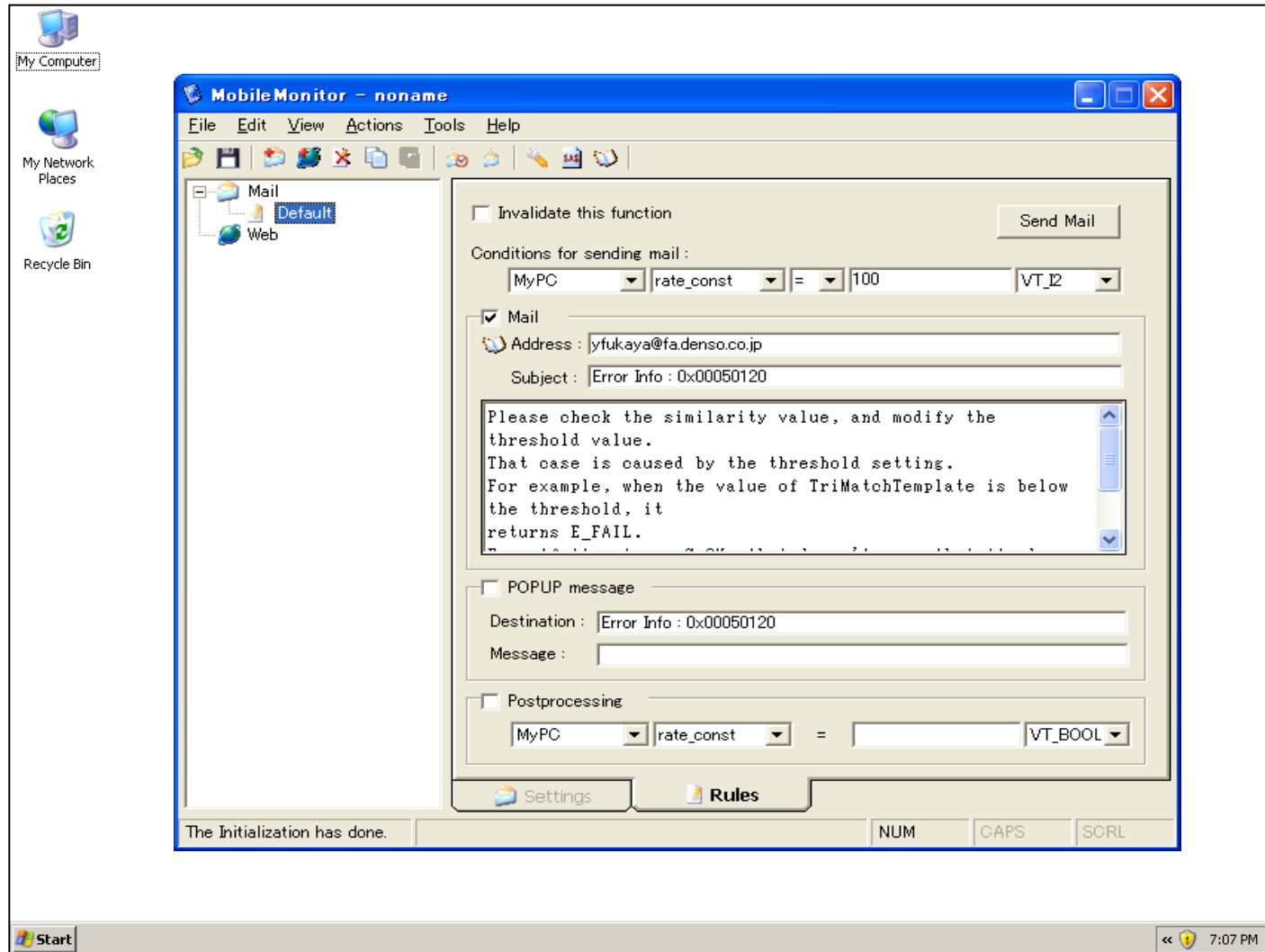
Applicazioni Robot Tools

Robot Tools supporta la diagnostica giornaliera ed ottimizza i costi di utilizzo dei robot



1. Mobile Monitor
2. Virtual TP
3. Control Log Analyzer
4. Easy Backup

1. Mobile Monitor



Funzioni del Mobile Monitor

The diagram illustrates the Mobile Monitor system. On the left, a dashed red box contains a vertical bus with four robot controller units connected to it. A green arrow labeled "Monitor" points from this bus to a central computer monitor. The monitor displays the Mobile Monitor software interface, which includes a configuration window for sending email notifications. The configuration window shows the following settings:

- この設定を無効にする
- 送信条件: MGF-RC1-E | I1 = 100 | VT_J4
- メール
 - アドレス: DemoMail@Demo.co.jp
 - 件名: 異常検出
 - 内容: 設備に異常あり。至急現場へ急行されたし。
- POPUPメッセージ
 - 送信先: DEMO_PC
 - メッセージ: 設備異常
- 後処理
 - MGF-RC1-E | F10 = | VT_BOOL

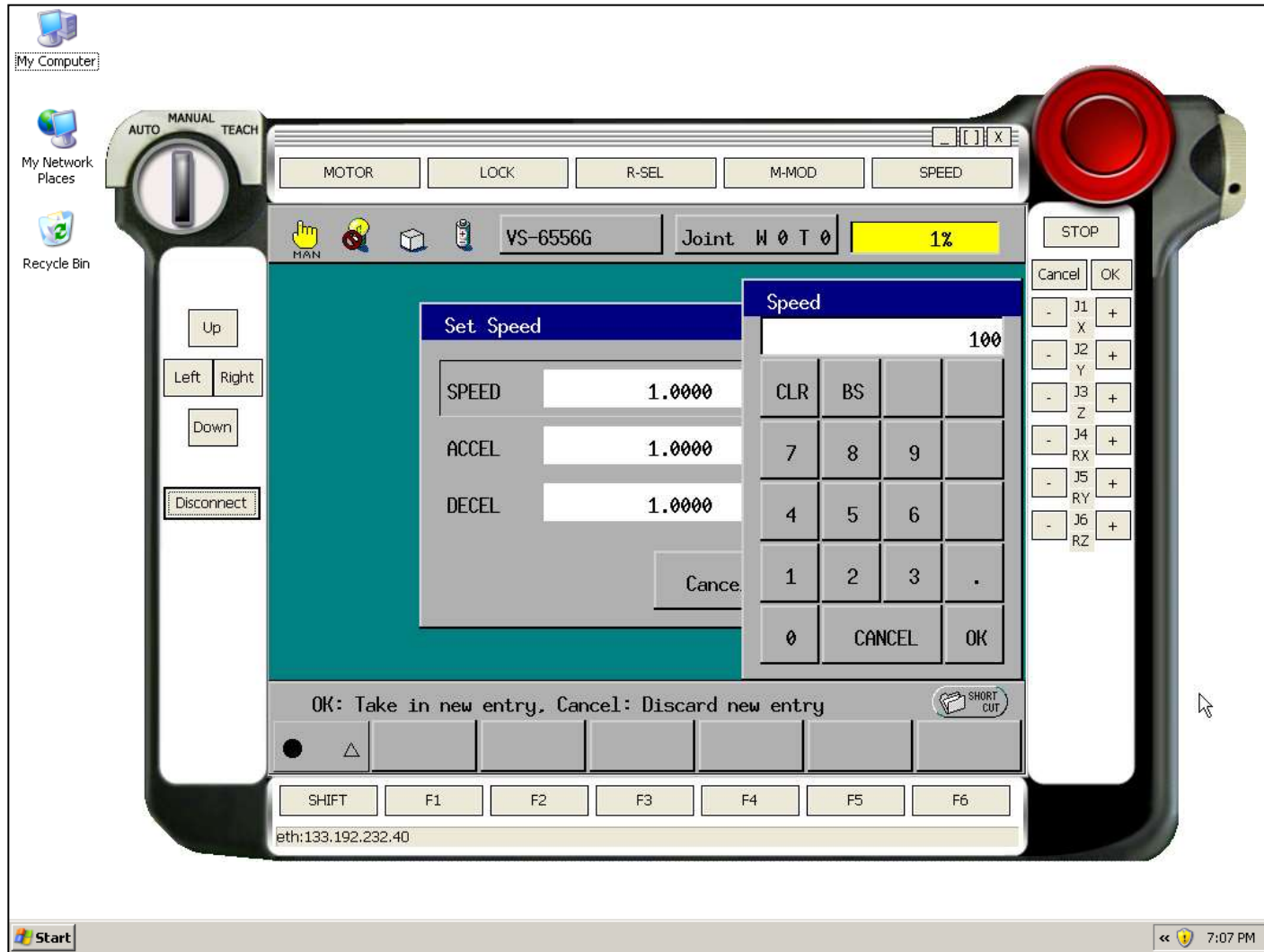
Buttons for "設定" (Settings) and "ルール" (Rules) are visible at the bottom of the configuration window. A red arrow labeled "Notifica" points from the configuration window to a hand holding a Compaq mobile phone. The phone screen displays a graphical interface with various colored blocks. Two yellow lightning bolts are shown striking the phone, and a green banner with the text "Robot Error" is positioned below the phone.

Funzioni Outline

Il Software controlla lo stato, ed invia , in caso di anomalia un messaggio e-mail al responsabile della produzione inerentemente all'anomalia del funzionamento.

Vantaggio : Manutenzione efficace dei Robot e “caccia” al problema

2. TP VIRTUALE

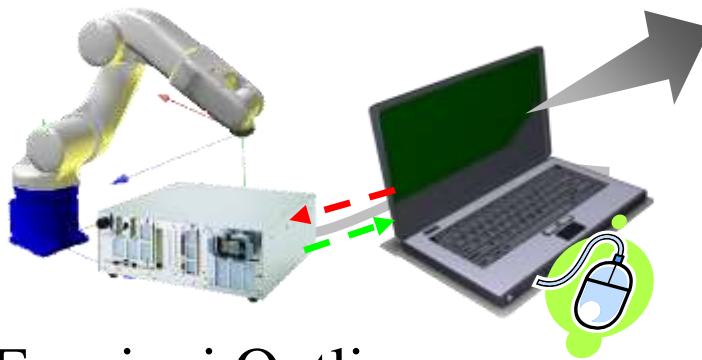


Funzioni del TP Virtuale

Operazioni in Manual Mode

Ripristino costante e ciclico dello schermo

Stesse operazioni come in caso di utilizzo del Teaching Pendant reale

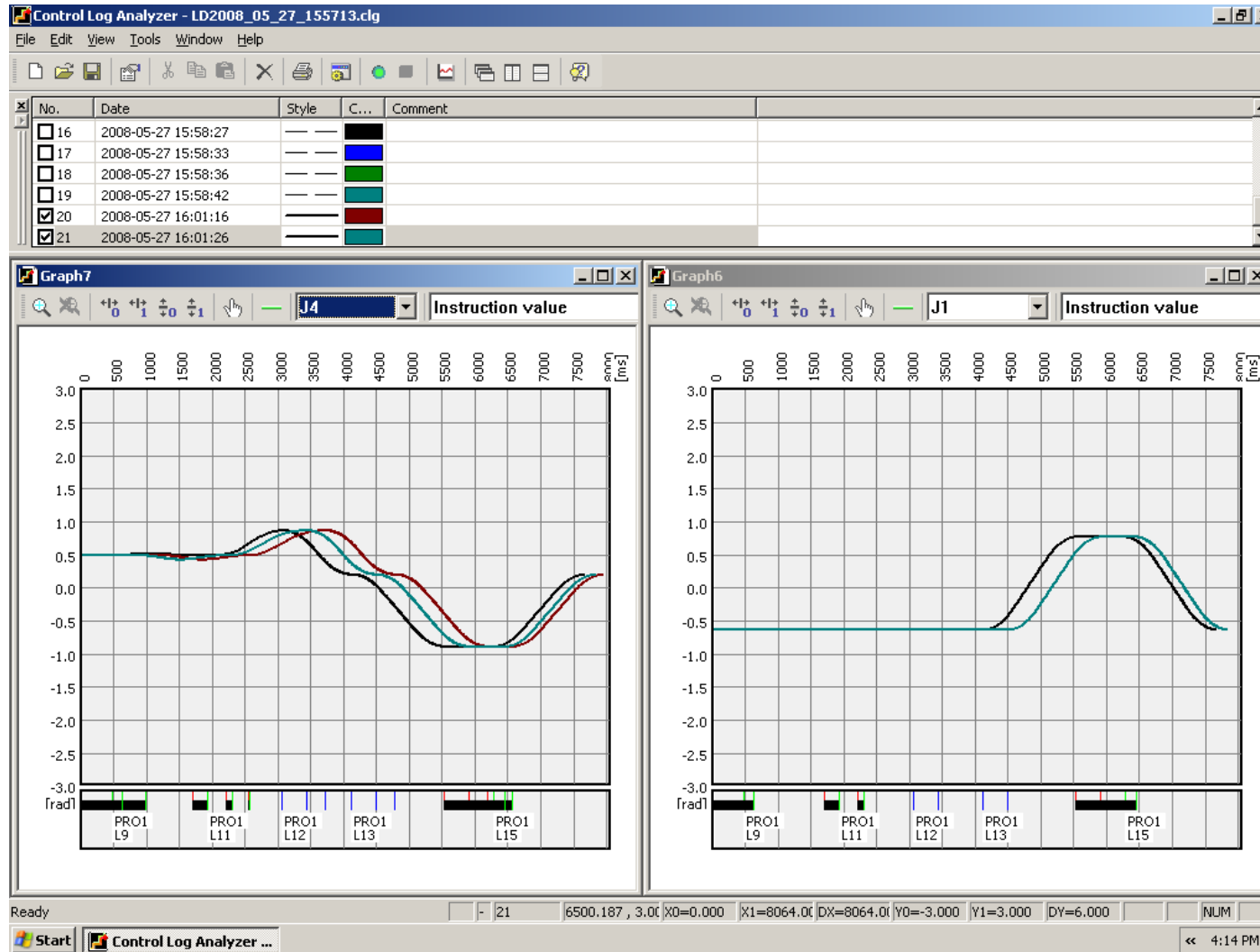


Funzioni Outline

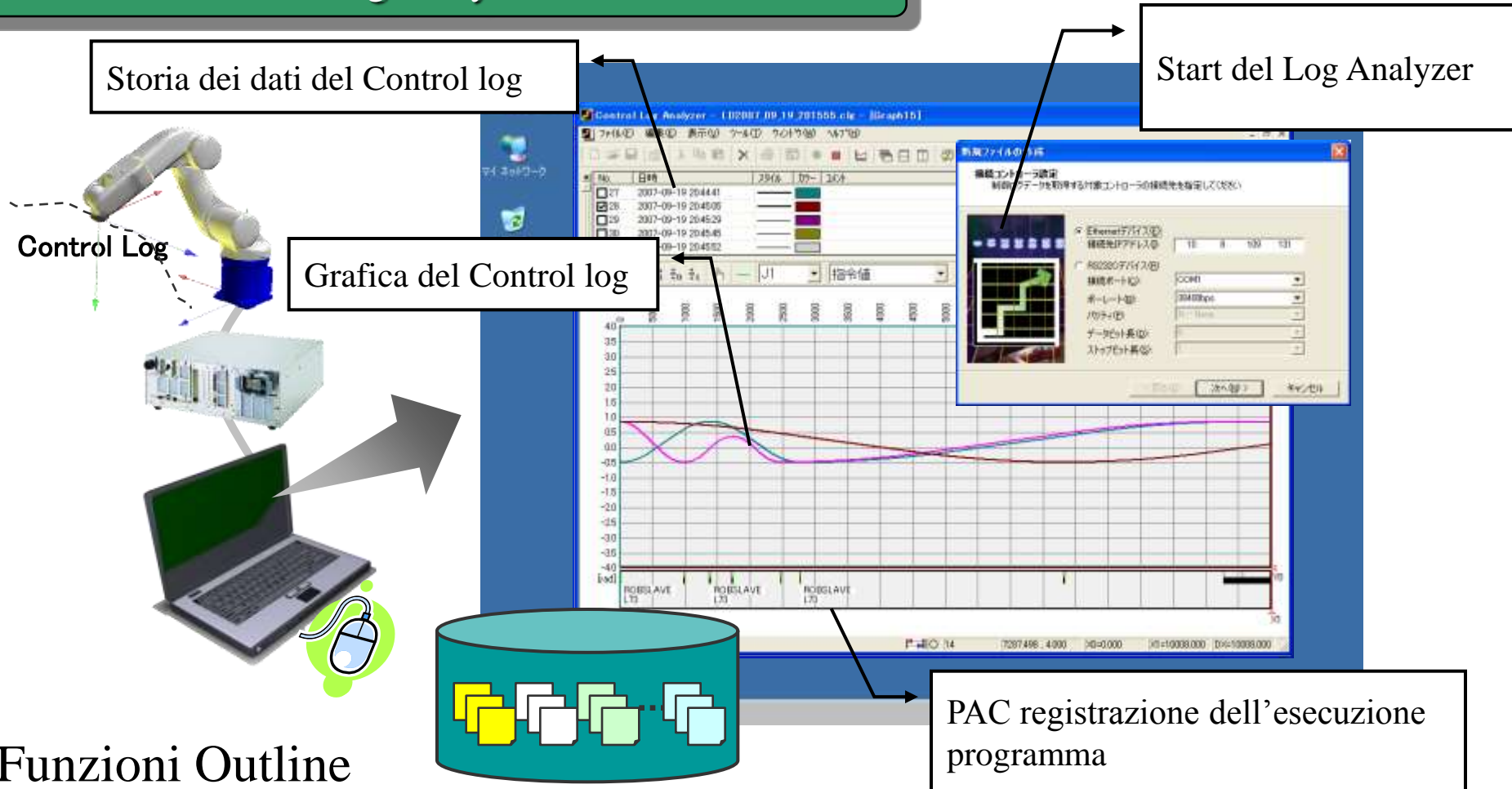
In combinazione con il Mini Pendant, il TP Virtuale supporta tutte le operazioni in manual mode.

Vantaggio : Supplemento al Mini Pendant e completo controllo del Robot

3. Control Log Analyzer



Funzioni del Control Log Analyzer

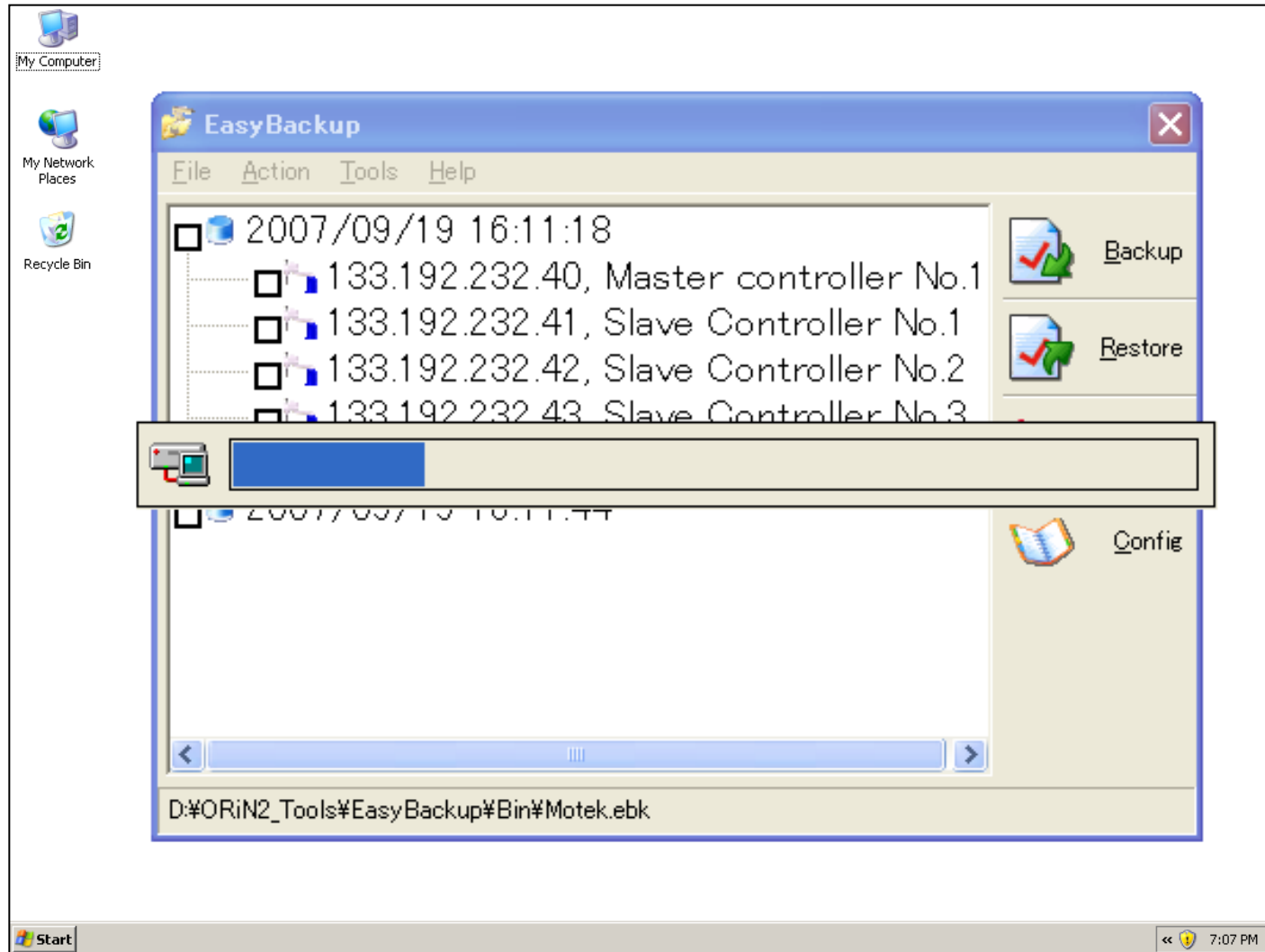


Funzioni Outline

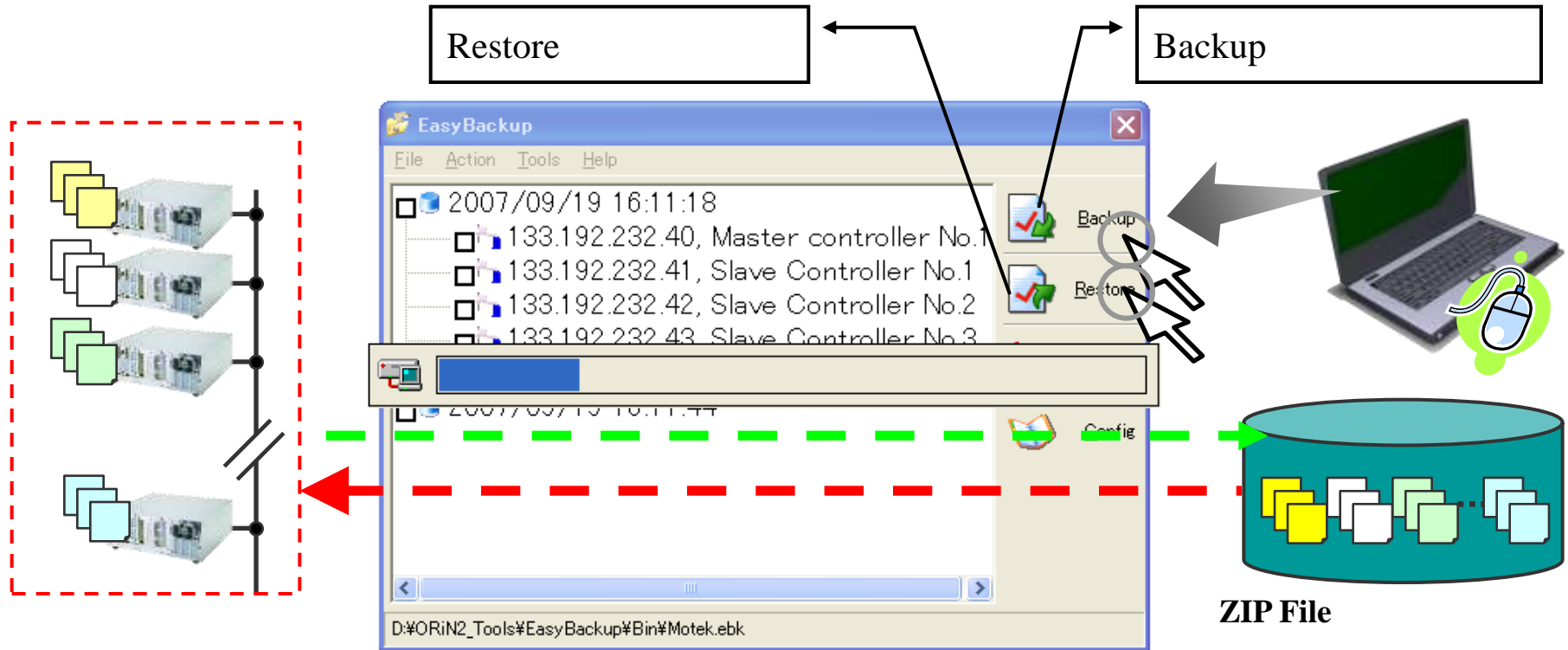
Il download dei dati, traccia il grafico dei dati di log per l'analisi visiva, e permette la verifica della correlazione tra l'errore e il Programma in esecuzione

Vantaggi : Controllo diagnostica in real-time, Visualizzazione e controllo dell'errore

4. Easy Backup



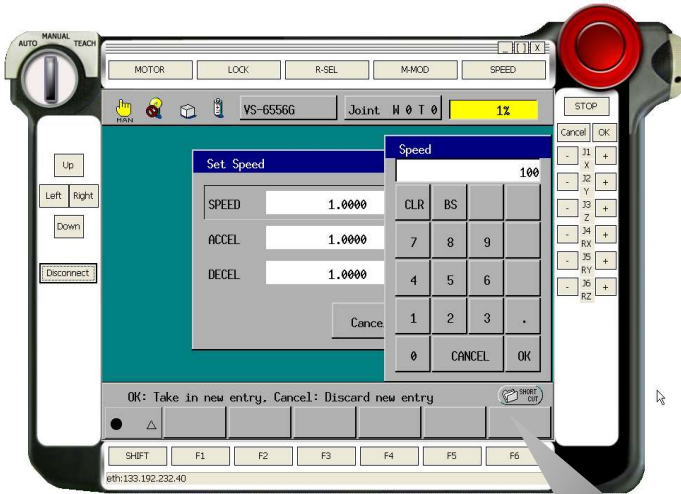
Funzioni di Easy Backup Outline



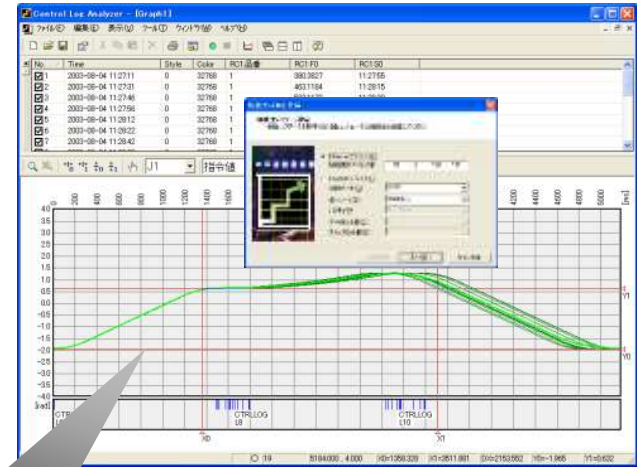
Function Outline

E' possibile eseguire il back-up e la memorizzazione totale dei dati del Controller Robot all'interno della rete , mediante una semplice operazione di "click".

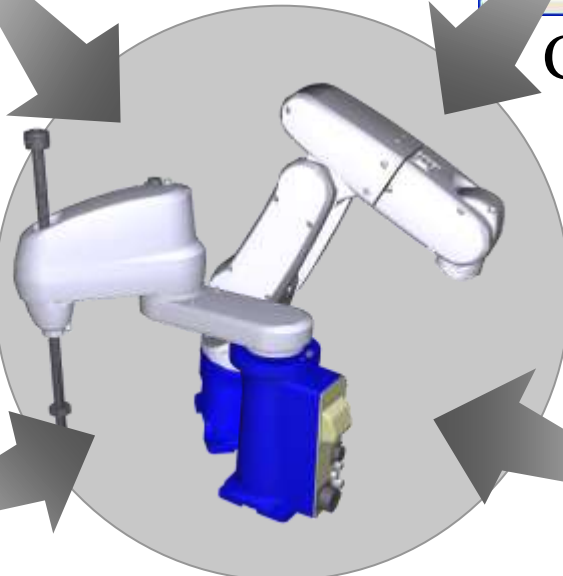
Vantaggi : Manutenzione efficace con tempi operativi più corti



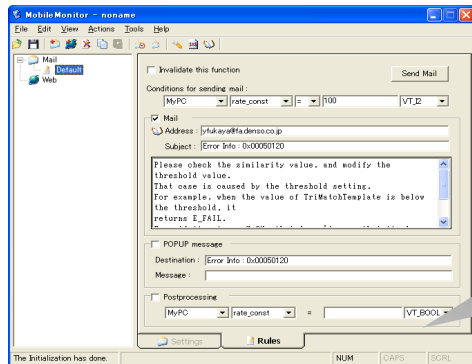
TP Virtuale



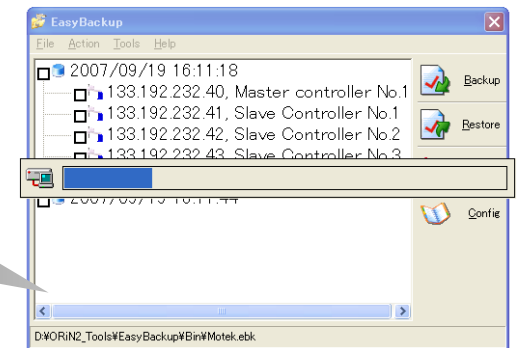
Control Log Analyzer



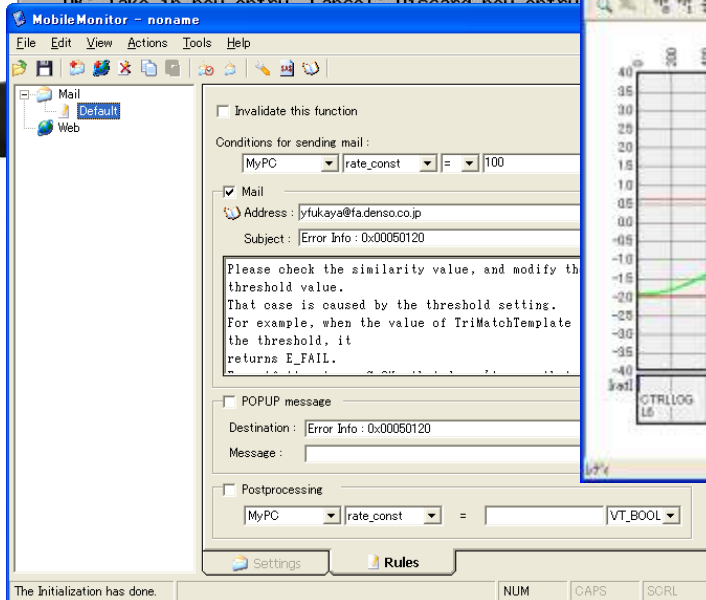
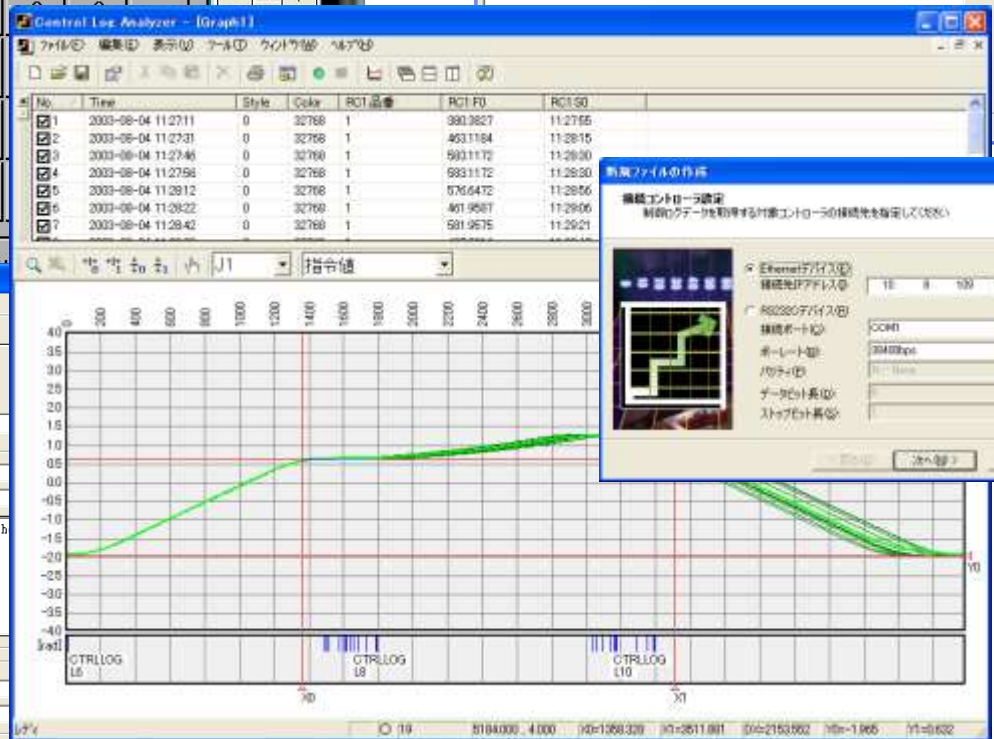
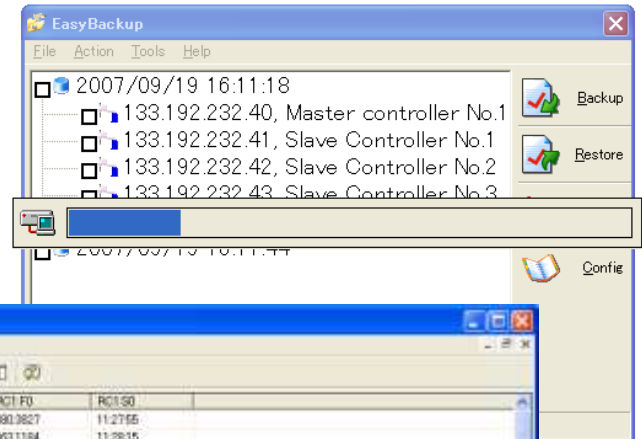
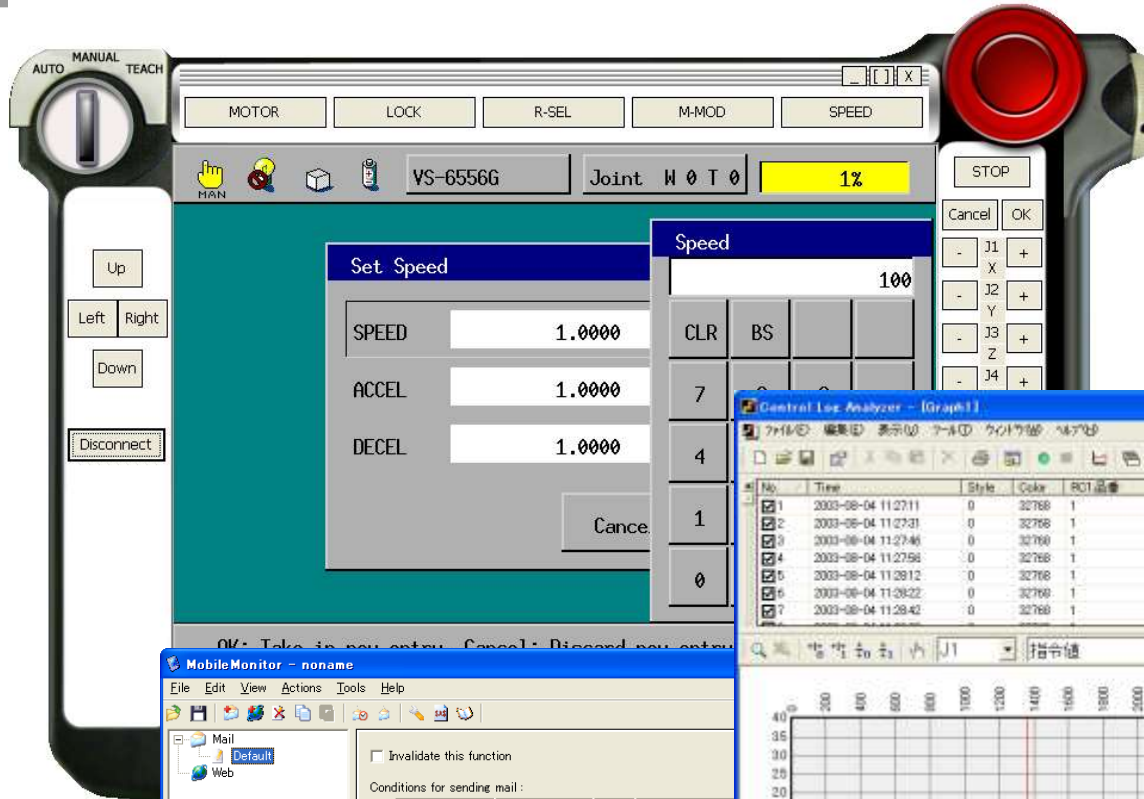
DENSO Robot



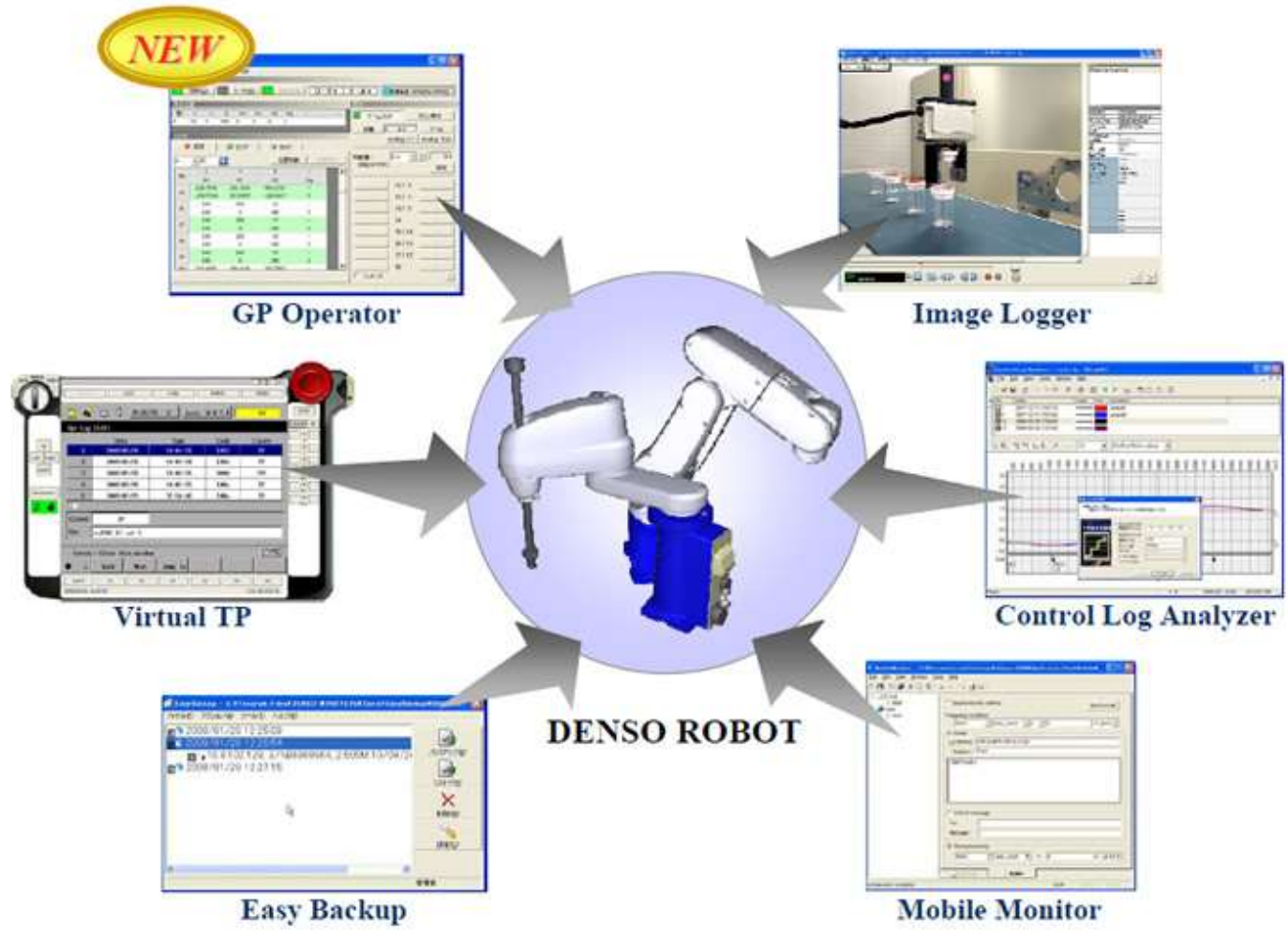
Mobile Monitor



Easy Backup



- Utility tool suite for DENSO robot operation and maintenance
- ORiN2 based applications for integrated robot management over the network
- Tools for effective daily maintenance and robot operation cost reduction

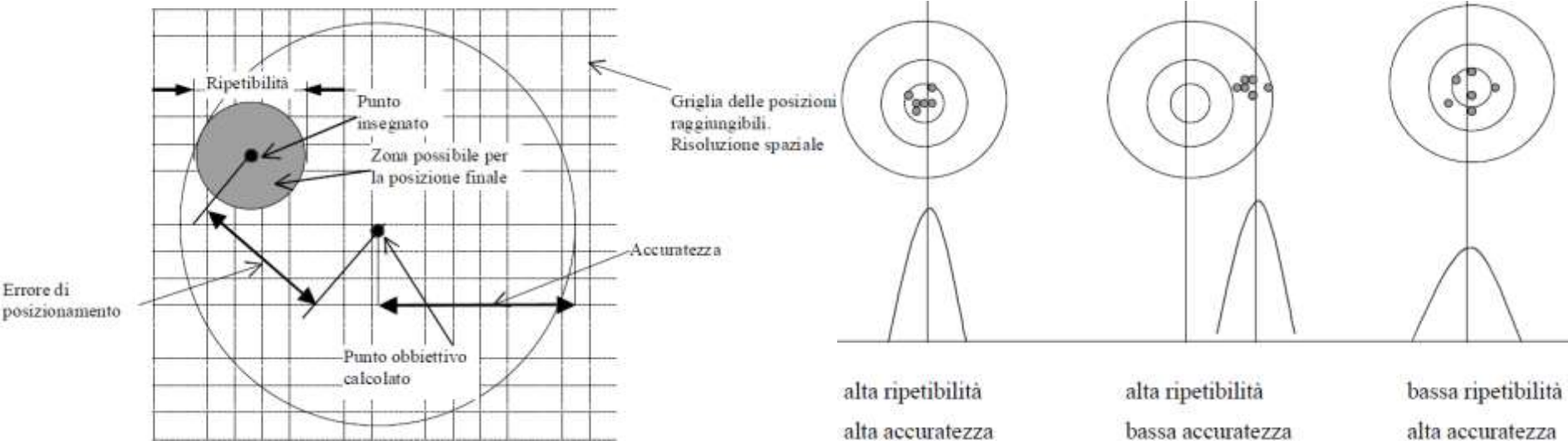


Product name	Function
GP Operator NEW	Connect your PC to a robot controller. You can operate a robot with a mouse/a gamepad easily. You can also convert a robot position into a chosen variable (P-type, J-type or T-type). It helps a developer who controls a robot with a PC on teaching.
Image Logger	Help to determine causes of sudden error and wrong assembly in your production. Capture images around the error and save equipment data (I/O, variable etc.). Specify the error cause through validation of the images and the data and contribute equipment improvement.
Virtual TP	Works with a controller set on a manual mode: various settings can be made on the GUI based Virtual TP. Robot teaching can also be done with a Mini Pendant.
Control Log Analyzer	Obtains Control Log from a designated controller and analyzes the robot operating status by graphing out the Control Log: visualizes the operating status.
Easy Backup	Backups and restores all data of multiple controllers with a single click. Consolidates the compressed data: enriches the portability and maintenance performance of robot facilities.
Mobile Monitor	Monitors controllers operating status and notifies errors or troubles through portable devices to an operator even not at the site.

- Implementing a professional robotic solution is a substantial and serious project which can have a major impact on the whole of your business. Whether you are investing in a single arm, or a complete automated production facility, it is vital that you are confident in the potential performance of your installation.
- Visual Components® – the world's leading provider of 3D robotic and manufacturing software created 3DCreate® which is a simple, quick and cost-effective software tool that enables machine builders, system integrators and manufacturers to simulate complete factory layouts in a virtual environment.
- This highly innovative and powerful solution provides all of the functions you need to create new simulated components from existing 3D CAD data, allowing you to customise, observe and evaluate your industrial robotic applications in advance.
- **Key advantages:**
 - Use ready-made robot models from online eCatalogue
 - Easy plug'n'play interface for layout design
 - Integrate robot cells with factory layouts
 - Parametric components suit various customer cases
 - Connect to an external controller
- For more detailed information please visit: www.visualcomponents.com

- Visual Components Robot Simulation with DENSO WAVE "WINCAPS3"
- Visual Components Robot Simulation with DENSO WAVE "WINCAPS3" Part2

- La griglia rappresenta l'insieme delle posizioni raggiungibili cioè la risoluzione spaziale.
- La posizione insegnata è quella presa sul campo che viene memorizzata come variabili di giunto.
- L'errore di posizionamento dipende dall'accuratezza del modello cinematico.
- L'accuratezza del modello cinematico dipende da parametri geometrici (tolleranze) cedevolezza, etc.
- E' più facile costruire robot ripetibili piuttosto che robot accurati.



- Esistono diversi modi per risolvere semplicemente questo punto:
 - Eseguire una adeguata calibrazione tra isola reale e isola virtuale
 - Usare robot detti “high accuracy robot”
 - Usare strumenti che correggono le discrepanze tra virtuale e reale direttamente durante il ciclo di lavoro (si pensi all’inseguimento giunto laser per isole di saldatura)



- **ROSY (Robot Optimization System) calibration kit for DENSO robots**
- Certain robotic tasks and applications require a level of precision and accuracy of pose that can only be achieved through more advanced methods of calibration.
- The ROSY (Robot Optimization System) calibration kit enables you to achieve these advanced levels of precision in a sophisticated, direct and straight forward manner.
- ROSY utilises a calibration sphere and cameras to assess kinetic errors. The resulting correction values are calculated and the control parameters can then be adjusted accordingly with a minimum of effort.
- **Key advantages:**
 - The user can increase the already exceptional accuracy of DENSO robots even further for special applications
 - The whole process can be accomplished easily and is usually completed in less than an hour
 - Identical and accurate robot cells can be created quickly and efficiently
 - On-site calibration service
- For more detailed information please visit: www.teconsult.de

- [ROSY.flv](#)
- [Robot Calibration with ROSY, EASY-ROB](#)

Industrial Examples



TrackViewer 1.2.1

Obj **Histo**

R1 Object

0	x	x	x
	57.3764	77.7739	164.014
	y	y	y
	128.257	170.487	117.604
	Angle	Angle	Angle
	83.1715	116.369	4.21569

R2 Object

0	x	x	x
	132.983	77.2874	294.807
	y	y	y
	156.794	89.4654	54.7118
	Angle	Angle	Angle
	120.249	83.345	109.563

Send

Area Sovrapposta (%)

51

Modalità di lavoro

Work

SAVE Actual IMG

Start Seq Stop Seq

Actual seq n

0 OFF

Prodotto

Cucchiaio manico piatto

Ciclo Ispezione (ms)

676

Play next img n 13 di 16

Sistema pronto Disco OK Robot 1 Conn Robot 2 Conn

Enable

SETTINGS

EXIT [F10]

443 Obj/s in 00:02:03.01 Obj/s/min 216.1 Reset

ImagingLab SRL
Consulenze e Prototipi:
Visione e Robotica
www.imaginglab.it - info@imaginglab.it

Obj **Histo**

R1 Object

0	x	x	x
	146.046	134.503	253.834
	y	y	y
	30.5348	154.81	171.32
	Angle	Angle	Angle
	83.5564	81.4666	73.5809

R2 Object

0	x	x	x
	186.553	94.8434	28.688
	y	y	y
	70.0634	126.879	29.6785
	Angle	Angle	Angle
	246.512	54.4294	274.658

Send

Area Sovrapposta (%)

51

Modaltà di lavoro

Work

SAVE Actual IMG

Start Seq Stop Seq

Actual seq n

0 OFF

Prodotta

Siringa

Ciclo Ispezione (res)

437

Play next img n 6 di 11

Sistema pronto Disco OK Robot 1 Conn Robot 2 Conn

Enable

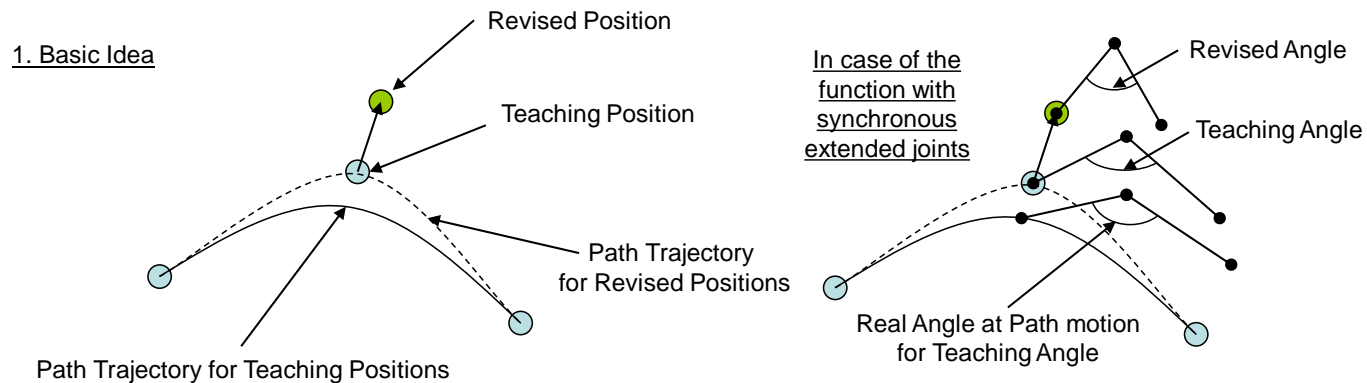
SETTINGS

EXIT [F10]

318 Obj/s in 00:00:33.57 Obj/s/min 568.2 Reset

ImagingLab SRL
Consulenze e Prototipi:
Visione e Robotica
www.imaginglab.it - info@imaginglab.it

Oggetto destinato a Robot 1
Oggetto destinato a Robot 2
Già prelevato / non prelevabile



2. Difference between the function with synchronous extended joints and the one with asynchronous extended joints

the function with asynchronous extended joints

The revised position is calculated based on the Cartesian Coordinates.

the function with synchronous extended joints

The revised position is calculated based on the Joint Angles.

The teaching position is translated to joint angles, and the joint angles are treated as the target angles.

3. How to use the FIGCHECK.MAX_DISPLACEMENT_dJ* in cOrbitGenSync.ini

In case of the function with synchronous extended joints

This parameters are used as the limited angles for the difference between the teaching joint angle and the revised joint angle, in order to check the error of the convergence algorithm.

Therefore, if the parameters are larger, then the error will not cause.

REQUEST: After the parameters are larger, check the motion in the WINCAPS3

- DENSO Robotics - Robot performs vision inspection

Special Examples



The aim of this project is to add 2D vision to the BARMAN demonstrator shown in the figure. The BARMAN is composed of two DENSO robots. In its basic release it picks up bottles, uncorks them and places them on the rotating table. It then rotates the table, so that people can pick them up and drink.

The tasks of the Barman are summarized here:

- (i) to survey the foreground and check if empty glasses are present;
- (ii) to rotate the table and move glasses to the background;
- (iii) to monitor for a bottle on the conveyor, recognize it, pick it up, uncork it and fill the glasses;
- (iv) to rotate the table to move glasses to the foreground zone.

These simple operations require that suitable image processing is developed and validated. The software environment is the Halcon Library 9.0; the whole-project is developed in VB2005. The robot platform is the ORiN 2 (from DENSO).

- Robot Barman with machine vision

Look at the video to appreciate how 3D vision combined to a robot arm can increase the system flexibility in picking operations. The robot is a DENSO VS-6556G system. A laser slit is mounted close to the end effector, and scans the scene. Suitable 2D geometric Template Matching is used to get information on the scene.

3D raw data are segmented to interpret the scene, and to correctly pick objects up. The 3D optical head is formed by a CMOS B/W camera (1280x1024 resolution) and a lasiris laser projector, equipped with a cilindic lens, to form a light plane. The LabView graphic environment is used to develop the measurement procedures. The Robot motion libraries are developed by ImagingLab.

- Optolab Roboscan II

- DENSO Robotics - Robot serves ice cream

- Folding napkins

DENSO

**Thank you for your
attention!**



K.L.A.IN.robotics

ing. Fabio Tampalini Ph.D.
senior technical manager

DENSO

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