THE HISTORY
of the MOTOMAN industrial robot
1. The programming unit was used to move each robot axis and save its position. When running the program the robot would assume each position in the very same order that they were recorded.

2. RB control cabinet.

Yasnac RB and MOTOMAN-L10

MOTOMAN-L10
- Introduced in 1977
- Five axes
- Maximum workload 10 kg (including gripper)
- Weight 470 kg

Control system RB
- Programming capacity 250 positions, extendable to 600 and 350 instructions
- 16 input signals and 15 output signals
- 99 robot jobs in magnetic memory
- 63 welding parameters
- Dimension 1600x650x700 mm
- Weight 350 kg

The very first Motoman robot
MOTOMAN-L10 was the first robot which Yaskawa introduced on the market. Its control system was equipped with a separate programming pendant used to record the robot’s position one by one. The control system had a magnetic memory which did not require a backup.

New positions, points, could be added or moved, but it was impossible to erase any of them in the recorded program. Four finished programs could be accessed from separate keys on the programming unit.

Using a few points to calculate a straight line or a circle (so called interpolation) was not possible. Consequently it was necessary to record quite a lot of points in order to complete a welding line.
Yasnac RG and MOTOMAN-L10W

<table>
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<th>MOTOMAN-L10W</th>
<th>MOTOMAN-L10WA</th>
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<td>Introduced in 1983</td>
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<td>Five axes</td>
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<td>Maximum workload 10 kg</td>
<td>Maximum workload 5 kg</td>
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<td>Weight 280 kg</td>
<td>Weight 280 kg</td>
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Control system RG

- Introduced in 1980
- Controls up to six axes
- Programming capacity 1000 pos (600 instructions).
- 99 robot jobs in magnetic memory (external memory on tapes)
- 22 input signals and 21 output signals
- 127 welding parameters
- Linear and circular interpolation possible
- Dimensions 1600x650x700 mm
- Weight 350 kg

Many improvements to robot and controller

The work area in the new Motoman L10W was increased by 80% and the robot wrist is more narrow. The robot was made of a light aluminum alloy which helped reduce the size of its motors.

The model L10WA, with its extra wrist axis called A, was the world's first six axes robot. The control system RG could handle either this robot model, or the ordinary L10W and an external axis. However, the L10W-models were almost exclusively used with the next generation controller RX.

The later versions of RG control system enabled circular and linear interpolation, three dimensional shifting of a robot job and pendular motion. It was even possible to control it from an external computer, but that was not put to much practical use.
Yasnac RX and MOTOMAN L-series

MOTOMAN-L106
- Introduced in 1985
- Six axes
- Maximum workload 10 kg
- Weight 350 kg

Control system RX
- Introduced in 1983
- Controls up to eight axes (the robot's six plus two external axes)
- Programming capacity 2,200 pos and 1,200 instructions (extendable to 5,000 pos)
- 249 robot jobs in memory
- 127 welding parameters
- 48 input signals, 24 output signals plus 2 analogue outlets
- Dimensions 700x1100x580 mm
- Weight 200 kg

Other models in the series
L15, L30, L60 and L120

Introducing a whole robot series
This meant several robot models that could be operated with the same type of control system. The L-series included robots able to handle workload up to 120 kg. There was direct drive on the three wrist axes RBT.

The later versions of the RX controller were equipped with “modern” functions like COM-ARC (seam tracking), multi layer, 3D-shift, parallell shift etc. In order to synchronise robot welding with a rotating manipulator the TRT function was developed. Operator safety features included automatic low speed during programming and a teach-lock mechanism which prohibits operation through other equipment than the programming unit.
Yasnac ERC and MOTOMAN K-series

MOTOMAN-K10S
- Introduced in 1988
- Six axes
- Maximum workload 10 kg
- Weight 300 kg

Control system ERC
- Controls up to 12 axes
- Programming capacity 2,200 pos and 1,200 instructions, extendable to 10,000 pos and 5,000 instructions.
- 55 input signals and 35 output signals (extendable to 96/44)
- Dimensions 700x1140x580 mm

Other robots in the series
K3S, K6SB, K30WSB, K60S and K100S

Advanced functions
The K-series of robots had a direct drive on all six axes. This meant that the power was transferred to the axes directly and not through long chain transmissions or link-arms.

The ERC control system was able to control more axes than any other controller at the time. It had a lot of improved features like electronic seam tracking (ComarcII) and Multi Layer functions which meant that external sensors and seam tracking devices were no longer necessary. Other smart features were user coordinates, a step by step position control (forwards and backward,) fine adjustment of speed etc. The programming pendant weighted only 0.9 kg and featured a small display (12 characters) and a three positions dead-mans handle.
Yasnac MRC and MOTOMAN SK-series

**MOTOMAN-SK16**
- Introduced in 1994
- Six axes
- Maximum workload 16 kg
- Weight 280 kg

**Control system MRC**
- Controls up to 21 axes
- Synchronised patented control of two robots
- Programming capacity 2,200 pos (extendable to 60,000 pos)
- 48 input and 48 output signals (extendable to 144/144)
- Dimensions 900x1600x650 mm
- Weight 190 kg

**Other robots in the series**
SK6 C, SK16-6, SK45-30, SK120, SK300 and SK-16

**Improved performance**
With the introduction of the robots in the SK-series the maximum workload was increased by 300%. The system could control more axes as the previous one, and it could also synchronise the motions of two robots.

The MRC introduced some new functions well suited for machine handling and necessary when synchronising two robots: e.g. Multi tasking, servo float and S-move.

MRC also made it possible to edit robot jobs from an ordinary PC, so called offline programming. Although it had been possible to read robot jobs as text files before, it was only now possible to return changes made in the PC or even send completely new programs to the controller.
Motoman XRC and the UP-series

MOTOMAN-UP20
- Introduced in 1998
- Six axes
- Maximum workload 20 kg
- Weight 280 kg

Control system XRC
- Controls up to 27 axes
- Synchronised control of three (four) robots
- Programming capacity 5,000 pos and 3,000 instructions, extendable to 60,000 pos and 20,000 instructions
- 40 input and 40 output signals (extendable to 256/256)
- Dimensions 800x900x650 mm
- Weight 190 kg

Other robots in the series

Increased usability
The XRC control system has a Windows oriented interface with directories and folders. Several types of PC-software for job editing, file transfer or offline programming and simulation are available.

Some interesting new features introduced with XRC are Form Cutting (used in laser-, plasma or water cutting), shock sensor functions and the ability to have acceleration/retardation in any point.
MOTOMAN Robot history

NX100 and application dedicated robots

MOTOMAN-EA1400N
- Introduced in 2004
- Six axes
- Maximum workload 3 kg
- Weight 130 kg

MOTOMAN-ES165N
- Introduced in 2004
- Six axes
- Maximum workload 165 kg
- Weight 1100 kg

Control system NX100
- Controls up to 36 axes
- Synchronised control of four robots
- Programming capacity 60,000 pos and 10,000 instructions
- 40 input and 40 output signals (extendable to 1024/1024)
- Dimensions 800x1000x650 mm
- Weight 170 kg

Other robot series
EA-series (arc welding)
EPL-series (palletizing)
ES-series (spot welding, general application)
HP (general application)
PX-series (painting)

Application dedicated robots
Each robot series is specially designed for its specific application, such as arc welding, palletizing or painting. In many of these models the supply cables are fitted into the upper robot arm, rather than hanging on the outside, which significantly increases the robot’s freedom of movement.

In 2006 the brand new robot models: human sized single armed MOTOMAN-IA20 and dual armed MOTOMAN-DA20 are taking this concept one step further with all of the supply cables hidden in the robot arm.
DX100 and brand new robot types

MOTOMAN-SDA10
- Introduced in 2008
- 15 axes
- Maximum workload 10 kg
- Weight 220 kg

MOTOMAN-VA1400
- Introduced in 2009
- Seven axes
- Maximum workload 7 kg
- Weight 150 kg

Control system DX100
- Controls up to 72 axes
- Synchronised control of eight robots
- Programming capacity 200,000 pos, 10,000 instructions and 15,000 PLC steps
- 40 input and 40 output signals (extendable to 2048/2048)
- Dimensions 800x1000x650 mm
- Weight 250 kg

Other robot series
MA-series (arc welding)
MPL-series (palletizing)
ES-series (spot welding, general application)
MH and HP-series (general application)
MPK, MPP and MYS (picking and packing)
SIA (flexible single arm)

Saving time and money
DX100 offers improved user friendliness and system economy. Robots conserve power during idle time, providing up to 25% in energy savings, and the new features of the programming pendant reduces the need for separate equipment and thus the overall cost. Communication with business networks have been made easier, making it possible e.g. for robot technicians to supervise robots located elsewhere.
FS100 with Picking & Packing robots

MOTOMAN-MPP3

- Introduced in 2011
- Four axes
- Maximum workload 3 kg
- Weight 115 kg

Control system FS100

- Controls up to 8 axes
- Programming capacity 10,000 pos, 1,000 instructions and 1,500 PLC steps
- 28 inputs and 28 output signals (extendable to 1024/1024)
- Dimensions 470x200x420 mm
- Weight 20 kg

Other robot series

MH and HP-series (general application)
MPK (picking and packing)

Small, fast and open

Designed for packaging and small parts handling the FS100 has the performance required for high-speed operations. Its software architecture is open to enable machine builders and system integrators to develop their own customised solutions.

The streamlined and compact design requires little space for installation, thus saving valuable production space. As the FS100 uses the same teach-in programming as the high-performance DX100 controller, it is also possible to have both controller types in a production line without additional operator training.

18. The FS100 features an open software architecture which enables users to develop customised solutions. It also uses the same programming pendant as DX100.

19. The MPK2’s compact, slim arm design with internal cables allows reach into confined spaces.
**DX200 high performance controller**

**MOTOMAN-MH24**
- Introduced in 2015
- Six axes
- Maximum workload 24 kg
- Weight 268 kg

**Control system DX200**
- Controls up to 72 axes
- Programming capacity 200,000 pos, 10,000 instructions and 15,000 PLC steps
- 40 inputs and 40 output signals (extendable to 4096/4096)
- Dimensions 800x100x650 mm
- Weight 180 kg

**Other robot series**
MA and VA-series (arc welding)
MS (spot welding)

**Safety and accuracy**
DX200 often eliminates the need for separate PLC and human machine interface (HMI) and delivers significant cost savings at system level, while decreasing work cell complexity and improving overall reliability. Dynamic interference zones protect the robot arm and provide advanced collision avoidance.

The Advanced Robot Motion (ARM) control provides high performance, best-in-class path planning and dramatically reduces teaching time. Supports coordinated motion for multiple robots and auxiliary/external axes.
22. The Human-friendly service robots “SmartPal” and the “RoboPorter”.

23. Clean room robots for semiconductors and solar panels.

24. Physical therapy robot for the lower extremities.

**YASKAWA’s drive for innovation**

Since Yaskawa Electric Corporation was established, our spirit and drive for innovation has continued. The research centre that was originally started in 1921, cooperates with the research section of each business department. We try to do our best to develop new technology that is good for people and the earth.

Our aim is to focus on our core business of industrial robots. At the same time, we also intend to create a market for robots that are easier to use, and that function in domains more closely involved with people.

**Biomedical fields**

Yaskawa Electric Corporation is working on the development of analytical pretreatment and preparation support devices having greater-than-human reproducibility and accuracy with the use of robots in an effort to contribute to a Japan-originated bio-revolution and creation of a new robot market.

**Medical, nursing care and welfare equipment**

Generally, deterioration in bodily functions, cognitive function and motivation with aging are recognized, and a decline in bodily functions is a critical factor that is said to have a stronger correlation with mortality than age. The Yaskawa Research & Development Center is committed to the development of advanced robotics technology such as livelihood-supporting robots that can co-exist with people. This includes service robots for the purpose of maintenance and improvement of bodily functions as well as rehabilitation after disease or illness.