The New Product Line Concept

Adaptable, fast & accurate

S4C Industrial Robot Controller

ABB Flexible Automation
S4C – Your best performer:

Highly adaptable to your specific needs
The fastest cycle times and the highest accuracy
Superior reliability and safety

The S4C Industrial Robot Controller is the result of more than 300 man years of development from a user base of over 11,000 S4 controllers. It heralds a new era in robot control, offering levels of user-adaptability, performance and reliability unequalled by other systems. The S4C can be configured to match your specific needs, from a single robot system to complete large-scale factory automation systems.

The S4C is a compact, highly configurable, modular system – hence the designation “C”, that will deliver superior performance in your applications. Making certain that you get the best from your robot installations, while allowing plenty of opportunity for expansion, development and change in the future.

Today’s best robot controller

The S4C robot controller uses powerful, configurable software and has a unique dynamic model-based feed-forward control system which provides self-optimising motion. The QuickMove™ functions support this capability. Tests by users have shown work cycle time advantage up to 25%, and the more complex the process, the bigger the advantage for the S4C. The unique path holding capability, implemented in the TrueMove™ functionality, is independent of the robot speed. Path holding is the most accurate on the market for arm-type robots. At the same time the continuous improvement in product reliability gives high system availability for production. The personnel-safety features and error-recovery procedures are unique.

The S4C provides a wide range of options for configuration of the system to meet your operational needs precisely.
The S4C software is highly configurable. This ensures that each user can be provided with optimum functionality adapted to their needs. This overcomes the many limitations of fixed dialogue systems and the limited adaptability of multi-language software systems.

A fully adaptable system for different user’s needs
With the powerful RAPID™ robot language and the extensive functionality available in RobotWare™ software, users are provided with a very powerful system. The open language and system configurability permit the addition of new functionality and allow the functionality to be adapted to the user's specific needs. The system is designed to be easy to use for the operator, powerful for the programmer and accessible for the maintenance personnel.

This in contrast to the limited capability and adaptability of fixed dialogue systems, and the limited adaptability of multi-language software systems.

Extensive communications capability for integration and control
The controller contains fieldbus and serial channels for PLC and PC connections. Using the distributed I/O system, I/O devices can be placed up to 100 metres from the controller. Robot control from PC is possible using the Ethernet, and a number of alternative fieldbuses are available for distributed devices. The controller can thus be integrated into single work-cell systems and into large-scale factory automation systems.

Complete process control

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</table>

The S4C software is highly configurable. This ensures that each user can be provided with optimum functionality adapted to their needs. This overcomes the many limitations of fixed dialogue systems and the limited adaptability of multi-language software systems.

The S4C is an integrated solution for efficient production with extensive configuration and interfacing capabilities.
Plain language communication reduces the risk of misunderstanding and errors.

User defined error handling routines built with RAPID define how the system responds to error conditions.

User-adapted man-machine interface

The high-level RAPID™ robot language is powerful, open and portable. It permits unlimited functionality – new functions can be made locally to meet specific user needs. Portability means that the software can be transferred to a PC and development can be carried out wherever is most convenient.

The ability to create personalised dialogues together with the use of pick-lists and passwords mean that the software interface to the user can be adapted to different user’s needs. The user can choose from 10 national languages.

The operator is presented with understandable messages in plain language, together with suggestions for recovery actions when required. The operator will quickly become familiar with the system thereby reducing the risk of misunderstanding and errors. Powerful error handling and restart procedures ensure high availability.

RobotWare software products

RobotWare is a family of software products designated to increase your productivity and lower your total cost of owning and operating robots. These products represent the most powerful set of robot tools available – tools you can depend on to help you, no matter what job you are doing or what your experience level is. There are four classes of products:

**BaseWare™**; robot operating system and communication software,
**DeskWare™**; off-line user training and support PC software,
**FactoryWare™**; on-line user adapted functionality PC software,
**ProcessWare™**; ArcWare, SpotWare, GlueWare etc.

The same compact control cabinet and control pendant are used for all robots. Data is fully compatible with PC formats. Built-in diskette unit in the control cabinet for accurate and reliable transfer of program data to standalone PCs.
Your robot software on your desktop

DeskWare™ software provides powerful tools for offline programming, simulation, training and application development. FactoryWare™ products are designed to be used in PCs that are connected to robots on the factory floor.

The software on the PC is the same S4C software as in the robot, so you will work with a highly accurate and productive system – all in the familiar Windows environment.

The S4C software is available also to Companies providing simulation packages such as RRS products.
The fastest cycle times and the highest accuracy

Work cycle times and path following accuracy make an important contribution to overall performance. The S4C controller offers high TCP (Tool Center Point) speeds and the highest acceleration rates in the industry. The ABB QuickMove™ functions ensure workcycle times that are up to 25% faster than traditional robot systems. The function ensures that at least one drive motor is always giving maximum torque. This gives the highest possible acceleration and deceleration of axes without deviation from the path. TrueMove™ functions provide the best path accuracy and reliability independent of the robot TCP speed, – with excellent speed holding. Tests carried out according to ISO procedures confirm these features which result in the highest production rates of high quality parts that the industry can offer.

Optimized path following is also achieved for external axes by using feed-forward control. The highest levels of speed and accuracy are delivered with total consistency under all conditions, ensuring quality, speeding up production and making a major contribution to overall plant productivity.

Examples of ISO test results at rated load and speed

<table>
<thead>
<tr>
<th>ROBOT TYPE</th>
<th>IRB 2400/10</th>
<th>IRB 4400/60</th>
<th>IRB 6400/2.4-120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated load</td>
<td>10 kg</td>
<td>60 kg</td>
<td>120 kg</td>
</tr>
<tr>
<td>Rated speed</td>
<td>1 m/s</td>
<td>1 m/s</td>
<td>1 m/s</td>
</tr>
<tr>
<td>Repeatability RP</td>
<td>0.05 mm</td>
<td>0.07 mm</td>
<td>0.1 mm</td>
</tr>
<tr>
<td>Linear path accuracy AT</td>
<td>0.44 mm</td>
<td>0.83 mm</td>
<td>2.1 mm</td>
</tr>
<tr>
<td>Linear path repeatability RT</td>
<td>0.14 mm</td>
<td>0.29 mm</td>
<td>0.53 mm</td>
</tr>
<tr>
<td>Path velocity fluctuation FV</td>
<td>1.6%</td>
<td>2.2%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Minimum positioning time to 0.2 mm</td>
<td>0.21 sec</td>
<td>0.2 sec</td>
<td></td>
</tr>
<tr>
<td>Minimum positioning time on 350 mm linear path to 0.4 mm</td>
<td>0.55 sec</td>
<td>0.6 sec</td>
<td>0.23 sec</td>
</tr>
<tr>
<td>Average power consumed on ISO test paths</td>
<td>330W</td>
<td>700W</td>
<td>1,000W</td>
</tr>
</tbody>
</table>

"Rated speed" designates test speed, according to the ISO standards.
The S4C is designed to the highest level of operational reliability. The electronics and drives are mounted in a shielded ventilated cabinet with the drives fully protected against dust and dirt. Separating the internal and external connections has meant that the basic unit is very well protected and rarely needs attention after initial installation. Multiple safety interlocks, error-recovery procedures and low energy consumption also improve reliability.

**Lowest energy consumption, longer working life**

The use of sealed drive units and the reduction of solder points by 35% increase reliability and reduce maintenance. The system has a high resistance to electromagnetic interference. Energy consumption is 50-70% that of other robot systems, achieved by the use of well balanced robot arms and an optimised drive-train design. This also results in less heat build up and lower noise levels. The electronics are designed to withstand cabinet temperatures up to 70°C and can operate at up to 52°C ambient temperature without extra cooling.

**User safety**

User safety is designed into the S4C, with multiple safety interlocks, easily accessible emergency stop, circuit status signals, 3-position enable device and the plain language text messages on the programmer unit. The operator can also be directed about appropriate recovery actions.

The twin channel safety circuit with supervision is continuously monitored and complies fully with international standards. Passwords protect the robot program from unauthorised interference. It is ABB’s ambition that our robot controllers will continue to hold a leading position in improving personnel safety. Safety aspects have a high priority in our development.

**Total Support**

As with all ABB Flexible Automation products the S4C is supported by a world wide organisation, round the clock. With local assistance never more than a phone call away. The local team is your guarantee that you get maximum availability from your robot systems.

The electronic design results in a clear and uncluttered layout for high reliability and easy access.
Technical data
S4C Industrial Robot Controller

PERFORMANCE

Controlled axes 12
Control principles Dynamic model
Self optimising
Completely coordinated
12 axes interpolation
7-frame coordinate chain
Corner path concept
Automatic singularity handling

Control hardware
Multi-processor system
32 bit with floating point
Up to 24 Mb RAM memory
RAM disk
Up to 35,000 instructions

Control software
Object-oriented design
High-level RAPID robot language
Portable, open, expandable
PC-DOS file format
RobotWare software products

ELECTRICAL CONNECTIONS

Power supply voltage
200-600 V, 50-60 Hz
Transformer included

PHYSICAL

Cabinet size (H x W x D)
950 x 800 x 540 mm

Weight
240 kg

Cabinet variants
For process hardware

Lifting eyes
Can be removed

Wheels
Can be mounted

ENVIRONMENT

Ambient temperature
5-52°C

Relative humidity
max 95%

Form of protection
IP 54

EMC
Immune and emission-free

USER INTERFACES

Control panel
On cabinet or external

Control pendant
Portable and light
Joystick and keypad
5 user-designated keys
Display 16 lines x 40 characters
Windows-style communication
Emergency stop
All programming functions available

PC
Connection for PC
PC monitoring and control

Off-line
"S4 software on a PC"
DeskWare™ software for PC
Off-line ProgramMaker™
Virtual robot on PC
RMS from simulation companies
QuickTeach™ training on PC

Languages
Choice between 10 national languages for MMC and Manuals
Possibility to add user dialogues and references

Maintenance
LEDs and test points for electronic software
Recovery procedures
Logging with clock

Safety
Safety and emergency stops
Software functions
Passwords
2-channel safety circuits with supervision
3-position enable device

MACHINE INTERFACES

Digital inputs/outputs
up to 512 signals, 24V DC
120V AC or relay outputs

Analogue inputs/outputs
up to 129 signals ±10V ±20 mA

Network
Ethernet (10 Mbit/s per second)

Fieldbuses
Allen Bradley PLC
CAN
Interbus-S
Profibus

Process interfaces
Media and signals for upper arm
Space in controller for equipment

Robot vision
OptiMaster integrated

Diode drive
For 3.5 MB-DOS

SENSOR INTERFACES

Search stop with automatic program shift

Vision system

Steer tracking

Contour tracking

Conveyor following

USER DEFINED FUNCTIONALITY

Pull-down menus, dialogues and joystick for robot motion,
function keys and windows
Cut-and-paste, copy, delete, search, change functions, undo
Manager functions for different user needs
File handling
RAPID — powerful and open robot language
Process/Ware, application packages
Motion to a position or fly-by at a defined distance
Linear, joint and circular interpolation
Mirror function
Soft servo function
Unlimited rotating axes 4 and 6
Restart on path
Forward/backward/simulated wait and input testing
Multi-tasking functions
Concurrent I/O function
Independent motion of external axes
Position fixed I/O function
Master-slave functions
Real-time clock function
Hot-edit functions
Unlimited number of data

PROGRAM FEATURES

Error handling

Reach monitoring

Corner paths

Start-up sequences

I/O and instruction pick lists

Predefined data

Robot configuration

Process interfaces

User-defined functions

Error handling

Data and dimensions may be changed without notice.