

## 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.*

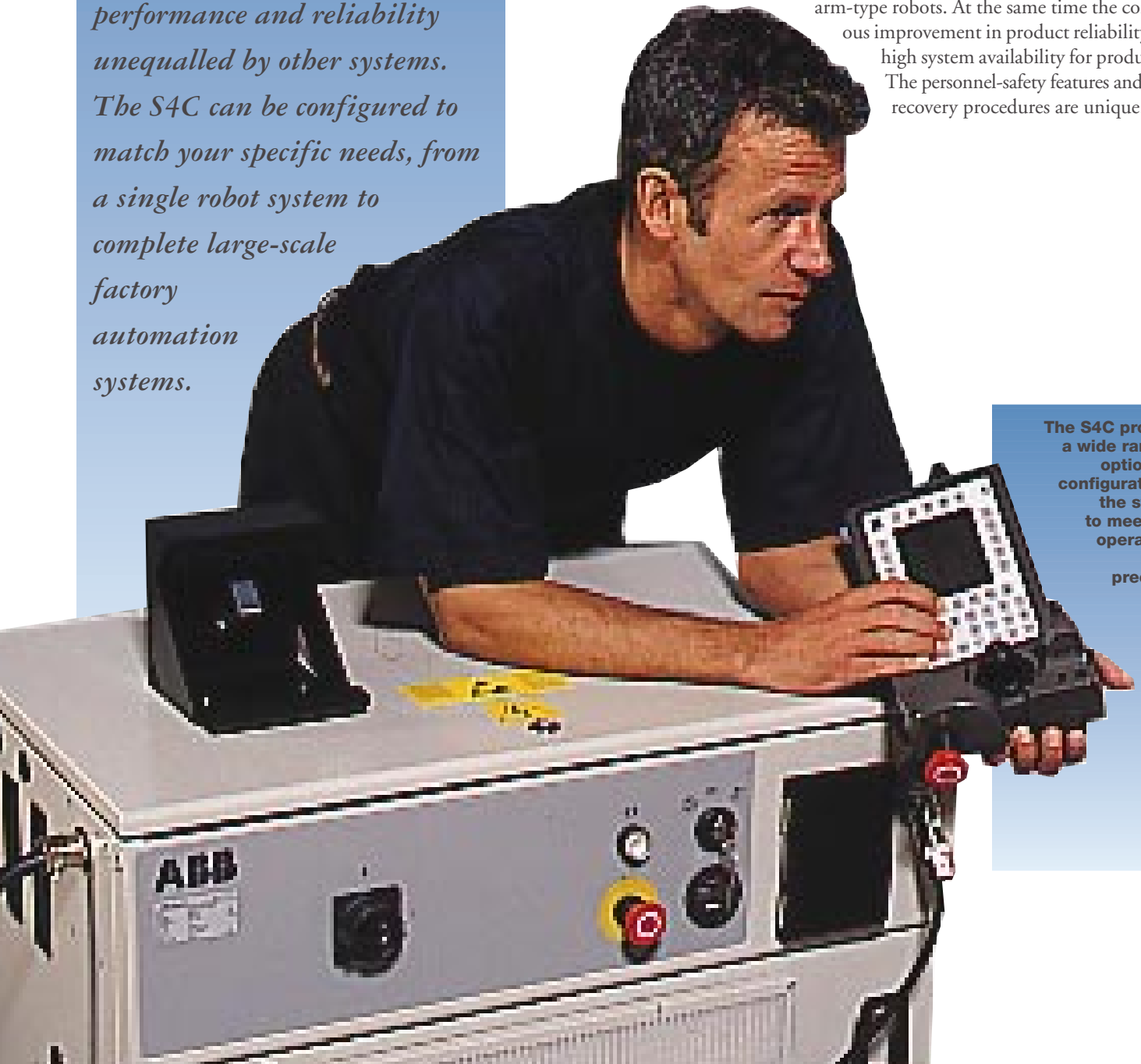
The S4C is a compact, highly configurable, modular system – hence the designation "C", that will deliver superior performance in your applications. Making certain that you get the best from your robot installations, while allowing plenty of opportunity for expansion, development and change in the future.

## **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.**



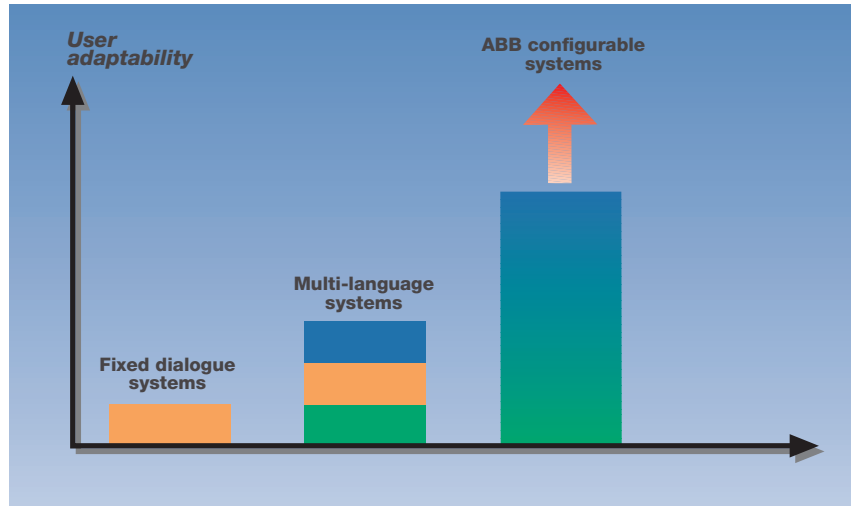
## A fully adaptable system for different user's needs

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.

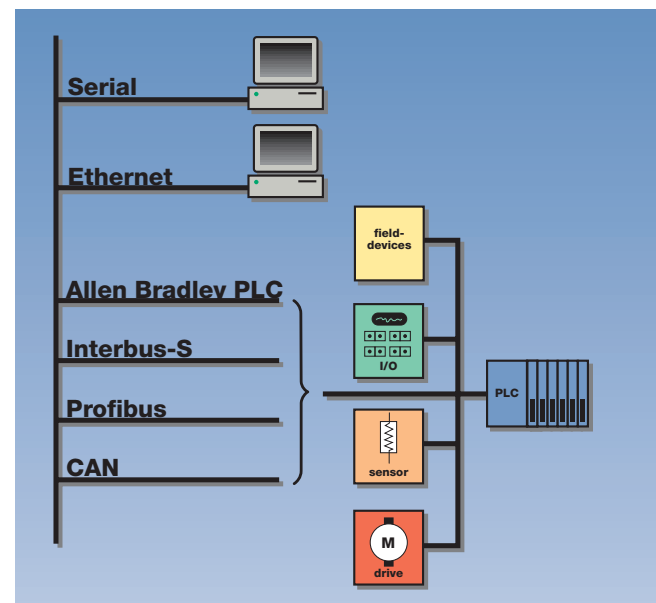


The S4C software is highly configurable. This ensures that each user can be provided with optimum functionality adapted to their needs. This overcomes the many limitations of fixed dialogue systems and the limited adaptability of multi-language software systems.

The S4C is an integrated solution for efficient production with extensive configuration and interfacing capabilities.

## Complete process control

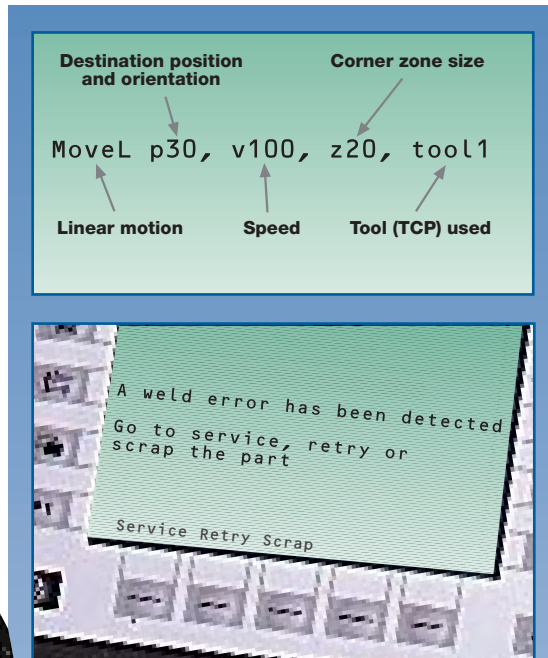
Industries and applications	Equipment	Operating functions	Management functions	Programming functions
<b>Body in White</b> Spot welding Material handling Arc welding Sealing Press tending	<b>Robots</b> IRB 1400 IRB 2400 IRB 4400 IRB 6400 IRB 5400 IRB 8400	Start-up procedures Operator dialogues Function keys Hot editing Error messages Error recovery	Supervision Control & communication Fault handling Process logging	Start-up and configuration Motion instructions Functions and procedures Routine parameters Arithmetic and logical expressions Arrays of up to three dimensions Modular programs Global and local data and routines Pick lists Program management Editing Testing procedures
<b>Consumer Goods</b> Picking Packing Palletising	<b>Manipulators</b> Track motions Process equipment			
<b>Foundry</b> Material handling Machine tending Spraying Ladelling	<b>Sensors</b> Communication RobotWare™ software			
<b>Metal Fabrication</b> Arc welding Painting Machine tending Polishing				



# Highly adaptable in hardware and software to your specific needs

Every motion instruction is complete and the layout is easy to understand. This reduces the risk of programming faults, and increases the re-usability of the instructions.

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

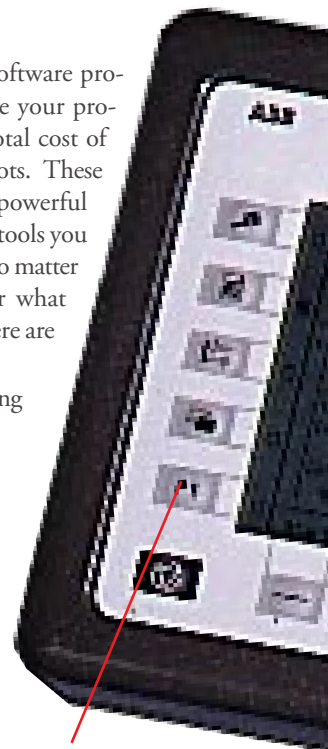
RobotWare is a family of software products designed to increase your productivity and lower your total cost of owning and operating robots. These products represent the most powerful set of robot tools available – tools you can depend on to help you, no matter what job you are doing or what your experience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

**BaseWare™**; robot operating system and communication software,

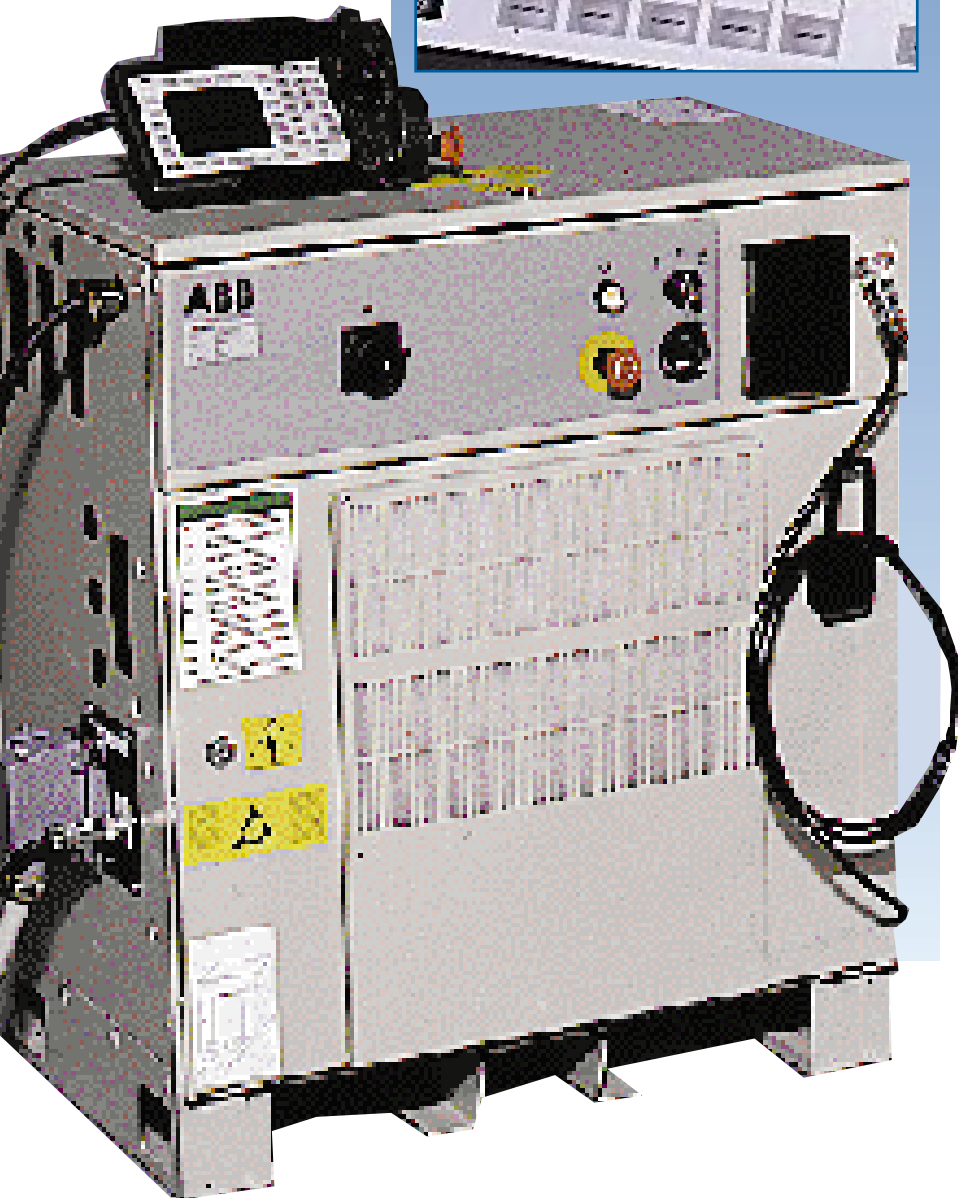
**DeskWare™**; off-line user training and support PC software,

**FactoryWare™**; on-line user adapted functionality PC software,

**ProcessWare™**; ArcWare, SpotWare, GlueWare etc.



Customer designated key



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.

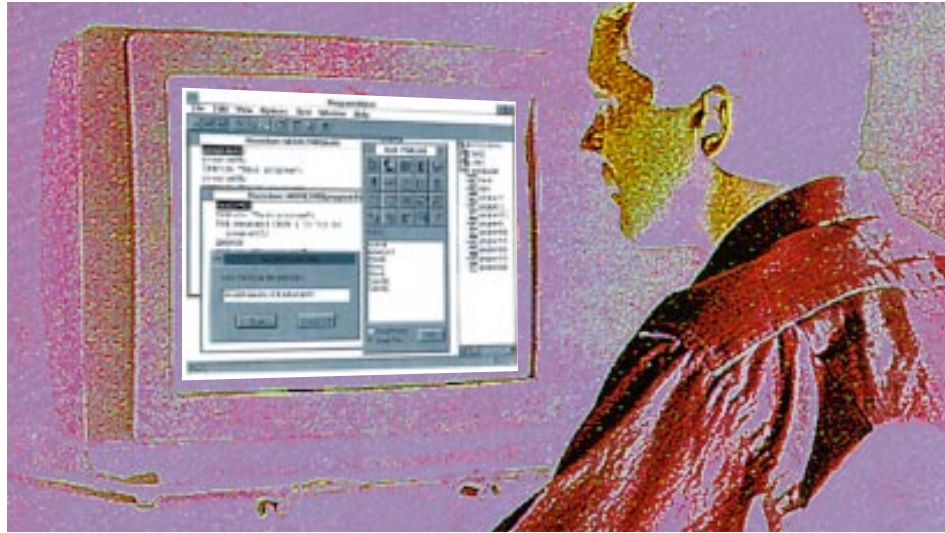


## Your robot software on your desktop

DeskWare™ software provides powerful tools for off-line 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.



**Ergonomically designed casing makes the control pendant easy to handle. Equipped with large clearly marked keys for easy reading in shopfloor conditions.**

**Displays are adapted to user's needs.**

**Five customer designated keys allow local command structures and actions.**

**3-position enabling device and hold-to-run device.**

**Joystick for axes jogging while keeping your eye on the robot.**

**Emergency stop conveniently situated for rapid access.**

**Back-lit LCD screen provides clear messages adapted to the actual installation and local language.**

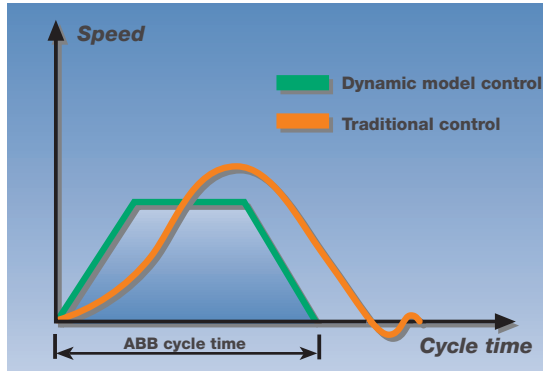
**The control pendant is conveniently sized for ease of use and lightweight (<1 kg) to avoid operator fatigue.**



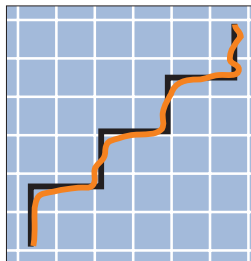
# The fastest cycle times and the highest accuracy

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.

Optimised 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.



The unique self-optimising dynamic model control ensures that at least one robot axis is always running at maximum torque. This results in the fastest TCP acceleration and deceleration. Robot cycle times are the fastest in the industry, and do not depend on individual axis' speeds.



Traditional robot control

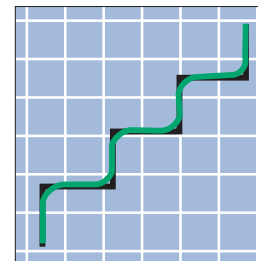
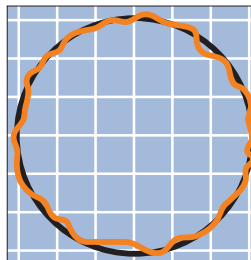


ABB dynamic model control

Robot making a zig-zag path at 450 mm/s, corner radius 20 mm.



Traditional robot control

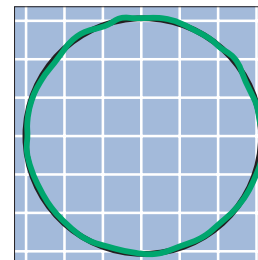
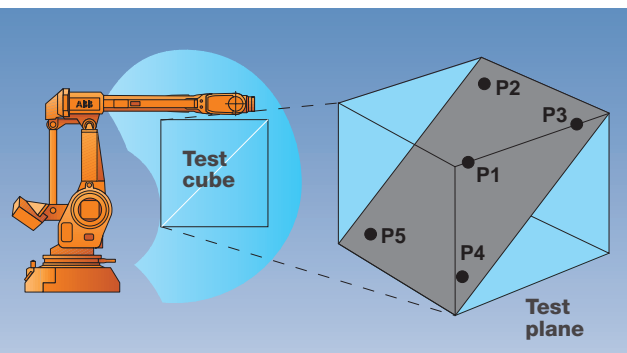


ABB dynamic model control

Robot making a 30 mm circle at 150 mm/s.



Average values of tests carried out on the inclined ISO test plane with all robot axes moving.

## Examples of ISO test results at rated load and speed

ROBOT TYPE	IRB 2400/10	IRB 4400/60	IRB 6400/2.4-120
Rated load	10 kg	60 kg	120 kg
Rated speed	1 m/s	1 m/s	1 m/s
Repeatability RP	0.05 mm	0.07 mm	0.1 mm
Linear path accuracy AT	0.46 mm	0.83 mm	2.1 mm
Linear path repeatability RT	0.14 mm	0.29 mm	0.53 mm
Path velocity fluctuation FV	1.6%	2.2%	2.4%
Minimum positioning time	to 0.2 mm	to 0.4 mm	to 0.4 mm
on 35 mm linear path	0.21 sec	0.2 sec	0.23 sec
on 350 mm linear path	0.55 sec	0.6 sec	0.59 sec
Average power consumed on ISO test paths	330W	700W	1,000W

"Rated speed" designates test speed, according to the ISO standards.

# Superior reliability and safety

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.

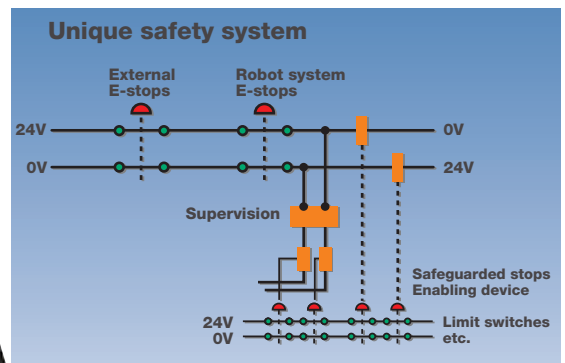
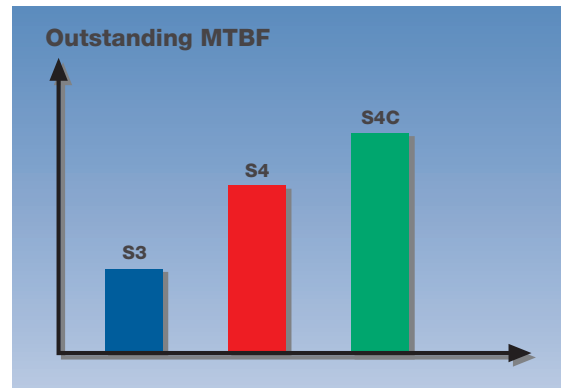
## Total Support

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.

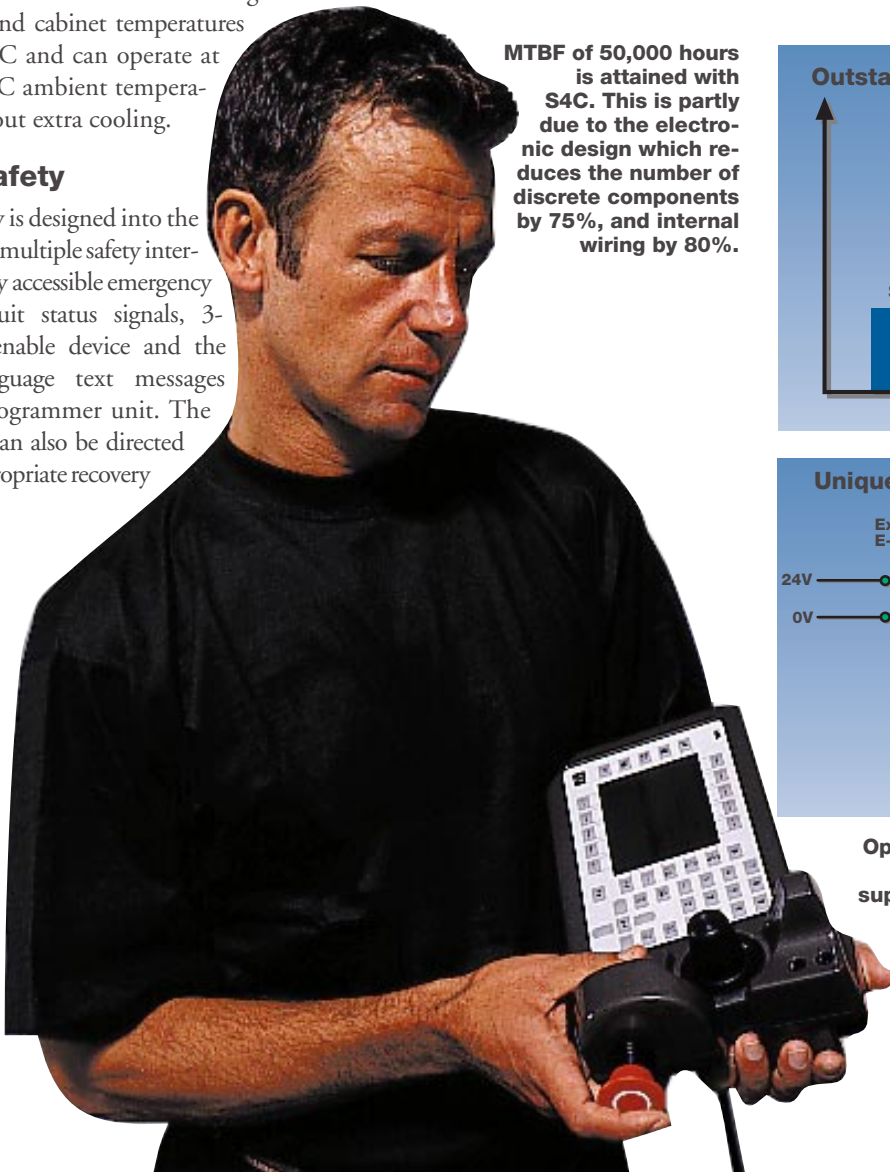


The electronic design results in a clear and uncluttered layout for high reliability and easy access.

MTBF of 50,000 hours is attained with S4C. This is partly due to the electronic design which reduces the number of discrete components by 75%, and internal wiring by 80%.



Operator and workplace safety is a primary concern. Two-channel circuits with supervision make the S4C one of the safest robot controllers in the field.





# 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

Supply voltage	200-600 V, 50-60 Hz Transformer included
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### PHYSICAL

Cabinet size (H x W x D)	950 x 800 x 540 mm same size for complete robot range
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 RRS 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 boards Diagnostic software Recovery procedures Logging with clock

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

Digital inputs/outputs	up to 512 signals, 24V DC 120V AC or relay outputs
Analogue inputs/outputs	up to 120 signals ±10V ±20 mA
Serial channels	RS 232 and RS 485
Network	Ethernet (10 Mbits 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
Diskette drive	For 3.5" MS-DOS

### SENSOR INTERFACES

Search stop with automatic program shift
Vision system
Seam tracking
Contour tracking
Conveyor following

### USER DEFINED FUNCTIONALITY

Program instructions
Operator dialogues
Names for all objects and data
I/O and instruction pick lists
Predefined data
Robot configuration
Start-up sequences
Corner paths
Process monitoring
Event logging
Diagnostics, error messages
Error handling

### PROGRAM FEATURES

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
ProcessWare, application software 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

Data and dimensions may be changed without notice.



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