ROBOTICS

Product manual

Arc welding equipment for IRB 1520ID

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Product manual

Arc welding equipment for IRB 1520ID

IRC5

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Revision: B

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Additional copies of this manual may be obtained from ABB.

Original instructions.

ABB AB, Robotics
Robotics and Motion
Se-721 68 Västerås
Sweden

Table of contents

Overview of this manual

About this manual

This manual contains instructions for:

- electrical installation and configuration of the welding equipment
- maintenance of the welding equipment.

Usage

This manual should be used during:

- installation
- maintenance work

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

Maintenance/repair/installation personnel working with an ABB Robot must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.

Organization of chapters

The manual is organized in the following chapters:

Chapter	Contents
Safety, service	Safety information that must be read through before performing any installation or service work on robot. Contains general safety aspects as well as more specific information on how to avoid personal injuries and damage to the product.
Technical description	Overview of the welding equipment.
Installation	Required information about electrical installation of the welding equipment.
Operation	Programming instructions for the power source and the wire feeder unit.
Maintenance	Procedures that describe how to perform maintenance of the welding equipment.

References

Documentation referred to in the manual, is listed in the table below.

Document name	Document ID	
Product manual - IRB 1520	*3HAC043435-001*	
Circuit diagram - IRB 1520	*3HAC039498-007*	
Product specification - IRB 1520	*3HAC043437-001*	

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Document name	Document ID	
Operating manual - General safety information [i]	*3HAC031045-001*	
Application manual - Torch services	*3HAC050981-001*	
Product manual - IRC5	*3HAC021313-001*	
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*	
Operating manual - KempArc SYN 300/400/500, DT 400	*1920130 -1*	

[i] This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

Revisions

Revision	Description
-	First edition.
A	This revision contains the following updates: • The lower feed rollers in the wire feeder system are redesigned to contain one groove only, see *Wire feeder system on page 42* and *Wire feed unit on page 73*.
B	This revision contains the following updates: • Minor corrections.

1 Safety

1.1 Introduction to safety information

Overview

The safety information in this manual is divided into the following categories:

- General safety aspects, important to attend to before performing any service work on the robot. These are applicable for all service work and are found in *General safety information on page 10*.
- Safety signals and symbols shown in the manual and on the robot, warning for different types of dangers, are found in *Safety signals and symbols on page 25*.
- Specific safety information, pointed out in the procedures. How to avoid and eliminate the danger is either described directly in the procedure, or in specific instructions in the section *Safety related instructions on page 27*.

1.2 General safety information

1.2.1 Introduction to general safety information

Definitions

This section details general safety information for personnel performing installation, maintenance and repair work.

Sections

The general safety information is divided into the following sections.

Section	Examples of content
Safety in the robot system on page 11	This section describes the following: • safety, service • limitation of liability • related information
Protective stop and emergency stop on page 13	This section describes protective stop and emergency stop.
Safety risks on page 14	This section lists dangers relevant when working with the product. The dangers are split into different categories. • safety risks during installation or service • risks associated with live electrical parts
Safety actions on page 22	This section describes actions which may be taken to remedy or avoid dangers. • fire extinguishing • safe use of the teach pendant or jogging device

1.2.2 Safety in the robot system

Validity and responsibility

The information does not cover how to design, install and operate a complete system, nor does it cover all peripheral equipment that can influence the safety of the entire system. To protect personnel, the complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

The users of ABB industrial robots are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that the safety devices necessary to protect people working with the robot system are designed and installed correctly. Personnel working with robot must be familiar with the operation and handling of the industrial robot as described in the applicable documents, for example:

- *Operating manual - IRC5 with FlexPendant*
- *Operating manual - General safety information* [I]
- *Product manual*

[I] This manual contains all safety instructions from the product manuals for the robots and the controllers.

The robot system shall be designed and constructed in such a way as to allow safe access to all areas where intervention is necessary during operation, adjustment, and maintenance.

Where it is necessary to perform tasks within the safeguarded space there shall be safe and adequate access to the task locations.

Users shall not be exposed to hazards, including slipping, tripping, and falling hazards.

Connection of external safety devices

Apart from the built-in safety functions, the robot is also supplied with an interface for the connection of external safety devices. An external safety function can interact with other machines and peripheral equipment via this interface. This means that control signals can act on safety signals received from the peripheral equipment as well as from the robot.

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the industrial robot will not cause injury or damage even if all safety instructions are complied with.

Related information

Type of information	Detailed in document	Section
Installation of safety devices	*Product manual for the robot*	Installation and commissioning
Changing operating modes	*Operating manual - IRC5 with FlexPendant*	Operating modes

Continues on next page

1.2.2 Safety in the robot system
Continued

Type of information	Detailed in document	Section
Restricting the working space	*Product manual for the robot*	Installation and commissioning
Load limits for tools and workpieces	*Product specification for the robot*	Load diagrams
Configuration of safety module (requires Functional safety options)	*Application manual - Functional safety and SafeMove*	

1.2.3 Protective stop and emergency stop

Overview

The protective stops and emergency stops are described in the product manual for the controller.

1.2.4 Safety risks

1.2.4.1 Safety risks during installation and service work on manipulators

Overview

This section includes information on general safety risks to be considered when performing installation and service work on the manipulator.

These safety instructions have to be read and followed by any person who deals with the installation and maintenance of the manipulator. Only persons who know the robot and are trained in the operation and handling of the manipulator are allowed to maintain the manipulator. Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to install, maintain, repair, or use the manipulator.

The integrator of the final application is required to perform an assessment of the hazards and risks (HRA).

General risks during installation and service

- The instructions in the product manual in the chapters *Installation and commissioning*, and *Repair* must always be followed.
- Emergency stop buttons must be positioned in easily accessible places so that the robot can be stopped quickly.
- Those in charge of operations must make sure that safety instructions are available for the installation in question.
- Those who install or service/maintain the robot must have the appropriate training for the equipment in question and in any safety matters associated with it.

Spare parts and special equipment

ABB does not supply spare parts and special equipment which have not been tested and approved by ABB. The installation and/or use of such products could negatively affect the structural properties of the robot and as a result of that affect the active or passive safety operation. ABB is not liable for damages caused by the use of non-original spare parts and special equipment. ABB is not liable for damages or injuries caused by unauthorized modifications to the robot system.

Personal protective equipment

Always use suitable personal protective equipment, based on the risk assessment for the robot installation.

Nation/region specific regulations

To prevent injuries and damages during the installation of the robot, the regulations applicable in the country concerned and the instructions of ABB Robotics must be complied with.

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Non-voltage related risks

- Make sure that no one else can turn on the power to the controller and robot while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.
- Safety zones, which must be crossed before admittance, must be set up in front of the robot's working space. Light beams or sensitive mats are suitable devices.
- Turntables or the like should be used to keep the operator out of the robot's working space.
- If the robot is installed at a height, hanging, or other than standing directly on the floor, there may be additional risks than those for a robot standing directly on the floor.
- The axes are affected by the force of gravity when the brakes are released. In addition to the risk of being hit by moving robot parts, there is a risk of being crushed by the parallel arm (if there is one).
- Energy stored in the robot for the purpose of counterbalancing certain axes may be released if the robot, or parts thereof, are dismantled.
- When dismantling/assembling mechanical units, watch out for falling objects.
- Be aware of stored heat energy in the controller.
- Never use the robot as a ladder, which means, do not climb on the motors or other parts during service work. There is a serious risk of slipping because of the high temperature of the motors and oil spills that can occur on the robot. There is also a risk of the robot being damaged.

To be observed by the supplier of the complete system

When integrating the robot with external devices and machines:

- The supplier of the complete system must ensure that all circuits used in the safety function are interlocked in accordance with the applicable standards for that function.
- The supplier of the complete system must ensure that all circuits used in the emergency stop function are interlocked in a safe manner, in accordance with the applicable standards for the emergency stop function.

Complete robot

Safety risk	Description
Hot components!	**CAUTION** Motors and gearboxes are HOT after running the robot! Touching motors and gearboxes may result in burns! With a higher environment temperature, more surfaces on the manipulator will get HOT and may also result in burns.

Continues on next page

1.2.4.1 Safety risks during installation and service work on manipulators
Continued

Safety risk	Description
Removed parts may result in collapse of the robot!	**WARNING** Take any necessary measures to ensure that the robot does not collapse as parts are removed. For example, secure the lower arm according to the repair instruction if removing the axis-2 motor.
Removed cables to the measurement system	**WARNING** If the internal cables for the measurement system have been disconnected during repair or maintenance, then the revolution counters must be updated.

Cabling

Safety risk	Description
Cable packages are sensitive to mechanical damage!	**CAUTION** The cable packages are sensitive to mechanical damage. Handle the cable packages and the connectors with care in order to avoid damage.

1.2.4.2 CAUTION - Hot parts may cause burns!

Description

During normal operation, many robot parts become hot, especially the drive motors and gearboxes. Sometimes areas around these parts also become hot. Touching these may cause burns of various severity.

Because of a higher environment temperature, more surfaces on the robot get hot and may result in burns.

There is also a risk of fire if flammable materials are put on hot surfaces.

Elimination

The following instructions describe how to avoid the dangers specified above:

	Action	Information
1	Always use your hand, at some distance, to feel if heat is radiating from the potentially hot component before actually touching it.	
2	Wait until the potentially hot component has cooled if it is to be removed or handled in any other way.	
3	Do not put anything on hot metal surfaces, e.g. paper or plastic.	

1.2.4.3 Safety risks related to tools/work pieces

Safe handling

It must be possible to safely turn off tools, such as milling cutters, etc. Make sure that guards remain closed until the cutters stop rotating.

It should be possible to release parts by manual operation (valves).

Safe design

Grippers/end effectors must be designed so that they retain work pieces in the event of a power failure or a disturbance to the controller.

Unauthorized modifications of the originally delivered robot are prohibited. Without the consent of ABB it is forbidden to attach additional parts through welding, riveting, or drilling of new holes into the castings. The strength could be affected.

CAUTION

Ensure that a gripper is prevented from dropping a work piece, if such is used.

1.2.4.4 Safety risks during operational disturbances

General

- The industrial robot is a flexible tool that can be used in many different industrial applications.
- All work must be carried out professionally and in accordance with the applicable safety regulations.
- Care must be taken at all times.

Qualified personnel

Corrective maintenance must only be carried out by qualified personnel who are familiar with the entire installation as well as the special risks associated with its different parts.

Extraordinary risks

If the working process is interrupted, extra care must be taken due to risks other than those associated with regular operation. Such an interruption may have to be rectified manually.

1.2.4.5 Risks associated with live electric parts

Voltage related risks, general

Work on the electrical equipment of the robot must be performed by a qualified electrician in accordance with electrical regulations.

- Although troubleshooting may, on occasion, need to be carried out while the power supply is turned on, the robot must be turned off (by setting the main switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The main supply to the robot must be connected in such a way that it can be turned off from outside the working space of the robot.
- Make sure that no one else can turn on the power to the controller and robot while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.

The necessary protection for the electrical equipment and robot system during construction, commissioning, and maintenance is guaranteed if the valid regulations are followed.

All work must be performed:

- by qualified personnel
- on machine/robot system in deadlock
- in an isolated state, disconnected from power supply, and protected against reconnection.

Voltage related risks, IRC5 controller

A danger of high voltage is associated with, for example, the following parts:

- Be aware of stored electrical energy (DC link, Ultracapacitor bank unit) in the controller.
- Units such as I/O modules, can be supplied with power from an external source.
- The main supply/main switch
- The transformers
- The power unit
- The control power supply (230 VAC)
- The rectifier unit (262/400-480 VAC and 400/700 VDC. Note: capacitors!)
- The drive unit (400/700 VDC)
- The drive system power supply (230 VAC)
- The service outlets (115/230 VAC)
- The customer power supply (230 VAC)
- The power supply unit for additional tools, or special power supply units for the machining process.
- The external voltage connected to the controller remains live even when the robot is disconnected from the mains.
- Additional connections.

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Voltage related risks, robot

A danger of low voltage is associated with the robot in:

- The power supply for the motors (up to 800 VDC).
- The user connections for tools or other parts of the installation (max. 230 VAC).

Voltage related risks, tools, material handling devices, etc.

Tools, material handling devices, etc., may be live even if the robot system is in the OFF position. Power supply cables which are in motion during the working process may be damaged.

1.2.5 Safety actions

1.2.5.1 Safety fence dimensions

General

Install a safety cell around the robot to ensure safe robot installation and operation.

Dimensioning

The fence or enclosure must be dimensioned to withstand the force created if the load being handled by the robot is dropped or released at maximum speed. Determine the maximum speed from the maximum velocities of the robot axes and from the position at which the robot is working in the work cell (see the section *Robot motion* in the *Product specification*).

Also consider the maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the robot.

1.2.5.2 Fire extinguishing

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the robot or controller!

1.2.5.3 Enabling device and hold-to-run functionality

Three-position enabling device

The three-position enabling device is a manually operated, constant pressure push-button which, when continuously activated in one position only, allows potentially hazardous functions but does not initiate them. In any other position, hazardous functions are stopped safely.

The three-position enabling device is of a specific type where you must press the push-button only half-way to activate it. In the fully in and fully out positions, operating the robot is impossible.

Note

The three-position enabling device is a push-button located on the teach pendant which, when pressed halfway in, switches the system to MOTORS ON. When the enabling device is released or pushed all the way in, the manipulator switches to the MOTORS OFF state.

To ensure safe use of the teach pendant, the following must be implemented:

- The enabling device must never be rendered inoperational in any way.
- During programming and testing, the enabling device must be released as soon as there is no need for the robot to move.
- Anyone entering the working space of the robot must always hold the teach pendant. This is to prevent anyone else from taking control of the robot without his/her knowledge.

Hold-to-run function

The hold-to-run function allows movement when a button connected to the function is actuated manually and immediately stops any movement when released. The hold-to-run function can only be used in manual mode.

How to operate the hold-to-run function for IRC5 is described in *Operating manual - IRC5 with FlexPendant*.

1.3 Safety signals and symbols

1.3.1 Safety signals in the manual

Introduction to safety signals

This section specifies all dangers that can arise when doing the work described in the user manuals. Each danger consists of:

- A caption specifying the danger level (DANGER, WARNING, or CAUTION) and the type of danger.
- A brief description of what will happen if the operator/service personnel **do not** eliminate the danger.
- Instruction about how to eliminate danger to simplify doing the work.

Danger levels

The table below defines the captions specifying the danger levels used throughout this manual.

Symbol	Designation	Significance
 xx0200000022	DANGER	Warns that an accident *will* occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, and so on.
 xx0100000002	WARNING	Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0200000024	ELECTRICAL SHOCK	Warns for electrical hazards which could result in severe personal injury or death.
 xx0100000003	CAUTION	Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0200000023	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

Continues on next page

1.3.1 Safety signals in the manual
Continued

Symbol	Designation	Significance
 xx0100000004	NOTE	Describes important facts and conditions.
 xx0100000098	TIP	Describes where to find additional information or how to do an operation in an easier way.

1.4 Safety related instructions

1.4.1 DANGER - First test run may cause injury or damage!

Description

Since performing a service activity often requires disassembly of the robot, there are several safety risks to take into consideration before the first test run.

Elimination

Follow the procedure below when performing the first test run after a service activity, such as repair, installation, or maintenance.

DANGER

Running the robot without fulfilling the following aspects, may cause severe damage to the robot.

	Action
1	Remove all service tools and foreign objects from the robot and its working area.
2	Verify that the robot is secured to its position, see installation section in the product manual for the robot.
3	Verify that any safety equipment installed to secure the robot arm position or restrict the robot arm motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Install all safety equipment properly.
6	Make sure all personnel are standing at a safe distance from the robot, that is out of its reach behind safety fences, and so on.
7	Pay special attention to the function of the part that previously was serviced.

Collision risks

CAUTION

When programming the movements of the robot, always identify potential collision risks before the first test run.

1.4.2 DANGER - Make sure that the main power has been switched off!

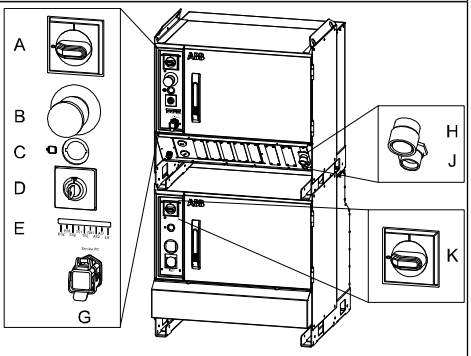
Description

Working with high voltage is potentially lethal. Persons subjected to high voltage may suffer cardiac arrest, burn injuries, or other severe injuries. To avoid these dangers, do not proceed working before eliminating the danger as detailed below.

Elimination, IRC5 Single Cabinet Controller

	Action	Note/illustration
1		

Elimination, IRC5 Dual Cabinet Controller

	Action	Note/illustration
1	Switch off the main switch on the Drive Module.	 xx0600002783 K: Main switch, Drive Module
2	Switch off the main switch on the Control Module.	A: Main switch, Control Module

1.5 Arc welding related safety

1.5.1 Special safety instructions

Welding robot system

The following points should be observed in all work in or around the welding robot system:

- Consider the welding robot equipment as a single unit.
- The welding robot system consists of many different parts, which in addition to the robot, also includes positioners and other peripheral equipment.
- The entire system communicates via electrical signals and can therefore bring about movements in completely different components to those directly affected.

Workplace

The following points should be observed in all work in or around the workplace:

- Make sure that the workplace is in order before the system is put into operation. If malfunctions are discovered on or in the system, these must be rectified before starting.
- Consult trained personnel or the system manager if your own knowledge is insufficient to implement the measures.

Before operation

The following points should be observed before putting the welding robot system into operation:

- All guards and all safety equipment must be fitted before the robot system is started.
- The safety equipment must not be disengaged, bypassed or in any other way modified so that it does not provide the intended protection.
- Test running with the operating mode selector (key switch) in the 100% position should only be carried out by qualified personnel who are aware of the risks this involves.

During operation

The following points should be observed when the welding robot system is in operation:

- Do not remain within the risk zone (the robot and positioner working area) when the system is operational. If it is absolutely essential that you remain within the risk zone in order to carry out the work, the following must be observed.
- Never work alone in the risk zone when the system is in operation. One person should stand outside the risk zone to stop the equipment if a hazard arises while work is being carried out inside the risk zone.
- Exercise extreme care when operating the robot/positioner. Always remember that these can perform unexpected movements when executing a program.

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1.5.1 Special safety instructions
Continued

Even when the robot system seems to perform the same movement pattern over and over again for an extended period, the pattern can suddenly change.

- Be aware that weld splatter represents a fire and burn risk

During maintenance work

The following points should be observed before beginning maintenance work:

- Bring the jogging device for the robot system with you when entering the risk zone so that no one else can start the robot system.
- Make sure to release the three-position enabling device when the robot or positioner does not need to be operated.
- The robot system will be in standby mode with the motors shut off. The operating mode selector (key switch) on the control cabinet's control panel will be in the "Manual reduced speed <250 mm/s" position, and the three-position enabling device must then be used to operate the robot system. In this mode the robot and positioner movements are limited to a speed of no more than 250 mm/s.

1.5.2 Protective equipment

General

Do not wear loose-fitting garments or belts, bracelets, etc., that can become entangled in the robot or positioner. Always use the prescribed personal protective equipment.

Personal protective equipment

Personnel should have the following protective equipment:

Equipment	Description
Safety goggles	Protect the eyes against loose particles, sharp edges and sharp components.
Welding helmet with welding glass	Protect the eyes and skin against radiation and burn injuries.
Dry and undamaged gloves	Protect against radiation and burn injuries, as well as electric shocks.
Dry and undamaged protective clothing	Protect against radiation and burn injuries, as well as electric shocks.
Shoes with insulated soles	Protect against radiation and burn injuries, as well as electric shocks.
Ear protection	Protects hearing when using certain welding settings.
Protective screens and curtains	Protect other persons located in the vicinity of the station.

1.5.3 Light barriers

Light barriers function

The light barriers in the robot system are used to stop the robot and positioner if anyone enters the risk zone where moving parts are activated. The light barriers can, where appropriate, be replaced by hatches, sliding doors or gates.

Pre reset

A pre-reset button is located inside the service area. It is used in connection with resetting the safety circuits for the light barriers. The pre-reset prevents unintentional starting when the operator is inside the service area.

	Action
1	Press the pre-reset button (this permits a pre-reset of the safety circuits for the light barriers of 10 seconds).
2	Press and hold the *start button (operator ready button)* on the operator panel within 10 seconds.

1.5.4 Risk of fire

WARNING

There is a risk of fire in connection with welding.

Safety measures

The following points should be observed:

- Observe local fire regulations for welding.
- Clean the area around the workplace regularly and ensure that the area is free of combustible material.
- Check that all connections in the welding current circuit are properly tightened. Poor contact can result in inferior welding results and a risk of fire.
- Check that the cables are correctly dimensioned. Cables that are underdimensioned can constitute a fire risk due to overheating.

Fire extinguishing

Use carbon dioxide (CO_2) if the equipment catches fire.

1.5.5 Risk of explosion

Gas cylinders

There is a great risk of the gas cylinders exploding in the event of a fire. Observe local safety instructions with regard to the handling and storing of gas cylinders.

1.5.6 Risk of electric shock

WARNING

The welding wire is live during the welding process even before the arc is ignited.

Safety measures

The following points should be observed:

- Do not mix up the phase and grounding conductors when connecting the equipment to the main supply.
- The workpiece, fixtures and positioner are usually in direct contact with the welding circuit, and should therefore be regarded as live.
- Do not touch live parts of the equipment with your bare hands or with damp gloves.
- Equip the operator station with an insulating mat.
- The welding circuit shall not be grounded without necessary measures being taken to ensure proper functioning of the grounding conductor.
- The welding circuit must not be broken during the welding process.

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2 Technical description

2.1 Overview of welding equipment

Content

The welding equipment is adapted to an industrial robot and is controlled by the IRC5 control system and Arc Welding software.

The welding equipment consists of:

- An external power source, installed between the robot and the controller.
- A wire feeder unit, installed on the robot.
- A bobbin, installed on the robot.

Usage

The welding equipment should only be used for MIG (Metal Inert Gas) and MAG (Metal Active Gas) welding. Only use the equipment according to the instructions in this manual.

WARNING

The equipment is not intended for use in explosive environments.

Note

ABB disclaims all responsibility and any claims for damages or warranty undertakings, if equipment is used in other areas than MIG/MAG welding

Accuracy

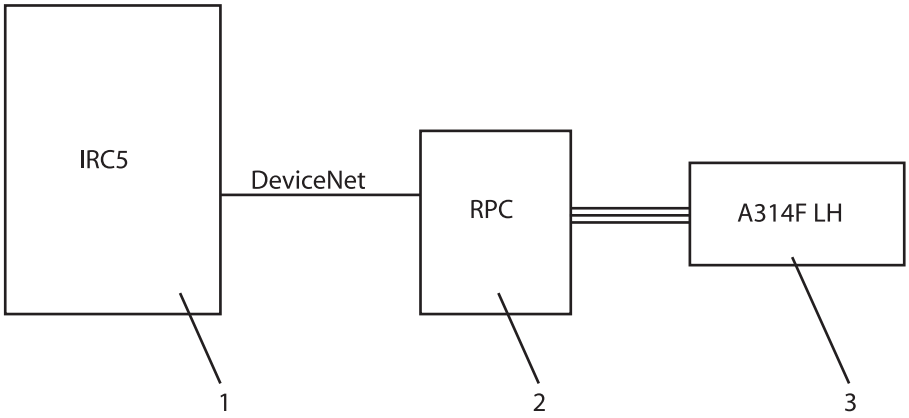
Fully digital communication by DeviceNet.

Safety

If an error occurs an error code is displayed on the FlexPendant to help the user to solve problems.

2.2 Principle design

Robot welding system



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1	Control module (IRC5)
2	Welding power source
3	Wire feeder unit (A314F LH)

Technical data

Together with the AW software in the robot, the welding equipment consists of and has the following characteristics:

Type	Description
Power source, RPC S Series / RPC P Series	400 A synergic and 350 A pulse power sources. Lightweight, compact and modular design. Synergic programs library for the most common materials. 90/100 memory channels for different welding parameters. SmarTac function as a standard feature.
Wire feeder system, A314F LH	Four wheel wire drive mechanism with metallic feed rolls. Gas valve. Speed range: 0 m/min. – 25 m/min.
Options	Weld guide Torch cleaner, TSC Wire cutter Automatic TCP-gauging BullsEye

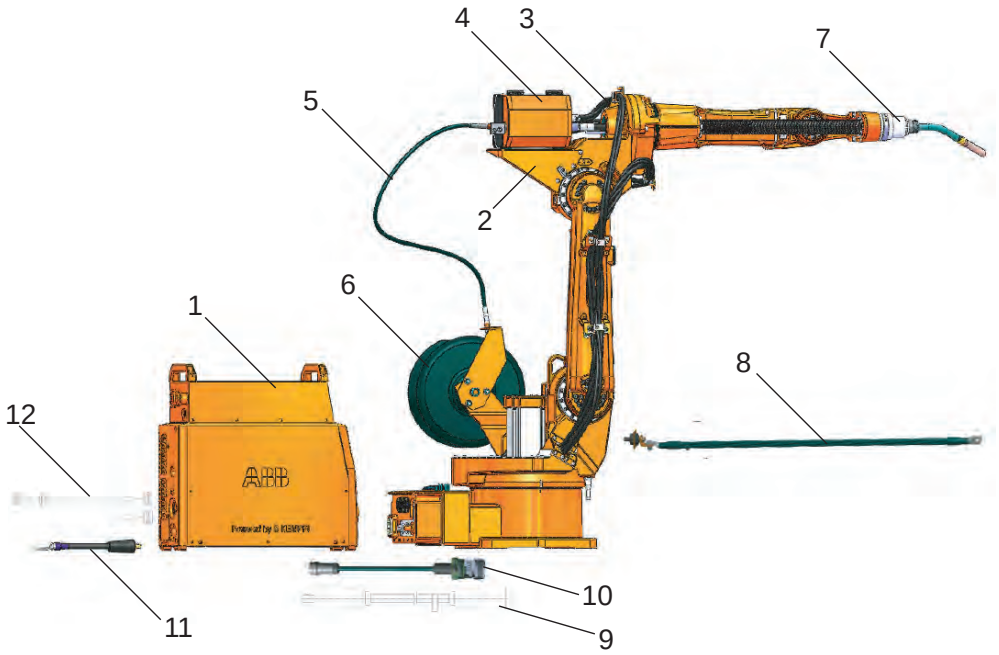
2.3 Components

Example of welding equipment

The welding equipment can include the following components:

- Welding power source.
- Wire feeder unit mounted on the robot arm and fitted with a Euro-socket for connecting the welding torch.
- Attachment for the wire feeder mechanism and cables.
- Hoses for gas and compressed air, as well as cables for signal and power supplies.
- Cable for the welding current.
- Cable for the power source.

Industrial robot with welding equipment



xx1100000485

1	Welding power source (RPC)
2	Attachment
3	Cable and Hose set
4	Wire feeder unit
5	Wire conduit
6	Bobin
7	Welding gun
8	Welding Base Cable Harness
9	Current cable
10	Welding signal Floor Cable

Continues on next page

2.3 Components
Continued

11	Returncable 95 mm²
12	Cable DeviceNet

Continues on next page

2.3.1 Power source

Welding applications

The RPC Series power sources are suitable for synergic MIG/MAG, synergic 1-MIG/MAG and basic MIG/MAG welding. The power sources support the three welding processes:

- Normal MIG welding
- 1-MIG welding (Default)
- Wise-MIG (Optional)

In normal MIG welding the wire-feed speed and the welding voltage are adjusted separately.

Unlike the above, 1-MIG and Wise-MIG processes are synergetic welding processes where the welding voltage and other welding parameters are interconnected so that the welding power and arc length are adjusted to attain optimal welding values.

The Wise-MIG process is an optional feature intended for welding automation. It must be acquired separately and is therefore not available in all configurations.

Further information

The power source is described more in detail in Operating manual - KempArc.

2.3.2 Wire feeder system

2.3.2.1 Overview

Usage

The wire feed system A314F LH is intended to be mounted directly on the robot, which results in a short cable bundle and a good wire feed. Furthermore, a smaller floor area is required.

> **Note**
>
> A314F LH should be used for gas arc welding

Bobbin

If a bobbin is used it may be necessary to adjust the brake hub, see *Adjusting the brake hub of the bobbin on page 60*.

Working area

The wire feeder system A314F LH meets Arc Welding and Application Equipment's recommended layout setup. This means that the robot has a full working area within a section of ±170° for A314F LH around axis 1.

The orientation of the bobbin and the wire conduit bracket should be adjusted according to the working range of axis 2 and axis 3. If not adjusted, the lifetime of the wire conduit will be reduced greatly due to sharp bends. The default orientation of the bobbin and the wire conduit bracket is upward. Adjust the orientation so that there doesn´t occur any sharp bends on the wire.

> **CAUTION**
>
> Great care should be exercised outside of this sector, for example when programming, otherwise the welding equipment can be damaged

Technical specifications

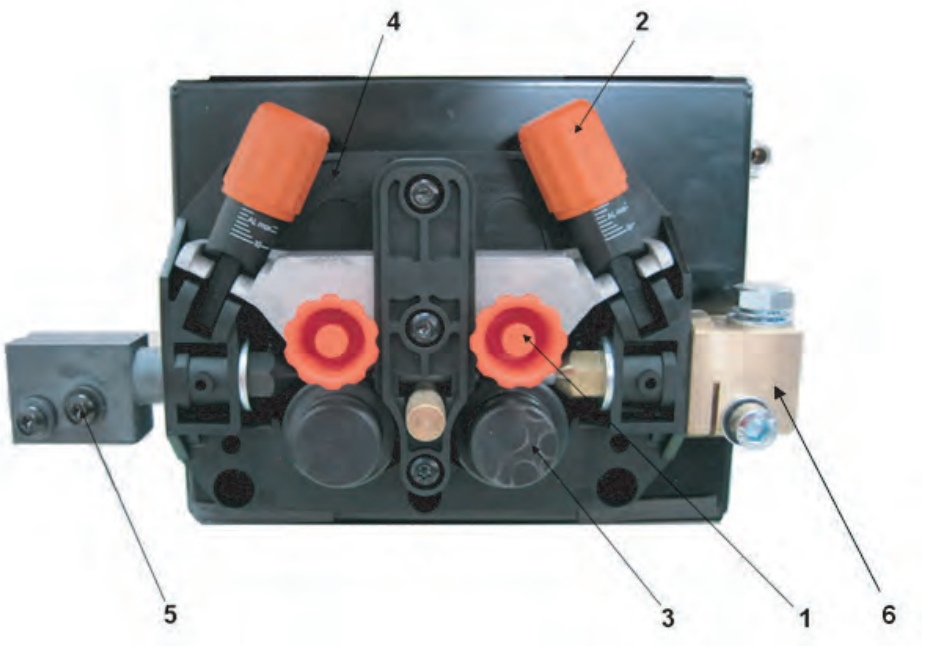
A314F LH	Data
Operating voltage	50 VDC
Rated power	100 W
Load ability 40°C 80% ED	600 A
Load ability 40°C 100% ED	500 A
Wire feeder speed	0 - 25 m / min
Diameter of filler wire, Fe, SS, Flux cored wire	0.8 - 1.6 mm
Diameter of filler wire, Al	1.0 - 1.6 mm
Welding gun connector	Binzel ROBO Power Connector (RPC)
Operating temperature range	-20ºC to +40ºC
EMC class	A

Continues on next page

A314F LH	Data
Protection class	IP23S
External dimensions	269 x 175 x 169 mm
Weight	3.6 kg

2.3.2.2 Wire feeder unit

Illustration



xx1100000398

1	Upper feed rollers
2	Adjuster screw
3	Lower feed rollers
4	Motor (On the back)
5	Screws
6	ROBO Torch connector

Feed rollers

Wire is fed using two pairs of feed rollers which are linked to each other. The two upper rollers are spring-loaded. The power from the motor is transferred to the rollers via a pinion on the motor shaft.

The pressure between the upper and lower rollers can be adjusted individually using an adjuster screw. All rollers are fitted with sleeve bearings. The lower feed rollers have a groove for one wire diameter. The default wire diameter is 1.2 mm. The whole rollers must be replaced if another wire diameter is used.

Motor

The motor is of a permanent magnetized type and is equipped with an optical tachometer meter for accurate speed control.

Continues on next page

Bobbin

When the bobbin is used the wire liner is fitted directly to the feed mechanism and is locked by screws.

Connections and switches on the wire feeder unit (Inlet side)

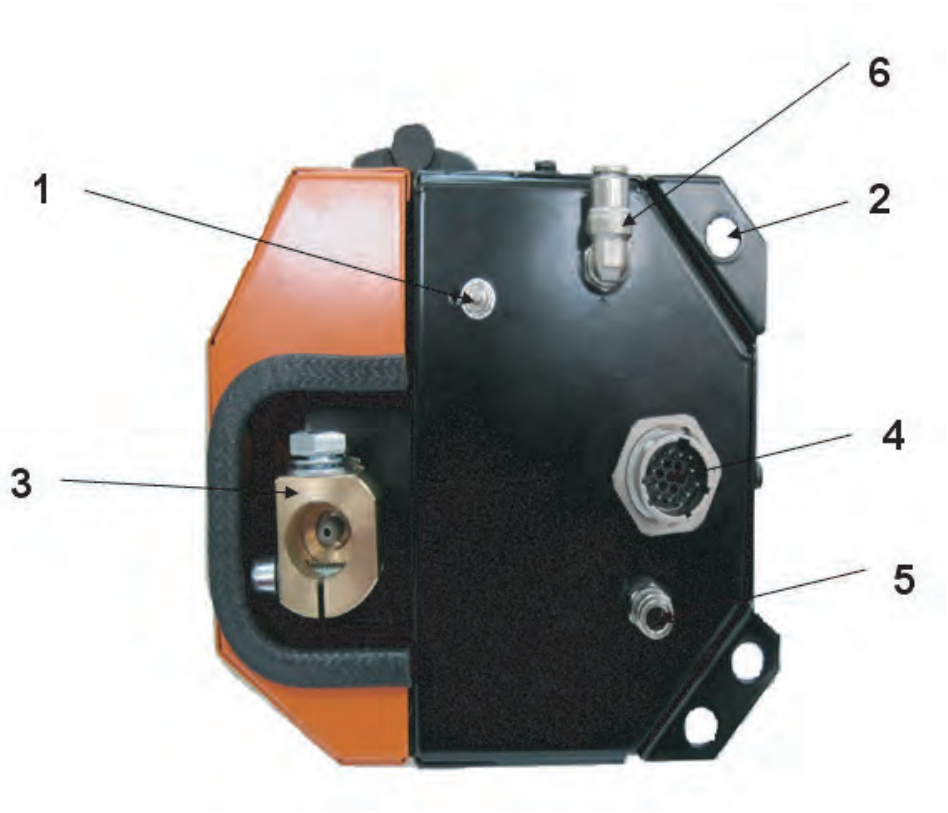
xx1100000412

1	Wire feed inlet

Continues on next page

2.3.2.2 Wire feeder unit
Continued

Connections and switches on the wire feeder unit (Outlet side)



xx1100000399

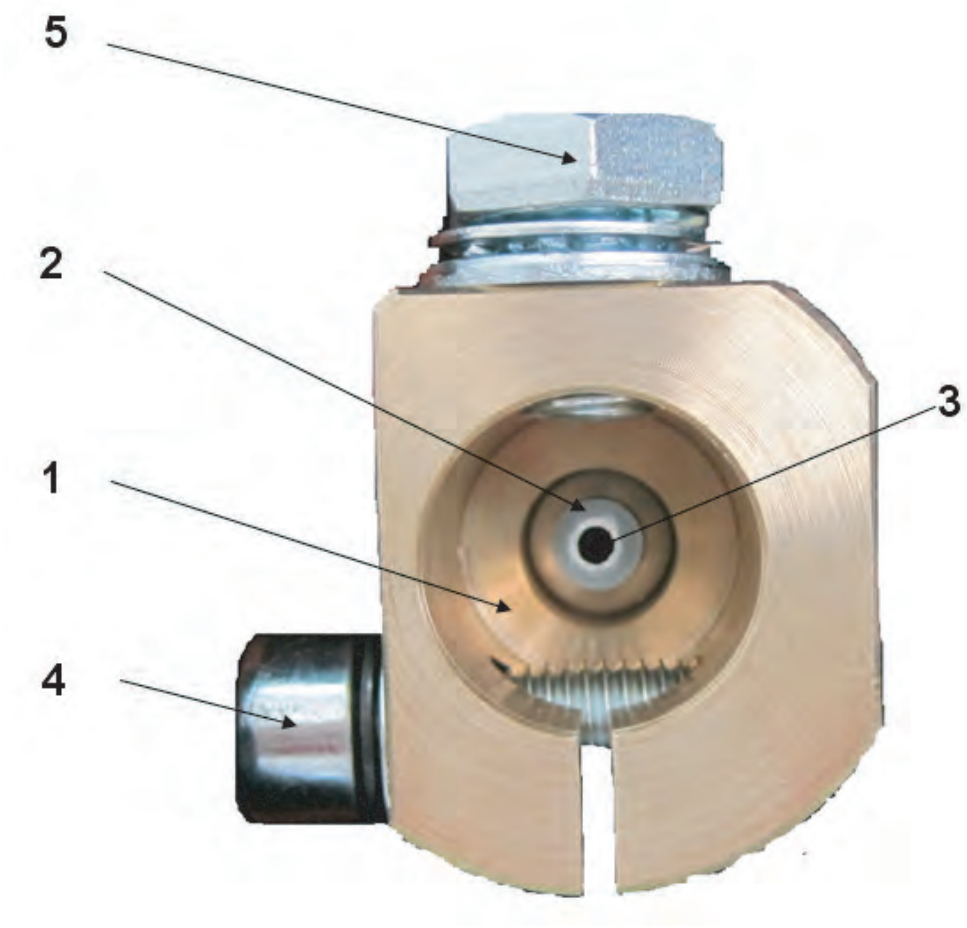
1	Wire in switch (Switch for manual wire feed (inch.)
2	Air connector (Compressed air connection to the welding torch)
3	Torch connector (Binzel ROBO Power Connector) connection for the welding torch.
4	Control connector
5	Shielding gas connector IN (for 8mm hose)
6	Shielding gas connector OUT (for 6mm hose)

Wire inch switch

When the switch is pressed the wire feeder motor starts but the gas valve does not open and the power source is not activated. The wire feed pace is 2 m/min for the first two seconds, and then 10 m/min. When the button is released, the wire feeder stops.

Continues on next page

Torch connector



xx1100000400

1	Hole for torch pin
2	Wire liner
3	Hole for wire
4	Lock screw for torch pin
5	Lock screw for cable lug

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3 Installation

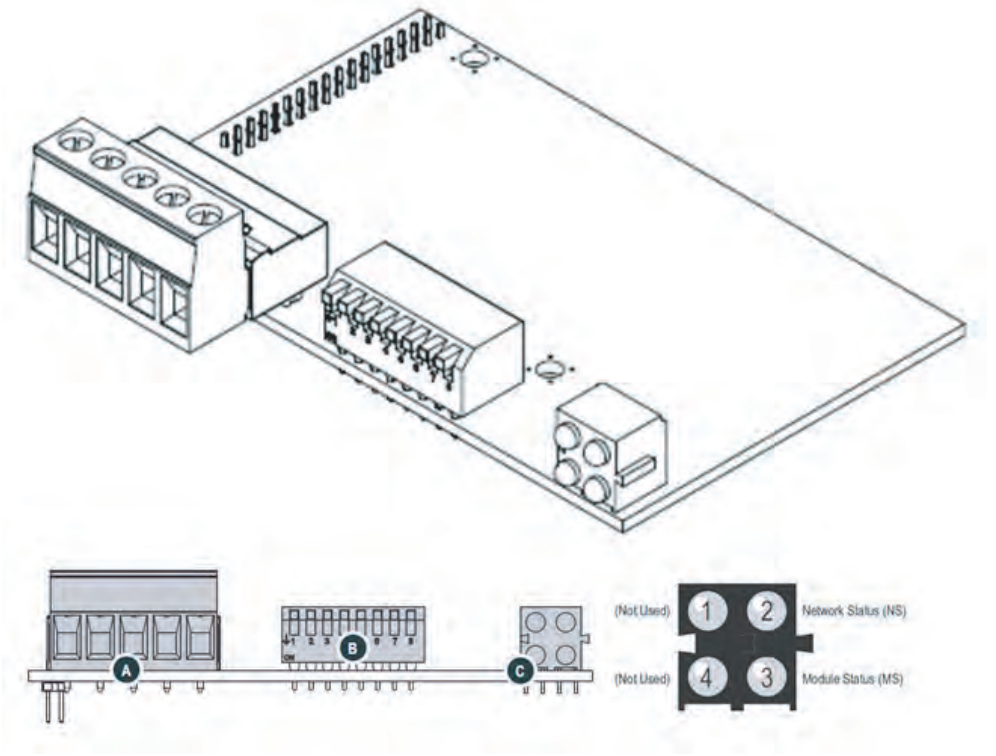
3.1 Connecting the welding equipment

3.1.1 Installing the DeviceNet card and cable

Overview

DeviceNet is used for communication between the robot controller IRC5 and the power source. The card is installed in the power source according to the Operating manual - KempArc. This section contains information about the DeviceNet card.

DeviceNet card design



xx1100000401

A	DeviceNet Connector
B	Configuration Switches
C	Network Status LEDs
1	(Not used)
2	Network Status (NS)
3	Module Status (MS)
4	(Not used)

Continues on next page

3.1.1 Installing the DeviceNet card and cable
Continued

DeviceNet connector

The module supports both 5.08 mmm and 3.84 mm pluggable screw connectors to board connector.

MAC ID and Baud rate configuration

On a DeviceNet network, each node must be assigned its own unique Mac ID. The Mac ID is a value between 0 and 63 used to identify each node. The Mac ID and Baud rate settings can be set using a physical DIP-switch.

Switches 1 and 2 specify the baud rate, while switches 3 through 8 specify the Mac ID.

S1	S2	Baudrate
OFF	OFF	125k
OFF	ON	250K
ON	OFF	500K
ON	ON	(reserved)

S3	S4	S5	S6	S7	S8	Mac ID
OFF	OFF	OFF	OFF	OFF	OFF	0
OFF	OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	OFF	ON	OFF	2
OFF	OFF	OFF	OFF	ON	ON	3
...	...	...	...	...	...	...
ON	ON	ON	ON	OFF	OFF	60
ON	ON	ON	ON	OFF	ON	61
ON	ON	ON	ON	ON	OFF	62
ON	ON	ON	ON	ON	ON	63

xx1100000409

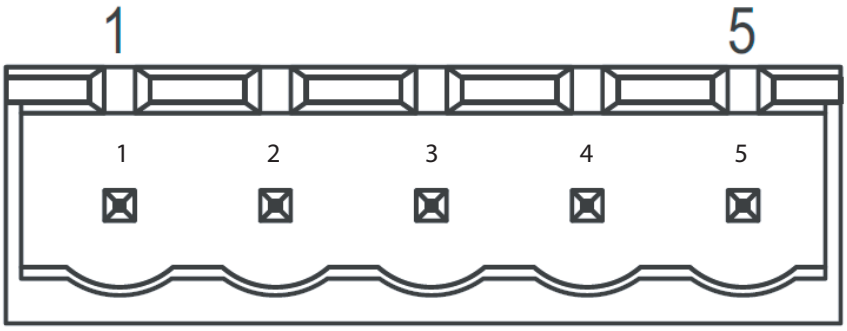
ABB Default configuration:

For the first power source: Baud rate: 500K Address: 30.

For the second power source: Baud rate: 500K Address: 31

For the third power source: Baud rate: 500K Address: 32

For the fourth power source: Baud rate: 500K Address: 33



xx1100000402

	Signal	Description
1	V-	Negative supply voltage (DC 0V)
2	CAN_L	CAN_L bus line
3	SHIELD	Cable shield
4	CAN_H	CAN_H bus line
5	V+	Positive supply voltage (DC 24V)

3.1.2 Installing the power source

Installing the power source

Refer to the Operating manual for the power source to:

	Action	Note
1	Locate the power source at an appropriate installation location.	
2	Connect the power source to the electric network.	
3	Connect the welding and earthing cables.	
4	Install the field bus card and the field bus cable (DeviceNet card and DeviceNet cable). Additional information is found in xx.	

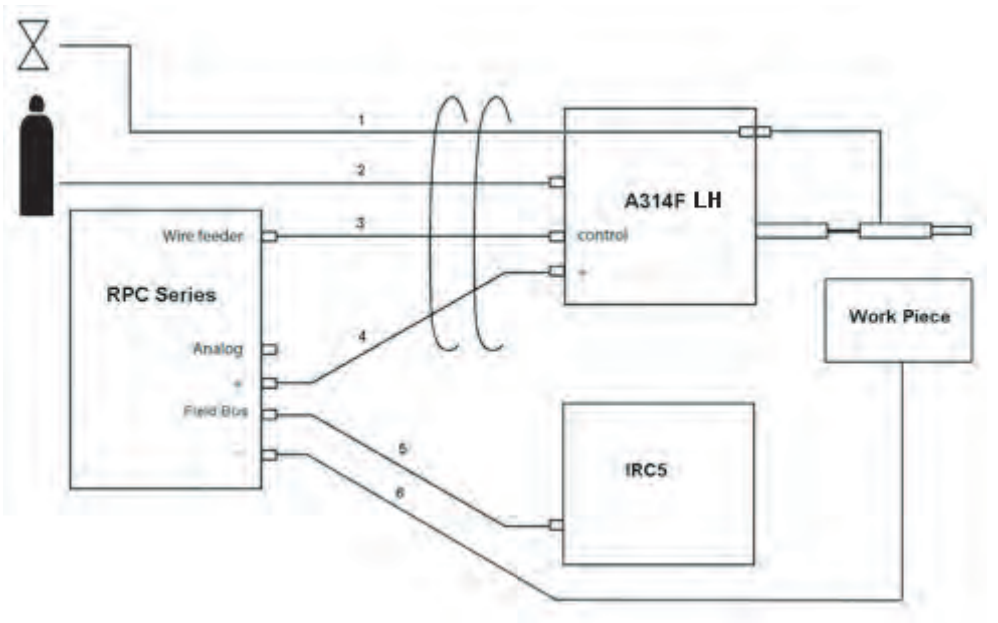
Requirements and detailed instructions for all of the steps above are found in the Operating manual - KempArc.

3.1.3 Connecting the cables and hoses

WARNING

All personnel working with the welding robot system must have a full understanding of the applicable safety instructions.

Connection layout



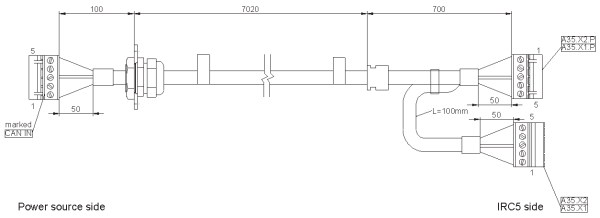
xx1100000403

1	Compressed air hose
2	Shield gas hose
3	Feeder cable
4	Welding cable (positive)
5	DeviceNet cable
6	Welding cable (negative)

Continues on next page

Connection points for cables and hoses

The cables and hoses are connected as follows.

<table>
<tr><th>Cable / house</th><th>Type</th><th>Connection points</th></tr>
<tr><td>DeviceNet cable</td><td></td><td>Connect the cable between the IRC5 controller and the power source.
Connect the connector CAN IN to the DeviceNet card through the Robot Control hole on the power sources rear panel.
Connect the connectors A35.X1.P/X2.P to terminal A35.X1 or A35.X2 in the IRC5 controller, by entering through the gland plate XS.7.
Note
Each end of the DeviceNet bus must be terminated with a 121 ohm resistor. The two terminating resistors should be as far apart as possible.
 

xx1100000404
<table>
<tr><th>Signal description</th><th>Terminal</th><th>Color</th></tr>
<tr><td>V-</td><td>1</td><td>Black</td></tr>
<tr><td>CAN L</td><td>2</td><td>Blue</td></tr>
<tr><td>DRAIN (NC)</td><td>3</td><td>Gray</td></tr>
<tr><td>CAN H</td><td>4</td><td>White</td></tr>
<tr><td>V+</td><td>5</td><td>Red</td></tr>
</table></td></tr>
<tr><td>Feeder cable (signal cable)</td><td>A314F LH</td><td>Connect the cable between the wire feeder unit and the power source, through the robot base.</td></tr>
<tr><td>Shield gas hose</td><td>Black house</td><td>Connect the hose between the central gas supply or the gas cylinder and the wire feeder unit.</td></tr>
<tr><td>Compressed air hose</td><td></td><td>Connect to the compressed air supply. System pressure: approximately 6 bar.</td></tr>
<tr><td>Wire guide input</td><td></td><td>The welding wire is taken to the wire feeder through a metallic wire guide adapter. Push the wire guide to the end of the adapter and screw in with the top fixing locks. Attach a wire guide input at the end of the adapter to serve as a bend support for the wire guide and to prevent the wire from bending too heavily. Fix the wire guide input with the bottom fixing locks.</td></tr>
<tr><td>Current cable</td><td></td><td>Connect the current cable from the wire feeder unit to the power source.</td></tr>
</table>

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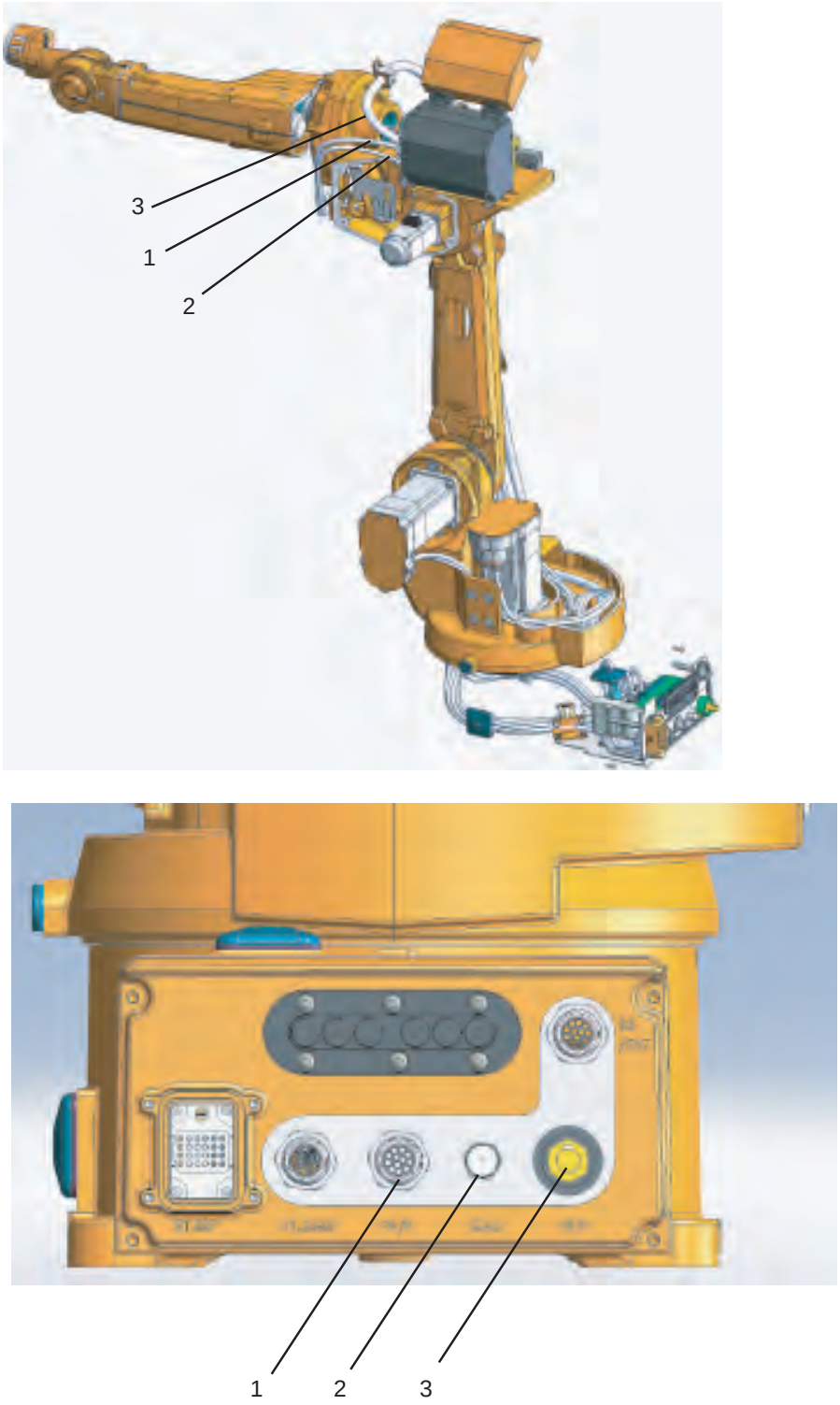
3.1.3.1 Connecting the feeder cable

Connection on robot base and on wire feeder A314F LH



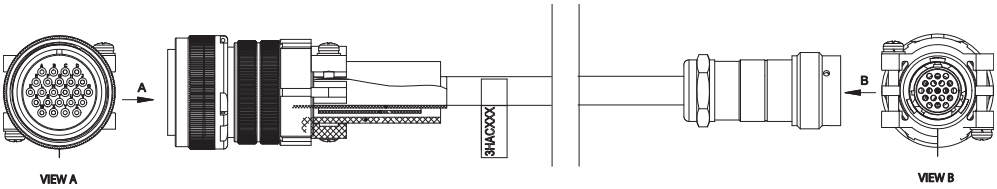
xx1100000431

1	Control feeder cable to A314F LH, connection on robot base and on wire feeder

Continues on next page

2	Connection, gas feed on robot base and on wire feeder
3	Connection, current cable on robot base and on wire feeder

Feeder cable (floor cable for welding signal)



xx1100000408

A	To the power source (pin)
B	To the robot base (socket)

Signal description

Signal description for feeder cable for control signal (24 way MIL connector)

Connector to power source (MS4106A24-28P-689)					Signal Cable 3HAA2513-2/1		Conector to robot base 3HAC022151-003
Pin	**Signal**	**Type**	**Level**	**Note**	**Wire color**	**Wire type**	**Pin**
A	Wire feed motor +	input	0 V to +24 V	Wire feed motor voltage +	BU	AWG24	A
B	Wire feed motor -	input	0 V	Wire feed motor voltage -	Violet	AWG24	B
C	Gas valve +	input	0 V / +24 V	Gas valve control voltage +	Grey	AWG24	C
D	Gas valve -	input	0 V	Gas valve control voltage -	White	AWG24	D
E	nc.	-	-	-	-	-	nc.
F	nc.	-	-	-	-	-	nc.
G	nc.	-	-	-	-	-	nc.
H	nc.	-	-	-	-	-	nc.
J	nc.	-	-	-	-	-	nc.
K	Tacho +5 V	input	+5 V	Tacho supply voltage	White Blue	AWG26	G
L	Tacho GND	input	0 V	Tacho supply GND	White Green	AWG26	H
M	Tacho signal	output	0 V / +5 V	Tacho signal from wire feeder	White Yellow	AWG26	J
N	nc.	-	-	-	-	-	nc.
P	Isolated +24 V	input	+24 V	Analog supply voltage	Black	AWG24	E

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3.1.3.1 Connecting the feeder cable

Continued

Connector to power source (MS4106A24-28P-689)					Signal Cable 3HAA2513-2/1		Conector to robot base 3HAC022151-003
Pin	**Signal**	**Type**	**Level**	**Note**	**Wire color**	**Wire type**	**Pin**
Q	Isolated GND	input	0 V	Analog supply GND	Yellow Green	AWG24	F
R	nc.	-	-	-	-	-	nc.
S	nc.	-	-	-	-	-	nc.
T	Wire inch	output	0 V / +24 V	Wire test feed	Or-ange Green	AWG26	K
U	Thruougput4	output	0 V / +24 V	Free for future use	Blue Green	AWG26	M
V	Thruougput5	output	0 V / +24 V	Free for future use	Violet Green	AWG26	N
W	nc.	-	-	-	-	-	nc.
X	nc.	-	-	-	-	-	nc.
Y	nc.	-	-	-	-	-	nc.
Z	Thruougput6	output	0 V / +24 V	Gasnozzle sensing	White Red	AWG26	L

3.2 Configuring the welding equipment

Overview

On delivery the equipment is configured according to the applicable configuration data which is stored on the disk that comes with the delivery.

The data can be read and modified by way of the robot FlexPendant.

Installation disk

The configuration file on the installation disk contains configuration data for the welding equipment.

Note

As the disk is unique for the equipment supplied, it should be stored in a safe place. The program number indicated on the disk corresponds to the configuration in question, and should be referred to in case of service matters regarding the function of the welding equipment.

Reload configuration data

In case the configuration data must be reloaded, proceed in one of the following ways:

Alternative	Description
Reboot the robot	The original configuration will be restored.
Loading by using the FlexPendant	Use this alternative if individual parameters need to be changed compared to the original configuration.
Loading a new configuration file	(EIO:CFG) Executed by way of the robot instruction: System Parameters\File\Add or Replace Parameters\ "file".cfg.

Default configuration

In ABB default configuration, the power source is controlled by the robot in the way of schedule/memory channel (sometime called as job) and the power source is recommended to work in 1-MIG mode.

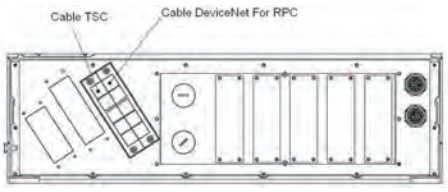
3.3 Installing accessories

3.3.1 Torch cleaner (TSC)

Note

The torch cleaner (TSC) communicates with the IRC5 controller by standard I/O communication. Basically it needs three digital outputs and two digital inputs. For detailed information refer to Product Specification - TSC.

Connecting the torch cleaner

	Action	Note
1	Install the torch cleaner.	 xx1100000413 Cable entry can easily be made through the gland plate (DeviceNet cable used) at the bottom of the control cabinet.
2	Configurate the I/O ports.	The I/O ports belong to the ABB standard I/O board, which is the one installed in the controller. Refer to the I/O configuration file.
3	Connect the line to the port of standard I/O board.	Connection needs to be done according to the I/O configuration file.

Example of configuration file

Here is an example of the configuration file for torch cleaner, as for reference:

```
EIO.CFG_1.0:5:0:
#
# using the spare DOI ports of ABB standard IO unit (d651)
# which is installed in the PIB Box. If using another IO unit,
# this definition can be used as the reference.
EIO_UNIT:
-Name "B_PROC_10" -UnitType "d651" -Bus "DeviceNet1" -DN_Address 10
EIO_SIGNAL:
-Name "doTS1_SpOn" -SignalType "DO" -Unit "B_PROC_10" -UnitMap "35"
-Name "doTS1_St" -SignalType "DO" -Unit "B_PROC_10" -UnitMap "38"
-Name "doTS1_AiBl" -SignalType "DO" -Unit "B_PROC_10" -UnitMap "39"
-Name "diTS1_ClOp" -SignalType "DI" -Unit "B_PROC_11" -UnitMap "7"
-Name "diBE_SENSE" -SignalType "DI" -Unit "B_PROC_10" -UnitMap "8"
#
```

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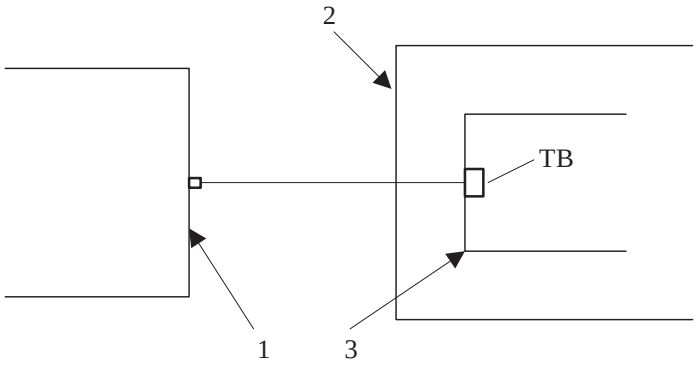
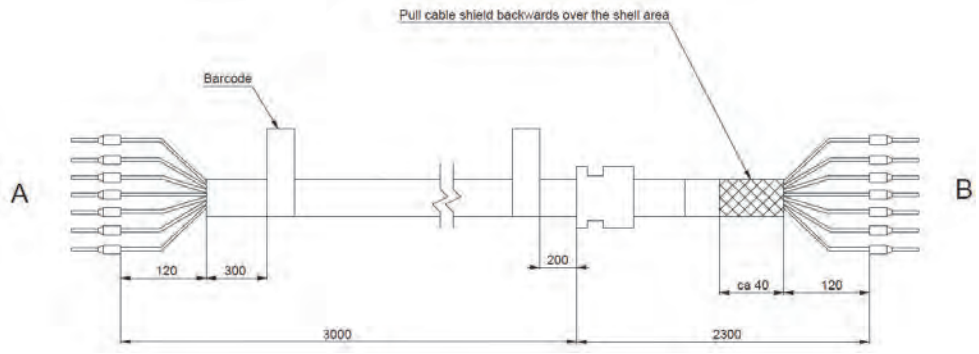
Block diagram



xx1100000414

1	TSC
2	Control module
3	Terminal block of IO board

Cable for torch cleaner



xx1100000415

Signal description

Signal description	Color	A (TSC)	A (BINZEL)	B (I/O Unit)
24V DC	White	4	6	
0V DC	Brown	2 and 8	3,4 and 5	
Lubrication	Green	11	8	
Cleaning	Yellow	10	7	
Wire cutter	Gray	1	NC	
Cleaning finished	Pink	7	9	
BullsEye	Blue	16	10	
Shield	SC	NC	NC	PE

3.3.2 Adjusting the brake hub of the bobbin

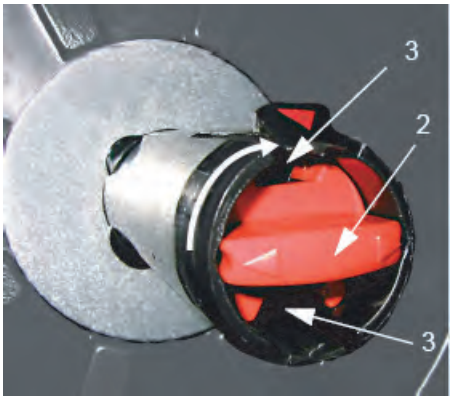
Introduction

If a bobbin is used it may be necessary to adjust the brake hub.

WARNING

At high wire speed and when the bobbin is new, the wire can roll off when the wire feeder unit stops. To avoid this, change the brake hub's preset value of 5 kpcm (= 0.5 Nm).

Adjusting the brake hub of the bobbin

	Action	Note
1	Localize the brake hub (1).	 xx1100000416
2	Turn the knob (2) on the brake hub until the arrows are in line with each other (locked bobbin position).	 xx1100000417
3	The springs (3) on each side of the knob are screwed in at the same time to increase the braking force.	

Tip

If the wire feed speed is so high that this adjustment does not have any effect, Marathon Pac should be used

3.4 Before commissioning

Actions before commissioning

DANGER

Make sure all safety requirements are met when performing the first test run. These are further detailed in the section *DANGER - First test run may cause injury or damage! on page 27*.

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4 Operation

4.1 Power source

Operating the power source

RPC S series power source is designed to be used only with A314F LH wire feeder unit and RF 59 control panel. Normally ABB will offer RPC S-400.

Refer to the Operating manual - KempArc for instructions of how to operate the power source and to learn more about its control panel and functions.

RPC P series power source is designed to be used only with A314F LH wire feeder unit and KF 62 control panel. Normally ABB will offer RPC P-350. Welding applications vary, so the equipment must adapt. RPC P-350 features K60 interface, a clear and logical LCD menu display. Arc Wizard menu allows the operator to refine, adapt and manage the arc process and system function before, during and after welding.

Refer to the Operating manual - KempArc for instructions of how to operate the power source and to learn more about its control panel and functions.

Continues on next page

4.1.1 Programming the power source

Default configuration

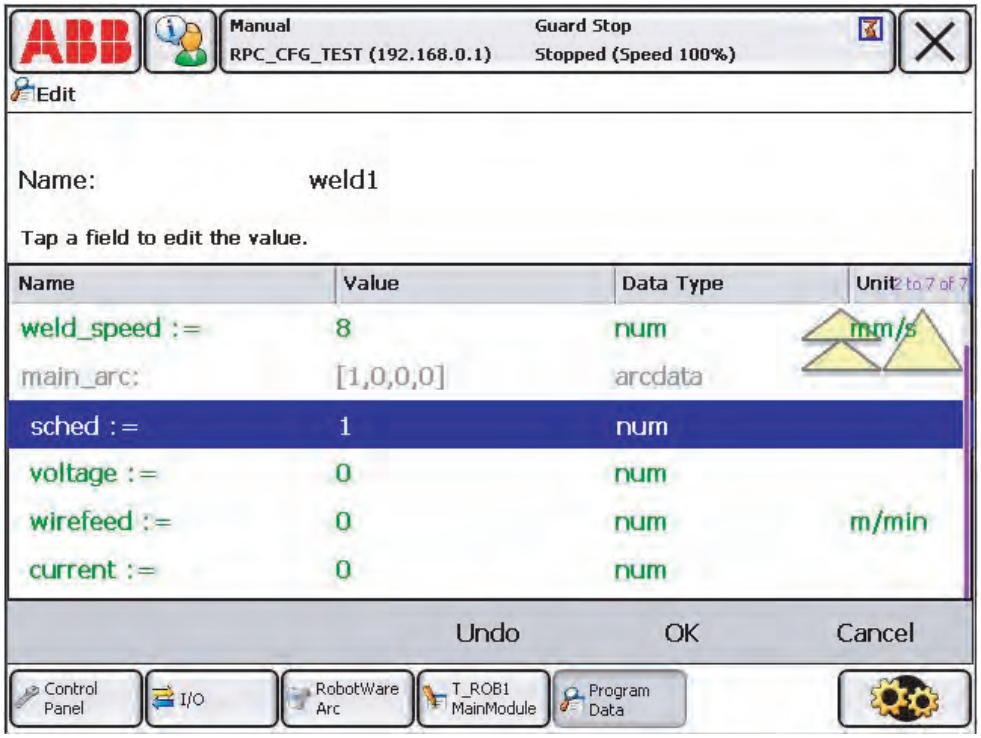
In the default configuration from ABB, the power source is controlled by the robot in the way of schedule/memory channel and the power source is recommended to work in 1-MIG mode.

Before programming

Before programming in IRC5, a set of welding parameters for the seam to be welded needs to be stored in a selected memory channel. See Operating manual - KempArc for details.

Programming - setting the welding speed and the schedule number

When programming in IRC5, usually in the component welddata, it is only necessary to set welding speed and schedule number. Welding voltage and wire feed speed is saved in the selected schedule/memory channel.



xx1100000418

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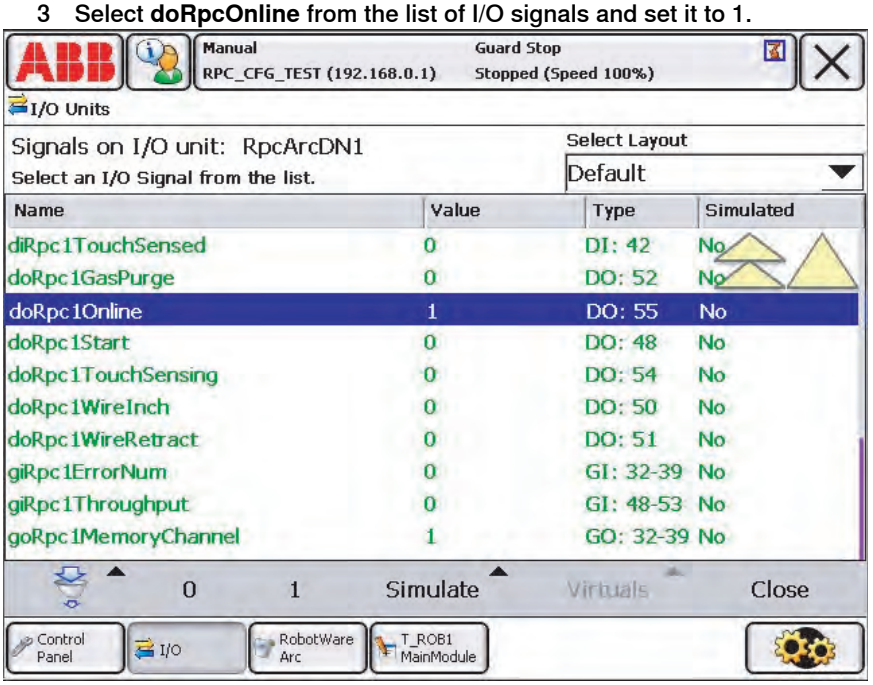
Optional programming - setting the welding voltage and wire feed speed

It is possible to also specify the welding voltage and wire feed speed directly, which will override the value in the selected memory channel, but these two values only take effect when the signal doRpcOnline is set to 1.

Step 1 - set signal doRpcOnloine to 1

Choose one of the two methods.

Method	Description
1	On the FlexPendant, in manual mode. 1 On the **ABB** menu, tap **I/O units**. 2 Tap **RpcArcDN1**. 3 Select **doRpcOnline** from the list of I/O signals and set it to 1.  xx1100000419

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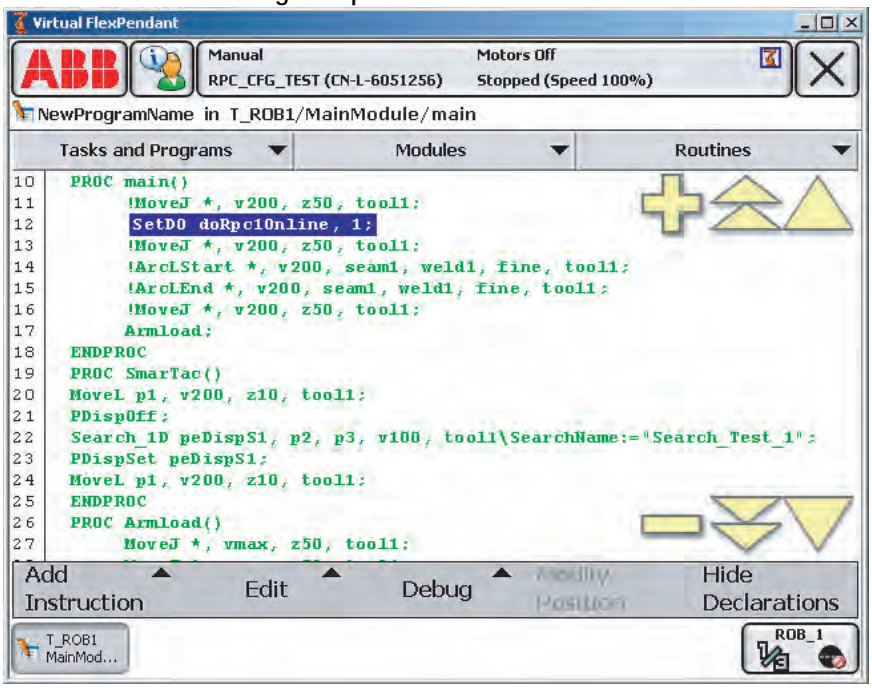
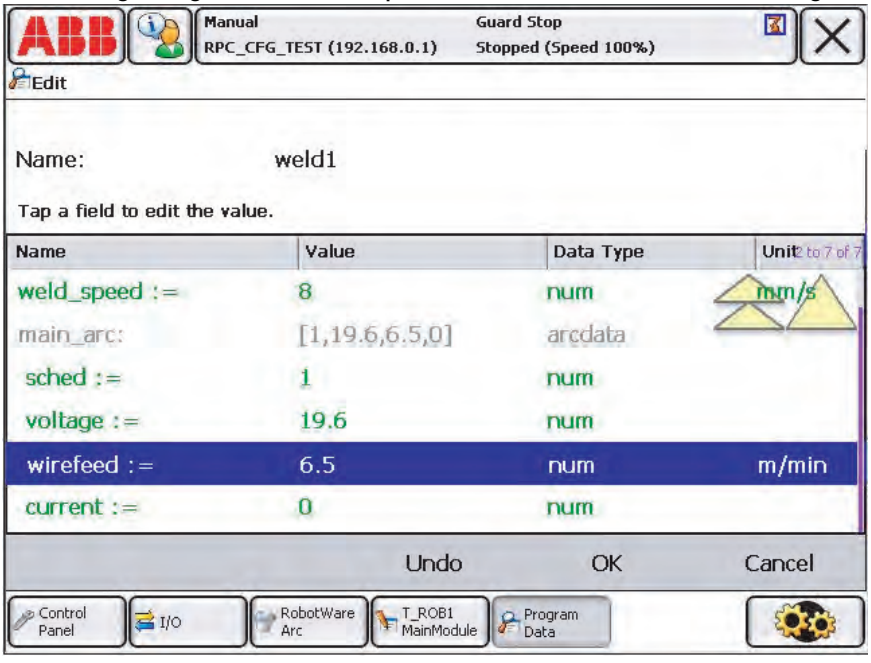
4.1.1 Programming the power source

Continued

Method	Description
2	In a RAPID program: Add instruction for setting "doRpcOnline" to 1.  xx1100000423

Step 2 - set the voltage and wire feed speed

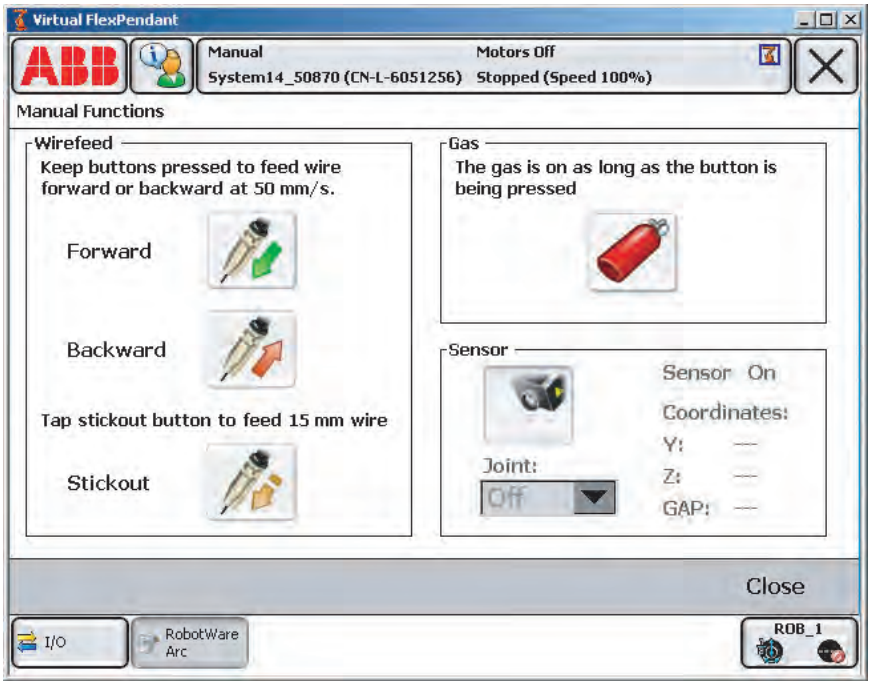
	Action
3	Set welding voltage and wire feed speed in the welddata, as shown in the figure:  xx1100000424 During welding, the specified welding voltage and wire feed speed override the value in the selected memory channel.

4.2 Wire feeder unit

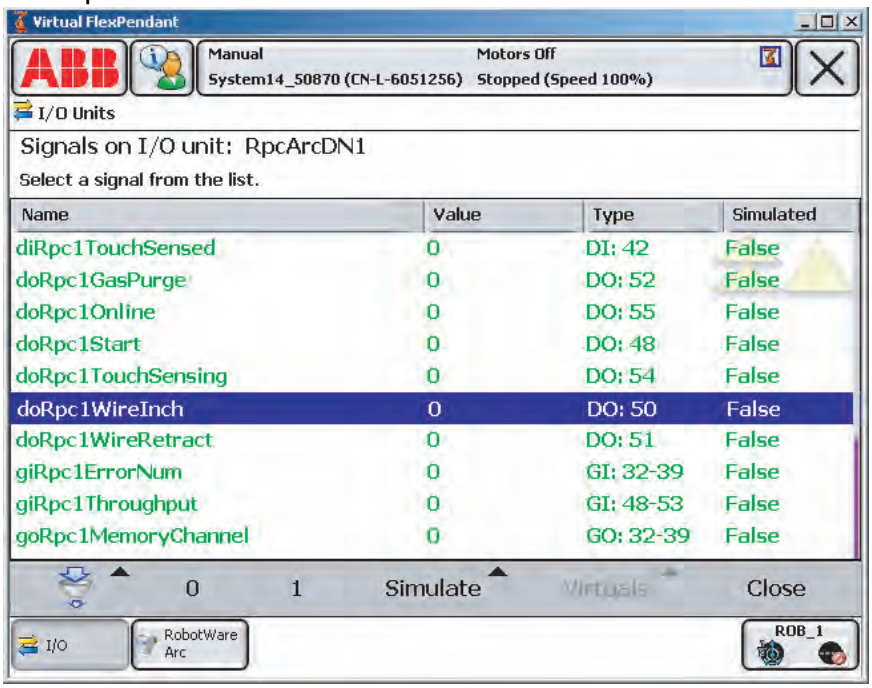
Threading the wire and adjusting tightness

Refer to Operating manual - KempArc for instructions of how to thread the wire and adjust the tightness.

Manual wire feed - different methods

Method	Description
1	Push the button for manual wire feed on the front of the wire feeder unit.
2	Activate the function Manual wire feed (Forward or Backward) from the robot's FlexPendant in test mode under the following window: ABB Menu\RobotWare Arc\Manual functions.  xx1100000425 **Note** If tapping the “Stickout “button from the robot's FlexPendant in test mode, the wire feeder will feed 15 mm wire every time.

Continues on next page

Method	Description
3	Activate the robot output (doRpc1WireInch or doRpc1WireRetract) from the robot's FlexPendant in test mode under the following window: ABB Menu\I/O Units\RpcArcDN1.  xx1100000426

Explanations for the different methods of manual wire feed

The table shows the differences between the methods.

Method	Explanation
1	When the Wire inch button is pressed, the wire feeder motor starts but the gas valve does not open and the power source is not activated. The wire feed pace is 2 m/min for the first two seconds, and then 10 m/min. When the button is released, the wire feeder stops.
2	The arc weld function “Manual Wire feed” is called from the robot's programming unit. The robot activates the output (doRpc1WireInch or doRpc1WireRetract) and the function is the same as when the Manual feed button on the wire feeder unit is pressed in. The function is active as long as the button is hold.
3	The function is active as long as the output signal (doRpc1WireInch or doRpc1WireRetract) is set to 1.

5 Maintenance

5.1 Introduction

Planning maintenance

Please consider the utilisation level and working environment of the equipment when planning routine maintenance.

Unnecessary downtime and equipment failure are avoided with correct operation of the equipment and with regular maintenance.

Safety

WARNING

This work must only be carried out by persons trained in the complete installation, who are aware of the particular risks associated with its different parts.

DANGER

Disconnect the mains supply and (if possible) secure the switch before starting work on the equipment.

In some cases however, it is necessary to work with the mains supply switched on, special care and safe working methods must be used.

CAUTION

Only use genuine spare parts and extra accessories that are recommended by ABB.

5.2 Daily maintenance

Daily maintenance procedures

- Check the overall condition of the welding gun. Remove welding spatter from the contact tip and clean the gas nozzle. Replace worn or damaged parts. Only use original ABB spare parts.
- Check the condition and connection of the welding circuit components: welding gun, earth return cable and clamp, sockets and connectors.
- Check the condition of the feed rolls, needle bearings and shafts. Clean and lubricate bearings and shafts with a small quantity of light machine oil if necessary. Assemble, adjust and test function.

5.3 Service shop maintenance

General

ABB Service Workshops complete maintenance according to their ABB service agreement.

The major points in the maintenance procedure are listed as follows:

- Cleaning of the machine
- Checking and maintenance of the welding tools
- Checking of connectors, switches and potentiometers
- Checking of electric connections
- Checking of mains cable and plug
- Damaged parts or parts in bad condition are replaced by new ones
- Maintenance testing.
- Operation and performance values of the machine are checked, and when necessary adjusted by means of software and test equipment.
- ABB Service Workshops can also test and load firm ware and welding software.

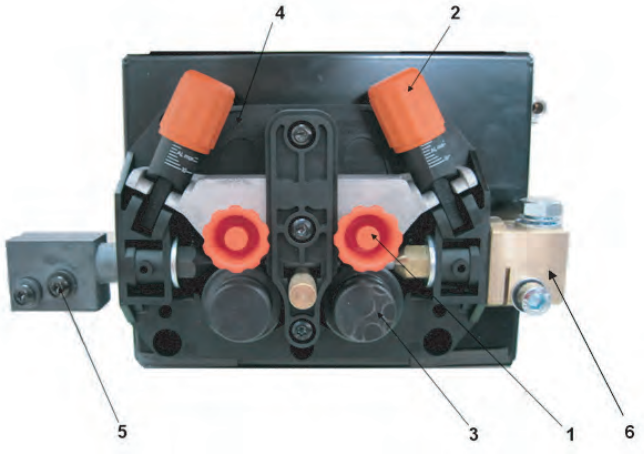
5.4 Power source

Maintenance information

See Operating manual - KempArc for both periodical and regular maintenance and for information about disposal of the machine.

5.5 Wire feed unit

Illustration of the wire feed unit



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1	Upper feed rollers
2	Adjuster screws
3	Lower feed rollers
4	Motor (On the back)
5	Inlet guide and screws

Regular maintenance

	Action	Note
1	Make a visual inspection of the equipment. Correct errors, if any, for reliable operation.	
2	Purge the inside of the feed unit as necessary by compressed air at reduced pressure.	
3	Clean the grooves in the feed rollers and the bore of the outlet nozzle.	To ensure satisfactory feed of the wire, the grooves in the feed rollers should be cleaned at regular intervals.
4	Purge the wire conduit by compressed air when changing the wire and as necessary. When the wire conduit is worn out, replace it.	
5	Use filler wire that is free of impurities.	Dirt can cause slipping.

Changing the wire

There is a groove in the feed rollers, for a specified wire diameter.

Replace the feed rollers to change the groove if changing the wire diameter.

Continues on next page

Note

The bearings of the motor and the gearbox are permanently lubricated and maintenance-free.

5.6 Before commissioning

DANGER

Make sure all safety requirements are met when performing the first test run. These are further detailed in the section *DANGER - First test run may cause injury or damage! on page 27*.

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ABB AB, Robotics
Robotics and Motion
S-721 68 VÄSTERÅS, Sweden
Telephone +46 (0) 21 344 400

ABB AS, Robotics
Robotics and Motion
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.
Robotics and Motion
No. 4528 Kangxin Highway
PuDong District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics and Motion
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

www.abb.com/robotics