Product Manual

Welding equipment and wire feed system

A314E/316E/324E-L IRC5

3HEA 801219-002 2005-05

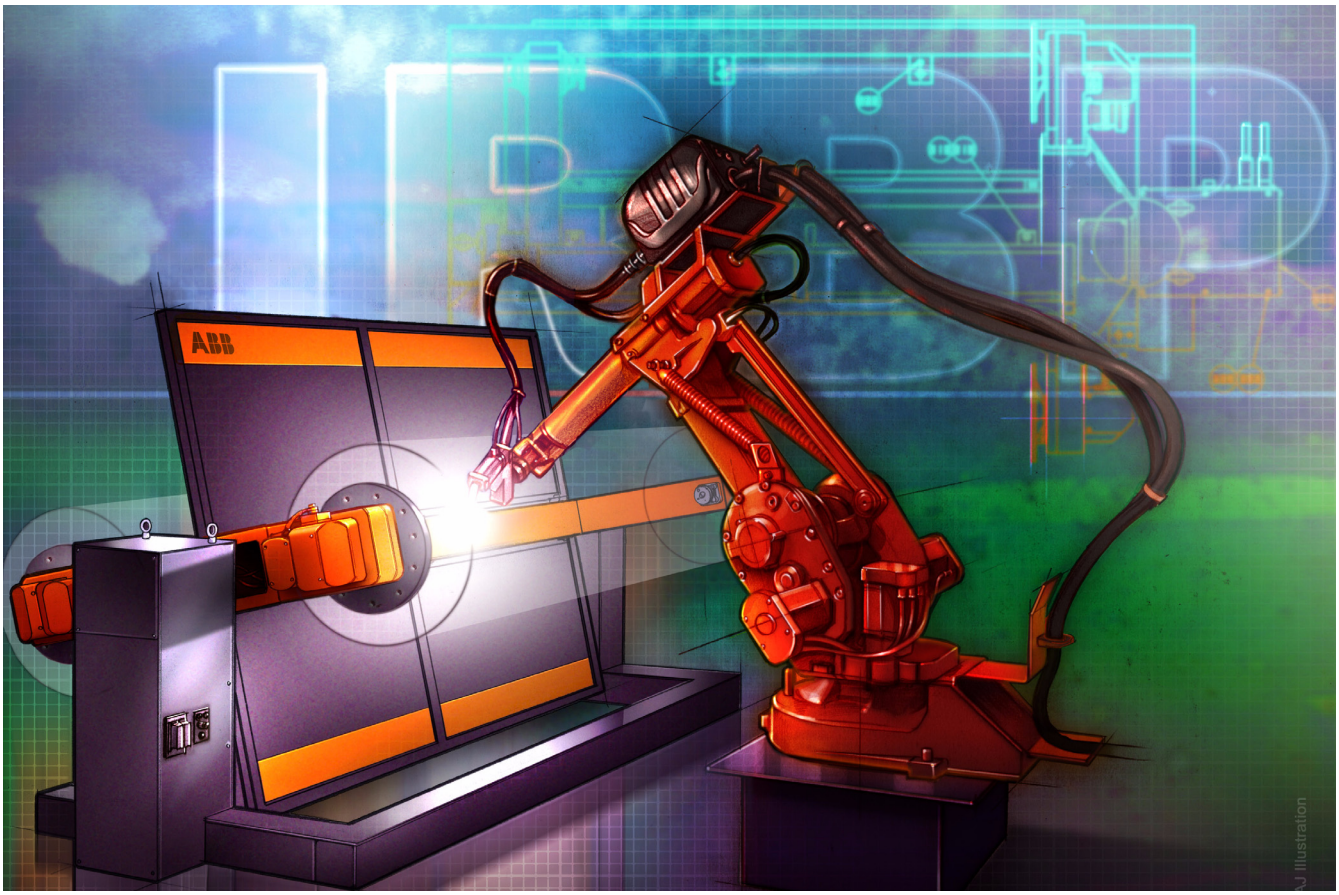


ABB Automation Technologies AB
Arc Welding Products
SE-69582 Laxå
Sweden

Contents

Welding equipment and wire feed system 3HEA 801219-002 2005-06

1 Introduction

About this manual

This manual provides information on:

- Mechanical/electrical installation.
- Operation
- Repair/maintenance.

Read through all included manuals carefully, especially the sections about safety before you start to unpack, install and use the station.

Usage

This manual is intended for use in conjunction with:

- Installation
- Operation
- Maintenance
- Repairs

Who should read this manual?

This manual is intended for:

- Operators
- Installation personnel
- Repair and maintenance personnel

Basic knowledge

Readers of this manual must be:

- Familiar with industrial robots and the relevant terminology.
- Familiar with the equipment.
- Skilled in mechanical and electrical installation/maintenance/repairs.

2 Safety

2.1 General

A robot is heavy and extremely powerful regardless of its speed. A stoppage or longer stop can be followed by rapid, dangerous movements. Even if the robot's pattern of movement is predetermined, an external signal can affect the movement sequence, resulting in unanticipated movement.

It is therefore important that all safety instructions are observed when entering a safety supervised area.

2.2 Safety instructions

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

Safety instructions can be found under tab 1 in the AW system manual for all steps that involve risk for personal injury or material damage. In addition, they are included in the instructions for each step.

General warnings, where the intention is to avoid problems, are only included in the pertinent instructions.

User environment

FUMES AND GASES - Can be hazardous to your health.

It is the responsibility of the buyer/user to ensure that national statutes regarding the working environment are respected. The following should also be implemented:

:

Action
• Make sure that satisfactory exhaust devices are installed and used.
• Make sure that there is sufficient lighting over the workplace.
• If possible use environment-friendly shielding gas and vegetable oil for splatter cleaning.

Reference document

Document	Described in:
Related safety instructions.	AW System manual, chapter introduction and safety

Warning symbols (signals)

Symbol explanations

The different types of warnings are set out in the following chapters according to the table below:

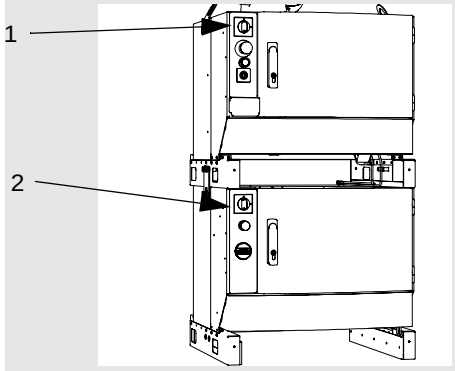
Symbol	Name	Meaning
	Danger	Warning that serious or life-threatening personal injury and/or serious damage to the product will occur if the instructions are not followed.
	Warning	Warns of the risk of personal injury or serious damage to the product. Always follow the instructions that accompany this symbol.
	Electric shock	Warns of possible electric shock that can cause life-threatening or serious personal injury. Always follow the instructions that accompany this symbol.
	Caution	Draws your attention to the fact that damage to the product may occur if an action is not performed or is performed incorrectly.
	Static electricity ESD	The ESD symbol indicates a risk of static electricity that may cause serious damage to the product.
	Note	Information about important parts.
	Tips	This symbol refers to an instruction providing further information on a particular step.

2.2.1 DANGER – Ensure that the main power switch is turned off.

Description

Work with high voltage entails a potential lethal hazard. Persons subjected to high voltages can suffer heart failure, burns or other serious injuries. To avoid such injuries, never begin a job without first eliminating the risks to safety. These are described below.

Elimination

	Action	Info/Illustration
1.	Turn off the main power switch at the control module.	
2.	Turn off the main power switch at the drive module.	
3.	Single robot stations	All voltage is lost when the main switch on the drive module (DM1) is switched off.

2.2.2 WARNING – The unit is sensitive to ESD.

Description

ESD (electrostatic discharge) is the transfer of electrostatic charges between two objects with varying charges, either through direct contact or through an electrical field.

The discharge contains very little electricity and is therefore not hazardous to humans, however, electronics can be damaged by the high voltages.

Elimination

	Action	Info/Illustration
1.	Use an ESD bracelet.	The bracelet must be regularly tested to ensure that it is undamaged and functions properly.
2.	Use an ESD-protected floor mat.	The mat must be grounded through a voltage regulating resistor.
3.	Use an ESD-protected table mat.	The mat shall produce a controlled discharge of static electricity and must be grounded.

Location of attachment point for ESD bracelet

Button (A/B) for the ESD bracelet is located on the computer unit in the control module. The location is shown in the following figure.

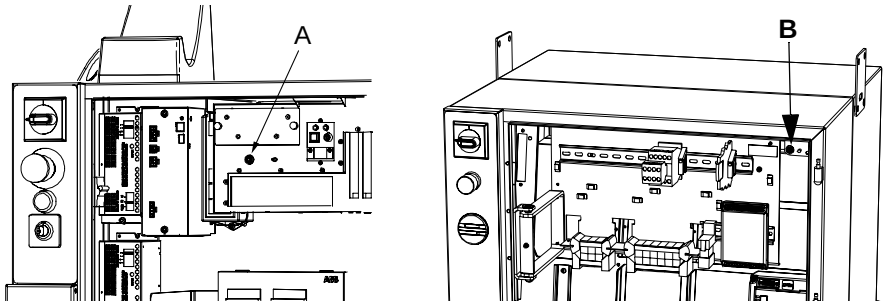


Figure 1 Location of attachment point for ESD bracelet

Item	Name
A	Attachment point for ESD bracelet in the control module.
B	Attachment point for ESD bracelet in the drive module.

3 Technical Description

3.1 General

The welding equipment A314E/316E/A324E-L (E for Extended range) is adapted for the control from the IRB 140/1400/2400 robot with the IRC5 control system. Together with the AW software in the robot and the PIB process interface the system has the following characteristics:

Working area

With an optical tachometer, with a high frequency resolution in the wire feed unit, a stable wire feed is obtained, across the speed range:
0.3 m/min. – 30 m/min.

Accuracy

The transfer of information between the robot and the welding equipment is done in series in the form of numerical data by way of a CAN bus, guaranteeing great accuracy.

Programmability

All programming of the welding process is done from the FlexPendant.

Safety

The welding equipment is fitted with sensors for the supervision of the welding process. If an error occurs an error message is displayed on the FlexPendant.

Flexibility

The transfer of programmable configuration data enables the adaptation to different power sources and feed units.

3.2 Welding equipment

Intended for

The welding equipment should only be used for MIG/MAG welding and according to instructions in the documentation.

With all other usage of the equipment. ABB disclaims all responsibility and any claims for damages or warranty undertakings

The equipment is not intended for use in explosive environments.

Tryckvakter

Type	Description
Gas sensor	The pressure switch functions as an open contact, which closes when the pressure rises. The switch is pre-calibrated for 0.2 bar (equivalent of approx. 5 l/min.). The pressure switch indicates when the gas is empty, or if some other object is obstructing the gas flow.
Water sensor, Option	A water sensor is selected when a water cooled welding torch is included.

3.3 Principle design

The welding equipment consists of:

Components	Type
Wire feed system	• A314E (for robot IRB 1400) • A316E (for robot IRB 1600) • A324E-L (for robot IRB 2400)
Welding power source	• RPB 320/420/520 • LRC 430 • MigRob 500
Options	**The following options are available for the Welding equipment:** • welding torch set (Dinse, Binzel) • joint locator, "Smartac" • torch cleaner “TC” • wire cutter • automatic TCP-gauging “BullsEye”

3.3.1 Robot Welding System

Welding power source LRC 430

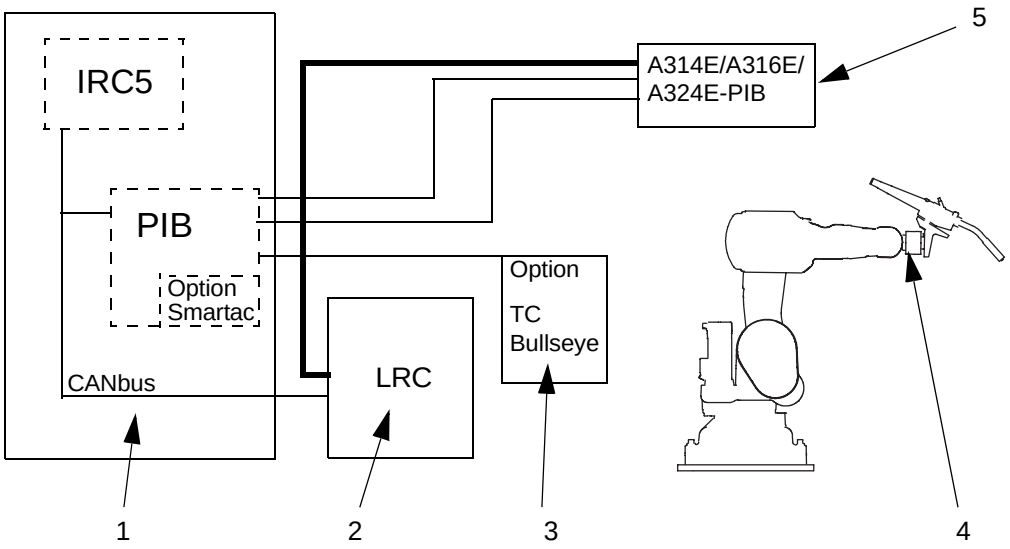


Figure 2. Overview of "ARCITEC" connections LRC 430

Pos	Description	Pos	Description
1	Control module	4	Collision sensor
2	Welding power source	5	Gas/water sensor
3	Wire cutter/ BullsEye (option)		

Welding power source MigRob 500

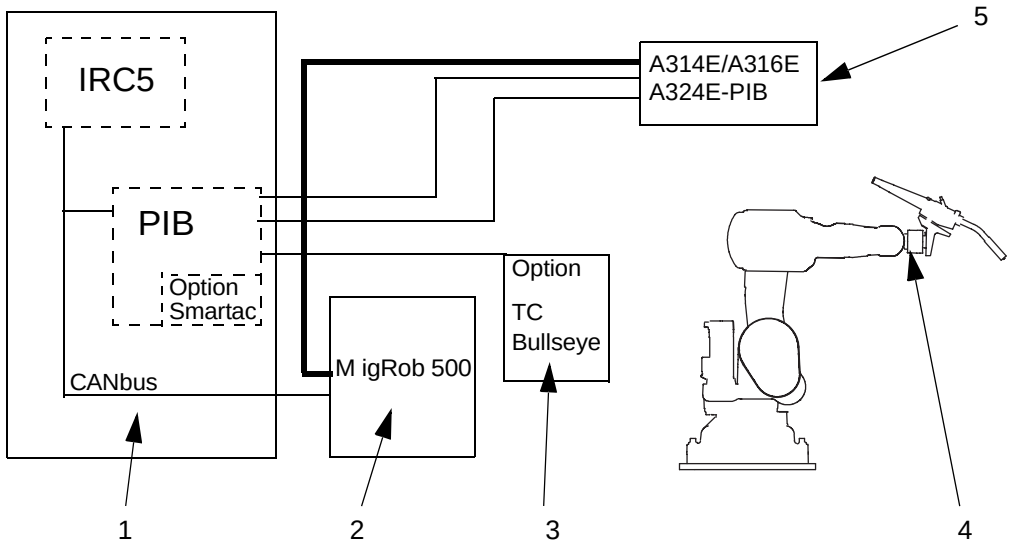


Figure 3. Overview of connection MigRob 500

Pos	Description	Pos	Description
1	Control module	4	Collision sensor
2	Welding power source	5	Gas/water sensor
3	Wire cutter/ BullsEye (option)		

Welding power source RPB

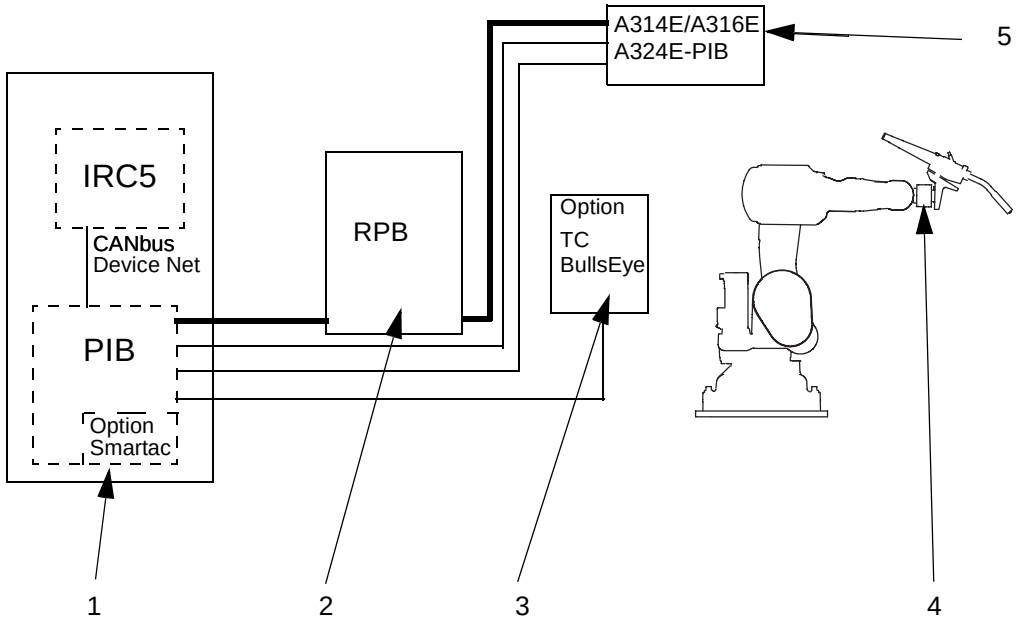


Figure 4. Overview of connections RPB

Pos	Description	Pos	Description
1	Control module	4	Collision sensor
2	Welding power source	5	Gas/water sensor
3	Wire cutter/ BullsEye (option)		

3.4 Components

General

The welding equipment can include the following components:

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

Overview

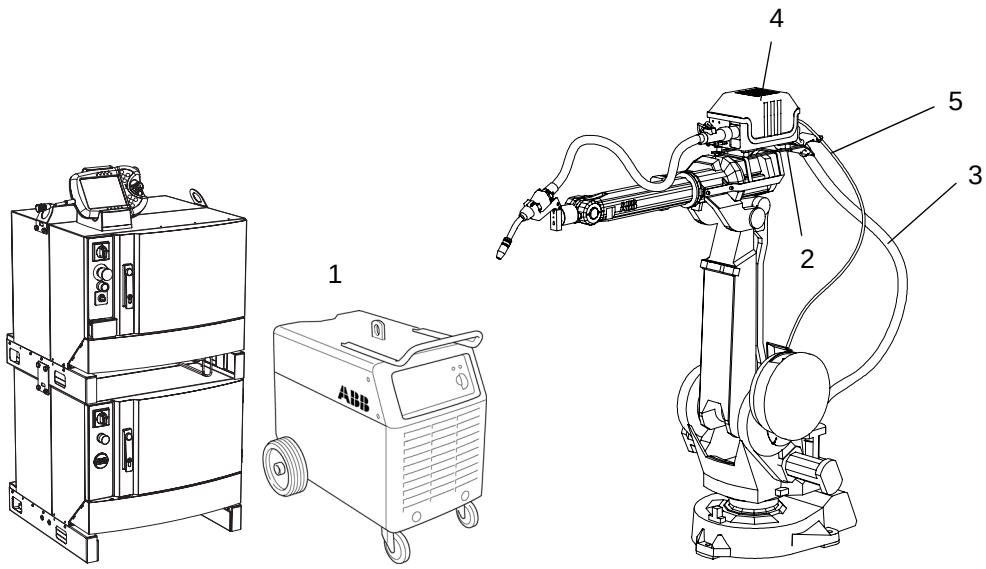


Figure 5. IRB 2400 with welding equipment

Pos	Description	Pos	Description
1	Welding power source	4	Wire feed unit
2	Attachment	5	Wire conduit
3	Hoses/cables for welding current		

3.5 Wire feed systemA314E/316E/A324E-L

3.5.1 General

There are two options of wire feed systems:

- Bobbin
- Marathon pac.

A314E/316E/A324E-L should be used for gas arc welding.

It is intended to be mounted directly on the robot IRB 1400/IRB1600/IRB 2400L, which results in a short cable bundle and a good wire feed, furthermore, a smaller floor area is required.

Bobbin

If a bobbin is used it may be necessary to adjust the brake hub. See *“Adjusting the brake hub (bobbin)” on page 33*

Working area

The wire feed system A314E/316E/A324E-L meets Arc Welding & Application Equipment’s recommended layout setup.
This means the robot has a full working area within a section of ±150° for A314E/316E/A324E-L, around axle 1.

Great care should be exercised outside of this sector, e.g. when programming otherwise the welding equipment can be damaged.
This is especially the case for IRB 1600 and “Bending backwards” movements.

Technical specifications and requirements

Type	Data
Wire diameter	0,8 mm - 1,6 mm
Max wire feed speed	30 m/min.
Permitted ambient temperature	0ºC - +40ºC

3.5.2 Wire feed unit

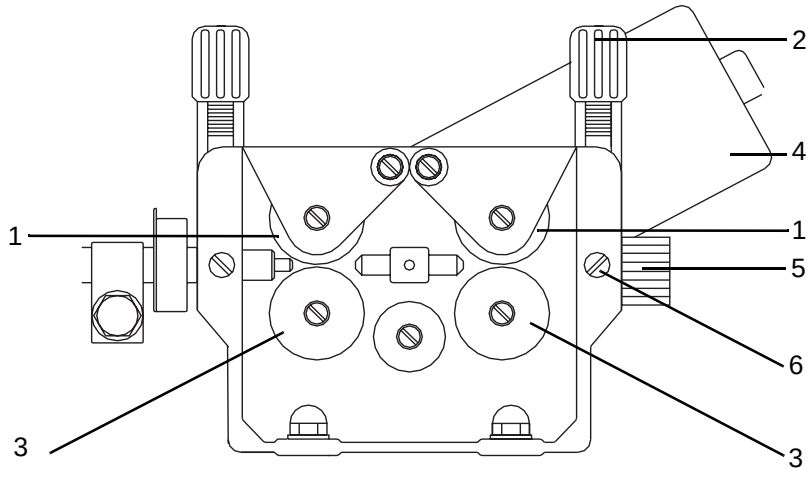


Figure 6. Wire feed unit

Pos	Description	Pos	Description
1	Upper feed roller	4	Motor
2	Adjuster screw	5	Inlet guide
3	Lower feed roller	6	Screw

Feed rollers

Wire is fed using two pairs of feed rollers, see Figure 8, which are linked to each other. The two upper rollers (1) 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 (2).

All rollers are fitted with sleeve bearings.

The lower feed rollers (3) have grooves for two different wire diameters. The rollers are turned so that the marking for the required wire diameter is facing forwards.

Motor

The motor (4) is of a permanent magnetized type and is equipped with an optical tachometer meter for accurate speed control.

Marathon Pac

An inlet guide (5) is fitted when the marathon pac is used. The nozzle is locked using the screw (6).

Bobin

When the bobbin is used, the wire liner is fitted directly to the feed mechanism and is locked by the screw (6).

3.5.3 Control and indicating devices on the wire feed unit

Type	Description
WIRE FEED	Switch for manual wire feed.
RESET (Option)	Switch for resetting the torch collision sensor.
AIR	AIR connection to the welding torch.
IN	Connection for water (blue hose). Applies to water cooled torches.
OUT	Connection for water (red hose). Applies to water cooled torches.
Euro-socket	Connection for the welding torch.

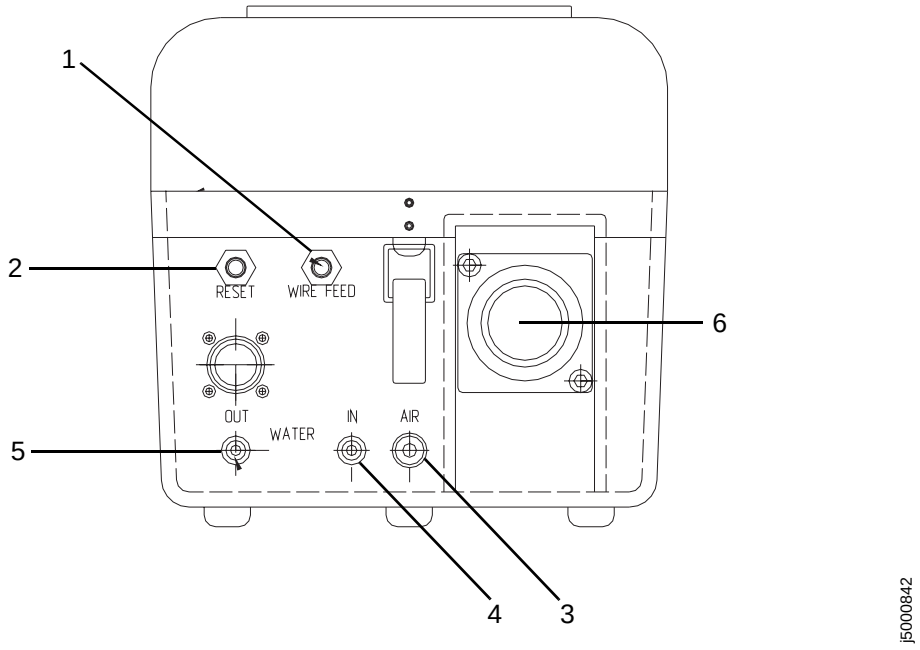


Figure 7. Side of the wire feed unit.

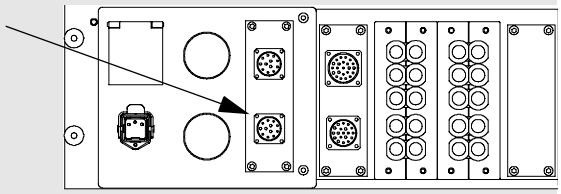
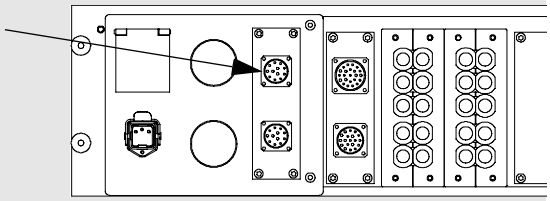
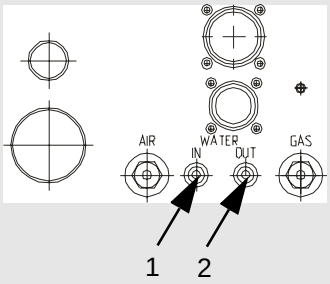
Pos	Description	Pos	Description
1	Switch “WIRE FEED”	4	Connection “IN”
2	Switch “RESET” Option	5	Connection “OUT”
3	Connection “AIR”	6	Euro-socket

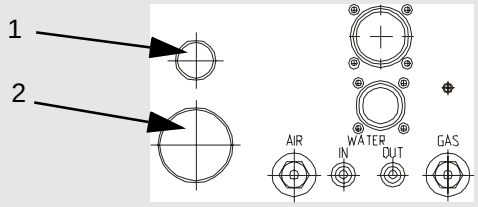
4 Installation

4.1 Connection of welding equipment

All personnel working with the welding robot system must be fully conversant with the applicable safety instructions that are available.

The cables and hoses are connected as follows. For more information, see Figure 12.

Cable/Hose	Type	Connection
Feeder cable 1 (signal cable)	A314E/316E/ 324E-L	Foot of the robot - Control module 23-pole connection at both ends.  *Figure 8. Connection on control module*
Feeder cable 2 (Power cable)	A314E/316E/ 324E-L	Foot of the robot - Control module 12-pole connection at foot of the robot and 19-pole connection at Control module. .  *Figure 9. Connection on control module*
Gas	Red hose	Connected to the central gas supply or to the gas cylinder.
Cooling water	Blue hose (1) Red hose (2)	IN OUT  *Figure 10. Wire feed unit*

Cable/Hose	Type	Connection
Air in	PVC-slang D14/8	Connected to the compressed air supply, system pressure, approx., 6 bar.
Wire guide input (1)	for bobin for Marathon Pac	 *Figure 11. Wire feed unit*
Welding cable (2)	95 m^2	
Current cable		Connect the current cable from the wire feed unit to the power source.

4.1.1 Overview

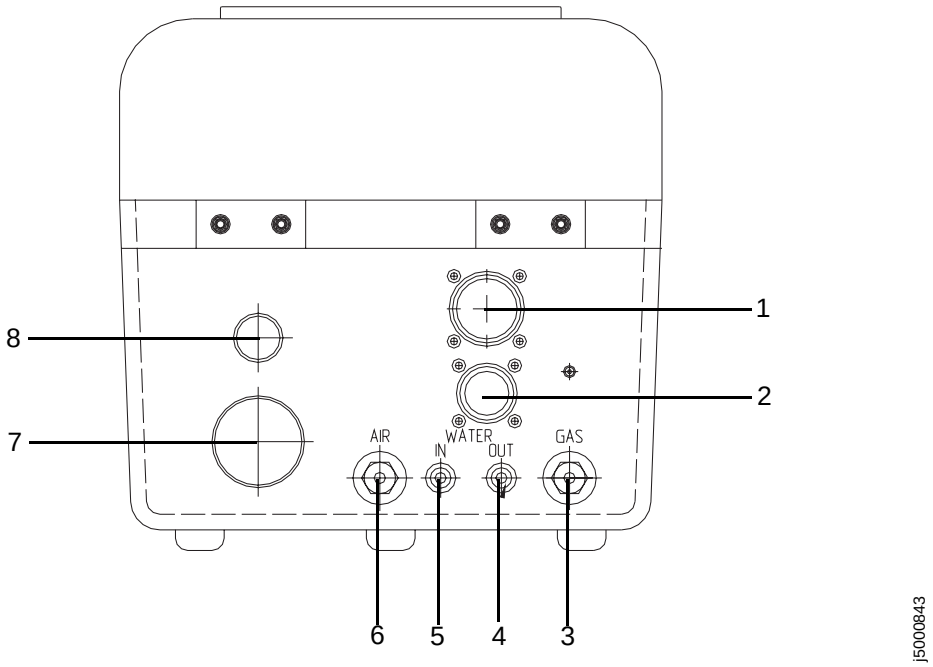


Figure 12. Connections on wire feed unit

Pos	Description	Pos	Description
1	Feeder cable 1	5	Water IN (blue hose)
2	Feeder cable 2	6	Air hose
3	Hose for gas (red)	7	Welding cable
4	Water OUT (red hose)	8	Wire guide

4.1.2 Circuit diagram

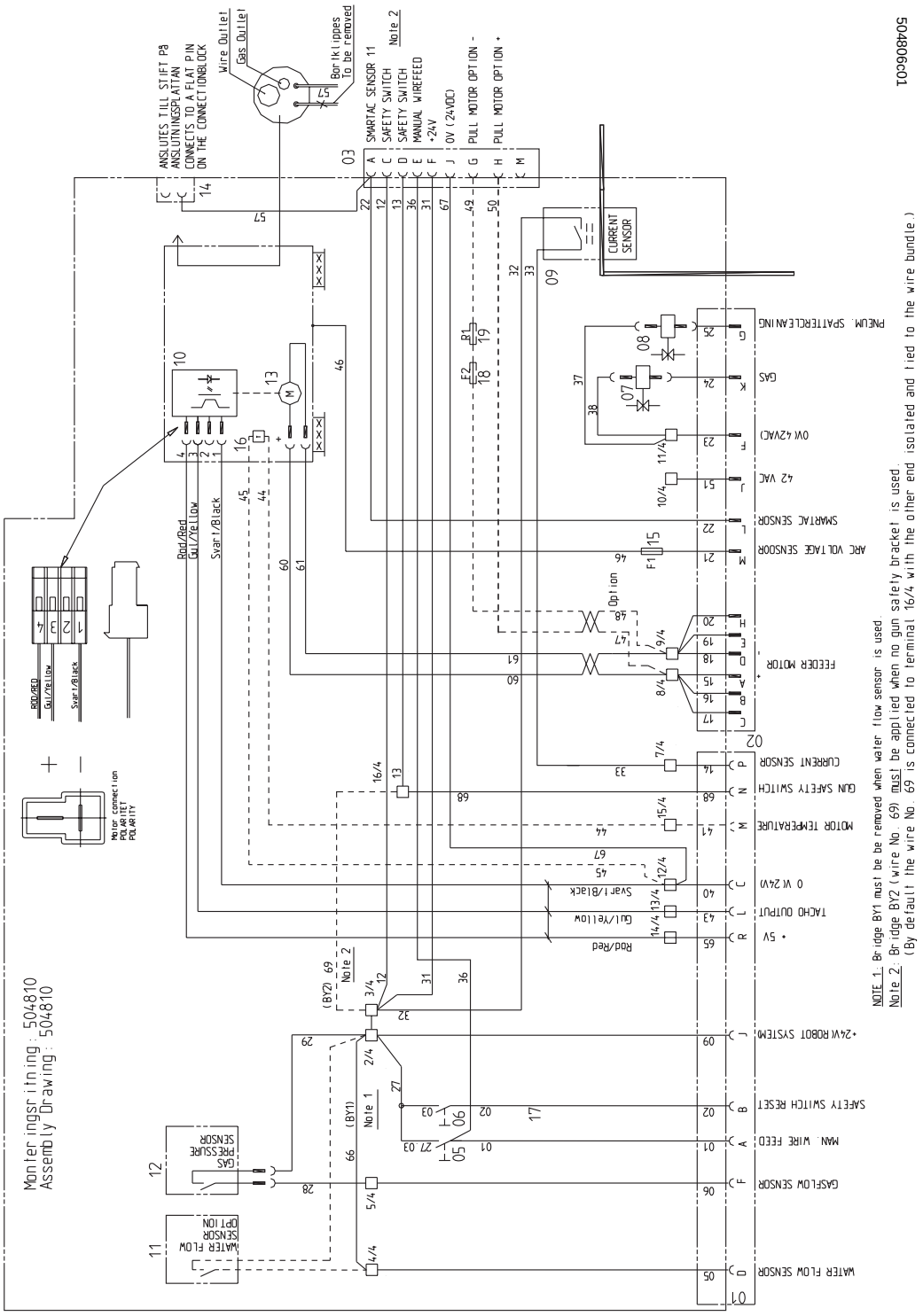


Figure 13. Circuit diagram, wire feed unit A314E/316E/324E-L

4.1.3 Connection of feeder cables

Feeder cable 1, signal cable (FEED 1)

Block diagram

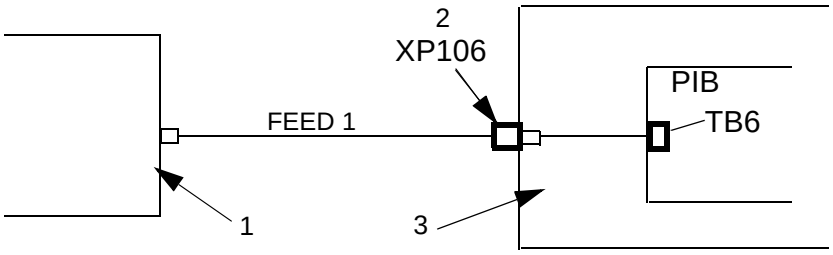


Figure 14. Block diagram Feeder cable 1

Pos	Description	Pos	Description
1	Wire feed unit, circuit diagram see Figure 13.	3	Control module
2	Connection		

Feeder cable 1

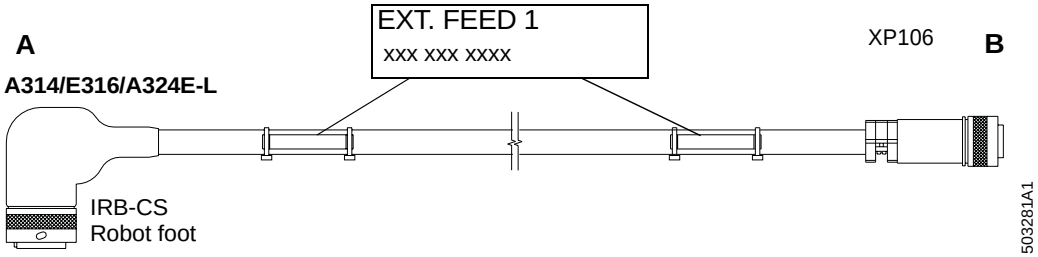


Figure 15. Feeder cable 1, A314E/A316E/A324E-L.

Pos	Description	Pos	Description
A	Wire feed unit	B	Control module

Signal description

Signal description for feeder cable 1 A314E/A316E/A324E-L:

Signal description	A	B	Color
Gun Reset	B	B	White
Gun Crash Sensor	N	N	Brown
Current Sensor	P	P	Green
Water Flow Sensor	D	D	Yellow
Gas Flow Sensor	F	F	Gray
Tacho +	K	K	Pink
Tacho - (Encoder Tacho input)	L	L	Blue
Manual Wire Feed	A	A	Red
24 VDC Supply	J	J	Black
0 VDC (24 VDC) / Encoder Tacho Common	C	C	Violet
Motor Temperature	M	M	Gray/Pink
Auxiliary Motor	E	E	Red/Blue
ADM Tacho (+) Encoder Tacho input	G	G	White/Green
ADM Tacho (-)	H	H	Brown/Green
+5V Encoder Tacho	R	R	White/Yellow
Spare (not used)	S	S	Yellow/Brown

Feeder cable 2, power cable (FEED 2)

Block diagram

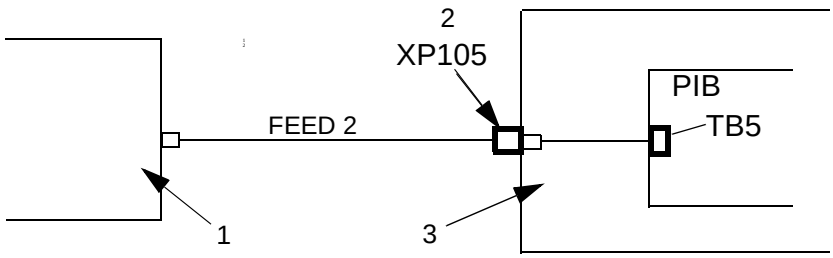


Figure 16. Block diagram Feeder cable 2

Pos	Description	Pos	Description
1	Wire feed unit, circuit diagram see Figure 13.	3	Control module
2	Connection		

Feeder cable 2

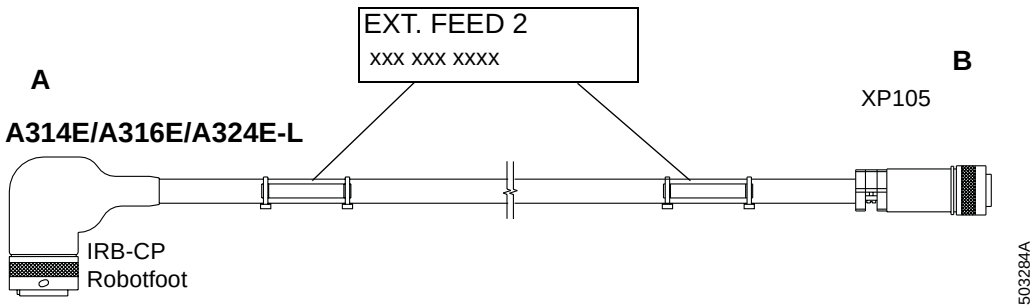


Figure 17. Feeder cable 2, A314E/A316E/A324E-L.

Pos	Description	Pos	Description
A	Wire feed unit	B	Control module

Signal description

Signal description for feeder cable 2 A314E/A316E/A324E-L

Signal description	A	B	Color
Motor +	A	A	White
Motor +	B	B	Brown
Motor +	C	C	Green
Motor -	D	D	Yellow
Motor -	E	E	Gray
Motor -	H	H	Pink
Pneumatic Spatter Cleaning (42/115VAC)	G	G	Blue
Gas Valve (42/115 VAC)	K	K	Red
Arc Voltage Gun	M	M	Black
Smartac 1	L	L	Violet
Aux Motor Supply (42/115 VAC phase)	J	J	Gray/Pink
Aux Motor Supply (42/115 VAC common)	F	F	Red/Blue

4.2 Configuration of Welding Equipment

4.2.1 General

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.

4.2.2 Installation disk

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.

The following files on the installation disk contain configuration data for the welding equipment:

File	Configuration data for:
RPB_FhpE.cfg	• welding power source RPB 320/420/520and • wire feed unit A314E/316E/324E-L_PIB
Lrc_FhpE.cfg	• welding power source LRC 430 and • wire feed unit A314E/316E/324E-L_PIB
MigRob_FhpE.cfg	• welding power source MigRob 500 and • wire feed unit A314E/316E/324E-L_PIB

4.2.3 Reload configuration data

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

Alternative	Description
Reboot the robot	The original configuration will be restored.
Loading using the FlexPendant	In those cases where 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.` For more information, see *"Configuration" on page 52*.

4.3 Connection of Welding Power Sources

4.3.1 Welding power source LRC 430

Block diagram

Power source LRC/MigRob is connected to terminal A12.X2 on the control module.

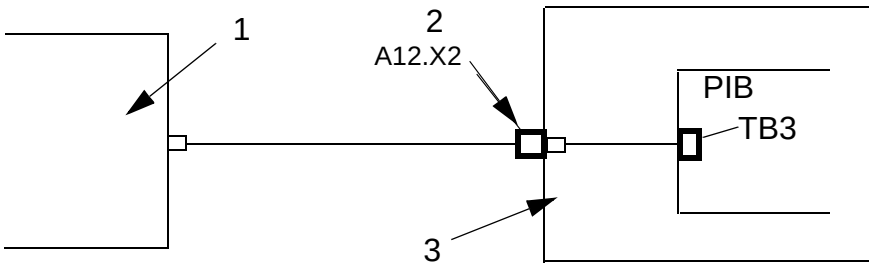
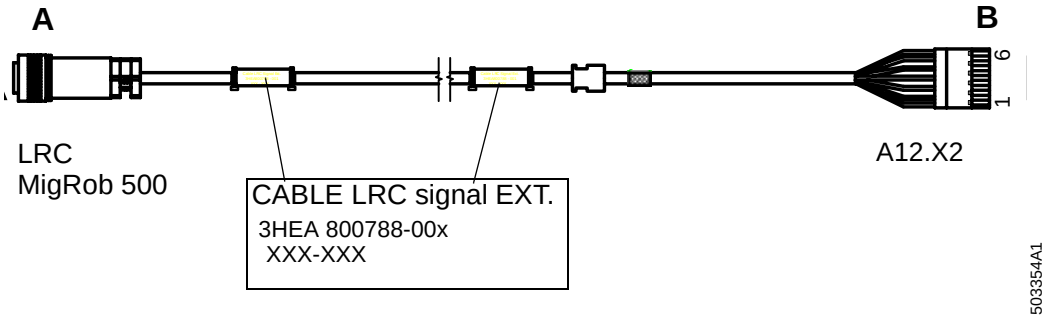


Figure 18. Block diagram LRC/ MigRob

Pos	Description	Pos	Description
1	Welding power source	3	Control module
2	Terminal		

Control cable



Figur 19 Control cable for LRC /MigRob

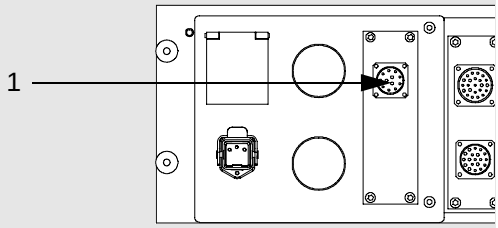
Pos	Description	Pos	Description
A	Welding power source	B	Control module

Signal-description

Signal description for control cable LRC/MigRob:

Signal description	Part/Core	A	B
Spare	1	D	1
Spare	2	E	2
Ext. enable	3	F	3
Ext. enable	4	C	4
Welding minus (OKC)	5	M	5
Welding measure - (Ext.)	6	J	6
Welding measure + (Ext.)	7	H	7
Shield	SH	SH	PE

Connecting CAN-bus/ DeviceNet

	Action	Info/Illustration
1.	Connect the CAN-bus from welding power source to output X107 on the control module. This output is internally connected to the control system's CAN-bus loop, output A35.X1	 *Figure 20. Cable inlets on control module*

4.3.2 Welding power source RPB

Block diagram

Power source RPB is connected to terminal **XS107** on the control module.

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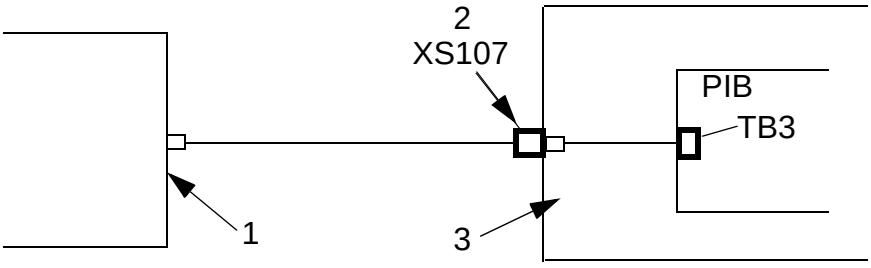


Pos	Description	Pos	Description
1	Welding power source	2	Control module
2	Terminal		

Control cable

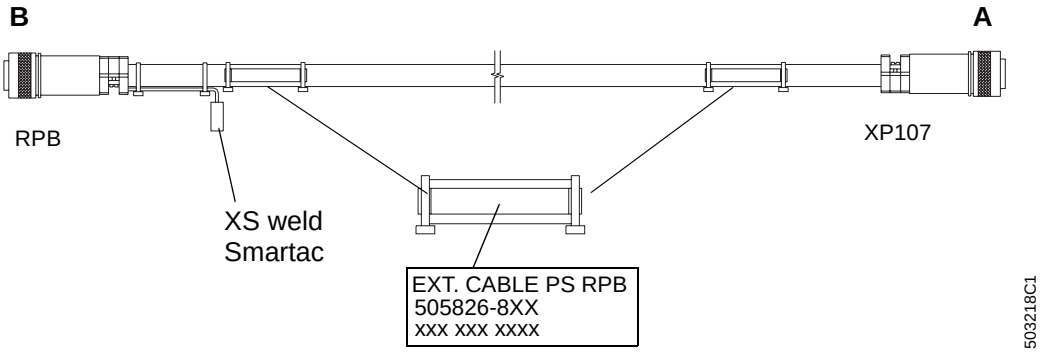


Figure 21. Control cable RPB

Pos	Description	Pos	Description
A	Control module	B	Welding power source

Signal-description

Signal description for control cable RPB:

Signal description	Part/Core	A	B	
0 V	wh (par 1)	B	B	
Start PS	bu (par 1)	C	E	
Ref.	wh (par 2)	A bridged with D	-	
0V	or (par 2)	D bridged with A	A	
WELD-/WELDOBJ.		F	-	XS WELD
Shield		SH	NC	

4.3.3 Reference documents

Document	Document ID.
Product manual for welding power source LRC	
Product manual for welding power source MigRob 500	
Product manual for welding power source RPB	
Welding torch PKI	
Welding torch Binzel	

4.4 Installation of accessories

4.4.1 Cooling unit OCE 2

The cooling unit is included in welding torch set PKI 500R and Binzel WH 455D

Connect the cable bundle

Connect the cable bundle to the cooling unit as follows:

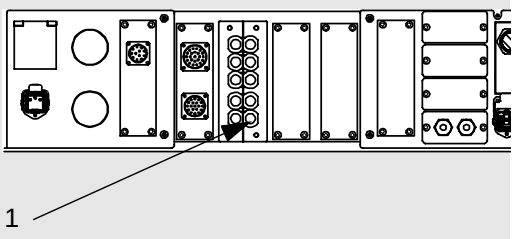
- Red water hose to the cooling unit's return connection **IN**.
- Blue water hose to the cooling unit's feed connection **OUT**.
- Air hose to the compressed air supply.
- Gas hose to the gas cylinder.

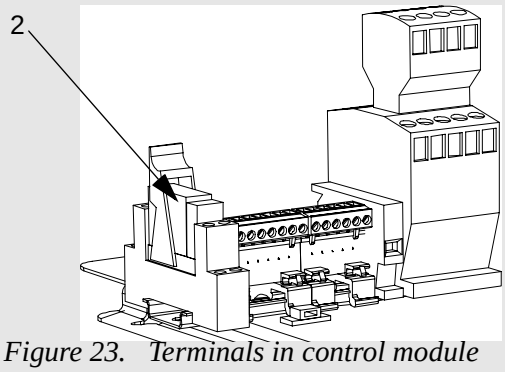
Connect the cooling unit's mains cable

Connect the cooling unit's mains cable as follows:

Type	Connection
RPB	Mains cable for cooling unit is connected to welding power source.
MigRob/LRC 430	The mains cable is connected to terminal A12.K11 in control module.

LRC 430/ MigRob

	Action	Info/Illustration
1.	Cable entry can easily be made through the cover on the control module for process options.	 *Figure 22. Cable inlets on control module*

	Action	Info/Illustration
2.	Connect the cable from the cooling unit to relay A12.K11 inside the control module.	 *Figure 23. Terminals in control module*

Fill the cooling unit with water

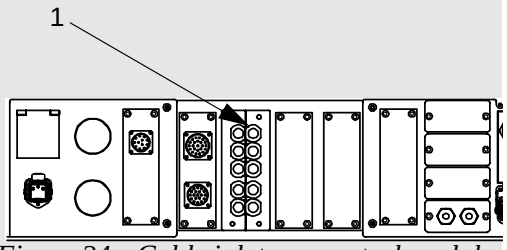
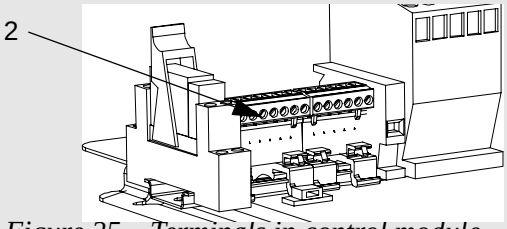
See the separate manual under section “Cooling unit” for a description of the cooling unit.

	Action
1.	Fill the cooling unit with water and any anti-freeze. **Distilled water is recommended**
2.	Check the flow in the welding torch by opening the cooling unit’s return hose connection IN until water comes in.
3.	If the water guard is ordered afterwards, the strap in the wire feed unit must be removed before the guard can be used. This is done as follows: • Unscrew the strap By1 on the terminal in the wire feed unit between connections 2 and 4.

Reference document

Document	Document ID.
Product manual for OCE2	

4.4.2 Torch cleaner

	Action	Info/Illustration
1.	Cable entry can easily be made through the cover on the control module for process options.	 *Figure 24. Cable inlets on control module*
2.	Connect the Torch cleaner to terminal A12.X1	 *Figure 25. Terminals in control module*

Block diagram .

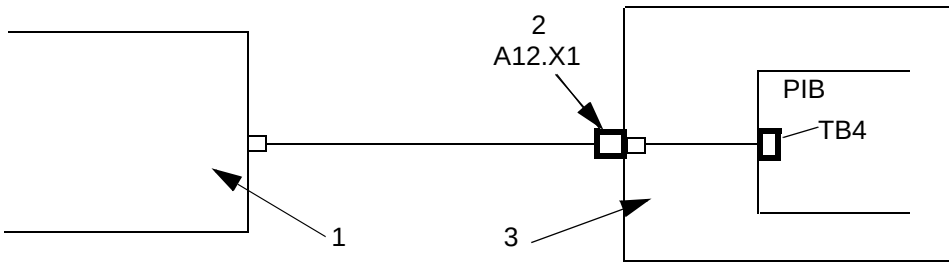


Figure 26. Block diagram

Pos	Description	Pos	Description
1	Torch cleaner	3	Control module
2	Terminal		

Cable for Torch cleaner

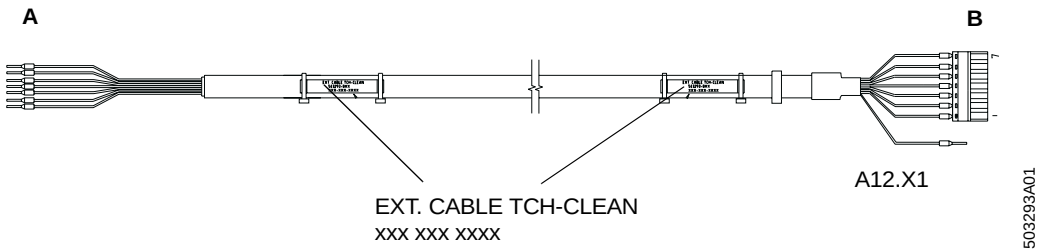


Figure 27. Cable for torch cleaner

Pos	Description	Pos	Description
A	Torch cleaner	B	Control module

Signal description

Signal description for Torch cleaner.

Signal description	Color	A (TC96)	A(BINZEL)	B
24V DC	White	4	6	1
0V DC	Brown	2 & 8	3, 4 & 5	2
Lubrication	Green	11	8	3
Cleaning	Yellow	10	7	4
Wire cutter	Gray	1	NC	5
Cleaning Finished	Pink	7	9	6
BullsEye	Blue	16	10	7
Shield	SC	NC	NC	PE

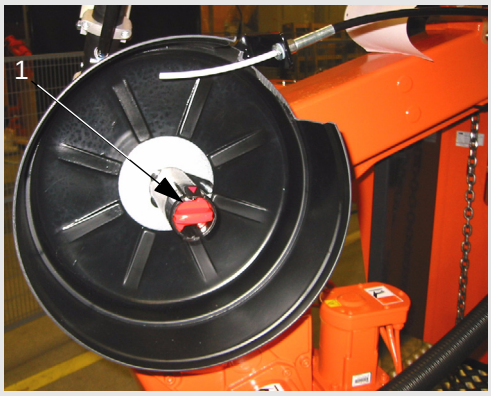
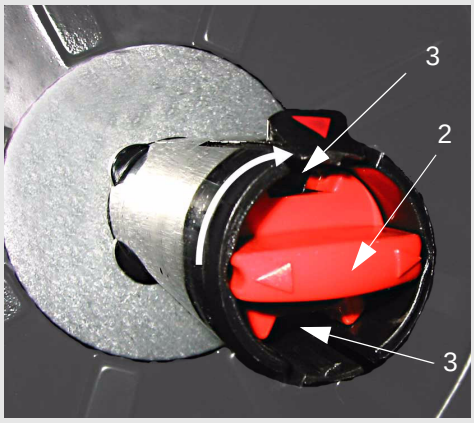
Reference documents

Document	Document ID.
Product manual for TC96	
Product manual for Binzel	

4.5 Adjusting the brake hub (bobbin)

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

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

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

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

4.6 Before commissioning

All guards and all safety equipment must be positioned before the station is commissioned. This should be especially observed in connection with maintenance and service.

Before commissioning, the following should be checked:

	Action
1	Check that no tools have been forgotten.
2	Check that the fixture and workplace are well secured.
3	Check that all parts and guards are in place and that they are well secured.
4	Check that all functions are correct.

5 Maintenance

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

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.

Note!
Only use genuine spare parts and extra accessories recommended by ABB.

5.1 Wire feed unit

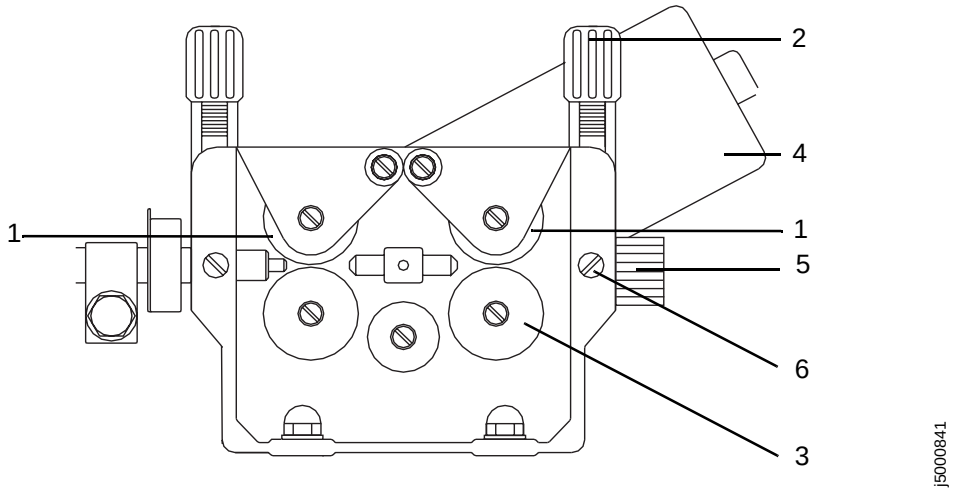


Figure 28. Wire feed unit

Pos	Description	Pos	Description
1	Upper feed roller	4	Motor
2	Adjuster screw	5	Inlet guide
3	Lower feed roller	6	Screw

Regularly

	Action	Info/Illustration
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 wire feeding the grooves in the feed rollers should be cleaned at regular intervals.
4.	The wire conduit should always be purged by compressed air when changing the wire and as necessary. • When worn out, change the wire conduit.	
5.	Use filler wire free of impurities.	Dirt can cause slipping.

Wire changing

There are two grooves in the feed rollers, one for each wire diameter.

To change grooves the rollers are turned so that the markings for the required wire diameter come outwards.

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

5.1.1 Before commissioning

All guards and all safety equipment must be positioned before the station is commissioned. This should be especially observed in connection with maintenance and service.

	Action
1	Check that no tools have been forgotten.
2	Check that the fixture and workpiece are well secured.
3	Check that all parts and guards are in place and that they are well secured.
4	Check that all functions are correct.

6 Repair

6.1 Changing wire feed motor

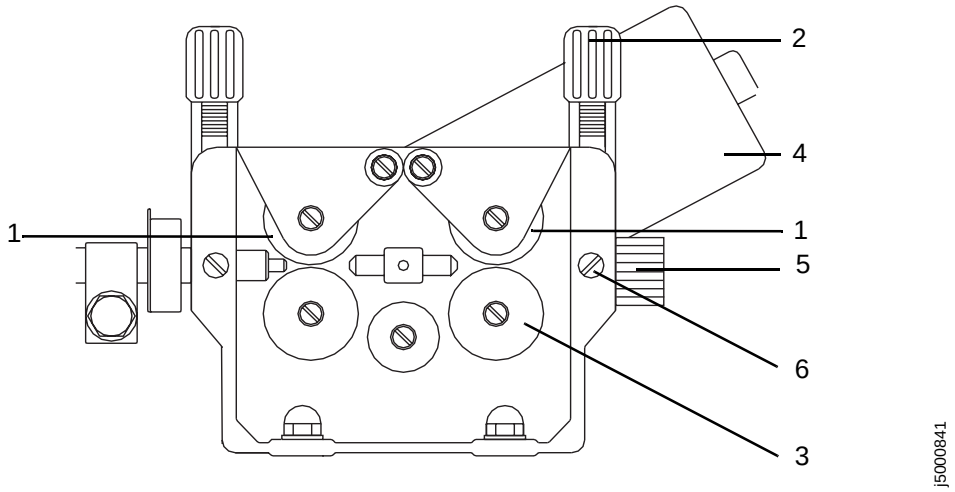


Figure 29. Wire feed unit

Pos	Description	Pos	Description
1	Upper feed roller	4	Motor
2	Adjuster screw	5	Inlet guide
3	Lower feed roller	6	Screw

Dismounting

	Action
1.	Release both feed rollers.
2.	Remove the drive wheel and the three cap screws.
3.	Lift out the motor.

Mounting

When replacing or repairing the drive motor the drive motor shaft must be centered to both the feed rollers with a centering device to avoid wear on the cogs and bearings.

	Action
1.	Fit the new motor.
2.	Center the motor's drive shaft to both feed rollers by means of the centering device.
3.	Fit the drive wheel and the three cap screws.
4.	Fit the two drive rollers.

Centering device

Designation	Order number
Centering device	500 332-001

6.1.1 Before commissioning

All guards and all safety equipment must be positioned before the station is commissioned. This should be especially observed in connection with maintenance and service.

Before commissioning, the following should be checked:

	Action
1	Check that no tools have been forgotten.
2	Check that the fixture and workpiece are well secured.
3	Check that all parts and guards are in place and that they are well secured.
4	Check that all functions are correct.

7 PIB Process Interface Board

7.1 General

The PIB is an I/O unit with integrated wire feed regulator communicating directly with the ABB robot control system IRC5 for control and monitoring of the robot welding.

The configuration is done in the same way as for a standard I/O unit.

The PIB characteristics are determined by the transfer of configuration parameters for power sources and feed units.

The communication with the robot computer is serial and is maintained by way of a CAN bus.

The PIB I/O connections are grouped together for direct cable connection to units such as power sources, wire feed units, torch cleaners, sensors, etc., see *Figure 30.*

- welding power source
- wire feed unit
- torch cleaner
- sensors

7.1.1 Overview

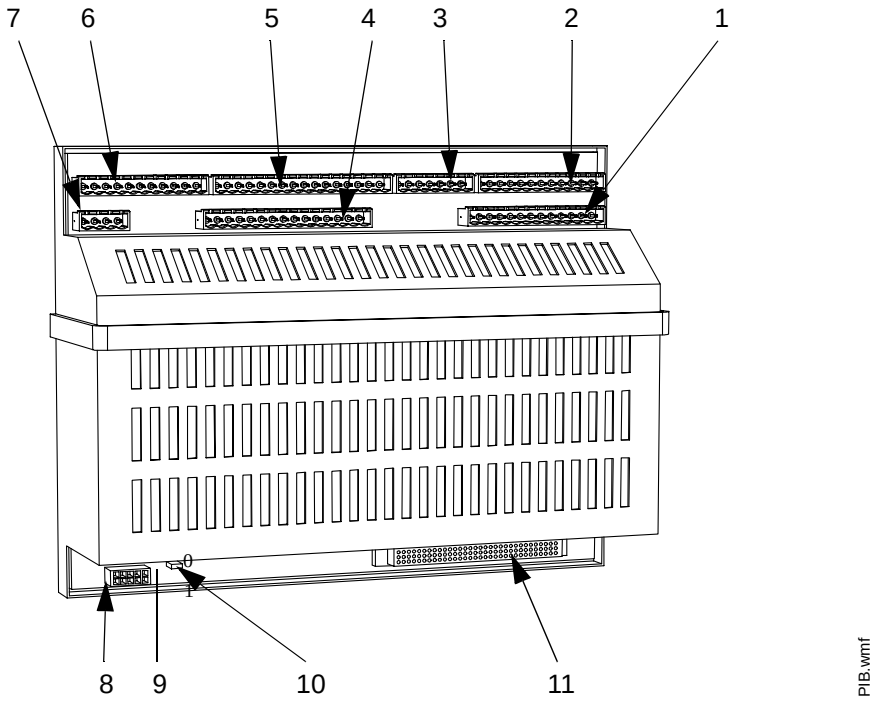


Figure 30. Terminals on PIB

Pos	Description	Pos id
1	Terminal for power supply and interlocking	A121.TB1
2	Terminal for CAN-bus/DeviceNet	A121.TB2
3	Terminal for TSC	A121.TB4
4	Terminal for wire feed (signal)	A121.TB6
5	Terminal for wire feed (motor)	A121.TB5
6	Terminal for welding power source	A121.TB3
7	Terminal	A121.TB11
8	D-sub for loading program	
9	Jumper	A121.TB9
10	Switch for loading program	
11	Euro connector “Add on board” for sensor	

7.2 Technical Specification

7.2.1 Mechanical Data

Type	Data
Dimensions:	257x196x72.5 mm
Weight:	2.1 kg
Enclosure class:	IP 20

7.2.2 Electrical Data

Type	Description	Data
Power supply:	*Figure 31. on page 49* -Transformers	
Digital outputs:	Continuous load/output:	max 350 mA
	Total output load:	max 1.6 A, < 70°C
	Tripping of overload protection per output	370 mA
	Remark: Regarding capacitive load > 0.05 uF a temporary overload can arise at the start causing the overload protection to trip. If this occurs a current-limiting resistor must be connected in series with the connected load.	
Digital inputs 24 V DC:	Incoming voltage, switch on:	15 - 35 V
	Incoming voltage, switch off:	-35 to +5 V
	Impedance	4 kohm, resistive
42V AC outputs:	Max current:	1A at < 70°C
Relay outputs:	Max voltage:	250V AC
	Max current: Note: Sparc protection has to be externally connected	10 A
Analog outputs:	Outgoing voltage:	0 - 15 V, < = 100 mA, < = 70°C.

7.2.3 Environmental Data

Temperature data:	**Storage**	**Operation**	**According to:**
Cold:	-40ºC, 16 h	+5ºC, 2 h.	IEC 68-2-1
Heat:	+70ºC, 16 h	+70ºC, 2 h	IEC 68-2-2
Change:	-40ºC / + 70ºC 2 cycles		IEC 68-2-14
Vibration:			EC 68-2-6
EMC: (Electro Magnetic Compatibility)			EN 50199
LVD: (Low Voltage Directive)			EN 60204

7.3 Safety

7.3.1 Personal Safety

Moving parts which according to the EU machinery directives might cause personal injury are interlocked via the robot holding device and emergency circuit.
Such functions are:

- Manual wire feed
- Mechanical cleaning of the torch.

Interlocking

Figure 37. shows the build-up of the PIB interlocking system.
If national regulations require that also the power source shall be interlocked, the interlocking system can be completed by a relay opening the control circuit of the power source.

Manual wire feed

On manual wire feed via the welding torch or the push-button of the feed unit, the wire can be fed without holding down the holding device up to max. 6 meters per minute. The speed will increase as long as the push-button is activated.

Manual wire feed: See *"Manual wire feed with PIB and IRC5" on page 60*,

7.3.2 Machine safety

Collision Detection

The Collision detection robot function is set as standard on the A314E/316E/324E-L systems.

Important!
The mechanical safety bracket function on PIB must be deactivated through the connection of +24V to PIB input TB 6.2.
A lack of this signal will be interpreted as a collision by PIB and the wire feed will be blocked.
Bridge By2, in the wire feed is prepared for this and on delivery is made when a safety bracket is not installed. See note 2 ***Figure 13. on page 19*****.**

Safety bracket

The mechanical safety bracket is ordered as an option.

Important!
Bridge By2, must be open when the safety bracket is installed. See note 2 ***Figure 13. on page 19***

The following description *Collision Sensor 7.3.3* applies when the safety bracket is installed.

7.3.3 Collision Sensor

General

The PIB is designed to be used with a welding torch with collision sensor.

In normal status the sensor is to supply 24V DC to the PIB input TB6.2.

The collision sensor controls the Run Chain relay in the PIB. The relay is of the two-pole type and is integrated in the general stop chain (G-stop) of the robot. In normal status the relay is active.

When the collision sensor is activated

When the collision sensor is activated the Run Chain relay opens, resulting in an opened G-stop chain, leading to quick-stop of the motion due to the fact that the robot goes from operation mode to stand-by mode. The error message G-stop comes up on the robot programming unit. The message remains until it has been acknowledged by way of the OK button.

Operation after collision

To enable putting the robot into operation again the G-stop chain must first be closed.

If the torch has occasionally been out of position but has sprung back again, the G-stop chain closes and the robot is ready to be used again.

If the torch remains in the wrong position, for example after having collided with the weld object, the fixture, etc., the robot must be moved in order to make the torch spring back. On the front of the ABB wire feed units A-314 there is a spring-back push-button (reset) for this purpose.

Reset

Operation after collision

When the collision sensor is reset the PIB microprocessor activates the Run Chain relay and closes the G-stop chain. It is then possible to put the robot into service again, by using the robot joystick to manoeuvre the robot to make the torch spring back, resetting the collision sensor in closed position. The reset function is automatically acknowledged.

Program start

The start of the running of the program is blocked until acknowledged. Trying to start before acknowledgement will result in the Run Chain relay opening and the G-stop chain breaking. The reset procedure must then be repeated.

Limitations

To prevent the PIB remaining in the reset function - due to circuit interruption, for example - and to ensure that a further collision will stop the robot, the reset time is limited to 1 minute. After that the G-stop is interrupted again and the reset procedure must be repeated.

What is said above applies both to manual running of the robot and to running by way of the program.

Running by program

When running the robot by way of the program there appears an additional error message, expressly indicating that the collision sensor has been activated.

The error messages

Message	Description
Message 1: PIB error, warning	Welding torch has crashed. If torch still crashed, reset from wire feed. • Move robot with joystick, its not allowed start prg. Message 1 is shown together witth G-stop (general stop) if the welding torch is still in an incorrect position.
Message 2: PIB error, warning	Welding torch has been resetted.
Message 3: PIB information	Torch back to normal position after being down.

Messages 2 and 3 will come up after restart in this order. If the collision is of short duration and the torch breaks only momentarily and springs back again, message 1 will not be displayed. Messages 2 and 3 will be displayed, however.

7.3.4 Electronics

Design

PIB is designed to withstand the short-circuiting of the outputs and overloading of the motor regulator.

The overloaded output is switched off. The function resumes when the power supply is switched on again after the power supply to the PIB has first been cut and the overload eliminated.

Motor regulator

The motor regulator is protected by a current limiter on the drive stage.

Units

Units connected to the PIB are also protected as the max. and min. data can be configured, for example, max. reference for the power source, max. speed of the connected wire feed unit.

Error messages

As evident from *"7.11 Diagnostics – Error Handling" on page 63* an error message is displayed to demand a proposed action.The weld process is not interrupted.

7.4 Versions and options

7.4.1 Voltage versions

PIB is available in two voltage versions, see table bellow and *Figure 32.* for more information.

Voltage version	Description	Ordering no.
005-Low voltage	Wire feed units with voltage supply to the final stage of the feed unit regulator of max. 42V AC/ 10A	501 700-880
006-High voltage	Wire feed units with voltage supply to the final stage of the feed unit regulator of max. 115V AC/ 3.5A	501 700-881

Warning! Connecting 115V AC to the low-voltage version of PIB will destroy the PC board.

The high-voltage version:
A protective earth conductor (min. 2.5 mm^2) shall be connected between the upper PIB metal bar and the protective earth bar of the robot cabinet before the unit is switched on.

Transformers

There are transformers available for the particular voltage. They are to be connected to terminal XT21 for 230V AC/ 3.15A in the control module.

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Version	Article number
Low voltage (LV)	501 714-001
High voltage (HV)	501 714-002

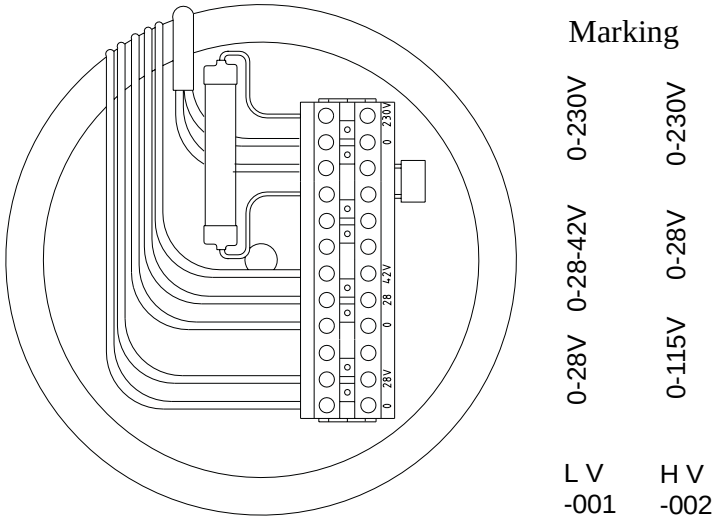


Figure 31. Transformer

7.5 Marking and Version Handling

Hardware version

Figure 32. shows the location and disposition of the article and manufacturing numbers. This marking indicates the hardware version of PIB – not the software one.

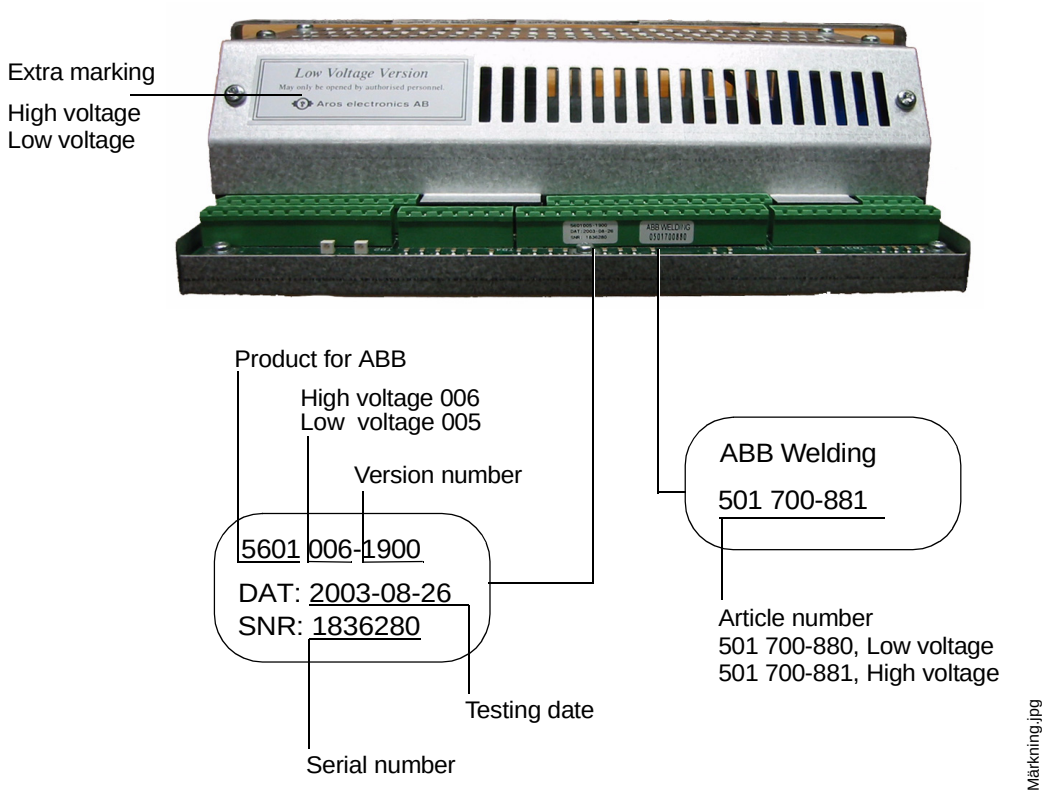


Figure 32. Marking and Version Handling.

Software version

The software version is indicated under the configuration menu in the programming unit for the robot as a non-editable four digit number. The number is automatically updated when the software version is changed.

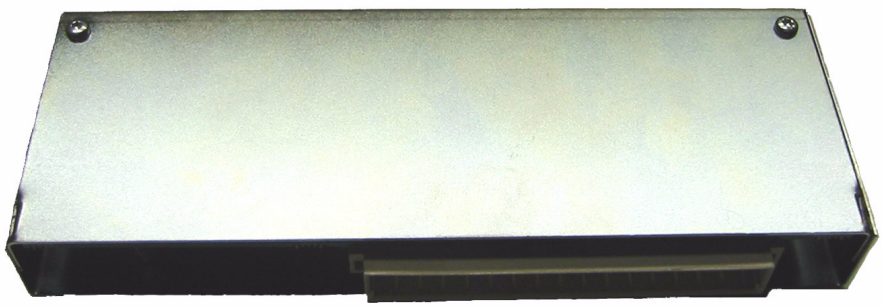
7.6 Options

7.6.1 Smartac

The unit is an “Add on” unit and is connected to the PIB by way of a 32-pole connector of the Euro type, see Figure 30.

smartac på PIB.jpg

Figure 33. Smartac connected to PIB



smartac.jpg

Figure 34. Smartac

7.7 Configuration

7.7.1 General

Programmable parameters enable the adaptation to different types of welding equipment.
The configuration parameters determine:

- the control properties
- the scale factors
- the offset values
- the max. and min. values, etc.

7.7.2 Configuration parameters

These factors are listed and their values can be edited on the FlexPendant under the menu:

```
Misc\System\Parameters\IO signals\Types?Units\PIB-name
(=configured IO-name)
```

Modified values are automatically transferred to the PIB board when restarting the robot.

When changing the PIB

Previous configuration parameters stored in the robot will be automatically transferred to the new PIB card (Exception see chapter on *page 53)*
Configuration data for ABB's standard welding equipment are included in the AW system configuration diskettes
See *"Configuration parameters" on page 65*, where all the parameters are listed and defined.

When changing PIB the unit must be restarted 2 times.

7.8 Installation

7.8.1 Adaptation to IRC5 control system

General

PIB includes two program versions, depending on the robot system. Which program version is active is determined by the TB9 jumper.

IRC5

For robot systems from IRC5 the TB9 jumper shall be open (removed or parked on one of the pins).

The jumper in this position supports:

- The transfer of configuration data from the robot FlexPendant.
- Automatic transfer of configuration data from the robot when changing PIB. See description in *"Configuration parameters" on page 52*.

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Bygling_TB9_överblick.jpg

Figure 35. Jumper TB9.

At delivery

All PIB equipment delivered separately or as spare parts is pre-configured for ARCITEC/ LRA and wire feeder A314 (jumper TB9 closed) on delivery.

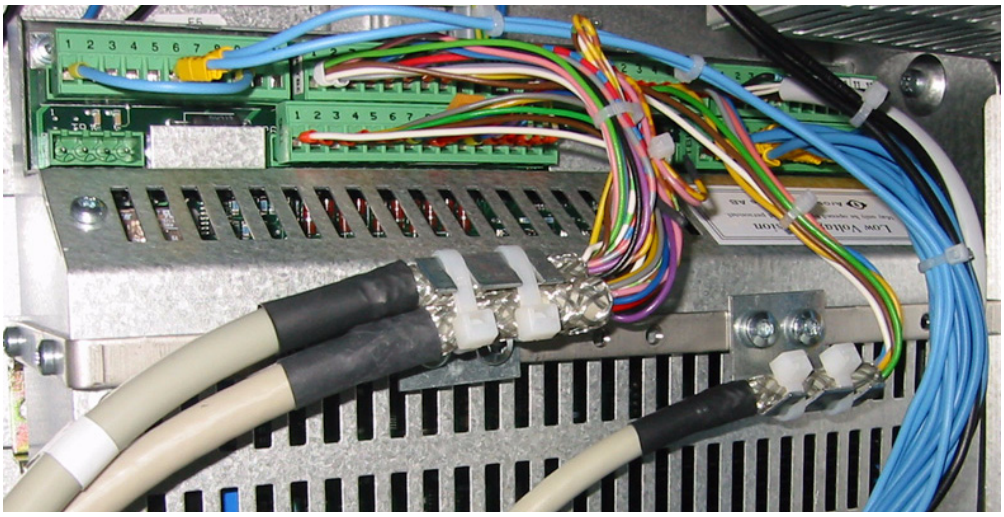
Type of delivery	Description
Complete system	When a complete system is delivered the TB9 position is determined.
Spare part or component	For use together with IRC5 the jumper is removed and the parameter transfer takes place according to *"IRC5" on page 53*.

7.8.2 Connecting Cable Shields

The metal bar on the upper side of the PIB is provided with holes for the fitting of 2 cable clamps included with the delivery of the PIB.

	Action
1.	Screw the clamps tightly onto the metal bar.

In order for the PIB to function correctly it is important that the shield connections are made precisely, see *Figure 36.* This mainly applies to the two cables from the wire feed unit. If possible, they should be routed at some distance from each other.



Skärmning av kablar.jpg

Figure 36. Shielding.

7.8.3 Signal Connections

For more information see *Figure 30. on page 40*, and *Figure 37. on page 59*.

TB stands for Terminal Block.

7.8.4 Table - Signal Connections

TB1, Power Supply and Interlocking

	Designation	Function, Voltage	Out	In	Explanation
1	Motor Supply	AC			Power supply for the motor regulator, interlocked 42V max. for PIB 501700-880 115V max. for PIB 501700-881
2	Motor Supply Common	AC			Zero, power supply
3	Supply solenoid valves	AC			Power supply not interlocked for solenoid valves and push feed unit
4	Logic supply	28V AC			Power supply for logic circuits
5	Logic supply common	0V AC			Zero, power supply for logic circuits
6	Ground	0V DC			Ground, screen
7	I/O 24 VS	DC		x	Interlocked 24V DC
8	Manual Wirefeed out	24V DC	x		Control signal for closing the interlocking contactor
9	Run Chain A1	Relay contact			Run Chain A
10	Run Chaiu A2	Relay contact			Run Chain A
11	Run Chain B1	Relay contact			Run Chain B
12	Run Chain B2	Relay contact			Run Chain B
13	24V Ext	24V DC	x		24V DC (*Figure 37. on page 59*)

Table - Signal Connections

TB2, CAN bus Connection

	Designation	Function, Voltage	Out	In	Explanation
1	Sys 0V	DC			System 0 (=Robot I/O zero
2	CAN Low	Serial communic.			CAN Low [1]
3	Ground	DC			Ground, screen
4	CAN High	Serial communic.			CAN High [1]
5	Sys 24V	DC		x	System 24 V (=Robot I/O 24 V)
6	0V	DC			0 V for addressing
7	NA 0	Jumper, NC=active			Binary addressing, not connected to TB2:6=1
8	NA 1	Jumper, NC=active			Binary addressing, not connected to TB2:6=2
9	NA 2	Jumper, NC=active			Binary addressing, not connected to TB2:6=4
10	NA 3	Jumper, NC=active			Binary addressing, not connected to TB2:6=8
11	NA 4	Jumper, NC=active			Binary addressing, not connected to TB2: 6=16
12	NA 5	Jumper, NC=active			Binary addressing, not connected to TB2: 6=32

1. Terminator resistor 120 Ohm to be fitted between TB2/2 and TB2/4 if PIB is the farthest off I/O unit in the system. See recommendations regarding the connection of terminator resistance in the robot product manual.

TB3 Connection to Power Source

	Designation	Function, Voltage	Out	In	Explanation
1	Start Power Source A	Closing contact	x		Control relay for power source (or cooling fan, ARCITEC)
2	Start Power Source B	Closing contact	x		Control relay for power source (or. cooling fan, ARCITEC)
3	Weld ref.	Analog 0-15 V	x		Reference for welding voltage
4	Ref. Common	Analog common	x		Reference zero
5	Induct. Ref	Analog 0-15 V	x		Reference for setting of the inductance
6	Weld Object	Analog		x	Sensing the welding voltage on weld object [1]
7	Arc Voltage Gun	Analog	x		Return the welding voltage to power source
8	Arc Voltage object	Analog			Sensing the welding voltage on weld object for PDM.[2]
9	24 V Ext	Supply voltage	x		For external relay
10	0 V	Supply voltage	x		For external relay
11	NC				Not connected

1. Common connection to the welding object and the power source, negative pole for Smartac/PIB.
2. PDM=Process Data Monitoring.

TB4 Connection to torch cleaner and TCP detector

	Designation	Function, Voltage	Out	In	Explanation
1	24V DC	Supply	x		
2	0V DC	Supply, zero	x		
3	Lubrication	Digital 24V DC	x		Lubrication for cleaning reamer
4	Cleaning	Digital 24V DC	x		Cleaning reamer
5	Wire Cutter	Digital 24V DC	x		Cutting the wire
6	Cleaning finished	Digital 24V DC		x	Cleaning finished
7	Bulls Eye	Digital 24V DC		x	TCP search stop

TB5 Connection 1 to Wire Feed Unit

	Designation	Function, Voltage	Out	In	Explanation
1	Motor +	0-60/0-170V DC	x		Motor voltage
2	Motor -		x		Motor voltage
3	Pneum Spatter Cleaning	42V AC	x		To solenoid valve for Pneumatic spatter cleaning
4	Gas Valve	42V AC	x		To solenoid valve for shielding gas
5	Arc Voltage Gun	0-70V DC		x	Arc voltage feed-back [2]
6	Smartac 1	40V DC	x		Search voltage for Smartac Sensor 1
7	42V AC	Phase	x		Supply voltage for Push feed unit
8	42V AC Common	Zero	x		Supply voltage for Push feed unit
9	Smartac 2	40V DC	x		Search voltage for Smartac Sensor 2 [1]
10	Spatter Cleaning A	Closing contact			Alternative parallel function for TB5:3 [2]
11	Spatter Cleaning B	Closing contact			Alternative parallel function for TB5:3 [2]
12	Gas Valve A	Closing contact			Alternative parallel function for TB5:4 [2]
13	Gas Valve B	Closing contact			Alternative parallel function for TB5:4 [2]
14	Tig Mode	24V DC	x		Option
15	Feed Reverse	24V DC	x		Control signal for motor reversing
16	HF Ignition	24V DC	x		Option

1. When using the Smartac sensor 2 TB5:5 and TB5:9 shall be bridged. See Product manual for Smartac.
2. Adapted contact protector required

Table - Signal Connections

TB6 Connection 2 to Wire Feed Unit

	Designation	Function, Voltage	Out	In	Explanation
1	Gun reset	24V DC		x	Resetting the collision sensor
2	Gun Crash	24V DC		x	Collision sensor
3	Current Sense	24V DC		x	Welding current sensor
4	Water Flow	24V DC		x	Water flow sensor
5	Gas Flow	24V DC		x	Gas flow sensor
6	NC	NC			Bridged with TB 6/10
7	Encoder TG INPUT	DC Puls		x	DC- or AC-tacho/input for encoder tacho
8	Man. Wire Feed	24/DC		x	Manual wire feed
9	+ 24V	Supply voltage	x		Supply voltage
10	0 V	Supply voltage	x		Supply voltage/ common for encoder tacho
11	Temp	Analog		x	Temperature sensor in wire fed unit
12	Aux Motor	24V DC	x		Control signal for Push feed unit
13	PDM Tacho +	AC/DC		x	Tacho for Process data monitoring
14	PDM Tacho -	AC/DC		x	Tacho for Process data monitoring
15	+ 5V (alt + 15V[1])	DC	x		Supply voltage for encoder tacho

1. PIB High Voltage

TB11

	Designation	Function, Voltage	Out	In	Explanation
1	Weld Current A	Analog		x	Shunt connection for PDM
2	Weld Current A	Analog		x	Shunt connection for PDM
3	HF Ignition	24V DC		x	Indication of HF ignition, Option
4	Smartac sense detect	24V DC	x		Alternative for sens. detect. via CAN-bus

7.8.5 Elementary Diagram - Power Supply and Interlocking

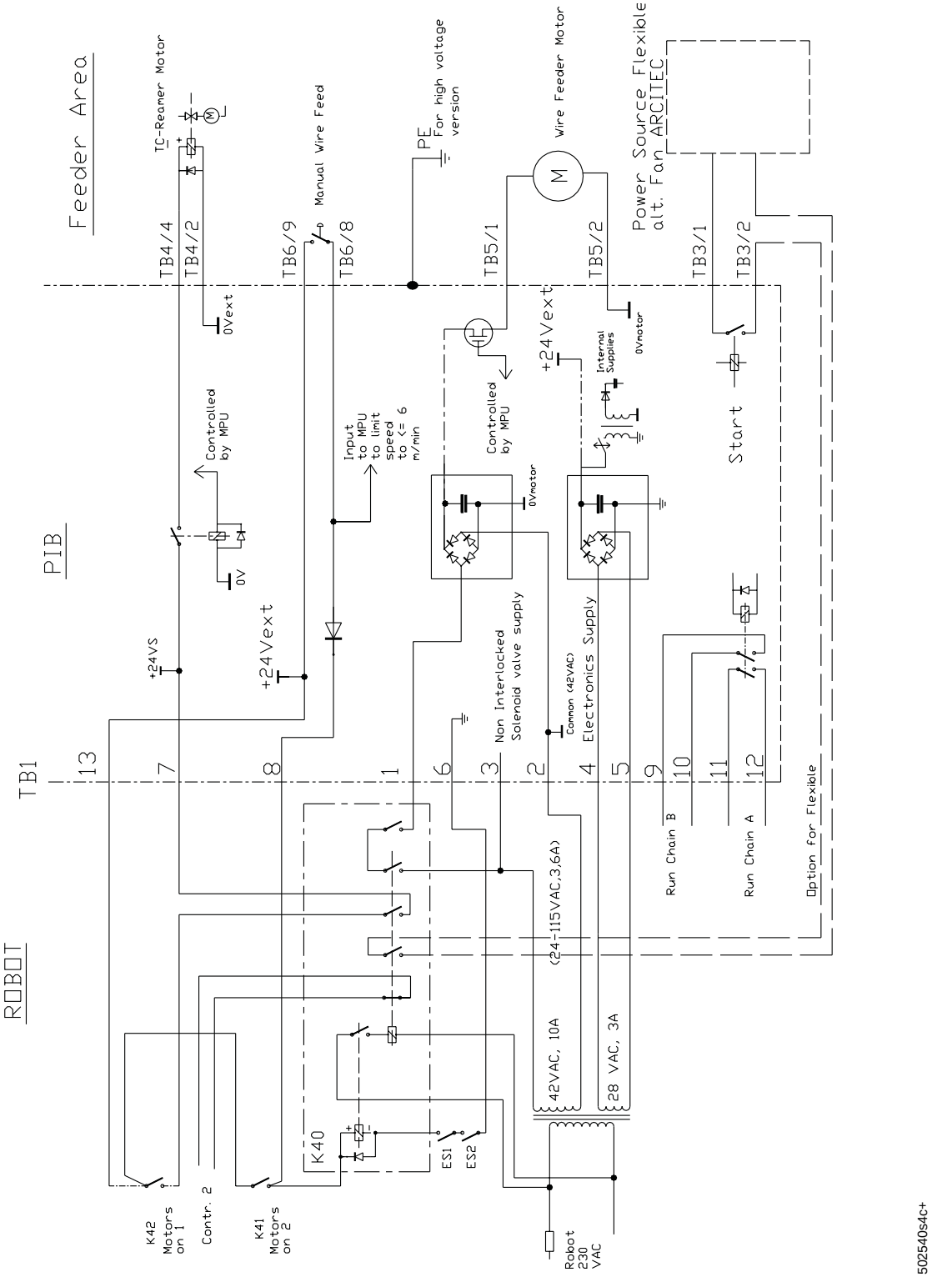


Figure 37. Elementary Diagram - Power Supply, safety and Interlocking.

7.9 Manual wire feed with PIB and IRC5

7.9.1 Possibilities and limitations

Manual wire feed can be carried out in three different ways:

- By pushing in the non-locking push button for manual wire feed on the welding torch or on the front of the wire feed unit.
- By activating the function **Manual wire feed** from the robot's Flexpendant in test mode under:

  `Program window\Arcweld\Manual wirefeed.`
- By activating the robot output **doFEED** in combination with the setting of a speed reference under the I/O window in:

  `aoFEED_REF..`

Characteristics and differences

The table below shows the characteristics and differences between the methods.

Observe comment 3 below regarding the limitation in functionality for method 3.

Method	Speed[1]	Ramping function	Safety pad pressed in	Setting the reference
1	Max. 6m/min.	yes	no	automatically
2	Max. 9m/min.	yes	yes	automatically
3	The full speed range	no	yes	yes, manually Limited validity[2]

1. Speed: If the speed range is limited by the configuration parameters MotorMaxSpeed or MotorMinSpeed the limitation applies.
   For ARCITEC it also applies: If the speed range is limited by the configuration parameter MotorMachineID the limitation applies.
2. **Note: The reference only applies as long as aoFEED is not changed by any other function: The methods 1 and 2 or execution of a program with another value.** After using methods 1 or 2 the reference is reset.

Explanation

The table below shows the differences between the methods.:

Method	Explanation
1	The arc weld function “Manual Wire feed” in the robot is called from PIB. The robot input diMAN_WF is activated. The robot activates the output doFEED with a reference in aoFEED that increases as a function of the time the wire feed button is pressed in. The function is active as long as the button is pressed in. The speed is limited to max. 6 m/min. by PIB[1].
2	The arc weld function “Manual Wire feed” is called from the robot's programming unit. The robot input diMAN_WF is activated. The robot activates the output doFEED with a reference in aoFEED that increases as a function of the time the Manual feed button is pressed in. The function is active as long as the button is pressed in.
3	The reference range is expressed as 0 - 0.5 m/s (0 - 30 m/min.). The function is active as long as doFEED is set to 1.

1. Limitation for reasons of personal safety.

7.10 Service and Programming Aids

7.10.1 CAN-Assist, art no. 502 800-880

Passive Mode

PC based tool that in Passive Mode allows listening to the CAN-bus traffic in the Weld system during the current process.

Master Mode

In Master Mode, with the connection to the robot master disconnected, the I/O-function in the different units in the system can be activated, parameters loaded or changed.

CAN-Assist is supplied as a package with hardware and a CD containing software and documentation.

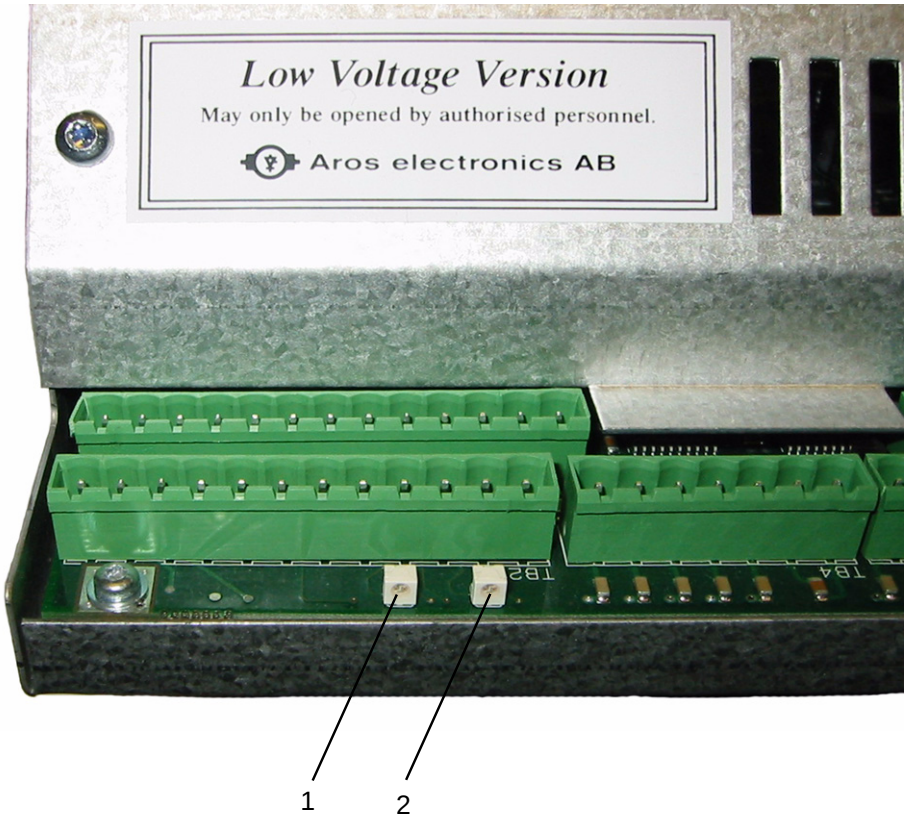
7.11 Diagnostics – Error Handling

7.11.1 Light-emitting diodes

The PIB is fitted with two light-emitting diodes according to the DeviceNet specification.

.

Light-emitting diode	Description
NS	(Network Status), indicates the function of the CAN bus.
MS	(Module Status), indicates the PIB function.



Lysdioder.jpg

Figure 38. Light-emitting diodes on PIB

Pos	Description	Pos	Description
1	MS	2	NS

Error Handling

Indication	Description
Green light	Indicates correct function
Red light	Indicates incorrect function
Changing light	During the initiation phase, which can take a few seconds, the light of the diodes changes.

7.11.2 In the event of an error on PIB

In the event of an error on PIB an error message is given to the FlexPendant as a warning to call action, see *"Error messages" on page 64*.

The weld process is not interrupted but action is required.

Acknowledge error messages

	Action
1.	Error messages are acknowledged by pressing OK.

Error messages

From PIB with version numbers -503. -0702 and from -1100 and higher the number of error messages is limited to the following:

Error messages	Description
80001 2 PIB error, warning	Analog outputs outside limits • Check the limits in ctrl.conf.part motor max/min. Speed and max Volt.
80001 4 PIB error, warning	Digital Output overloaded in PIB, fatal error • Check the output connections. • Reset with power switch.[1]
80001 11 PIB error, warning	Supply voltage 24 Volt on PIB too low • Check incoming power supply.

1. The overloaded (short-circuited) output is switched off by its overcurrent protection. The weld process is only interrupted if the process supervision is affected. The function resumes when the power supply to the PIB is switched on after the power supply to the PIB has first been cut and the overload eliminated.

Appendix A:

A - 1: Configuration parameters

The configuration parameters are defined for 3 demands:

1. They should be an integer in order to simplify handling in the microprocessor in the PIB.
2. The integer should be large enough so that the desired accuracy and resolution are obtained.
3. Programming from the robot should be possible to be expressed in actual quantities, for example, 21.4 m/min. for the wire speed, 32.2 V for the welding voltage, etc. A multiplier with one or more indexes to the power of ten is required in several cases:

   The setting range for the parameters and a number that defines what the configuration value is to be multiplied by in order to express the true relation is stated in the column **“Parameter range/denomination”** in *“Table - Configuration parameters.” on page 68*.

Example:

If **“MotorCurrentLim”** is defined to the value **80**, the definition means **“Motor Current Limit** {0...100}0.1 A” that the max permitted current is **8** A.
If **“ProcEquipRefConv”** is defined to the value **8260,** the definition means {1000...30000}E-3 that the relation Output voltage/Reference is **8.260** etc.

The conversion factor for the wire feed with AC-tacho:

The conversion factor is obtained from
k_0 =g x n x 100/(p x D x 60) [Hz/m/min. x 100],
where:

k_0	is the conversion factor for tacho type 0
g	is the gearbox's gear factor
n	is the number of tacho periods/motor speed
D	is the feed roller's diameter in meters
100	is the multiple

In those cases k_0 should be >65535, Tacho type 2 should be configured and at the same time the conversion factor should be defined as k2 = k_0 /2.
The maximum permitted tacho frequency is 27000 Hz, which limits the maximum theoretical feed speed to Vmax = (p x D x 60 x 27000/(g x n)[m/min.]

Control parameters for the wire feed

The control parameters are:

- Feed Forward factor
- Motor Regulator P-factor
- Motor Regulator I-factor

These parameters are tested for the wire feed units supplied as standard and adjustment should be avoided. Modifications can result in incorrect speed or instability. Adjustment ought to be carried out in consultation with service personnel from ABB Automation Technologies AB

Transfer of parameters between the robot and PIB

The configuration parameters are sent from the robot's system parameter memory to the PIB each time the system voltage is switched on. If the parameters are equal to those already in the PIB no writing to the PIB is carried out.

If the parameters in PIB differ to those being sent from the robot, for example, with the replacement of PIB, the parameters that differ in PIB are written, which means that the new PIB gets the same configuration as the previous one.

In order for the new parameters to apply the system must be restarted twice.

System definition

If the parameter “System definition”, is changed, which involves a change of the I/O type for PIB, the parameter transfer takes place in two steps. First the redefinition of the new I/O unit in the robot takes place, which requires a restart.

During the next start the transfer to the PIB takes place and in order for the parameter to apply to the PIB another restart of the robot is required. Thus, in this case, two restarts are required. The second time it is sufficient with a “warm boot” of the system.

A - 2: Table - Configuration parameters.

The table contains all the parameters defined for PIB. They are shown and can be edited from the robot's FlexPendant.

All parameters are not implemented as standard. Parameters that are implemented and which must have the correct value to function correctly are marked by an asterisk and bold type.

Parameter name	Parameter name in FlexPendant	Parameter behavior	Parameter range/ denomination
Software Revision	SoftwareRevison	Current software revision (read-only)	-
Motor Max Voltage	MotorMaxVoltage	Maximum allowed voltage for the DC-motor connected.	{0...110} V **60** (Used as standard value)
Motor Current Limit	MotorCurrentLim	Maximum allowed current for the DC-motor connected.	{0...100} 0.1 A **100** (Used as standard value)
*Motor Max Speed	MotorMaxSpeed	Maximum allowed setting for motor speed in motor speed quantity units	{0...500} 0.1 **300** (Used as standard value)
*Motor Min Speed	MotorMinSpeed	Minimum allowed setting for motor speed in motor speed quantity units	{0...500} 0.1 **5** (Used as standard value)
*Motor Regulator P-factor	MotorRegPFactor	Proportional factor of the motor speed PI regulator.	{0...100}% **18** (Used as standard value)
*Motor Regulator I-factor	MotorRegIFactor	Integrating factor of the motor speed PI regulator.	{0...100}% **25** (Used as standard value)
*Motor Regulator Feedforward-factor	MotorFeedForward	Feedforward factor of the motor speed PI regulator.	{0...100}% **10** (Used as standard value)
Motor Temp Limit	MotorTempLimit	Maximum allowed temperature for the motor.	{0...255} °C
*Motor Brake Ratio	MotorBreakRatio	Defines the duty cycle of the brake transistor.	{0...255} 0 = No brake. **255** = Full brake **255** (Used as standard value)
Motor Control Error Time Limit	MotorCtrlErrTimeLim	Defines the maximum allowed time for difference between motor speed set value and actual value before setting the alarm	{0...255} 1/10 s

Parameter name	Parameter name in FlexPendant	Parameter behavior	Parameter range/ denomination
*Motor Tacho Conversion Factor	MotorTachoConv	For AC: 100 Frequency in Hz for 1 motor speed quantity. For DC: 10000 Voltage in V for 1 motor speed quantity.	{0...65535} **20650** (Used as standard value) AC (tacho type 0): 0.01 Hz / motor speed quantity AC fast (tacho type 2): 0.02 Hz / motor speed quantity DC (tacho type 1): e-4 V / motor speed quantity
*Motor Tacho Type	MotorTachoType	Determines type of tacho connected and used by the motor speed regulator of the PIB. Valid types are AC-tacho and DC-tacho	{0,1} 0 (AC-tacho) 1 (DC-tacho) 2 (Fast AC-tacho **0** (Used as standard value))
Motor DC Offset	MotorTachoDCOffset	Motor speed offset for DC-tacho connected	{-1000...1000} 0.01 m/min. (Or r/min, l/min)
*Process Equipment Reference Convers., Flexible	ProcEquipRefConv	Conversion factor between the process quantity in the set value and the reference voltage	{1000...30000}e-3 Process quantity / Vref
*Process Equipment Reference Offset, Flx.	ProcEquipRefOffset	Offset value for the process. Given in process quantity units.	{0...1000} 0.1 V
*Process Equipment Max Reference Voltage	ProcEquipMaxRef	Maximum allowed reference voltage.	{0...1000} 0.1 V
Process Data Monitoring Speed Conversion Factor	PdmSpeedConv	For AC: 100 Frequency in Hz for 1 motor speed quantity motor speed. For DC: 10000 Voltage in V for 1 motor speed quantity motor speed	{0...65535} AC: 0.01 Hz / motor speed quantity DC: e-4 V / motor speed quantity
Process Data Monitoring Tacho Type	PdmTachoType	Type of tacho used for true process quantity measurement	{0,1} 0 (AC-tacho)
Process Data Monitoring Tacho DC Offset	PdmTachoDCOffset	PDM DC tacho offset	{-1000...1000} 0.01 motor speed quantity
Process Data Monitoring Current Shunt Conversion	PdmShuntConv	Scale factor for the shunt used in PDM.	{0...65535} e-5 mV/A 15000
Process Data Monitoring Shunt Offset	PdmShuntOffset	PDM Shunt offset	{-32000...32000} mA
*Sensor Detection Sensitivity, Smartac	SensorDetectionSens	Defines the search voltage drop for detection of contact with workpiece	{0...255} 1/10 V

Table - Configuration parameters.

Parameter name	Parameter name in FlexPendant	Parameter behavior	Parameter range/ denomination
*Sensor Search Voltage Valid Limit, Smartac	SensorSearchVoltValidLim	Defines the lowest allowed search voltage for start of search.	{0...40} V
*System Definition	SystemDefinition	Defines the PIB system configuration	(0,1) 0 = (Flexible) 1 = Not in use (Arcitec S4CPlus) 2 = Integrated Power source IRC5
*Machine Identification code, ARCITEC	MotorMachineID	The motor machine identification for the wirefeed range of the current wirefeed motor. Only valid for Arcitec system	{0..255} According to wirefeed motor cable
Inductance Reference conversion	OptProcEquipRefConv	Conversion factor between the process quantity in the set value and the reference voltage	(1000...30000)e-3 Process quantity / Vref
Inductance Reference Offset	OpProcEquipRefOffs	Offset value for the process. Given in process quantity units.	(0...1000) 0.1 V

A - 3: Loading of configuration file

```
#*************************************************************
#
#   (c) ABB Automation Technologies AB,
#   Arc Welding Products
#
#   File: ESABMig_FhpE.cfg
#   Description:
#     ArcWeld PIB EIO-parameter configuration for PowerSource
#     ESABMig 400t/500t and WireFeeder A314E/A324E
#     with DC Pulsed Tacho.
#     Speed range 0.5 to 30 m/min.
#   Created:
#   Written by:
#   Version 1.0
#           1.0 LOJ
#               Initial Release
#
#*************************************************************
```

Installation

If you have received a config file on a CD, see example above, you can install it as follows:

1. Copy the **cfg-file** to a floppy, or use a PC/ Laptop and the Ethernet/ Service channel, use the FTP client to transport files manually between the PC and the robot controller storage memory.

   These actions are carried out in the same way as in a file manager or in Windows Explorer.

2. With the System Parameter Window of the FlexPendant displayed select: **FILE\ Add or replace parameters**
3. Select the **cfg-file** from the floppy, or from the directory that the file was transferred to.
4. Make a restart.

More information can be found in the User´s Guide.

Appendix B:

B - 1: System accuracy: verification and trimming possibilities.

Wire feed: Feed unit A314E/316E/A324E-L

A check of the wire feed unit's accuracy ought to be carried out by measuring the motor tachometer's pulse frequency and not by measuring the fed wire and time measurement in order to avoid errors, due to wire slip and errors during starting and stopping.

The right speed presupposes that the friction in the wire conduit system is not so high that the wire feed regulator reaches the current limit (10A).

The frequency signal is available across terminal TB6: 7 (5 V pulse) and 10 (0 V) on PIB, or between terminals 13/4 (5V pulse) and 12/4 (0V) in the wire feed unit.

The measurement is appropriately carried out using a multimeter with frequency measurement, for example, Fluke 87 or the like. If problems occur due to switch-disturbances from the motor current a capacitor, max 0.02 µF, can be connected across the measurement clips.

If an oscilloscope is used it should be galvanically separated from ground in order to prevent disturbances on the tacho signal that can affect the function of the wire feed unit.

- The wire feed unit's configuration factor: 20650.
- The wire feed unit's pulse amplitude: 4.5 - 5V
- $f = v \times G \times N / (pi \times D \times 60)$

where:

f	Frequency, Hz
v	Wire speed, m/min.
G=24	The gear's gear ratio
N=60	Number of periods per turn of the motor
D=0,037 m	Feed roller's diameter (contact diameter for the welding wire)

Relation between the frequency and wire speed

m/min.	Hz	m/min.	Hz	m/min.	Hz
0,5	103	10,5	2168	20,5	4233
1,0	206	11,0	2271	21,0	4336
1,5	310	11,5	2374	21,5	4439
2,0	413	12,0	2478	22,0	4542
2,5	516	12,5	2581	22,5	4646
3,0	619	13,0	2684	23,0	4749
3,5	723	13,5	2787	23,5	4852
4,0	826	14,0	2891	24,0	4955
4,5	929	14,5	2994	24,5	5059
5,0	1032	15,0	3097	25,0	5162
5,5	1136	15,5	3200	25,5	5265
6,0	1239	16,0	3304	26,0	5368
6,5	1342	16,5	3407	26,5	5471
7,0	1445	17,0	3510	27,0	5575
7,5	1549	17,5	3613	27,5	5678
8,0	1652	18,0	3716	28,0	5781
8,5	1755	18,5	3820	28,5	5884
9,0	1858	19,0	3923	29,0	5988
9,5	1961	19,5	4026	29,5	6091
10,0	2065	20,0	4129	30,0	6194

Welding power sources

General

When using PIB to control the power source with an analog reference (Flexible Mode) the reference characteristics are determined by the parameters:

- `ProcEquipRefConv` (gain),
- `ProcEquipRefOffset` (offset**)** and
- `ProcEquipMaxRef` (Max):

When replacing PIB or the power source the weld result can deviate from previous result depending on the tolerances in the analog circuits in PIB and the power source.

By adjusting one or both of the two first-mentioned parameters above it is possible to eliminate the difference and avoid comprehensive modification to the weld program.

If a power source has no base voltage (reference is linear from 0 V) for example, LRC and others, the gain is adjusted by **ProcEquipRefConv**.

On a power source that has base voltage (output voltage at ref. 0V) for example, RPA and others, adjustment of both parameters is necessary. With several iterations where Offset is adjusted at the lowest current weld value and the gain is adjusted at the highest current weld value, the weld result is trimmed to acceptable similarity to the result before the replacement.

Adjustment

The adjustment is appropriately made in small increments.

For example, if the welding voltage is assessed to be 5% too low, the configuration value is reduced by a value that is < 5%, if the welding voltage is too high, the configuration value is increased by < 5%, etc. Note - inverted conditions.

The procedure is repeated until the desired result is achieved.

The procedure is suitable if similarity between several power sources is required.

It is recommended that changes are noted for the PIB or the power source that have caused the change if the standard configuration is not used.

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