Product Manual

Welding Equipment/M2001
A140E/A314E/A324E-L
Flexible(LAF/RPB), ARCITEC(LRB/LRC)

ABB

CONTENTS

1 General

This manual is made up of a safety section, technical description of the wire feed system A140E/A314E/A324E-L, information on installation and operating the system and schematics. Another separate manual contains the spare parts list.

The manuals can either be purchased as freestanding documents or as optional sections to the *Product Manual* for the IRBP welding robot system.

Read all supplied manuals and safety directives carefully before unpacking and starting the installation.

2 Safety

2.1 General

The purchaser/user of ABB's robot welding equipment is responsible that the equipment is installed and used in the manner stated by the supplier. Also adhere to the standards and safety directives of respective countries.

Read carefully through all the manuals supplied, especially the section covering safety, before unpacking, setting up, or using the station.

This equipment is only intended for gas shielded arc welding, so-called MIG/MAG welding, and may only be used in accordance with the instructions set out in the documentation. With all other usage of the equipment we disclaim all responsibility and any claims for damages or warranty undertakings. Follow the directives of respective countries.

The equipment is not intended for use in explosive environments.

Save all manuals supplied!

2.2 Manufacturer's declaration

A manufacturer's declaration, as set out in the Machinery Directive 89/393/EEC, Annex II B is supplied with all deliveries to EU and EEA countries. See Figure 1.

ABB	Declaration by the manufacturer		3HEA 500005		B
	Tillverkardeklaration				
	Standard	Type	Scale	Code	K1O

Year	Week	Design checked by	Accepted for prod by	Drawing checked by	Drawn by		indicates	Sheet	1
1994	52				TDM A.Ja		R_a in µm	Cont	

Declaration by the manufacturer
as defined by machinery directive 89/392/EEC Annex II B

Herewith we declare that this product

manufactured by

ABB Welding Systems AB
S-695 82 LAXÅ / SWEDEN

with order number:

is intended to be incorporated into machinery or assembled with other machinery to constitute
machinery covered by this directive and must not be put into service until the machinery, into
which it is to be incorporated, has been declared in conformity with the provisions of
the directive 93/68/EEC, amending directive 89/392/EEC.

Applied harmonised standards in particular:

EN 292-1	Safety of machinery. Basic terminology, methodology
EN 292-2	Safety of machinery. Technical principles and specifications
EN 294	Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs
EN 349	Safety of machinery. Minimum gaps to avoid crushing of parts of the human body
EN 418	Safety of machinery. Emergency stop equipment, functional aspects
EN 563	Safety of machinery. Temperatures of touchable surfaces
EN 614-1	Safety of machinery. Ergonomic design principles
EN 775	Manipulating industrial robots. Safety (ISO 10 218 with European modifications)
EN 60204	Electrical equipment of machines (IEC 204-1 with European modifications)

....
(Development manager)

| Alteration No.	Alteration	sign, year, month entered

Figure 1   Manufacturer's declaration.

2.3 Installation

- When unpacking, check that all the equipment has been supplied and that it has not been damaged during transportation. Damaged or broken equipment can mean a safety risk.

- Remove all packaging after unpacking to avoid the risk of fire. Leave suitable packaging for recycling.

- Ensure that the equipment, or parts of it, do not tip or fall over when unpacking or transporting.

- "Secure" the load before it is taken from the packaging.

- Make sure that cables do not rest against sharp edges. If possible run cables in cable trenches to prevent the risk of tripping.

- Welding fumes and any gases that may be formed or used when welding can be hazardous to inhale. It is the responsibility of the purchaser/user that satisfactory extraction devices are installed and used. Follow the directives of respective countries.

- The purchaser/user is also responsible that sufficient lighting is provided over the workplace. As a suggestion, lighting can be integrated in the fume extraction equipment.

- If possible use environment friendly shielding gas, for example, MISON (AGA) and environment friendly vegetable based oil for spatter cleaning.

2.4 Usage

All personnel working with the equipment must have sufficient training in its use and be well-conversed with applicable safety directives. Incorrect use can result in personal injury and damage to the equipment.

Ensure the working area is in order before the system is commissioned. If faults are discovered on or in system these should be rectified before start-up.

Call skilled personnel or the system manager if your own knowledge is insufficient to implement the requisite actions.

All protection and safety equipment must be fitted to the station before it is used. This should be especially observed in connection with maintenance and service routines.

Safe working methods must be employed to prevent injury. Safety equipment must not be disconnected, bypassed or in any other way modified so its protectiveness ceases.

Ensure that no one is within the risk area before resetting the safety equipment and before the station is started.

Use personal safety equipment, e.g. welding helmet with welding glass, protective clothing and gloves to protect the eyes and skin from injuries caused by rays and burning. Also protect others by setting up suitable screens and drapes.

Do not touch the welding gun's gas nozzle or the hot work piece directly after welding. Use protective gloves.

If possible, carry out spatter cleaning in a special area where welding spatter and oil can be collected. Welding spatter and oil on the floor brings about a risk of slipping.

2.5 Fire risk

There is a risk of fire in connection with welding. Ensure the area around the workplace is free from inflammable material. Clean the area regularly. Follow local directives for welding.

Make sure all connections in the welding current circuit are correctly tightened. Bad connections will result in an inferior welding result and the risk of fire. Cables that have not been dimensioned correctly, i.e. too light, can also bring about a fire risk due to overheating.

2.5.1 Fire fighting

Use carbon dioxide (CO_2) to extinguish equipment if it should start to burn.

Note that in the event of a fire there is a great risk of gas cylinders exploding. Follow local safety directives relating to the handling of gas cylinders.

2.6 Risk of electric shock

Do not mix up the phase and ground cables when connecting the equipment to the mains supply.

Do not touch "live" parts of the equipment with bare hands or with damp gloves or clothes.

Welding wire is connected to voltage during the welding process even before the arc is ignited.

Welding circuits should **not be grounded** bearing in mind the risk of the ground cable being damaged by prohibited welding current paths.

The welding circuit must not be broken while welding is in progress.

2.7 Maintenance and service

There is still a risk of injury even if the equipment's mains supply has been switched off.

Warning for a falling robot or falling load on the manipulator when the brakes are released.

Warning for protruding welding wire and welding spatter coming from the gun when servicing.

Do not look directly into the gun; use protective glasses.

3 Technical Description

The welding equipment A140E/A314E/A324E-L (**E** for Extended range) is adapted for the control from the IRB 140/1400/2400 robot with the S4Cplus control system. Together with the AW software in the robot and the PIB process interface the system has the following characteristics:

- **Large 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 robot programming unit.

- **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 robot programming unit.

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

Standard welding equipment consists of the A140E/A314E/A324E-L_PIB wire feed unit and one of the following power sources:

- LAF 635R (not valid for A314E/A324E-L, FlexArc Compact)
- RPB 320/420/520
- LRB 400, integrated in Control cabinet,- ARCITEC-system
- LRC 430 - ARCITEC-system (not valid for A140E, FlexArc Compact)

It can be adapted to the following power sources by using a connection kit:

- ESABMIG 400/500t
- Miller Delta Weld Series

The following options are available to the Welding equipment:

- welding gun set
- joint locator, "Smartac"
- torch cleaner "TC"
- wire cutter
- automatic TCP-gauging "BullsEye"
- TSC Torch Service Center consisting of:
  Torch cleaner "TC", Wire cutter and automatic TCP-gauging "BullsEye"

Robot Welding System

"Flexible Interface" for power sources RPB, ESABMIG and LAF.
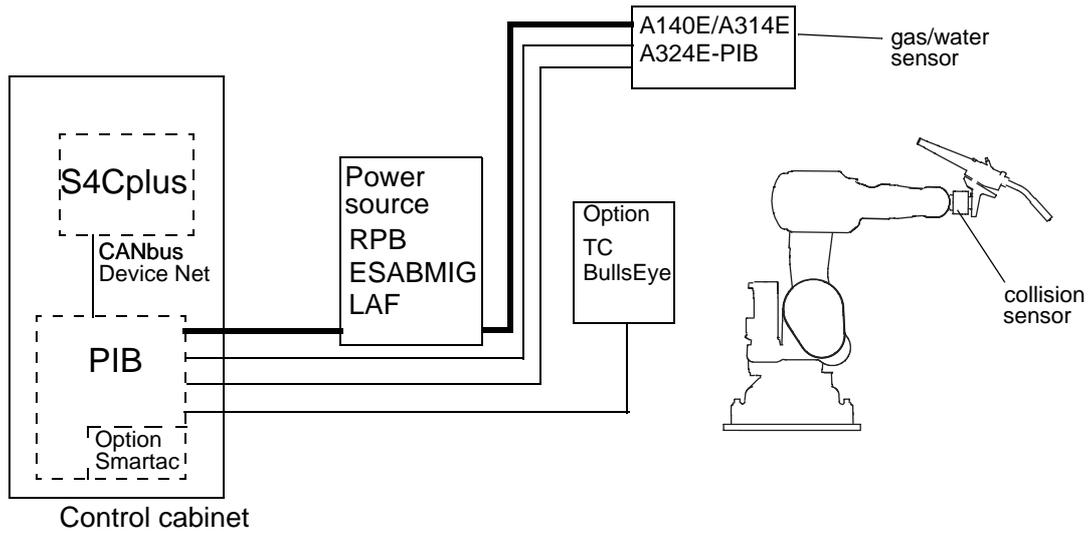

Figure 2   Overview of "Flexible Interface" connections.

"ARCITEC" with integrated power source LRB400, or separate LRC430
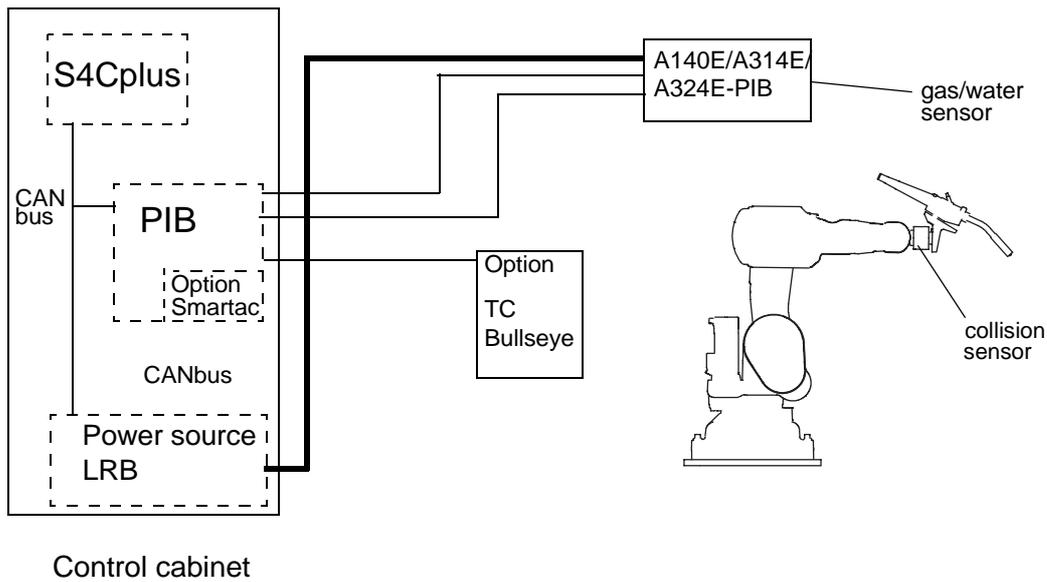
Figure 3   Overview of "ARCITEC" connections LRB.
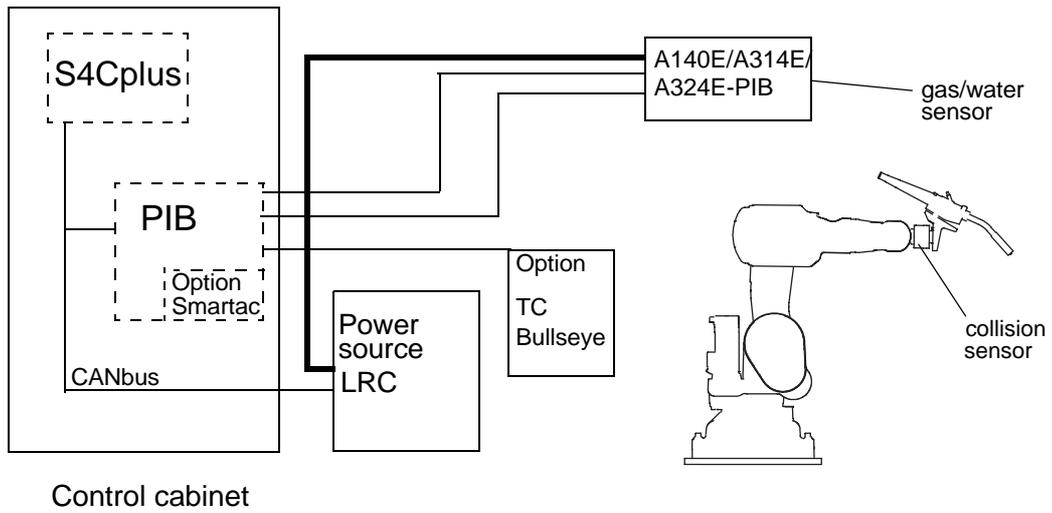
Figure 4   Overview of "ARCITEC" connections LRC.

Incorporated components A140E

1   Wire feed mechanism mounted and fitted with a Euro-socket for connecting the welding gun.

2   Connections for media.

3   Cable for the power source - control cabinet, *valid for separate power source.*

4   Separate power source

5   Power source, integrated in separate cabinet, placed under the control cabinet (not in picture).

6   Welding gun
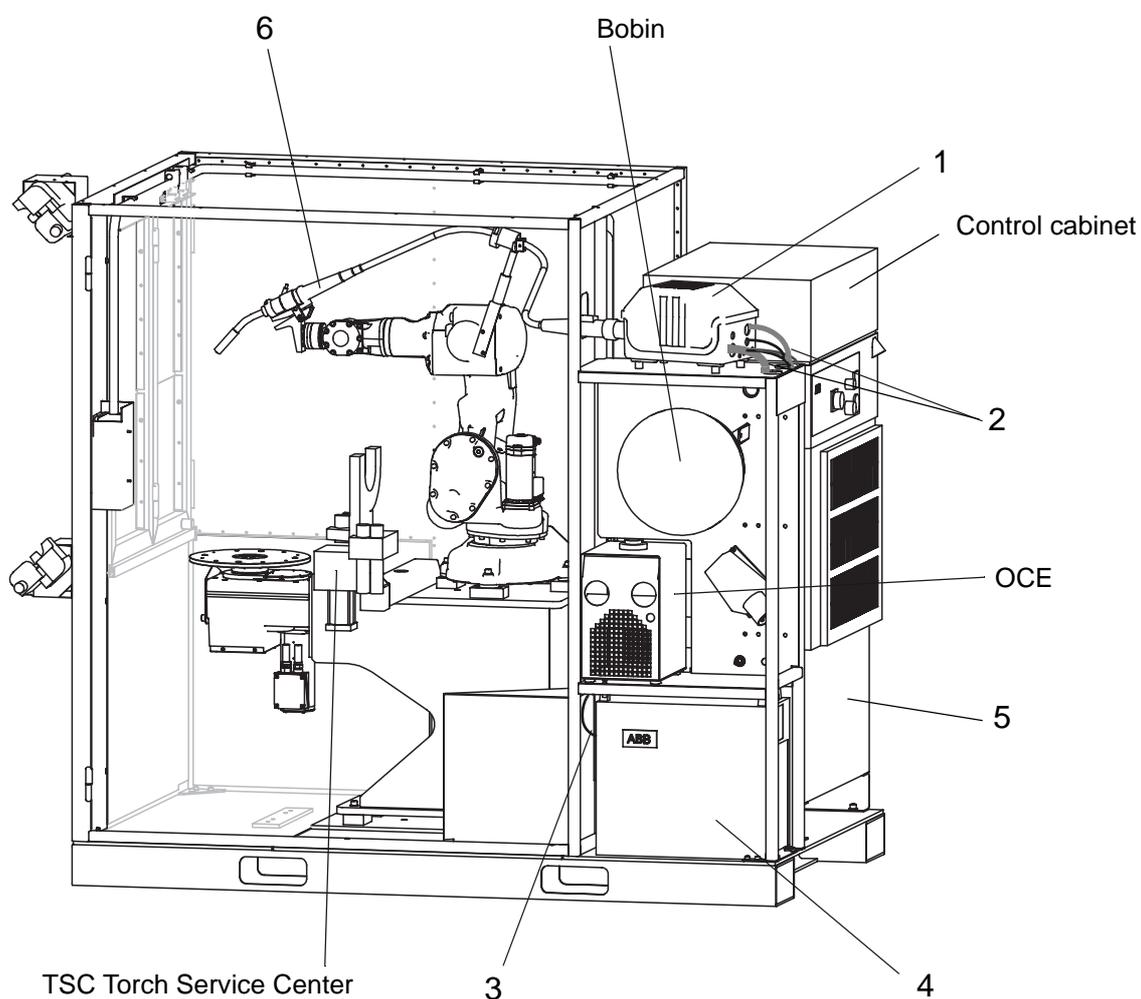
Figur 5   Robot Welding System with separate power source.

Incorporated components A314E/A324E-L

1 Wire feed mechanism mounted on the robot arm and fitted with a Euro-socket for connecting the welding gun.

2 Attachment for the wire feed mechanism and cables.

3 Hoses for gas, water and compressed air, as well as cables for signal and power supplies.

4 Cable for the welding current.

5 Cable for the power source - control cabinet, *valid for separate power source.*

6 Separate power source (with Flexible Interface).

7 Power source, integrated in cabinet.
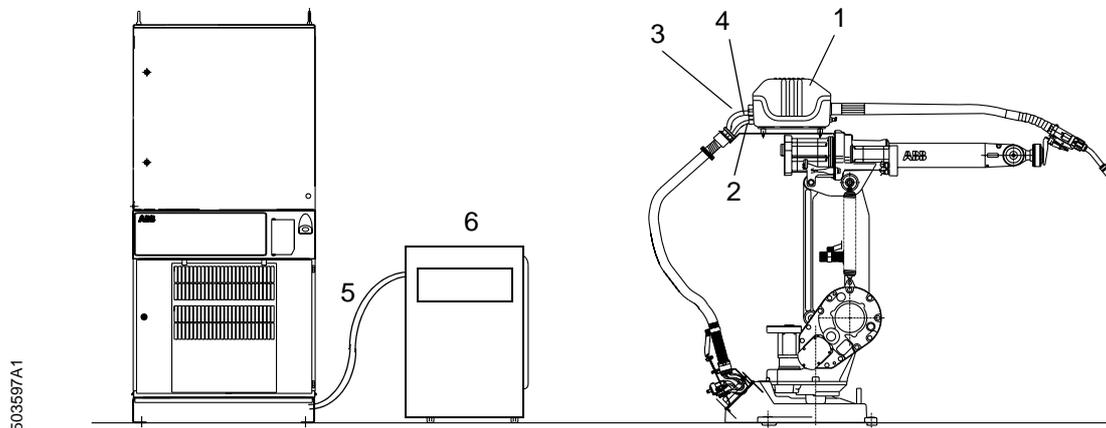
Figure 6   Robot Welding System with separate power source.
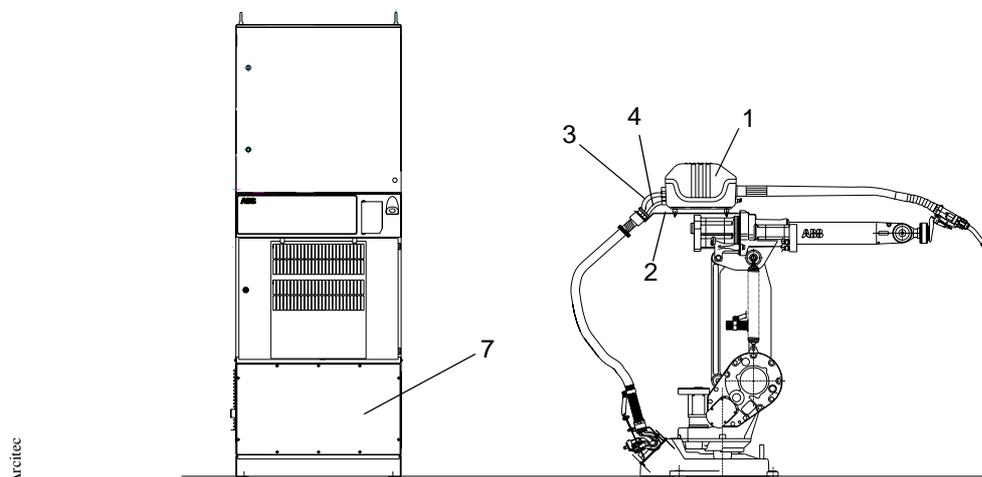
Figure 7   Robot Welding System with integrated power source.

3.1   Wire feed system A140E/A314E/A324E-L

There are two options of wire feed systems: bobbin or marathon pac.

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

3.2   Wire feed system A314E/A324E-L

The wire feed system A314E/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/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.

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

3.2.1 Wire feed unit

Wire is fed using two pairs of feed rollers, see Figure 8, which are linked to each other. The power from the motor is transferred to the rollers via a pinion on the motor shaft. The two upper rollers (**1**) are spring-loaded.

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.

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

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

When the bobbin is used, the wire liner is fitted directly to the feed mechanism and is locked by screw (**6**). The wire can roll off of the bobbin when the feed mechanism stops at a high wire feed speed. To rectify this, the preset value on the brake hub is changed to 5 kpcm (= 0,5 Nm), by turning the knob until the arrows align with each other (locked bobbin position). The springs on each side of the knob are turned synchronously inwards to increase the braking effect. If the wire feed speed is too high so that the adjustment has no effect then the marathon pac ought to be used.
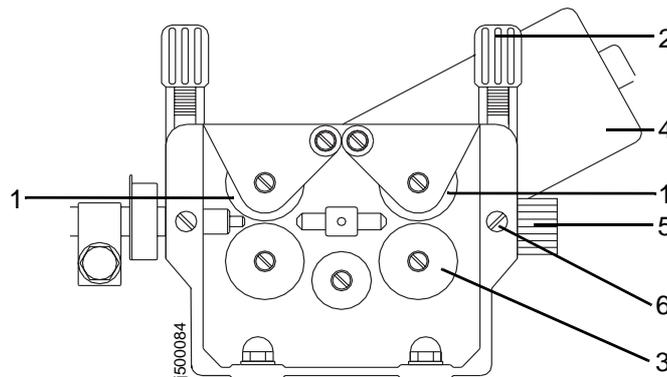

Figure 8   Wire feed unit.

To guarantee proper wire feed the grooves in the feed rollers must be cleaned at regular intervals. The wire used should be as clean as possible as filth can give rise to slippage.

Replacement - Repair

When refitting the drive motor in the event of replacement or repair of the motor the motor shaft must be centered in relation to the two feed rollers, using the centering device (art. no. 500 332-001) in order to avoid wear as regards teeth and bearings.

Dismantling

1 Remove the two drive rollers.

2 Dismount the driving gear and the three Allen screws. The drive motor can now be lifted out.
The remounting is performed in the reverse order, excepted the use of the centering device.

3.2.2 Control and indicating devices on the wire feed unit

1 **WIRE FEED** switch for manual wire feed.

2 **RESET** switch for resetting the gun collision sensor.

3 **AIR** connection to the welding gun.

4 Connection **IN** for water (blue hose). Applies to water cooled guns.

5 Connection **OUT** for water (red hose). Applies to water cooled guns.

6 Euro-socket for the welding gun.
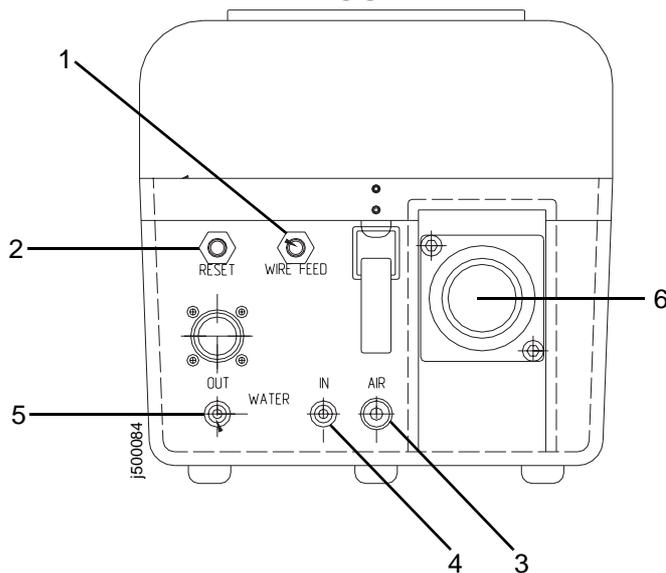
Figure 9   Side of the wire feed unit.

3.2.3 Main data

Wire diameters	0.8 mm - 1.6 mm
Max. wire feed unit	30 m/min.
Permitted ambient temperature	0ºC - +40ºC

3.3 PIB Process Interface Board

The PIB is an I/O unit particularly adapted for welding robot systems and handles the communication between the robot control system and the welding equipment.

The PIB is described in detail in chapter 6 of this manual.

4 Installation

4.1 Configuration of Welding Equipment

4.1.1 Flexible Interface/ ARCITEC (LRB/LRC)

On delivery the equipment is configured according to applicable configuration data which are stored on the disk that comes with the delivery. The data can be read and modified by way of the robot programming unit. See chapter *6.5*.

For the definition of configuration data, see *"Appendix 1" on page 59*.

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

RPB_FhpE.cfg   Explanation: Configuration data for power source
RPB 320/420/520 and wire feed unit
A140E/A314E/A324E-L_PIB

ESABMIG_FhpE.cfg Explanation: Configuration data for power source
ESABMIG 400/500t and wire feed unit
A140E/A314E/A324E-L_PIB

Lrb_FhpE.cfg   Explanation: Configuration data for power source
LRB/LRC and wire feed unit
A140E/A314E/A324E-L_PIB

Laf_FhpE.cfg   Explanation: Configuration data for power source
LAF and wire feed unit A140E/A314E/A324E-L_PIB

MILL_FhpE.cfg   Explanation: Configuration data for power source
Miller Delta Weld Series and
A140E/A314E/A324E-L_PIB

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

- **Roboot the robot**: The original configuration will be restored.

- **Loading using the programming unit:** 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.** Se "Appendix 5" on page 69.

Important!

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.

4.2   Installation of the wire feed system

The cables are connected as follows (see Figure 10):

1   **Feeder cable 1, A140E,** Feed unit - Control cabinet
23-pole connection at both ends
Feeder cable 1, A314E/A324E, Foot of the robot - Control cabinet
23-pole connection at both ends

2   **Feeder cable 2, A140E** Feed unit - Control cabinet
12-pole connection at Wire feed unit and 19-pole connection
at Control cabinet.
Feeder cable 2, A314E/A324E Foot of the robot - Control cabinet
12-pole connection at foot of the robot and 19-pole connection
at Control cabinet.

3   Gas (red hose). Connected to the central gas supply or to the gas cylinder. The pressure guard functions as an **open contact device,** which means it makes with a rising pressure. The guard is precalibrated to 0.2 bar (equivalent to approx. 5 l/min.). The guard indicates when the gas is finished or if an object prevents the gas flow.

4   Connection **OUT** for water (red hose).

5   Connection **IN** for water (blue hose).

6   Air in (PVC hose **D14/8**). Connected to the compressed air supply, system pressure, approx., 6 bar.

7   Welding cable 95 m^2.

8   Wire guide input for bobbin and Marathon Pac.

Finally connect the current cable from the wire feed unit to the power source.
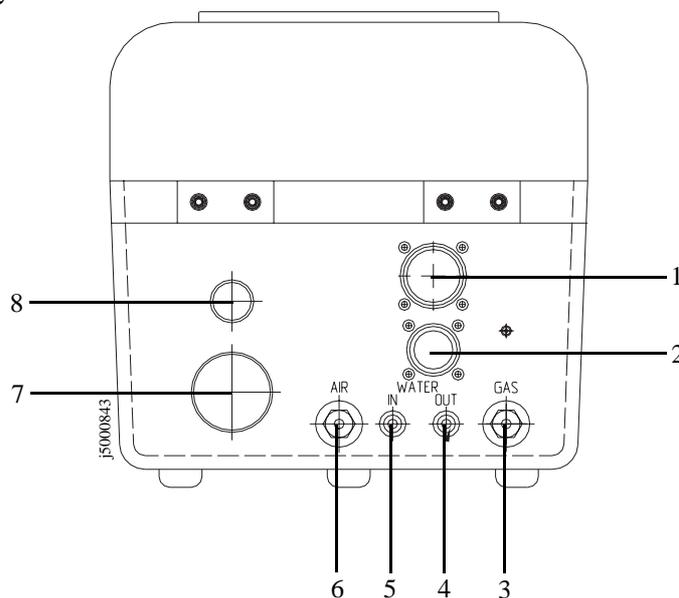
Figure 10
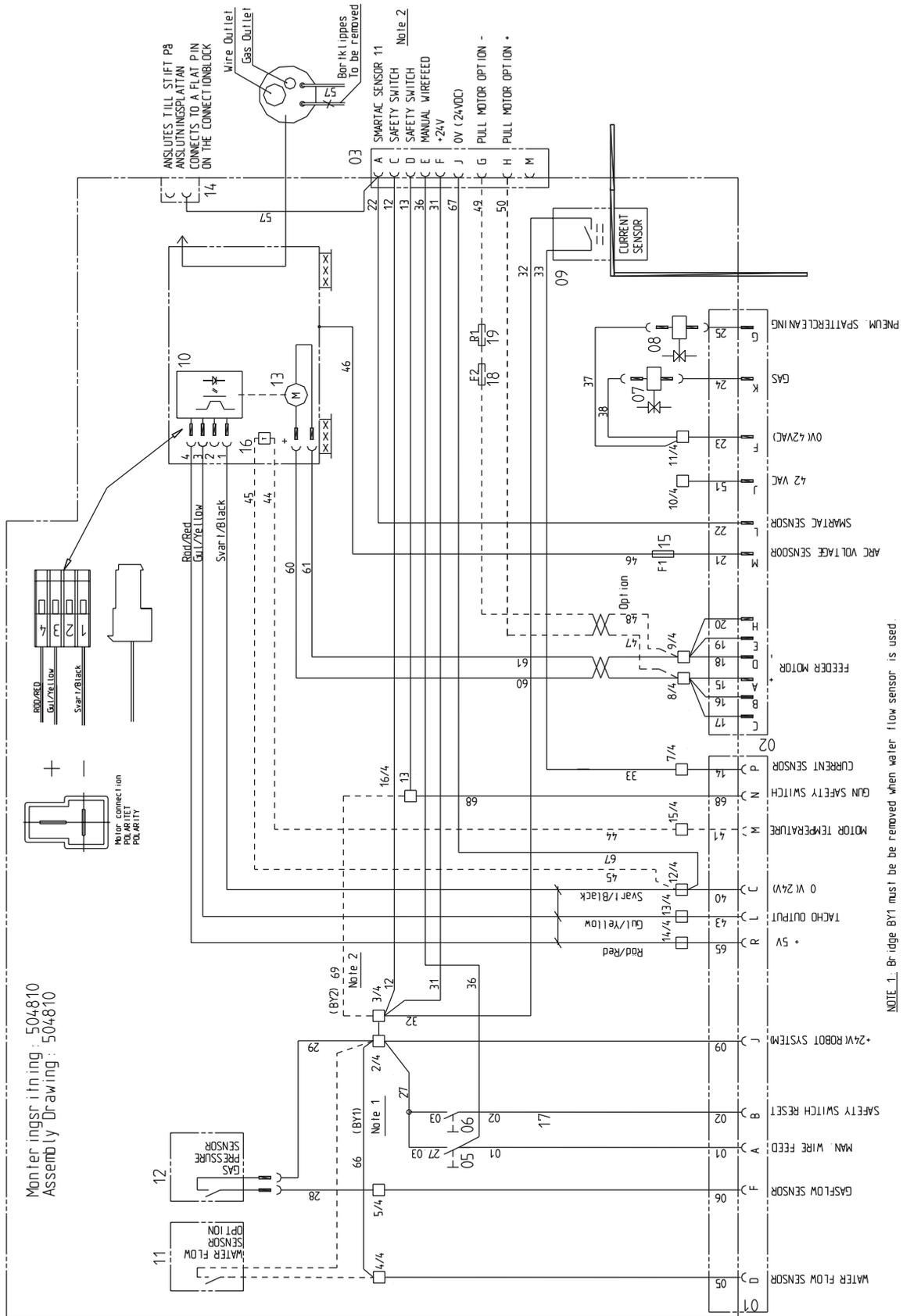
Figure 11   Circuit diagram, Wire feed unit A140E/A314E/A324E-L_PIB

Kopplingstabell kablar/ Connection table, cables
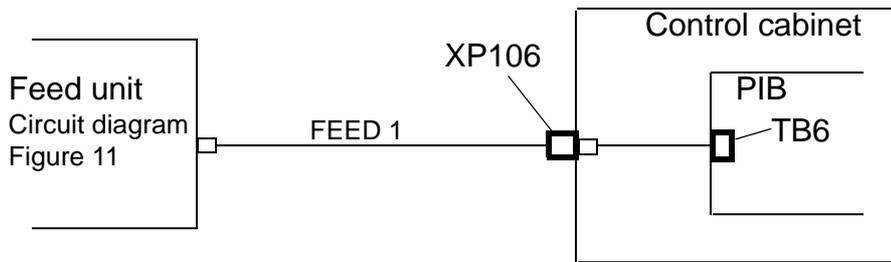
Feeder Cable 1, A140E/A314E/A324E-L

Signalbeskrivning/ Signal Description	A	B	Färg	Colour
Gun Reset	B	B	Vit	White
Gun Crash Sensor	N	N	Brun	Brown
Current Sensor	P	P	Grön	Green
Water Flow Sensor	D	D	Gul	Yellow
Gas Flow Sensor	F	F	Grå	Gray
Tacho +	K	K	Rosa	Pink
Tacho - (Encoder Tacho input)	L	L	Blå	Blue
Manual Wire Feed	A	A	Röd	Red
24 VDC Supply	J	J	Svart	Black
0 VDC (24 VDC) / Encoder Tacho Common	C	C	Violett	Violet
Motor Temperature	M	M	Grå/Rosa	Grey/Pink
Auxiliary Motor	E	E	Röd/Blå	Red/Blue
ADM Tacho (+) Encoder Tacho input	G	G	Vit/Grön	White/Green
ADM Tacho (-)	H	H	Brun/Grön	Brown/Green
+5V Encoder Tacho	R	R	Vit/Gul	White/Yellow
Spare (not used)	S	S	Gul/Brun	Yellow/Brown
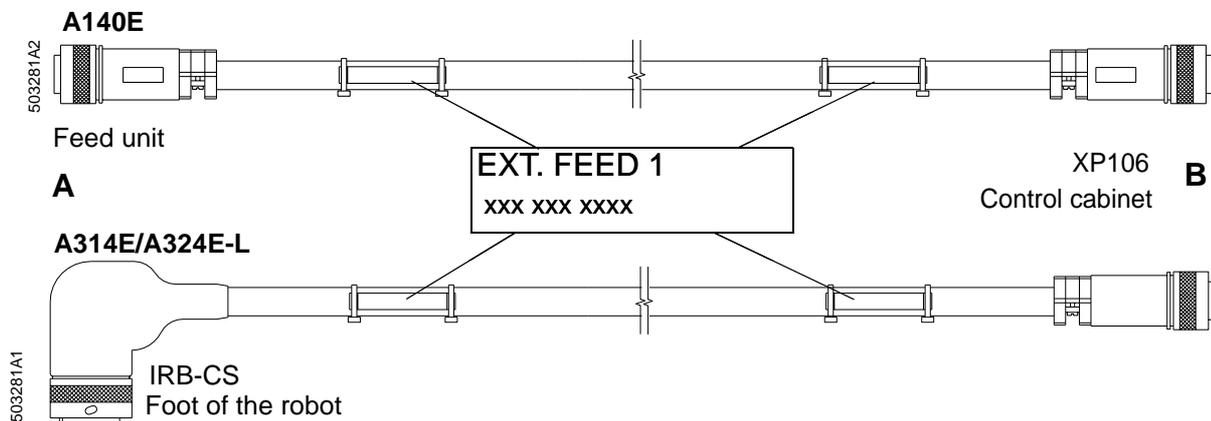
Figure 12   Feeder cable 1, A140E/A314E/A324E-L.
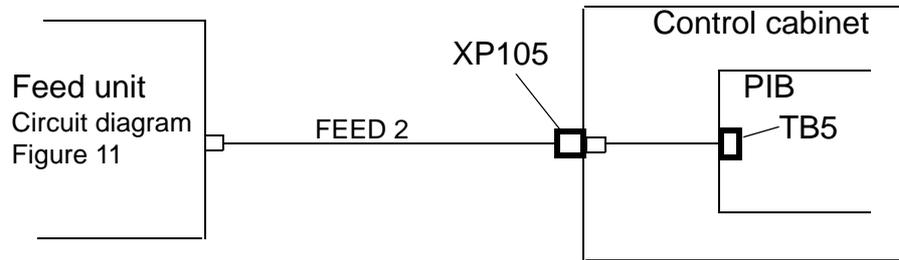
Feeder Cable 2, A140E/A314E/A324E-L

Signalbeskrivning/ Signal Description	A	B	Färg	Colour
Motor +	A	A	Vit	White
Motor +	B	B	Brun	Brown
Motor +	C	C	Grön	Green
Motor -	D	D	Gul	Yellow
Motor -	E	E	Grå	Gray
Motor -	H	H	Rosa	Pink
PneumaticSpatter Cleaning (42/115VAC)	G	G	Blå	Blue
Gas Valve (42/115 VAC)	K	K	Röd	Red
Arc Voltage Gun	M	M	Svart	Black
Smartac 1	L	L	Violett	Violet
Aux Motor Supply (42/115 VAC phase)	J	J	Grå/Rosa	Grey/Pink
Aux Motor Supply (42/115 VAC common)	F	F	Röd/Blå	Red/Blue
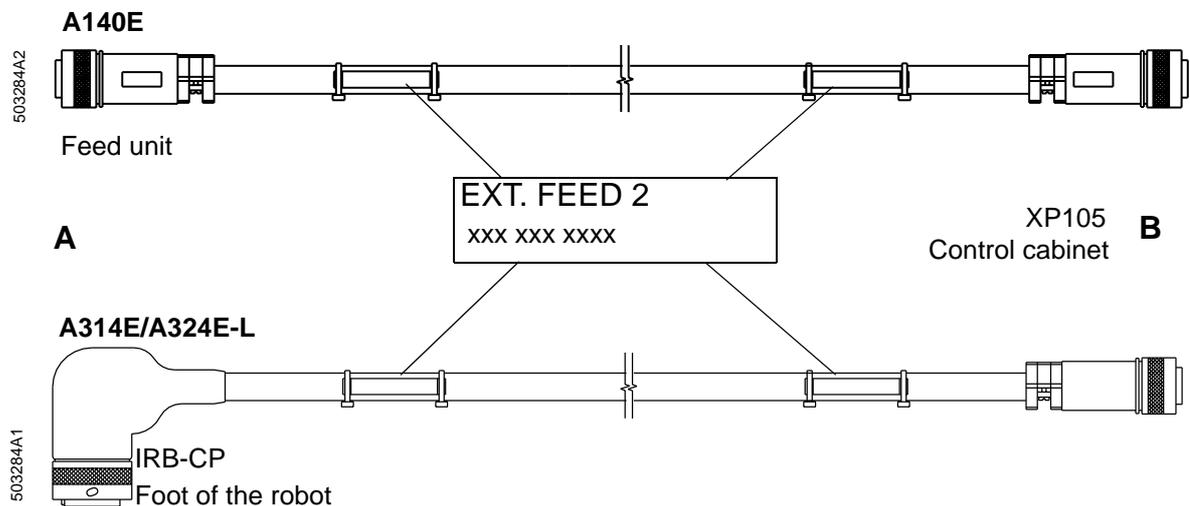
Figure 13   Feeder cable 2, A140E/A314E/A324E-L.

4.3 Connection of Power Sources

ESABMIG 400/500t

Power source ESABMIG is connected to terminal **XP107** on the Control cabinet.
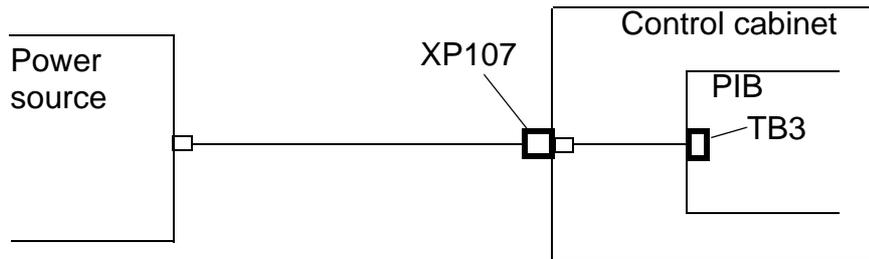
Control cable ESABMIG

Signalbeskrivning/ Signal Denomination	Part/Core	A	B	
42V AC	1	A	B	
Start PS	2	B	F	
Ref.	3	C	K	
0V	4	D	L	
Weld-/Weld Object	5	F	-	XS weld
Arc Voltage Gun	6	G	H	
	PE	NC	NC	
	SHIELD	SH	NC	

B   **A**

ESABMIG   XP107
                                                                 Control cabinet

XS weld
SmarTac

EXT. CABLE PS ESABMIG
xxx xxx xxxx
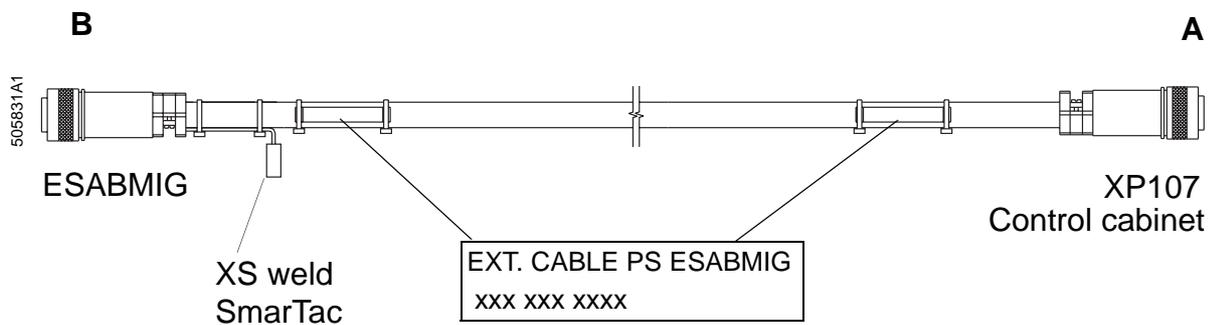
Figure 14   Control cable ESABMIG

RPB

Power source RPB is connected to terminal **XP107** on the Control cabinet.
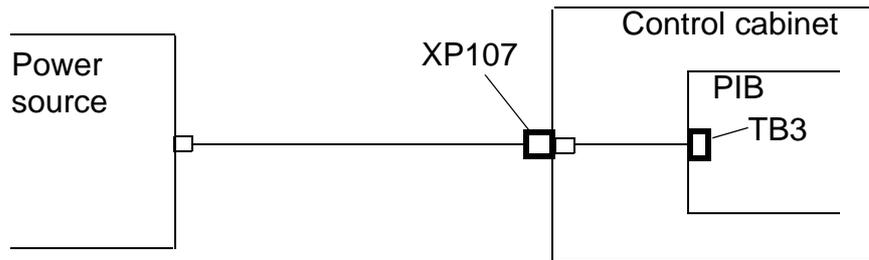
Control cable RPB

Signalbeskrivning/ Signal Denomination	Part/Core	A	B	
0 V	wh (par/pair 1)	B	B	
Start PS	bu (par/pair 1)	C	E	
Ref.	wh (par/pair 2)	A byglas med D/ A bridged with D	-	
0V	or (par/pair 2)	D byglas med A/ D bridged with A	A	
WELD-/WELDOBJ.		F	-	XS WELD
SH		SH	NC	
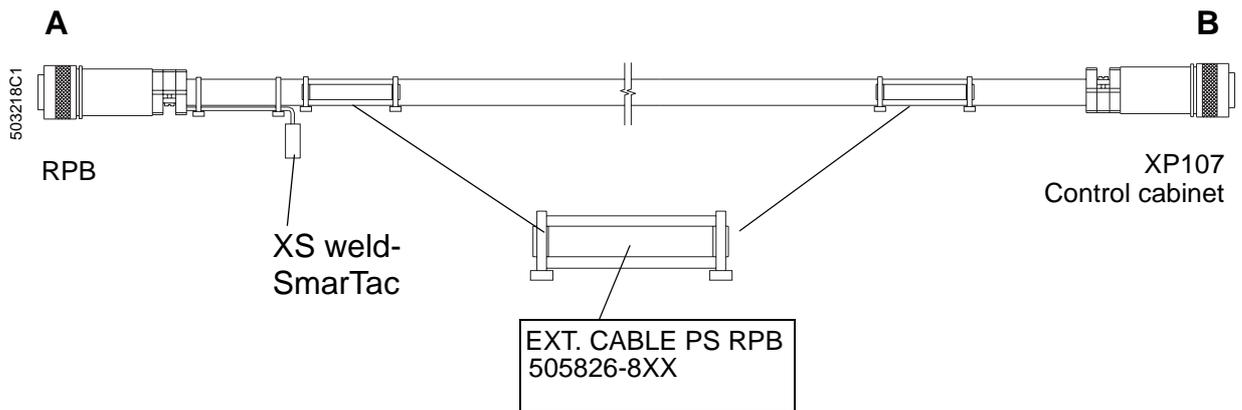
Figure 15   Control cable RPB.

LAF

Power source LAF is connected to terminal **XP107** on the control cabinet.
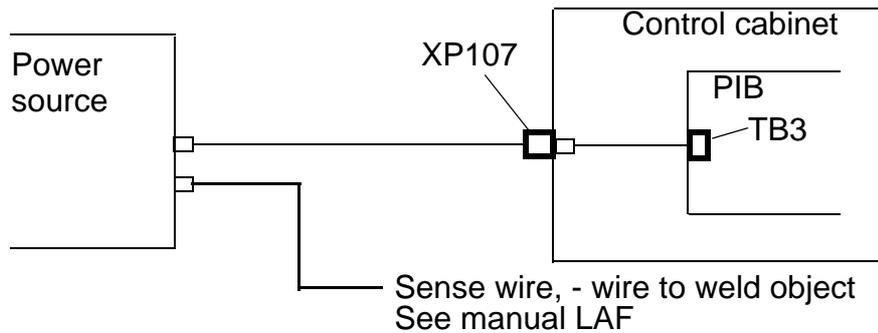
Control cable LAF

Signalbeskrivning/ Signal Denomination	A	B
Startingång: Anslutning för yttre slutande kontakt mellan A och B./Start: External closing contact between A and B.	A	A
Startingång: Anslutning för yttre slutande kontakt mellan A och B./Start: External closing contact between A and B.	B	B
Referensingång för Svetsspänning: (0 - 10 V) från serie nr. 136-301-0001 Reference input: (0 - 4.09 V) From serial no 136-301-0001	C	C
0 V, (Referens) / (Reference common)	D	D
Bågspänningsåterföring från svetspistol./ Arc Voltage feed back from the welding gun.	G	G
Svetsminusanslutning för fogsökare Smartac./ Weld-/Weld object for seam finder Smartac.	H	F
Skärmen anslutet via kondensator till strömkällans hölje./ The shield is connected by a capacitor to power source case.	NC	NC
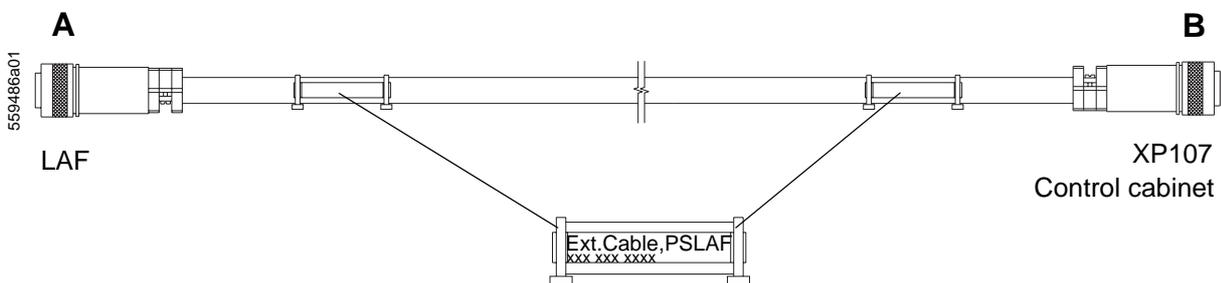
Figure 16   Control cable LAF.

LRC

Power source LRC is connected to terminal **A204.X202** on the Control cabinet.
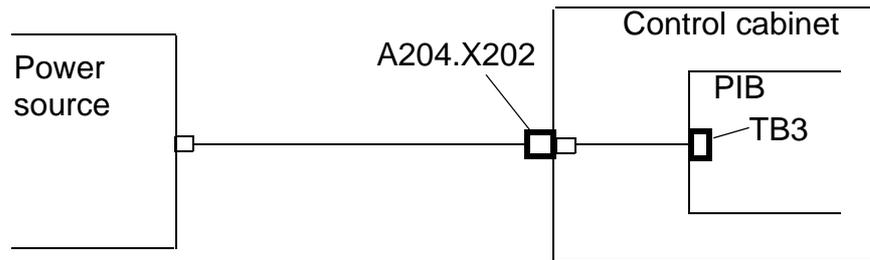
Control cable LRC

Signalbeskrivning/ Signal Denomination	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
	SH	SH	PE
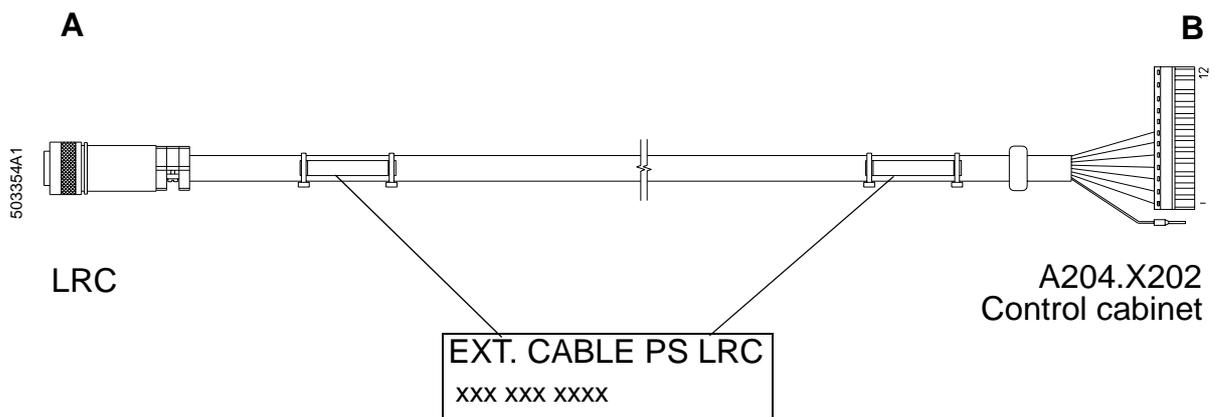
Figure 17   Control cable LRC

4.4   Installation of accessories

4.4.1   Cooling unit OCE 2

(included in welding gun set PKI 500R and Binzel WH 455D)

1   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.

2   Connect the cooling unit's mains cable as follows:

-   For ESABMIG, RPB, LAF: The mains cable is connected to terminal **A202X3:5,6** in the control cabinet.

-   For LRB, LRC: The mains cable is connected to terminal **A204:X202:10,11** in the control cabinet.

3   Fill the cooling unit with water and any anti-freeze (for detailed information refer to the OCE 2 manual). Check the flow in the welding gun by opening the cooling unit's return hose connection **IN** until water comes in.

4   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**.

4.4.2 Torch Cleaner TC

For LAW, RPB, LAF ARCITEC: Mechanical torch cleaner TC is connected to terminal XP108 on the control cabinet.
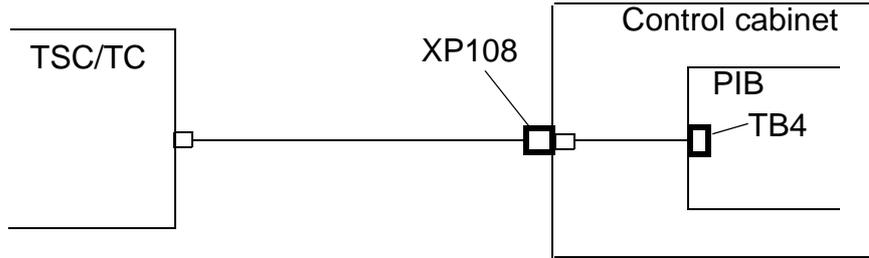
Cable -Torch cleaner

Signalbeskrivning/ Signal Denomination	Färg	Colour	A (TC96)	A(BINZEL)	B
24V DC	Vit	White	4	1	1
0V DC	Brun	Brown	2 & 8	3 & 4	2
Lubrication	Grön	Green	11	7	3
Cleaning	Gul	Yellow	10	6	4
Wire cutter	Grå	Grey	1	NC	5
Cleaning Finished	Rosa	Pink	7	2	6
Bullseye	Blå	Blue	16	10	7
Shield	SC	SC	NC	NC	PE
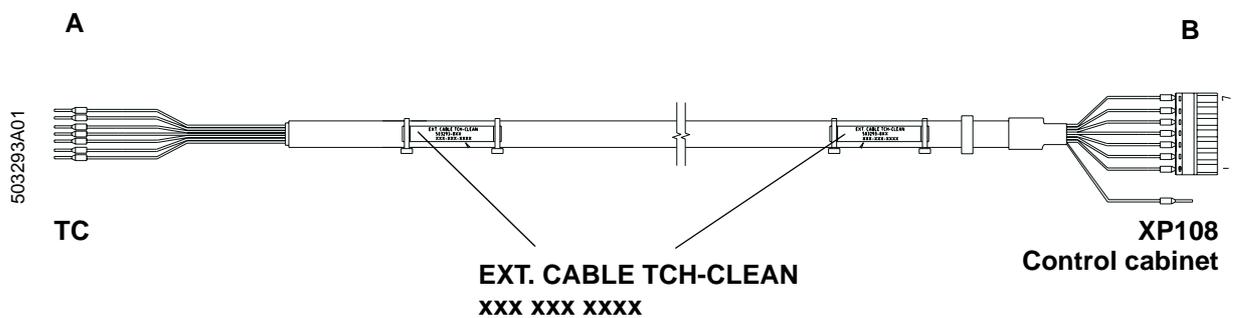
Figure 18   Cable - Torch Cleaner

5 Maintenance

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.

5.1 Wire feed unit

Make a visual inspection of the equipment and correct errors, if any, for reliable operation.

1   Purge the inside of the feed unit as necessary by compressed air at reduced pressure.

2   Clean the grooves in the feed rollers and the bore of the outlet nozzle.

3   The wire conduit should always be purged by compressed air when changing the wire and as necessary. When worn out change the wire conduit.

4   Use filler wire free of impurities.

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

After maintenance (also installation and service) on the equipment, check the following before starting up:

- that no tools have been forgotten
- that fixtures and work piece are secured well
- that all parts and guards are replaced
- that functions are correct.

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

6 PIB Process Interface Board

6.1 General

The PIB is an I/O unit with integrated wire feed regulator communicating directly with the ABB robot control system S4Cplus 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, gun cleaners, sensors, etc. See Figure 19.
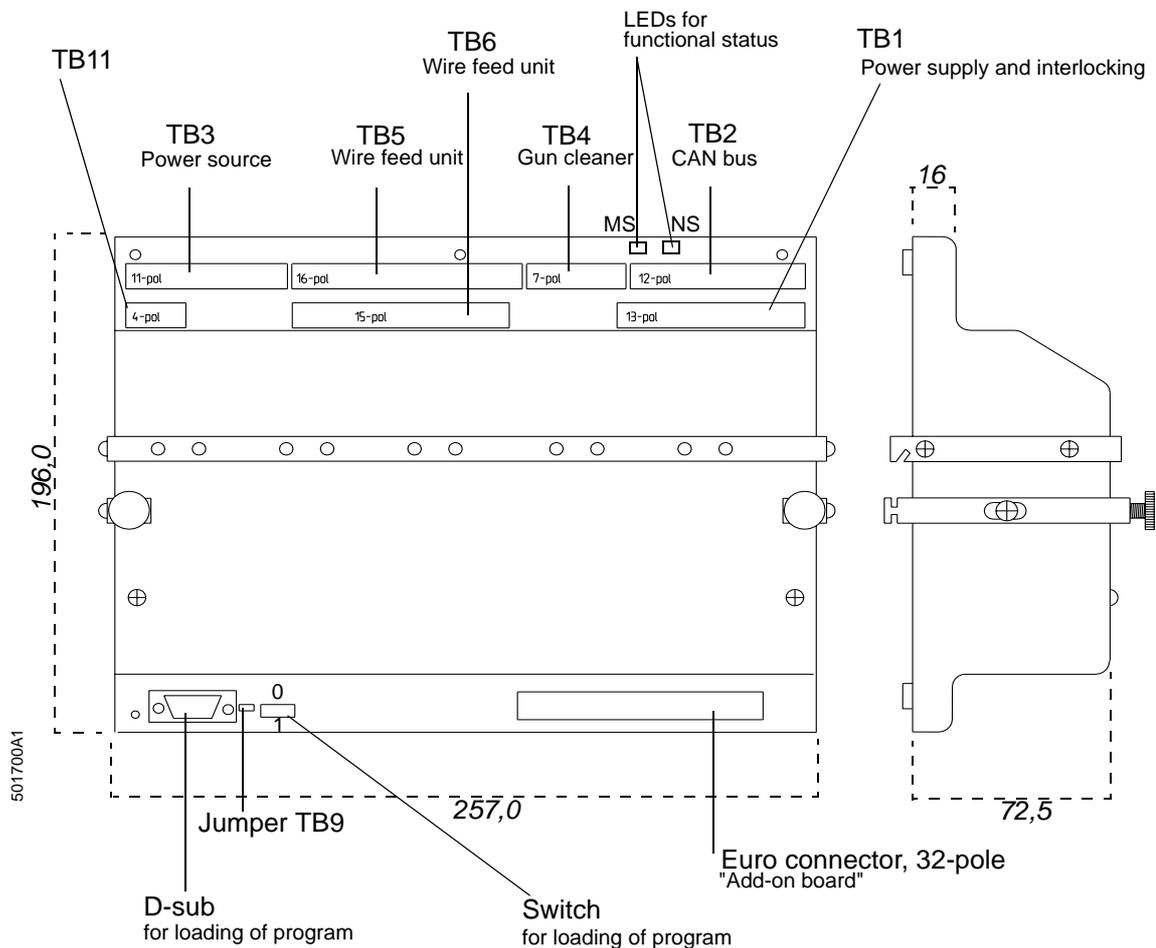
Figure 19   Dimensions and Terminal Designations.

6.2 Voltage Version - Power Supply - Article Number

PIB is available in two voltage versions:

- for feed units with voltage supply to the final stage of the feed unit regulator of max. 42V AC/ 10A, article no. 501 700-880.

- for feed units with voltage supply to the final stage of the feed unit regulator of max. 115V AC/ 3.5A, article no. 501700-881.

They are marked Low voltage or High voltage. See Figure 20.

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

Personal safety

The high-voltage version:
A protective earth conductor (min. 2.5 mm2) shall be connected between the upper PIB metal bar and the protective earth bar of the robot cabinet before the unit is switched on.

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

See the section *Transformers on page 53*.

6.3 Program Versions

PIB includes two program versions. Which program version is active is determined by the TB9 jumper. See Figure 21.

1 For robot systems from **S4Cplus** with Flexible (see section 6.5) and ARCITEC-LRB/LRC **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 programming unit.
- Automatic transfer of configuration data from the robot when
  changing PIB. See description in (Transfer of parameters between the robot and PIB, on page 60).

2 For the robot system S4C with ARCITEC/LRA the TB9 jumper must be closed.
- The transfer of configuration data according to point **1** is not supported.
- The configuration for ARCITEC/LRA is done on delivery.

Note:
When a complete system is delivered the TB9 position is determined.

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

*For use together with **S4Cplus** the jumper is removed and the parameter transfer takes place according to point **1**.*

6.4 Marking and Version Handling

Figure 20 shows the location and disposition of the article and manufacturing numbers. This marking indicates the hardware version of PIB – not the software one.

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.

Extra marking

High voltage/
Low voltage

PIB15sv

ABB product

High voltage 006
Low voltage 005

Version number

5601 006-0200

0000002 990825

ABB Welding

501 700-881

Testing date

Article number
501 700-880, Low voltage
501 700-881, High voltage

Serial number
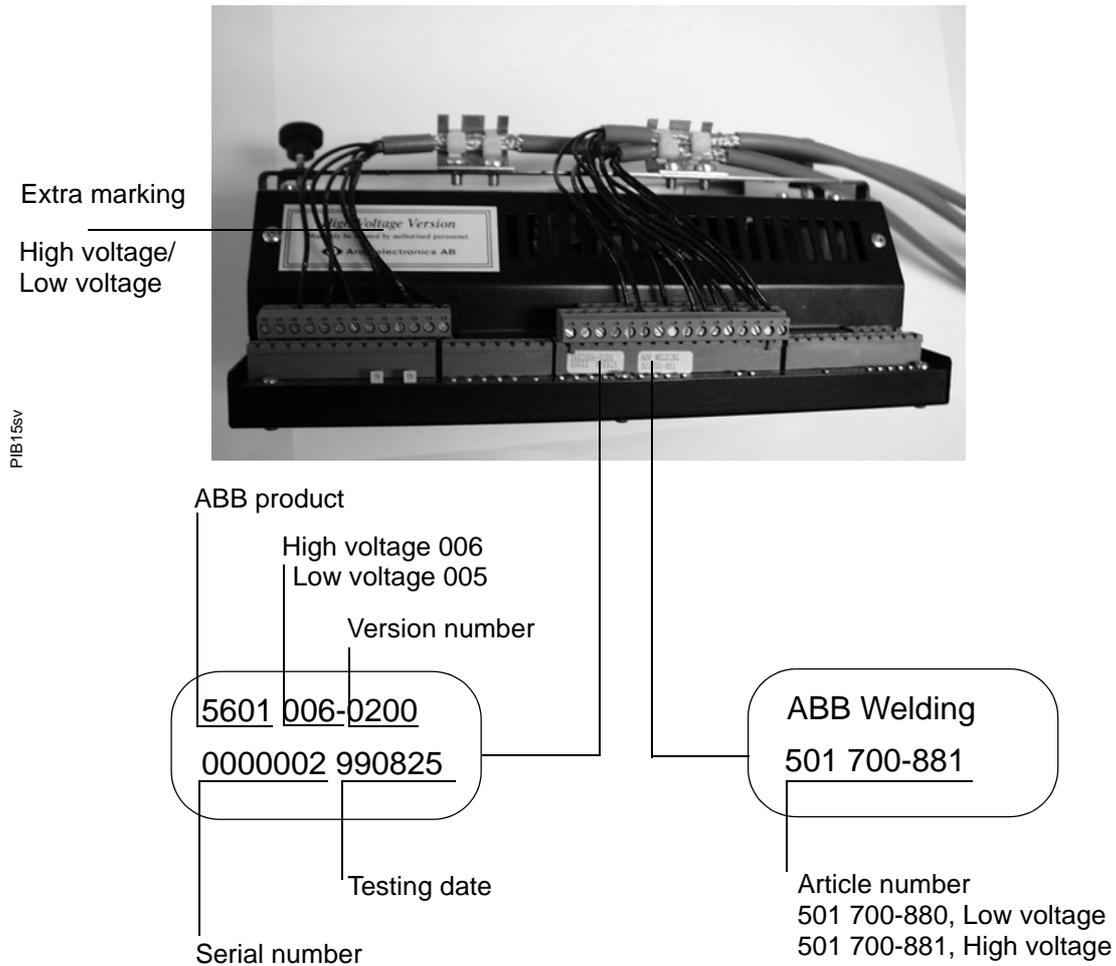
Figure 20   Marking and Version Handling.

6.5 Configuration

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.

Flexible

- A manual standard power source enabling remote control by way of analogue references and with the on/off function, for example ESABMIG 400/500t , RPB 320/420/520, LAF, Miller Delta Weld, etc.
- A wire feeder of the DC type with AC/DC tachometer as speed feed-back.

ARCITEC

- A wire feeder of the DC type with AC/DC tachometer as speed feed-back.

These factors are listed and their values can be edited under the menu: **Misc\System\Parameters\IO signals\Types⇒Units\PIB-name (=configured IO-name)** on the programming unit of the robot. 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 6.3 and section 2*).

Configuration data for ABB's standard welding equipment are included in the AW system configuration diskettes, which can be ordered according to the price list for standard products.

See *Appendix 1; Configuration parameters*, where all the parameters are listed and defined.

6.6 Options for Increased Functionality

PIB is prepared for connection of a supplementary board increasing the functionality. The board is to be connected to a 32-pole connector of the Euro type. See Figure 19 on page 35.

Smartac (joint search and tracking device):

See section 6.15.

6.7 Software Maintenance

PIB is equipped with a programming terminal and programming switches for loading the software into the program memory on the PIB, see Figure 21.

Replacement of the software is only demanded in exceptional cases, for example, after a software revision or functional upgrade and ought to be carried out by the PIB supplier or by trained ABB personnel.

This type of programming should not be confused with loading configuration parameters.

Important!
The programming switches must be set to the "Normal position" (see the figure below) in order for the PIB to work.

Figure 21   Jumper.

PIB Process Interface Board
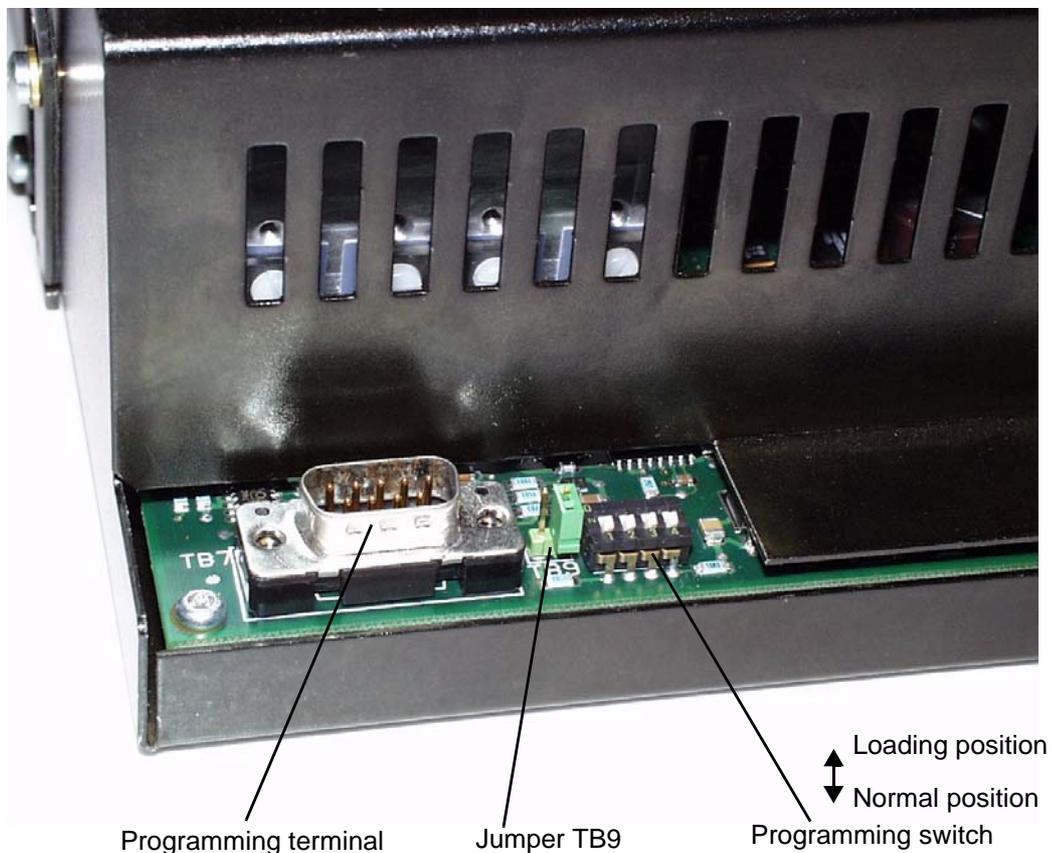
6.8 Service and Programming Aids

6.8.1 CAN-Assist, Art. no. 502 800-880

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

6.9 Diagnostics – Error Handling

The PIB is fitted with two light-emitting diodes according to the DeviceNet specification, see Figure 19 on page 35.
One of the diodes has the designation NS (Network Status) and indicates the function of the CAN bus. The other one has the designation MS (Module Status) and indicates the PIB function.

Correct function is indicated by a green light coming on and incorrect function by a red light. During the initiation phase, which can take a few seconds, the light of the diodes changes.

Exception: On ARCITEC LRA/S4C (jumper TB9 made) does not indicate NS while MS indicates the status as set out above.

During software execution on the robot (start, stop and current execution) the continuous transfer from PIB of the function status from the PIB as well as from the weld process takes place via the sensors connected to the PIB.

In the event of an error on PIB an error message is given to the robot programming unit as a warning to call action, see the table below. **The weld process is not interrupted.**

If the error concerns process supervision (shield gas, weld current) **the weld process is interrupted** with the error message "Arc Supervision".

Error messages are acknowledged by pressing OK.

When the error is corrected a message appears to confirm the this. If a two errors occur at the same time and the first error is not corrected this is shown during the next restart. If the second error is corrected the previous error returns during the next start. If both errors are eliminated at the same time only the last one is confirmed.

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

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	**9** PIB error stop:[2] **Motor drive transistor overtemp in PIB.** **Check friction in wire conduit.**
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 resumed 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.
2. The error does not cause a stop. The text will be changed to "PIB error, warning" in later robot software versions.

6.10   Connecting Cable Shields

The metal bar on the upper side of the PIB is provided with holes for the fitting of 2 cable clamps coming with the delivery of the PIB. The clamps are to be screwed 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 22. This mainly applies to the two cables from the wire feed unit. If possible, they should be routed at some distance from each other.
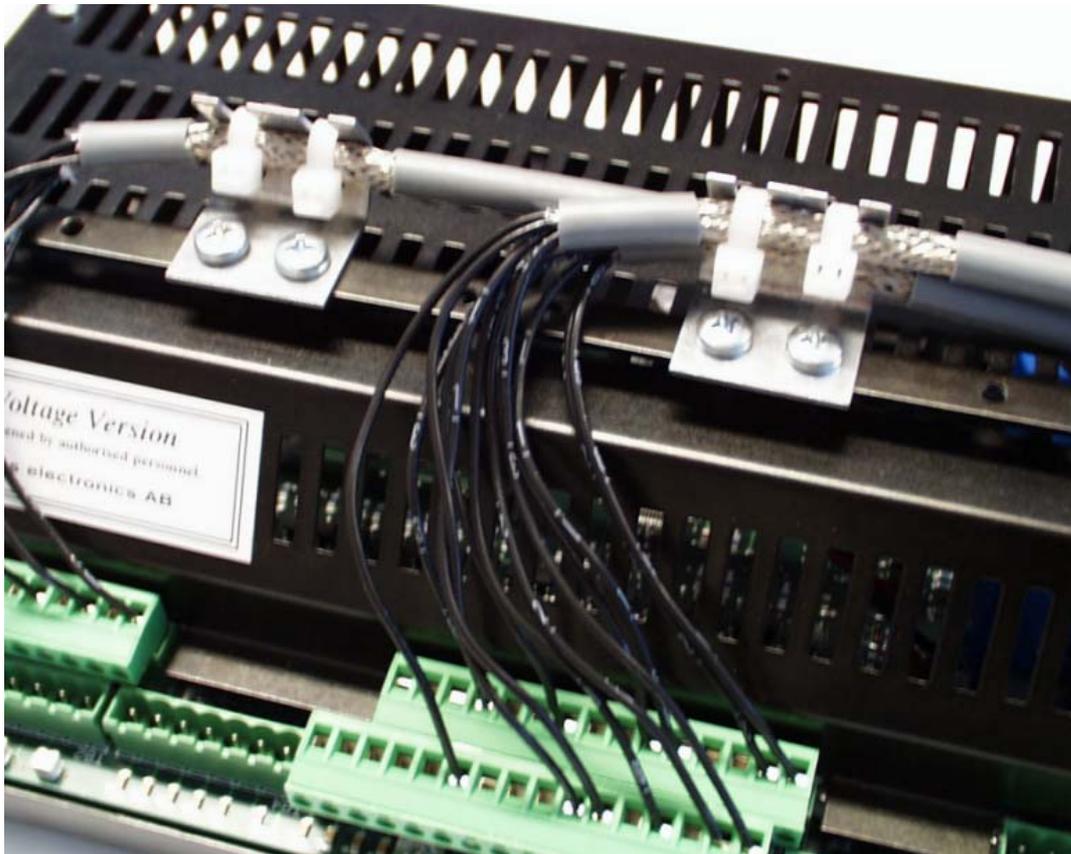
Figure 22   Shielding.

6.11 Safety

6.11.1 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 and mechanical cleaning of the gun.

Figure 23 on page 51 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.

On manual wire feed via the welding gun or the push-button of the feed unit, the wire can be fed without holding down the holding device up to max. 6 metres per minute. The speed will increase as long as the push-button is activated. For speeds higher than 6 m/min the holding device must be held down. For ARCITEC/LRA the speed is constant - 5 m/min.

Manual wire feed: Appendix 2 on page 63, Possibilities and limitations.

6.11.2 Machine safety

Collision Detection

As from the 2003 price list (from SSF 957) the Collision detection robot function, (Robot option no. 541) is set as standard on the A314/A324E-systems.

The function and its installation are described in the robot's "User Guide ", chapter 12, System parameters/ Manipulator/ Tuning the motion supervision.

Important! The mechanical safety bracket function on PIB must be deactivated through the connection of +24V to PIB input TB 6.2, ses chapter 6.11.3.
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 wire feed diagram Figure 11 on page 23.

Safety bracket (Welding torch holder with collision sensor)

The mechanical safety bracket is ordered as an option.

Important! Bridge By2, must be open when the safety bracket is installed. See note 2 wire feed diagram Figure 11 on page 23.

The following description in chapter 6.11.3 applies when the safety bracket is installed.

6.11.3 Machine Safety - Collision Sensor

The PIB is designed to be used with a welding gun 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 the Run Chain relay opens, resulting in 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.

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

If the gun has occasionally been out of position but has sprung back again, the G-stop chain closes and the robot is fit for use again.

If the gun 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 gun 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 Function

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 gun spring back, resetting the collision sensor in closed position. The reset function is automatically acknowledged.

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.

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. 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 are:

Message 1:   PIB error, warning:
Welding Gun has crashed. If gun still crashed, reset from wire feed.
Move robot with joystick. Not allowed to start prg.

Message 1 comes up in combination with a G-stop with the welding gun remaining in the wrong position.

Message 2:   PIB error, warning:
Welding Gun has been reset.

Message 3:   PIB information:
Gun 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 gun breaks only momentarily and springs back again, message 1 will not be displayed. Messages 2 and 3 will be displayed, however.

6.11.4 Machine Safety - Electronics

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

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.

As evident from the section *Diagnostics – Error Handling on page 40* an error message is displayed to demand a proposed action.The weld process is not interrupted.

6.12 Signal Connections

See also Figure 19 on page 35 and Figure 23 on page 51.

TB stands for Terminal Block.

6.12.1 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 Wire Feed out	24V DC	x		Control signal for closing the interlocking contactor
9	Run Chain A1	Relay contact			Run Chain A
10	Run Chain 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 (see Figure 23 on page 51)

TB2 - CAN bus Connection

	Designation	Function, Voltage	Out	In	Explanation
1	Sys 0V	DC			System 0 (=Robot I/O noll)
2	CAN Low	Serial comm.			CAN Low *
3	Ground	DC			Ground, screen
4	CAN High	Serial comm.			CAN High *
5	Sys 24V	DC		x	System 24 V (=Robot I/O 24V)
6	0V	DC			0V 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	Linkage, NC=active			Binary addressing, not connected to TB2: 6=32

*. 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*
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**
9	24 V Ext	Supply voltage	x		For external relay
10	0 V	Supply voltage	x		For external relay
11	NC				Not connected

TB4 - Connection to gun 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

* Common connection to the welding object and the power source, negative pole for Smartac/PIB.

** PDM=Process Data Monitoring

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 Clea-ning	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**
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**
10	Spatter Cleaning A	Closing contact			Alternative parallel function for TB5:3*
11	Spatter Cleaning B	Closing contact			Alternative parallel function for TB5:3*
12	Gas Valve A	Closing contact			Alternative parallel function for TB5:4*
13	Gas Valve B	Closing contact			Alternative parallel function for TB5:4*
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

* Adapted contact protector required.

** When using the Smartac sensor 2 TB5:5 and TB5:9 shall be bridged.
See section 6.15.2

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	+ 24 V	Supply voltage	x		Supply voltage
10	0 V	Supply voltage	x		Supply voltage/ common for encoder tacho
11	Temp PTC	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	DC	x		Supply voltage for encoder tacho

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

6.12.2 Elementary Diagram - Power Supply and Interlocking
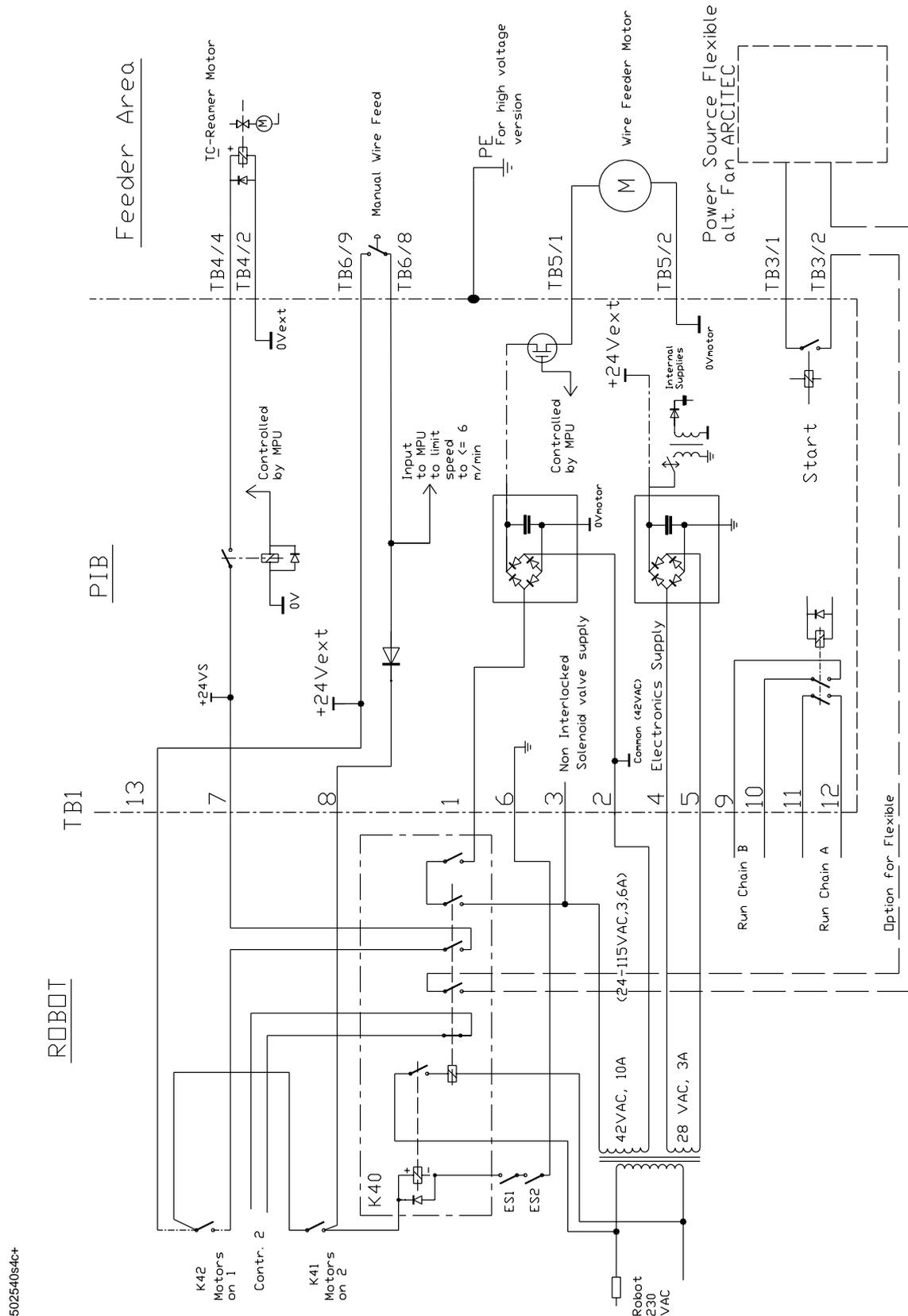
Figure 23   Elementary Diagram, Power Supply, Safety and Interlocking.

6.13   Technical Specification

6.13.1   Mechanical Data

Dimensions: 257x196x72.5 mm

Weight: 2.1 kg

Enclosure class: IP 20

6.13.2   Electrical Data

Power supply: See Figure 24 on page 53 - 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 24V DC: Incoming voltage, switch on: 15 to 35V.
Incoming voltage, switch off: -35 to +5V.
Incoming impedance, 4 kohm, resistive.

42V AC outputs: Max. current: 1A at < 70°C.

Relay outputs: Max. voltage: 250V AC.
Max. current: 10 A.
Note: Sparc protection has to be externally connected.

Analog outputs: Outgoing voltage: 0 - 15 V, < = 100 mA, < = 70°C.

6.13.3   Environmental Data

Temperature data:

Storage	Operation	According to
Cold 40° C, 16h	+5° C, 2 h	IEC 68-2-1
Heat +70° C, 16 h	+70° C, 2 h	IEC 68-2-2
Change – 40° C / +70° C, 2 cycles		IEC 68-2-14

EMC: (ElectroMagnetic Compatibility) According to standard EN 50199.

LVD: (Low Voltage Directive) According to LVD standard EN 60204.

6.14 Transformers

Article No. 501 714-001/-002

Marking

0-230V	0-230V
0-28-42V	0-28V
0-28V	0-115V
L V -001	H V -002

Low Voltage

R=2,2 Ohm 10W

gul/yellow

230V 50Hz   P1

gul/yellow

brun/brown

svart/black   28V 7.5A Uo=28.9V

röd/red   42V 7.5A Uo=43.5V

vit/white

28V 3A Uo=28.9V

vit/white

High Voltage

R=2,2 Ohm 10W

gul/yellow

230V 50Hz

gul/yellow

orange

S1   115V 2.7A Uo=118.9V

orange

vit/white

S2   28V 3A Uo=28.9V

vit/white
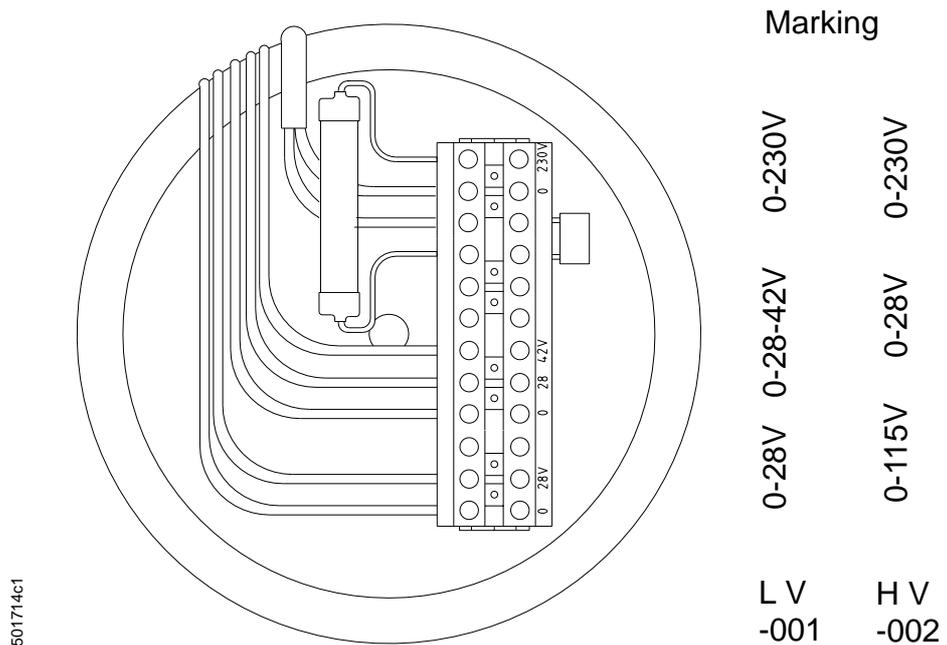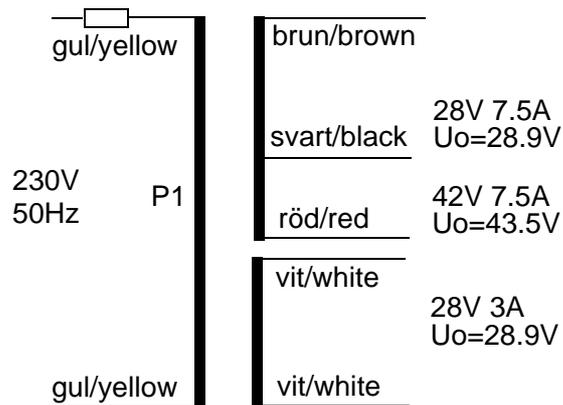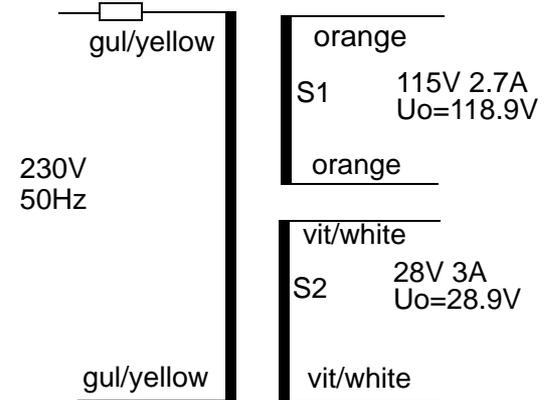
Figure 24   Transformers.

6.15 SmartacPIB

6.15.1 General

Smartac/PIB is a further development of the ABB joint search device Smartac. Mechanically and electrically it is integrated with the ABB welding interface PIB (Process Interface Board).

Figure 25

The unit has two sensor inputs, which can be activated one at a time or simultaneously.

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

Figure 26

The search properties of Smartac/PIB are determined by two adjustable parameters, Voltage Valid Limit and Sensor Detection Sensitivity. They are transferred from the robot together with other PIB configuration data. See point 6.14 Configuration Parameters.

The search properties can thereby be adapted to the existing circumstances of the search circuit.

6.15.2 Sensors

In the welding system A314/A324 containing PIB, the input for sensor 1 is connected to the gas cup of the welding gun, whereas sensor input 2 is connected to the welding nozzle for searching by way of the welding wire.

Using sensor 2 it is usually necessary to disconnect the welding circuit to avoid current diversion through the power source resulting in too low search voltage.

Searching with sensor 2 is only used for special applications.

6.15.3 Function Description - Searching

The search of the joint is usually done using a search routine in the robot program. The following description assumes that the ABB Flexible Automation signal names and robot configuration apply.

In deliveries containing Smartac, programs for the search routine and configuration parameters are pre-loaded. When Smartac is delivered as an option, a diskette containing the corresponding data comes with the delivery.

Note.
The configuration parameters for Smartac usually must be modified to fit the application in question.

In the event the configuration parameters must be modified, the same conditions apply as for PIB. See the section Configuration.

Activating the Sensor (Sensor 1)

The sensor is activated by a message from the robot to the PIB, doSE1_SEL=1, applying the search voltage to the gas cup of the welding gun.

The search voltage connected between the gas cup and the object to be searched is generated by a voltage source galvanically separated from other current circuits.

Checking the Sensor (Voltage Valid Limit)

When a sensor is activated the search voltage will depend on the insulating properties of the open search circuit.

Low insulation value between the sensor and the parts having electrical contact with the object to be searched will reduce the search voltage, due to for example the passage of current through the water when a water-cooled welding gun is used, soot formation, etc.

Increased contact resistance due to oxide layers, oil film, soot, etc. in combination with decreased search voltage makes it more difficult to achieve reliable contact between the sensor and the search object.

Using the adjustable parameter Voltage Valid Limit a level can be set under which the search shall not continue.

Configuration range: 0 – 40 V in increments of 1V.

If the present search voltage is higher than the Voltage Valid Limit, the message diSe_Valid=1 will be sent from the PIB to the robot giving the robot the signal for carrying on the search.

Sensitivity (Sensor Detection Sensitivity)

The adjustable parameter Sensor Detection Sens determines the sensitivity of the sensor. Configuration range: 0-25.5V in steps of 0.1V.

The Smartac trigger level is locked by the message doSE_REF=1 from the robot according to the following:
Trigger level = the present search voltage - the Sensor Detection Sens value.

Under normal conditions reliable search is achieved using values $> = 1V$.

Detection

When during the search the gas cup gets into contact with the search object the sensor input is exposed to voltage drop.

If the voltage drops below the trigger level the PIB will send the search stop message diSE1_DET=1 to the robot, and the co-ordinates of the search object can be registered.

See Appendix 4 on page 67, "Optimising the search circuit".

6.15.4 Delivery

Smartac is delivered as Smartac complete, article no. 503500-880, consisting of:

- Smartac unit, see Figur 27 on page 57
- Software, contained in the system diskette when a complete system is delivered, and in a separate diskette when Smartac is delivered separately
- User's Guide with program description and examples. .

6.15.5 Technical Data

Accuracy: Max. deviation $\pm$ 0.25 mm at a search speed of 20 mm/sec.

Marking: See Figur 27.

Mechanical Data

Weight: 0.220 kg
Dimensions: 22x65x185 mm (see Figur 27)
Enclosure class: IP 20.

Electrical Data:

Max. search voltage: 40V
Max. search current: 4.3 mA.

Environmental data: See point 6.16.3

185 mm

65

53

Delivery data

Product number
ABB

Version number

503400A1

xxxxxxx-xxxx
xxxxxxx xxxxxx

22

15

10

Serial number

Date of testing

ABB article number
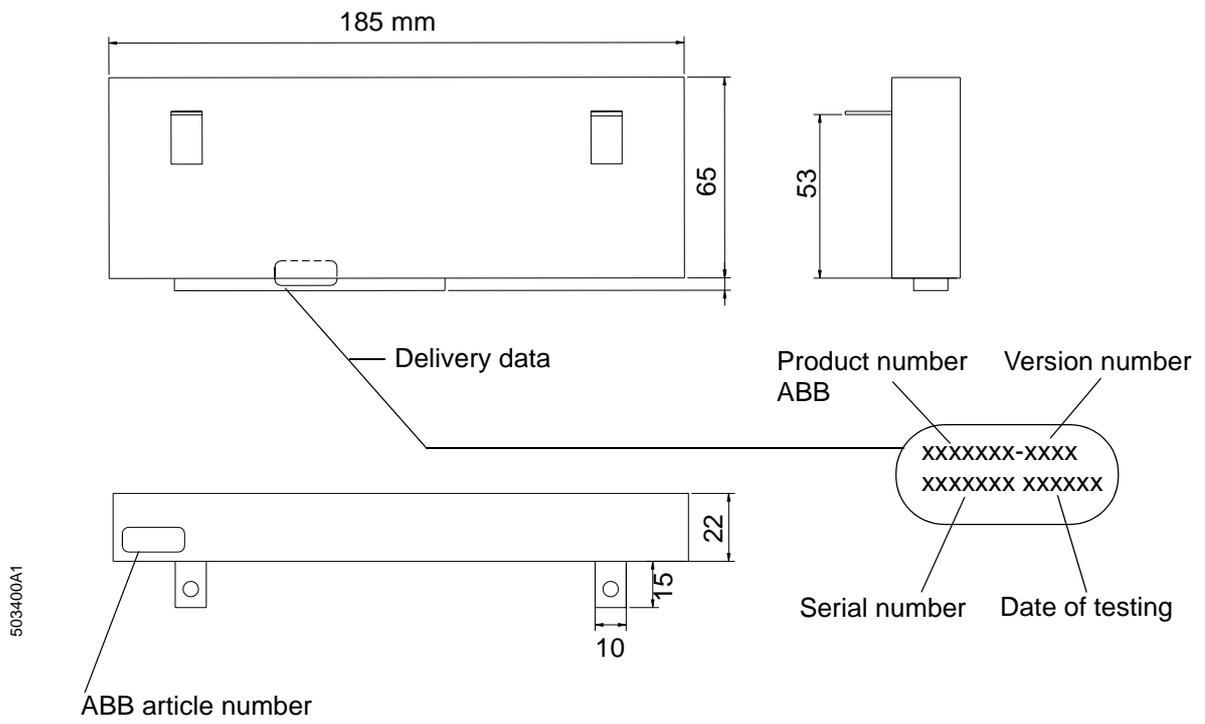
Figur 27   Smartac unit.

7 Appendix 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 61* . For 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/(π x D x 60) [Hz/m/min x 100], where:

- k_0 is the conversion factor for tacho type 0

- g = The gearbox's gear factor

- n = Number of tacho periods/motor speed

- D = Feed roller's diameter in metres

- 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 = (π 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 Technology Products 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[1].
In order for the new parameters to apply the system must be restarted.
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.

Table - Configuration parameters.

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

---

1. Note that the jumper TB9 should be open.

Appendix1eng_Konfigurationsparametrar.fm

7.0.1 Table Configuration parameters

Parameter name	Parameter name in teach pendant	Parameter behavior	Parameter range/ denomination
Software Revision	SoftwareRevison	Current software revison (readonly)	-
Motor Max Voltage	MotorMaxVoltage	Maximum allowed voltage for the DC-motor connected.	{0...110} V
Motor Current Limit	MotorCurrentLim	Maximum allowed current for the DC-motor connected.	{0...100} 0.1 A
*Motor Max Speed	MotorMaxSpeed	Maximum allowed setting for motor speed in motor speed quantity units	{0...500} 0.1
*Motor Min Speed	MotorMinSpeed	Minimum allowed setting for motor speed in motor speed quantity units	{0...500} 0.1
*Motor Regulator P-factor	MotorRegPFactor	Proportional factor of the motor speed PI regulator.	{0...100} %
*Motor Regulator I-factor	MotorRegIFactor	Integrating factor of the motor speed PI regulator.	{0...100} %
*Motor Regulator Feedforward-factor	MotorFeedForward	Feedforward factor of the motor speed PI regulator.	{0...100} %
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
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
*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} AC (tacho type 0) : 0.01 Hz / motor speed quantity AC fast (tacho type 2): 0.02 Hz / motor speed quantity DC (tacho yype 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)
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 Monito-ring Tacho Type	PdmTachoType	Type of tacho used for true process quantity measurement	{0,1} 0 (AC-tacho)
Process Data Monito-ring 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 Monito-ring 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
*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 (Arcitec)
*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

8 Appendix 2

Manual wire feed with PIB and S4Cplus, possibilities and limitations:

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

1   By pushing in the non-locking push button for manual wire feed on the welding gun or on the front of the wire feed unit.

2   By activating the function *Manual wire feed* from the robot's programming unit in test mode under: *Program window\Arcweld\Manual wirefeed*.

3   By activating the robot output *doFEED* in combination with the setting of a speed reference in *aoFEED_REF* under the I/O window..

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	Explanation
1	Max. 6m/min	yes	no	automatically	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[2].
2	Max. 9m/min	yes	yes	automatically	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 full speed range	no	yes	yes, manually **Limited validity**[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. 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. Limitation for reasons of personal safety.

    3. **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.

9   Appendix 3

System accuracy: verification and trimming possibilities.

Wire feed: Feed unit A140E/A314E/A324E-L/A324E-S.

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 table below shows the relation between the frequency and wire speed.

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

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.)

Welding equipment
Appendix 3

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

Power source (does not apply to ARCITEC)

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

ProcEquipRefConv (gain), **ProcEquipRefOffset** (offset) and **ProcEquipMaxRef.**(Max 48 V DC):

When replacing PIB or the power source the weld result can deviate from previous result depending on the tolerances in the analogue 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, LAF 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.

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.

10   Appendix 4

Smartac; Optimising the search circuit

The function of the Smartac is, to a great extent, dependent on the insulation characteristics of the search circuit.

1   Water cooled gun

Distilled water or demineralizized water should be used for the best function.
The welding gun should be filled with the water when searching. In other words: The cooling pump should be switched on.
The above also applies when the Smartac is commissioned and the configuration parameters for **SensorSearchVoltLim** and **SensorDetectionSens** are determined.

2   Elimination of false search stop due to current transfer between sensors 1 and 2.

Problems: A search stop occurs when the non active sensor attains contact with the workpiece before the active sensor.
For example: The search stop occurs when the welding wire (sensor 2) attains contact with the workpiece before sensor 1 (gas cup) although sensor 2 is not activated (or connected) [1]

Reason: Even with relatively good insulation (>50 kOhm) between the gas cup and welding wire there is a current transfer that will give a voltage drop on the active sensor when the passive sensor touches the workpiece which, if the sensitivity is too high, will give a search stop.
The reason is the high internal resistance in the sensing circuit in Smartac.

The above applies analogously for sensor 2 when it is used as the active sensor (even if the welding circuit is isolated by a contactor).

Actions:

- It is checked when searching that a search stop does not occur if the inactive sensor makes contact with the workpiece.
  Which, for example, for sensor 1 is simply performed by connecting the weld wire to the workpiece during the search phase and analogously for sensor 2 connect the gas cup to the weld object during the search phase.
  If a search stop occurs the configuration for "SensorDetectionSens" is changed to a lower sensitivity (which means higher value).
  Where appropriate, it may be necessary to first lower the level for approved search voltage "SensorSearchVoltLim".

  The robot system must be restarted when the configuration has been changed (warm boot).

---

1. Strapping between TB 5:5 and TB 5:9 on PIB not carried out.

- Perform searching in this way so that the risk of the wrong sensor coming into contact first with the workpiece is minimised.

11 Appendix 5

Loading of configuration file

```
#******************************************************************
#
#   (c) ABB Automation Technology Products AB,
#     Arc Welding & Application Equipment
#
#   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
#
#******************************************************************
```

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 Teach Pendant 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.

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ABB