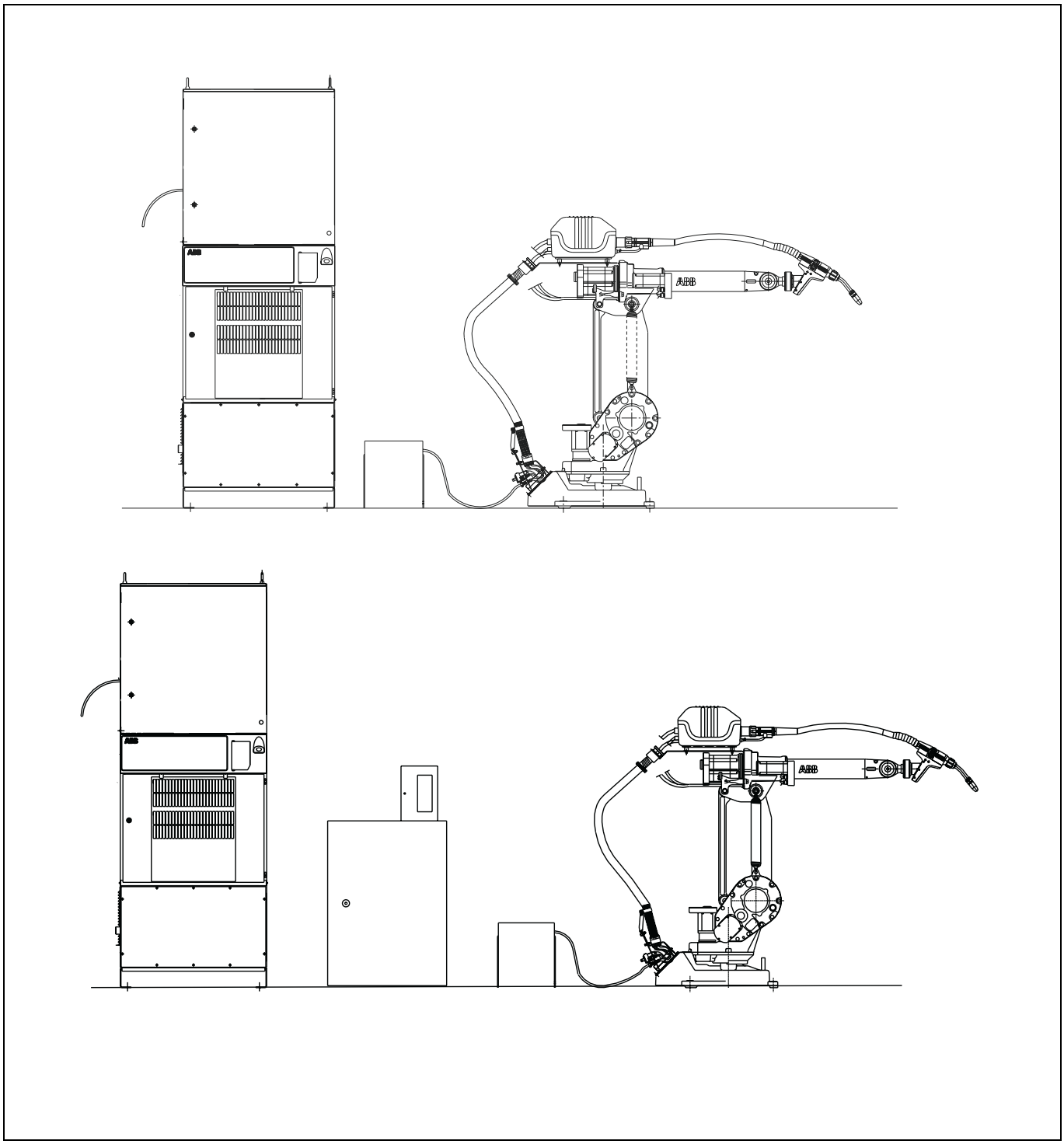
# Product manual

## Welding Equipment

## A314i,A324iL/Aluminium

### ARCITEC/S4Cplus

504 106-502
2001-04-03



## ABB Flexible Automation

### Welding Systems

Artikelnummer: 504 106-502

Datum: 2001-04-03

ABB Flexible Automation AB

Welding Systems

S-695 82 Laxå

Sverige

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# 1 General

This manual is made up of a safety section, technical description of the wire feed system A140/A314i/A324L, 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<br>Tillverkardeklaration | | | | | 3HEA 500005 | | B | |
| | Standard Type | | | | | Scale | | Code K1O | |
| Year 1994 | Week 52 | Design checked by | Accepted for prod by | Drawing checked by | Drawn by TDM A.Ja | E | $\sqrt{}$ indicates $R_a$ in µm | Sheet 1 | 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) |

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(Development manager)

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|---|---|---|
| | | |
| | | |

*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

## 3.1 Welding equipment

The welding equipment meets *Welding System's* recommended layout setup. This means the robot has a full working area within a section of ±150° for A314i, A324iL/aluminium, around axle 1. Great care should be exercised outside of this sector, e.g. when programming otherwise the welding equipment can be damaged.

The welding equipment is adapted for the control of the IRB 1400 robot with the S4C control system. Together with the AW software of the robot and the PIB process interface the system gets the following characteristics:

- **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 the welding process is interrupted and error messages are displayed on the robot programming unit.
- **Flexibility** - The transfer of programmable configuration data enables the adaptation to different power sources and feed units.

**Incorporated components**

**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** Cable attachment

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

**5** Cable for the welding current

**6** Welding gun with wire feed mechanism

**7** Power source, integrated in cabinet

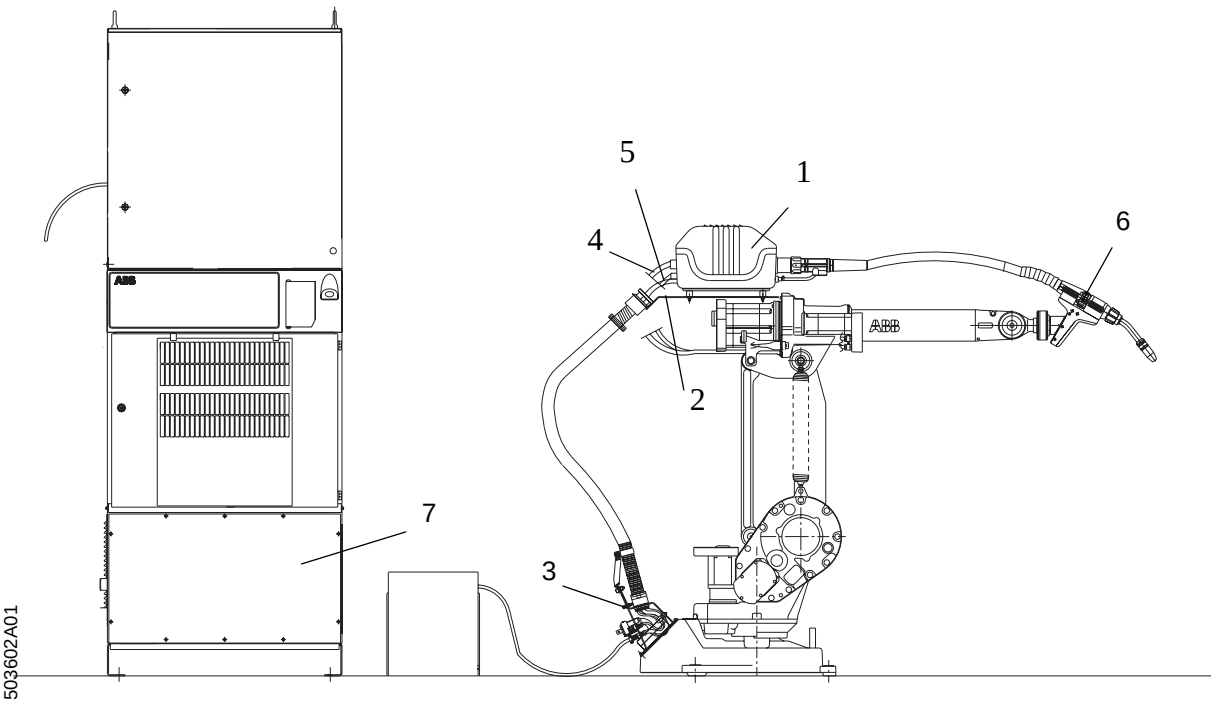



*Figure 2 Welding equipment with wire feed unit (7 kg bobbin) and integrated power source.*

The following options are available to A314i/Aluminium:

- Torch cleaner TC for PKI 500A
- Wire cutter
- BullsEye
- Sensor Interface, Smartac
- TSC Torch Service Centre, including Torch cleaner, Wire cutter and BullsEye

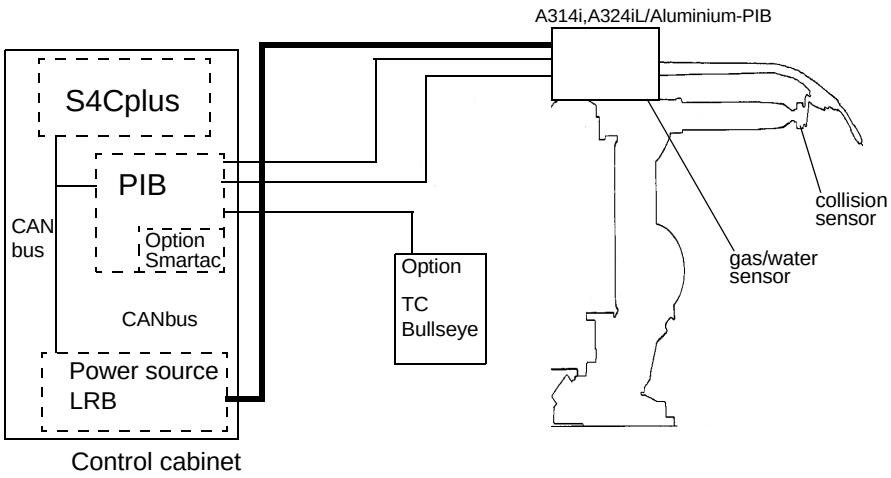



*Figure 3 Overview - connections.*

## 3.2 Wire feed system, A314i,A324iL/Aluminium

In addition, there are two options of wire feed systems: 7 kg bobbin or 40 kg bobbin.

**7 kg bobbin:** It is intended to be mounted directly on the robot IRB 1400, which results in a short cable bundle and a good wire feed, furthermore, a smaller floor area is required.

**40 kg bobbin:** The equipment consists of a free-standing cabinet with a device for feeding the wire. The cabinet has humidity control using a thermostically controlled heater.

**Customer's connection for 40 kg bobbin**

**Sensor Functions**

- The wire sensor measures the remaining amount of wire on the bobbin as well as position of the wire.
- The distance of sensitivity is 1000mm.
- Hysteresis on turn-off is 10% of the set turn-off distance.
- There are three indication points (**2**):
  Check-up indication → yellow
  Service indication → green
  Pollution indication → red
- The distance of sensitivity is adjusted by way of the potentiometer (**1**).
- The optical transducer (**3**) must be kept free of foreign particles and the optics are to be cleaned.
- The sensor cable (**4**) must not be sharply bent as the optical fibres can be damaged.

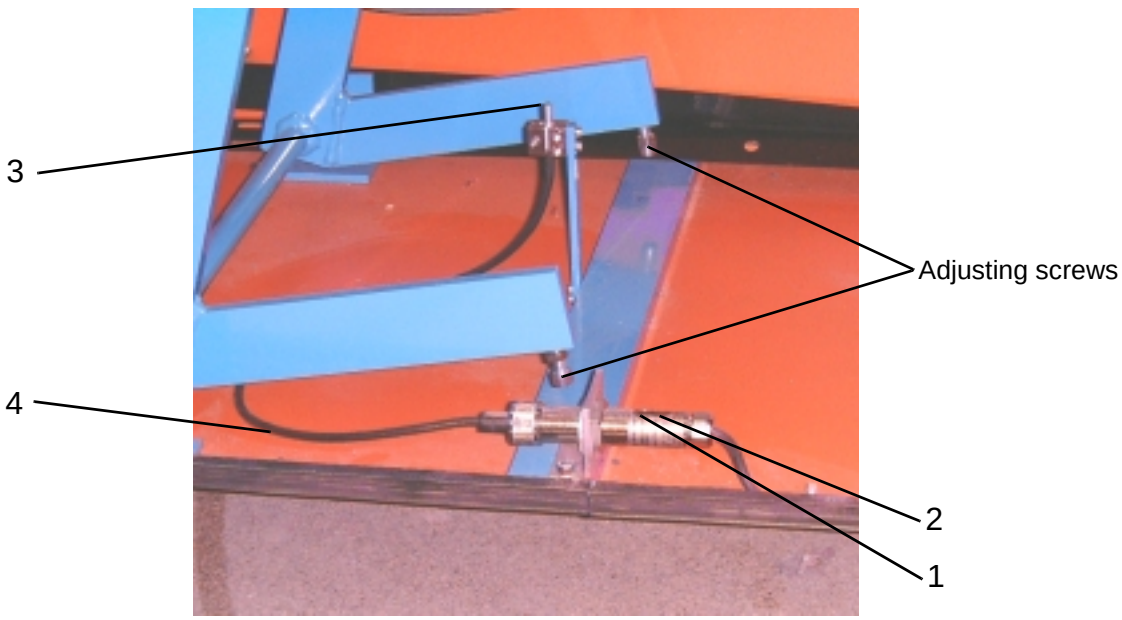
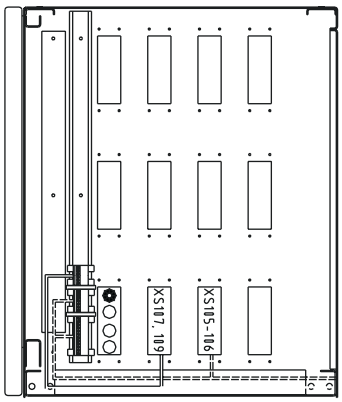



*Figure 4*

In the robot control cabinet a terminal block, XT101 is located. Here an optional alarm device can be connected to the transducer signal; "wire remaining".




*Figur 5 Terminal block XS 110.*

| XS 110 6pole | Signals |
|---|---|
| 1 | 42V AC |
| 2 | 0V AC |
| 3 | 24V DC |
| 4 | 0V DC |
| 5 | Wire remaining closing |
| 6 | Wire remaining disconnecting |

### 3.2.1 Wire feed unit

The wire feed system is of the Push-Push type. The welding gun is fitted with two Euro-sockets for quick-connection - one for the swan neck and one for the hose bundle.
The wire feed unit with tacho-controlled motor is fitted in the head of the welding gun.

The wire feed system is designed for the wire dimensions Ø 0.8 - 1.6 mm. On delivery the system is fitted with feed rollers for 1.2 mm wire diameter and the corresponding wire conduit.

The hose bundle is fitted with a button for manual wire feed when changing the wire and a connector for the break-mount.

The rear feed unit for the 7 kg bobbin is placed in the feed unit box on the robot, and for the 40 kg bobbin in the winding-off device. In both cases the units are pro-

vided with a feed motor, the torque of which is controlled by way of a rotary potentiometer.

The adjustment of the torque depends on the diameter and the type of alloying material of the wire as well as the length and the degree of bending of the hose.

**N.B.** The following values are for guidance only:

| Diameter | Torque adjustment, 7 kg bobbin | Torque adjustment, 40 kg bobbin |
|---|---|---|
| Ø 0,8 mm | 60 - 70 % | 65 - 75 % |
| Ø 1,0 mm | 70 - 80 % | 75 - 80 % |
| Ø 1,2 mm | 70 - 80 % | 75 - 85 % |
| Ø 1,6 mm | 75 - 85 % | 80 - 90 % |

The suspension of the bobbin is mounted in ball bearings and is provided with a bobbin brake.

The feed roller pressure should be as low as possible without causing the wire feed rolls to slip.
Note that different types of wire alloys require different roller pressure.

### Loading wire (7kg)

Mount the bobbin on the brake hub ensuring that the spigot on the hub engages with the hole in the bobbin.

Unlock the pressure roller on the rear wire feed unit and swing the top roller completely open.

Load the wire manually ensuring the wire is correctly placed around the brake mechanism roller.

When the wire appears between the pressure roller and the feed roller and into the gun liner, close and lock down the pressure roller.
Unlock the pressure device in the feed unit of the gun and swing the pressure roller completely open.

Activate the *Wire feed* button on the feed unit.

When the wire appears in the feed unit of the gun, guide the wire into the neck liner then close the pressure roller and fully lock the pressure device. Remove the contact tip, activate the wire feed button until the wire feeds out of the neck, replace (or renew) the contact tip (using the correct tool) and cut the wire to the correct length for welding.

### Adjusting the torque

Activate the *Wire Feed* button on the feed unit.

If the wire feeds out of the gun from the rear feed unit only (the slave), decrease the

torque using the potentiometer in the black box until the feeding stops.

If the feed rollers in the rear unit (slave) spin, increase the pressure on the pressure roller using the adjusting screw. Lock the adjustment with the locking nut.

**Note:**

For both the rear and gun feeders, the required pressure depends on the grade and diameter of the wire.

Too high a pressure may cause deformation of the wire, leading to bad welding result.

**Loading wire (40kg)**

Mount the bobbin on the brake hub ensuring that the spigot on the hub engages with the hole in the bobbin.

Unlock the pressure roller on the front and rear wire feed unit and swing the top rollers completely open.

Load the wire manually ensuring the wire is correctly placed around the brake mechanism roller, see Figure 7.

If necessary, adjust the wire spool so as **not** to get the wire in contact with the handle see Figure 6 and Figure 4, (adjusting screws).

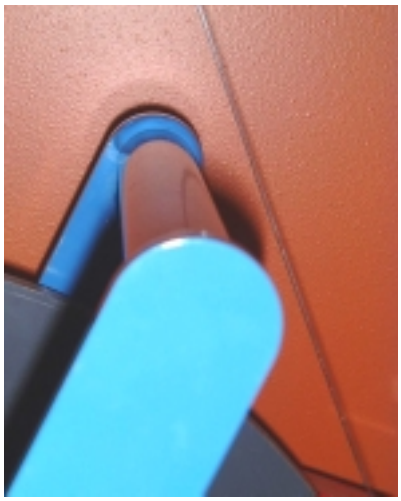


*Figure 6*

When the wire appears between the pressure roller and the feed roller and into the gun liner, close and lock down the pressure roller.

The wire can be advanced through the wire liner by pushing the wire feed button on top of the rear wire feed unit.If necessary, adjust the pressure of the pressure arm so that the feed roller does not spin.

In the course of loading it might be necessary to adjust the torque to maximum. This is adjusted by the rotary potentiometer on top of the rear wire feed unit.

Activate the *Wire feed* button on the feed unit.

When the wire appears in the feed unit of the gun, guide the wire into the neck liner then close the pressure roller and fully lock the pressure device. Remove the contact tip, activate the wire feed button until the wire feeds out of the neck, replace (or renew) the contact tip (using the correct tool) and cut the wire to the correct length for welding.

**Adjusting the torque**

When the wire has been loaded, check the feeding of the wire by activating the wire feed button on the gun. Make a test weld with the torque set to maximum.

Make a test weld and observe the arc. If there are disturbances in the wire feed (usually seen oscillations or instabilities in the arc length), decrease the torque gradually until the arc is stable.

**Note:**

For both the rear and gun feeders, the required pressure depends on the grade and diameter of the wire.

Too high a pressure may cause deformation of the wire, leading to bad welding result.

### 3.2.2 Control and indicating devices on the wire feed unit

**1** **WIRE FEED** switch for manual wire feed, valid for 7 kg bobbin.

**2** **RESET** switch for resetting the switch attachment.

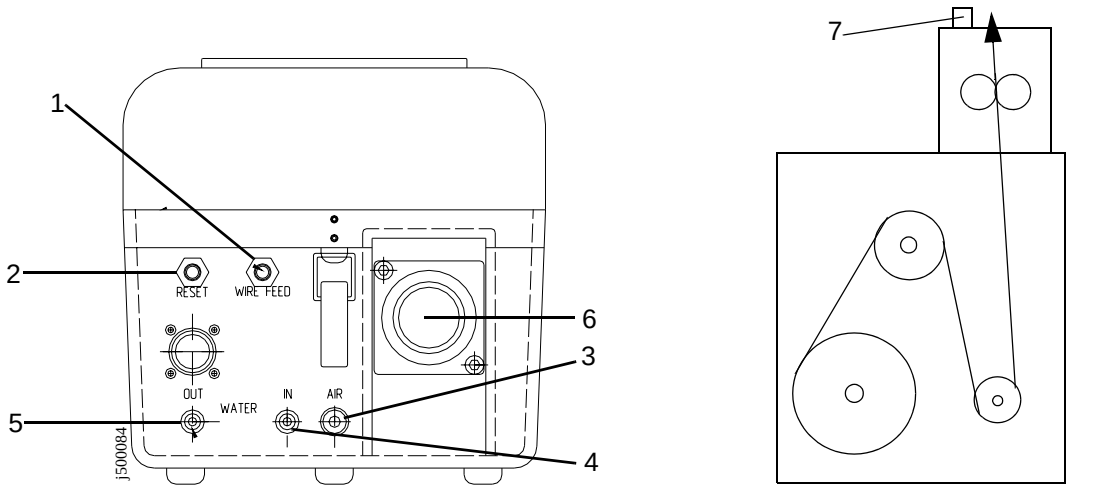
**3** **AIR** connection to the welding gun.

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

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

**6** Euro-socket for the welding gun.

**7** Switch for manual wire feed on the winding-off unit, valid for 40 kg bobbin.




*Side of the wire feed unit.* *Wire path in winding-off unit (40 kg)*

*Figure 7*

### 3.2.3 Main data

| | |
|---|---|
| **Wire diameters** | 0.8 mm - 1.6 mm |
| **Wire feed speed range** | 2,5 - 18 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 7 of this manual.

# 4 Installation

## 4.1 Connect the cables as follows (see Figure 8):

**1** **Feeder cable 1, A314i/A324iL,** Foot of the robot - Control cabinet 23-pole connection at both ends

**2** **Feeder cable 2, A314i/A324iL** 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.

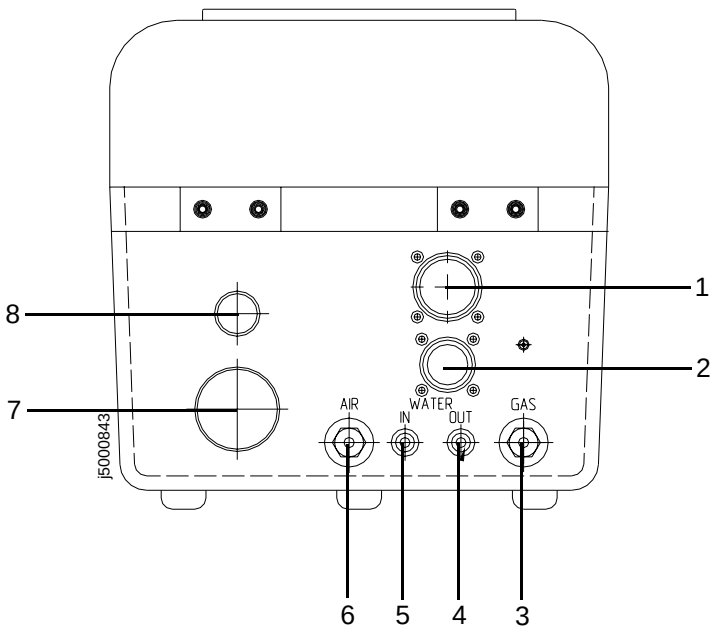



*Figure 8*

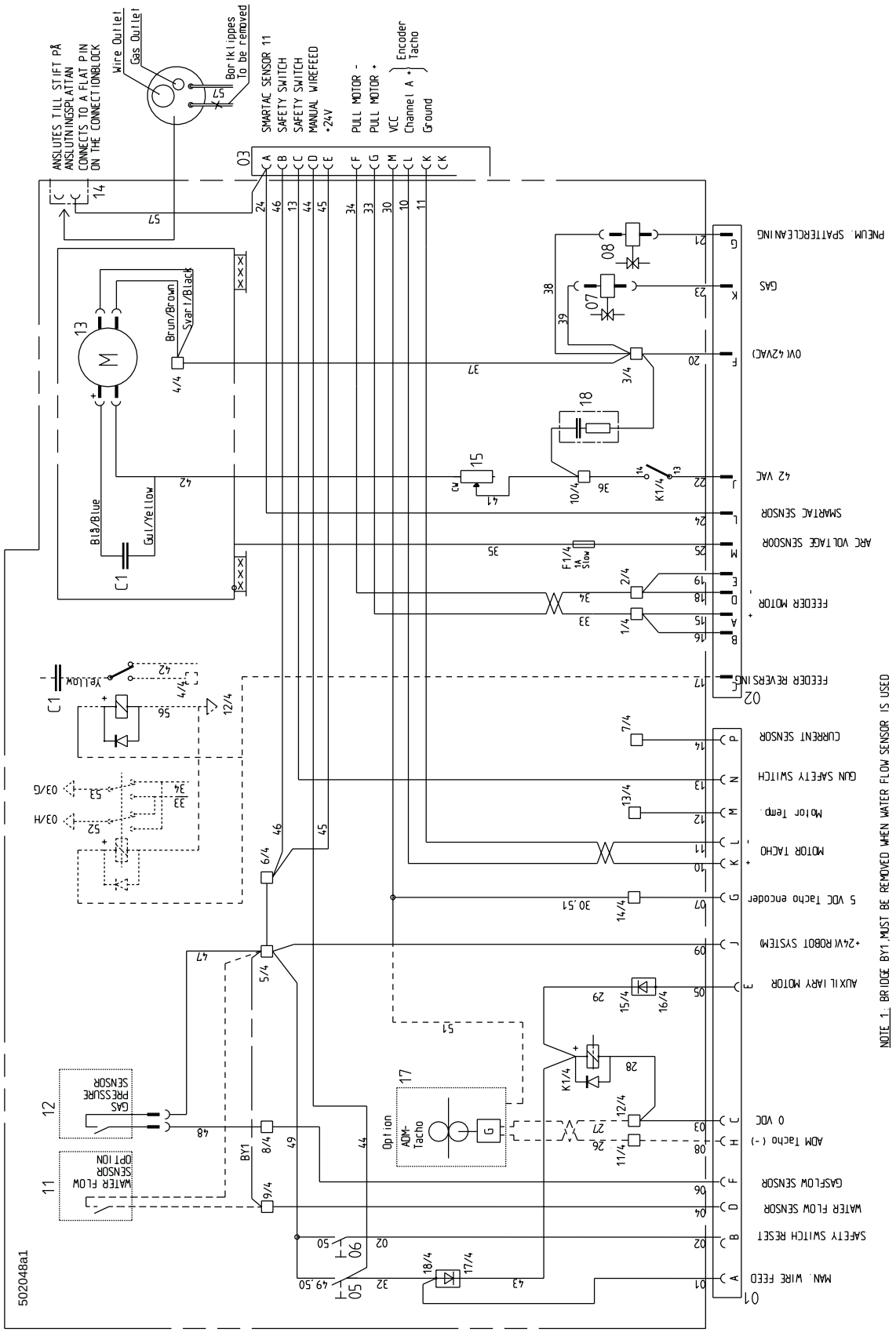



*Figure 9 Circuit Diagram, Feeder unit - Aluminium, 7 kg.*

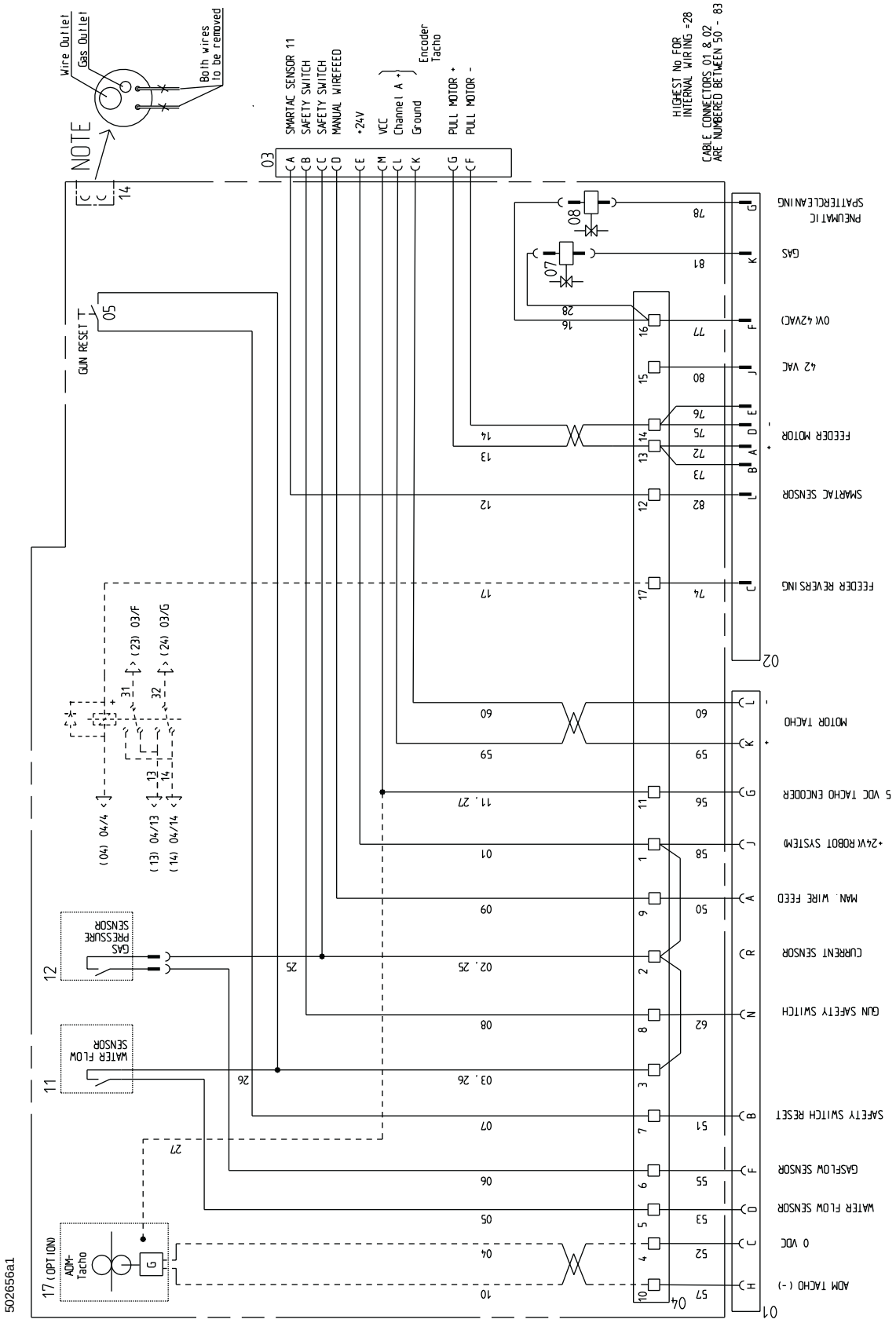
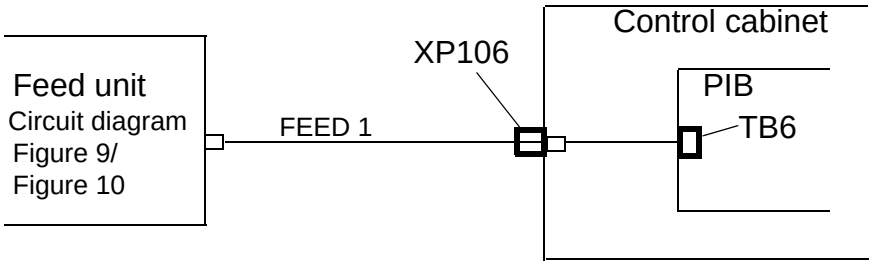


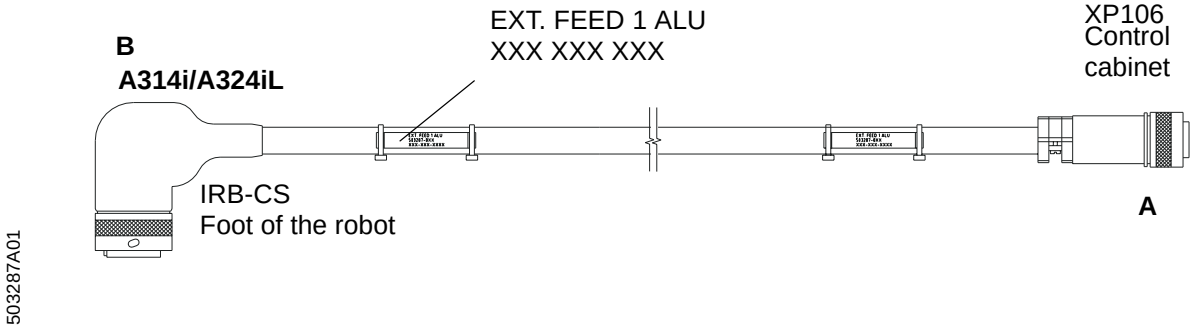

*Figure 10 Circuit Diagram, Feeder unit - Aluminium, 40 kg.*

**Kopplingstabell kablar/ Connection table, cables**

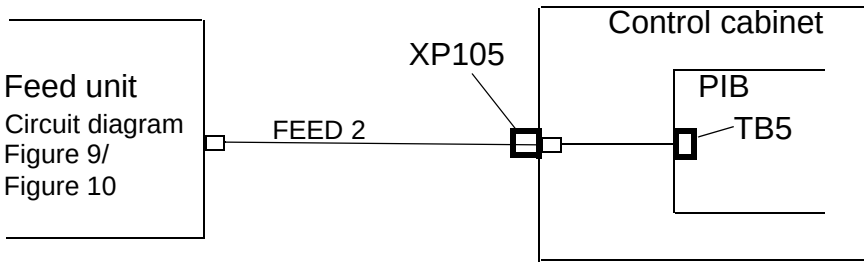



Feeder cable 1, A314i,A324iL/Aluminium

| **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 | Rose |
| 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/Rose |
| Auxiliary Motor | E | E | Röd/Blå | Red/Blue |
| ADM Tacho (+) Encoder Tacho input | G | G | Vit/Grön | White/Green |
| PDM Tacho (-) | H | H | Brun/Grön | Brown/Green |
| +5V Encoder Tacho | R | R | Vit/Gul | White/Yellow |
| Spare (not used) | T | T | Gul/Brun | Yellow/Brown |

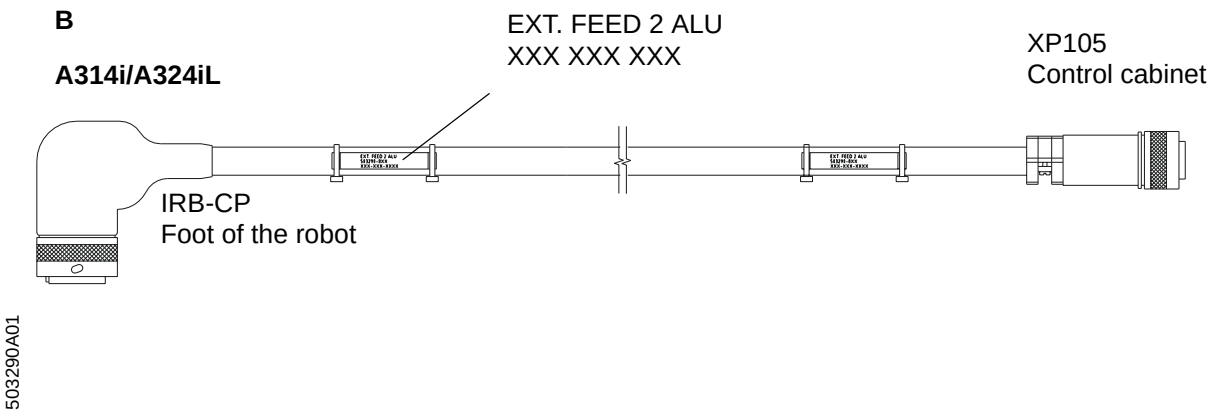



*Figur 11 Feeder cable 1, A314i,A324iL/Aluminium.*



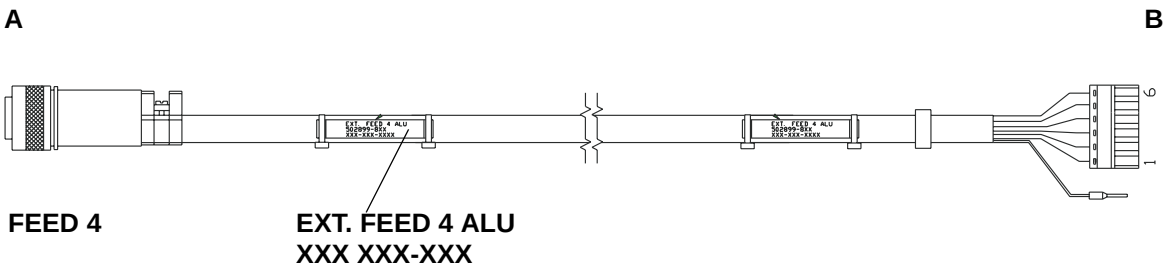

Feeder cable 2, A314i,A324iL/Aluminium

| **Signalbeskrivning/ Signal Description** | **A** | **B** | **Färg** | **Colour** |
|---|---|---|---|---|
| Motor + | 1 | A | Vit | White |
| Motor + | 1 | B | Brun | Brown |
| Feeder Reversed | 15 | C | Grön | Green |
| Motor - | 2 | D | Gul | Yellow |
| Motor - | 2 | E | Grå | Grey |
| NC | NC | NC | Rosa | Rose |
| Pneumatic Spatter Cleaning (42/115 VAC) | 3 | G | Blå | Blue |
| Gas Valve (42/115 VAC) | 4 | K | Röd | Red |
| Arc Voltage Gun | 5 | M | Svart | Black |
| Smartac 1 | 6 | L | Violett | Violet |
| Aux Motor Supply (42/115 VAC phase) | 7 | J | Grå/Rosa | Grey/Rose |
| Aux Motor Supply (42/115 VAC common) | 8 | F | Röd/Blå | Red/Blue |



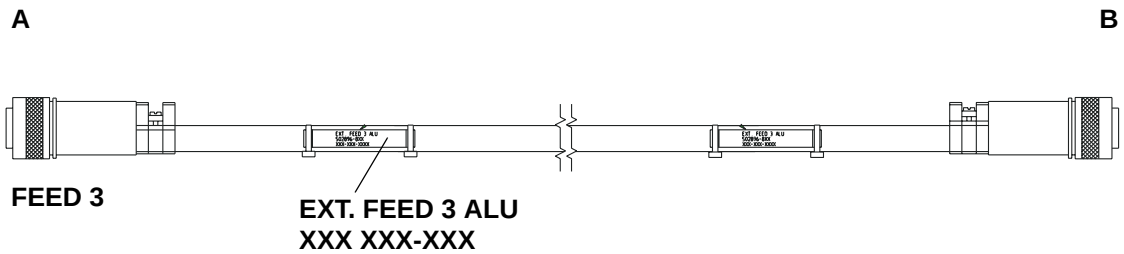

*Figur 12 Feeder cable 2, A314i,A324iL/Aluminium.*

| Kabeldel/Cable part | A | B | Namn/Name |
|---|---|---|---|
| 1 | A | T11:0 | 0V AC |
| 2 | B | T11:42 | 42V AC |
| 3 | C | XT 101:11 | 24V DC from robot |
| 4 | F | XT 101:12 | 0VDC |
| 5 | D | XT 101:13 | Wire remaining (light on) |
| 6 | E | XT 101:14 | Wire remaining (dark on) |
| GN/YE | M | XT 101:15 | PE |




*Figur 13 Cable to bobbin cabinet, A314i,A324iL/Aluminium*

| Kabeldel/Cable part | A | B | Namn/Name |
|---|---|---|---|
| 1 | A | PIB TB5:8 | 0V AC |
| 2 | B | PIB TB5:7 | 42V AC |
| 3 | G | PIB TB6:12 | 24V DCAuxilary motor |
| 4 | H | PIB TB6:10 | 0VDC |
| 5 | D | PIB TB5:5 | Arc voltage gun |
| 6 | F | PIB TB6:8 | Man.Wire Feed |
| GN/YE | C | NC * | PE |




*Figur 14 Cable to feeder unit cabinet, A314i,A324iL/Aluminium*

## 4.2 Installation of accessories

### 4.2.1 Cooling unit OCE 2

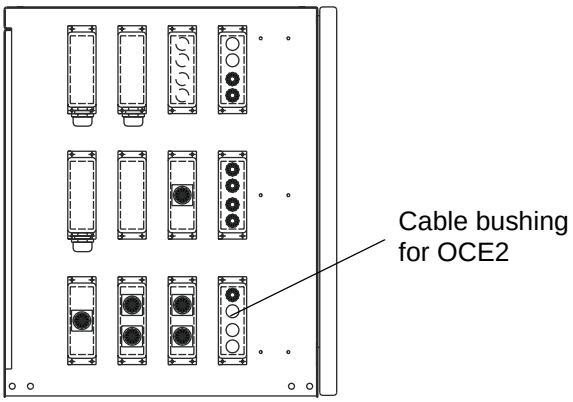
**1** Place the cooling unit OCE 2 on the floor (for detailed information refer to the OCE 2 manual).

**2** 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.

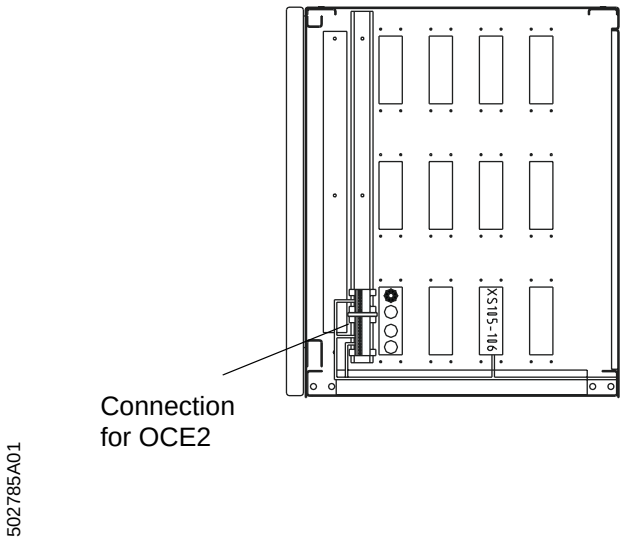
**3** Connect the cooling unit's mains cable as follows:

- On LRB: Connect the mains cable to terminal **A204:X202 plint 10-11** in the robot cabinet. Remove the blind plug and fit the strain relief gland in the cabinet wall..




503050A02

*Figure 15 Connection OCE2.*



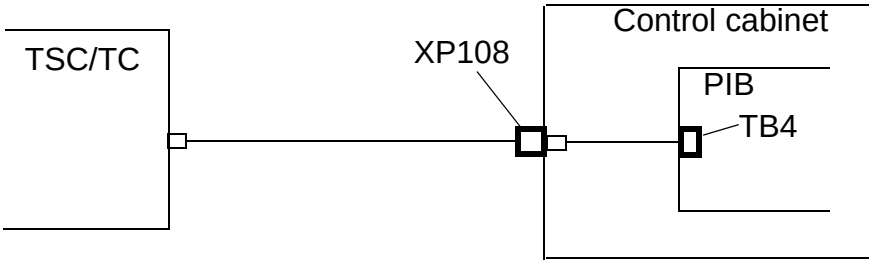

**4** Fill the cooling unit with water and any anti-freeze (for detailed information refer to the OCE 2 manual). Check the flow in the welding gun by opening the cooling unit's return hose connection **IN** until water comes in.

**5** 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**.

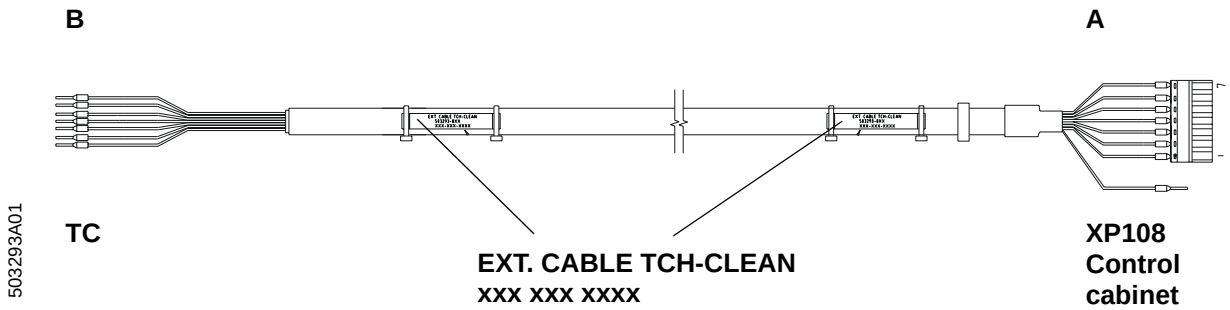
### 4.2.2 Spatter cleaning device TC

Connect the mechanical spatter cleaning device TC to PIB, terminal TB4.




Cable, spatter cleaning

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




*Figur 16 Cable, Spatter cleaning.*

# 5 Maintenance and Service

The function of the welding equipment as well as the reliability in operation are dependent on proper handling and maintenance. For the best operation economy and for the warranty undertakings to apply, only use genuine 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.

## 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 with dry compressed air at reduced pressure.

**2** Loosen the pressure arm:

- Dismount the feed roller by loosening the Hexagon screw.
- Clean the grooves in the feed roller.
- Mount the feed roller and replace the pressure arm.

**3** Clean the wire conduit using dry compressed air each time the wire is changed or as necessary. Replace the wire conduit if worn.
When replacing the wire conduit: Make sure the length corresponds to the length of the hose bundle with contact device.
Deburr the cut ends of the wire conduit.

**4** Use filler wire free of impurities.

## 5.2 Replacing the contact tip

**1** Remove the gas nozzle and clean it of welding spatter.

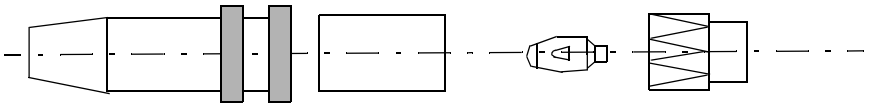
**2** Wipe off the thread inside the gas nozzle and the thread of the torch neck.

**3** Check and clean the spatter shield of the gas nozzle. Replace the shield if worn.

**4** Loosen the threaded contact tip using an 8 mm key. Replace the tip if worn.

**5** Check and clean the gas distributor and replace if worn.

**6** Screw the gas distributor, the contact tip and the gas nozzle cup with spatter shield together in reverse order.



**Do not use pliers or the like when assembling the parts!**

**Check the gas nozzle and the contact tip each time the welding stops. Replace worn parts as necessary.**

## 5.3 Before starting the operation

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 secure
- that all parts and guards are replaced
- that functions are correct.

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

# 6 Operation

See the section *PIB Process Interface Board.*

## 6.1 Configuration of the Welding Equipment

See the section 7.3

***Note!***

*For use together with ARCITEC/LRA/Aluminium PIB requires a special configuration, which is effected on delivery.*

*PIB as a spare part is therefore to be ordered with the designation PIB- AluFun-Pack, which contains the working moments of the configuration.*
*See the spare parts list.*

# 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 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, which gives a high degree of flexibility.

The communication with the robot computer is serial and is maintained by way of a CAN bus, which means considerably simplified wiring and less dependence on the location.

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 17.

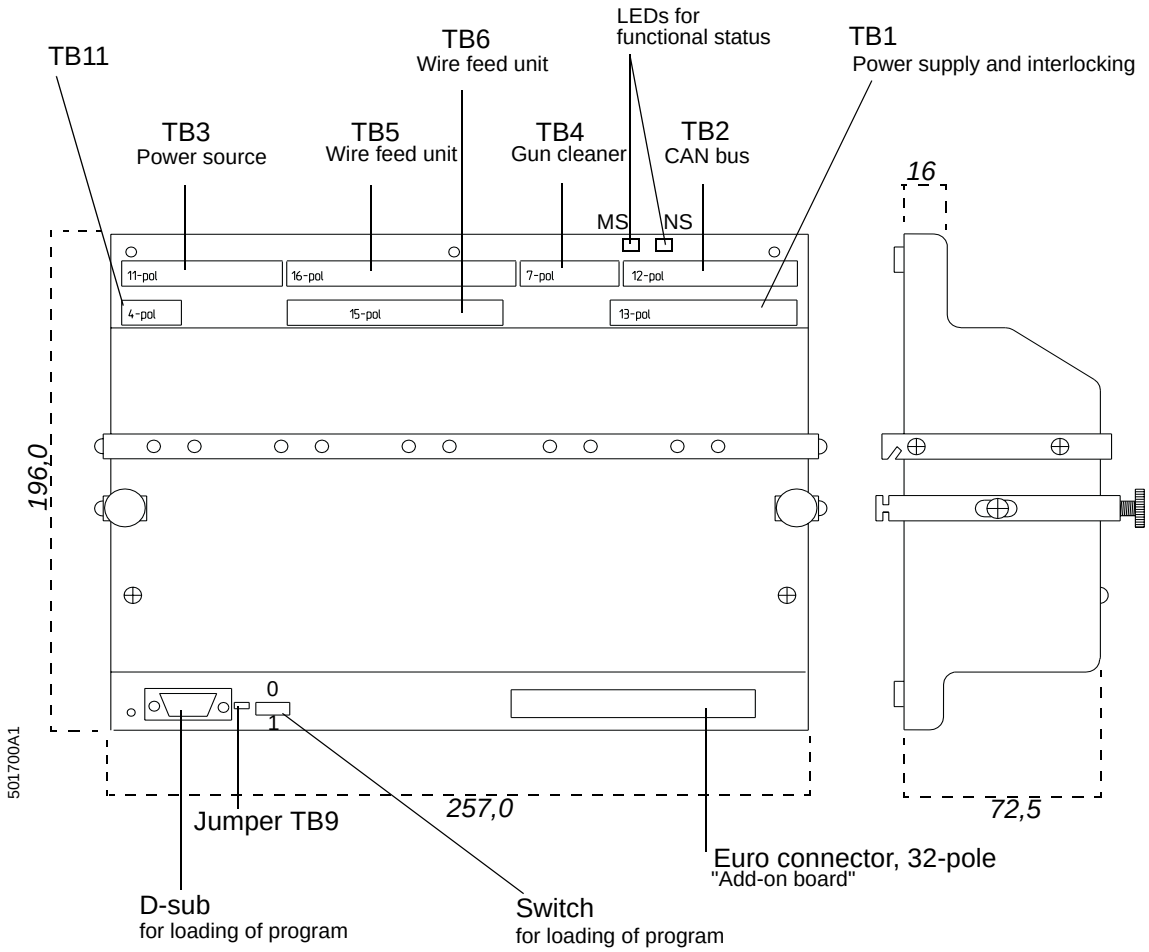



*Figure 17 Dimensions and Terminal Designations.*

## 7.2 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 18.

**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 56*.

## 7.3 Program Versions

PIB includes two program versions. Which program version is active is determined by the TB9 jumper. See Figure 19.

**1** For robot systems from **S4Cplus** with Flexible (see section 7.5) 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.

**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-configuered 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**.*

## 7.4 Marking and Version Handling

Figure 18 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 of the robot as a non-editable three-digit number. (Software revision, see section 7.14.3.) The number is automatically updated when the software version is changed.

The software version is also indicated when using the simulation program (BF). See the section *Service and Programming Aids on page 40*. Then the software version is indicated in the form of a letter and a two-digit number.

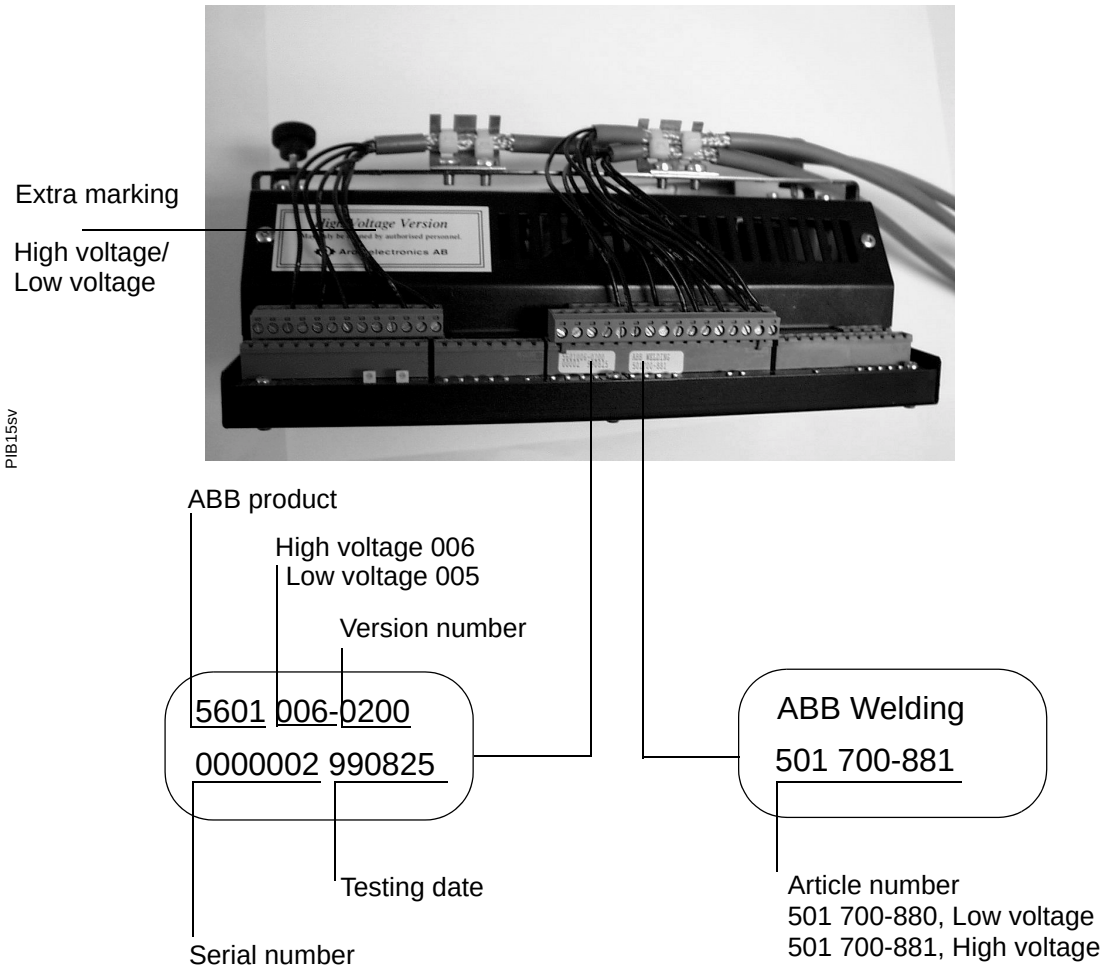



*Figure 18 Marking and Version Handling.*

## 7.5 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 LAW 350R/ 500R, RPA 400, Miller Delta Weld).
- 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 (=configuered IO-name)** on the programming unit of the robot. Modified values are automatically transferred to the PIB board when starting the robot.

When changing the PIB, previously configuration parameters stored in the robot will automatically be transferred to the new PIB card when the voltage is switched on.

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 the *Table - Configuration Parameters on page 53* where all the parameters are listed and defined.

## 7.6 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 17 on page 35.

**Smartac (joint search and tracking device):**

See section 7.17.

## 7.7 Software Maintenance

By way of a PC, the loader program DosFlash and a cable connected between the serial port of the PC and the programming terminal of PIB new software can be transferred to the PIB program memory.

The cable shall be a 9-pole D-sub extension cable of the pin-pin connection type with socket contacts.

PIB is set to programming position

- by setting the programming switches to position 0 which is the loading position (all switches).

After the download the switches must be reset to position 1 (all switches).

See Figure 19.

The loader program with description and revised software can be ordered free of cost.
To obtain the cable, please apply to a supplier of data equipment.

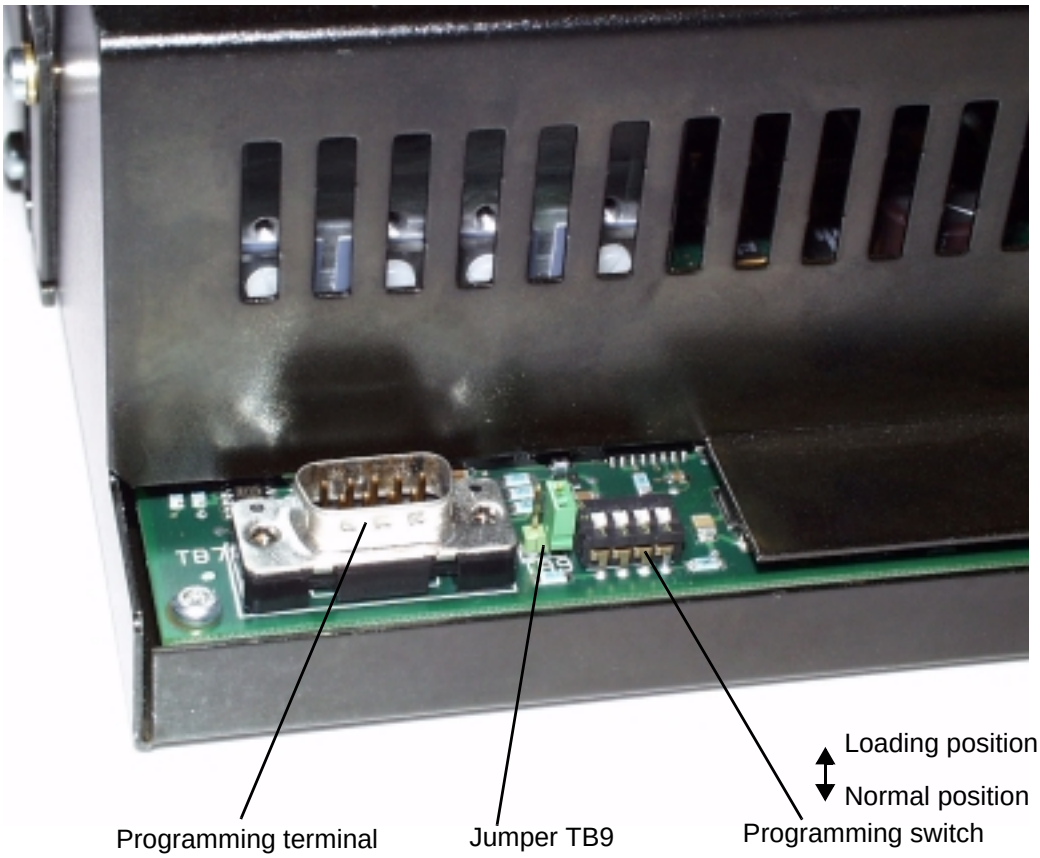



*Figure 19 Jumper.*

## 7.8 Service and Programming Aids

A simulation tool in PC Windows environment has been developed for the PIB. The designation of the program is BF, version 2.2.

- Configuration parameters can be loaded into or read from the PIB.
- All inputs and outputs can be activated as well as the functions of the power source and the wire feed unit.
- The functions of PIB and other connected units can be tested. The CAN bus cable between the PIB and the robot is connected to the tool instead of the robot.

To use the simulation program a PC CAN interface is required, consisting of a PCMCIA board with dongle.

The BF program is supplied on request free of cost. With the delivery you get information from us about supplier and type of CAN bus tool.

## 7.9 Diagnostics – Error Handling

The PIB is provided with two light-emitting diodes according to the DeviceNet specification. See Figure 17 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 one. During the phase of initiation, which can last for a couple of seconds, the light of the diodes changes.

**All other error indications are in the form of messages sent to the robot programming unit.**

**The PIB is checked for registered errors only in the course of running.**

The errors are categorised as **Warning** errors and **Stop** errors. A text comes up to explain the error and to recommend action.

When an error of the **Stop** category occurs, PIB stops the wire feed unit and the gas flow. By way of the monitoring of the process (welding current and gas) welding errors are registered in Arc Supervision. When using standard welding power sources. See the section *Configuration on page 38*.

**Error messages are acknowledged by pressing OK.**

When starting the computer only the last error occurred is displayed. When the error is remedied a message comes up to confirm the correction. If two or more errors are eliminated at the same time only the last one is confirmed. Remaining error, if any, is displayed next time the program is started.

The main heading of the errors is 80001 and is stored in the robot error log under the heading of User defined.

**Table of Error Messages**:

**2** PIB error, warning:
Analog output outside limits.
Check the limits in PIB ctrl. conf. part motor max/min Speed and max Volt.

**3** PIB error, warning:
Long diff. betwee req. actual Motor Speed.

**4** PIB error, warning:
Digital Output overloaded in PIB, fatal error.
Check the Output connections. Reset with Power switch.

**5** PIB error, stop:
Motor Overtemperature in PIB.
Check friction in wire conduit and the Motor TempLimit in PIB ctrl.conf.

**6** PIB error, stop:
PowerSource reference output overloaded.
Check connections.

**7** PIB error, stop:
Motor overloaded.
Check motor connections, friction in wire conduit, MotorCurrentLimit.

**8** PIB error, stop:
Motor Supply error in PIB
Check AC supply for PIB from transformer. Reset unit with Power Switch.

**9** PIB error stop, stop:
Motor drive transistors overtemp, in PIB.
Check friction in wire conduit.

**11** PIB error, warning:
Supply voltage 24 Volt on PIB too low.
Check incoming power supply. Reset unit with Power Switch.

**13** PIB error error, stop:
Power Source supply 24 Volt on PIB too low.
Check power supply. Reset with Power Switch.

**15** PIB error, stop:
AC supply logic 28 volt has been down.
Check incoming power supply to PIB. Reset unit with Power Switch.

## 7.10 Assembly - Enclosure

The PIB is provided with a fastening device to be fitted against a DIN rail, TS 35x15. The PIB is protected against mechanical damage and electronic discharge (ESD) by its enclosure, which **must not** be removed in order to try locating errors. In the event of complaint or repair the PIB is to be returned complete in the enclosure.

When installing PIB in the robot cabinet, it should be mounted where adequate cooling is provided.

If the PIB is not to be installed into the robot cabinet, a cabinet of the corresponding enclosure class (IP54) and with a volume that gives proper cooling should be used.

The PIB is designed for operation in **max. 70oC** ambient temperature.

See the section *Environmental Data on page 55*.

## 7.11 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.

For proper function of the PIB the shield connection must be accurately done. See Figure 20. This mainly applies to the cables from the wire feed unit. If possible, they should be laid at some distance from each other.

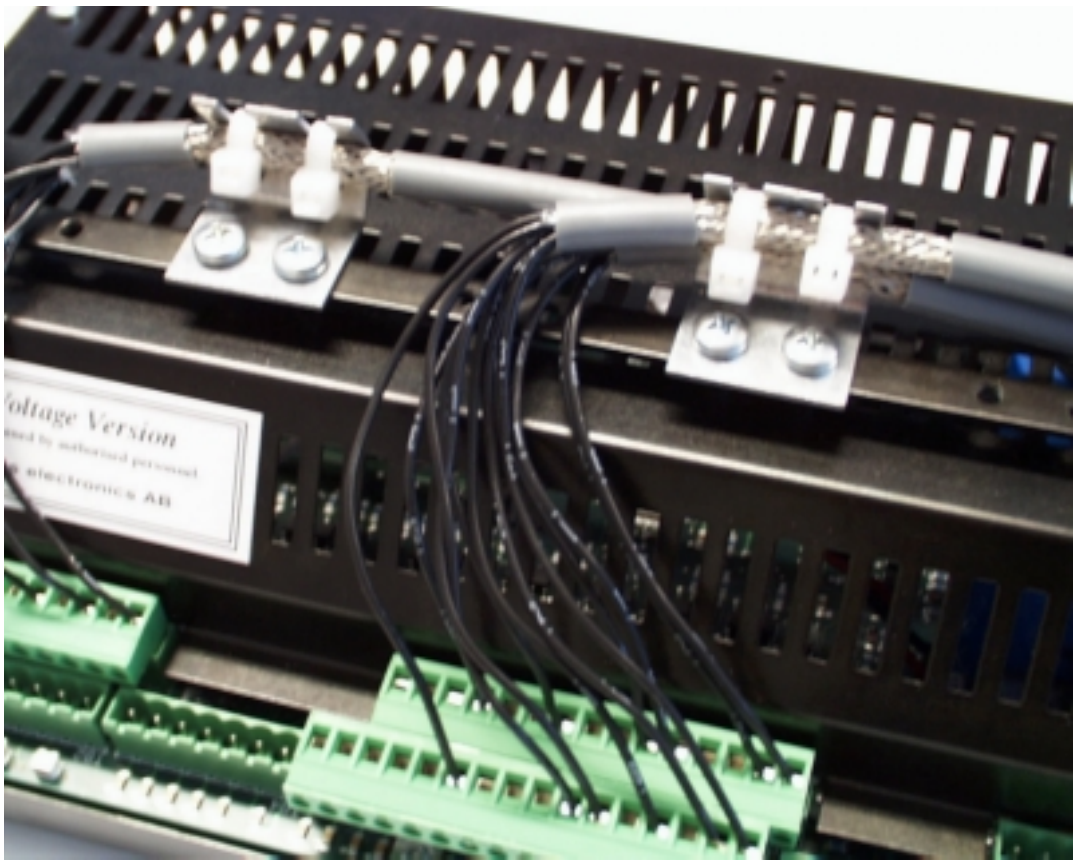


*Figure 20 Shielding.*

## 7.12 Safety

### 7.12.1 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 21 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.

### 7.12.2 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:
WeldingGun 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:
WeldingGun 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.

### 7.12.3 Machine Safety - Electronics

PIB is designed to be proof against short-circuiting of the outputs and overheating of the drive electronics for the motor regulator.

Also units connected to the PIB are protected by the fact that max. and min. data can be configuered, for example max. reference for the power source, max. speed or temperature of the wire feed unit connected.

As appears from the section *Diagnostics – Error Handling on page 40* an error message is displayed indicating the degree of action taken by the PIB - a message of warning only, or a stop message announcing stop of the ongoing process.

The stop message comes up when the error can lead to permanent damage, for example through overheating.

When an output is short-circuited it will be disconnected, and only a message of warning is displayed.

In both cases the function goes back to normal status when the temperature has gone down or the short-circuit has been eliminated and PIB restarted.

## 7.13 Signal Connections

See also Figure 17 on page 35 and Figure 21 on page 51.

TB stands for Terminal Block.

### 7.13.1 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<br>42V max. for PIB 501700-880<br>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 (see Figure 21 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 adressing |
| 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 spattercleaning |
| 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 7.17.2

### 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 | Tacho + | AC/DC | | x | DC- or AC-tacho |
| 7 | Tacho - | AC/DC | | 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 |

### 7.13.2 Elementary Diagram - Power Supply and Interlocking

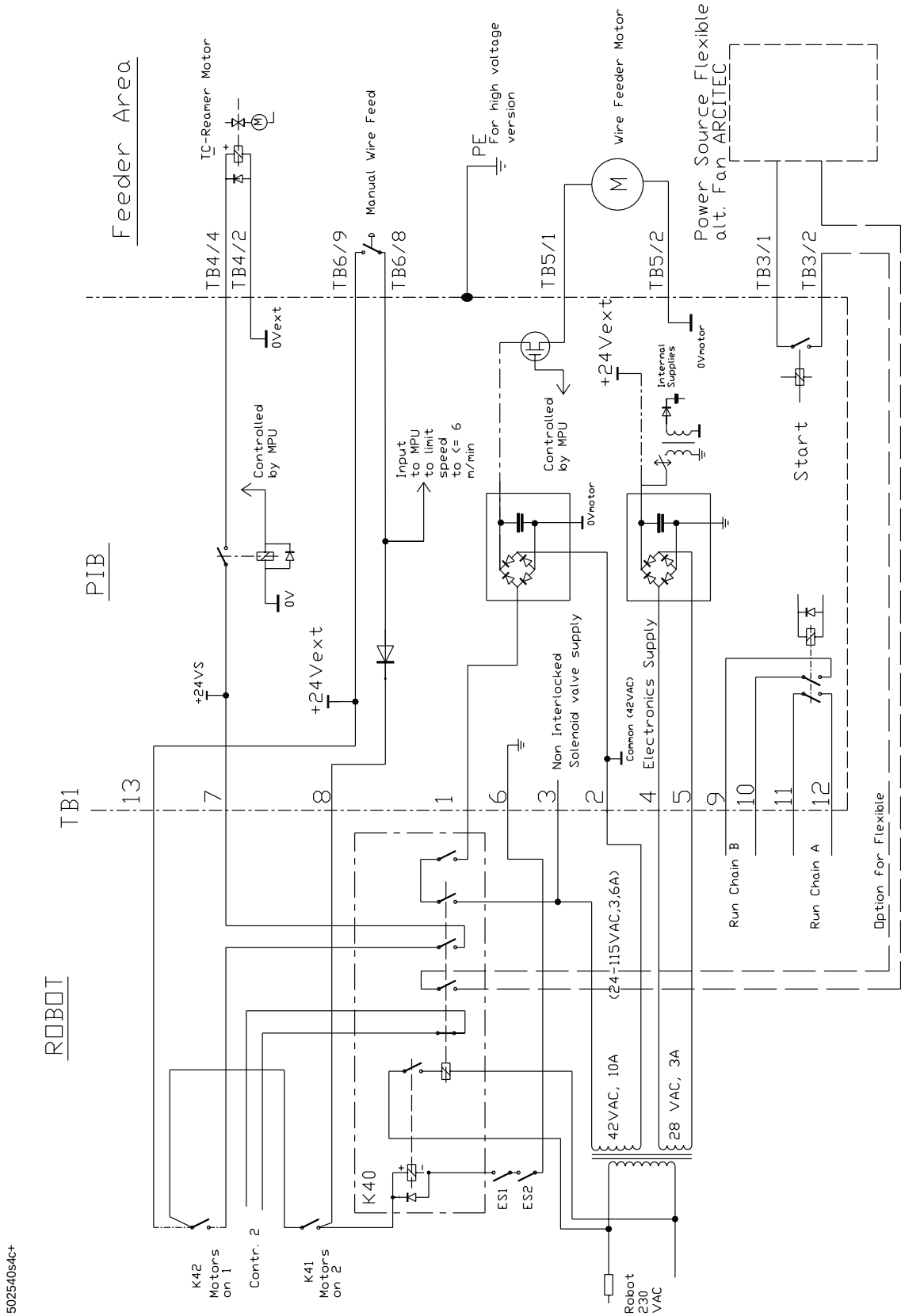



*Figure 21 Elementary Diagram, Power Supply, Safety and Interlocking.*

## 7.14 Configuration Parameters

The configuration parameters are to meet 3 requirements:

**1** The parameter value must be an integer in order to facilitate the handling in the PIB microprocessor.

**2** The value of the integer must be high enough to secure the desired accuracy and resolution.

**3** When programming from the robot actual quantities shall be used, for example 21.4 m/min for the wire feed speed, 32.2V for the welding voltage, etc. A multiplier of 10, 102 or more is required in many cases.

### 7.14.1 Conversion Factor for Feed Units with AC tacho

The conversion factor is derived from:

$k_0 = g \times n \times 100/(\pi \times D)$ [Hz/m/min], where

- $k_0$ is the conversion factor of tacho type 0
- g = Gear ratio factor
- n = Number of tacho periods/ motor turn
- D = The diameter of the feed rollers in metres
- 100 is the multiplier

If the calculation results in $k_0 > 65535$, the tacho type 2 is to be configuered as well as the conversion value $k2 = k_0/ 2$.

Max. permissible tacho frequency is 27000Hz, which reduces the max. feed speed to $Vmax = \pi \times D \times 60 \times 27000/ (g \times n)$, where Vmax (m/min) is the max. permissible wire feed speed of the wire feed unit in question.

### 7.14.2 Regulation Parameters

The regulation parameters are:
- the Feed Forward Factor
- the Motor Regulator P-factor
- the Motor Regulator I-factor.

These parameters are tried out for the standard wire feed units supplied and should not be adjusted. Modifications can lead to wrong speed and instability.

If adjustments are necessary this should be done in consultation with the supplier.

### 7.14.3 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.<br>For DC: 10000 Voltage in V for 1 motor speed quantity. | {0...65535}<br>AC (tacho type 0) : 0.01 Hz / motor speed quantity<br>AC fast (tacho type 2): 0.02 Hz / motor speed quantity<br>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}<br>0 (AC-tacho)<br>1 (DC-tacho)<br>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 Conversion | 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 | 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 | SensorDetectionSens | Defines the search voltage drop for detection of contact with workpiece | {0...255} 1/10 V |
| Sensor Search Voltage Valid Limit | SensorSearchVoltValid Lim | Defines the lowest allowed search voltage for start of search. | {0...100} V |
| System Definision | SystemDefinition | Defines the PIB system configuration | (0,1) 0 (Flexible) 1 (Arcitec) |
| Machine Identification code | 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 |

## 7.15 Technical Specification

### 7.15.1 Mechanical Data

**Dimensions**: 257x196x72.5 mm

**Weight**: 2.1 kg

**Enclosure class**: IP 20

### 7.15.2 Electrical Data

**Power supply:** See Figure 22 on page 56 - 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.

### 7.15.3 Environmental Data

Temperature data:

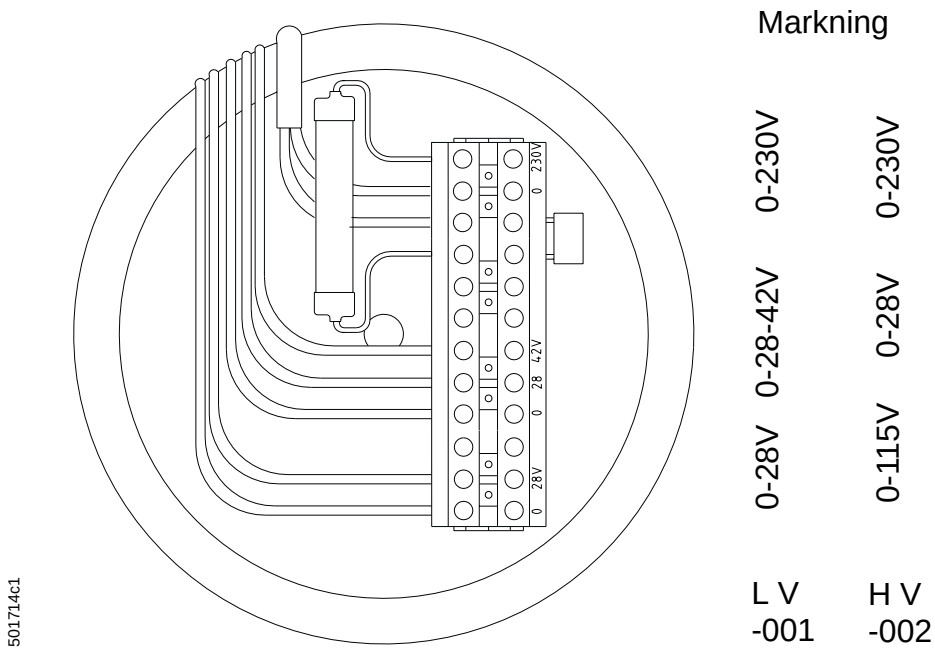
| Storage | Operation | According to |
|---|---|---|
| Cold 40° C, 16h | +5° C, 2 h | IEC 68-2-1 |
| Heat +70° C, 16 h | +70° C, 2 h | IEC 68-2-2 |
| Change – 40° C / +70° C, 2 cycles | | IEC 68-2-14 |

**EMC**: (Electro Magnetic Compatibility) According to standard EN 50199.

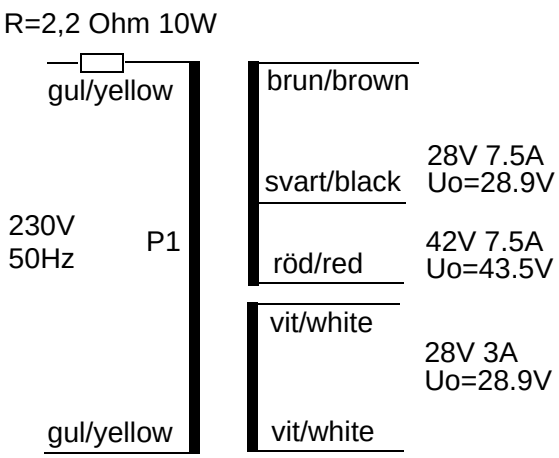
**LVD**: (Low Voltage Directive) According to LVD standard EN 60204.

## 7.16 Transformers

**Article No. 501 714-001/-002**




**Low Voltage**




**High Voltage**

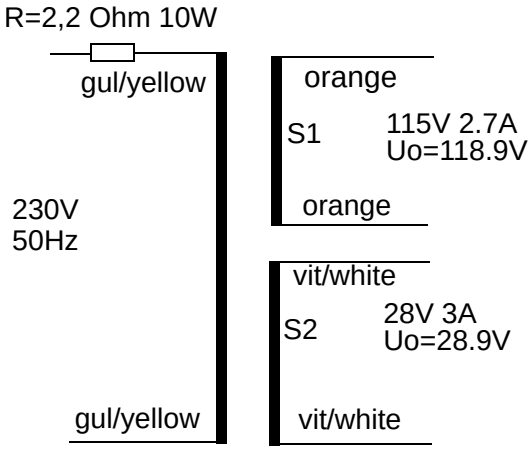



*Figure 22 Transformers.*

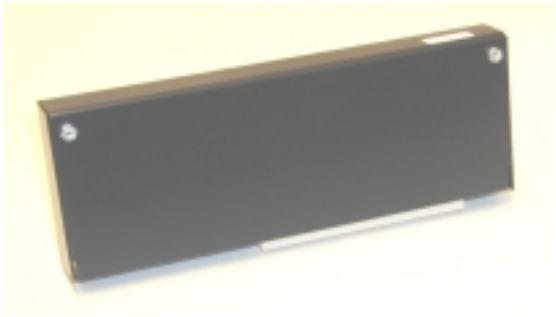
## 7.17 SmartacPIB

### 7.17.1 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).

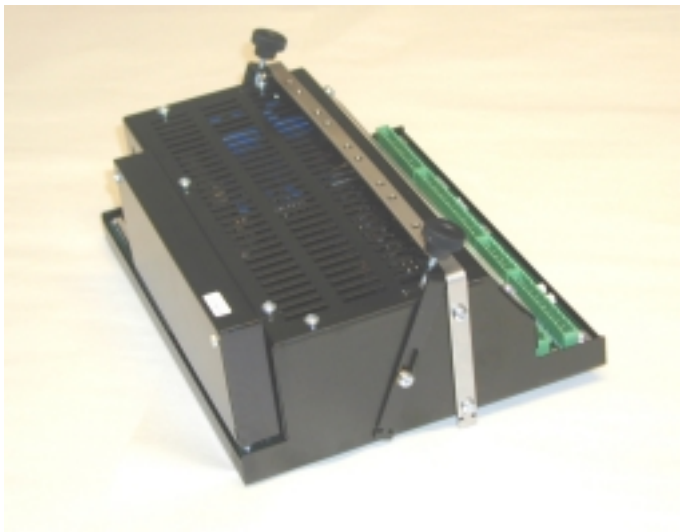
The unit has two sensor inputs, which can be activated one at a time or simultaneously.

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.



smartac

*Figure 23*



smartac-pib

*Figure 24*

The search properties of Smartac/PIB are determined by two of the 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.

### 7.17.2 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 divertion through the power source resulting in too low search voltage.

Searching with sensor 2 is only used for special applications.

### 7.17.3 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 – 100V in steps 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: 0-10V 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.

### 7.17.4 Delivery

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

- Smartac unit
- 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.

### 7.17.5 Technical Data

**Accuracy**: Max. deviation ± 0.25 mm at a search speed of 20 mm/sec.

**Marking**: See Figure 25.

**Mechanical Data**

Weight: 0.220 kg
Dimensions: 22x65x185 mm (see Figure 25)
Enclosure class: IP 20.

**Electrical Data:**

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

Environmental data: See point 6.16.3

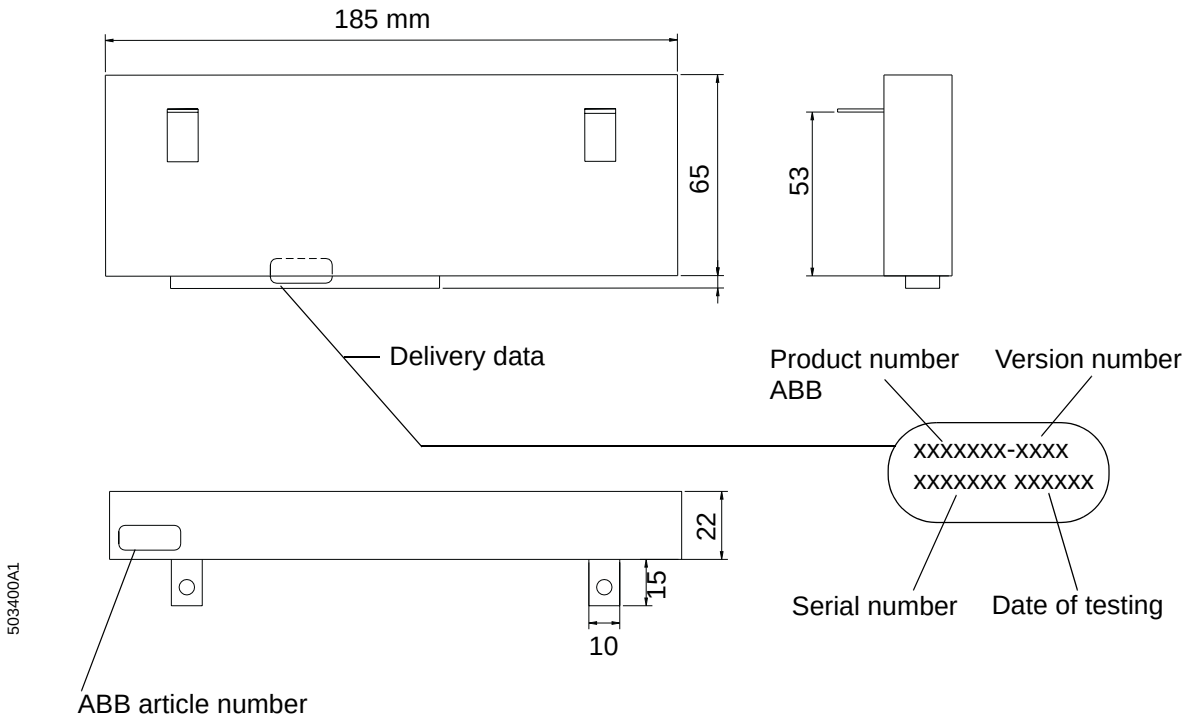

185 mm
65
53
Delivery data
Product number
ABB
Version number
xxxxxxx-xxxx
xxxxxxx xxxxxx
22
15
10
Serial number
Date of testing
ABB article number
503400A1

*Figure 25*

**504 106-502**
**2001-04-03**