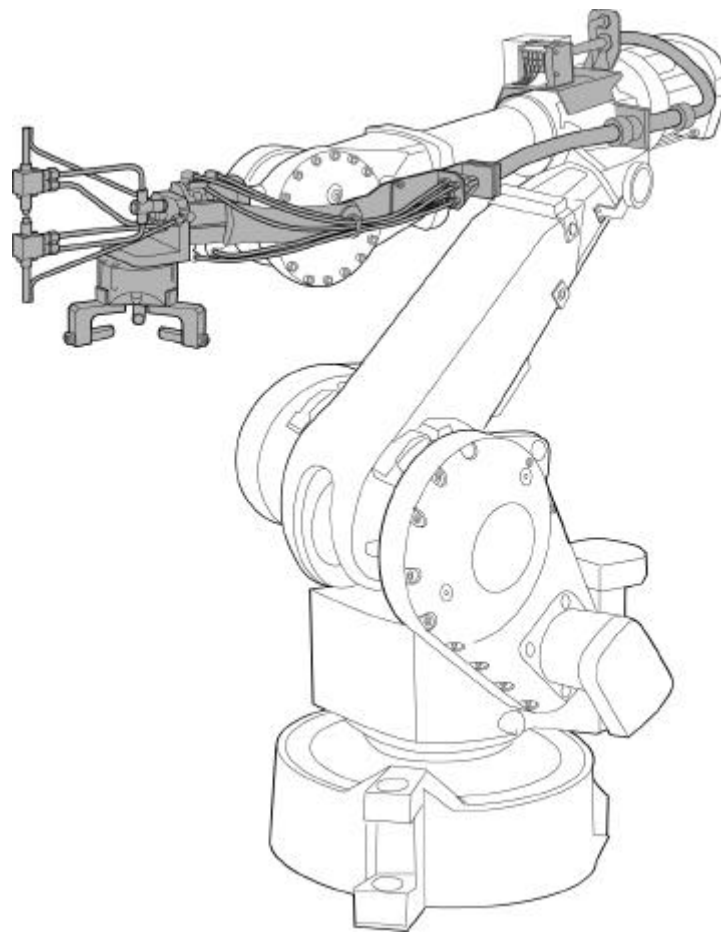


Product Specification

RobExtractSpray 2400/4400

3HXC 7111-1
December 1999



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1 General

RobExtractSpray 2400 and 4400 are robot tool systems built to extract casted products from die-casting machines and to spray the mould with oil in order to lubricate and cool it. The system provides the tool with compressed air and lubrication fluid without limiting the agility of the robot.

RobExtractSpray consists of:

- Valve unit
- Hose package with spring loaded hose
- Swivel
- 3 finger gripper
- Spraying nozzles

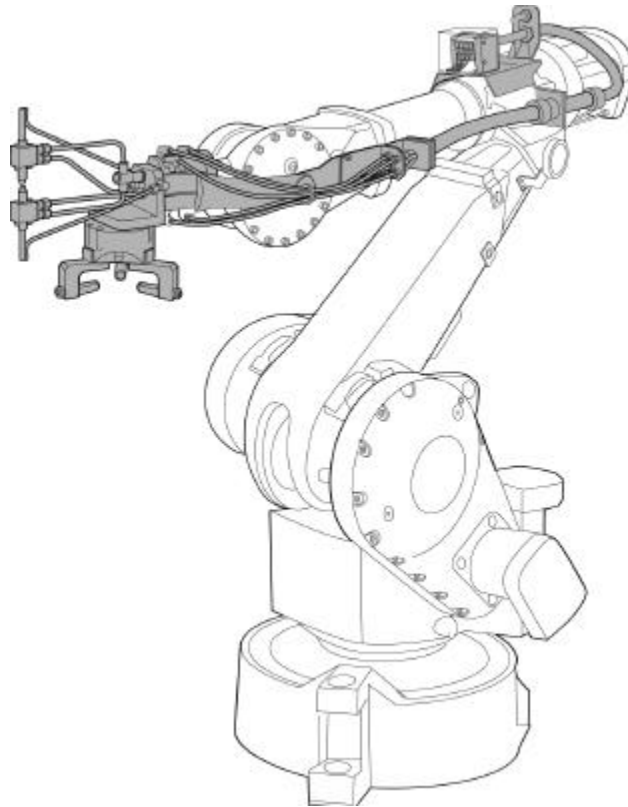


Figure 1 RobExtractSpray mounted on a IRB 4400.

RobExtractSpray tool system is developed for the IRB 2400, 2400L and 4400 robots. Due to the swivel and the spring-loaded hose, it requires a minimum amount of maintenance, these parts also guarantee to keep full agility for the robot. The 3-finger gripper gives a good grip on the biscuit, and it is adaptive to conical biscuits.

The robots are described in separate documentation.

Work cycle

1. After a die-casting operation the robot enters and removes the casted detail.
2. The robot sprays the mould and exits the machine.
3. The robot checks the casted detail so that the whole piece has been lifted out from the die-casting machine at the check station (not included) before next casting cycle can begin. Depending on the complexity in the spraying, it can be necessary that the robot exits the die-casting machine and leaves the detail before returning and proceeds with the spraying.

1.1 Die-casting machines

RobExtractSpray for IRB 2400 is suitable for the following die-casting machines:

Idra	OL-220, OL-320
Italpresse	IP-200, IP-300
Bühler	H-250, H-400

RobExtractSpray for IRB 4400 is suitable for the following die-casting machines:

Idra	OL-4200, OL-560, OL-700
Italpresse	IP-400, IP-550, IP-750
Bühler	H-630, H-800

The reach and the closing doors on the machine should be checked in every case. RobExtractSpray might be suitable for die-casting machines not listed here.

1.2 Robots

Both IRB2400 and IRB 4400 are industrial robots with six axis, developed for industrial manufacturing using flexible, robot based automation.

Robots equipped with RobExtractSpray need to be bought with option 041 from the robot specification form. Integrated hose and cabling for connecting external equipment on the manipulator to the rear end of the upper arm.

In the figure below the different movement patterns are shown and the numbering of the different axis.

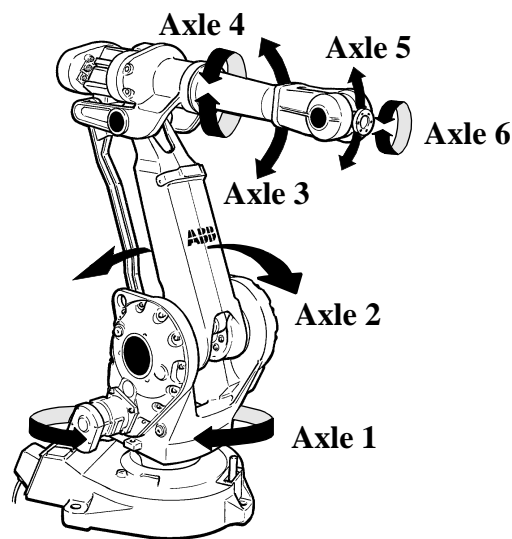


Figure 2 This figure shows the agility of the robot IRB 2400, and how they are numbered. The axis on IRB 4400 are numbered exactly the same and have the same agility.

2 Description

The figure below shows the tool system RobExtractSpray. The main parts of the tool system are:

- Swivel (1), chapter 2.1
- Spraying nozzles (2), chapter 2.2
- Gripper (3), chapter 2.3.
- Hose package with spring loaded hose (4), chapter 2.4.
- Valve unit (5), chapter 2.5
- Swivel dog (6), chapter 2.4

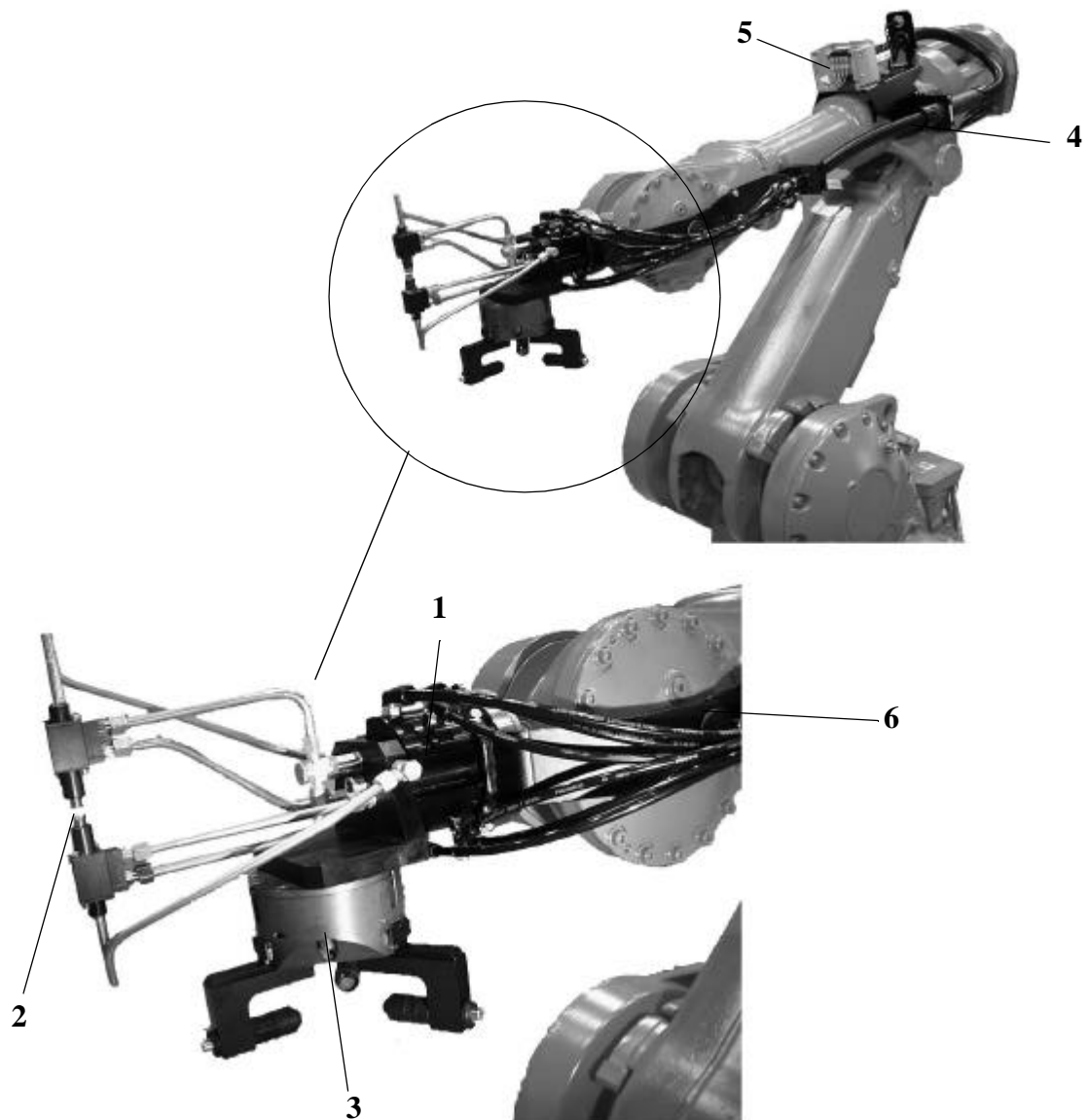


Figure 3 RobExtractSpray

2.1 Swivel

The Swivel consists of two parts: the swivel axle and the swivel housing. The swivel axle is made out of steel with a coating of nickel-phosphor alloy, the swivel housing is made out of black aluminated aluminum.

When the swivel is attached to the connecting flange (axis 6) the swivel can rotate in the same time as the swivel housing is kept still by the swivel dog. The media cables are attached to the swivel housing, this makes it possible to transfer media to the tool with the cables stationary. In principal, it is possible to rotate the tool an infinite number of turns without retaining the original position. This shortens the cycle times considerably.

The swivel has 6 channels that lead the media through the connections in the swivel housing further to the different channels in the swivel axle. The channels lead the media further to the top of the swivel axis, where it is connected to the tool. When the axis is rotating the channels in the axle are in contact with the groove in the swivel housing which makes the media transfer consistent.

Sealing rings separates the different grooves in the swivel housing. This consists of an O-ring and a slide ring. The sealing rings are attached to the swivel housing with the slide ring towards the axle. The O-ring is, somewhat, compressed some to create a constant pressure on the slide ring.

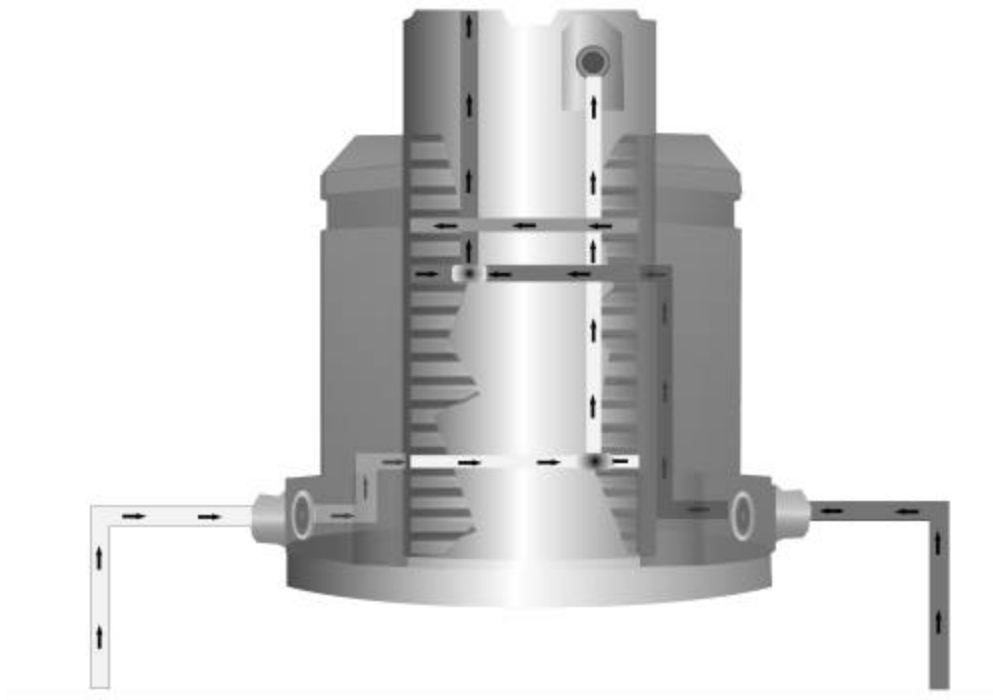


Figure 4 Swivel principle.

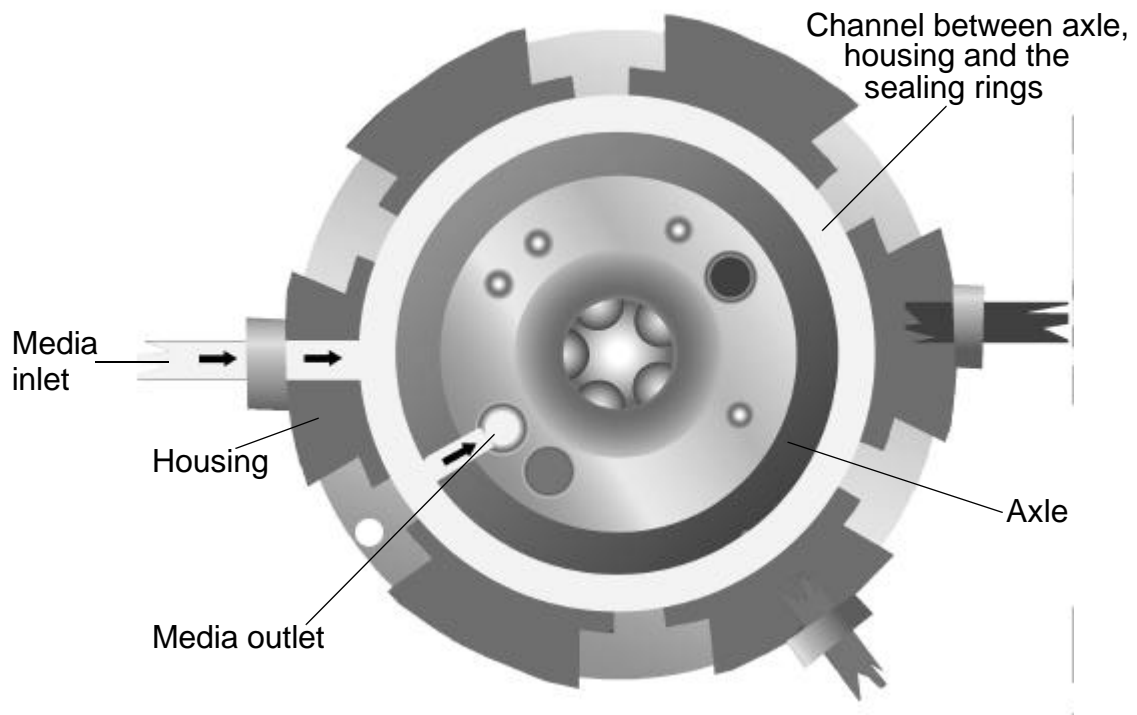


Figure 5 Cross-section of a swivel

2.2 Spraying nozzles

The spraying nozzles are used to spray the mould with lubricating fluid (oil). When the casted detail is lifted out from the mould the robot rotates axis 6 so that the spraying nozzles are held towards the mould when the lubrication fluid is sprayed. The robot can be programmed so that the whole mould is sprayed.

The lubrication fluid is transferred from the valve unit in separate pipes to the spraying nozzles where it is mixed with air. The spraying nozzles can be adjusted to adapt the amount of lubrication by turning the adjustment bolts, see Figure 6. The spraying nozzles can be used one at the time or both at the same time.

If more than 2 spraying nozzles are needed, they can be replaced by the customer or by a trained system integrator. These nozzles are not a standard option from ABB Flexible Automation.

The cleaning pipes are used to clean the mould by blowing compressed air in the mould before the lubricating fluid is sprayed. The valves maneuvers the cleaning pipes.

The swivel dog is used to hold the swivel housing in position.

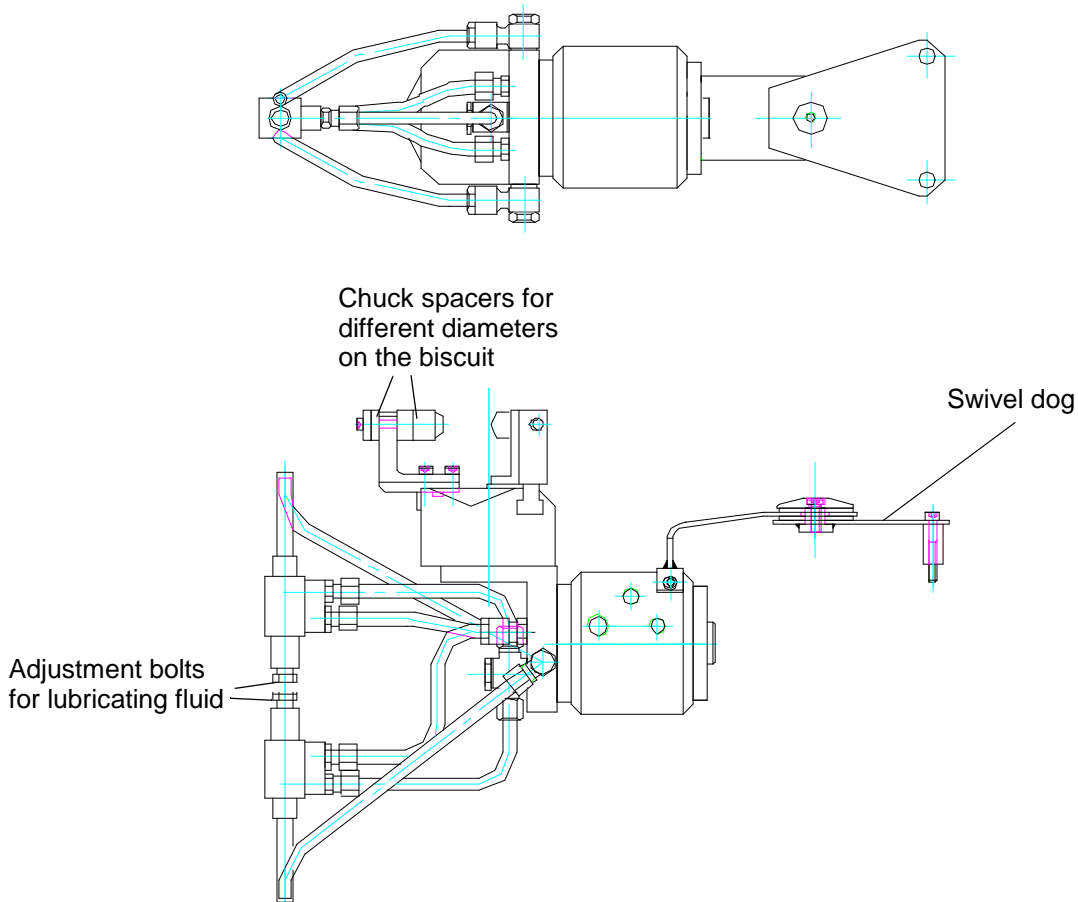


Figure 6 Gripper with spraying nozzles, cleaning pipes and swivel dog.

2.3 Gripper

The gripper is used to grip the casted product in the biscuit. The swivel and the gripper are attached with channels in the angled attachment, see Figure 7. This provides a hoseless transfer of compressed air to the gripper. The gripping pads on the grip fingers are grooved and fitted in a ball and socket joint in order to give maximum hold also to conical biscuits.

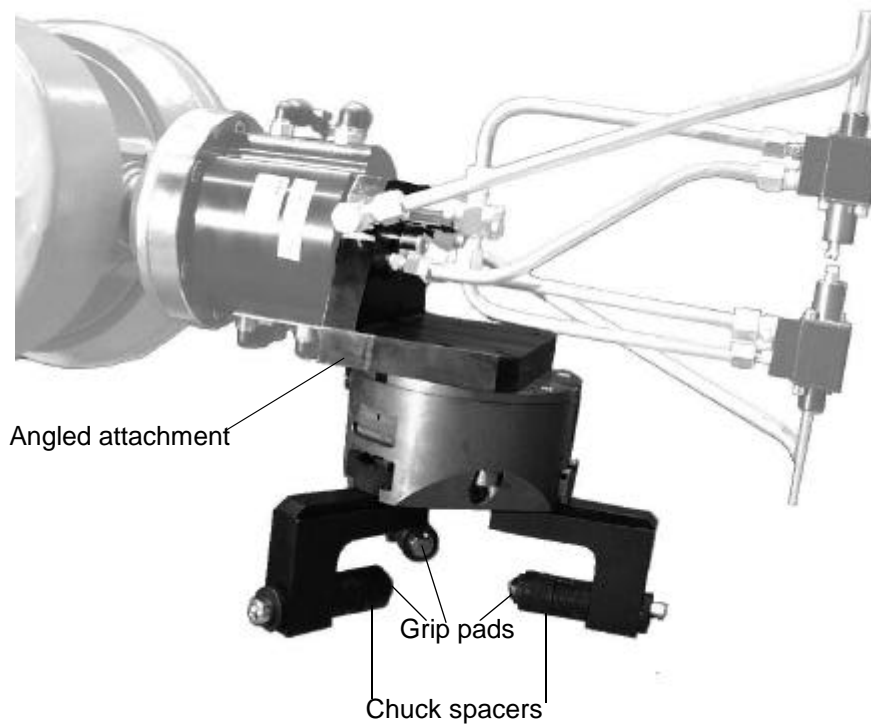


Figure 7 Gripper

The chuck spacers on the grip fingers can be moved in order to change the gripping diameter in the gripper (see Figure 8 and Figure 9).

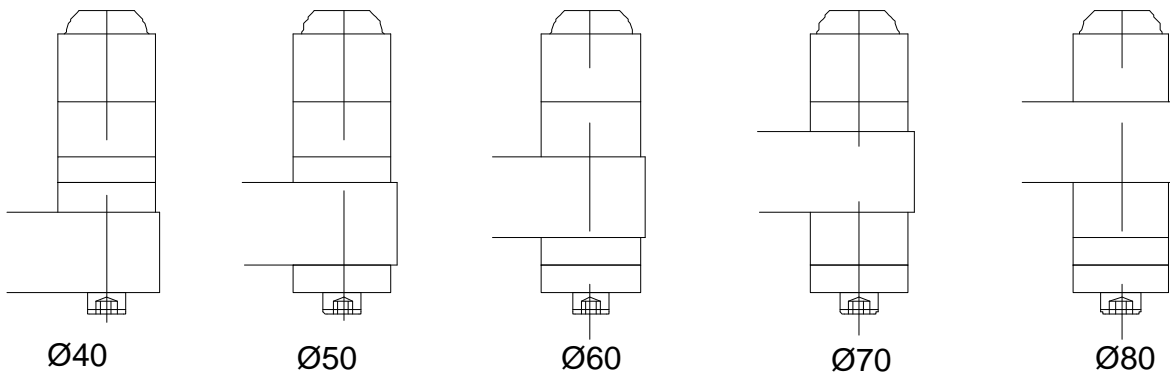


Figure 8 The spacers on the gripper can be moved in order to change the gripping diameter, the figure above shows the grip fingers on RobExtractSpray for IRB 2400.

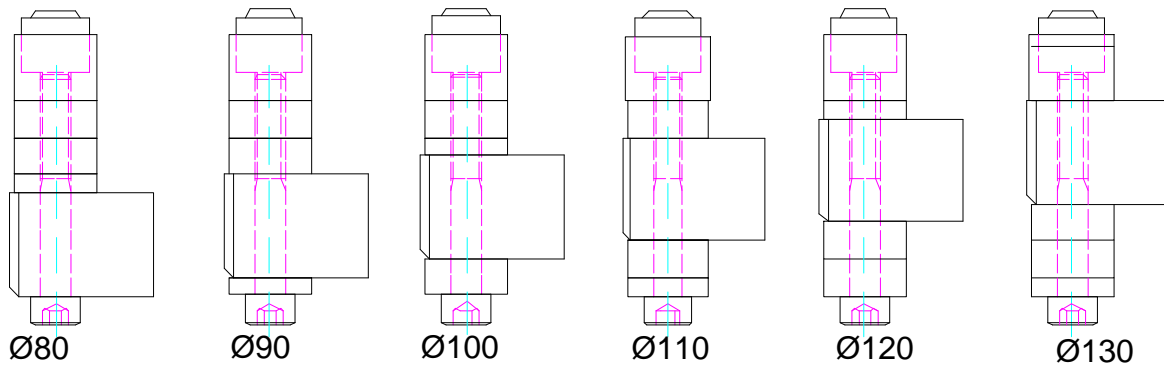


Figure 9 The spacers on the gripper can be moved in order to change the gripping diameter, the figure above shows the grip fingers on RobExtractSpray for IRB 2400

The grip fingers on the chuck opens a few millimetres (13 mm on the 4400, 8 mm on the 2400 (per grip finger)) when it is gripping the biscuit. The grip fingers are controlled by compressed air from valve 1 and 2 in the valve unit.

On the top of every grip finger there are grooved pads in ball and socket joints. This makes it possible for the gripper to take the biscuit without risk of slipping.

2.4 Hose package and spring-loaded hose

Between the valve unit (see chapter 2.5) and the swivel the hoses are lead in a protective hose (1). It is used as a protection for the compressed air hose and the hose for lubricating media, so that they do not rub against the robot arm when it is rotating. The hose package is lead backwards in a curve from the valve unit and thereafter to the attachment for the swivel dog (2). This allows the hose package to be elastic when the robot axis 4 rotates (see Figure 2). The spring in the spring loaded hose (3) pulls the hose back when axis 4 returns to the original position. This patent applied feature makes the hose package staying close the upper arm of the robot all the time.

The front part of the hose package are attached to the swivel dog, which in it's turn are anchored to the swivel housing. Since that the swivel housing do not rotate with axis 6, the hose package will only follow axis 5. All hoses are jointed at the attachment for the swivel dog (2), this facilitates changing the front part of the hose.

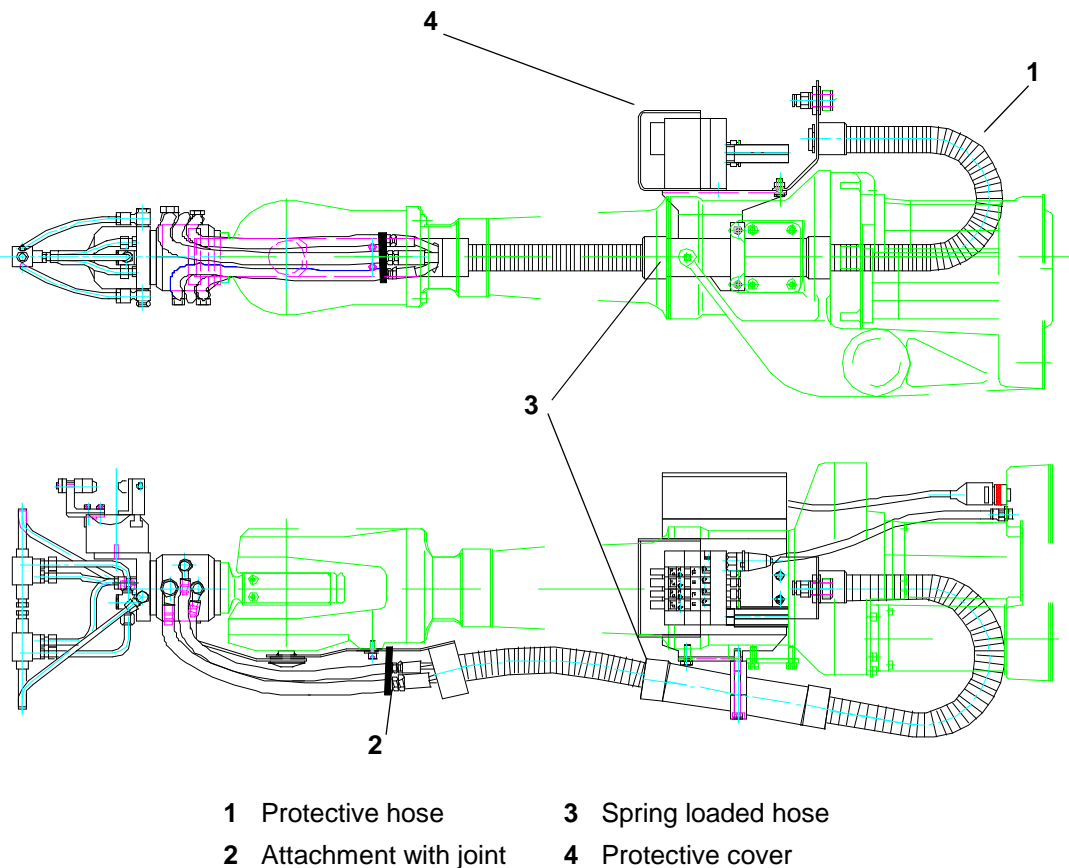


Figure 10 RobExtractSpray for IRB 2400 seen from the side (above) and seen from above (under)

2.5 Valve unit

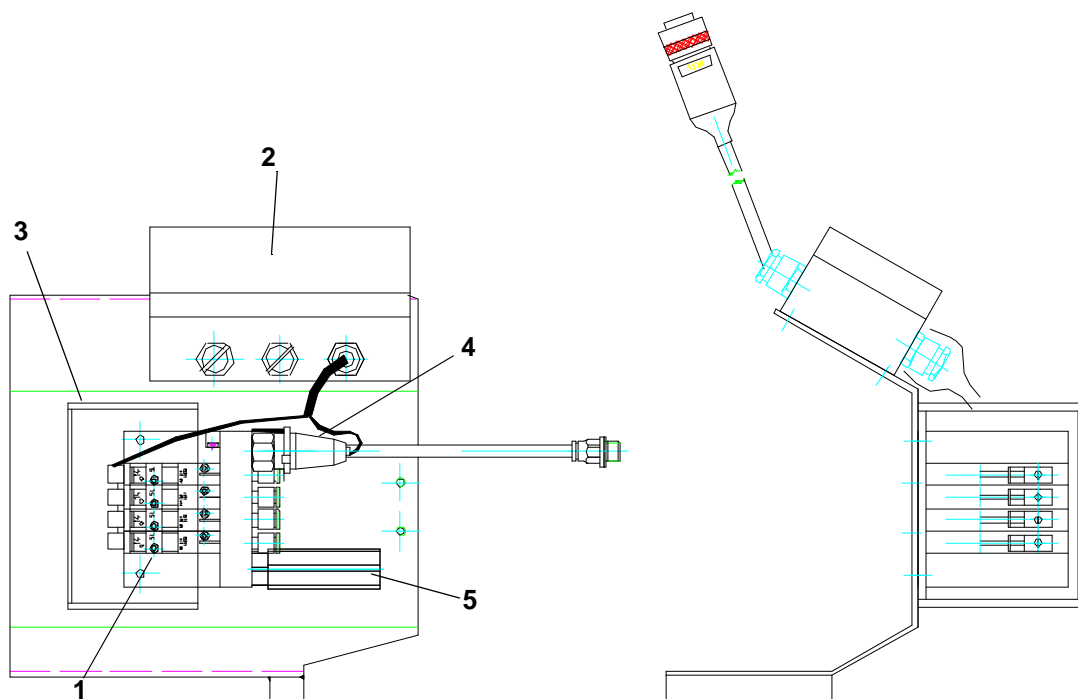
The valve unit, (1), is secured on the robot axis 4, by the valve unit the connection box (2) are mounted to which the signal cable are connected. The valve unit are controlling the compressed air to the tool with signals from the robot controller.

The valve unit is a compact unit with pneumatic multipole connection that consists of four individual controlled Compact Performance-valves.

The unit is protected from splash from the spraying nozzles by a semi-open plastic cover (3).

The control signals are sent from the robot controller to the connection box where they are directed to the valve unit. In the valve unit there are four different valves that controls different parts of the tool. Valve 1 and 2 controls the grip function, valve 4 controls the spraying nozzles and valve 3 controls the cleaning pipes.

A pressure switch (4) and a silencer (5) are also parts of the valve unit.



- | | |
|-------------------|-------------------|
| 1 Valve unit | 4 Pressure switch |
| 2 Connection unit | 5 Silencer |
| 3 Plastic cover | |

Figure 11 Valve unit for RobExtractSpray

2.6 Connections

The compressed air and the signals are connected to the robot base and then connected to the valve unit by the customer connections (2 and 3). The lubrication fluid is not connected to the valve unit, it is connected to the connection by the hose package (1). The connecting hose with lubricating fluid shall be lead from above, e.g. from the die-casting machine or from a media supply mast. The hose should be of flexible spiral type, in order to make it better in following the robot movements.

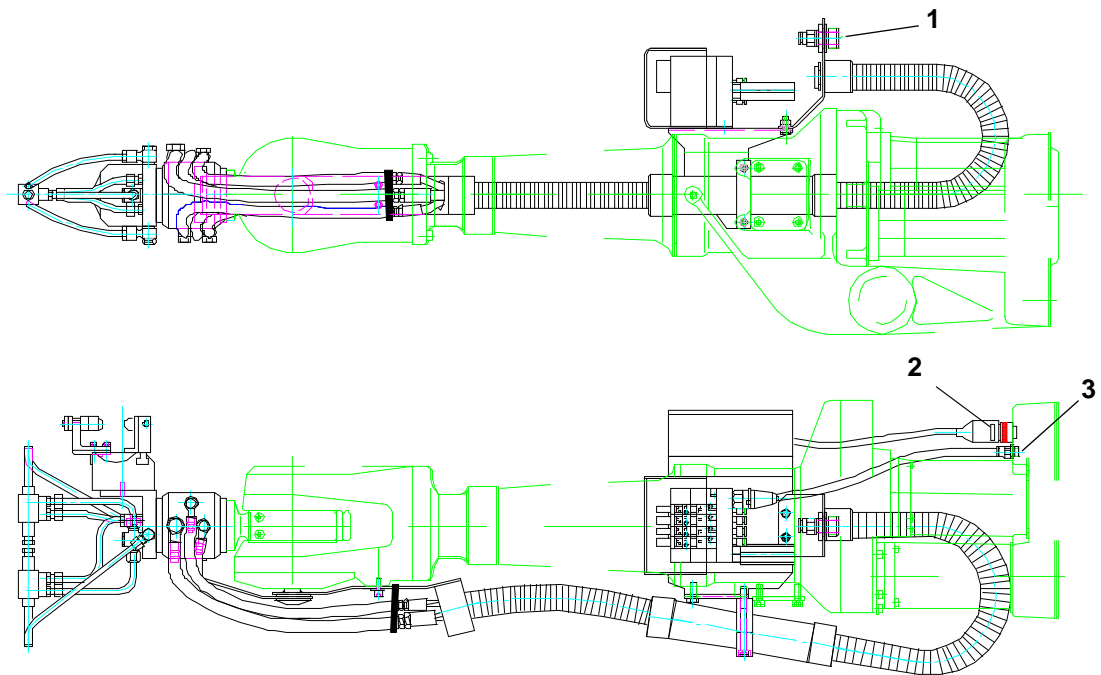


Figure 12 Connecting signals and compressed air to RobExtractSpray

3 Technical specifications

3.1 RobExtractSpray for IRB 2400 and 2400L

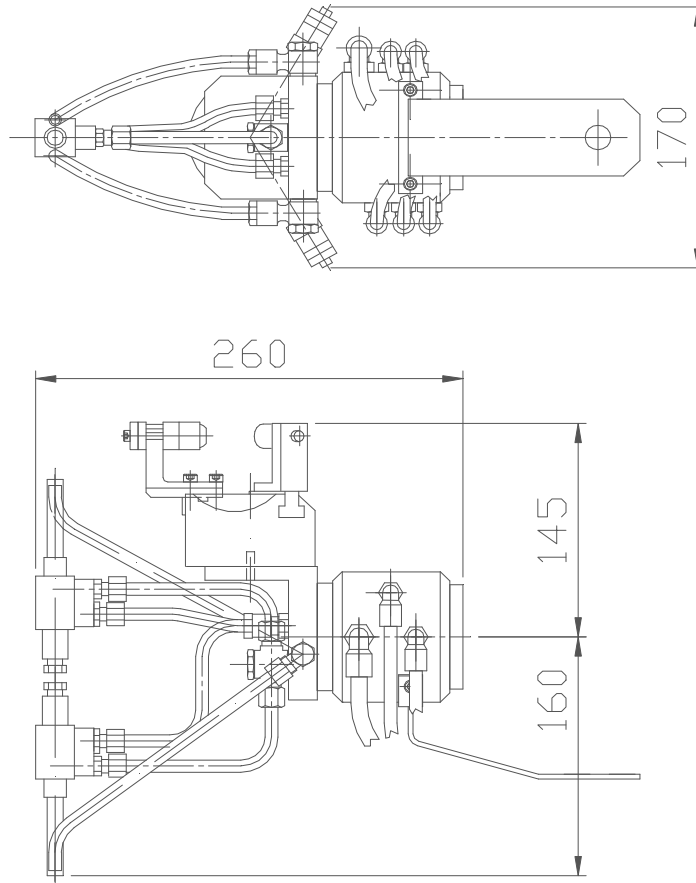


Figure 13 RobExtractSpray for IRB 2400 and 2400L

Length	260 mm
Height	170 mm
Width	305 mm
Weight	5.2 kg

Measurements adapter plate on 2400

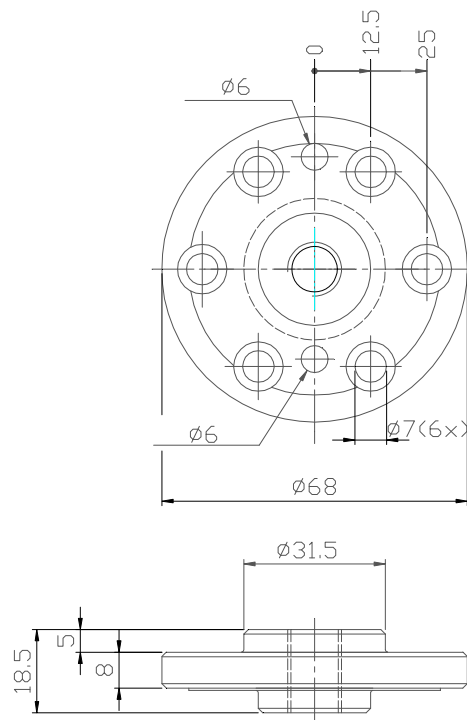


Figure 14 Adapter plate on 2400

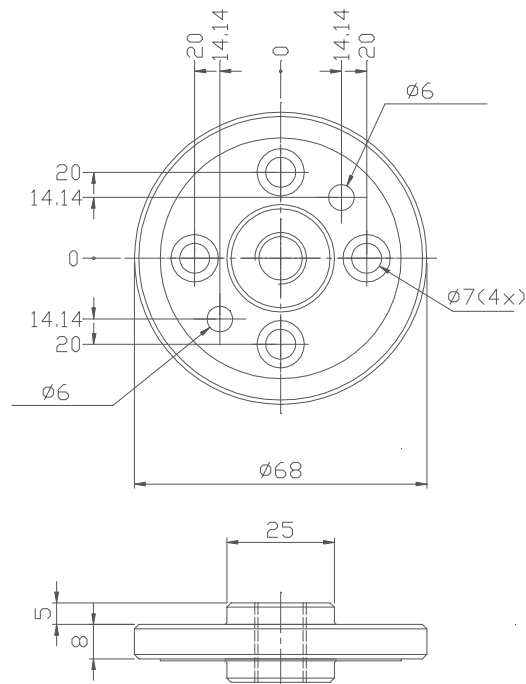


Figure 15 Adapter plate on 2400L

3.2 RobExtractSpray for IRB 4400

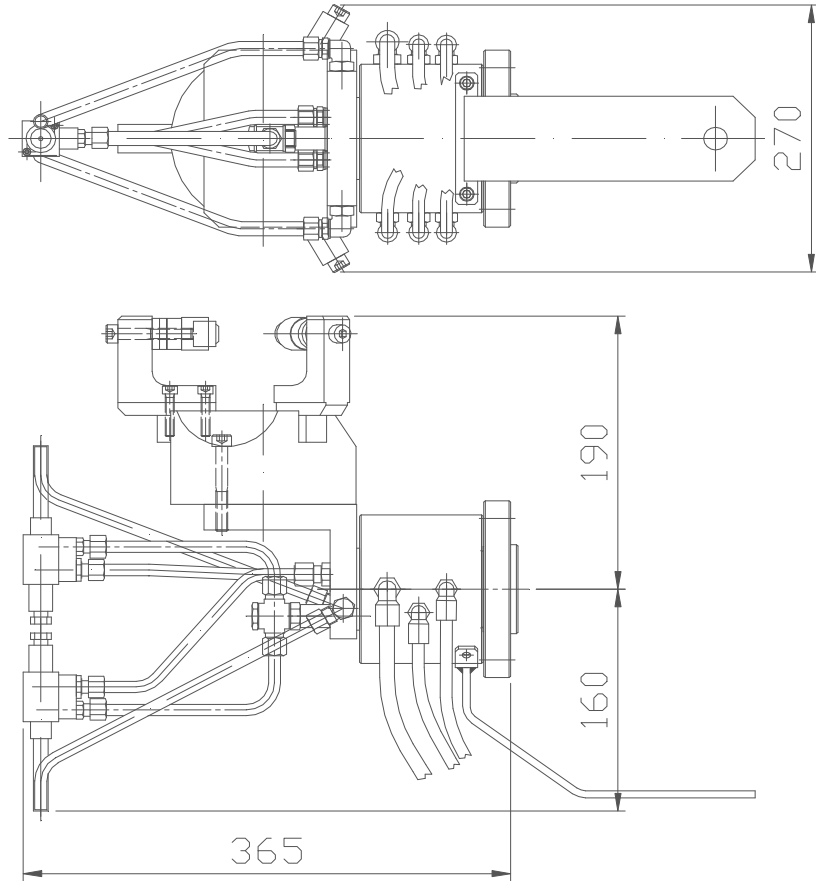
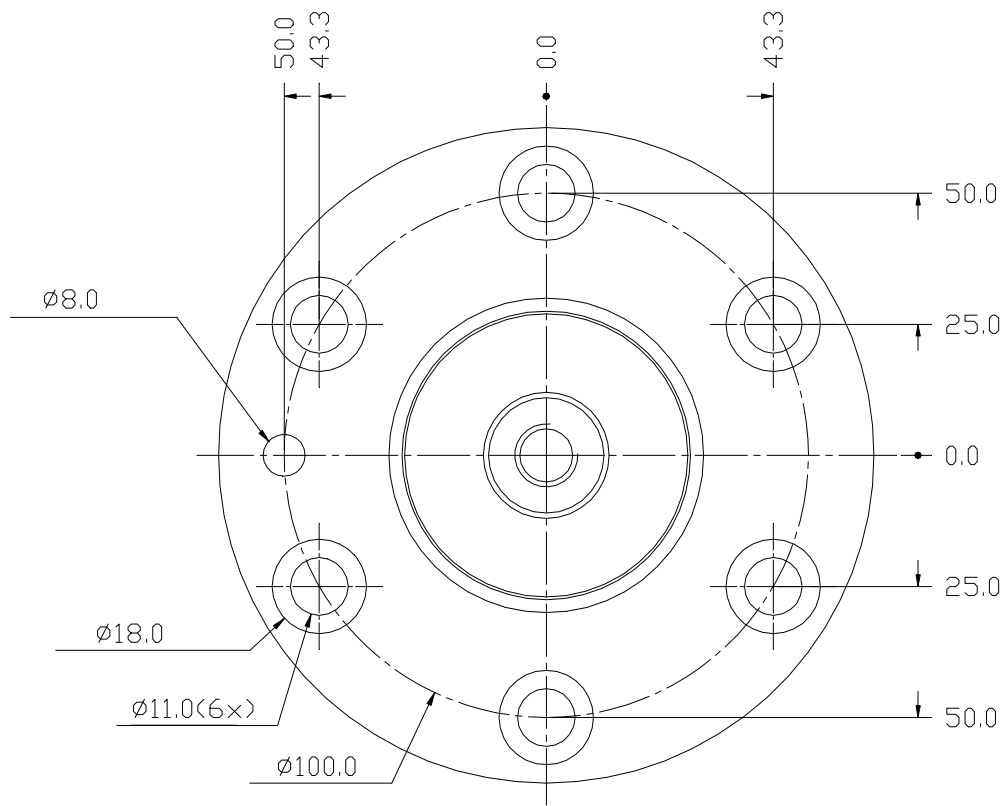


Figure 16 RobExtractSpray for IRB 4400

Length	470 mm
Height	270 mm
Width	335 mm
Weight	12.1 kg

Attachment on 4400



3.3 Valve unit

Valves

Valve type:	Festo CPV-14-V1
Number of valves:	4
Solenoid:	24 V DC, 0.75W
Type:	Monostabile
Flow rate:	800 l/min.
Protection class:	IP 65
Pressure limitation:	1-10 bar

Connection box

No. of insert connection block:	23
Dimensions (l x w x h):	160 x 80 x 57mm
Protection class:	IP 54

Connection to the robot application interface

Connection to upper arm cabling R2.CS with Burndy connectors.

3.4 Hose and cabling

Compressed air hose

Cross section area, duct: 23.7 mm²

Lubrication fluid hose

Cross section area, duct: 38 mm²

Protective hose

Outer diameter: 345 mm

Signal cable

Cross section area: 12 x 2 x 0.25mm²
Connector: Burndy

3.5 Media

Compressed air

Air quality: Oil- and waterfree filtered air, max 25µm

Air pressure: 6 bar

Lubrication

Lubrication pressure: 6 bar

Flow rate

Swivel: 16 l/min at 3.6 bar

Spraying nozzles: 70cm³/sec at 6 bar

3.6 Grip unit

Swivel

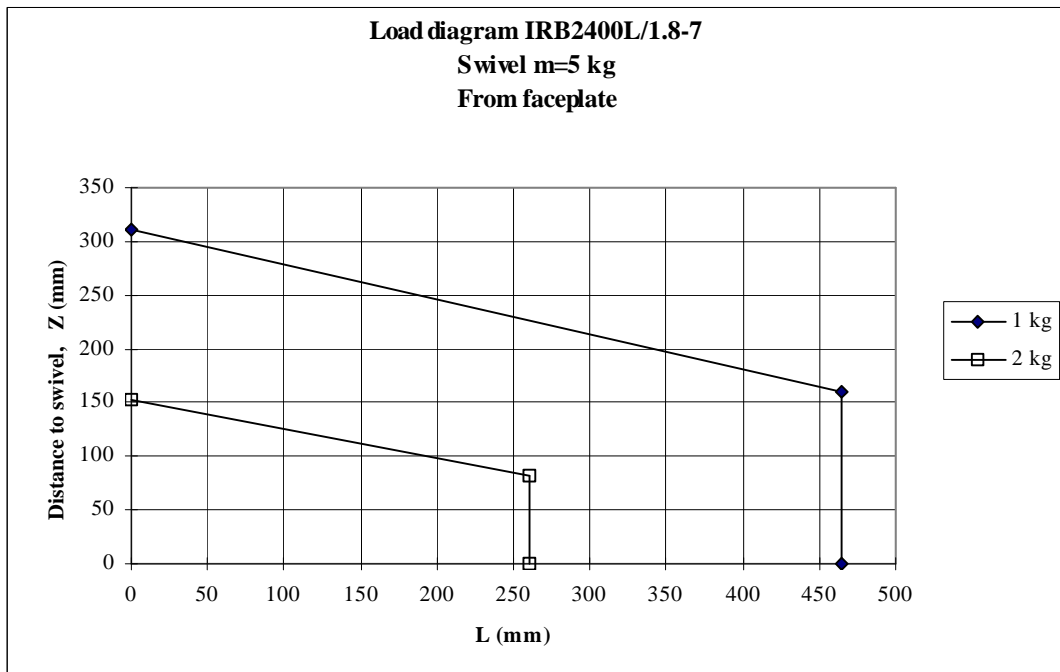
Number of channels:	6
Swivel axle:	Steel with a coating of nickel-phosphor alloy
Swivel housing:	Black aluminated aluminium

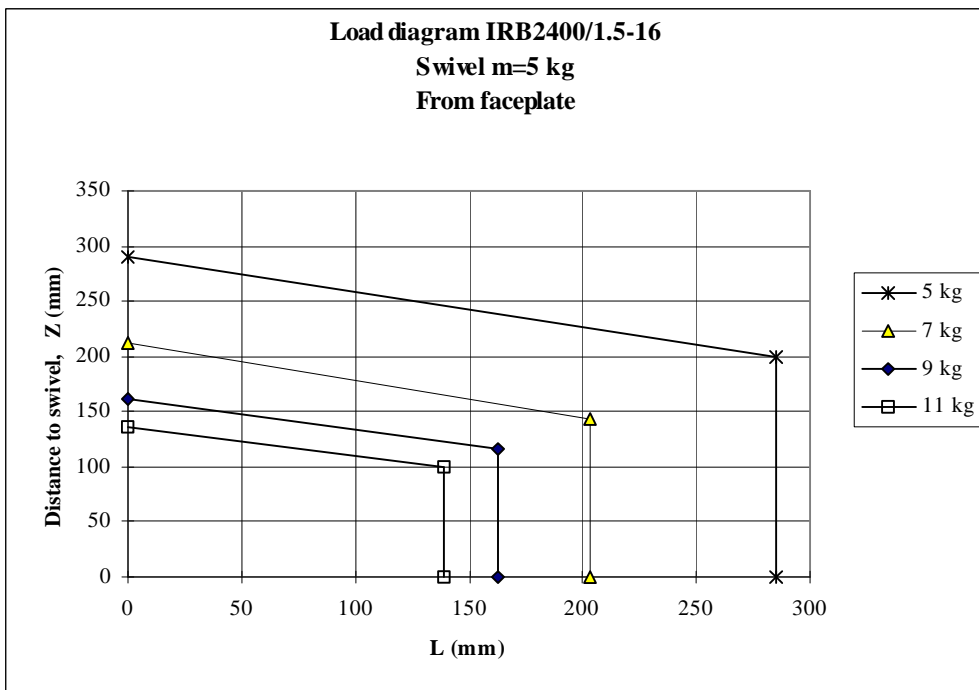
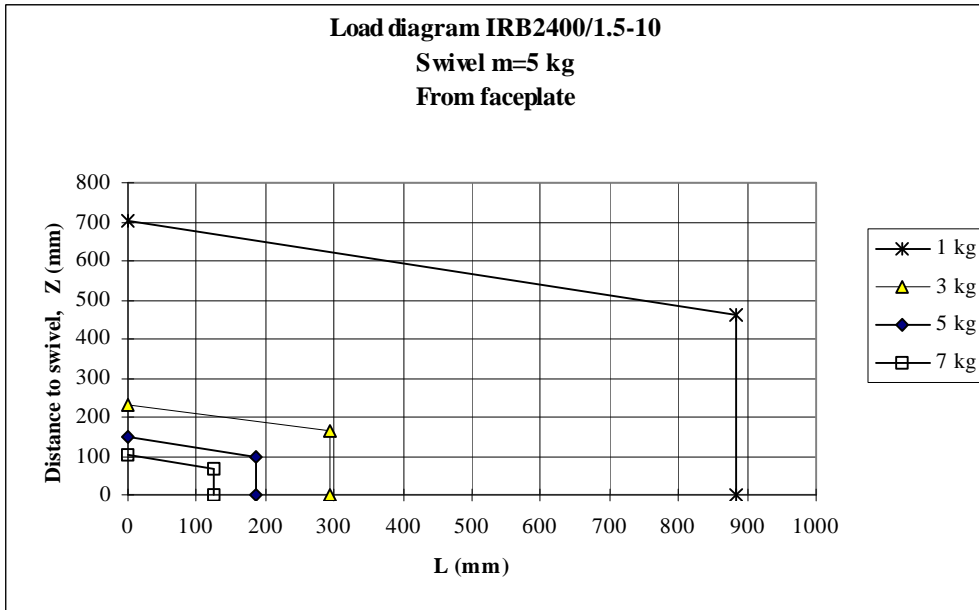
Gripper

For IRB 2400:	Schunk PZN 80-1/S
For IRB 4400:	Schunk PZN 125-1/S

3.7 Handling capacity

The gripper Schunk PZN 80-1/S, used on RobExtractSpray for IRB 2400, can handle products of a weight up to 5.3 kg. For more detailed information about how much the robot IRB 2400 can handle, see load diagrams below. The gripper Schunk PZN 125-1/S, used on RobExtractSpray for IRB 4400, can handle products of a weight up to 15.5 kg. This sets the limit for RobExtractSpray on IRB 4400.





4 Variants

4.1 RobExtractSpray for IRB 2400

3HXC 0000-44

Valve unit, spring loaded hose, swivel and grip unit with spraying nozzles.

4.2 RobExtractSpray for IRB 2400L

3HXC 0000-89

Valve unit, spring loaded hose, swivel and grip unit with spraying nozzles.

4.3 RobExtractSpray for IRB 4400

3HXC 0000-92

Valve unit, spring loaded hose, swivel and grip unit with spraying nozzles.

