

## Product manual

### FlexGripper-Claw

IRB 660/460





Product manual  
FlexGripper-Claw

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Revision: -

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## Overview

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### About this manual

This manual provides instructions for the FlexGripper-Claw. Each chapter concerning the FlexGripper-Claw contains information on:

- mechanical structure & working principle
- mechanical /electrical installation
- maintenance
- repair
- trouble shooting
- spare parts

Read through this document carefully, especially the sections about safety, before you start to unpack, install and use the FlexGripper-Claw.

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### Usage

This manual should be used during:

- installation
- operation
- maintenance work
- repair work

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### Who Should Read This Manual?

This manual is intended for:

- operators
- installation personnel
- repair and maintenance personnel

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### Prerequisites

The reader should be:

- familiar with industrial robots and the relevant terminology
- familiar with the equipment
- skilled in mechanical & electrical installation/maintenance/repairs

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### Organization of Chapter

The manual is organized in to the following chapters:

Chapter	Contents
1.	Safety
2.	FlexGripper-Claw
3.	FlexGripper UI

*Continues on next page*

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Overview

*Continued*

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## Reference

Reference	Document ID
Product manual - IRB 660	3HAC025755-001
Product manual - IRB 460	3HAC039611-001
Product manual - IRC5 Robot Controller	3HAC021313-001

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## Revision

Revision	Description
-	First edition



# 1 Safety

## 1.1. Introduction

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### Overview

The safety information in this manual is divided into two categories:

- General safety aspects, important to attend to before performing any service work on the FlexGripper. These are applicable for all service work and are found in *General safety information on page 8*.
- Specific safety information, pointed out in the procedure when the danger is imminent. How to avoid and eliminate the danger is either detailed directly in the procedure, or further detailed in separate instructions, found in *Safety related instructions on page 17*.



### NOTE!

This manual includes only the safety information related to this product.

The FlexGripper can be used together with IRB660 or IRB460. Please refer the Robot and IRC5 Controller manuals for more details on safety.

# 1 Safety

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## 1.2.1. Safety in the manipulator system

## 1.2 General safety information

### 1.2.1. Safety in the manipulator system

---

#### Validity and responsibility

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

The users of ABB products are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed, and that the safety devices necessary to protect people working with the system are designed and installed correctly.

Personnel working with manipulators must be familiar with the operation and handling of the industrial manipulator, as described in the following documents:

- Operating Manual - IRC5 with FlexPendant (M2004)
- Product Manual

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#### Connection of external safety devices

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

---

#### Limitation of liability

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

---

#### Related information

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

## 1.2.2. Safety risks

### 1.2.2.1. Safety risks during installation and service work on the FlexGripper

---

#### Overview

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

---

#### General risks during installation and service

- The instructions in the Product manual in the section *Installation and Commissioning on page 26* must always be followed.
- Emergency stop buttons must be positioned in easily accessible places so that the manipulator can be stopped quickly.
- Those in charge of operations must make sure that safety instructions are available for the installation in question.
- Those who install the FlexGripper must have the appropriate training for the manipulator system in question and in any safety matters associated with it.

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#### Nation/region specific regulations

To prevent injuries and damage during the installation of the manipulator system, the regulations applicable in the country concerned and the instructions of ABB manipulatorics must be complied with.

## 1 Safety

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### 1.2.2.2. Safety risks related to tools/workpieces

#### 1.2.2.2. Safety risks related to tools/workpieces

---

##### Safe handling

It must be possible to safely turn off tools, such as milling cutters. Make sure that guards remain closed until the cutters stop rotating. It should be possible to release parts manually (valves).

##### Safe design

FlexGrippers are designed so that they retain workpieces in the event of a power failure or a disturbance to the controller.

#### 1.2.2.3. Safety risks related to high speed



##### **WARNING!**

Particular care must be taken with the FlexGripper-Claw.

Risk of gripped workpiece uncontrolled gravity drop during high speed movement.

# 1 Safety

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## 1.2.2.4. Safety risks during operational disturbances

### 1.2.2.4. Safety risks during operational disturbances

---

#### General

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

---

#### Qualified personnel

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

---

#### Extraordinary risks

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

### 1.2.2.5. Risks associated with live electric parts

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**Voltage related risks, general**

- Although trouble shooting may, on occasion, have to be carried out while the power supply is turned on, the manipulator must be turned off (by setting the main switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The main supply to the manipulator must be connected in such a way that it can be turned off outside the manipulator's working space.

---

**Voltage related risks, controller IRC5**

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

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

---

**Voltage related risks, manipulator**

A danger of high voltage is associated with the manipulator in:

- The power supply for the motors (up to 800 VDC)
- The user connections for tools or other parts of the installation (max. 230 VAC, see chapter Installation and commissioning in the Product manual).

---

**Voltage related risks, tools, material handling devices and so on**

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

# 1 Safety

---

## 1.2.3.1. Safety fence dimensions

### 1.2.3. Safety actions

#### 1.2.3.1. Safety fence dimensions

---

##### General

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

---

##### Dimensioning

Dimension the fence or enclosure to enable it to withstand the force created if the load being handled by the FlexGripper is dropped or released at maximum speed.



#### 1.2.3.2. Fire extinguishing



**NOTE!**

Use a CARBON DIOXIDE (CO<sub>2</sub>) extinguisher in the event of a fire in the manipulator system (manipulator or controller)!

### 1.2.3.3. Safe use of the FlexPendant



#### NOTE!

The enabling device is a push-button located on the side of the FlexPendant which, when pressed half way in, takes the system to MOTORS ON. When the enabling device is released or pushed all the way in, the manipulator is taken to the MOTORS OFF state.

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

- The enabling device must never be rendered inoperative in any way. During programming and testing, the enabling device must be released as soon as there is no need for the manipulator to move. The programmer must always bring the FlexPendant with them, when entering the manipulator's working space. This is to prevent anyone else taking control of the manipulator without the programmer being aware of it.

---

#### Enabling device

The enabling device is a manually operated constant pressure push-button which, when continuously activated in one position only, allows potentially hazardous functions but does not initiate them. In any other position, hazardous functions are stopped safely. The enabling device is of a specific type where you must press the push-button only half-way to activate it. In the fully in and fully out positions, manipulator operation is impossible.

---

#### Hold-to-run function

The hold-to-run function allows movement when a button connected to the function is actuated manually, and immediately stops any movement when released. The hold-to-run function can only be used in manual mode. How to operate the hold-to-run function is detailed in the Operating manual - IRC5 with FlexPendant.

## 1.3 Safety related instructions

### 1.3.1. Safety signals, general




#### General

This section specifies all the dangers that may arise from performing the work detailed in the manual. Each danger is detailed in its own section consisting of:

- A caption specifying the danger level (DANGER, WARNING or CAUTION) and the type of danger.
- A brief description of what will happen if the operator/service personnel do not eliminate the danger.
- An instruction of how to eliminate the danger to facilitate performing the activity at hand.

#### Danger levels

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





Symbol	Designation	Signification
	DANGER	Warns that an accident will occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, and so on
 en1011002	WARNING	Warns that an accident may occur if the instructions are not followed, that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height and so on.
 en1011003	ELECTRIC SHOCK	The electrocution or electrical shock symbol indicates electrical hazards which could result in severe personal injury or death.

*Continues on next page*

# 1 Safety

## 1.3.1. Safety signals, general

*Continued*

Symbol	Designation	Signification
 en1011004	CAUTION	Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, and so on Furthermore, it applies to warnings that include function requirements when fitting and removing equipment, where there is a risk of damaging the product or causing a breakdown.
 en1011005	ELECTROSTATIC DIS-CHARGE(ESD)	The electrostatic discharge (ESD) symbol indicates electrostatic hazards which could result in severe damage to the product.
 en1011006	NOTE	Note symbols alert you to important facts and conditions.
 en1011008	TIP	Tip symbols direct you to specific instructions, where to find additional information or how to perform a certain operation in an easier way.

### 1.3.2. Safety symbols on the FlexGripper labels

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#### Introduction to labels

This section describes safety symbols used on labels (stickers) on the FlexGripper. Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.


---

#### Types of labels

Both the manipulator and the FlexGripper are marked with several safety and information labels, containing important information about the product. The information is useful for all personnel handling the FlexGripper system, for example during installation, service, or operation. The safety labels are language independent, they only use graphics.

---

#### Symbols on safety labels

Symbol	Description
	Heat Risk of heat that can cause burns.

### 1.3.3. Safety guidelines

---

#### Safety guidelines while working with FlexGripper

- See the IRB 660 or IRB 460 Product manual for information on safety.
- All persons working in the system must be sufficiently trained. Incorrect installation and/or use can cause injuries to persons and/or damage to equipment.
- Damaged or broken equipment can result in a risk to safety.
- Do not continue to work with the FlexGripper if you find any fault in any parts of it.
- Do not over power the pneumatic devices.
- Use pressure relief valves.
- Repair any air leaks immediately.
- Wear safety glasses when working with pneumatic cylinders. Maintenance, assembling, adjustments and other works on the FlexGripper, such as: replacement of pneumatic cylinders , should only be implemented by skilled and qualified workers, when the FlexGripper is not under air-pressure.
- It should be possible to release parts by manual operation (valves).
- Do not touch the FlexGripper while it is connected to air pressure.
- While assembling, adjusting and working on the FlexGripper, it is mandatory to implement safety regulations so that no fingers or other body parts are in proximity to the moving parts of the FlexGripper. There is risk and danger of injury.
- Do not use temporary arrangements to make the FlexGripper work. This may lead to severe damage.
- Ensure all the bolts have been tightened before starting any operation after maintenance work.
- Ensure no foreign material is lying on the FlexGripper before starting any operation.
- During operation the FlexGripper must be protected by fixed or interlocking guards according to the safety laws and regulations in the country concerned.
- It should not be possible to reach any moving parts when the Flexgripper is operating and the safety guards are fenced and interlocked.

## 2 FlexGripper-Claw

### 2.1. Specification


**NOTE!**

This section describes products the ABB FlexGripper-Claw can lift and the ABB FlexGripper-Claw specifications. Use this information to judge whether the ABB FlexGripper-Claw is suitable to lift the product in question.

This FlexGripper-Claw handles soft bags which do not have a dense and a rigid structure.

**Storage conditions**

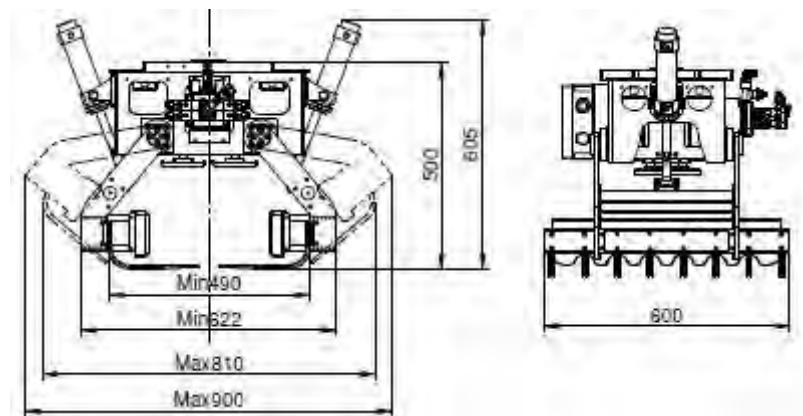
Ambient temperature	0° C (32° F) - 55° C (131° F)
Relative humidity	Maximum 90%
Explosive environments	Not permitted

**Operating conditions**

Ambient temperature	5° C (41° F) - 50° C (122° F)
Relative humidity	Maximum 90%
Explosive environments	Not permitted

**FlexGripper-Claw weight**

FlexGripper variants	Weight
FlexGripper-Claw	60 kg

**FlexGripper-Claw size**


en10120624

**Product specification**

Bag height range	Bag length range	Bag width range	Max. weight per lift	Handled products
120 - 250 mm	300 - 750 mm	250 - 450 mm	50 kg	1

*Continues on next page*

## 2 FlexGripper-Claw

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### 2.1. Specification

*Continued*



#### **NOTE!**

Due to variations in size, weight, design, surface, rigidity, porosity and centre of gravity, please judge if your products can be lifted by ABB FlexGrippers according to the above FlexGripper parameters and product specifications.

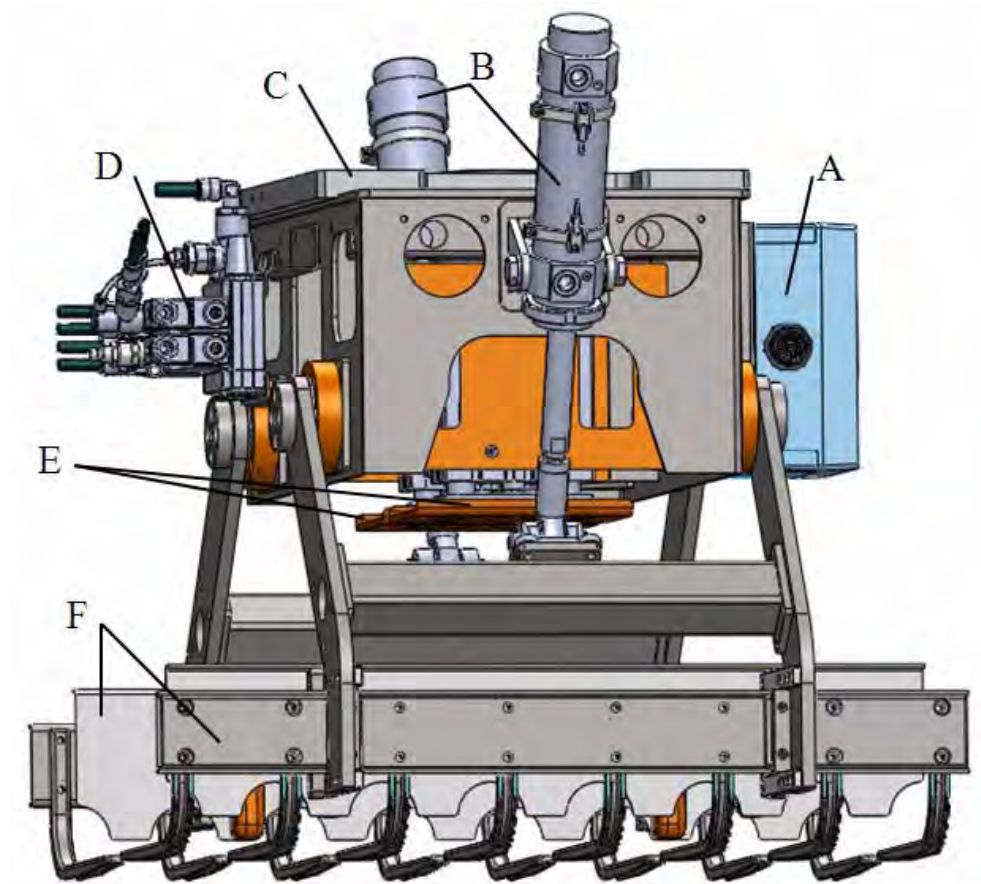


## 2.2 Mechanical structure & working principle

### 2.2.1. General

The FlexGripper-Claw lifts products by inserting the supporting claws below the bottom of the product. The push plates press the product on its upper surface to maintain the shape of the bag and to prevent it from slipping when the robot is moving with the FlexGripper.

The action of the push plates and two claws are separately controlled by pneumatic cylinders (operating at 4 - 6 bar). The pressure regulator on the FlexGripper can adjust the air pressure of the pneumatic system.



en1011043

Figure 2.1 FlexGripper-Claw

Pos	Part	Description
A	Terminal box	Signals connections for the FlexGripper.
B	Pneumatic cylinder	Adjusts the movement of the moving claws. The stroke is 80 mm.
C	Flange	Installs the FlexGripper to the robot wrist.
D	Valve unit	Controls compressed air inlet and outlet of the pneumatic cylinders.

*Continues on next page*

## 2 FlexGripper-Claw

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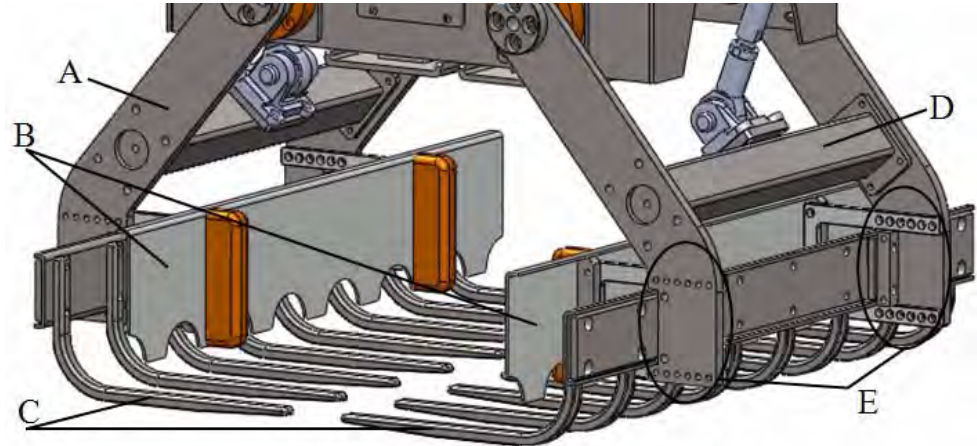
### 2.2.1. General

*Continued*

Pos	Part	Description
E	Push plates	Press the product on its upper surface to maintain the shape of the bag and to prevent it from slipping when the robot is moving with the FlexGripper. Stroke 80mm.
F	Claw unit	Grips the products and can be adjusted according to the products size.

### 2.2.2. Claw unit

The opening and closing of the claw unit is controlled by two pneumatic cylinders. The width between the two support plates can be adjusted for the size of the products by adjusting the support plate mounting location.



en1011044

Figure 2.2 Claw unit

Pos	Part	Description
A	Claw arm	Connects the claws and the base beam.
B	Support plate	Used to adjust the claw gripping width.
C	Claw finger	Eight fingers on each side. 80mm finger intervals.
D	Link rod	Connects the pneumatic cylinder and supports the claw arm.
E	Adjusting screw holes	Used to adjust the mounting location of the support plates.

There are two lines of mounting screw holes (6 holes in each line at intervals of 10mm) on each claw arm to adjust the support plate mounting location (See E in Figure 2.2). The adjustment distances for each side are 10, 20, 30, 40, 50, 60, 70, 80, 90, 100mm, which means the gripping width can be adjusted manually over a range of 200mm. The adjustment should be done symmetrically.

## 2 FlexGripper-Claw

---

### 2.3.1. Overview

## 2.3 Installation and Commissioning

### 2.3.1. Overview

---

This instruction is primarily intended for use when unpacking and installing the gripper for the first time. It also contains information useful during later installation of the FlexGripper.

The FlexGripper was packed by the standard of sea transportation, land transportation and air transportation on delivery.



#### **NOTE!**

Lifting should be done by four people or by a crane.

Do not hold the solenoid valves, terminal box or connectors when lifting the gripper.

## 2.3.2. Unpacking



### NOTE!

Only 24V power is used in FlexGripper.

Short circuit protection should be implemented by a fuse in the control cabinet by the customer.

### Inspection

The FlexGripper-Claw is supplied in a wooden box. Be sure to stand the package with the upper face upwards. Open the package and check for any visible transport damage. If the FlexGripper is damaged, contact ABB.

### Packing list

Check the following item list in the standard delivery package before proceeding with the installation of the FlexGripper.

No.	Item	Description
A	Flange	
B	Screws	For IRB460: 6x M10 screws to install the flange to the robot wrist; 16x M6 screws to mount the flange to the FlexGripper. For IRB660: 11x M12 screws to install the flange to the robot wrist; 16x M6 screws to mount the flange to the FlexGripper.
C	Preassembled FlexGripper	
D	Cables	Compressed air hose (blue). Signal cable (green). For IRB 460: circular connector For IRB 660: harting connector Black corrugated pipe as cable protection
E	Cable bracket	
F	CD	Including : one product manual

*Continues on next page*

## 2 FlexGripper-Claw

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### 2.3.2. Unpacking

*Continued*



#### NOTE!

Before installing the FlexxGripper, open the package and take out the flange. Keep the FlexGripper in the box for the convenience of later installation. If the FlexGripper is not to be installed immediately, it must be stored. For storage conditions see: [Storage conditions on page 21](#).

---

#### Pre-requisites for mounting

The checklist below details items that should be observed before the installation of the FlexGripper.

1. Visually inspect the FlexGripper to make sure it is not damaged.
2. Make sure the expected operating environment of the FlexGripper conforms to the specifications described in [Operating conditions on page 21](#).
3. Make sure the area around the robot wrist has no particles that would impede the installation of the FlexGripper or be dangerous to the operator.

Please adjust the width between the two plates according to the size of the product to be gripped before mounting. For information on the adjustment, please see [Claw unit on page 25](#).



#### DANGER!

Before commencing any service work, be sure all the safety clauses have been strictly observed!

Make sure that the power is off before starting any work.



#### NOTE!

ABB recommend that air connected to the FlexGripper should be: 4-6 bar, filtered and non-lubricated.

---

#### Recommended standard tightening torque

For the torque values needed during installation, please see the following table.

The table below specifies the recommended standard tightening torque for oil-lubricated allen head screws (recommended class 12.9).

Dimension	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6
M6	10
M8	24
M10	47
M12	82
M16	200

### 2.3.3. Adjustment

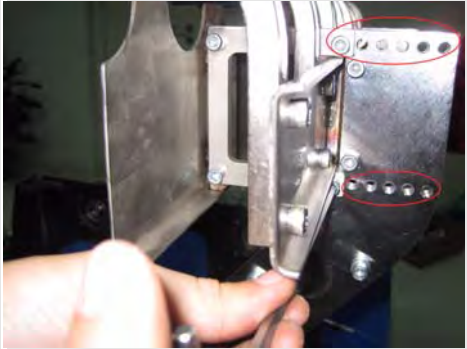
When delivered, the width between the support plates is set wide enough to make mounting of the FlexGripper possible. If needed, please refer to the following instructions for how to adjust the width between the two plates according to the size of the product.

#### Adjustment instructions



#### **DANGER!**

Turn off all electric power and pneumatic pressure supplies to the gripper!

No	Action	Info/Illustration
1.	Loosen the screws holding the press plate (see figure), the width between the two rails can be adjusted along the X-axis to suit the size of the product.	 en1011045
2.	Adjust the width of the plates and tighten the screw. Note and reference to the torque figures table.	

## 2 FlexGripper-Claw

### 2.3.4. Mounting the FlexGripper-Claw

### 2.3.4. Mounting the FlexGripper-Claw

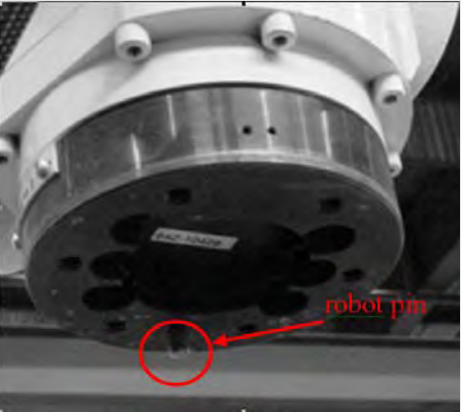




**DANGER!**

Before commencing any service work, be sure all the safety guidelines have been strictly observed!


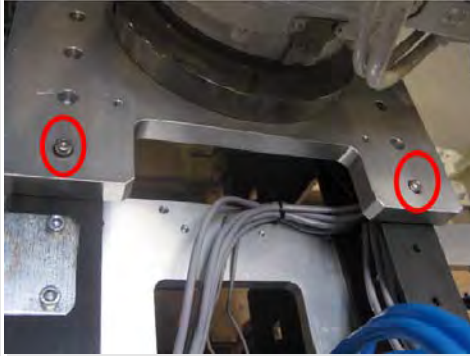
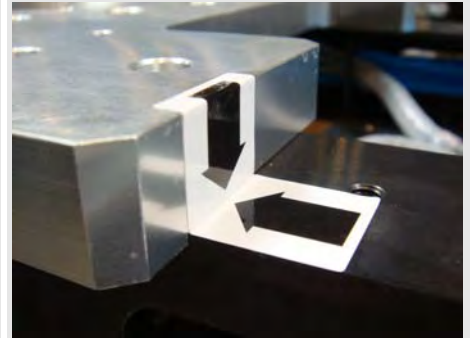



Make sure that the power is switched off before starting any work.

#### Mounting the FlexGripper-Claw on robot

No	Action	Info/Illustration
1.	Locate the wooden package so that it can be reached by the robot. Jog the robot wrist to the correct working height for the operations to be carried out.	
2.	Insert the robot pin in the non threaded hole in the robot wrist.	 en1011031
3.	Mount the flange on the robot wrist using the 6 supplied M10 screws and tighten to 47 Nm (or the 11x M12 screws tightened to 80 Nm).  <b>NOTE!</b> The robot pin is inserted in to the non threaded holes in the robot wrist and flange to guarantee the orientation of the FlexGripper.	 en1011015.
4.	Jog the robot to find the location of the FlexGripper. Set the robot wrist to a low position (see Robot User's Guide).	

*Continues on next page*


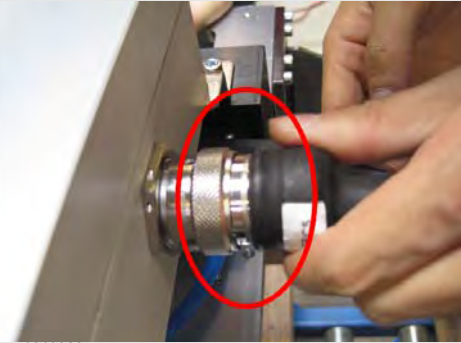


No	Action	Info/Illustration
5.	<p>Mount the flange to the FlexGripper beam using the supplied 16×M6 bolts and tighten to 10Nm from above downward.</p> <p></p> <p><b>NOTE!</b></p> <p>The labels on the flange and the FlexGripper indicate the directions of mounting.</p> <p>Make sure the locking groove on the flange engages with the frame of the FlexGripper.</p>	 <p>en1011016</p>  <p>en1011017</p>
6.	<p>Attach the cable bracket on the flange and the cable routing to the robot wrist.</p> <p></p> <p><b>NOTE!</b></p> <p>Pass the cables through the plastic corrugated pipe which is used as the cable protection.</p>	 <p>en1011018</p>  <p>en1011019</p>

## 2 FlexGripper-Claw

### 2.3.4. Mounting the FlexGripper-Claw

*Continued*

No	Action	Info/Illustration
7.	Connect the power and air cables to the manipulator wrist.	 en1011020
8.	Connect the compressed air supply cable to the valve unit and the power & signal cable to the terminal box.	 en1011023
9.	Jog the robot wrist to lift the FlexGripper package, then pull down the wooden box and separate it from the FlexGripper.	
10.	Set axis 4 to zero angle position. Manipulate the robot to check if axis 4 can rotate to the position of angle 180 clockwise and anticlockwise without tensioning of the cables and distortion of the corrugated pipe.	



#### NOTE!

Make sure that the standard tool kit and attached screws, washers and dowels are used during the mounting.

## 2.3.5. Commissioning



### NOTE!

ABB recommend that air connected to the FlexGripper should be: 4-6 bar, filtered (5µm), and non-lubricated.

After the electrical and pneumatic connection of the FlexGripper, test if the FlexGripper operates correctly.



### NOTE!

Only 24V power is used in FlexGripper.

Short circuit protection should be implemented by a fuse in the control cabinet by the customer.



### CAUTION!

Hot parts may cause burns!

## Mechanical commissioning

Jog the robot to do the following actions: claw open, claw close, push plate down, push plate up and check that the FlexGripper operates correctly.

Pay attention to the following:

- The operation speed and smoothness. If the open and close time of the FlexGripper-Claw is more than 0.6 s, adjust the throttle valves of the pneumatic cylinders until the operation time is less than 0.6 s.
- Check if the clawing force is suitable to handle the products. A reducing valve is used to adjust the compressed air pressure of the press plates. The clamping force standard should be the force that the product can be steadily gripped and lifted without falling down.
- Check if any interference exists between cables or robot components.

## Rapid routines

Routines	Description
PFPSInitInterrupt()	This routine is called to initialize the interrupt program. The signal 'DI10_02_ClawCylinder1_Closed' is monitored.
PFPS_MainEntry()	This routine is the main entry of the 'Test run' process. It can not be renamed, modified or deleted.
PFPSClawCylinder()	This routine is called when the claw is set to be open or close.
PFPSFixCylinder()	This routine is called when the push plates go up and down.
PFPS_PickUpBox()	This routine is called when the robot goes to pick up boxes.
PFPS_PlaceDownBox()	This routine is called when the robot goes to place down boxes.
exePickPlace()	This routine is called when the robot goes to pick up and place down boxes. The two routines 'PFPS_PickUpBox()' and 'PFPS_PlaceDownBox()' are called during the process.

*Continues on next page*

## 2 FlexGripper-Claw

---

### 2.3.5. Commissioning

*Continued*



#### **NOTE!**

The claw is open, when 'DO10\_02\_ClawCylinder1\_Close' is set to be '0' and 'DO10\_01\_ClawCylinder1\_Open' is set to be '1'. The claw is close, when 'DO10\_02\_ClawCylinder1\_Close' is set to be '1' and 'DO10\_01\_ClawCylinder1\_Open' is set to be '0'.

PFPSClawCylinder()

```
PROC PFPSClawCylinder()
  IF Present (Open) THEN
    SetDO DO10_02_ClawCylinder1_Close,0;
    SetDO DO10_01_ClawCylinder1_Open,1;
    WaitDI DI10_01_ClawCylinder1_Opened,1;
  ENDIF
  IF Present (Close) THEN
    SetDO DO10_01_ClawCylinder1_Open,0;
    SetDO DO10_02_ClawCylinder1_Close,1;
    WaitDI DI10_02_ClawCylinder1_Closed,1;
  ENDIF
ENDPROC
```



#### **NOTE!**

The push plates are up, when 'DO10\_06\_FixCylinder1\_Down' is set to be '0' and 'DO10\_05\_FixCylinder1\_Up' is set to be '1'. The push plates are down, when 'DO10\_06\_FixCylinder1\_Down' is set to be '1' and 'DO10\_05\_FixCylinder1\_Up' is set to be '0'.

PFPSCFixCylinder

```
PROC PFPSCFixCylinder
  IF Present (Up) THEN
    SetDO DO10_06_FixCylinder1_Down, 0;
    SetDO DO10_05_FixCylinder1_Up, 1;
    WaitDI DI10_05_FixCylinder1_Up,1;
  ENDIF
  IF Present (Down) THEN
    SetDO DO10_05_FixCylinder1_Up, 0;
    SetDO DO10_06_FixCylinder1_Down, 1;
    SetDO DO10_06_FixCylinder1_Down, 1;
  ENDIF
ENDPROC
```

*Continues on next page*

**NOTE!**

The target points 'pHome', 'pPick' and its offsets must be defined and taught firstly.

PFPS\_PickUpBox()

```
PROC PFPS_PickUpBox()
    MoveJ pHome, v100, fine, tPFPSClawGrip\WObj:=wobj0;
    TPWrite " Robot move to pick postion! ";
    MoveL Offs(pPick,-10,0,100), v100, z20, tPFPSClawGrip\WObj:=wobj0;
    MoveL pPick, v100, fine, tPFPSClawGrip\WObj:=wobj0;
    GripLoad PFPSLoadFull;
    TPWrite " Robot start to pick up box! ";
    PFPSClawCylinder \Close;
    IWatch itClawMonitor1;
    PFPSFixCylinder \Down;
    WaitTime\InPos, 1;
    bPartPicked:=TRUE;
    WaitTime\InPos, 0.2;
    TPWrite " Robot finish to pick up box! ";
    MoveL Offs(pPick,0,0,50), v50, z10, tPFPSClawGrip\WObj:=wobj0;
    TPWrite " Robot move to home postion! ";
    MoveJ pHome, v100, fine, tPFPSClawGrip\WObj:=wobj0;
ENDPROC
```

## 2 FlexGripper-Claw

---

### 2.3.5. Commissioning

*Continued*



#### **NOTE!**

The target points 'pHome', 'pPlace' and its offsets must be defined and taught firstly.

PFPS\_PlaceDownBox()

```
PROC PFPS_PlaceDownBox()
    TPWrite " Robot move to place postion! ";
    MoveL Offs(pPlace,-10,0,100), v100, z20, tPFPSClawGrip\WObj:=wobj0;
    MoveL pPlace, v100, fine, tPFPSClawGrip\WObj:=wobj0;
    TPWrite " Robot start to place down box! ";
    ISleep itClawMonitor1;
    WaitTime\InPos, 0.5;
    PFPSClawCylinder \Open;
    TPWrite " Robot finish to place box! ";
    GripLoad PFPSLoadEmpty;
    WaitTime\InPos, 0.2;
    TPWrite " Robot finish to place box! ";
    MoveL Offs(pPlace,0,0,50), v100, z50, tPFPSClawGrip\WObj:=wobj0;
    TPWrite " Robot move to home postion! ";
    MoveJ pHome, v100, fine, tPFPSClawGrip\WObj:=wobj0;
ENDPROC
```

*Continues on next page*

---

**Reference Rapid codes**

The gripper function can be checked with using rapid codes. Modify the data in rapid codes as needed before using:

MODULE MainModule

CONST robtarget

pPick:=[[1509.83,-1023.10,949.73],[1.47514E-06,0.00818497,-0.999967,-1.02733E-06],[-1,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

PERS tooldata

tPFPSClawGrip:=[TRUE,[[0,0,200],[1,0,0,0]],[60,[0,0,200],[1,0,0,0],0,0,8]];

PERS Loaddata

PFPSLoadFull:=[50,[0,0,-100],[0.502933,0.508892,-0.496959,0.491039],2,4,8];

PERS Loaddata PFPSLoadEmpty:=[0.001,[0,0,0.001],[1,0,0,0],0,0,0];

PERS num cycletime:=3.111;

PERS num pace:=0;

PROC main()

var clock MyClock;

MoveJ pPick, vmax, fine,tPFPSClawGrip\WObj:=wobj0;

ConfJ \off;

confl \off;

pace:=0;

clkreset MyClock;

clkstart MyClock;

! zone radius 400mm

for i from 1 to 5 do

PFPSClawCylinder \Close;

PFPSFixCylinder \Down;

GripLoad PFPSLoadFull;

MoveC Offs(pPick,0,117,283),Offs(pPick,0,400,400),vmax,z200,

tPFPSClawGrip\WObj:=wobj0;

MoveL Offs(pPick,0,2000,400), vmax, z200, tPFPSClawGrip\WObj:=wobj0;

MoveL Offs(pPick,0,2000,0), vmax, z200, tPFPSClawGrip\WObj:=wobj0;

PFPSFixCylinder \Up;

PFPSClawCylinder \Open;

GripLoad PFPSLoadEmpty;

!Gripper start to back!

MoveL Offs(pPick,0,2000,400), vmax, z200, tPFPSClawGrip\WObj:=wobj0;

MoveL Offs(pPick,0,400,400), vmax, z200, tPFPSClawGrip\WObj:=wobj0;

MoveC Offs(pPick,0,117,283),pPick, vmax, fine,

tPFPSClawGrip\WObj:=wobj0;

*Continues on next page*

## 2 FlexGripper-Claw

---

### 2.3.5. Commissioning

*Continued*

```
endfor
waituntil\inpos,true;
clkStop MyClock;
cycletime:=clkRead(MyClock)/5;
pace:=3600/cycletime;
ENDPROC
PROC PFPSClawCylinder(\switch Open | switch Close)
  IF Present (Open) THEN
    SetDO DO10_02_ClawCylinder1_Close,0;
    SetDO DO10_01_ClawCylinder1_Open,1;
    WaitDI DI10_01_ClawCylinder1_Opened,1;
  ENDIF
  IF Present (Close) THEN
    SetDO DO10_01_ClawCylinder1_Open,0;
    SetDO DO10_02_ClawCylinder1_Close,1;
    WaitDI DI10_02_ClawCylinder1_Closed,1;
    WaitDI DI10_04_ClawCylinder2_Closed,1;
  ENDIF
ENDPROC
PROC PFPSCFixCylinder(\switch Up | switch Down)
  IF Present (Up) THEN
    SetDO DO10_06_FixCylinder1_Down, 0;
    SetDO DO10_05_FixCylinder1_Up, 1;
    WaitDI DI10_05_FixCylinder1_Up,1;
  ENDIF
  IF Present (Down) THEN
    SetDO DO10_05_FixCylinder1_Up, 0;
    SetDO DO10_06_FixCylinder1_Down, 1;
    !WaitDI DI10_06_FixCylinder1_Down,1;
  ENDIF
ENDPROC
ENDMODULE
```

---

### Software commissioning

For detailed software commissioning procedure, see [FlexGripper-Claw function test on page 81](#).



## 2.4 Maintenance

### 2.4.1. General

---

This chapter details all maintenance activities recommended for the FlexGripper-Claw. For the torque values needed during maintenance, please see *Recommended standard tightening torque on page 28*.



#### **WARNING!**

During maintenance, disconnect the mains voltage before any work is started. Even if the voltage is switched off there still remains a safety risk. Pneumatic and electric connections should be disconnected before performing any maintenance activity on the FlexGripper.

---

#### **Safety information**

Before any service work is started, it is extremely important that all safety information is read and followed! There are general safety aspects that must be read through, as well as more specific safety information that describe danger and safety risks when performing the procedures. Read the chapter *Safety on page 7* before performing any service work.

## 2 FlexGripper-Claw

---

### 2.4.2. Regular Inspection of FlexGripper-Claw

#### 2.4.2. Regular Inspection of FlexGripper-Claw

---

Perform general visual system inspection regularly before starting an operation. Parts that need to be visually inspected with a more regular interval (less than a half year and so on) are:

Type	Action
Fastener	Check that the fastener is not lose.
Claw fingers	Check for any distortion of the fingers.
Cable protection	Check the wear extent of the cable protection.
Pneumatic accessory	Regularly check that the piston rods of the cylinders are free from dust particles and check that there is no air leakage. Ensure all the Valve terminal connectors are tightened properly and check that there is no air leakage

Parts that need to be disassembled and inspected with a relatively longer interval (one year and so on) are:

Type	Action
Joint pin	Disassemble all the joint pins in the FlexGripper-Claw to check their wear extent.

---

### 2.4.3. Regular replacement

---

In any of the following situations, the corresponding component should be replaced:

- The claw unit/claw finger is distorted
- The corrugated pipe has worn out
- Pins in the FlexGripper-Claw have worn out seriously
- Any component that no longer functions correctly
- Any component that has exceeded its lifetime

## 2 FlexGripper-Claw

---

### 2.5.1. Instruction

## 2.5 Repair

### 2.5.1. Instruction

---

This chapter details all repair activities recommended for the FlexGripper-Claw.

---

#### Safety information

Before any service work is started, it is extremely important that all safety information is read! There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing specific steps in a procedure. Make sure to read through the chapter *Safety on page 7* before commencing any service work.



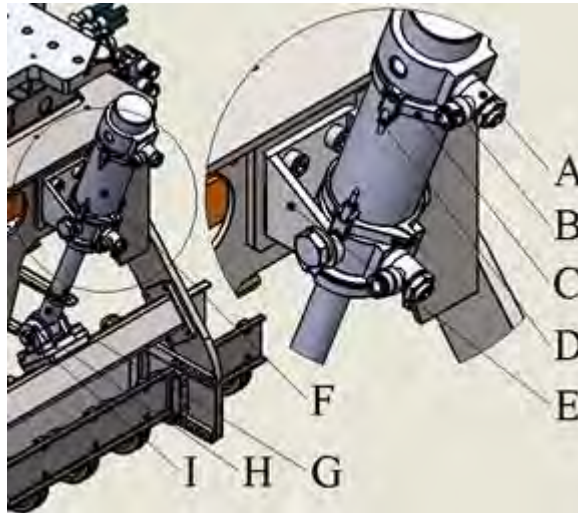
#### **NOTE!**

Make sure that the FlexGripper-Claw is disconnected from the mains power supply before starting any repair work.

## 2.5.2. Pneumatic cylinder

### 2.5.2.1. Replacing the cylinder of the claw

#### Location of cylinder



en1012001

Position	Part
A	Flow valve
B	Quick connector
C	Limit switch strap
D	Magnetic proximity switch
E	Bracket
F	Pneumatic cylinder
G	Spherical hinge
H	Bracket
I	Pin

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## 2 FlexGripper-Claw

### 2.5.2.1. Replacing the cylinder of the claw

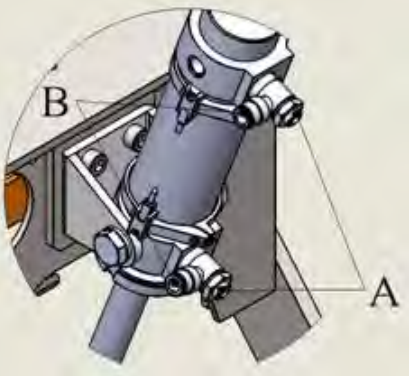
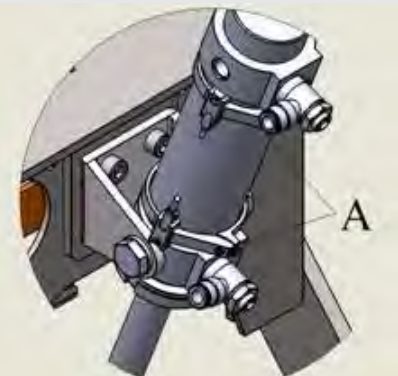
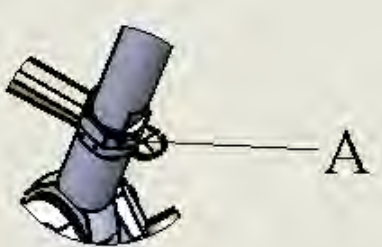
*Continued*

Use this procedure to remove the cylinder.

#### **DANGER!**

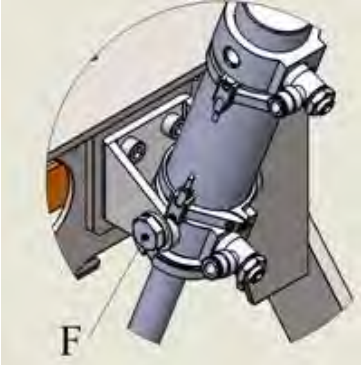
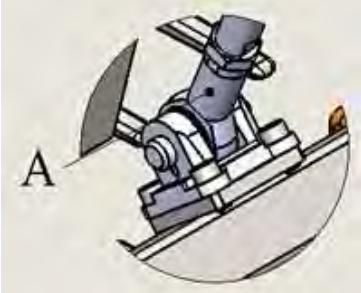
Turn off all electric power and pneumatic pressure supplies to the gripper!



Action	Note
1. Drain the air from the cylinder.	Disconnect air cable on cylinder.
2. Remove flow valve and quick connector.	 en1012002 Parts: A: Flow valve , B: Quick connector
3. Loosen the small bolt and pull out the magnetic proximity switch from the Limit switch strap. Remove the limit switch strap.	 en1012003 Parts: A: Small bolt
4. Loosen nut.	 en1012004 Parts: A: Small nut

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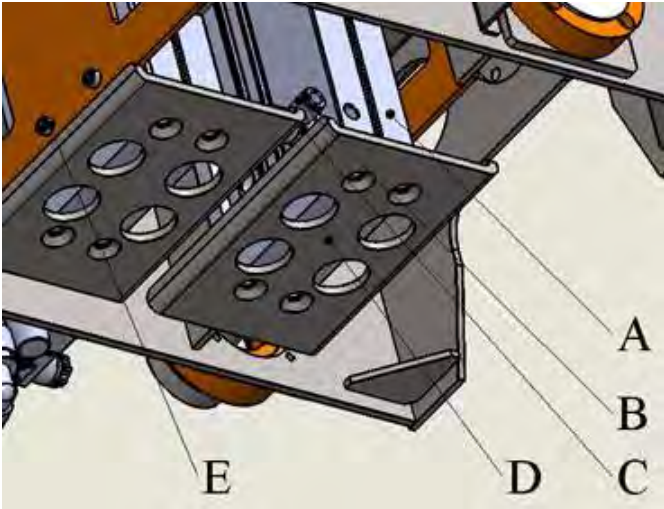
	Action	Note
5.	Loosen bolt of bracket and remove it.	 <p>en1012005</p> <p>Parts: A: Bolt of bracket</p>
6.	Loosen spherical hinge and remove it.	 <p>en1012005</p> <p>Parts: A: Spherical hinge</p>
7.	Remove pneumatic cylinder.	

## 2 FlexGripper-Claw

### 2.5.2.2. Replacing cylinder of press plate

#### 2.5.2.2. Replacing cylinder of press plate

The cylinder is located as shown in the figure.



en1012006

Position	Part
A	Pneumatic cylinder
B	Quick connector
C	Flow valve
D	Press plate
E	Bolt

Use this procedure to remove the cylinder.

#### **DANGER!**


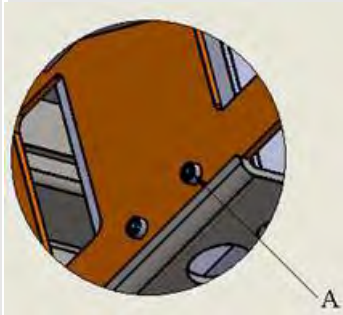

Turn off all electric power and pneumatic pressure supplies to the gripper!



	Action	Note
1.	Drain the air from the cylinder.	Disconnect air cable on cylinder.
2.	Remove flow valve and quick connector.	<p>en1012002 Parts: A: Quick connectorB: Flow valve</p>

*Continues on next page*



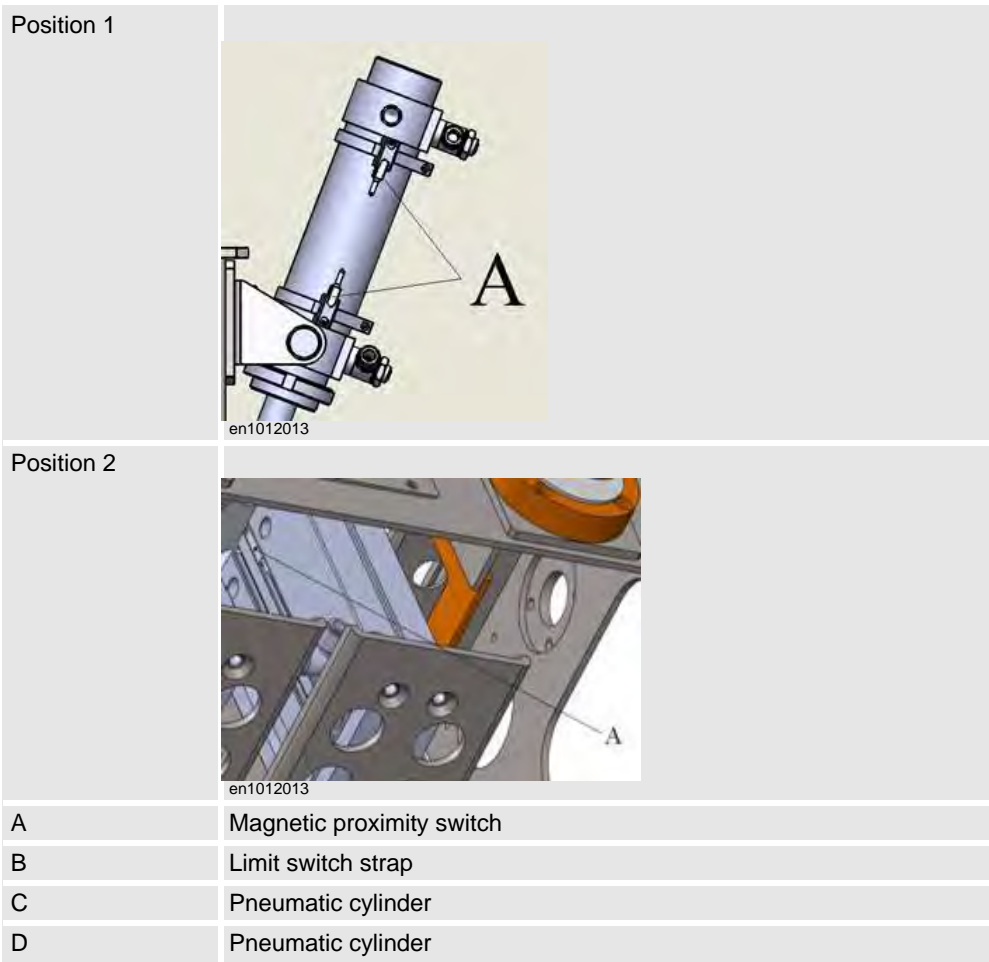
	Action	Note
3.	Remove magnetic proximity switch.	 <p>en1012003</p> <p>Parts: A: Small bolt</p>
4.	Loosen nut.	 <p>en1012004</p> <p>Parts: A: nut</p>
5.	Remove press plate.	 <p>en1012005</p> <p>Parts: A: Bolt of bracket</p>
6.	Remove pneumatic cylinder.	

## 2 FlexGripper-Claw

### 2.5.3. Magnetic proximity switch

### 2.5.3. Magnetic proximity switch

The magnetic proximity switch is located as shown in the figure.



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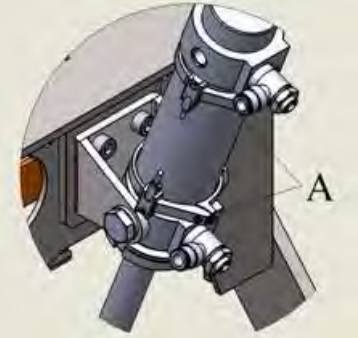
#### Position 1

Use this procedure to remove the magnetic proximity switch.

#### **DANGER!**

Turn off all electric power and pneumatic pressure supplies to the gripper!



Action	Note
1. Loosen the small bolt and pull out the magnetic proximity switch.	 <p>en1012015</p> <p>Parts: A: Small bolt</p>
2. Open the terminal box and remove the cable.	See circuit diagram for details.
3. Remove the magnetic proximity switch.	


#### Position 2

Use this procedure to remove the magnetic proximity switch.

#### **DANGER!**

Turn off all electric power and pneumatic pressure supplies to the gripper!



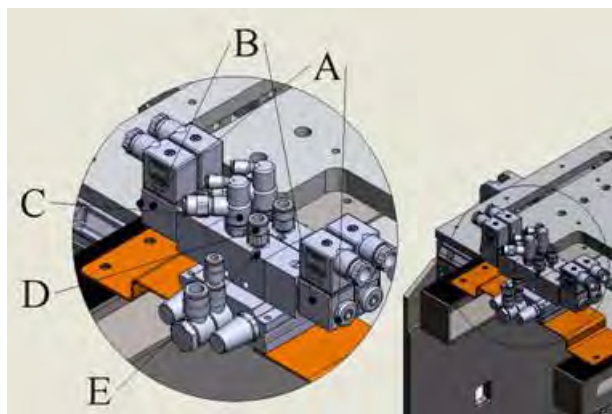
Action	Note
1. Loosen the small bolt and pull out the magnetic proximity switch from the Limit switch strap.	 <p>en1012016</p> <p>Parts: A: Small bolt</p>
2. Open the terminal box and remove the cable.	See circuit diagram for details.
3. Remove the magnetic proximity switch.	

## 2 FlexGripper-Claw

### 2.5.4. Solenoid valve

### 2.5.4. Solenoid valve

The solenoid valves are located as shown in the figure.



en1012019

Position	Part
A	Nut
B	Power supply
C	One way valve
D	Quick connector
E	Bolt

Use this procedure to remove the solenoid valve.

#### **DANGER!**

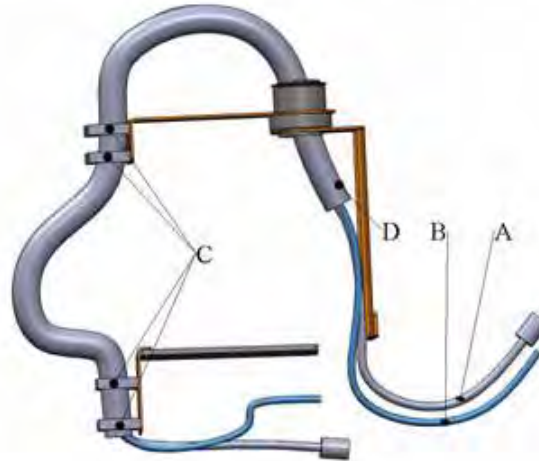
Turn off all electric power, pneumatic pressure supplies to the gripper!



	Action	Note
1.	Drain the air from the cylinder	Pull out air cable
2.	Remove one way valve	
3.	Remove quick connector	
4.	Loosen nut	
5.	Remove power supply	
6.	Loosen bolt	
7.	Remove solenoid valve	

### 2.5.5. Dress cable

The dress cable is located as shown in the figure.



en1012020

Position	Part
A	Electrical cable
B	Main Compressed air hose
C	Corrugated pipe clip
D	Dress cable

Use this procedure to remove the Dress Cable.

#### **DANGER!**

Turn off all electric power, pneumatic pressure supplies to the gripper!



	Action	Note
1.	Drain the air from the cylinder.	Pull out air cable
2.	Pull out the main compressed air hose from the two side quick connector.	
3.	Pull out electrical cable from both sides (one side theGripper terminal box and the other side the Robotaxis 6).	
4.	Open corrugated pipe clip.	
5.	Remove Dress cable.	

## 2 FlexGripper-Claw

---

### 2.6.1. Start-up failures

## 2.6 Trouble shooting

### 2.6.1. Start-up failures

---

#### Consequences

Problem starting the system

---

#### Symptoms and causes

- LEDs not lit on the sensors.
- Air hose hangs loosely on the gripper.

---

#### Recommended actions

	Action	Info/illustration
1.	Make sure the robot system has started up and correctly is connected.	
2.	Make sure the air source is open.	
3.	Make sure the gripper cable and air hose are correctly connected to the dress cable.	
4.	Make sure the gripper cable is correctly connected to the terminal box on the gripper.	

## 2.6.2. Gripper not responding

---

### Consequences

The gripper cannot be operated using the FlexPendant.

---

### Recommended actions

	Action	Info/illustration
1.	Make sure the gripper system has started up.	
2.	Make sure the connection to the I/O board is correct.	
3.	Make sure that there is no air leakage.	

## 2 FlexGripper-Claw

---

### 2.6.3. Wrong movement

### 2.6.3. Wrong movement

---

#### Consequences

The fault can cause severe injuries or death to personnel in the area or severe damage to the manipulator and/or surrounding equipment.

---

#### Symptoms and causes

The movement of the gripper part is not as expected during commissioning.

---

#### Recommended actions

	Action	Info/illustration
1.	Make sure the connection to the I/O board is correct.	
2.	Check the connection in the terminal box.	



## 2.6.4. Low performance

---

### Consequences

Clamp or hook movement is sluggish and sometimes stalls.

---

### Symptoms and causes

- Connection error
- Low air pressure
- Excessive friction

---

### Recommended actions

	Action	Info/illustration
1.	Make sure the electrical and air connections are correctly and firmly connected.	
2.	Make sure the air pressure is between 4 bar and 6 bar.	
3.	Make sure there is not excessive friction between moving parts (See section Mechanical noise).	

## 2 FlexGripper-Claw

---

### 2.6.5. Problem jogging the gripper

### 2.6.5. Problem jogging the gripper

---

#### Consequences

Gripper can not reach the rotation range.

---

#### Symptoms and causes

Cable or air hose routing.

---

#### Recommended actions

	Action	Info/illustration
1.	Make sure the cable and air hose are correctly routed.	

## 2.6.6. Mechanical noise

---

### Consequences

- Failing bearings cause the palletizing accuracy, and in severe cases, the workpiece may fall down uncontrolly.
- The gripper part or workpiece may fall down.

---

### Symptoms and causes

- Worn bearings
- Loose bolts

---

### Recommended actions

	Action	Info/illustration
1.	Determine which bearing is emitting the noise.	
2.	Make sure the bearing has sufficient lubrication.	
3.	Replace the bearing to a new one.	

---

	Action	Info/illustration
1.	Determine which bearing is emitting the noise.	
2.	Tighten the bolts to the recommended torque.	

## 2 FlexGripper-Claw

---

### 2.6.7. Workpiece drop on power down

### 2.6.7. Workpiece drop on power down

---

#### Consequences

The fault can cause severe injuries or death to personnel in the area or severe damage to the manipulator and/or surrounding equipment.

---

#### Symptoms and causes

- Faulty valve.
- Faulty air connection or air leakage.

---

#### Recommended actions

	Action	Info/illustration
1.	Determine which valve causes the workpiece to drop.	
2.	Check the air hose connection.	

## 2.6.8. Workpiece drop on air down

---

### Consequences

The fault can cause severe injuries or death to personnel in the area or severe damage to the manipulator and/or surrounding equipment.

---

### Symptoms and causes

- Faulty valve or air connection.
- Faulty air connection or air leakage.

---

### Recommended actions

	Action	Info/illustration
1.	Determine which valve causes the workpiece to drop.	
2.	Check the air hose connection.	

## 2 FlexGripper-Claw

---

### 2.6.9. No Input signal detected

### 2.6.9. No Input signal detected

---

#### Consequences

Can not run work program.

---

#### Symptoms and causes

- No signal detected in UI. LEDs not lit on the I/O board.
- Faulty connection.

---

#### Recommended actions

	Action	Info/illustration
1.	Make sure the LEDs sensors are lit and all the connections are firmly connected.	
2.	Check the connection on the I/O board.	

## **2.7 Decommissioning**

### **2.7.1. Introduction**

---

**Introduction**

This section contains information to consider when taking a product, FlexGripper, out of operation. It deals with how to handle potentially dangerous components and potentially hazardous materials.

---

**General**

All used grease, oils and dead batteries must be disposed of in accordance with the current legislation of the country in which the FlexGripper units are installed. If the FlexGripper units are partially or completely disposed of, the various parts must be grouped together according to their nature (that is, all iron together and all plastic together), and disposed of accordingly. These parts must also be disposed of in accordance with the current legislation of the country in which the FlexGripper units are installed.

## 2 FlexGripper-Claw

---

### 2.7.2. Environmental information

#### 2.7.2. Environmental information

---

##### Hazardous material

The table specifies some of the materials in the FlexGripper and their respective use throughout the product.

Dispose of the components properly to prevent health or environmental hazards.

Material	Example application
Copper	Cables
Steel	Screws, base-frame, and so on
Cast iron/nodular iron	Claw fingers
Plastic/rubber (PVC)	Cables, connectors, and so on
Aluminium	Flange

---

##### Oil and grease

Where possible, arrange for the oil and grease to be recycled. Dispose of via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

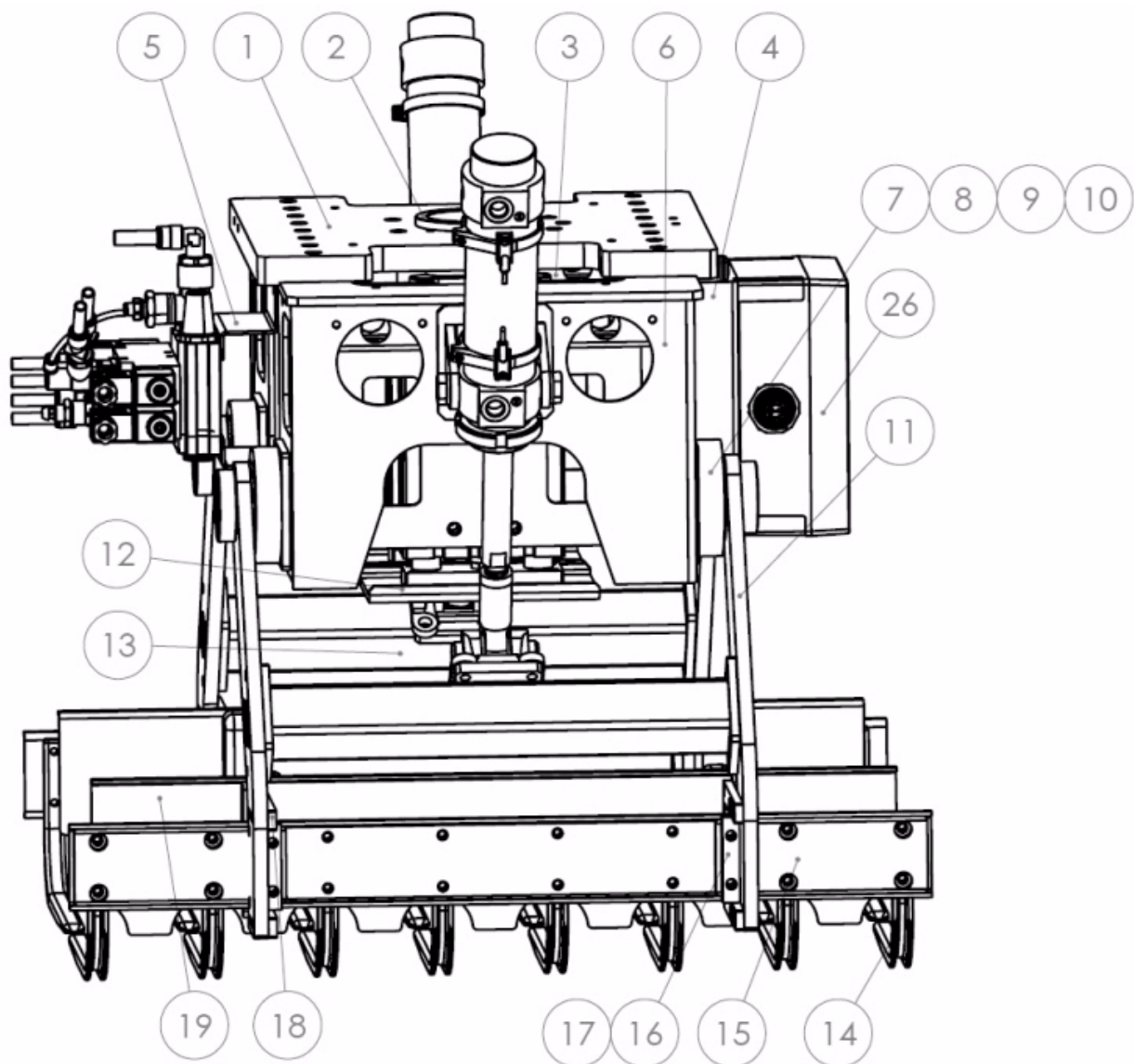
Also note that:

- Spills may form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired. Spillage may penetrate the soil causing ground water contamination.



## 2.8. Spare parts

### Mechanical parts



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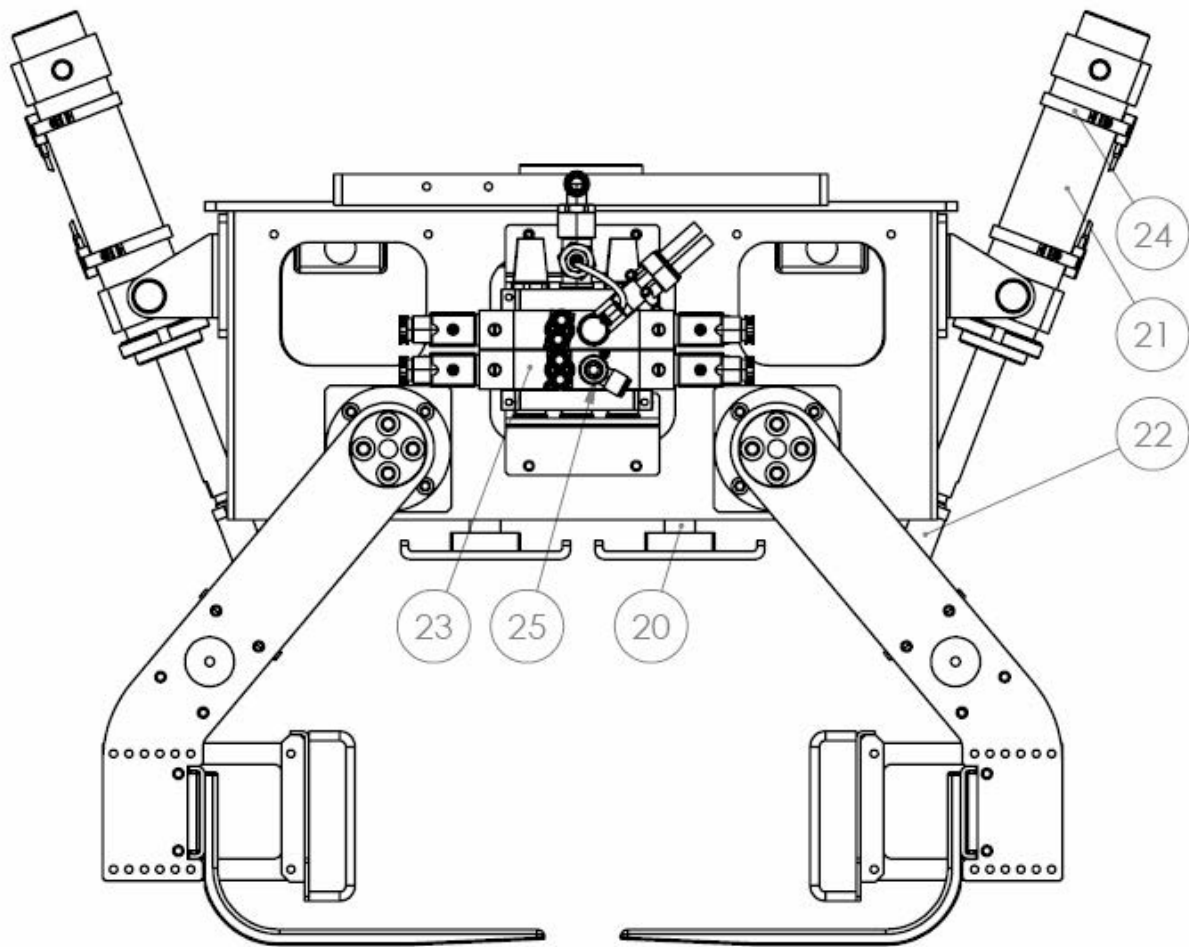
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## 2 FlexGripper-Claw

### 2.8. Spare parts

*Continued*

#### Pneumatic parts



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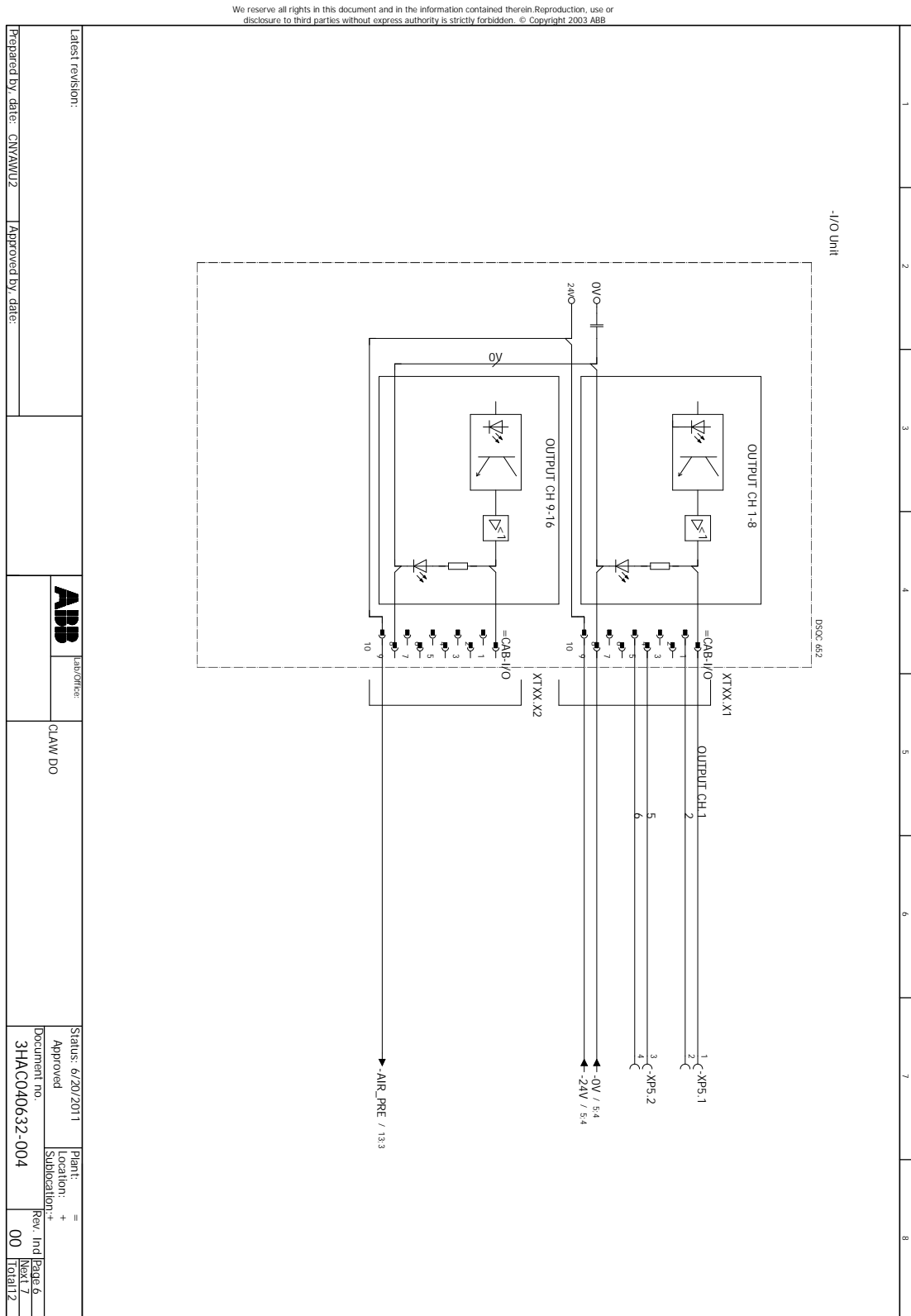
#### Spare parts list

Pos	Part No.	Description	Qty	Note / Dimension
1	3HAC040415-001	Flange plate for 460	1	Product in IRB 460
1	3HAC040417-001	Flange plate for 660	1	Product in IRB 660
2	3HAC040416-001	Shaft fitting for 460	1	Product in IRB 460
2	3HAC040418-001	Shaft fitting for 660	1	Product in IRB 660
3	3HAC040486-001	Cable rack	2	
4	3HAC040487-001	Electric bracket	2	
5	3HAC040488-001	Valve bracket	2	
6	3HAC038597-001	Frame machining	1	
7	3HAC040489-001	Bearing house	4	
8	3HAC040559-001	Bearing	4	
9	3HAC038598-001	Shaft	4	
10	3HAC038720-001	Washer	4	
11	3HAC038599-001	Link rob	4	
12	3HAC038716-001	Press plate	2	
13	3HAC038601-001	Connect rod machining	2	
14	3HAC040577-001	Claw machining	16	
15	3HAC038717-001	Clamp plate assem welding	2	
16	3HAC038607-001	Nut plate	4	
17	3HAC038606-001	Connect nut	4	
18	3HAC038602-001	Connect nut plate	4	
19	3HAC038605-001	Clamp plate assem 1 welding	2	
20	3HAC040823-001	Pneumatic cylinder	2	
21	3HAC040826-001	Pneumatic cylinder	2	
22	3HAC040794-001	Spherical hinge	2	
23	3HAC040830-001	Basic module	1	
23	3HAC040831-001	Terminal module	1	
23	3HAC040832-001	Quick twist joint	1	
23	3HAC040833-001	Quick twist joint	1	
23	3HAC040834-001	Quick twist joint	1	
23	3HAC040835-001	Quick twist joint	1	
23	3HAC040836-001	Muffle	2	
23	3HAC040837-001	Quick twist joint	3	
23	3HAC040838-001	Solenoid valve	2	
23	3HAC040805-001	Socket	4	
23	3HAC040839-001	Quick connector (plastic)	3	
23	3HAC040840-001	Quick twist joint	1	
23	3HAC040841-001	Joint	1	
23	3HAC040842-001	Sealed valve	1	
24	3HAC040843-001	Limit switch strap	4	
25	3HAC040915-001	Micro pressure control valve	1	
26	3HAC039438-001	Gripper terminal box unit	1	

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### FlexGripper-Claw DO

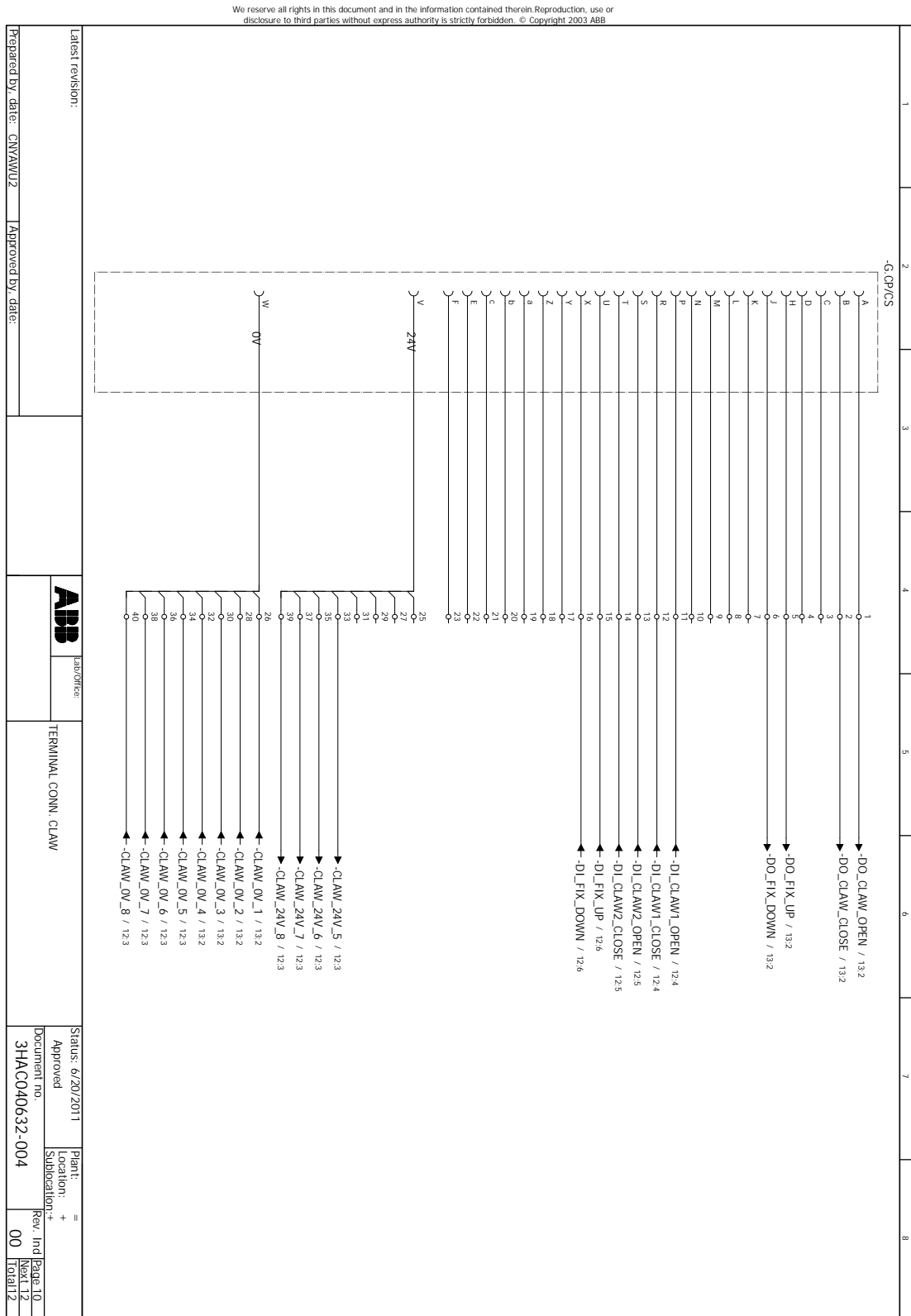


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FlexGripper-Claw teminal connection



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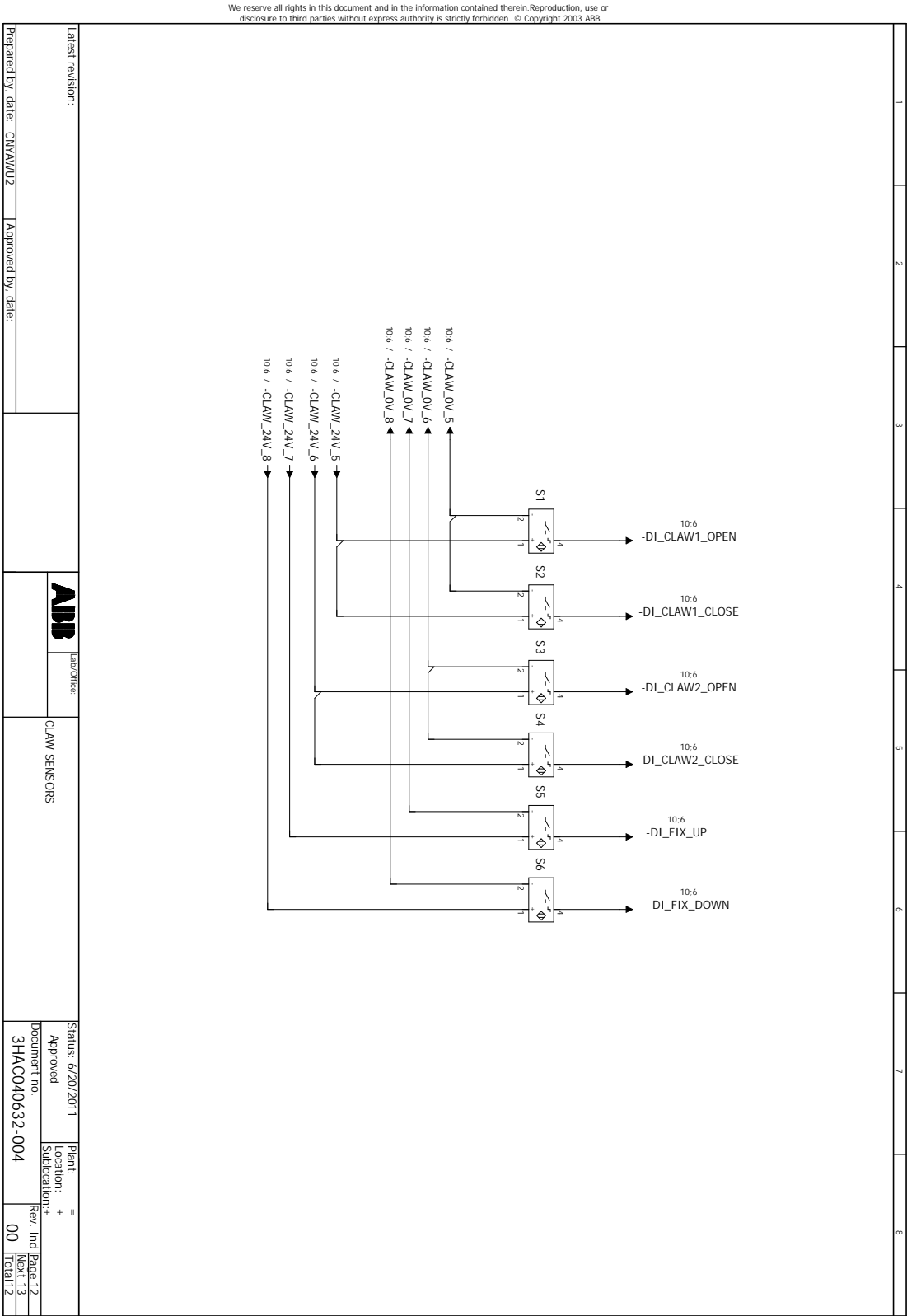
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2 FlexGripper-Claw

2.9.1. Electrical circuit

Continued

FlexGripper-Claw sensor connection



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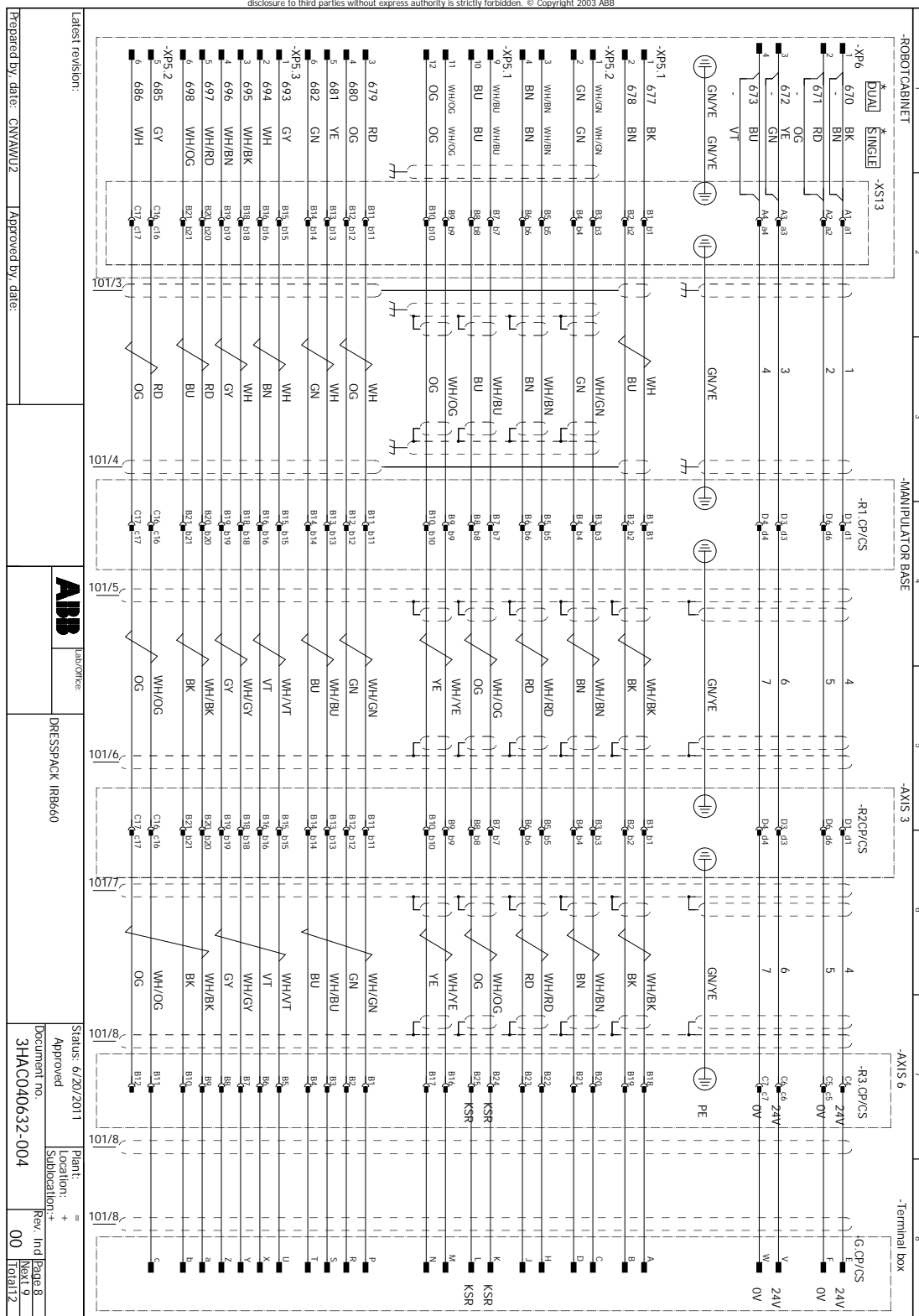
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## DRESSPACK IRB660

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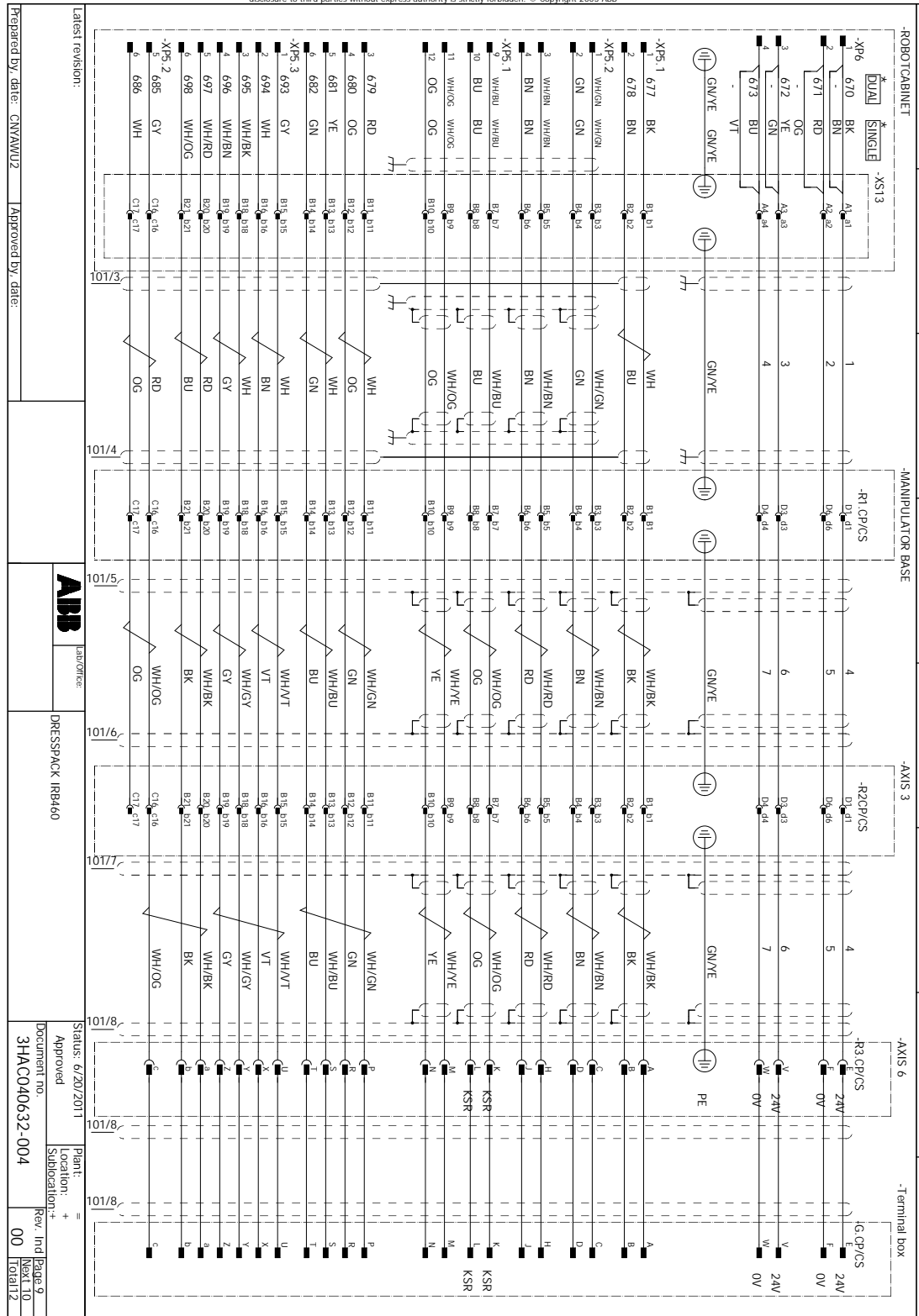
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### 2.9.1. Electrical circuit

Continued

## DRESSPACK IRB460

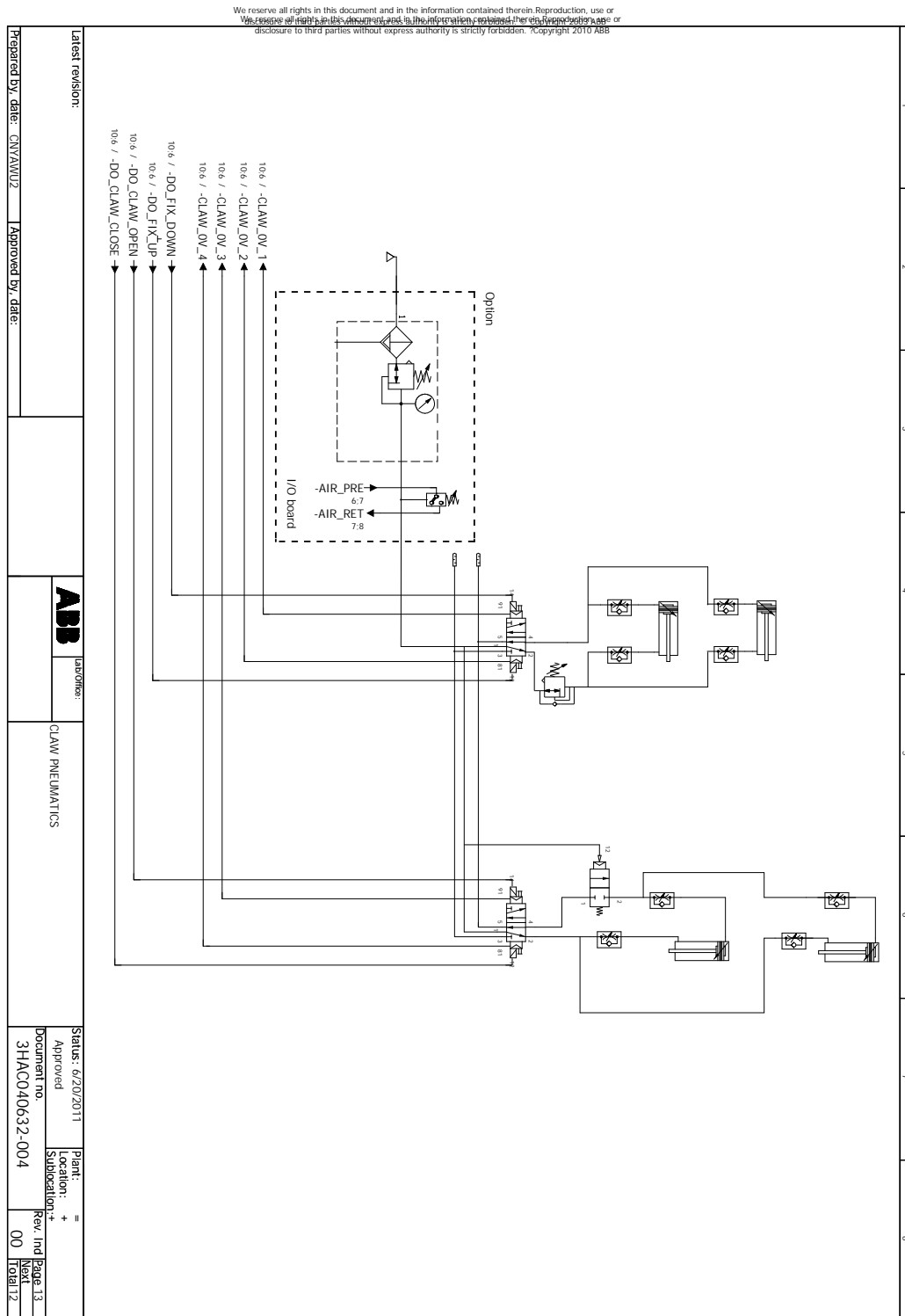
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3HAC040149-003-18

## 2.9.2. Pneumatic circuit

### FlexGripper-Claw pneumatic circuit



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## 2 FlexGripper-Claw

---

### 2.9.2. Pneumatic circuit

## **3 FlexGripper UI**

## 3 FlexGripper UI

---

### 3.1.1. Installing FlexGripper UI FlexPendant application

## 3.1 Software installation

### 3.1.1. Installing FlexGripper UI FlexPendant application



**NOTE!**

Only 24V power is used in FlexGripper.

Short circuit protection should be implemented by a fuse in the control cabinet by the customer.

---

#### Robot controller configuration requirement

Hardware	DSQC 652 board
RobotWare	RobotWare 5.13.02, includes the following options: <ul style="list-style-type: none"><li>• 617-1 FlexPendant Interface</li></ul>

---

#### FlexGripper UI FlexPendant application installation

Use the following procedure:



**NOTE!**

Before installing FlexGripper UI FlexPendant application, make sure that you have RobotStudio installed on your laptop.

1. Copy the FlexGripperUI folder into the mediapool folder of your laptop. Copy the MULTIFLEXGRIPPERUI folder from the FlexGripperUI FlexPendant GUI installation CD to C:\Program Files\ABB Industrial IT\Robotics IT\Mediapool on your laptop (If the path to mediapool folder is not as above, find the mediapool folder on your PC).
2. Create a robot controller system for FlexGripperUI with RobotStudio.
  - On the Online ribbon-tab of RobotStudio, click System Builder to bring up a dialog box.
  - In the Actions group click Create New... to start the wizard.
  - Follow the instructions on the wizard to enter a name and path of the system, then enter a controller key and a drive key for the system.
  - In the Add Additional Options page, browse and select the FlexGripperUI option key from C:\Program Files\ABB Industrial IT\Robotics IT\Mediapool\MULTIFLEXGRIPPERUI\Internal\_Use\_Key. Then click the arrow to add the FlexGripperUI option key to the Added options list. Click Next to go to the next page.
  - In the Modify Options page, make sure the following options are selected: a DeviceNet option (according to your hardware configuration), 616-1 PC Interface, 617-1 FlexPendant Interface and MULTIFLEXGRIPPERUI.
  - Click Finish. The controller system is created. See Operating manual - RobotStudio for more detailed information.

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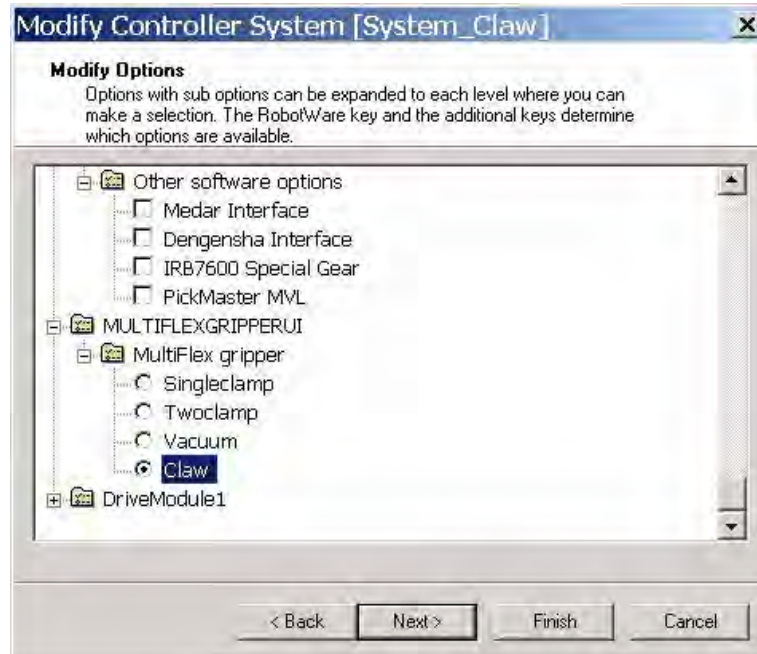
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3. Download the system to robot controller.

4. Warm start the controller.

The FlexGripperUI application icon is shown on the ABB main menu on the FlexPendant.

Note: For the FlexGripper UI option, Singleclamp option represents FlexGripper-Clamp 1, Twoclamp option represents FlexGripper-Clamp 2, Vacuum option represents FlexGripper-Vacuum, Claw option represents FlexGripper-Claw.



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### 3 FlexGripper UI

#### 3.1.2. I/O signal configuration

#### 3.1.2. I/O signal configuration

FlexGripper-Claw signal configuration

I/O signal	I/O board	Controller	Electric box		
			Signal	24V	0V
DO1001(DO10_01_ClawCylinder1_Open)	DO1	XT5.1.1	1	-	26
DO1002(DO10_02_ClawCylinder1_Close)	DO2	XT5.1.2	2		28
Spare		XT5.2.1			
Spare		XT5.2.2			
DO1005(DO10_05_FixCylinder1_Up)	DO5	XT5.2.3	5		30
DO1006(DO10_06_FixCylinder1_Down)	DO6	XT5.2.4	6		32
Spare		XT5.1.9			
Spare		XT5.1.10			
Spare		XT5.1.11			
Spare		XT5.1.12			
DI1001(DI10_01_ClawCylinder1_Opened)	DI1	XT5.1.3	11	33	34
DI1002(DI10_02_ClawCylinder1_Closed)	DI2	XT5.1.4	12	35	36
Spare		XT5.1.5			
Spare		XT5.1.6			
DI1005(DI10_05_FixCylinder1_Up)	DI5	XT5.3.1	15	37	38
DI1006(DI10_06_FixCylinder1_Down)	DI6	XT5.3.2	16	39	40
Spare		XT5.3.3			
Spare		XT5.3.4			
Spare		XT5.3.5			
Spare		XT5.3.6			
Spare		XT5.2.5			
Spare		XP6.1			
DI1013(DI10_13_AirPressure),used for deteecompressedairsorcepressure	DI13	XP6.2	23	25	
	24V	XP6.3			
	0V	XP6.4			



### 3.1.3. Back-up and I-Start

---

#### Back up the system



Use this procedure to back up your system:

**NOTE!**

We recommend performing a backup:

- Before installing a new RobotWare.
  - Before making any major changes to instructions and/or parameters to make it possible to return to the previous settings.
  - After making any major changes to instructions and/or parameters and testing the new settings to retain the new successful setting.
1. Tap the ABB menu and then tap Backup and Restore.
  2. Tap Backup Current System....A page showing the selected path opens.
  3. Specify a backup folder name and path.
  4. Tap Backup.

A backup folder is created according to your settings.

---

#### Restart and return to default setting (I-start)



Use this procedure to make an I-start

**NOTE!**

After I-start, the system's state will be resumed but any changes done to system parameters and other settings will be lost. Instead, system parameters and other settings are read from the originally installed system on delivery. Therefore it is important to always make a back up before I-start.

1. Make a backup of the system.
2. On the ABB menu, tap Restart. The restart page is displayed.
3. Tap Advanced... to select restart method. The select restart method dialog is displayed.
4. Tap I-start, then tap OK.
5. Restore the backup system.

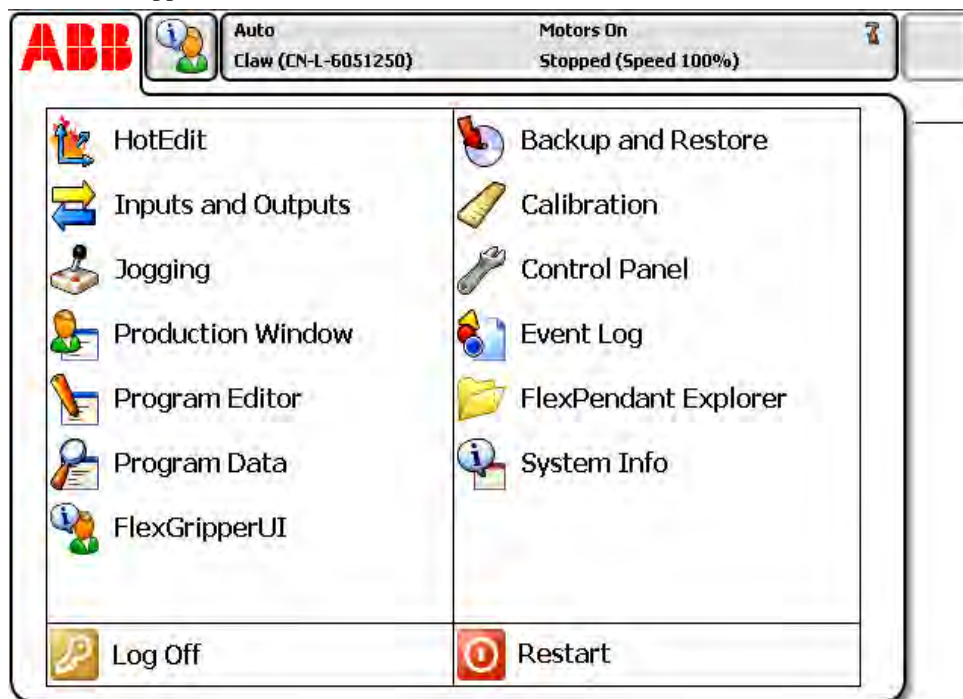
## 3 FlexGripper UI

### 3.2.1. FlexGripper UI main interface

## 3.2 Operation

### 3.2.1. FlexGripper UI main interface

Enter FlexGripper UI



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The FlexGripper UI has three function blocks: Tool handle, TCP edit and Production which you can see after entering the main interface.



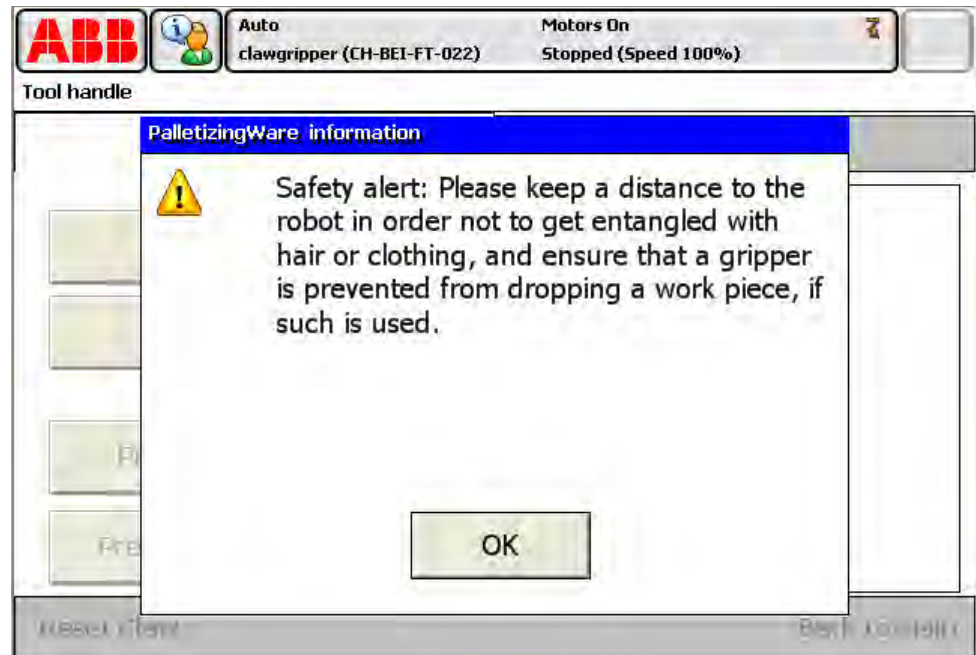
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### 3.2.2. Tool handle

#### 3.2.2.1. FlexGripper function test

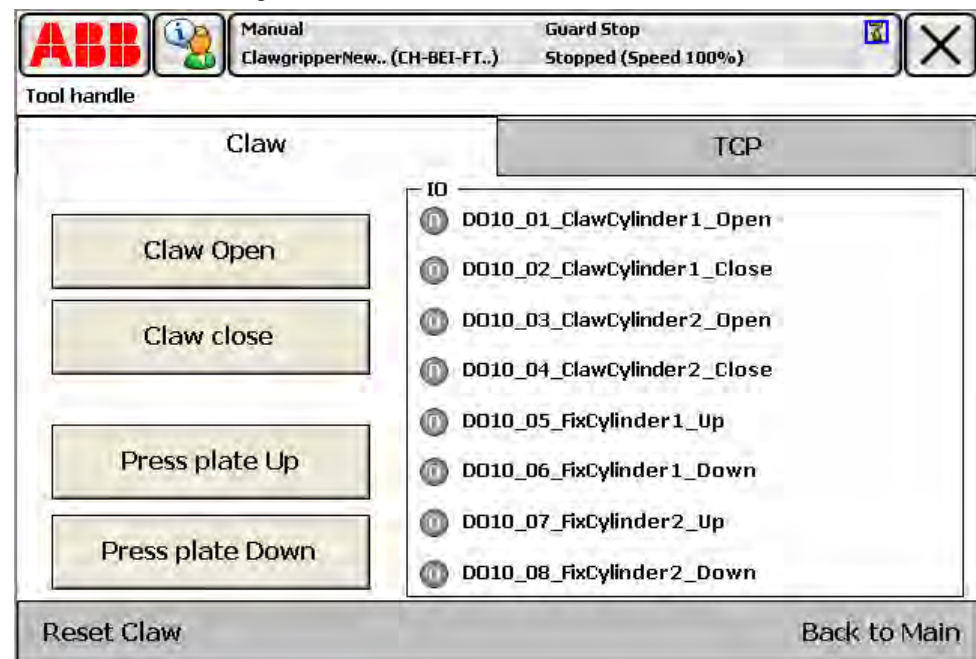
##### FlexGripper-Claw function test

Touch the Tool handle button, the following interface shows with a safety alert warning the danger could result from the robot operation.



en1011055

Press OK, the following screen shows:



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### 3 FlexGripper UI

---

#### 3.2.2.1. FlexGripper function test

*Continued*

You can operate the functions displayed and check if the corresponding signals status is correct. The functions displayed are Claw open, Claw close, Press plate up and Press plate down.

Function and signal status (FlexGripper-Claw)

Button Name	Description	Signal status
Claw Open	To pull out the two claw cylinders and push claws close.	DO10_01_ClawCylinder1_Open DO10_03_ClawCylinder2_Open button lights up and change to 1
Claw Close	To pull back two claw cylinders and pull back claws open.	DO10_02_ClawCylinder1_Close DO10_04_ClawCylinder2_Close button lights up and change to 1
Push Plate Up	To pull out the two push plate cylinders and push down the push plate.	DO10_05_FixCylinder1_Up DO10_07_FixCylinder2_Up button lights up and change to 1
Push Plate Down	To pull back two push plate cylinders and pull back the push plate.	DO10_06_FixCylinder1_Down DO10_08_FixCylinder2_Down button lights up and change to 1



#### NOTE!

After entering the main interface and touching any of the buttons, a warning message would shows prompting converting to manual mode.

Switch the control mode from auto mode to manual mode, the operations are now available. Touch Back to Main button, the interface returns to the main interface..

### 3.2.2.2. TCP edit

Note: The TCP configuration includes three elements: TASK, Storage type and Scope.

Their scopes are:

Task: T\_ROB1

Storage type: Persistent and variable

Scope: Task, Global and Local

If the scope and storage type of the TCP is not correct it can not be monitored.

Touch TCP tab, the following interface would shows:

ABB

Auto System\_VACUUM.. (CH-BEI-FT..) Motors On Stopped (Speed 100%)

Tool handle

Vacuum TCP

Current TCP: Select TCP

Tool	Load
trans x:	mass:
trans y:	cog x:
tran z:	cog y:
rot q1:	cog z:
rot q2:	inertia x:
rot q3:	inertia y:
rot q4:	inertia z:

Edit TCP Apply Back to Main





en1011057

The grey column indicates data columns are not editable. The white columns indicate they are in editable mode.

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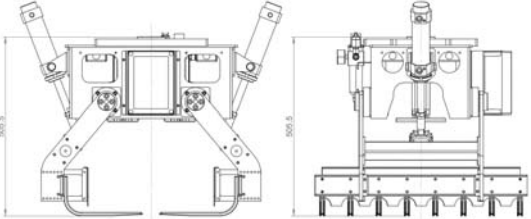
TCP operation

Action	Procedure						
Select TCP	<p>Touch Select TCP button, then the TCP list shows.</p> <div><div><div></div><div><div>Manual</div><div>System_VACUUM.. (CN-L-031..)</div></div><div><div>Guard Stop</div><div>Stopped (Speed 100%)</div></div><div></div></div><div>Select TCP</div><div>Select the TCP from list:</div><table><tr><th>Name</th><th>Value</th><th>TXT_LISTVIEW_MODULE</th></tr><tr><td>tPFPSVacGrip</td><td>[TRUE,[[0,0,300],[1,0,0,0]],87,[0...</td><td>Template</td></tr></table><div><div>Refresh</div><div>OK</div><div>Cancel</div></div></div> <p>en1011058</p> <p>Select the TCP needed, and touch OK. The related parameters of the TCP are automatically loaded into the Tool field on the left and the Load field on the right.</p>	Name	Value	TXT_LISTVIEW_MODULE	tPFPSVacGrip	[TRUE,[[0,0,300],[1,0,0,0]],87,[0...	Template
Name	Value	TXT_LISTVIEW_MODULE					
tPFPSVacGrip	[TRUE,[[0,0,300],[1,0,0,0]],87,[0...	Template					
Edit TCP	<p>Choose the “Edit TCP” button, the column turns from grey to white indicating the content is editable. Choose one field, a soft keyboard shows which is used to input TCP data.</p> <div><div><div><div>7</div><div>8</div><div>9</div><div>←</div></div><div><div>4</div><div>5</div><div>6</div><div>→</div></div><div><div>1</div><div>2</div><div>3</div><div>⌫</div></div><div><div>0</div><div>+/-</div><div>.</div><div></div></div><div><div>OK</div><div>Cancel</div></div></div></div> <p>en1011059</p> <p>The soft keyboard consists of 0-9 numbers, positive/negative sign (+/-), decimal point, and an arrow left/right symbol used to move cursor left/right. The cross button has the function of backspace. For data description and valid data scope, see Table TCP Parameter description, After the editing, touch OK to confirm the editing. Then touch Apply, the editing is saved which is indicated by the data input columns turning grey.</p>						

*Continued***TCP Parameter description**

Type	Parameter	Description
Tool	trans x	The X-value of TCP position in mm
	trans y	The Y-value of TCP position in mm
	trans z	The Z-value of TCP position in mm
	rot q1	The q1 value in the quaternion (q1, q2, q3, q4) of the orientation of the tool coordinate system
	rot q2	The q2 value in the quaternion (q1, q2, q3, q4) of the orientation of the tool coordinate system
	rot q3	The q3 value in the quaternion (q1, q2, q3, q4) of the orientation of the tool coordinate system
	rot q4	The q4 value in the quaternion (q1, q2, q3, q4) of the orientation of the tool coordinate system
Load	mass	The weight of the tool in kg.
	cog x	The X-value of the center of gravity of the tool load (x, y and z) in mm
	cog y	The Y-value of the center of gravity of the tool load (x, y and z) in mm
	cog z	The Z-value of the center of gravity of the tool load (x, y and z) in mm
	inertia x	The X-value of the moments of inertia of the tool relative to its center of mass around the tool load coordinate axes in kgm2
	inertia y	The Y-value of the moments of inertia of the tool relative to its center of mass around the tool load coordinate axes in kgm2
	inertia z	The Z-value of the moments of inertia of the tool relative to its center of mass around the tool load coordinate axes in kgm2

**Default TCP of FlexGrippers**

FlexGripper type	Default TCP value	Default TCP location illustration
FlexGripper per-Claw	[TRUE, [[0,0,505.5], [1,0,0,0]], [57, [5.3,0.5,230.9], [1,0,0,0],0,0,1.735]]	 en1011080

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*Continued*



**NOTE!**

The default TCP is only valid when no product is gripped by the FlexGripper. After the product is gripped, the TCP location should be adjusted according to the new center of gravity.

If the user wants to add a TCP themselves, they can add a TCP in the program. Then the newly added TCP can be shown in the TCP list when tapping Select TCP in the TCP interface.



### 3.2.3. Tune

#### 3.2.3.1. Position Tune

The position tune function is used to fine tune the robot target location as the pick/place location and home location.

Note: The robot target configuration includes three elements: TASK, Storage type and Scope.

Their scopes are:

Task: T\_ROB1

Storage type: Persistent and variable

Scope: Task, Global and Local

If the scope and storage type of the robot target is not correct it can not be monitored.

Touch the Tune button in the FlexGripper UI main interface, and enter the Tune interface. By default, there are three robot targets listed: pPick, pPlace and pHome (For FlexGripper-Vacuum, there are three more targets: pPickPallet, pSearch and pSearchEnd).

ABB Manual System\_VACUUM.. (CN-L-031...) Guard Stop Stopped (Speed 100%)

Tune tool0 wobj0

Position tune Work object tune Test run

Select one robot target from the list to edit. Then press Apply.

Choose robot target:  
pPick

Add target Teach

Pos offset  
Increment: 0.1 0.5 1 5

X (mm): 0

Y (mm): 0

Z (mm): 0

Apply Back to Main

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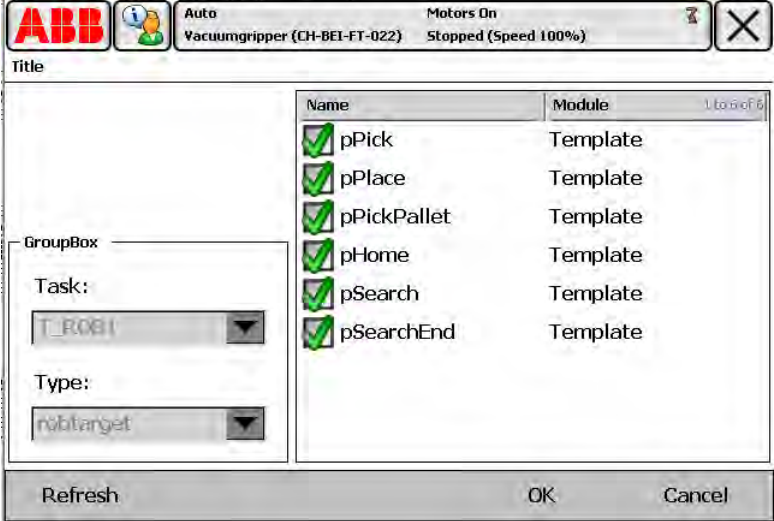
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### 3 FlexGripper UI

#### 3.2.3.1. Position Tune

*Continued*

#### Robot target edit

Action	Procedure
Add target	<p>Touch the Add target button, in the screen shown, the left side shows the target contribution, ie Task, Type, the right side shows the target list with the module described. Select the target needed, which is then ticked in the square before its name.</p>  <p>en1011061</p> <p>The targets listed are selected by default. Touch the target to remove the tick and deselect a target. Select OK, the selected targets are added to the Choose robot target column.</p>
Teach target	<p>Touch the Teach button, the selected robot target position is taught. Meanwhile the corresponding parameters of the TCP are automatically loaded into the Pos offset column.</p>
Target position offset	<p>After target teach, if the robot doesn't reach the exact position, the offset function can be used to fine tune the robot target.</p> <p>In the Pos offset column, touching the plus sign increases the position in mm and the minus sign decreases it. The increment unit can be adjusted in 0.1mm, 0.5mm, 1mm or 5mm. After the offset, touch Apply, the offset target is saved.</p>

### 3.2.3.2. Work object tune

A work object is a coordinate system used to describe the position of a work piece. The work object consists of two frames: a user frame and an object frame. All programmed positions will be related to the object frame. The object frame is related to the user frame and the user frame is related to the world coordinate system.

Note: The work object configuration includes three elements: TASK, Storage type and Scope. Their scopes are:

Task: T\_ROB1

Storage type: Persistent and variable

Scope: Task, Global

If the scope and storage type of the work object is not correct it can not be monitored.

Touch the Work object tune tab to enter the work object tune interface.

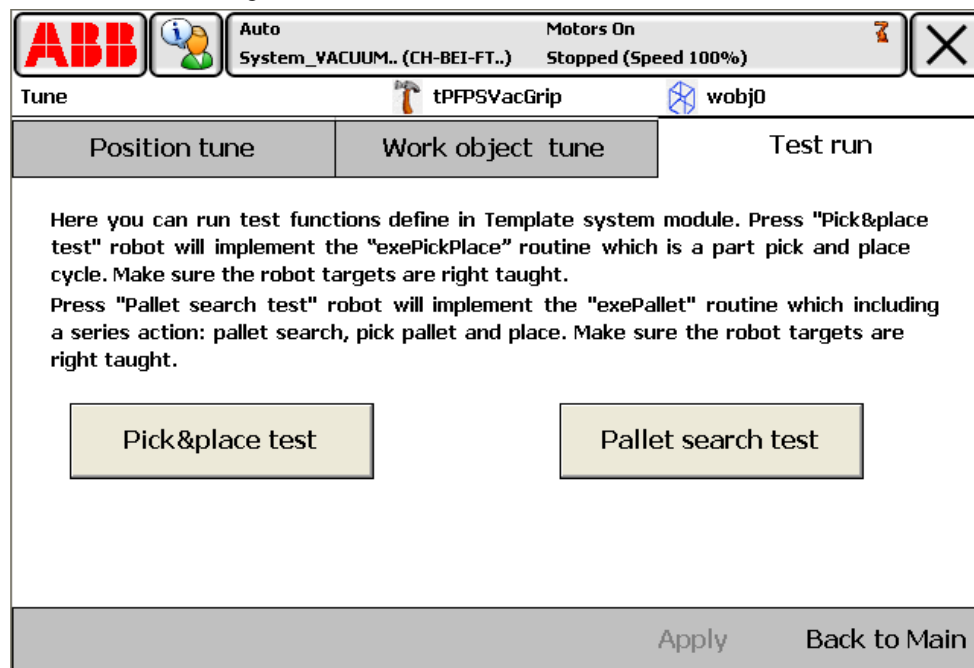
en1011062

Work object tune operation

Action	Procedure
Choose work target	Choose work object from the drop down list on the left. The work object (x, y, z) in mm shows up on the right.
Tune the work object	Touch the minus button to decrease the value and the plus button to increase the value. The tuning unit can be 0.1mm, 0.5mm, 1mm or 5 mm. After editing, touch Apply, the modification is saved.

#### 3.2.3.3. Test run

After the TCP edit, Position tune and work object tune, the functions defined in the Template system module can be tested in Test run. For FlexGripper-Claw, after entering the Test run interface, the following interface shows:



en1011065

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*Continued*

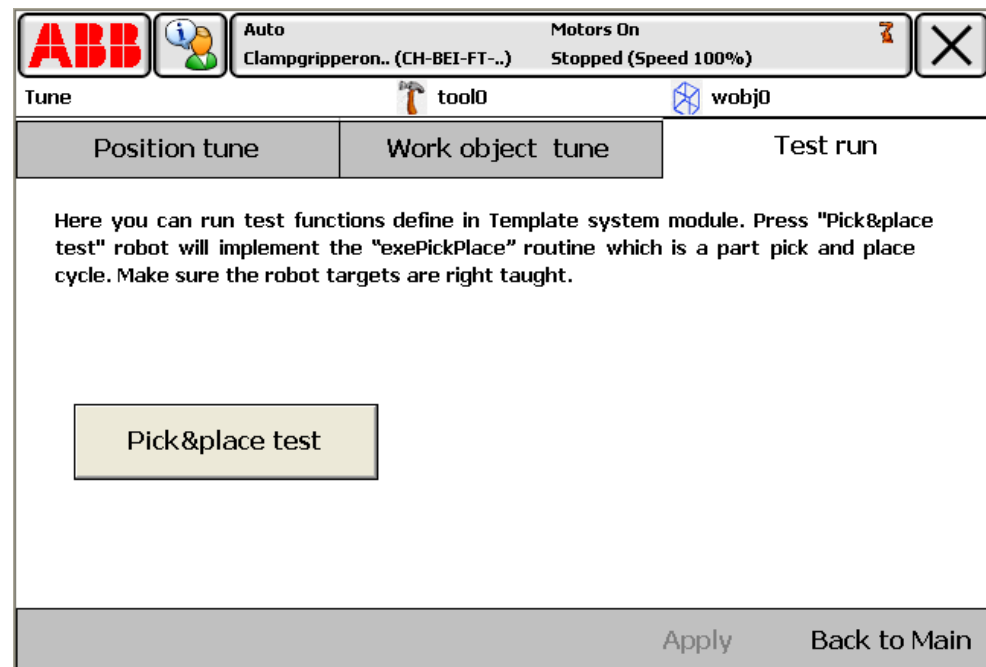
Press the Product Pick&place button, the robot implements the exePickPlace routing which includes a part pick and place cycle. Press the Pallet pick&place button, the robot will implement the exePallet routing which includes a series action: pallet search, pick pallet and place.

**NOTE!**

when pressing any of the test buttons, a message shows prompting you to press the run button. Press the run button. Before the test, the TCP should be edited according to the real payload in testrun.

In the pick operation and place operation, the loads of the FlexGripper are different. So the user must set the new TCP, payload and work object according to the different load situation.

For FlexGripper-Clamp (FlexGripper-Clamp 1, FlexGripper-Clamp 2) and FlexGripper-Claw, after entering the Test run interface:



en1011066

Press the Pick&place test button, the robot implements the exePickPlace routing which includes a part pick and place cycle.

Note: when pressing any of the test buttons, a message shows prompting you to press the run button. Press the run button. Before the test, the TCP should be edited according to the real payload in test run, and all the robot target positions must be accurate.

In the pick operation and place operation, the loads of the FlexGripper are different. So the user must set the new TCP, payload and work object according to the different load situation.

## **3 FlexGripper UI**

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### **3.2.4.1. Production monitor**

## **3.2.4. Production**

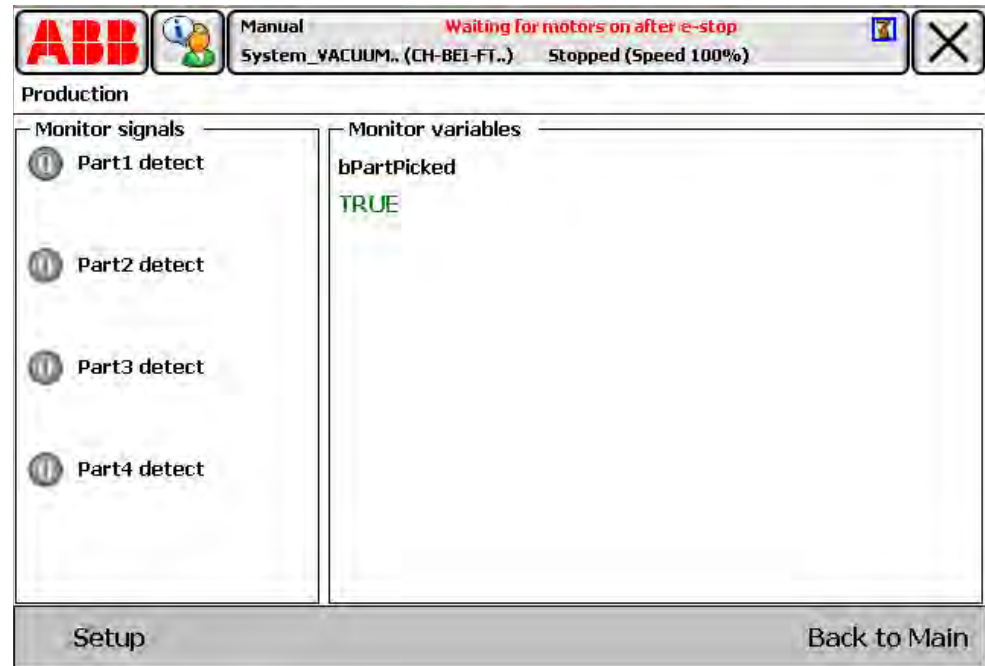
### **3.2.4.1. Production monitor**

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The production interface shows monitor signals on the left and monitor variables on the right. Users can monitor the production by the status of signals and variables. Users can check if the signal status or variable status is correct. If it is not in the right condition, check the corresponding equipment.

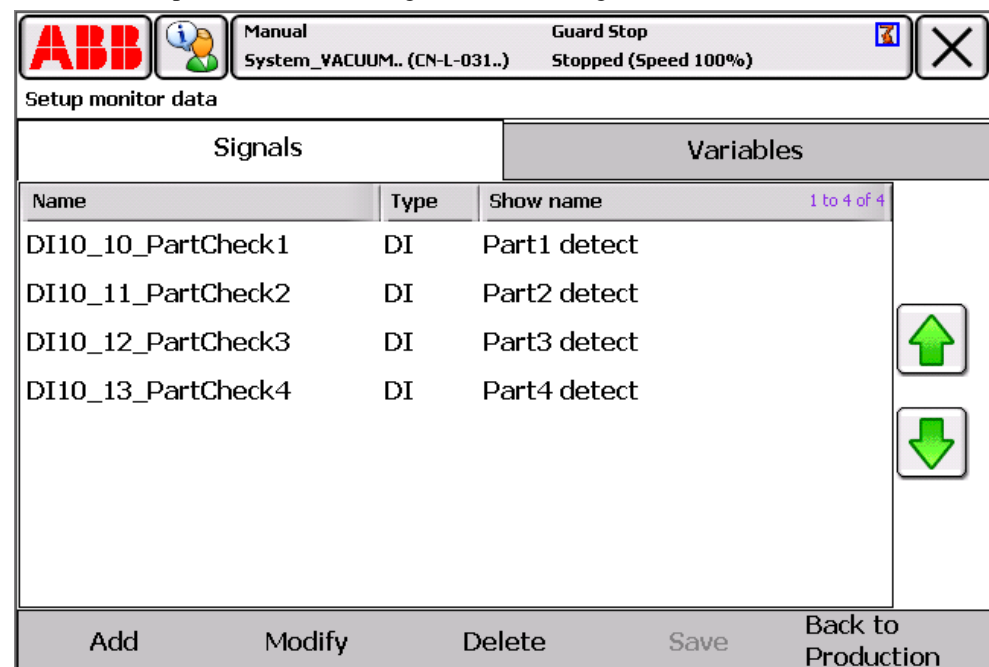
## 3.2.4.2. Setup

The production interface shows monitor signals on the left and monitor variables on the right. The monitoring signals and variables shown can be set by the Setup function.



en1011067

Touch the Setup button, the following interface with signal list shows.



en1011068

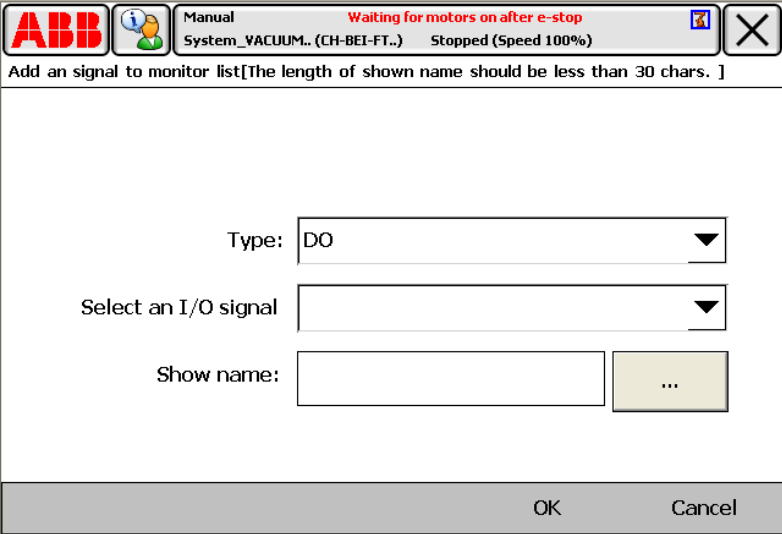
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After selecting one of the signals, using the two arrows buttons (see picture above) on the right to choose former signals or signals below.

Use the yellow double triangle/single triangle buttons to go to the first/last page or to move the page up/down.

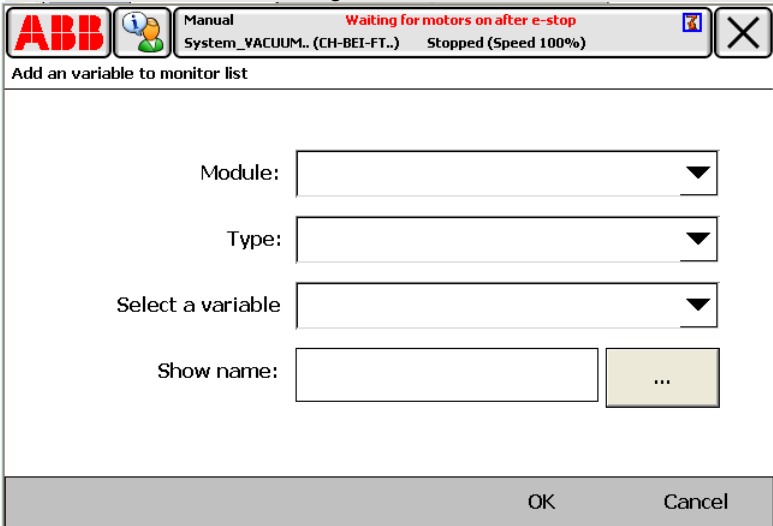
Signal edit

Action	Procedure
Add signal	<p>Touch Add button, then choose signal type, the signal to be added and edit its shown name by touching the button with an ellipsis sign.</p>  <p>en1011073</p> <p>A soft keyboard shows. Choose signal type for the signal to be added, edit its name by touching the button with an ellipsis. Type in the signal name. The signal name should be no longer than 25 characters which can only include numbers, letters and underline sign. Note: No more than 12 signals can be added.</p>
Modify signal	<p>Select the signal to be modified and press the Modify button. You can then modify its type, signal and name in the dropdown list or the soft keyboard. Press cancel if no modification is needed.</p>
Delete signal	<p>Select the signal to be deleted and press delete. The signal is then deleted from the monitor signal list.</p>

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## Variable edit

Action	Procedure
Add variable	<p>Touch Add button, the following interface shows:</p>  <p>en1011074</p> <p>Choose the module followed by the variable type to be added from the dropdown list. You can edit its name by selecting the button with the ellipsis. A soft keyboard shows with which you can enter the variable name.</p> <p>Note: The variable shown name should be no longer than 25 characters which can include numbers, letters and the underline sign.</p> <p>Note: No more than 12 variables can be added.</p>
Modify variable	Select the variable to be modified and press the modify button. The variable, its module, type and name can be modified in the drop dropdown list or by using the soft keyboard. Select cancel if no modification is needed.
Delete variable	Select the variable to be deleted and press delete. The variable is deleted from the monitor variable list.

When you have finished editing, select Save to save any changes. Press the Back to Production button to return to the Production main interface.

**NOTE!**

The variable configuration includes three elements: TASK, Storage type and Scope.

Their scopes are:

Task: T\_ROB1;

Scope: Global, Task and local

Storage type: only Persistent

If the scope and storage type of the variable is not correct it can not be monitored.

### 3.3. Trouble shooting

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#### Variable can not be monitored

Description	Can not monitor the variables
Possible reason	<ul style="list-style-type: none"><li>• The scope of variable is not correct</li><li>• The storage type of variable is not correct</li></ul>
Solution	<ul style="list-style-type: none"><li>• Make sure the variable and the storage type are correct</li></ul>

The valid scope of variables is:

Task: T\_ROB1;

Scope: Global, Task and local

Storage type: Persistent

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#### TCP can not be edited

Description	Can not edit the TCP
Possible reason	<ul style="list-style-type: none"><li>• The scope of the TCP is not correct</li><li>• The storage type of the TCP is not correct</li></ul>
Solution	<ul style="list-style-type: none"><li>• Make sure the scope and the storage type are correct</li></ul>

The valid scope of TCP is:

Task: T\_ROB1;

Scope: Global, Task and local

Storage type: Persistent and Variable

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#### Robot target can not be edited

Description	Can not edit the robot target
Possible reason	<ul style="list-style-type: none"><li>• The scope of the robot target is not correct</li><li>• The storage type of the robot target is not correct</li></ul>
Solution	<ul style="list-style-type: none"><li>• Make sure the scope and the storage type are correct</li></ul>

The valid scope of robot target is:

Task: T\_ROB1;

Scope: Global, Task and local

Storage type: Persistent and Variable

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#### Work object can not be edited

Description	Can not edit the work object
Possible reason	<ul style="list-style-type: none"><li>• The scope of the work object is not correct</li><li>• The storage type of the robot target is not correct</li></ul>
Solution	<ul style="list-style-type: none"><li>• Make sure the scope and the storage type are correct</li></ul>

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The valid scope of the work object is:

Task: T\_ROB1;

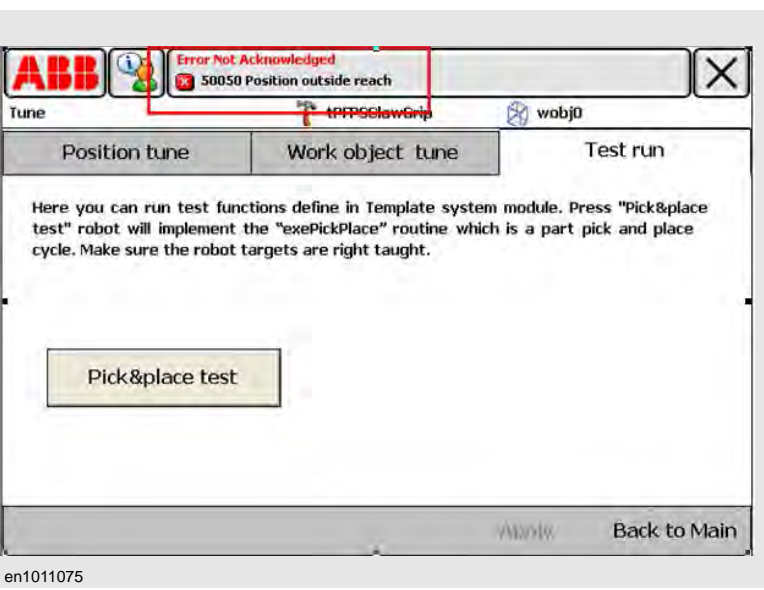
Scope: Global, Task

Storage type: Persistent and Variable

#### FlexGripper UI icon can not be displayed on the ABB main menu of the FlexPendant

Description	Can not display FlexGripper UI icon on FlexPendant
Possible reason	<ul style="list-style-type: none"> <li>The FlexGripper UI FlexPendant application is installed incorrectly.</li> <li>The FlexPendant Interface option is not selected when creating a robot system.</li> </ul>
Solution	Check if the FlexGripper UI option is selected for the current system from ABB main menu->SystemInfo->SystemProperties->Additional Option on the FlexPendant. If the option is not displayed in the list, reinstall the TrueView application.

#### Position out of reach

Description	
Possible reason	Robot target position is out of reach of the robot.
Solution	Check and change the robot target position to a valid scope.

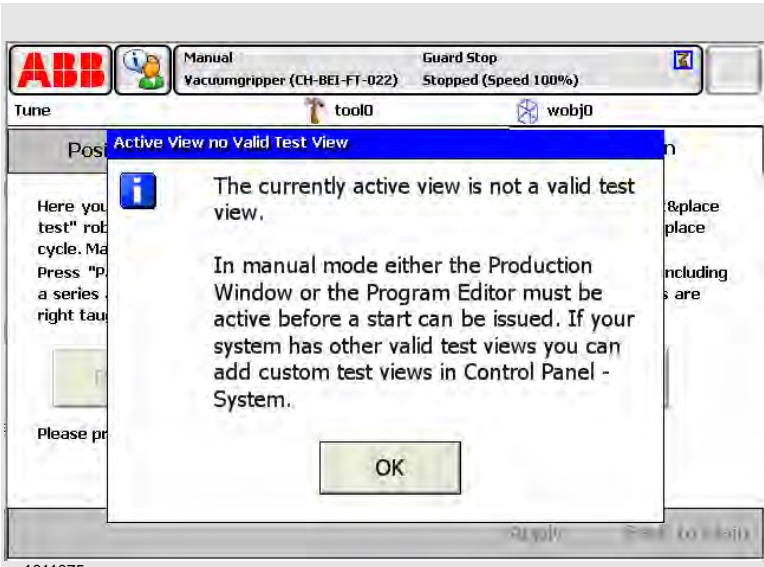
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## 3 FlexGripper UI

### 3.3. Trouble shooting

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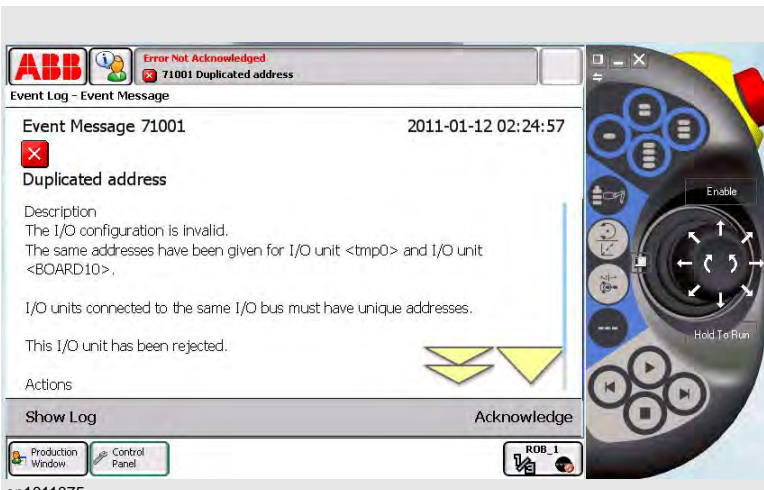
#### Active view no valid test view

Description	 <p>en1011075</p>
Possible reason	The current test view is not a valid test view.
Solution	Enter Control panel->Flexpendant-> AdditionalTestView, check if the test view of the FlexGripper UI is selected.

#### Two many views

Description	When all the 6 places of the task bar are occupied by views, a warning message box will pop up when clicking on the GUI icon.
Possible reason	Too many views are opened at the same time.
Solution	Close one or more of the views not in use.

#### Duplicated address

Description	 <p>en1011075</p>
Possible reason	Two I/O units with the same addresses name 'BOARD10'.

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Solution	Enter Control panel->Configuration-> Unit->BOARD10, edit the addresses name to BOARD11.
	Before software installation, edit the content 'DN_Address 10' to 'DN_Address 11' in EIO.cfg. For example, C:\Program Files\ABB Industrial IT\Robotics IT\MediaPool\FlexGripperUI\Sys-par\Claw\EIO.cfg.







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