INSTRUCTION MANUAL

Original version

Collaborative robot arm

Model: Arm 0810

Serial No.: Refer to Identification Plate on the robot and controller cabinet.
Generation: 1st generation
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1 Identification

1.1 Supplier information

Manufacturer: Kassow Robots ApS
Oliefabriksvej 57
2770 Kastrup

Phone: +45 32 16 08 10
E-mail: info@kassowrobots.com

1.2 Product description

Description: Collaborative robot arm
Model: Arm 0810
Serial No.: Refer to Identification Plate on the robot and controller cabinet.
Generation: 1st generation
Year: 2018

1.3 Document version

<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
<th>Date of issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK01</td>
<td>First version</td>
<td>Xx-xx 2018</td>
</tr>
</tbody>
</table>
1.4 Incorporation certificate

DECLARATION OF INCORPORATION OF PARTLY COMPLETED MACHINERY

[Directive 2006/42/EC, Annex II-B]

Manufacturer
Name: Kassow Robots ApS
Address: Oliefabriksvej 57
2770 Kastrup, Denmark
Phone: +45 32 18 08 10
Hereby declare that the partly completed machinery:

Partly completed machinery
Type: Arm 0810
Series number:
Generation: 1 st. generation
Year: 2018

Satisfies the following essential requirements of Machinery Directive 2006/42/EC in accordance with the sections in Annex I:

Applicable EHS/As of Annex I
1.1.2.a, 1.1.2.b, 1.1.2.c, 1.2.2, 1.3.1, 1.3.4, 1.3.5, 1.5.4, 1.5.8, 1.6.5, 1.7.1.2, 1.7.3, 1.7.4

It is also declared that the technical documents for this partly completed machinery have been compiled in accordance with Annex VII, Part B. The technical documents are delivered to market surveillance authorities when requested.

Directives
And where it is appropriate, complies with the provisions in following other directives:

Machinery Directive 2006/42/EF
EMC directive 2004/108/EC
Low Voltage 2014/35/EU

Standards
EN 60204-1:2006 - Safety of machinery - Electrical equipment of machines - Part 1: General requirements [IEC 60204-1:2006 (Modified)]

Requirements
This partly completed machinery must not be put into service until the final machine, which it is to be incorporated in, has been declared in conformity with relevant directives.

Responsible person for technical documents
Company: Kassow Robots ApS
Address: Oliefabriksvej 57, 2770 Kastrup, Denmark
Name: Kristian Kassow

Signature
Place [ ] Date [ ] Position [ ] Signature [ ]
## 2 General

| ![Book Icon] | Before the robot is commissioned, this instruction manual must be thoroughly read and understood! |
| ![Warning Icon] | This warning symbol indicates that special precautionary measures must be taken. If the safety precautions are not observed, it may lead to hazardous conditions and result in personal injury or damage to property. |
| ![Information Icon] | This symbol indicates that the following information is important. |
3 Definitions

3.1 Technical terms and abbreviations

In the following, the technical terms and abbreviations used in this instruction manual are described.

<table>
<thead>
<tr>
<th>Word</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructed</td>
<td>A person having received the necessary training to carry out programming of the robot in a safe and responsible way.</td>
</tr>
<tr>
<td>Operator</td>
<td>A person having received the necessary training to carry out daily operation and cleaning.</td>
</tr>
</tbody>
</table>

3.2 Manuals for the robot arm

<table>
<thead>
<tr>
<th>Manual</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>This instruction manual</td>
<td>- Part of the robot arm delivery</td>
</tr>
<tr>
<td>Controller cabinet</td>
<td>- On request</td>
</tr>
<tr>
<td>Software manual</td>
<td>- On request</td>
</tr>
</tbody>
</table>

3.3 Precautionary measures

In case specific tasks require the use of personal protective equipment, this requirement is to be observed by all occupational groups.

During cleaning and maintenance, the robot arm must be put in a safe condition.

It is the integrator's responsibility to provide a circuit breaker and a description of how other connections like e.g. air supply etc. is disconnected.

3.4 Function description

The industrial robot arm is a robot system used for manufacturing. It is automated, programmable and capable of movement up to seven axes.

The typical application of the robot is welding, painting, assembly, pick and place, packaging and labeling. All accomplished with high endurance, speed, and precision.
4 Product description

4.1 Robot arm construction

The robot consists of the robot arm, a controller cabinet, a teach pendant and the connection cables between those.

Figure 1: Picture of the Robot arm

1. The robot arm consists of 7 geared servo motors connected mechanically by machined extrusions and castings and connected electrically by a 48V power supply bus and a serial communication bus.

2. The controller cabinet house various power supplies; the computer which coordinated the
movements of the 7 geared servo motors; the I/O board, which has a range of safety related functions and allow various electrical connections; the relays on the robot arm power supply bus; connectors for connecting to wall socket, robot arm and teach pendant and an E-stop button, a Protective stop button and a play/pause/resume toggle button.

3. The teach pendant / HMI which allows the user to program the robot system and which house two buttons, which when pushed allow the user to manually manipulate the robot arm, and an E-stop button, a Protective stop button and a play/pause/resume toggle button.

The wires connecting the system components are: Two wires with connector in both ends between robot arm and controller cabinet; one wire fixed to the teach pendant and with a connector in the other end, to connect teach pendant to controller cabinet and one wire with a 3P CEE female connector in one end and male connector in the other end, to connect wall socket with controller cabinet.

4.2 Proper use

It is only intended to be incorporated into or assembled with other robotry or other partly completed robotry or equipment, thereby forming one completed robotry to which 2006/42/EC applies.

Operating Modes:

The robot can be operated manually and automatically. It is automated, programmable and capable of movement up to 7 axes. The typical application of the robot is including welding, painting, assembly, pick and place, packaging and labelling. All accomplished with high endurance, speed, and precision.

Only the use of appropriate and standardized tools is considered. The robot is intended for use in an indoor industrial environment.

Capacity: 10 kg
Reach: 85 cm

The robot is intended only for professional use. The robot is intended to be used by persons with knowledge and experience in the use of a collaborative robot.

This documentation is aimed at Instructed persons with the following knowledge and skills:

• Knowledge of mechanical engineering

• Knowledge of electrical and electronic systems

• Knowledge of the robot controller system

The robot is intended to be programmed and maintained by a skilled/qualified user following the instructions given in the operating instruction manual. The robot may only be used under the operating conditions foreseen in this Instructions manual. The robot is only intended as a collaborate robot. Any other use beyond such operating conditions is deemed not conform to the Instructions manual and the manufacturer cannot accept any liability whatsoever for subsequent loss or damage.
4.3 Improper use

Any use or application deviating from the proper use is deemed to be impermissible misuse. The robot is not intended to be used at locations having an explosion or fire hazard. The robot is not intended to be used outside.

4.4 Modification

Any alterations or additions to the robot must be filed in the technical documentation of the robot. If necessary, the Declaration of Conformity must be updated and signed again. The responsibility for this rests with the owner of the robot.

4.5 Before the commissioning

Before the commissioning of the robot, it is controlled that all parts have been installed according to the documentation and instructions from the manufacturer.

Before the commissioning of the robot, all relevant personnel must be instructed in the documentation of the robot – including instruction manual, maintenance instructions, diagrams etc.

4.6 Use limits

The integrator must define user limits according to the specific task where the robot arm is to be used. Special attention must be taken according to EN ISO 12100 pk. 5.3.2

4.7 Space limits

The robot must be placed on a solid surface that can hold up to minimum 1000 Nm. Not to be used in a wet environment.

4.8 Time limits

The robot is intended for an operational life of 20 years.
5 Robot arm specifications

5.1 Specification table

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement (length x width x height)</td>
<td>[mm]</td>
<td>1180 x 280 x 200</td>
</tr>
<tr>
<td>Weight</td>
<td>[kg]</td>
<td>24</td>
</tr>
<tr>
<td>Power consumption</td>
<td>[W]</td>
<td>2350</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>[VAC]</td>
<td>200-240</td>
</tr>
<tr>
<td>Supply current</td>
<td>[A]</td>
<td>16</td>
</tr>
<tr>
<td>Supply frequency</td>
<td>[Hz]</td>
<td>50/60</td>
</tr>
<tr>
<td>Max. speed</td>
<td>[mm/s]</td>
<td>2500</td>
</tr>
<tr>
<td>Max. static force on tool flange center (payload)</td>
<td>[kg]</td>
<td>10</td>
</tr>
<tr>
<td>Max. static torque on tool flange center</td>
<td>[Nm]</td>
<td>25</td>
</tr>
<tr>
<td>Reach</td>
<td>[mm]</td>
<td>850</td>
</tr>
<tr>
<td>Required bed plate flatness</td>
<td>[mm/m]</td>
<td>0.5</td>
</tr>
<tr>
<td>Sound level</td>
<td></td>
<td>Below 70dB (A)</td>
</tr>
</tbody>
</table>

Figure 2: Specification table
5.2 Payload diagram

Due to the static torque limit of the wrist joints, the allowed payload is reduced if the distance between the payload Center of Gravity and the Tool Flange Center is beyond 150mm. The payload diagram shows the allowed payload as a function of this distance.

![Payload diagram](image)

**Figure 3: Payload diagram**
5.3 **Robot Frames, kinematics and mechanical interfaces**

![Robot arm dimensions diagram](image)

**Figure 4: Robot arm dimensions**
5.4 Stopping distance

The robot stopping distance depend on the load, speed and configuration of the robot. The diagram below gives an approximate value for stopping distance at 1m/s Tool Flange Center speed.
6 Safety information

6.1 Safety functions

Safety functions evaluate external and internal signals of the whole system which can act immediately to halt the robot or cut him loose from power if necessary.

Before operating the robot, the operator must seek information about the safety functions and protection equipment of the robot.

The use and operation of the robot must only be initiated when all safety functions are fully present and in an operable condition!
Defective safety functions and protection equipment may lead to loss of safety and hazardous situations.

In case defective safety functions and protective equipment is found, do the following:

1. Stop the robot immediately.
2. Make sure the robot cannot restart by disconnecting the supply sources to the robot.

The following safety and protection devices are installed on the robot:

**Emergency stop, function**

The emergency stop function is a supplementary safety function, with the purpose of preventing a source of hazard from arising caused by the improper use of the robot. As an example, a source of hazard could result in personal injury, damage to the robot or ongoing work, or it may arise because another safety function is failing.

The emergency STOP buttons are present at both Teach pendant and Robot cabinet. These are used to initiate a robot motion or other potentially hazardous situation.

While Emergency buttons provide immediate interaction and safety for the operator, the internal variables are also continuously monitored to avoid any internal damage to the system.

The integrity guards check for the basic life conditions of the system, including temperatures, voltage or...
The emergency STOP always provoke immediate halt of the robot, followed by the power cut to all executive parts of the robot.

The emergency stop must be tested at least every 12 months. The emergency stop is stop category 3 PL d according to EN 10218-1:2011

### Components included in the safety function.

<table>
<thead>
<tr>
<th>Input part</th>
<th>Logical part</th>
<th>Output part</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>L</td>
<td>O</td>
</tr>
</tbody>
</table>

- **Emergency stop push button** – Teach Pendant,– Controller Cabinet
  - The emergency stop push-button is shaped like a red mushroom switch on a yellow background. Emergency stop of the robot is made by activating the emergency stop push-button.
  - The emergency stop push-buttons are placed at the following places of the robot:
    - The emergency STOP buttons are present at both Teach pendant and Controller cabinet.

The component is fault excluded and is considered to always work when the emergency stop push-button is activated.

- **I/O Board**
  - I/O Board monitoring the safety function.
  - The service life of the controller is 20 years.
  - The safety function i.e. the robot must not be used beyond 20 years. The use beyond 20 years is conditional to the fact that the relevant components are replaced by new components of identical or improved properties than the original ones.

- **Power relays.**
  - Disconnects the power supply to the moving parts.
  - The maximum number of couplings per annum is assumed to be 52.
  - The service life of the components (T10d value) is calculated based upon the number of couplings.
  - An increased number of couplings may affect the performance of the safety device.
The Protective STOP can be used interactively by the operator to pause and continue the running program. Internally, the system can also provoke the Protective STOP to apply limit energy guards upon the system when some conditions are met and warn the user about the case. Depending on the type of diverging values, the program can continue its normal operation when the Protective STOP is released.

There are 2 types of protective stop.

**Protective stop Path:**

The robot arm as fast as possible without deviating from it trajectory. The program can be resumed by releasing the protective stop button and then press play on the teach pendant screen or pause play buttons.

The performance level achieved is PLd.

**Protective stop Fast:**

Each robot joint utilizes full stopping torque power stays un robot but is limited by a safe power system. The program cannot be resumed but needs to be started from beginning by pressing unlock un the teach pendant screen and then press play on the teach pendant screen or pause play buttons.

The performance level achieved is PLd.

For programming refer to I/O-Board User Interface in the software manual

**The protective stop must be tested at least every 12 months.**

The protective stop is stop category 2 PL d according to EN 10218-1:2011

**Displays and alarms**

When activating an emergency stop, the status will appear on the teach pendant:

"Emergency stop of the robot is activated"

When activating an P stop, the status will appear on the teach pendant:

"P stop of the robot is activated"

**Operating conditions**
The work of the emergency function is unchanged throughout any operation modes of the robot.

**Maintenance and test**

The emergency stop function must be activated and tested before commissioning after each installation or reinstallation of the robot.

**As a minimum, the emergency stop function must be visually checked and activated at least every 12 months.**

The safety function complies with EN ISO 13849-1:2015.

The emergency stop function is constructed as a category 3, performance level d.

Additional emergency stops added to the robot, must also be constructed as performance level d.

The following safety-oriented functions are preconfigured and can be integrated into the system via the safety interface of the robot controller:

Operator safety (= connection for the monitoring of physical safeguards)

- External Emergency stops (Electro mechanic switch)
- External Protective stops (Electro mechanic switch)
7 Handling

This section describes how the robot is to be operated in various situations. Where specific personal qualifications are required, this will be described.

Installation and dismounting of the robot must be carried out by qualified and trained personnel. To prevent accidents, all safety instructions must be observed.

7.1 Transport and storage

The robot arm, controller, teach Pendant, cables and documents is delivered by Kassow Robots in two suitable boxes which can be handled safely by one person.

The delivery boxes can also be used for safe storage if necessary.

7.2 Unpacking and general handling of the robot arm

When unpacking the robot, it is to be controlled if damage to the robot has occurred during the transport. Damage affecting the functionality or safety of the robot must be repaired before the robot is put into operation.

Unpacking the robot arm:

The robot arm can be taken directly from box to the mounting platform by two persons where one is holding the robot arm while the second person is mounting the robot base with four screws.

If the robot arm need to be stored temporally, after removed from the box, it should be stored on a soft surface.

The robot controller can be placed directly on the floor or mounted on the wall using the wall mounting brackets.

The teach pendant can be placed in teach pendant bracket in the front of the controller or on a wall.

Cables are connected after the controller, and robot arm is mounter correctly.

7.3 Safe disposal of packing material and robot arm

Packing materials, robot arm, control cabinet and pendant must be deposited according to local law.

7.4 Installation and assembly of the robot arm
7.4.1 Electrical installation

The connection of the robot must only be made by an authorized electrician. During the installation, the law of the country must be followed.

For the proper connection and information of voltage and power consumption, see chapter 6.1 specification table.

The robot is supplied with power via the outlet.

The circuit breaker of the robot is placed at the left side of the controller cabinet.

7.4.2 Connections

Various tools can be mounted on the mounting flange on the robot.

![Figure 5: Robot arm tool flange](image)

Figure 5: Robot arm tool flange


8 Operating the robot arm

In the following it is described how the robot arm is operated in an appropriate and safe way. The safety instructions described in this instruction manual e.g. chapter 7 must be observed.

Refer to the Software Manual and Controller Cabinet Documentation for detailed descriptions.

8.1 Safe operation

Integrator of the collaborative robot must perform an overall Declaration of Conformity (CE) regarding the work area. Special attention must be payed regarding the tools applied to the collaborative robot and external emergency stop and safety functions.

8.2 Error situations

Errors are communicated on the teach pendant. Any error description can be accessed pushing the red triangle on the upper right side of the display, POS 8 on figure 6.

Refer to the Software Manual for details.

8.2.1 Hard Reset of Tablet
If teach pendant is frozen beyond recovery from software, a hardware reset can be necessary. The procedure are simple:

Locate the small ø2mm hole found on the left side of the teach pendant. Use the small tool delivered with the robot* and guide this into the hole. Push it in until you feel that the momentary button inside the cover is pushed. Push it in, until the restart option present itself on the screen and choose this option. The teach pendant will restart and automatically boot and open the robot controller screen. You have successfully restartet the teach pendant.

If the restart option does not present itself, keep pushing (8 sec) until the teach pendant is shut down . Release the button and press again one time to start the teach pendant. The teach pendant will restart and automatically boot and open the robot controller screen. You have successfully restartet the teach pendant.

*If this tool is lost, you can us the shank of a 2mm drillbit (Do not use the sharp end of the drill!).

8.3 Signals to be observed

A button on the teach pendant show shows different states of the robot.
- **Green:** Robot is operating normally
- **Blinking green:** Robot is holding its position/is paused, program can be resumed
- **Red:** Emergency stop / Protective stop is activated
- **Yellow:** RC detected an unnormal situation
- **Blue:** Resets robot after emergency stop

**Figure 7: Teach pendant**

### 8.4 Accessories

If the robot arm is to be placed in extreme dusty, wet, hot or cold environments, please contact Kassow Robots for advice on additional equipment.

### 8.5 Service intervals, maintenance and cleaning

The daily tidying-up and cleaning of the robot and its surroundings is made by the operator or specially trained cleaning staff. During this work, the same requirements for the use of tools and personal protective equipment apply as for the operational work.

It is recommended to clean visible and reachable surfaces which are contaminated, with moist cloth with soap.

It is recommended to perform service on the robot at least every 12 months.

### 8.6 List of spare parts and consumables
Insert list of spare parts or refer to an annex.

No changes may be made to the robot arm control cabinet. Should parts be replaced, serviced and maintained, this must be done by Kassow Robots or through their service partners.

Sikkerheds relateret dele skal med i reservedelslisten

Nødstops tryk samt kontakter