

Load Limiter

(with Manifold)

ULD-100

ULD-160

ULD-300

Version 2.0 Last revision November 2012



Dear customer,

Thank you for the confidence that you have placed in our company by purchasing an IPR load limiter.

Every load limiter is fully assembled in the plant and is subject to an individual test. This includes examining their complete proper functioning and safe working.

These instructions illustrate how the load limiter is set up and operates. In addition, all the main details for assembly, commissioning and maintenance are clearly arranged.

Please carefully read through the contents.

Do directly contact us if any of your questions are not answered in these instructions. We are at the following address.

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Translation of the original assembly instructions

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1. General

1.1. Information on these instructions

These instructions enable the load limiter to be safely and effectively handled. These instructions form part of the machine and should be kept close to it so that the personnel responsible can easily access them.

The personnel involved must have carefully read through these instructions and understood them before beginning any work. Keeping to all the safety and handling pointers in these instructions is the basis on which work is done safely.

Also applying are any local health & safety regulations and the general safety conditions where the machine is used.

Illustrations in these instructions are there to assist in basic understanding; they may deviate somewhat from the actual design.

Also follow the generally valid, statutory and other binding regulations of European and national legislation as well as the accident prevention and environmental protection provisions in force in your country.

1.2. Terms of the guarantee




The terms of the guarantee can be found in the manufacturer's general terms & conditions of business. Please turn to our Customer Service (for contact data see cover) if any matters are not clear.

2. Safety

This section provides an overview on all the important safety aspects for protecting people and for reliable, no-trouble operations. Further task-related safety instructions are included in the sections on the service life phases.

2.1. Symbol explanations

Safety instructions are identified by symbols in these instructions. The safety instructions are introduced by signalling words expressing the degree of hazard involved.

	CAUTION! Points to a possible dangerous situation which - if not avoided - may result in either minor or slight injuries.
	NOTE! Points to a possible dangerous situation which - if not avoided - may result in either material or ecological damage.
	This symbol brings useful tips and recommendations to one's notice as well as information on efficient, no-trouble operations.

2.2. Use as intended

The load limiter ULD is an aid in detecting mechanical overloading, e.g. as a result of crashes at commissioning, in the case of program changes or in normal operation and issues an electrical signal to the robot.

Load limiters are not ready-to-use machines as envisaged under the EU Machinery Directive. Load limiters are solely for fitting/attaching to machinery and equipment.



NOTE!

You must use this load limiter exclusively in accordance with the operating conditions and performance specifications established in these instructions.

2.3. Inappropriate use

Any other use or one going beyond that described in the "Intended Use" chapter is deemed to be inappropriate and will void all warranty or guarantee claims.

It is the owner - and not the manufacturer - who accepts liability for damage resulting from this.



NOTE!

The load limiter must not be used in any explosive environment.

2.4. General risks

The load limiter was state-of-the-art manufactured at the time of delivery. Even so, dangers could still proceed from it if the safety information listed here in these instructions is not followed.

- The personnel involved must have carefully read through these instructions and understood them before beginning any work.
- The instructions must always be available for all users where the load limiter is deployed.
- These instructions are also to accompany the load limiter if it is handed over to third parties.
- Do not delve into moving components or handle them during on-going operations.
- Never open protective covers under ongoing operations.
- Only authorized specialist personnel - outside the danger zone - are allowed to carry out any work such as assembly, commissioning, operating, dismantling and maintenance.
- Before any work is begun on the load limiter, the energy supply needs to be disconnected and the line system relieved of pressure. Secure the system against being unintentionally reactivated for the duration of the work.
- Ensure during commissioning that all pneumatic connections are either allocated or firmly closed.

2.5. Owner obligations

Together with the safety instructions in these instructions, the valid safety, accident prevention and environmental protection regulations in force where the machine is used must be adhered to.

As part of his obligation to exercise due care, the owner is to ensure that:

- The load limiter is used as intended
- During the entire period of use of the machine a check is to be made on whether his operating instructions comply with the ongoing status of the standards & codes and, if necessary, he is to adapt them.
- The responsibilities for installation, operation, fault rectification, maintenance and cleaning are clearly settled and laid down.
- All those dealing with the machine have both read these instructions and understood them. In addition, he has to regularly train the personnel involved and inform them as to hazards/risks.

2.6. Requirements placed on the personnel

The variety of tasks described in these instructions place differing requirements on the qualifications of those performing these tasks.

Only appropriate specialist personnel or a duly instructed person under the supervision of specialist personnel are allowed to carry out any work such as assembly, commissioning, operating, dismantling and maintenance.

In view of his technical training, knowledge, experience and knowledge of the relevant standards and regulations, the specialist is in a position to perform the work he has been entrusted with and - on his own - to recognize/avoid any hazards.

3. Specifications

(Please refer to the ongoing catalogue or Internet for specifications of the individual load limiters)

3.1. General basic data

Min. operating pressure:	2 bar
Max. operating pressure:	10 bar
Temperature range:	5 °C to 80 °C (higher if request ed)
Drive:	pneumatic, no oiled air!
Material:	Casing of high-strength aluminium hard-coated/ partly hardened steel/ Operating parts of hardened tool-steel
Tolerance Data Thread:	+/- 0.1mm
Alignment Pin Hole:	+/- 0.02mm

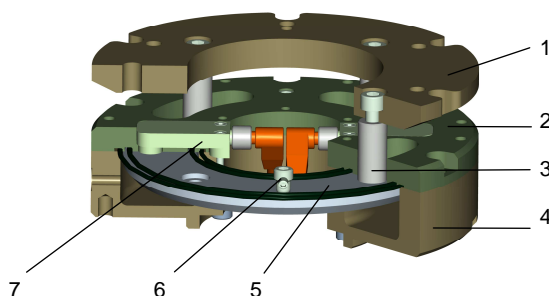
3.2. Operating conditions

The working environment is not to contain any dirt, dust, spray or vapours. The machine is to be used at temperatures between 10 °C and 40 °C.

The maximum (non-condensing) relative air humidity is to be between 10 % and 70 %.

4. Setup and function

4.1. Overview



1	Tool side	5	Piston
2	Cover	6	Adjusting Screw
3	Column	7	Sensor ULD
4	Housing		

4.2. Brief description

Robot and tool plate are held pneumatically in position and from under normal conditions of work a rigid unit. The release forces and/or moments are given by the adjusted air pressure. In case of an overloading the adapter flange will give way. A sensor detects deflection and gives a signal to the robot control, which stops the robot unit. When the collision is eliminated, and the tool brought again into vertical position, the unit can be centered manually in initial position over the two inserted adjusting screws.

ULD Load Limiter offer many advantages:

- Protects the robot from overloadcaused by collisions
- A switch signals the robot to stop if an overloading occurs
- Easy and precise manual resetting into the starting position
- The overload threshold value can be variable adjusted pneumatically in a wide range
- High repeatability
- Specially designed for robots and gantries with internal cable routing
- Easy transfer of signal and supply lines
- Data and supply lines are protected against external damage

The load limiter, ULD, is mounted between the robot arm and the robot tool; when positioned between the tool holder flange of the robot and the tool holder flange of the ULD, it forms an exactly aligned and parallel connection.

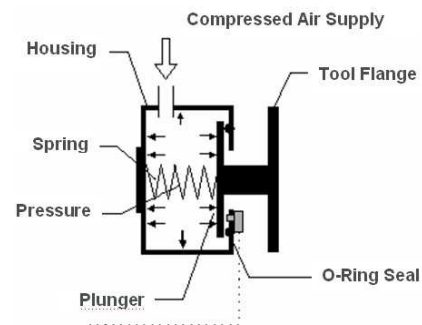


Fig.: Principal of functioning of load limiter

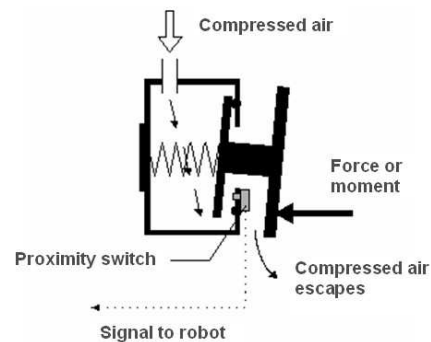


Fig.: Principal of functioning of load limiter after a collision

In the case of mechanical overloading (due to compressive force or overturning moment onto the columns), the plunger is displaced and the compressed air in the load limiter's pressure chamber escapes.

Built-in proximity switches detect the deflection and issue an electrical signal to the robot. The release forces or release moments are dependent on the size and can be set by means of the air pressure.

Overload types

In principle, if the robot collides with an obstacle, three types of overloading occur.

Moment overloading

Moment overloading occurs if the robot with the tool collides laterally with an obstacle.

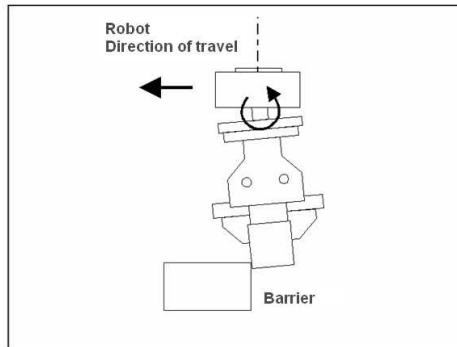


Fig.: Deflection resulting from moment overloading

Axial overloading

Axial overloading occurs if the compressive force in the z-direction to the load limiter exceeds the overload threshold value.

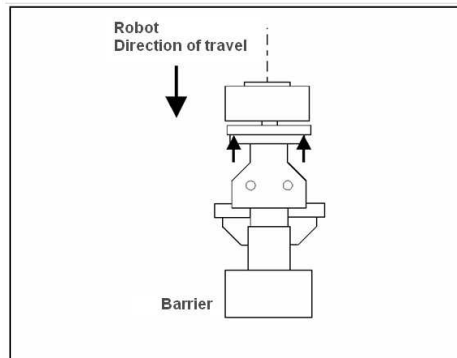


Fig.: Deflection resulting from axial overloading

Torsion overloading

Torsion overloading occurs in the case of a rotation round the z-axis when the maximum torsion moment is exceeded.

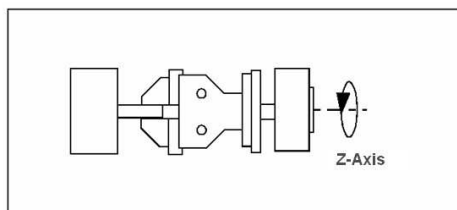


Fig.: Deflection resulting from torsion overloading

5. Transport, packing, storage

5.1. Transport

Immediately check on the delivery when received as to completeness and any transport damage.

Proceed as follows if there are signs of external damage:

- Do not accept the delivery or only under reservation.
- Note down the extent of damage on the transportation documents or on the forwarder's delivery note.
- Initiate the complaint procedure.



Object to any shortcoming as soon as it is discovered. Claims for damages can only be filed within the valid times set aside for complaints.

Transportation temperature -20 °C to 65 °C.

Protect against external impact (jolt, blow, vibration).

5.2. Packing

The packing is to protect the components up to the assembly stage from transportation damage, corrosion and other kinds of damage. Thus, the packing is to be left intact and only removed just before actual assembly.

Only recyclable materials are used for the packing.

Dispose of packaging materials in accordance with the respectively valid statutory regulations and local requirements.

5.3. Storage

Store packs under the following conditions:

- Do not store outdoors.
- Store at a dry and dust-free location.
- Do not expose to corrosive media.
- Protect from direct sunlight.
- Avoid mechanical shocks.
- Temperature for storage: 15 °C to 35 °C.
- Relative air humidity: max. 60 %.
- In cases of storage exceeding 3 months, regularly check on the general condition of all the parts and packing. If need be, either recondition the conservation protection or renew it.



Information may also be on the packs which extend beyond the requirements set out here. They are to be correspondingly kept to.

6. Assembly and commissioning



CAUTION!

Before assembling the load limiter, the energy supply needs to be disconnected and the line system relieved of pressure.

Make a note of the safety instructions and general hazards listed on Page 2.

6.1. Assembly

The assembly drill holes and pneumatic connections can be taken from our ongoing catalogue.

The load limiter must only be fastened at the threads provided for the purpose. If needed, manufacture an appropriate adapter flange or acquire it from the manufacturer.

Tighten the assembly bolts with thread locking adhesive (e.g. Loctite 4052) or with Schnorr/Nord lock washers, as appropriate.

Provide compressed air at 2-10 bar.

Install pneumatic connections at the housing; close off any connections not needed.

Mount the load limiter system ULD on a robot with a connecting flange according to DIN/ISO 9409 only with a suitable adapter flange!

You can order an adapter flange for the respective robot type from IPR!

Mount the adapter flange on the robot's tool holder flange

Place the adapter flange on the robot's connecting flange and screw it tight (tighten the screws with the tightening torque that is necessary for the screws).

Fastening the load limiter on the adapter flange

Place the load limiter system ULD on the adapter flange and screw it tight (tighten the screws with the tightening torque that is necessary for the thread type).

Mounting the tool on the load limiter system ULD

The load limiter system ULD is fitted with a standardized tool holder flange according to DIN/ISO 9409.

If the tool to be mounted is not fitted with the same DIN/ISO 9409 connecting flange as the load limiter system ULD, a suitable adapter flange is necessary.

You can obtain the necessary adapter flange from IPR!

When mounting the tool on the tool holder flange of the load limiter ULD, observe the information in the operating or assembly instructions of the respective tool manufacturer.

Mounting the tool with an appropriate connecting flange

Place the tool's connecting flange on the tool holder flange of the load limiter ULD and screw it tight (tighten the screws with the tightening torque that is necessary for the screws)

Note that when mounting the load limiter ULD into an existing robot system, the following sizes of the robot system are changed:

- The size of the operating area and with this of the danger area!
- The tool load is increased by the weight of the load limiter ULD, the payload is reduced due to the increase in the tool load and the increased distance of the centre of gravity of the load of the interface between the minor axis and the tool (tool holder flange robot load limiter system ULD).

Pneumatic equipment installation:

- Provide a 5/2 way impULDe valve or 5/3 directional control valve
- Provide compressed air at 2 – 10 bar
- Fit the compressed air lines on the handling device/robot
- Install a non-return valve in the compressed air line as close as possible to the load limiter, ULD
- Follow the instructions provided by the robot manufacturer
- Protect the compressed air lines against kinking, excessive bending and possible tearing out when the full work envelope of the handling device is being used
- Mount the compressed air hose on the hose nozzle and screw it with a with union nut

Electrical installation:

The load limiter is fitted out with proximity switches.

The connection face and the robot manufacturer's information are to be noted for installation on a robot I/O card as undertaken by the operating company.

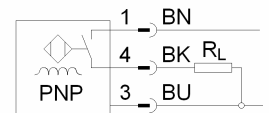


Fig.: Diagram proximity switches

Procedure:

- In the robot control, select the corresponding interrupt input for direct EMERGENCY-STOP function
- Fit the supplied load limiter connecting cable on the robot side
- Connect the connecting cable to the controller appropriately
- Insert the male connector into the socket and screw on the cap nut

Program cycle for resetting the load limiter:

Since you reset the load limiter ULD in the tool vertical position after a collision (z axis is vertical), you must run the robot arm to the corresponding position.

To automate this procedure, it is possible to provide an appropriate program cycle that can be activated manually when needed.



NOTE!

Programming must only be carried out by trained personnel with responsibility for the system.

6.2. Commissioning

- Check threaded unions and push-on connectors for firm seating
- Check freedom of movement of the electrical cables and pneumatic hoses for possible damaging edges.
- Check the air pressure
- Carry out assembly work in "Teach Mode" only
- No persons may be present in the danger area
- Secure robot against being unintentionally switched on.
- Determine the overload threshold value

To achieve effective functioning of the load limiter system, set the air pressure in the load limiter system ULD to the maximum torques and contact pressures that occur under normal handling and machining conditions.

- Inspect again the technical protection measures of the robot system.
- Check the robot's performance specifications with regard to the handling capacity and the payload.
- Start up the load limiter system
- Observe the safety information!
- If necessary, reprogram the robot

Switch on load limiter

- Remove operating personnel from the danger area
- Run the robot tool to the vertical position (set the robot to manual mode and run it manually into position or set up an additional program for positioning the load limiter and run the robot automatically to the reset position)

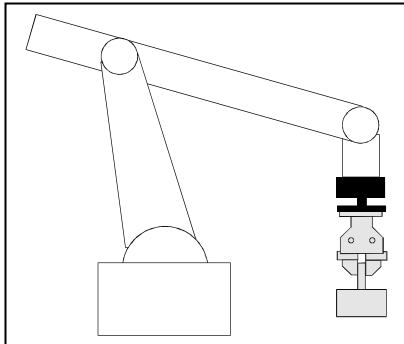


Fig.: The robot tool is in the vertical position

Position the load limiter

- Secure robot from being inadvertently switched on
- Turn the columns to the correct position until they lock in the centring
- Turn on the compressed air
- When the load limiter is correctly positioned, no more compressed air flows out
- If compressed air flows out, repeat the process

Switch on the robot

- Remove operating personnel from the danger area
- Run the robot to the starting position
- Put the robot into service

Put the robot into service

- Eliminating disturbances
- Robot stays in emergency stop condition
- Remove the obstacles that caused the collision from the robot operating area
- Check the robot system for damage and shut it down if necessary
- Run the robot to a suitable position
- Positioning the load limiter, Switch on the robot

7. Malfunctions

Immediately activate the emergency stop given malfunctions which pose a direct hazard for either people or material assets.

Establish reason for malfunctioning, inform the person responsible

The type of fault determines whether it is to be put right by oneself or by an authorised skilled worker.

Possible faults that could arise:

Air escapes from the load limiter

- Locking position not reached; turn the columns until the locking position is reached
- Foreign particles on sealing surface; remove the foreign particles
- Centring screw misaligned; adjust centring screw
- Examine load limiter seals and renew if necessary

Load limiter triggers too fast

- Air pressure set too low, increase air pressure

Signal for collision is issued but pressure is not released

- Sensor defective; if necessary, check sensor and replace it

Robot cannot be started

- Sensor connecting cable defective, replace if necessary

Robot no longer carries out positioning correctly

- Columns/centring screw dirty/worn-out; clean parts and replace if necessary

8. Maintenance and repairs



NOTE!

Make a note of the safety instructions and general hazards listed on Page 2.

8.1. Cleaning and upkeep



NOTE!

Corrosive cleaning agents could damage the load limiter seals and result in them ageing more rapidly.

Make a note of the following when cleaning and tending to the load limiters:

- Use protective caps and the like to firmly close all the openings
- Check that all connections are tight
- Use a metal cleaner
- Remove any coarse dirt and keep components such as sensors clean.

8.2. Maintenance

To retain load limiter functions, we recommend carrying out the following maintenance steps at least once a year:

- Clean the load limiter
- Check load limiter function; if necessary, get the manufacturer to service it
- Check load limiter for signs of external deformation, damage and wear; if necessary, get the manufacturer to service it

8.3. Corrective maintenance

The manufacturer provides you with a comprehensive repair service for compliance wrists.

To guarantee correct functioning, corrective maintenance work may only be carried out by the manufacturer.

IPR accepts absolutely no responsibility in the case of accidents at work due to maintenance work carried out on your own initiative!

9. Dismantling, decommissioning, disposal



CAUTION!

Before dismantling the load limiter, the energy supply needs to be disconnected and the line system relieved of pressure.

Make a note of the safety instructions and general hazards listed on Page 2.

9.1. Dismantling

At the end of its useful life, the load limiter must be dismantled and disposed of in an environmentally compatible manner.

Properly clean sub-assemblies and components and disassemble them with consideration given to the prevailing local health & safety and environmental protection provisions.

9.2. Decommissioning

- Run the robot tool to the vertical position
- Turn off the robot
- Turn off the compressed air

9.3. Disposal

Pass on disassembled parts for recycling if no arrangements have been made for returning them or disposal:

- Turn metals into scrap.
- Hand in plastic elements for recycling.
- Sort the rest of the components by material properties and dispose of accordingly.

10. Accessories

(Please refer to the ongoing catalogue or the Internet for individual load limiter accessories)

Setting the pressure control valve DS (optional)

To vary the sensitivity of the load limiter ULD for different tasks of the robot system during handling or machining, it is possible to use the pressure control valve DS to specify different air pressures.

Determine different machining steps with different torques or forces in robot handling or machining procedures

Determine the occurring torques or contact pressures that occur for the respective processing step (e.g. picking a workpiece or transporting a tool at high acceleration).

Contamination protection (You must check the setting of the air pressure and with this the overload threshold value in practice; if necessary, you must correct it!)

Adapter flange

An adapter flange is vital for mounting the load limiter ULD on the robot, since the load limiter ULD does not have a standard connection on the robot side.