**Related Documents:**

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|---|---|
| Assembly drawing | 998 6802110- |
| Current collector installation drawing | 991 6802112- |
| Outline drawing | 991 6802111- |
| Assembly and test specification | PTB 74069/138 |
| Maintenance manual | PTB 74070 |
| AR 363PK pneumatic hook tech. spec. | 998-6803230-801 |
| AR 363P winding device | 998-6803190-801 |
| CAN description | PTB 74136 |
| CC signals | PTB 74143 |

**Content:**



| Approved | | | | | |
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| Mod. | Date | Description | Made by | Sign 1 | Sign 2 |
| - | 2002.12.14. | Issued | Horváth R. | Lencsés L. | Jámbor Z. |
| B | 2004.10.11. | Modified | Horváth R. | Lencsés L. | Jámbor Z. |
| G | 2013.04.03. | Modified | Horváth R. | Galló J. | Galló J. |
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## 1. Application

The AR 163P type current collector provides a disconnectable contact between the trolleybus and the overhead with approximately the same contact force (between head and the OVL).
The control of the current collector is based on a microprocessor unit with sliding-mode control software written in C language. The raising of the poles is provided by springs and the lowering by pneumatic actuators. The vertical positions of the poles are measured by distance/angular transducers. If any of the poles leaves the overhead line, the control unit will operate immediately the high speed pneumatic valves and the cylinders will lowering the current collectors to the safe height very quickly and than move them to the roof for fixing by the hooks operated pneumatically.

## 2. Construction

The current collector system has six main parts:
the preassembled frames:

- the base with the holders of the rods and the pneumatic units for moving the roads to the central position (2 pieces)
  - the pneumatic pulling-down unit mounted on the bases (2 pieces)
- the control box with the electronic and pneumatic control units (1 piece)
- the poles of the current collector (2 pieces)
- the slipping heads (2 pieces)
- the pneumatically controlled hooks for fixing the poles (1 pieces)
- winding device (2 pieces).

### 2.1 The preassembled frames and control box

The bases of the rods are mounted to the frame by resin based isolators. The poles are assembled to their direct holders which are fixed to vertical axles for providing the necessary horizontal turning during operation. There are two main springs connected to each of the rods for providing their lifting and the right connecting force to the overhead line. The easy movement of the rods is provided by cylindro-conical bearings. The maximal and minimum height position of the current collector is limited by rubber dumper. The

friction noise from the overhead line is decreased by the rubber holders assembled between the frame and roof of the vehicle.
The central positioning of the poles of the current collector (in parallel position with the vehicle) in case of the pulling down or after the fast operation is provided by two pneumatic cylinders. One of them is serving for the rough and the other is for fine positioning.
The base of the current collector has a damping device (with rubber).
The task of the pneumatic puller unit is the pulling-down of the poles from the operational heights to the safe height. This movement of the poles can be initiated by the driver or by the control unit automatically in case of unexpected leaving the overhead line. The operational cylinders are built in tandem system with mounted linear/angular transducers.
The electronic and pneumatic control box has robust construction with IP 67 protection. Its task is the proper control and operation of the pneumatic cylinders (lifting/raising up, lowering, fast lowering, positioning, and fixing). The CC box contains the hardware of the control electronics and the pneumatic valves. The air connectors are push-in types, and the electric signals are connected by fast connectors, so the opening and closing the connections are quick and reliable. There is a separate connector for diagnostic and controll purposes (RS232, CAN). The frame of the box has to be connected to the body of the vehicle.

## 2.2 The poles of the current collector

The pole of the current collector made of light metal (aluminium) with fibre glass- polyester isolation covering. It is straight but can be ordered with bended end (15 degree). The heads connect to the rods with flexible wire. The current is conducted by the internal material of the rods and there are studs on the lower parts of the rods that isolated cables are connected to for taken the electric energy. The rods of the current collectors are isolated from the bases. The collector heads can be pull down to 1.45 m from ground (maintenance, according to Customer’s request)

2.3 The slipping head/trolley

The head of the current collector is clinched to the end of the poles by screws. Because of their light weight they can follow the overhead line easily.
There are 90-110 mm (it depends on Customer's request and standards) carbon sliders in the heads.

2.4 The pneumatically controlled hooks

They are independent units from the other parts of the current collector however they are controlled by the same control unit. Their task is the safe fixing of the rods in switched off position.

2.5 Rope retrievers/winding device

They are also independent units from the current collector. Their task is to keep the ropes tight and to damp the dynamic movements of the rods.

For the proper operation of the pneumatic parts of the current collector, a min 15 l air tank has to be installed close to (max. 1.5 meters, inside diameter of tube 12 mm) the system with a non-return valve for providing the operation of the current collector before connecting to the overhead line. The non-return valve can disconnect the current collector from the other parts of air system on the vehicle. The non-return valve and air tank is not part of current collector.
Almost of the screw are made of stainless steel. The covering of the components is polyester based painting for external application. The applied materials can provide long life time and ecstatic appearance.

## 3. Operation

In the basic position of the current collector, the poles are fixed by the hooks over the roof. When connecting to the overhead line, the fixing hooks are turning 90degree vertically and the poles can move up forced by the springs

but with pneumatic damping by the cylinders. The slipping heads can connect to the overhead line manually or automatically.

After connected to the overhead line, the springs provide the proper connecting force. In this case there is no over-pressure in the cylinders so they do not influence the operation or movement of the heads.

At the end of the service of the trolleybus, the driver can initiate the pull-down operation of the current collector from the driver cabin. The rods will be moved to the central position and fixed by the hooks.
If any of the heads jump out and leaves the overhead line, the control unit detects the un-proper movement and pull down the rods very quickly under the minimal operational height level, as well as, turn them to the central position and put them under the hooks. From this position, the heads can be connected to the overhead line as described above.

3.1 Lifting up/raising:

If the driver pushes the control button (up) for a short time (> 0.1 s) or CAN message, the followings will happen:
- the pols will move down,
- the hooks will open (turn),
- the poles will moving up.

The total time of the lifted actions is approx. 10-12 s.

3.2 Lowering and in dewirement:
If the driver pushes the control button (down) for a short time (> 0.1 s) or CAN message or happened dewirement, the followings will happen:

- the poles will move down,
- the hooks will open (turn),
- the poles will move up slowly to under the hook
- the hooks will close,
- the poles will move up for touching the hooks.

The total time of the procedure is 10 – 20 s depending on the actual height of the overhead line.

In wintertime in the morning (bellow -15 ºC), the first lifting up/raising is proposed to execute manually for protecting the sealing in the valves. In case of the next operations, the remote control of the current collector can be applied from the drivers cabin because of the heating in the control box provides the necessary temperature.

# TECHNICAL DATA

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|---|---|
| Rated voltage: | 1200 VDC |
| Rated current: | 400 A |
| Maximum starting current: | 600 A |
| Main circuit cable (wiring from vehicle): | 95 $mm^2$ |
| Collector shoe operating contact pressure: | 80 – 150 N |
| Maximum deviation of the trolleybus from the axis of the wire: | > 4500 mm* |
| Maximum angular displacement of the current colletor: | ≈±55° *** |
| Minimum operating height: | 420 mm** |
| Maximum operating height (from the ground): | 7200 mm |
| First lowering (dewirement) level: | 300 mm** |
| Maximum speed: | 90 km/h |
| Maximum reverse speed: | 15 km/h |
| Current collector head vertical angle of deviation: | ±20° |
| Current collector head horizontal angle of deviation: | ±55° |
| Operating ambient temperature: | -40 … +75 °C |
| Maximum operating above the sea level: | 2000 m |
| Maximum relative humidity (at 20 °C): | 95 % |
| Weight of the current collector system: | 227 kg |
| Weight of the control unit: | 20 kg |
| Operating voltage of the control unit: | 16,8 – 38 VDC |
| Operating current of the control unit: | < 2 A |
| Control unit insulation level: | IP 67 |
| Pneumatic-system input air pressure range: | 5,5 – 12 bar |
| Pneumatic-system operating pressure (optimal): | 8,4 bar |

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|---|---|
| Compressed air quality (inlet): | ISO 8573-1:1994 |
| - dirt particle size: | 15 µm |
| - dirt particle concentration: | 5 mg/m$^3$ |
| - oil aerosol and vapour: | 25 mg/m$^3$ |
| - water vapour pressure dewpoint: | -40 ºC |
| Pneumatic inlet pipe: | PUSH-IN, ø12x1 |
| Shock and vibration: | EN 61373 1/Class B |
| EMC testing: | EN 61000-4-2. 8.3.1<br>EN 50155-10.2.7, 10.2.6.3 |
| Main circuit: (overvoltage category) | OV4 (EN 50124-1) |
| (pollution degree) | PD4 (EN 50124-1) |
| Control unit: (overvoltage category) | OV2 (EN 50124-1) |
| (pollution degree) | PD3 (EN 50124-1) |
| Main circuit enclosure: | IP 00 |
| Control unit enclosure: | IP 67 |
| MTBF value: | 135.000 h (>15 years) |
| Type of Quality Certificate: | 3.1 - EN 10204:2005 |
| Standards: | IEC 60077<br>IEC 61373<br>IEC 60529<br>CEI 9-49<br>ECE 66<br>EN 50155<br>EN 61000<br>EN 50502 |

* with the trolley wire at a height of 5750 mm
** dimension relative to the current collector base plate
*** it depends on the rod lenght