1. Installation tools
No special tools are needed for simple systems; conductors will be supplied ready for installation.

For complex layouts with switches and curves the following tools are required:

- Curve tool: BVU 10/15
- Filler rod: FU 10, FU 10 VP, FU 10 S VP
- Table saw: KS 10
- Punch tool: LZ 10, LZ 10-VP
- Deburring tool: EGM (for burr removal on half-round file HRF conductor cuts)
- Adjustment jigger: ST 10 (for making short conductor sections, see 5.1)
- Assembling tool: MG 10 (for installing joint splice clips, joint covers and for checking/adjusting conductor slot width)
- Locking pin driver: ED 10 (for inserting locking pins into BFU alu anchor bar)
- Dismantle tool: DMW 10 (for dismantling conductor bars from supports)

2. Layout symbols

- Support beam track (monorail)
- Conductor rails
- Feed-in joint
- Feed terminal
- Compact hanger
- Compact hanger & locating clamps
- Transfer guide, straight
- Transfer guide, oblique
- Transfer guide, straight w/feed
- Transfer guide, oblique w/feed
- Isolating assembly
- Expansion section

3. System layout

Sketch 1

- L = Standard lengths of conductor: 6 m
- L1 = max. support spacing for straight runs: 0.6 m, for curves: 0.3 m
- L2 = permissible overhang: 0.2 m
- L3 = air gap between transfer guides at switches or drop sections: 3-6 mm

Installation procedure

4. Compact hanger

The compact hangers must be installed at exactly right angle with the track beam or hanger bracket.

Compact hanger, bolted type KA (photo1)
Each compact hanger is supplied complete with two M5 Thed bolts, nuts, washers and lock washers.
- Drill holes for 5 mm bolts.
- Install compact hanger.

Compact hanger, special design KD, KK and KS
To be used preferably for monorail systems.
Special compact hangers and attachment depending on monorail track.

Photo 1: Compact hanger KA 10–10 N
5. Conductors

Conductor sections are connected with feed-in joint splices (photo 2). It is important for good electrical contact that the conductor ends are clean and free of residue and that any burns are removed. The feed-in joint splices compensate the expansion and contraction of the conductors (see instructions 6 and photo 2). The joint splice is protected by an insulating cover. Standard conductor sections are supplied ready for the installation of the joint splice. If a section has to be cut during installation, the end has to be prepared as shown under instructions 5.1.

Installation sequence, when conductor is installed starting on the left and progressing towards the right, is as follows:
- Start installation at an anchor point (switch or end of system).
- Install standard length conductor sections.
- For system with curves refer to instr. 11.
- Make and install short conductor sections (see instr. 5.1). Maintain correct air gap between each conductor section (see instr. 6).
- Push joint splice cover onto the left end of the conductor bar. Push in splice cover far enough so that the conductor becomes accessible (see photo 3).
- Snap-in metal splice clip at the right end of the conductor (see photo 4).
- Install conductor section into compact hanger and push left end of conductor into the splice clip of the already installed conductor section.
- Use installation tool MG 10 to push joint splice cover over joint splice, tap lightly if required (see photo 5).
- Maintain correct air gap between each conductor section (see instr. 6 and photo 2).
- Impress joints with installation tool MG-ST 10. Press plastic part to the bottom of the conductor. (photo 5).

5.1 Preparing conductor end for joint splice

Prepare short sections in an efficient way. For preparation proceed as follows (fig 3):
- Measure exact length required.
- Use adjustment jig ST 10 and pull conductor approx. 80 - 100 mm out of insulating shroud.
- Use hollow end of ST 10 and push back conductor to stop (70 mm, see photo 6).
Mounting Instructions for U 10

Cut conductor to exact length required; use hacksaw or table saw KS (fine teeth blades only).

Use punch tool LZ 10 PE-VP to punch square holes into each end of conductor (see photo 7 and fig. 2).

Attention: avoid two punched holes (prolongation of opening)

Remove burr from cut
- outside the conductor profile with half-round file HRF (photo 8)
- inside the conductor profile with half-file RF (photo 9)

Use hollow end of ST 10, short setting, and push plastic shroud into center of conductor, (photo 6).

6. Conductor expansion and contraction

The special design of the feed-in joint splice UEV 10 compensates for expansion and contraction of the conductors due temperature difference.

The conductors have to be anchored with locating clamps USK 10 to assure controlled expansion and contraction and to avoid a push-along effect by dragging collectors. A fixpoint should be provided every 36 m for long, straight systems (see instr. 10).

Expansion section UDV 10/25 C-PE-VP (see photo 10) with expansion capability of max. 30 mm should be installed on systems with expansion joints in the track beam and/or in the building. Use locating clamps on each side of expansion section (see instr. 10.).

Dependent on the expected temperature difference an air gap “a” has to be set during installation (photo 2). Set air gap “a” according to the graph below for sections of max. 6 m.

Max. expected temperature = 40 °C.
Min. expected temperature = 0 °C.

Example (graph below):
Installation temperature = 20 °C
Air gap „a“ = 2 mm (joint)
15 mm (expansion joint)

According to the expected temperature difference of the above example, conductor bars installed at 20 °C ambient temperature should have an air gap of 2 mm; expansion joints 15 mm.

Measure „a“ in mm

If the temperature is higher than 40 °C or lower than 0 °C consider more joint sand conductor sections that are shorter than 6 m. In case of expansion joints in buildings use more joints or expansion sections.
7. Feed terminals
Install feed terminals close to the mains (refer to photo 11 and instr. 5).
- If required, preparation of conductor bar as shown under instructions 5.1.
- Max. two cables can be connected using a spade connector dim. 6.3 x 0.8 mm.
- Provide tension relief for feed-in cables.
- Impress feed terminal as per instr. 5
Make certain that connecting cables do not restrict movement of conductors or collectors and impede longitudinal expansion of conductors during temperature fluctuation.

8. Transfer guide (photo 12)
and transfer guide with feed-point
Transfer guides are used with switches, drop sections, turntables and air gaps; they are also used as end caps.

Installation procedure:
1) Chamfer conductor at punched side properly to allow easy push-over of the detent of the transfer guide.
2) Push transfer guides onto anchor bar BFU (photo 13).
3) Push conductor rails into transfer guides. Detents must fit properly.
4) Bolt anchor bars BFU to the appropriate attachment surface.
5) Impress transfer guides in the same way than joints (instr. 5, photo 5)

8.1 Placement of transfer guide
Straight transfer guides are used with straight track beam cuts. Oblique transfer guides are used on one side of an oblique cut track beam (see fig. 4, 5 and 6).

8.2 Conductor bar preparation
To install joint caps on top of each other, the PE-VP rail has to be cutted at one materail group (e.g. switch or lifter).

8.2.1 Preparation of conductor bar for phase and earth as shown under instructions 5.1.
8.2.2 For PE-VP (only for transfer guides)
- Cut section to length, if necessary.
- Pull conductor profile 90 – 100 mm out of the isolating profile with adjustment jig ST 10.
- Push back conductor profile by 80 mm.
- Cut conductor to exact length required; use hacksaw or table saw KS (fine teeth blades only).
- Use punch tool LZ 10 to punch square holes into each end of conductor (see photo 7 and fig. 2)
- **Attention:** avoid two punched holes (prolongation of opening).

- Remove burr from cut.
  - outside the conductor profile with half-round file HRF (photo 8).
  - inside the conductor profile with half-file RF (photo 9).
- Use hollow end of ST 10, short setting, and push plastic shroud into center of conductor (photo 6).

8.2.3 For phase, PE and PE-VP
- for transfer guides with end feed:
  - fix feed-in clamp to conductor profile (photo 14), leave the square hole open (fig. 2 and 7).
  - Push transfer guides on front side of the conductor profile until they snap into place (photo 12).
  - for USE 10: flat terminal plug 6,3 x 0,8 mm

8.3 Installation of anchor bars
- Mark drilling holes for BFU on attachment surface (see fig. 5 and 6). **Caution:** Make sure transfer guides have sufficient clearance when switch moves.
- Drill through-holes M 5 into attachment surface.
- Push transfer guides onto anchor bar BFU.
- Bolt anchor bar BFU to attachment surface.
- Insert locking pins to fix position of transfer guides. (Use pin driver ED 10).
- Make sure that the head of a fixing screw does not coincide with the track beam cut when having an oblique cut for switches. Facing transfer guides must be accurately aligned with each other to ensure smooth collector passage.
  Permissible max. gap between transfer guides is 6 mm, max. offset in both directions is ± 3 mm.
  Track beams of switches and drop sections must be properly aligned before starting the installation of conductor rails.

9 Isolating assembly
9.1 For phase and earth (photo 15)
- prepare conductor bar as shown under 5.1
  in addition: chamfer conductor at punched side properly to allow easy push-over of the detent of the isolating assembly.
The following combinations are possible:

- \( \text{LT/LT-} \) U 10 without feed terminals
- \( \text{LT/LTE-} \) U 10 with feed terminal on one side
- \( \text{LTE/LTE-} \) U 10 with feed terminal on both sides

After the two pieces have been pushed each onto a conductor they must be pressed together to interlock.

For impressing the isolating assembly refer to instr. 5.

If system hangers do not permit the isolating assembly to support against the track beam (distance contact surface to track beam more than 10 mm), additional compact hangers must be installed at approx. 100 mm distance left and right of the isolating assembly for stabilization.

9.2 For PE and VP

Isolating assemblies are formed by two transfer guides. Preparation of conductors as under instr. 8.

The following combinations are possible:

- \( \text{US 10 PE-VP} \) U 10 without feeding
- \( \text{1x US 10 PE-VP, 1x USE 10 PE-VP} \) U 10 with feeding at one side
- \( \text{2x USE 10 PE-VP} \) U 10 with feeding at both sides

Impress transfer guides as under instr. 5

10. Anchor points (Photo 16)

To prevent the conductor sections from sliding anchor points must be provided (see fig. 9).

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Consisting of</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Switches and drop sections</td>
<td>Transfer guide and BFU (see instructions 8.3)</td>
</tr>
<tr>
<td>2</td>
<td>Continuous long runs</td>
<td>USK 10 / USK 10 A locating clamps left and right of bolted-on compact hanger</td>
</tr>
<tr>
<td>3</td>
<td>Expansion sections at building or track expansion joints</td>
<td></td>
</tr>
</tbody>
</table>

The distance between two anchor points should not exceed 36 m (120').

**Sequence of work:** (Locating clamps)
- Bolt on compact hangers.
- Mark the position of the locating clamp before pushing the conductor into the bolted compact hanger.
- Bolt locating clamps on the conductors staggered left and right to the compact hanger. (image 16).
- Push the conductors into the hanger.

**Phase and PE**
- Install conductor bars, mark position of locating clamps before pushing conductor sections into compact hanger.
- Install locating clamps as marked on conductor sections and tighten securely; stagger locating clamps as shown in photo 16.
- Push conductor bars into compact hanger.

**PE-VP**
- Provide two borings diam. 3,2 at the back side of the conductor with the drilling template BS 10 A. Distance of borings as per instr. 10.
- Push a safety clamp USK 10 A in each boring and engage conductor in fixed compact hanger.
11. Bending of conductors

Horizontal or vertical curves can be supplied ready for installation. For curves to be made at the job site curve tool BVU 10 VP (photo 17) and filler rod FU 10 is required.

Bending procedure:
- Draw radius of curve on a floor or flat surface (fig. 11)
- Determine required length of curve (stretched length) and mark it on conductor section.
- Cut conductor section approx. 500 mm longer as required.
- Insert filler rod into conductor section.
- Turn handle on curve tool to lift upper roller. Insert conductor section with filler rod into the correct groove of lower rollers.
- Slightly increase pressure with upper rollers and push conductor back and forth.
- To avoid kinks, start each back-and-forth movement of the conductor an inch closer to the center of the curve.
- Repeat this procedure until the radius is obtained.
- Remove filler rod.
- Cut the conductor to the required length.
- On curves with smaller radii than 0.7 m a straight section of approx. 0.1 m on each end is required to assure a good splice (fig. 8).
- Pass through the curves with test collector and check conductor slot width (5 - 5.5 mm)

Attention:
Use the slotted conductor type U10/25 C PE-VP-G only for horizontal inner curves. Alternatively cut the non-slotted conductor at the back every 30 mm considering a depth of 11 mm and a slot width of 1 – 2 mm.

12. Collectors

Use collectors preferably only for one travel direction (photo 18). Use the collector type KDS 2/40 for travel in both directions. Compact collectors that swivel in and out must be adjusted vertically at right angle to the conductors. Example: carriers in monorail systems for maintenance reasons.

Make certain that connecting cables are high flexible and do not restrict movement of the collectors. Avoid formation of cable loops.

12.1 Collector brackets

Collector brackets must be installed exactly parallel and right angle to the conductor bars. Installation height from bracket to contact surface of the conductor is shown in the following table:

<table>
<thead>
<tr>
<th>Collector type</th>
<th>Bolt holes</th>
<th>Working height of collector mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>KST 2/40</td>
<td>phase M 5</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>ground M 6</td>
<td></td>
</tr>
<tr>
<td>KUFU 25-2 thru 10</td>
<td>2 x slotted holes 7 x 15</td>
<td>88</td>
</tr>
<tr>
<td>KDS 2/40-1 thru 12-14</td>
<td>2 x slotted holes 7 x 15</td>
<td>98</td>
</tr>
</tbody>
</table>

Holes for single collector installation must be on 14 mm centers if standard compact hangers are used.

13. Installation inspection

After installation has been completed inspect all components for correct fit, distance, line-up etc. Make trial runs and pay special attention to collector tracking.
14. Commissioning

Safety instructions
The conductor system U 10 and its components are designed in accordance with VDE 0100 and are touchproof according to VDE 0470, part 1. After installation the touch-proofness must not be restricted, e.g. make sure a maximum conductor slot opening of 5,5 mm.

After installation has been completed make test runs considering the following aspects:
First test run with low speed.
Collectors must run in conductors without vibration.
All transfer applications require special attention for proper passing over and re-tracking of collectors. If necessary open out the slot of the shrouding with the conductor joint assembly tool MG-SW 10.
Avoid sparking at collector carbons (sparking is caused by dirty and oxidised conductor surfaces.
Take care of proper passing over of collectors especially at transfer guides.

15. Maintenance instructions

Under normal working conditions the conductor system does require little maintenance.
We recommend to carry out the following maintenance work in regular intervals:

1. Inspection of conductors:
   Visual inspection in 4 weeks intervals. Control conductor expansion and look for burned spots.
   Remove carbon dust deposits especially in transfer guide and isolating assembly areas.
   Procedure:
   a) Manual cleaning with commercial vacuum cleaner.
   b) Additional adjustment of a cleaning collector (same design than collector).
   c) Use of additional automated vacuum cleaner in regular maintenance intervals.
   Adhere to the maximum vertical and horizontal offset of 3 mm at transfer sections for switches, lifting devices etc. The max. airgap between the two alternate transfer guides is 6 mm.

2. Inspection of collectors
   a) Mechanical control:
      Flexibility of links, bearings and support stems; check for mechanical wear and damages.
   b) Electrical control:
      Check the abrasion of brushes, the tightness of contact screws and cable fixings.
   c) Contact pressure:
      Use spring-scale to pull the collectors out of the conductor bar. The contact pressure must be approx. 3,5 N per brush.
MOUNTING INSTRUCTIONS FOR U 10

Curve tool

to bend the conductor U10 and U10 PE-VP vertical and horizontal. The filling rod has to be ordered separately.

Table saw

to cut isolating- and conductor profiles with length supplement. Connection: 220 V, 50 Hz.

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVU 10 VP</td>
<td>10,000</td>
<td>143 318</td>
</tr>
<tr>
<td>Filler rod FU 10 (4 m long)</td>
<td>0,340</td>
<td>165 234</td>
</tr>
<tr>
<td>Filler rod FU 10 S-VP (4 m long)</td>
<td>0,340</td>
<td>143 279</td>
</tr>
</tbody>
</table>

Conductor punch tool

To stamp the joint notch into the conductor profile at short lengths. Combitool U10 and U10-VP

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LZ 10 PE-VP</td>
<td>2,400</td>
<td>143 223</td>
</tr>
</tbody>
</table>

Deburring tool

Round file RF for deburring the inner side of short length of conductor profile

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF</td>
<td>0,085</td>
<td>143 330</td>
</tr>
<tr>
<td>HRF</td>
<td>0,085</td>
<td>165 264</td>
</tr>
</tbody>
</table>

Half-round file HRF for deburring the outer side of short length of conductor profile
**Adjustment jig**
to adjust short length of conductor and isolating profile

**Conductor joint assembling tool**
1. to impress the conductor profile into the joint
2. to open out the conductor slot
3. to close the joint cover

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 10</td>
<td>0,150</td>
<td>165 091</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MG-SW 10</td>
<td>0,125</td>
<td>165 093</td>
</tr>
</tbody>
</table>

**Locking pin driver**
for BFU aluminium anchor bars for transfer guides

**Conductor dismantle tool**
to dismantle the conductors out of the compact hanger

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED 10</td>
<td>0,010</td>
<td>165 277</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMW 10</td>
<td>0,039</td>
<td>165 119</td>
</tr>
</tbody>
</table>

**Boring template** for fixpoints

**Twist drill**
for preparation of borings for safety clamps
USK 10 A at fixpoints

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 10 A</td>
<td>0,150</td>
<td>282 3266</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Weight kg</th>
<th>Order-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twist drill Ø 3,2 mm</td>
<td>0,003</td>
<td>110 0162</td>
</tr>
</tbody>
</table>