Tolerance Compensation Unit
TCU-Z
Assembly and Operating Manual
Table of contents

1 General .................................................................................................................................. 5
  1.1 About this manual ........................................................................................................... 5
    1.1.1 Presentation of Warning Labels ............................................................................ 5
  1.1.2 Applicable documents ............................................................................................... 6
  1.1.3 Sizes .......................................................................................................................... 6
  1.1.4 Variants ....................................................................................................................... 6
  1.2 Warranty .......................................................................................................................... 6
  1.3 Scope of delivery ............................................................................................................. 7
  1.4 Accessories ..................................................................................................................... 7

2 Basic safety notes .................................................................................................................. 8
  2.1 Intended use ..................................................................................................................... 8
  2.2 Not intended use ............................................................................................................... 8
  2.3 Constructional changes .................................................................................................. 8
  2.4 Spare parts ...................................................................................................................... 8
  2.5 Environmental and operating conditions ....................................................................... 9
  2.6 Personnel qualification .................................................................................................. 9
  2.7 Personal protective equipment ...................................................................................... 10
  2.8 Notes on safe operation ............................................................................................... 10
  2.9 Transport ......................................................................................................................... 11
  2.10 Disposal ......................................................................................................................... 11
  2.11 Fundamental dangers ................................................................................................. 11
    2.11.1 Notes on particular risks ...................................................................................... 11

3 Technical data ...................................................................................................................... 12
  3.1 With "Locking" (MV) .................................................................................................... 12
  3.2 Without "Locking" (OV) ............................................................................................... 12

4 Assembly ............................................................................................................................ 13
  4.1 Assembly example ....................................................................................................... 13
  4.2 Mechanical connection ............................................................................................... 14
    4.2.1 Assembly at the robot .......................................................................................... 14
    4.2.2 Mounting at the handling device ....................................................................... 15
  4.3 Air connection .............................................................................................................. 16
  4.4 Mounting the sensor .................................................................................................... 16
    4.4.1 Programmable magnetic switch (MMS-P) ....................................................... 17

5 Troubleshooting .................................................................................................................. 18
  5.1 Product is not moving ................................................................................................. 18
  5.2 Product does not lock itself? ....................................................................................... 18
5.3  Product does not execute the full stroke for the locking?.......................... 18
5.4  Locking force decreases during locking...................................................... 18

6  Maintenance ................................................................................................... 19
6.1  Notes........................................................................................................... 19
6.2  Maintenance and lubrication intervals ......................................................... 19
6.3  Lubricants/Lubrication points (basic lubrication) ........................................ 20
6.4  Disassembling the product .......................................................................... 20
   6.4.1  Variant with locking (MV) ................................................................. 20
   6.4.2  Variant without locking (OV) .............................................................. 21
6.5  Servicing and assembling the product ........................................................ 21
6.6  Seal kit ........................................................................................................ 22
6.7  Assembly drawing ....................................................................................... 23
1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

This manual is an integral part of the product and must be kept accessible for the personnel at all times.

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

In addition to these instructions, the documents listed under (☞ 1.1.2, Page 6) are applicable.

1.1.1 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

<table>
<thead>
<tr>
<th>SIGNAL WORD</th>
<th>DESCRIPTION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DANGER</strong></td>
<td>Danger for persons! Non-observance will inevitably cause irreversible injury or death.</td>
<td></td>
</tr>
<tr>
<td><strong>WARNING</strong></td>
<td>Dangers for persons! Non-observance can lead to irreversible injury and even death.</td>
<td></td>
</tr>
<tr>
<td><strong>CAUTION</strong></td>
<td>Dangers for persons! Non-observance can cause minor injuries.</td>
<td></td>
</tr>
<tr>
<td><strong>NOTICE</strong></td>
<td>Material damage! Information about avoiding material damage.</td>
<td></td>
</tr>
</tbody>
</table>
1.1.2 Applicable documents

- General terms of business *
- Catalog data sheet of the purchased product *
- Assembly and Operating manuals of the accessories *

The documents marked with an asterisk (*) can be downloaded on our homepage www.schunk.com.

1.1.3 Sizes

This operating manual applies to the following sizes:

- TCU-Z 50
- TCU-Z 64
- TCU-Z 80
- TCU-Z 100
- TCU-Z 125
- TCU-Z 160
- TCU-Z 200

1.1.4 Variants

This operating manual applies to the following variations:

- TCU-Z Without "locking"
- TCU-Z With "locking"

1.2 Warranty

If the product is used as intended, the warranty is valid for 24 months from the ex-works delivery date under the following conditions:

- Observe the applicable documents (1.1.2, Page 6)
- Observe the ambient conditions and operating conditions (2.5, Page 9)
- Observe the specified maintenance intervals, (6, Page 19)

Parts touching the workpiece and wearing parts are not included in the warranty.
1.3 Scope of delivery

The scope of delivery includes

- Tolerance Compensation Unit TCU-Z in the version ordered

1.4 Accessories

The following accessories, which must be ordered separately, are required for the product:

- Sensors, plus extension cables as an option

A wide range of accessories are available for this product.

For information about which accessories can be used with the appropriate product version see catalog.
2 Basic safety notes

2.1 Intended use

This product is designed for compensating tolerances and positioning inaccuracies in handling workpieces.

- The product may only be used within the scope of its technical data, (☞ 3, Page 12).
- The product is intended for installation in a machine/system. The applicable guidelines must be observed and complied with.
- The product is intended for industrial use.
- Appropriate use of the product includes compliance with all instructions in this manual.

2.2 Not intended use

It is not intended use if the product is used, for example, as a pressing tool, stamping tool, lifting gear, guide for tools, cutting tool, clamping device or a drilling tool.

- Any utilization that exceeds or differs from the appropriate use is regarded as misuse.

2.3 Constructional changes

Making constructional changes

Modifications, constructional changes and subsequent work, e.g. additional threads, drill holes and safety devices may impair the operation and safety or damage the product.

- Constructional changes may only be done with SCHUNK's permission.

2.4 Spare parts

Use of unauthorised spare parts

Using unauthorised spare parts can endanger personnel and damage the product or cause it to malfunction.

- Use only original spare parts or spares authorised by SCHUNK.
2.5 Environmental and operating conditions

Requirements for the ambient and operating conditions

Due to incorrect ambient and operating conditions, dangers may arise from the product, which can cause serious injuries and substantial property damage.

- Make sure that the product is used only in the context of its defined application parameters, (☞ 3, Page 12).
- Make sure that the product has a sufficient size for the application.
- Observe maintenance and lubrication intervals, (☞ 6.2, Page 19).
- Make sure that the environment is free from splash water and vapors as well as from abrasion or processing dust. Exceptions are products that are designed especially for contaminated environments.

2.6 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

**Trained electrician**
Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.

**Pneumatics specialist**
Pneumatics specialists have been trained for this particular area of responsibility and know the relevant standards and regulations.

**Hydraulic specialist**
Hydraulic specialists have been trained for this particular area of responsibility and knows the relevant standards and regulations.

**Qualified personnel**
Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.
Basic safety notes

Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.

Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.7 Personal protective equipment

Using personal protective equipment

Not wearing personal protective equipment while working with the product, may result in dangers that impact the personnel's safety and health.

- While working with the product, observe the health and safety regulations and wear the required personal safety equipment.
- Observe the valid safety and accident prevention regulations.
- In case of sharp edges and corners and rough surfaces, wear protective gloves.
- In case of hot surfaces, wear heat-resistant protection gloves.
- When dealing with hazardous substances, wear protection gloves and goggles.
- In case of moving parts, wear tight protection clothes.

2.8 Notes on safe operation

Incorrect handling of the personnel

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Avoid any manner of working that may interfere with the function and operational safety of the product.
- Use the product as intended.
- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. This does not apply to products that are designed for special environments.
- Eliminate any malfunction immediately.
- Observe the care and maintenance instructions.
- Observe the current safety, accident prevention and environmental protection regulations regarding the product's application field.
2.9 Transport

**Handling during transport**
Incorrect handling during transport may impair the product's safety and cause serious injuries and considerable material damage.
- When handling heavy weights, use lifting equipment to lift the product and transport it by appropriate means.
- Secure the product against falling during transportation and handling.
- Stand clear of suspended loads.

2.10 Disposal

**Handling of disposal**
The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.
- Follow local regulations on dispatching product components for recycling or proper disposal.

2.11 Fundamental dangers

**General**
- Observe safety distances.
- Never deactivate safety installations.
- Install the provided protective product in the danger zone before switching on the product.
- Remove energy supplies before the installation, modification, maintenance or adjustment work. Make sure that no residual energy is remaining in the system.
- Do not move parts by hand while the energy supply is connected.
- Do not reach into the open mechanism or movement area of the product during operation.

2.11.1 Notes on particular risks

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of injury due to spring forces!</strong></td>
</tr>
<tr>
<td>Parts are under spring tension on products which clamp using spring force or which have a gripping force maintenance.</td>
</tr>
</tbody>
</table>
- Only specially trained staff should disassemble the product. |
## 3 Technical data

More technical data are included in the catalog data sheet. Whichever is the latest version.

### 3.1 With "Locking" (MV)

<table>
<thead>
<tr>
<th></th>
<th>TCU-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>64</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>0.18</td>
</tr>
<tr>
<td>permissible operating temperature [°C]</td>
<td>-10 to +90</td>
</tr>
<tr>
<td>Pressure medium</td>
<td>Compressed air, compressed air quality according to ISO 8573-1:7 4 4</td>
</tr>
<tr>
<td>Min. pressure [bar]</td>
<td></td>
</tr>
<tr>
<td>Max. pressure [bar]</td>
<td></td>
</tr>
<tr>
<td>Noise emission [dB(A)]</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2 Without "Locking" (OV)

<table>
<thead>
<tr>
<th></th>
<th>TCU-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>0.09</td>
</tr>
<tr>
<td>permissible operating temperature [°C]</td>
<td>-10 to +90</td>
</tr>
<tr>
<td>Noise emission [dB(A)]</td>
<td></td>
</tr>
</tbody>
</table>
4 Assembly

4.1 Assembly example

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>robot or gantry axis</td>
</tr>
<tr>
<td>2</td>
<td>adapter plate (optional from SCHUNK or provided by customer)</td>
</tr>
<tr>
<td>3</td>
<td>tolerance compensation unit</td>
</tr>
<tr>
<td>4</td>
<td>handling device e.g. Gripper</td>
</tr>
</tbody>
</table>

Optional, SCHUNK can provide an adapter plate with hole pattern for mounting holes.

The adapter plate (2) is mounted to the robot (1) and to the TCU-Z (3) (see our catalog for mounting data).

SCHUNK gripper types PGN-plus, DPG, PGB and JPG are attached directly to the TCU-Z.

For all other handling devices (4) is an adapter plate required.

Air connection and electrical cables must be fixed and bundled with cable clamp, in order that during use the greatest possible freedom of movement is possible.
4.2 Mechanical connection

**NOTICE**

Break of the product because of faulty installation is possible! Observe maximum depth of engagement at robot side and handling device.

**Levelness of the mounting surface**

The values apply to the whole mounting surface to which the product is mounted.

Requirements for levelness of the mounting surface (Dimensions in mm)

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Permissible unevenness</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100</td>
<td>&lt; 0.02</td>
</tr>
<tr>
<td>&gt; 100</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

4.2.1 Assembly at the robot

Mounting possibilities

The cylindrical pin, needed to fix the product, is not included in the delivery. The mounting screws (51) are pre-assembled in the product.

1. Fix the product on the fixing bore, using the cylindrical pin.
2. Tighten mounting screws (51) with a hexagon screwdriver.
   
   **NOTICE! Observe tightening torque**
Data for mounting at the robot-side adapter plate

<table>
<thead>
<tr>
<th>Item</th>
<th>Mounting</th>
<th>TCU-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>51</td>
<td>pan screw DIN 7984</td>
<td>M3</td>
</tr>
<tr>
<td></td>
<td>Tightening torque [Nm]</td>
<td>1.27</td>
</tr>
<tr>
<td></td>
<td>maximum screw-in depth Z [mm]</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>cylindrical pin fit diameter</td>
<td>Ø3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>h6</td>
</tr>
<tr>
<td></td>
<td>max. fitting depth [mm]</td>
<td>6</td>
</tr>
</tbody>
</table>

4.2.2 Mounting at the handling device

Data for mounting at the adapter plate / at the handling device

<table>
<thead>
<tr>
<th>Item</th>
<th>Mounting</th>
<th>TCU-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>thread diameter</td>
<td>M3</td>
</tr>
<tr>
<td>X</td>
<td>Max. screw-in depth [mm]</td>
<td>7</td>
</tr>
</tbody>
</table>
### 4.3 Air connection

**NOTICE**
Observe the requirements for the air supply ([Page 12](#)).

![Diagram of main connections](#)

| Main connections (Hose connection) | A = locked, B = unlocked |

<table>
<thead>
<tr>
<th>Designation</th>
<th>TCU-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>64</td>
</tr>
<tr>
<td>Thread in the main air connections</td>
<td>M5</td>
</tr>
</tbody>
</table>

### 4.4 Mounting the sensor

**NOTE**
Observe the assembly and operating manual of the sensor for mounting and connecting.

The product is prepared for using sensors

- Exact type designation of the compatible sensors, see catalog.
- Technical data of the matching sensors, see assembly and operating manual and data sheet.
  - The assembly and operating manual and the catalogue data sheet are included in the scope of delivery and can be downloaded from [www.schunk.com](http://www.schunk.com).
- If you require further information on sensor operation, contact your SCHUNK contact person or download information from our homepage.
4.4.1 Programmable magnetic switch (MMS-P)

**NOTICE**

Risk of damage to the sensor during assembly!

- Observe a maximum tightening torque of 10 Ncm for the set-screws.

**NOTE**

If there is no T-nut available, slide the sensor according to dimension l1 into the groove (2), (see table **setting dimensions**).

1. Turn the sensor (1) into the groove (2).
   OR: Slide the sensor (1) into the groove (2) until the sensor (1) stops at the T-nut (3).
2. Secure the sensor (1) using the set-screw (4).
   Tightening torque: 10 Ncm
3. Adjust sensor (1), see Sensor Assembly and Operating Manual.

<table>
<thead>
<tr>
<th>Dimension l1 [mm]</th>
<th>TCU-Z 50</th>
<th>TCU-Z 64</th>
<th>TCU-Z 80</th>
<th>TCU-Z 100</th>
<th>TCU-Z 125</th>
<th>TCU-Z 160</th>
<th>TCU-Z 200</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40.9</td>
<td>48.9</td>
<td>58.9</td>
<td>71.4</td>
<td>88.9</td>
<td>108.9</td>
<td></td>
</tr>
</tbody>
</table>
5 Troubleshooting

5.1 Product is not moving

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect air supply.</td>
<td>Check air supply.</td>
</tr>
</tbody>
</table>

5.2 Product does not lock itself?

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximity switch defective or set incorrect.</td>
<td>Disassemble and clean the product.</td>
</tr>
<tr>
<td>Pressure drops below minimum.</td>
<td>Readjust or change sensor.</td>
</tr>
</tbody>
</table>

5.3 Product does not execute the full stroke for the locking?

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dirt between cylinder and cylinder cover.</td>
<td>Disassemble and clean the product.</td>
</tr>
<tr>
<td>Pressure drops below minimum.</td>
<td>Check air supply.</td>
</tr>
</tbody>
</table>

5.4 Locking force decreases during locking

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed air can escape.</td>
<td>Check seals, if necessary, disassemble the product and replace seals.</td>
</tr>
<tr>
<td>To much grease in the mechanical movement space.</td>
<td>Clean and lubricate product.</td>
</tr>
<tr>
<td>Pressure drops below minimum.</td>
<td>Check air supply.</td>
</tr>
</tbody>
</table>
6 Maintenance

6.1 Notes

original spare parts
Use only original spare parts of SCHUNK when replacing spare and wear parts.

6.2 Maintenance and lubrication intervals

<table>
<thead>
<tr>
<th>Interval [Mio. cycles] for TCU-Z</th>
<th>Maintenance work</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 - 100</td>
<td></td>
</tr>
<tr>
<td>125 - 160</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Clean all parts thoroughly, check for damage and wear, if necessary replace seals and wearing parts ([6.5, Page 21])</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Treat all grease areas with lubricant ([6.3, Page 20])</td>
</tr>
</tbody>
</table>

For extreme ambient and application conditions, shortened maintenance cycles can ensure the lifespan is maintained.

NOTICE
Damage caused by insufficient lubricant!
Lubricants harden more quickly at temperatures above 60°C, leading to possible product damage.
• Reduce the lubricant intervals accordingly.
6.3 Lubricants/Lubrication points (basic lubrication)

SCHUNK recommends the lubricants listed.
During maintenance, treat all greased areas with lubricant. Thinly apply lubricant with a lint-free cloth.

<table>
<thead>
<tr>
<th>Lubricant point</th>
<th>Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metallic sliding surfaces</td>
<td>microGLEIT GP 360</td>
</tr>
<tr>
<td>All seals</td>
<td>Renolit HLT 2</td>
</tr>
<tr>
<td>Bores on the piston</td>
<td>Renolit HLT 2</td>
</tr>
</tbody>
</table>

6.4 Disassembling the product

6.4.1 Variant with locking (MV)

Position of the position numbers (see 6.7, Page 23)

⚠️ WARNING

Risk of injury from uncontrolled movements!
If the energy supply is switched on or residual energy remains in the system, parts may move unexpectedly and cause serious injuries.

- Switch off energy supply.
- Make sure there is no residual energy in the system

1. Disconnect cable connections.
2. Remove compressed air lines.
3. Remove product from handling device.
4. Remove screws (51) and separate product from the adapter plate.
5. Remove screws (52) from the housing-top (02).
6. **WARNING! Danger of injury due to spring forces! The cylinder piston is under spring tension.** Remove screws (53) then remove bolt (09).
7. Separate housing top (02) from the flange bottom (01).
8. Unscrew screws (49) and remove cylinder cover (04).
9. Remove cylinder piston (03) from the housing-top (02)
### 6.4.2 Variant without locking (OV)

Position of the position numbers (§ 6.7, Page 23)

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of injury from uncontrolled movements!</strong></td>
</tr>
<tr>
<td>If the energy supply is switched on or residual energy remains in the system, parts may move unexpectedly and cause serious injuries.</td>
</tr>
<tr>
<td>• Switch off energy supply.</td>
</tr>
<tr>
<td>• Make sure there is no residual energy in the system</td>
</tr>
</tbody>
</table>

1. Disconnect cable connections.
2. Remove compressed air lines.
3. Remove product from handling device.
4. Remove screws (51) and separate product form the adapter plate.
5. Remove screws (52) from the housing-top (02).
6. Remove screws (53) then remove bolt (09).
7. Separate housing top (22) from the flange bottom (01).

### 6.5 Servicing and assembling the product

Position of the position numbers (§ 6.7, Page 23)

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk of injury due to spring forces!</strong></td>
</tr>
<tr>
<td>The lid is under spring tension.</td>
</tr>
<tr>
<td>• Carefully disassemble the product</td>
</tr>
</tbody>
</table>

**Maintenance**
- Remove screws (52) from the flange-bottom (01) and replace shear-pads (15).
- Clean all parts thoroughly and check for damage and wear.
- Treat all greased areas with lubricant (§ 6.3, Page 20).
- Oil or grease bare external steel parts.
- Replace all wear parts / seals.
  - Position of the wearing parts (§ 6.7, Page 23)
  - Seal kit (§ 6.6, Page 22)

**Assembly** Assembly takes place in the opposite order to disassembly
## 6.6 Seal kit

<table>
<thead>
<tr>
<th>Seal kit for</th>
<th>ID number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCU-Z 64-MV</td>
<td>0324871</td>
</tr>
<tr>
<td>TCU-Z 80-MV</td>
<td>0324873</td>
</tr>
<tr>
<td>TCU-Z 100-MV</td>
<td>0324875</td>
</tr>
<tr>
<td>TCU-Z 125-MV</td>
<td>0324877</td>
</tr>
<tr>
<td>TCU-Z 160-MV</td>
<td>0324879</td>
</tr>
<tr>
<td>TCU-Z 200-MV</td>
<td>0324881</td>
</tr>
</tbody>
</table>

Contents of the sealing kit, ([6.7, Page 23](#)).
6.7 Assembly drawing

Assembling of the variant without locking (OV)
Assembling of the variant with locking (MV)

* Wearing part, replace during maintenance. Included in the seal kit. Seal kit can only be ordered completely.

** only for TCU-Z 64, TCU-Z 100. TCU-Z 160