Digital signal transfer device SC001
Operating Instructions 153/03
Table of Contents

1 Introduction .............................................................................................................. 5
  1.1 Manufacturer .................................................................................................. 5
  1.2 Subject to change without notice .................................................................... 5
  1.3 Completeness .................................................................................................. 5
  1.4 Supporting documents .................................................................................. 5
  1.5 Safekeeping .................................................................................................... 6
  1.6 Notation conventions .................................................................................... 6
    1.6.1 Abbreviations used .................................................................................. 7
    1.6.2 Hazard communication system ............................................................. 8
    1.6.3 Information system ................................................................................ 9

2 Safety .................................................................................................................... 10
  2.1 General safety information .......................................................................... 10
  2.2 Appropriate use ............................................................................................ 10
  2.3 Inappropriate use .......................................................................................... 11
  2.4 Personnel qualification ................................................................................ 11
  2.5 Operator duty of care .................................................................................. 11

3 Product description .......................................................................................... 13
  3.1 Function description .................................................................................... 14
  3.2 Performance features .................................................................................. 14
  3.3 Scope of delivery ........................................................................................ 15
  3.4 Setup/models ............................................................................................... 15
  3.5 AUX DIGITAL OUTPUT connection assignment ...................................... 16

4 Packaging, Transport and Storage ................................................................. 17
  4.1 Packaging ..................................................................................................... 17
# Table of Contents

4.1.1 Purpose .............................................................................................................. 17  
4.1.2 Suitability, structure and production ................................................................. 17  
4.1.3 Markings ............................................................................................................. 17  

4.2 Transportation, receipt and handling of shipments ........................................... 18  
4.3 Storage of shipments ............................................................................................... 19  

5 Commissioning ........................................................................................................ 20  
5.1 Electromagnetic compatibility ............................................................................. 20  
5.1.1 Wiring requirement of installation site ................................................................. 20  
5.1.2 Wiring requirement of operating site ................................................................. 20  
5.1.3 Wiring requirement in control cabinet ................................................................. 22  
5.2 Connecting digital signal transfer device ............................................................... 23  
5.3 Removing digital signal transfer device ................................................................. 24  

6 Technical Data ........................................................................................................... 25  
6.1 Modular signal transfer unit .................................................................................. 25  
6.1.1 Connection .......................................................................................................... 25  
6.1.2 Relay equipment ................................................................................................. 26  
6.2 Modular display unit ............................................................................................... 27  
6.3 Connection cable to display .................................................................................. 27  

7 Appendix .................................................................................................................... 29  
7.1 Digital remote display of positions (707281) ......................................................... 29  
7.2 Block diagram for tap position indicator ............................................................... 30  
7.3 Dimensional drawing for housing .......................................................................... 31  
7.4 7-segment display for remote display of positions - dimensional drawing (898700)...................................................................................................................... 32  
7.5 7-segment display for remote display of positions - detailed drawings .............................. 33  

8 MR worldwide ............................................................................................................. 34
1 Introduction

This technical file contains detailed descriptions on the safe and proper mounting, connection, commissioning and monitoring of the product.

It also includes safety instructions and general information about the product.

This technical file is intended solely for specially trained and authorized personnel.

1.1 Manufacturer

The product is manufactured by:
Maschinenfabrik Reinhausen GmbH
Falkensteinstraße 8
93059 Regensburg
Tel.: (+49) 9 41/40 90-0
Fax: (+49) 9 41/40 90-7001
E-Mail: sales@reinhausen.com

Further information on the product and copies of this technical file are available from this address if required.

1.2 Subject to change without notice

The information contained in this technical file comprise the technical specifications approved at the time of printing. Significant modifications will be included in a new edition of the technical file.

The document and version numbers of this technical file are shown in the footer.

1.3 Completeness

This technical file is incomplete without the supporting documentation.

1.4 Supporting documents

Also observe generally valid legislation, standards, guidelines and specifications on accident prevention and environmental protection in the respective country of use.
1.5 Safekeeping

This technical file and all supporting documents must be kept ready to hand and accessible for future use at all times.

1.6 Notation conventions

This section contains an overview of the abbreviations, symbols and textual emphasis used.
1.6.1 Abbreviations used

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
</tr>
<tr>
<td>A</td>
<td>Ampere</td>
</tr>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>AgSnO2</td>
<td>Silver tin oxide</td>
</tr>
<tr>
<td>BCD</td>
<td>Binary Coded Decimal</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DIN</td>
<td>Deutsches Institut für Normung (German Institute for Standardization)</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>I</td>
<td>Current</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>km</td>
<td>Kilometer</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>LDC</td>
<td>Line Drop Compensation</td>
</tr>
<tr>
<td>m</td>
<td>Meter</td>
</tr>
<tr>
<td>max.</td>
<td>Maximum</td>
</tr>
<tr>
<td>MR</td>
<td>Maschinenfabrik Reinhausen</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>min.</td>
<td>Minimum</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter</td>
</tr>
<tr>
<td>ms</td>
<td>Millisecond</td>
</tr>
<tr>
<td>mW</td>
<td>Milliwatt</td>
</tr>
<tr>
<td>RS-232</td>
<td>Serial interface (recommended standard)</td>
</tr>
<tr>
<td>s</td>
<td>Second</td>
</tr>
<tr>
<td>SC</td>
<td>Signal converter (signal transmitter)</td>
</tr>
<tr>
<td>T</td>
<td>Time</td>
</tr>
<tr>
<td>TTL</td>
<td>Transistor-Transistor-Logic</td>
</tr>
<tr>
<td>V</td>
<td>Voltage</td>
</tr>
<tr>
<td>$V_{\text{actual}}$</td>
<td>Actual voltage</td>
</tr>
</tbody>
</table>
1.6.2 Hazard communication system

Warnings in this technical file use the following format:

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Hazard level</th>
<th>Consequence of failure to comply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danger</td>
<td>Immediate threat of danger</td>
<td>Death or serious injury could occur</td>
</tr>
<tr>
<td>Warning</td>
<td>Possible threat of danger</td>
<td>Death or serious injury could occur</td>
</tr>
<tr>
<td>Attention</td>
<td>Possible dangerous situation</td>
<td>Minor or moderate injury could occur</td>
</tr>
<tr>
<td>Note</td>
<td>Possible dangerous situation</td>
<td>Damage to property could occur</td>
</tr>
</tbody>
</table>

The following signal words are used:

Table 1 Abbreviations used

Table 2 Signal words in warning notices
1 Introduction

Pictograms warn of dangers:

<table>
<thead>
<tr>
<th>Pictogram</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Danger</td>
</tr>
<tr>
<td>⚡️</td>
<td>Dangerous electrical voltage</td>
</tr>
<tr>
<td>🔥</td>
<td>Fire hazard</td>
</tr>
<tr>
<td>🛑</td>
<td>Danger of tipping</td>
</tr>
</tbody>
</table>

Table 3 Symbols used in warning notices

1.6.3 Information system

Information is designed to simplify and improve understanding of particular procedures. In this technical file they are laid out as follows:

Important information
2 Safety

2.1 General safety information

This technical file contains detailed descriptions on the safe and proper mounting, connection, commissioning and monitoring of the product.

Read this technical file through carefully to familiarize yourself with the product.

Particular attention should be paid to the information given in this chapter.

2.2 Appropriate use

The product and associated equipment and special tools supplied with it comply with the relevant legislation, regulations and standards, particularly health and safety requirements, applicable at the time of delivery.

If used as intended and in compliance with the specified requirements and conditions in this technical file as well as the warning notices in this technical file and attached to the product, then the product does not present any hazards to people, property or the environment. This applies throughout the product's full life, from delivery through installation and operation to disassembly and disposal.

The operational quality assurance system ensures a consistently high quality standard, particularly in regard to the observance of health and safety requirements.

Use is considered to be appropriate if

- the product is operated in accordance with this technical file and the agreed delivery conditions and technical data, and
- the associated equipment and special tools supplied with it are used solely for the intended purpose and in accordance with the specifications of this technical file.
- the product is used only with the transformer specified in the order.
2.3 Inappropriate use

Use is considered to be inappropriate if the product is used other than as described in Appropriate use.

Maschinenfabrik Reinhausen does not accept liability for damage resulting from unauthorized or inappropriate changes to the product. Inappropriate changes to the product without consultation with Maschinenfabrik Reinhausen can lead to personal injury, damage to property and operational disruption.

2.4 Personnel qualification

The product is designed solely for use in electrical energy systems and facilities operated by appropriately trained staff. This staff comprises people who are familiar with the installation, assembly, commissioning and operation of such products.

2.5 Operator duty of care

To prevent accidents, disruptions and damages as well as unacceptable adverse effects on the environment, those responsible for transport, installation, operation, maintenance and disposal of the product or parts of the product must ensure the following:

- All warning and hazard notices are complied with.
- Personnel are instructed regularly in all relevant aspects of operational safety, the operating instructions and particularly the safety instructions contained therein.
- Regulations and operating instructions for safe working as well as the relevant instructions for staff procedures in the case of accidents and fires are kept on hand at all times and are displayed in the workplace where applicable.
- The product is only used when in a sound operational condition and safety equipment in particular is checked regularly for operational reliability.
- Only replacement parts, lubricants and auxiliary materials which are authorized by the manufacturer are used.
- The specified operating conditions and requirements of the installation location are complied with.
- All necessary devices and personal protective equipment for each activity are made available.
- The prescribed maintenance intervals and the relevant regulations are complied with.
• Fitting, electrical connection and commissioning of the product may only be carried out by qualified and trained personnel in accordance with this technical file.

• The operator must ensure appropriate use of the product.
3 Product description

The signal transfer device for remotely displaying positions transfers digital signals generated in the motor-drive unit over large distances (up to max. 50 km). The digital signals can be prepared and displayed anywhere, usually in the control room.

Figure 1 Overview of digital signal transmission
3 Product description

3.1 Function description

The signal transmitter in the control room produces a stabilized voltage (terminal 1) on the position transmitter equipment fitted in the motor-drive unit.

Motor-drive unit:
The stabilized voltage (24 V DC) created on the position transmitter module (diode matrix) is transferred to the position transmitter board's slider via the position transmitter cable. For every motor-drive unit position, there is a button on the position transmitter board, which is approached by the slider. The buttons are connected with the position transmitter module via the position transmitter cable. In the position transmitter module, the buttons' signals are digitally coded using diode gates, to suit the tap changer's position designation and the desired code (BCD, dual, gray), and transferred to the outputs.

Control room:
The output signals of the position transmitter module are connected to the signal transmitter installed in the control room (terminals 2...12). These signals activate relays. There are 2 relays for each bit: one to activate the display (5 V DC, TTL level) and one for potential-free signal provision. The signals with their various codes are connected to the display using a serial cable (max. 20 m). In the display, the signal is converted into 7-segment code and displayed digitally. The original signal is also available, potential-free, on the signal transmitter. If further contacts are required, they can be provided using additional interposing relays.

3.2 Performance features

The product is particularly characterized by the following properties:

- High quality material
- Digital tap position capture via BCD code, gray code and dual code
- Global use possible thanks to wide-range power supply unit
3 Product description

3.3 Scope of delivery

The product is packaged with protection against moisture and is delivered as follows:

- Digital signal transfer device SC001

Please note the following:

1. Use dispatch documents to check that the delivery is complete.
2. Store the parts in a dry place until installation.
3. The product must remain in its airtight, protective wrapping and may only be removed immediately before installation.

The functional range of the product is dependent on the equipment ordered or the product version and not the content of this technical file.

3.4 Setup/models

Position transmitter equipment with a diode matrix is needed in the motor-drive unit. The diode matrix must be designed for the desired code and position designation of the motor-drive unit. The diode matrix in the motor-drive unit is connected to the signal transmitter in the control room via one line for the slider signal and one line for each bit of the digital signal.

A signal transmitter is needed in the control room. Due to its large voltage range, this is independent of voltage and given its modular structure, it is independent of code too. The signal transmitter generally features potential-free contacts at which the signal is also available decoupled. A display unit is also needed to display the operating position. The display contains 2.5 digits plus the sign (+/-) and is not dependent on the position number, just the code required.
### AUX DIGITAL OUTPUT connection assignment

<table>
<thead>
<tr>
<th></th>
<th>BCD</th>
<th>GRAY</th>
<th>DUAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 &lt;-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>31 &lt;-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>30 &lt;-</td>
<td>100</td>
<td>G100</td>
<td></td>
</tr>
<tr>
<td>29 &lt;-</td>
<td>80</td>
<td>Y10</td>
<td></td>
</tr>
<tr>
<td>28 &lt;-</td>
<td>40</td>
<td>A10</td>
<td>64</td>
</tr>
<tr>
<td>27 &lt;-</td>
<td>20</td>
<td>R10</td>
<td>32</td>
</tr>
<tr>
<td>26 &lt;-</td>
<td>10</td>
<td>G10</td>
<td>16</td>
</tr>
<tr>
<td>25 &lt;-</td>
<td>8</td>
<td>Y1</td>
<td>8</td>
</tr>
<tr>
<td>24 &lt;-</td>
<td>4</td>
<td>A1</td>
<td>4</td>
</tr>
<tr>
<td>23 &lt;-</td>
<td>2</td>
<td>R1</td>
<td>2</td>
</tr>
<tr>
<td>22 &lt;-</td>
<td>1</td>
<td>G1</td>
<td>1</td>
</tr>
<tr>
<td>21 -&gt;</td>
<td>V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4  AUX DIGITAL OUTPUT connection assignment
4 Packaging, Transport and Storage

4.1 Packaging

4.1.1 Purpose

The packaging is designed to protect the packaged goods both during transport and for loading and unloading as well as during periods of storage in such a way that no (detrimental) changes occur. The packaging must protect the goods against permitted transport stresses such as vibration, knocks and moisture (rain, snow, condensation).

The packaging also prevents undesired position changes of the packaged goods within the packaging during storage. The packaged goods must be prepared for shipment before actually being packed so that the goods can be transported safely, economically and in accordance with regulations.

4.1.2 Suitability, structure and production

The goods are packaged in a sturdy cardboard box. This ensures that the shipment remains in the intended transport position and that none of its components touches the load surface during transport or the floor after it is unloaded.

The box is designed for a maximum load of 10 kg.

Inlays inside the box stabilize the goods, preventing impermissible changes of position, and protect them from vibration.

4.1.3 Markings

The packaging bears a signature with symbols with instructions for safe transport and correct storage. The following symbols apply to the dispatch (of non-hazardous goods). Adherence to these symbols is mandatory.

Protect against moisture  Top  Fragile

Figure 2  Shipping pictograms
4.2 Transportation, receipt and handling of shipments

In addition to oscillation and shock stress, jolts must also be expected during transportation. In order to prevent possible damage, avoid dropping, tipping, knocking over and colliding with the product.

If a crate falls from a particular height (e.g. when slings tear) or experiences an unbroken fall, damage must be expected regardless of the weight.

Before acceptance, all deliveries must be checked by the recipient (acknowledgement of receipt) for the following:

- Completeness based on the delivery slip
- External damage of any type.

The checks must take place after unloading when the crate can be accessed from all sides.

If external transport damage is detected on receipt of the shipment, proceed as follows:

- Immediately record the transport damage found in the shipping documents and have this countersigned by the carrier.
- In the event of severe damage, total loss or high damage costs, immediately notify the sales department at Maschinenfabrik Reinhausen and the relevant insurance company.
- After identifying the damage do not modify the condition of the shipment further and also retain the packaging material, until an inspection decision has been made by the transport company or the insurance company.
- Record the details of the damage immediately together with the carrier involved. This is essential for any claim for damages!
- If possible, photograph damage to packaging and packaged goods. This also applies to signs of corrosion on the packaged goods due to moisture inside the packaging (rain, snow, condensation).
- Name the damaged parts.

When damages are hidden, i.e. damages which are not determined until unpacking after the receipt of the shipment, proceed as follows:

- Make the party responsible for the damage liable as soon as possible by telephone and in writing, and prepare a damage report.
- Observe, in this regard, the time periods applicable to such actions in the respective country. Inquire about these in good time.

With hidden damage, it is very hard to make the transportation company (or other responsible party) liable. Any insurance claims for such damages can only be successful if relevant provisions are expressly included in the insurance terms and conditions.
4.3 Storage of shipments

Selection and arrangement of the storage location should meet the following requirements:

- Stored goods are protected against moisture (flooding, water from melting snow and ice), dirt, pests such as rats, mice, termites and so on, and against unauthorized access.
- Store the box on timber beams and planks as a protection against rising damp and for better ventilation.
- Carrying capacity of the ground under the goods is sufficient.
- Entrance and exit paths are kept free.

Check stored goods at regular intervals. Also take appropriate action after storms, heavy rain or snow and so on.
5 Commissioning

5.1 Electromagnetic compatibility

The product was developed in compliance with the relevant EMC standards. To ensure compliance with the EMC standards, please note the following points.

5.1.1 Wiring requirement of installation site

Note the following when selecting the installation site:

- The system's overvoltage protection must be effective.
- The system's ground connection must comply with all technical regulations.
- Separate system parts must be joined by a potential equalization.
- The device and its wiring must be at least 10 m away from circuit-breakers, load disconnectors and busbars.

5.1.2 Wiring requirement of operating site

Note the following when wiring the operating site:

- The connection cables must be laid in metallic cable ducts with a ground connection.
- Do not route lines which cause interference (e.g. power lines) and lines susceptible to interference (e.g. signal lines) in the same cable duct.
- Maintain a gap of at least 10 cm between lines causing interference and those susceptible to interference.
- Reserve lines must be grounded at both ends.
- The device must never be connected using multi-pin collective cables.
Signal lines must be routed in shielded cables.

The individual conductors (outgoing/return conductors) in the cable core must be twisted in pairs.

The shield must be fully (360°) connected to the device or a nearby ground rail.
NOTE

Reduced effectiveness of the shielding.

Using "pigtails" may considerably reduce the effectiveness of the shielding.

► Connect shield to cover all areas.

5.1.3 Wiring requirement in control cabinet

Note the following when wiring the control cabinet:

- The control cabinet for fitting the device must be prepared in accordance with EMC requirements:
  - functional division of control cabinet (physical separation)
  - constant potential equalization (all metal parts are joined)
  - line routing in accordance with EMC requirements (separation of lines which cause interference and those susceptible to interference)
  - optimum shielding (metal housing)
  - overvoltage protection (lightning protection)
  - collective grounding (main grounding rail)
  - cable bushings in accordance with EMC requirements
  - any contactor coils present must be interconnected

- The device's connection cables must be laid in contact with the grounded metal housing or in metallic cable ducts with a ground connection.

- Signal and power/switching lines should be laid in separate cable ducts.
### 5.2 Connecting digital signal transfer device

Connect the lines to be wired to the device to the system periphery as shown in the connection diagrams supplied.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damage to digital signal transfer device and system periphery</td>
</tr>
<tr>
<td>An incorrectly connected digital signal transfer device may result in damage to the device itself and the system periphery.</td>
</tr>
<tr>
<td>► Prior to commissioning, be sure to check the entire configuration and the measuring and operating voltage.</td>
</tr>
</tbody>
</table>

To obtain a better overview when connecting cables, only use as many leads as necessary.

Use only the specified cables for wiring. You can connect all standard cables with a cross-section of up to 2.5 mm².
5.3 Removing digital signal transfer device

Two recesses in the PCB, accessible externally, are used to unlock the device from the cap rail.

- To remove, insert a screwdriver 2 into recess 1 and move it towards the housing.

![Figure 5 Disassembly]

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recess</td>
</tr>
<tr>
<td>2</td>
<td>Screwdriver</td>
</tr>
</tbody>
</table>
6 Technical Data

6.1 Modular signal transfer unit

6.1.1 Connection

see connection diagram Digital remote display of positions on page 29

<table>
<thead>
<tr>
<th>Power supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 connection terminals</td>
<td>51, 52 in a pluggable design</td>
</tr>
<tr>
<td>Input voltage</td>
<td>48...300 V AC, 48...425 V DC (50, 60 Hz)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actuation: 12 connection terminals, in a pluggable design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal 1</td>
</tr>
<tr>
<td>Terminals 2...10</td>
</tr>
<tr>
<td>Terminal 11, 12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potential-free contacts: 12 connection terminals, in a pluggable design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal 21</td>
</tr>
<tr>
<td>Terminals 22...30</td>
</tr>
<tr>
<td>Terminal 31, 32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-pole socket terminal strip (in accordance with RS-232)</td>
</tr>
<tr>
<td>5 V DC stabilized (TTL level)</td>
</tr>
</tbody>
</table>

Table 5 Actuation
6.1.2 Relay equipment

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>24 V DC</td>
</tr>
<tr>
<td>Contact material</td>
<td>AgSnO2</td>
</tr>
<tr>
<td>Nominal rating</td>
<td>170 mW</td>
</tr>
<tr>
<td>Response value</td>
<td>75 mW</td>
</tr>
<tr>
<td>Operating range/response class</td>
<td>DIN/IEC/VDE-2b</td>
</tr>
<tr>
<td>Response time/release time</td>
<td>5 ms/6 ms</td>
</tr>
<tr>
<td>AC/DC switching capacity</td>
<td>1500 VA/load limit curve</td>
</tr>
</tbody>
</table>

Table 6 Relay equipment

Figure 6 Maximum contact loadability of outputs with direct current

1 Ohmic load
6 Technical Data

**Definition of load limit curve:**
During 1000 cycles, there must not be any arcs lasting > 10 ms.

<table>
<thead>
<tr>
<th>Operating temperature:</th>
<th>-25 °C to +80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission distance:</td>
<td>max. 50 km (motor-drive unit to signal transmitter)</td>
</tr>
</tbody>
</table>

Table 7 Load limit curve, operating temperature, transmission distance

---

6.2 Modular display unit

see also [7-segment display for remote display of positions - dimensional drawing (898700)] on page 32

<table>
<thead>
<tr>
<th>Modular display unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control panel section:</td>
</tr>
<tr>
<td>Design:</td>
</tr>
<tr>
<td>Supply voltage:</td>
</tr>
<tr>
<td>Connection:</td>
</tr>
<tr>
<td>Actuation:</td>
</tr>
<tr>
<td>Operating temperature:</td>
</tr>
<tr>
<td>Transmission distance:</td>
</tr>
</tbody>
</table>

Table 8 Modular display unit

---

6.3 Connection cable to display

<table>
<thead>
<tr>
<th>Connection cable to display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model:</td>
</tr>
<tr>
<td>Standard length:</td>
</tr>
<tr>
<td>Operating temperature:</td>
</tr>
</tbody>
</table>

Table 9 Connection cable to display
7 Appendix

7.1 Digital remote display of positions (707281)
7.2  Block diagram for tap position indicator
7.3 Dimensional drawing for housing
7.4 7-segment display for remote display of positions - dimensional drawing
(898700)
7.5 7-segment display for remote display of positions - detailed drawings
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