Voltage Regulator
TAPCON® 230 expert

Supplement

2195774/01 EN . Protocol Specification MODBUS
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1 Introduction

The technical file contains detailed descriptions for implementing the MOD-BUS interface protocol.

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

1.1 Subject to change without notice

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

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

1.2 Completeness

This technical file is incomplete without the supporting documentation.

1.3 Supporting documents

The following documents apply to this technical file:

- Operating instructions for TAPCON® 230 expert
- Quick reference guide to TAPCON® 230 expert

1.4 Safekeeping

This technical file and all supporting documents must be kept ready at hand and accessible for future use at all times.
## 2 Physical interfaces

The device has been developed in accordance with applicable EMC standards. In regards to complying with EMC standards, please refer to the corresponding chapter on the topic of "Electromagnetic Compatibility" in the device’s operating instructions.

You can find additional information on wiring and routing instructions for the fiber-optic cable in the operating instructions for this device.

The following physical interfaces are available on the device for data transmission using the control system protocol:

<table>
<thead>
<tr>
<th>Interface</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RS232</strong></td>
<td>9-pin SUB-D connector</td>
</tr>
<tr>
<td></td>
<td>Pin 2: TxD</td>
</tr>
<tr>
<td></td>
<td>Pin 3: RxD</td>
</tr>
<tr>
<td></td>
<td>Pin 5: GND</td>
</tr>
<tr>
<td><strong>RS485</strong></td>
<td>3-pin bush from Phoenix MSTB 2.5/3-GF-5</td>
</tr>
<tr>
<td></td>
<td>Pin 1: GND (100 Ω ground resistance)</td>
</tr>
<tr>
<td></td>
<td>Pin 2: B (inverted)</td>
</tr>
<tr>
<td></td>
<td>Pin 3: A (non-inverted)</td>
</tr>
<tr>
<td></td>
<td>Polarity:</td>
</tr>
<tr>
<td></td>
<td>A &gt; B around 200 mV corresponds to 1</td>
</tr>
<tr>
<td></td>
<td>B &lt; A around 200 mV corresponds to 0</td>
</tr>
<tr>
<td></td>
<td>An inactive communication cable corresponds to 1.</td>
</tr>
<tr>
<td></td>
<td>The start bit has the designation 0.</td>
</tr>
<tr>
<td></td>
<td>Recommended terminating resistor 120 Ω.</td>
</tr>
<tr>
<td><strong>RJ45 (Ethernet)</strong></td>
<td>Optional Ethernet or Modem interface</td>
</tr>
<tr>
<td></td>
<td>Pin1: Tx+</td>
</tr>
<tr>
<td></td>
<td>Pin2: Tx-</td>
</tr>
<tr>
<td></td>
<td>Pin3: Rx+</td>
</tr>
<tr>
<td></td>
<td>Pin6: Rx-</td>
</tr>
<tr>
<td><strong>Fiber-optic cable (FO)</strong></td>
<td>F-ST (850 nm or 660 nm)</td>
</tr>
<tr>
<td></td>
<td>F-SMA (850 nm or 660 nm)</td>
</tr>
</tbody>
</table>

Table 1: Interfaces available
Figure 1: Voltage regulator connections

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS485</td>
</tr>
<tr>
<td>2</td>
<td>RS232</td>
</tr>
<tr>
<td>3</td>
<td>Fiber-optic cable</td>
</tr>
<tr>
<td>4</td>
<td>CAN bus</td>
</tr>
<tr>
<td>5</td>
<td>RJ45 (Ethernet)</td>
</tr>
</tbody>
</table>
3 Setting device parameters

In order to use the control system protocol, you need to set the device parameters.

Please refer to the device's operating instructions for more information regarding setting the device parameters.

You must set the following parameters:

If you are operating MODBUS via the RJ45 connection, the MODBUS RTU protocol is transferred to a network via a TCP/IP wrapper.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RS232</th>
<th>RS485</th>
<th>OF</th>
<th>RJ45</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication protocol</td>
<td>MODBUS ASCII or MODBUS RTU</td>
<td>MODBUS RTU: 8E1, 8O1, 8N1, 8N2</td>
<td>MODBUS RTU</td>
<td></td>
</tr>
<tr>
<td>MODBUS format</td>
<td>MODBUS ASCII: 7E1, 7O1, 7N2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication port</td>
<td>RS232</td>
<td>RS485</td>
<td>OF</td>
<td>RJ45</td>
</tr>
<tr>
<td>Baud rate communication</td>
<td>9.6; 19.2; 38.4 or 57.6 kilobaud</td>
<td></td>
<td>fixed 19.2 kilobaud (cannot be parameterized)</td>
<td>Speed of transfer: 10 Mbit/s</td>
</tr>
<tr>
<td>Network address</td>
<td>Not required</td>
<td></td>
<td></td>
<td>0.0.0.0</td>
</tr>
<tr>
<td>TCP port</td>
<td>Not required</td>
<td></td>
<td></td>
<td>1234</td>
</tr>
<tr>
<td>OF light on/off</td>
<td>Not required</td>
<td></td>
<td>ON: Light ON at 1</td>
<td>Not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OFF: Light OFF at 1</td>
<td></td>
</tr>
<tr>
<td>Local SCADA address</td>
<td>1 to 255 (0 = broadcast message)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCADA master address</td>
<td>Not required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsolicited messages</td>
<td>Not required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatedly unsolicited messages</td>
<td>Not required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appl. confirm. time exceeded</td>
<td>Not required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS485 transmit delay time</td>
<td>Not required</td>
<td>0...254 ms*</td>
<td>Not required</td>
<td>Not required</td>
</tr>
</tbody>
</table>

*) e.g. 2 ms, to compensate for the response time of an external RS485/RS232 transformer when changing between transmitting and receiving operation.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RS232</th>
<th>RS485</th>
<th>OF</th>
<th>RJ45</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI protocol</td>
<td></td>
<td></td>
<td></td>
<td>DNP3</td>
</tr>
</tbody>
</table>

Table 2: Device parameters
### 3 Setting device parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RS232</th>
<th>RS485</th>
<th>OF</th>
<th>RJ45</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI port</td>
<td>RS232</td>
<td>RS485</td>
<td>OF</td>
<td>RJ45</td>
</tr>
<tr>
<td>CI baudrate</td>
<td>9.6; 19.2; 38.4 or 57.6 kilobaud</td>
<td>Not required</td>
<td>Not required</td>
<td>0.0.0.0</td>
</tr>
<tr>
<td>IP address</td>
<td>Not required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCP port</td>
<td>Not required</td>
<td></td>
<td></td>
<td>1234</td>
</tr>
<tr>
<td>OF inversion</td>
<td>Not required</td>
<td></td>
<td>ON: Light ON at 1</td>
<td>Not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OFF: Light OFF at 1</td>
<td></td>
</tr>
<tr>
<td>CI address (SCADA)</td>
<td></td>
<td></td>
<td>1...9,999</td>
<td></td>
</tr>
<tr>
<td>Master address (SCADA)</td>
<td></td>
<td></td>
<td>0...9,999</td>
<td></td>
</tr>
<tr>
<td>Unsolicited messages</td>
<td></td>
<td></td>
<td>On/Off</td>
<td></td>
</tr>
<tr>
<td>Repeatedly unsolicited messages</td>
<td></td>
<td></td>
<td>1...100 (0 = infinite)</td>
<td></td>
</tr>
<tr>
<td>Appl. confirm. time exceeded</td>
<td></td>
<td></td>
<td>1...60 s</td>
<td></td>
</tr>
<tr>
<td>RS485 transmit delay time</td>
<td>Not required</td>
<td></td>
<td>0...254 ms*</td>
<td>Not required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Not required</th>
<th>Not required</th>
<th>Not required</th>
<th>Not required</th>
</tr>
</thead>
</table>

*) e.g. 2 ms, to compensate for the reaction time of an external RS485/RS232 transformer when changing between transmitting and receiving operation.
4 Protocol specification

The implementation of the MODBUS® communication protocol (ASCII and RTU mode) is based on the "Modicon MODBUS Protocol Reference Guide", PI-MBUS-300 Rev. J, Copyright 1996 of Modicon Inc.

Implementation of the protocol is described below.

4.1 Function codes

The following functions are supported:

<table>
<thead>
<tr>
<th>Function code</th>
<th>Group name</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Read coil status</td>
</tr>
<tr>
<td>02</td>
<td>Read input status</td>
</tr>
<tr>
<td>03</td>
<td>Read holding registers</td>
</tr>
<tr>
<td>04</td>
<td>Read input registers</td>
</tr>
<tr>
<td>05</td>
<td>Force single coil</td>
</tr>
<tr>
<td>06</td>
<td>Preset single register</td>
</tr>
</tbody>
</table>

Table 4: Supported function codes

No more than 1 register should be written with one request. No more than 1 coil should be switched with one request.

“Read input status” also includes the data points of “Read coil status”. “Read input registers” also includes the data points of “Read holding registers”

4.2 Error codes

The following error codes are implemented:

<table>
<thead>
<tr>
<th>Function code</th>
<th>Group name</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Illegal function</td>
</tr>
<tr>
<td>02</td>
<td>Illegal data</td>
</tr>
<tr>
<td>03</td>
<td>Illegal data value</td>
</tr>
</tbody>
</table>

Table 5: Implemented error codes

Multiple communication links are not supported. Communication is in half-duplex mode.

4.3 Addressing model

Addresses in this document relate to the Modbus PDU addresses.

Example

Reading the input status with address 8 results in reading address 7 in the discrete input block of the Modbus data model.
Figure 2: Modbus addressing model
## 5 Data points

The data points of the protocol are described in the following section.

### 5.1 Input status

<table>
<thead>
<tr>
<th>Point address</th>
<th>Group name</th>
<th>Name for state when value is 0</th>
<th>Name for state when value is 1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Desired voltage value 1</td>
<td>Voltage 1 inactive</td>
<td>Voltage 1 active</td>
<td>Activation status of desired voltage value 1</td>
</tr>
<tr>
<td>1</td>
<td>Desired voltage value 2</td>
<td>Voltage 2 inactive</td>
<td>Voltage 2 active</td>
<td>Activation status of desired voltage value 2</td>
</tr>
<tr>
<td>2</td>
<td>Desired voltage value 3</td>
<td>Voltage 3 inactive</td>
<td>Voltage 3 active</td>
<td>Activation status of desired voltage value 3</td>
</tr>
<tr>
<td>4</td>
<td>Parallel operation on/off</td>
<td>Parallel switch off</td>
<td>Parallel switch on</td>
<td>Status of software switch for parallel connection on/off</td>
</tr>
<tr>
<td>5</td>
<td>Parallel group 1</td>
<td>Parallel group 1 off</td>
<td>Parallel group 1 on</td>
<td>Activation status of parallel group 1</td>
</tr>
<tr>
<td>6</td>
<td>Parallel group 2</td>
<td>Parallel group 2 off</td>
<td>Parallel group 2 on</td>
<td>Activation status of parallel group 2</td>
</tr>
<tr>
<td>7</td>
<td>Master parallel</td>
<td>Master parallel operation method inactive</td>
<td>Master parallel operation method active</td>
<td>Activation status of master parallel operation method</td>
</tr>
<tr>
<td>8</td>
<td>Follower parallel</td>
<td>Follower parallel operation method inactive</td>
<td>Follower parallel operation active</td>
<td>Activation status of follower parallel operation method</td>
</tr>
<tr>
<td>9</td>
<td>AutoSync parallel</td>
<td>AutoSync parallel operation method inactive</td>
<td>AutoSync parallel operation method active</td>
<td>Activation status of AutoSync parallel operation method</td>
</tr>
<tr>
<td>10</td>
<td>Circulating current</td>
<td>Circulating current parallel operation method inactive</td>
<td>Circulating current parallel operation method active</td>
<td>Activation status of circulating current parallel operation method</td>
</tr>
<tr>
<td>11</td>
<td>Raise output</td>
<td><em>Raise output command inactive</em></td>
<td><em>Raise output command active</em></td>
<td>*Raise output relay closes when the AVR is setting a <em>Raise command</em></td>
</tr>
<tr>
<td>12</td>
<td>Lower output</td>
<td><em>Lower output command inactive</em></td>
<td><em>Lower output command active</em></td>
<td>*Lower output relay closes when the AVR is setting a <em>Lower command</em></td>
</tr>
<tr>
<td>13</td>
<td>Parallel operation status</td>
<td>Simplex mode</td>
<td>Parallel mode</td>
<td>Active parallel operation status of the voltage regulator</td>
</tr>
<tr>
<td>Point address</td>
<td>Group name</td>
<td>Name for state when value is 0</td>
<td>Name for state when value is 1</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>14</td>
<td>Parallel operation error</td>
<td>No error</td>
<td>Error</td>
<td>Parallel operation error status</td>
</tr>
<tr>
<td>15</td>
<td>Local/Remote status</td>
<td>Local (SCADA controls ignored)</td>
<td>Remote (SCADA controls enabled)</td>
<td>Control mode status of AVR</td>
</tr>
<tr>
<td>16</td>
<td>Overvoltage</td>
<td>No overvoltage</td>
<td>Overvoltage</td>
<td>Overvoltage detection status</td>
</tr>
<tr>
<td>17</td>
<td>Undervoltage</td>
<td>No undervoltage</td>
<td>Undervoltage</td>
<td>Undervoltage detection status</td>
</tr>
<tr>
<td>18</td>
<td>Overcurrent</td>
<td>No overcurrent</td>
<td>Overcurrent</td>
<td>Overcurrent detection status</td>
</tr>
<tr>
<td>19</td>
<td>Undercurrent</td>
<td>No undercurrent</td>
<td>Undercurrent</td>
<td>Undercurrent detection status</td>
</tr>
<tr>
<td>20</td>
<td>Status alarm relay</td>
<td>No alarm</td>
<td>Alarm</td>
<td>Status of the status alarm relay</td>
</tr>
<tr>
<td>21</td>
<td>Function monitoring</td>
<td>Normal mode</td>
<td>Function monitoring message</td>
<td>Function monitoring</td>
</tr>
<tr>
<td>22</td>
<td>Auto input</td>
<td>-</td>
<td>-</td>
<td>Activation status of auto input (edge triggered input)</td>
</tr>
<tr>
<td>23</td>
<td>Manual input</td>
<td>-</td>
<td>-</td>
<td>Activation status of manual input (edge triggered input)</td>
</tr>
<tr>
<td>24</td>
<td>Raise input</td>
<td>Raise input active</td>
<td>Raise input inactive</td>
<td>Status of raise input</td>
</tr>
<tr>
<td>25</td>
<td>Lower input</td>
<td>Lower input inactive</td>
<td>Lower input Active-Quick</td>
<td>Status of lower input</td>
</tr>
<tr>
<td>26</td>
<td>Active power flow direction</td>
<td>Positive active power flow direction</td>
<td>Negative active power flow direction</td>
<td>Direction of active power flow</td>
</tr>
<tr>
<td>27</td>
<td>Quick tap status</td>
<td>No Quick tap</td>
<td>Tap</td>
<td>Activation status of Quick tap regulation mode</td>
</tr>
<tr>
<td>28</td>
<td>Remote voltage level active</td>
<td>Voltage level parameter active</td>
<td>Remote voltage level active</td>
<td>Activation status of remote voltage level</td>
</tr>
<tr>
<td>29</td>
<td>GPO 1 output</td>
<td>GPO 1 inactive</td>
<td>GPO 1 active</td>
<td>Status of general purpose output 1</td>
</tr>
<tr>
<td>30</td>
<td>GPO 2 output</td>
<td>GPO 2 inactive</td>
<td>GPO 2 active</td>
<td>Status of general purpose output 2</td>
</tr>
<tr>
<td>31</td>
<td>GPO 3 output</td>
<td>GPO 3 inactive</td>
<td>GPO 3 active</td>
<td>Status of general purpose output 3</td>
</tr>
<tr>
<td>32</td>
<td>GPO 4 output</td>
<td>GPO 4 inactive</td>
<td>GPO 4 active</td>
<td>Status of general purpose output 4</td>
</tr>
<tr>
<td>33</td>
<td>GPO 5 output</td>
<td>GPO 5 inactive</td>
<td>GPO 5 active</td>
<td>Status of general purpose output 5</td>
</tr>
</tbody>
</table>
## 5 Data points

<table>
<thead>
<tr>
<th>Point address</th>
<th>Group name</th>
<th>Name for state when value is 0</th>
<th>Name for state when value is 1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>GPO 6 output</td>
<td>GPO 6 inactive</td>
<td>GPO 6 active</td>
<td>Status of general purpose output 6</td>
</tr>
<tr>
<td>35</td>
<td>GPO 7 output</td>
<td>GPO 7 inactive</td>
<td>GPO 7 active</td>
<td>Status of general purpose output 7</td>
</tr>
<tr>
<td>36</td>
<td>GPI 1 input</td>
<td>GPI 1 inactive</td>
<td>GPI 1 active</td>
<td>Status of general purpose input 1</td>
</tr>
<tr>
<td>37</td>
<td>GPI 2 input</td>
<td>GPI 2 inactive</td>
<td>GPI 2 active</td>
<td>Status of general purpose input 2</td>
</tr>
<tr>
<td>38</td>
<td>GPI 3 input</td>
<td>GPI 3 inactive</td>
<td>GPI 3 active</td>
<td>Status of general purpose input 3</td>
</tr>
<tr>
<td>39</td>
<td>GPI 4 input</td>
<td>GPI 4 inactive</td>
<td>GPI 4 active</td>
<td>Status of general purpose input 4</td>
</tr>
<tr>
<td>40</td>
<td>GPI 5 input</td>
<td>GPI 5 inactive</td>
<td>GPI 5 active</td>
<td>Status of general purpose input 5</td>
</tr>
<tr>
<td>41</td>
<td>GPI 6 input</td>
<td>GPI 6 inactive</td>
<td>GPI 6 active</td>
<td>Status of general purpose input 6</td>
</tr>
<tr>
<td>42</td>
<td>GPI 7 input</td>
<td>GPI 7 inactive</td>
<td>GPI 7 active</td>
<td>Status of general purpose input 7</td>
</tr>
<tr>
<td>43</td>
<td>GPI 8 input</td>
<td>GPI 8 inactive</td>
<td>GPI 8 active</td>
<td>Status of general purpose input 8</td>
</tr>
<tr>
<td>44</td>
<td>Position bit 0 input</td>
<td>Position bit 0 inactive</td>
<td>Position bit 0 active</td>
<td>Status of position bit 0 input</td>
</tr>
<tr>
<td>45</td>
<td>Position bit 1 input</td>
<td>Position bit 1 inactive</td>
<td>Position bit 1 active</td>
<td>Status of position bit 1 input</td>
</tr>
<tr>
<td>46</td>
<td>Position bit 2 input</td>
<td>Position bit 2 inactive</td>
<td>Position bit 2 active</td>
<td>Status of position bit 2 input</td>
</tr>
<tr>
<td>47</td>
<td>Position bit 3 input</td>
<td>Position bit 3 inactive</td>
<td>Position bit 3 active</td>
<td>Status of position bit 3 input</td>
</tr>
<tr>
<td>48</td>
<td>Position bit 4 input</td>
<td>Position bit 4 inactive</td>
<td>Position bit 4 active</td>
<td>Status of position bit 4 input</td>
</tr>
<tr>
<td>49</td>
<td>Position bit 5 input</td>
<td>Position bit 5 inactive</td>
<td>Position bit 5 active</td>
<td>Status of position bit 5 input</td>
</tr>
<tr>
<td>50</td>
<td>Position bit value input</td>
<td>Position bit value inactive</td>
<td>Position bit value active</td>
<td>Status of position bit value input</td>
</tr>
<tr>
<td>57</td>
<td>Simplex mode parallel operation</td>
<td>Parallel operation mode</td>
<td>Simplex mode</td>
<td>Status of simplex mode parallel operation</td>
</tr>
</tbody>
</table>

Table 6: Device data points: Input status
## 5.2 Coils

<table>
<thead>
<tr>
<th>Point address</th>
<th>Group name</th>
<th>Name for state when value is 0</th>
<th>Name for state when value is 1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Desired voltage value 1</td>
<td>-</td>
<td>Select voltage 1</td>
<td>Selection of desired voltage value 1 (only possible if there is no GPI set to a voltage). Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
<tr>
<td>1</td>
<td>Desired voltage value 2</td>
<td>-</td>
<td>Select voltage 2</td>
<td>Selection of desired voltage value 2 (only possible if there is no GPI set to a voltage). Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
<tr>
<td>2</td>
<td>Desired voltage value 3</td>
<td>-</td>
<td>Select voltage 3</td>
<td>Selection of desired voltage value 3 (only possible if there is no GPI set to a voltage). Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
<tr>
<td>3</td>
<td>Auto/Manual switch</td>
<td>Manual on</td>
<td>Auto on</td>
<td>Activation of auto or manual voltage regulation method. Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
<tr>
<td>4</td>
<td>Parallel operation on/off</td>
<td>Parallel group 1 off</td>
<td>Parallel group 1 on</td>
<td>Parallel operation on/off software switch. Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
<tr>
<td>5</td>
<td>Parallel group 2</td>
<td>Parallel group 2 off</td>
<td>Parallel group 2 on</td>
<td>Activation of parallel operation group 2 (only possible if there is no GPI set to a parallel operation group). Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
<tr>
<td>6</td>
<td>Master parallel</td>
<td>-</td>
<td>Selecting master parallel operation method</td>
<td>Master method selection (only possible if there is no GPI set to master/follower). Pulse/latch on/off times are fixed and hardware-dependent. Variable on/off times will be ignored.</td>
</tr>
</tbody>
</table>
### 5.3 Holding registers

<table>
<thead>
<tr>
<th>Point address</th>
<th>Group name</th>
<th>Transmitted value min./max.</th>
<th>Scaling multiplier/offset</th>
<th>Units</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Desired voltage value 1</td>
<td>490/1,400</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Desired voltage value 2</td>
<td>490/1,400</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Desired voltage value 3</td>
<td>490/1,400</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 8: Device data points: Holding registers
### 5.4 Input registers

<table>
<thead>
<tr>
<th>Point address</th>
<th>Group name</th>
<th>Transmitted value min./max.</th>
<th>Scaling multiplier/offset</th>
<th>Units</th>
<th>Resolution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Desired voltage value 1</td>
<td>490/1,400</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>Desired voltage value 2</td>
<td>490/1,400</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Desired voltage value 3</td>
<td>490/1,400</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>LSW operations counter</td>
<td>0/99,999,99 9</td>
<td>1/0</td>
<td>-</td>
<td>1</td>
<td>The operations counter value consists of LSW and MSW</td>
</tr>
<tr>
<td>4</td>
<td>MSW operations counter</td>
<td>0/99,999,99 9</td>
<td>1/0</td>
<td>-</td>
<td>1</td>
<td>The operations counter value consists of LSW and MSW</td>
</tr>
<tr>
<td>5</td>
<td>Tap position</td>
<td>-40/40</td>
<td>1/0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Measured voltage</td>
<td>0/1,700</td>
<td>10/0</td>
<td>V</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Voltage deviation</td>
<td>-1,000/2,470</td>
<td>10/0</td>
<td>%</td>
<td>1</td>
<td>Voltage deviation from desired voltage value in %</td>
</tr>
<tr>
<td>8</td>
<td>Active current</td>
<td>-22,000/22,000</td>
<td>100/0</td>
<td>%</td>
<td>1</td>
<td>1/5 A (100 % ≙ 1 A 100 % ≙ 5 A)</td>
</tr>
<tr>
<td>9</td>
<td>Reactive current</td>
<td>-22,000/22,000</td>
<td>100/0</td>
<td>%</td>
<td>1</td>
<td>1/5 A (100 % ≙ 1 A 100 % ≙ 5 A)</td>
</tr>
<tr>
<td>10</td>
<td>Measured current</td>
<td>0/22,000</td>
<td>100/0</td>
<td>%</td>
<td>1</td>
<td>1/5 A (100 % ≙ 1 A 100 % ≙ 5 A)</td>
</tr>
<tr>
<td>11</td>
<td>Frequency</td>
<td>0/22,000</td>
<td>100/0</td>
<td>%</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 9: Device data points: Input registers
## Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic compatibility</td>
</tr>
<tr>
<td>OF</td>
<td>Abbreviation for fiber-optic cable</td>
</tr>
<tr>
<td>RTU</td>
<td>Remote Terminal Unit</td>
</tr>
</tbody>
</table>
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