1. Application

The freely programmable REG-DPA regulator is used in medium and high-voltage grids to control arc suppression coils (Petersen coils) that are adjustable under continuous load. It can also solve all other control, measurement and recording tasks related to the Petersen coil.

Control methods:

- Classic

The regulator controls Petersen-coils in several ways. Depending on the requirements, the regulator can be set to a percentage or absolute detuning. For overhead transmission grids with high natural unbalance, a certain zero sequence voltage and detuning value can be set to balance between high neutral voltage displacement and right compensation. When an earth fault occurs, the regulator can correct the Petersen coil by the detuning and tune the grid to the resonance. There are a number of ways in which the regulator can control several Petersen coils in a compensation district.

- Optional current injection

In some grid configurations, it is possible that the Petersen coil cannot be tuned in the traditional way. For example such situations are:
  - Very balanced grids (cable grids)
  - Measuring signal that is heavily distorted by crosstalk (non-linear consumer or generator in the grid area)
  - Overhead transmission grids with asymmetrical conditions

The optional current injection can deal with all of these side-effects and accurately tune the Petersen coil to the real grid situation.

Resistor control (increase residual watt current)

It contains a freely configurable resistance control to increase the residual watt current supporting fault finding using the $\cos(\varphi)$ method. A thermal image of that resistor is computed to protect the same as an independent function unit.

Take over control tasks for pulse location

The free programmability of the regulator enables it to perform special tasks, such as controlling a pulse cabinet.

Pulse locating is a method to search for earth faults in the medium voltage grid by introducing a pulse pattern to the fault current. The regulator can be equipped with a background program that controls and monitors the pulse locating unit. This ensures that the conditions for successful pulse locating are met.

Control system / Communication

The REG-DPA regulator has a system bus (E-LAN) that enables it to communicate with other system devices.

A parallel (relay contacts) and serial remote control centre connection are available. The following protocols are available (additional protocols on request):

- IEC 60870 - 5 - 101 / 103 / 104
- IEC 61850
- DNP 3.0 over Ethernet
- DNP 3.0
- MODBUS RTU / MODBUS TCP
- SPABUS
2. Characteristics

**Multimaster system architecture**

The REG-DPA is part of a range of devices that is based on a standard hardware platform. If multiple devices are connected through the system bus E-LAN, every bus participant can be configured or read from a single PC. In addition, several PCs can access individual system participants (multimaster).

![Figure 1: REG-DPA regulator functions](image)

1. Voltage transducer (zero sequence voltage)
2. Position signal (resistance sensor) for the coil
3. Current transducer (e.g. current through the P-coil)
4. Binary inputs
5. Power supply
6. Display and processing unit
7. Binary outputs
8. Analogue outputs
9. E-LAN connection (2 x RS485 with repeater function)
10. COM1, RS232
11. COM2, RS232
12. COM3, RS485
13. Status - Signal (relay)

2.1 Regulator functions

![Figure 2: Regulation of the detuning](image)

A change in the grid’s switching status is recognized by a change in the zero sequence voltage. The regulator repositions the Petersen coil while taking into account the configurable conditions to the set detuning current.

The following data are displayed in addition to the regulator’s status:
- Coil position
- Zero sequence voltage
- Detuning (v)
- Total active current in the grid over the fault location (Iw)
- The resonance curve and its parameters

The switching status is monitored through a complex evaluation of the zero sequence voltage (value and phase).

**Regulation to percentage or absolute detuning current:**

The regulator positions the Petersen coil according to the configured setpoint value and effective positioning tolerance.

**Special requirements for the 110 kV grid**

Additional parameters can be taken into account for high-voltage grids, such as a maximum continuous adjacent zero sequence voltage. The following conditions are also taken into account:
- Value of the allowable zero sequence voltage
- Compensation limit = Value of the detuning current that may not be exceeded
Adjusting the Petersen coil during the earth fault:
The regulator can be configured so that the Petersen coil can be corrected by compensation value during an earth fault. Additional corrections can be made through binary inputs.

Parallel operation of Petersen coils:
A number of methods are available to control Petersen coils that are switched in parallel.
- Parallel control with communication over E-LAN (master-slave)
- Parallel control without communication
- Parallel control with recognition of external grid coupling (only with optional current injection)

2.2 Recorder and logbook function
An integrated recorder continuously records the progression of the zero sequence voltage and the coil position. The time line diagram can both be displayed and evaluated on the regulator or on a PC. This integrated ‘grid spy’ enables long-term changes in the zero sequence voltage to be recorded and monitored. The configuration software WinEDC is used to evaluate and archive recorded data on the PC.

The progression of the zero sequence voltage Uen is also displayed as a line diagram. The time grid (feed rate) for the recording is adjustable. The stored values and the allocated time can be displayed using a keyboard or PC.

2.3 Regulator statistics
Statistics mode displays the most important sum times and counters. This information can be used to determine how many tuning procedures were carried out in which time frame, and how many were successfully completed. It also enables you to recognize for how many tuning procedures the P-coil’s adjustment range was insufficient.

Statistics mode also records the number of earth faults and increases in residual watt current that were carried out.

![Statistics Page 1/5](image)
2.4 Resistor control

The freely configurable and autonomous resistor control automatically connects a resistor to increase the residual watt current in the event of an earth fault. A resistor's load is monitored with a 'thermal image' whereby the current zero sequence voltage is taken into account when it is connected. The connection is blocked in the event of over temperature. The remaining resistor connections are displayed in the screen until the limit temperature has been reached.

A recurring connection by transient earth faults can be suppressed.

A resistor can be connected manually through a binary input or the remote control system.

2.5 Configuration

The configuration of the regulator is menu driven, and therefore very easy.

Figure 7: Regulator Menu

The putting into operation of the regulator and its configuration for the P-coil (e.g. linearization of the coil position) is largely automatic. The process' reactions are continuously monitored and checked for plausibility. Errors are analysed and displayed in the status bar. Additional information and troubleshooting tips can be viewed as an additional menu.
3. Technical specifications

3.1 Regulations and standards

- IEC 61010-1
- CAN/CSA C22.2 No. 1010.1-92
- IEC 60255-22-1
- IEC 61326-1
- IEC 60529
- IEC 60068
- IEC 61000-6-2
- IEC 61000-6-4
- IEC 61000-6-5

3.2 AC voltage inputs

<table>
<thead>
<tr>
<th>AC voltage input (U_{\text{en}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero sequence voltage U_o</td>
</tr>
<tr>
<td>Shape of the curve</td>
</tr>
<tr>
<td>Frequency range</td>
</tr>
<tr>
<td>Internal consumption</td>
</tr>
<tr>
<td>Overload capacity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AC voltage input (U_{12})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronization voltage U_{12}</td>
</tr>
<tr>
<td>Shape of the curve</td>
</tr>
<tr>
<td>Frequency range</td>
</tr>
<tr>
<td>Internal consumption</td>
</tr>
<tr>
<td>Overload capacity</td>
</tr>
</tbody>
</table>

3.3 AC current inputs

<table>
<thead>
<tr>
<th>AC current inputs (I_p und I_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current range</td>
</tr>
<tr>
<td>Shape of the curve</td>
</tr>
<tr>
<td>Frequency range</td>
</tr>
<tr>
<td>Internal consumption</td>
</tr>
</tbody>
</table>

3.4 Potentiometer input

<table>
<thead>
<tr>
<th>Position signal (I_{\text{Pos}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
</tr>
<tr>
<td>Nominal value R_n</td>
</tr>
<tr>
<td>Measuring voltage</td>
</tr>
<tr>
<td>Current selectable through jumper (pure)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Error message when sensor breaks or is short circuited or when the voltage of the loop is outside of the measurement range.

3.5 Binary Inputs (BI)

<table>
<thead>
<tr>
<th>Binary inputs (BI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs E1 ... E16</td>
</tr>
<tr>
<td>Control signals U_{\text{st}}</td>
</tr>
<tr>
<td>Shape of the curve, permissible</td>
</tr>
<tr>
<td>48 V...250 V</td>
</tr>
<tr>
<td>H - Level</td>
</tr>
<tr>
<td>L - Level</td>
</tr>
<tr>
<td>Signal frequency</td>
</tr>
<tr>
<td>Input resistance</td>
</tr>
</tbody>
</table>

Potential isolation: Optocoupler; each galvanically isolated from each other.

Debouncing: Software filter with integrated 50Hz filter
3.6 Binary outputs (BO)

<table>
<thead>
<tr>
<th>Binary outputs (BO)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R 1 ... R13</td>
<td>max. switching frequency ≤ 1 Hz</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>Isolated from all device-internal potentials</td>
</tr>
</tbody>
</table>
| Contact load       | AC: 250 V, 5 A (cos ϕ = 1.0)  
                      | AC: 250 V, 3 A (cos ϕ = 0.4)  
                      | Switching capacity max. 1250 VA  
                      | DC: 30 V, 5 A resistive  
                      | DC: 30 V, 3.5 A L/R=7 ms  
                      | DC: 110 V, 0.5 A resistive  
                      | DC: 220 V, 0.3 A resistive  
                      | Switching capacity max. 150 W  |
| Inrush current     | 250 V AC, 30 V DC  
                      | 10 A for max. 4 s  |
| Switching operations| ≥ 5·10⁵ electrical |

3.7 Analogue outputs

<table>
<thead>
<tr>
<th>20 mA - Analogue outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>See order specifications</td>
</tr>
<tr>
<td>Output range Y1...Y2</td>
<td>-20 mA...0...20 mA, Y1 and Y2 freely programmable</td>
</tr>
<tr>
<td>Control limit</td>
<td>± 1.2 Y2</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>Optocoupler</td>
</tr>
<tr>
<td>Burden range</td>
<td>0 ≤ R ≤ 8 V / Y2</td>
</tr>
<tr>
<td>Alternating component</td>
<td>&lt; 0.5% of Y2</td>
</tr>
</tbody>
</table>

The output can be continuously short-circuited or operated open. The output connections are galvani-cally isolated from all of the other circuits.

3.8 Display

<table>
<thead>
<tr>
<th>Display</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LC – Display</td>
<td>128 x 128 displays graphics</td>
</tr>
<tr>
<td>Lighting</td>
<td>LED, switches off after 15 min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference temperature</td>
<td>23°C ± 1 K</td>
</tr>
</tbody>
</table>
| Input quantities     | Uₑ = 0 ... 120V  
                      | Uₑ₂ = 0,1 ... 230V  
                      | Iₑ = 0 ... 1A / 0 ... 5A  |
| Auxiliary voltage    | H = Hₑ ± 1 %  |
| Frequency            | 45 Hz...65 Hz  |
| Shape of the curve   | Sinusoidal, form factor 1.1107  |
| Burden (only for Characteristics E91...E99) | Rₑ = 5 V / Y2 ± 1 %  |
| Other                | IEC 60688 - Part 1  |
3.9 Electrical safety

<table>
<thead>
<tr>
<th>Electrical safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety class</td>
</tr>
<tr>
<td>Degree of pollution</td>
</tr>
<tr>
<td>Over-voltage category</td>
</tr>
</tbody>
</table>

**Category III**

- Input circuits for current and voltage transducer
- Control circuits, analogue inputs, analogue outputs, power supply, ELAN, COMs

**Category II**

- Operating voltages

<table>
<thead>
<tr>
<th>Voltage</th>
<th>E-LAN, COM1 ... COM3 Analogue inputs, analogue outputs Inputs 10...50 V</th>
<th>Voltage inputs, current inputs</th>
<th>Auxiliary voltage, sync voltage for binary inputs (E1...E16, Relay outputs R1...R13), status</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 V</td>
<td>Voltage 120 V</td>
<td>230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>85...264V</td>
<td>188...280V</td>
<td>18...72V</td>
</tr>
<tr>
<td></td>
<td>≤ 33 VA</td>
<td>≤ 15 W</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 Hz / 60 Hz</td>
<td>T1 250V</td>
<td>T2 250V</td>
</tr>
</tbody>
</table>

3.10 Power supply

<table>
<thead>
<tr>
<th>Stromversorgung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>AC</td>
</tr>
<tr>
<td>DC</td>
</tr>
<tr>
<td>Power consumption</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Microfuse</td>
</tr>
</tbody>
</table>

The following applies to all characteristics:
Voltage dips of ≤ 40 ms result neither in data loss nor malfunctions.

3.11 Electromagnetic compatibility

<table>
<thead>
<tr>
<th>Electromagnetic compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC requirements</td>
</tr>
</tbody>
</table>

**Interference emissions**

- Conducted and radiated emission
  - EN 61326 Table 3
  - EN 61000-6-4
- Harmonic currents
  - EN 61000-3-2
- Voltage fluctuations and flicker
  - EN 61000-3-3
- Conducted and radiated emission
  - EN 61326 Table 3
  - EN 61000-6-4

**Disturbance immunity**

- EN 61326 Table A1 and EN 61000-6-2
- ESD
  - IEC 61000-6-5 6 kV/8 kV contact/air
- Electromagnetic fields
  - IEC 61000-4-3 80 – 2000 MHz: 10 V/m
- Fast transient
  - IEC 61000-4-4 4 kV/2 kV
- Surge voltages
  - IEC 61000-4-5 4 kV/2 kV
- Conducted HF signals
  - IEC 61000-4-6 150 kHz – 80 MHz: 10 V
- Power-frequency magnetic fields
  - IEC 61000-4-8 100 A/m (50 Hz), continuous 1000 A/m (50 Hz), 1 s
- Voltage dips
  - IEC 61000-4-11 30% / 20 ms, 60% / 1 s
- Voltage interruptions
  - IEC 61000-4-11 100% / 5s
- Damped oscillations
  - IEC 61000-4-12, Class 3, 2.5 kV
3.12 Climatic conditions

<table>
<thead>
<tr>
<th>Ambient conditions</th>
<th>Temperature range</th>
<th>Transport and storage function</th>
<th>Transport and storage function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry cold</td>
<td>-15 °C ... +60 °C</td>
<td>IEC 60068-2-1, -15 °C / 16 h</td>
<td>IEC 60068-2-1, -15 °C / 16 h</td>
</tr>
<tr>
<td>Dry heat</td>
<td>-25 °C ... +65 °C</td>
<td>IEC 60068-2-2, +65 °C / 16 h</td>
<td>IEC 60068-2-2, +65 °C / 16 h</td>
</tr>
<tr>
<td>Humid heat constant</td>
<td>IEC 60068-2-78, + 40 °C / 93% / 2 days</td>
<td>IEC 60068-2-78, + 40 °C / 93% / 2 days</td>
<td>IEC 60068-2-78, + 40 °C / 93% / 2 days</td>
</tr>
<tr>
<td>Humid heat cyclical</td>
<td>IEC 60068-2-30, 12+12 h, 6 cycles +55 °C / 93%</td>
<td>IEC 60068-2-30, 12+12 h, 6 cycles +55 °C / 93%</td>
<td>IEC 60068-2-30, 12+12 h, 6 cycles +55 °C / 93%</td>
</tr>
<tr>
<td>Drop and topple over</td>
<td>IEC 60068-2-31, 100 mm drop height, unpackaged</td>
<td>IEC 60068-2-31, 100 mm drop height, unpackaged</td>
<td>IEC 60068-2-31, 100 mm drop height, unpackaged</td>
</tr>
<tr>
<td>Vibration</td>
<td>IEC 60255-21-1, Class 1</td>
<td>IEC 60255-21-1, Class 1</td>
<td>IEC 60255-21-1, Class 1</td>
</tr>
<tr>
<td>Shock</td>
<td>IEC 60255-21-2, Class 1</td>
<td>IEC 60255-21-2, Class 1</td>
<td>IEC 60255-21-2, Class 1</td>
</tr>
<tr>
<td>Earthquake resistance</td>
<td>IEC 60255-21-3, Class 1</td>
<td>IEC 60255-21-3, Class 1</td>
<td>IEC 60255-21-3, Class 1</td>
</tr>
</tbody>
</table>

3.13 Storage

<table>
<thead>
<tr>
<th>Storage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Firmware and recorder data Characteristic S2</td>
<td>Flash storage</td>
</tr>
<tr>
<td>Device characteristics and calibration data</td>
<td>serial EEPROM with ≥ 1000 k write/read cycles</td>
</tr>
<tr>
<td>Other data and recorder data Characteristic S1</td>
<td>SDRAM, battery-backed (plug-in lithium battery), backup to flash storage possible</td>
</tr>
</tbody>
</table>

3.14 Mechanical design

<table>
<thead>
<tr>
<th>Mechanical design</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>Sheet steel, RAL 7035 gray</td>
</tr>
<tr>
<td>Height</td>
<td>288 mm</td>
</tr>
<tr>
<td>Width</td>
<td>216 mm</td>
</tr>
<tr>
<td>Overall depth</td>
<td>114 mm</td>
</tr>
<tr>
<td>Mounting depth</td>
<td>87 mm</td>
</tr>
<tr>
<td>Mass</td>
<td>≤ 3 kg</td>
</tr>
<tr>
<td>Housing doors</td>
<td>with silica glass</td>
</tr>
<tr>
<td>Front panel</td>
<td>plastic, RAL 7035 gray, on aluminium supports</td>
</tr>
<tr>
<td>Control panel cutout</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>282 mm</td>
</tr>
<tr>
<td>Width</td>
<td>210 mm</td>
</tr>
<tr>
<td>Protection type</td>
<td>IP 54</td>
</tr>
<tr>
<td>Rain Test</td>
<td>3R UL50</td>
</tr>
<tr>
<td>In-panel mounting</td>
<td>in conformity with DIN 41494 Part 5</td>
</tr>
</tbody>
</table>

3.15 Optical Interface

The REG-DPA regulator can also be directly connected via a fibre optic cable interface. Sending and receiving devices are available for glass and plastic fibre optic cables. In addition, it can be choose between various mechanical connection possibilities (ST or FSMA connection). Features V13 to V19 give an overview of the various possibilities.

3.16 Electrical logical interface

Logic level of receiving output: CMOS
(U_{min} : > 0,9VCC, U_{max} < 0,1VCC @ Io = 1mA)

Logic level of receiving input: CMOS
(U_{min} : > 0,7VCC, U_{max} < 0,3VCC), Schmitt-Trigger
3.17 Optical transmitter

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Fibre</th>
<th>Pmin [dBm]</th>
<th>Pmax [dBm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass-ST</td>
<td>HFBR-1414-T</td>
<td>50/125µm NA=0,2</td>
<td>-19,8</td>
<td>-12,8</td>
</tr>
<tr>
<td>Glass-SMA</td>
<td>HFBR-1404</td>
<td>62,5/125µm NA=0,275</td>
<td>-16,0</td>
<td>-9,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100/140µm NA=0,3</td>
<td>-10,5</td>
<td>-3,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200µm HCS NA=0,37</td>
<td>-6,2</td>
<td>+1,8</td>
</tr>
<tr>
<td>POF_ST</td>
<td>HFBR-1515B</td>
<td>1mm POF</td>
<td>-7,5</td>
<td>-3,5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200µm HCS</td>
<td>-18,0</td>
<td>-8,5</td>
</tr>
<tr>
<td>POF_SMA</td>
<td>HFBR-1505C</td>
<td>1mm POF</td>
<td>-6,2</td>
<td>0,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200µm HCS</td>
<td>-16,9</td>
<td>-8,5</td>
</tr>
</tbody>
</table>

3.18 Optical receiver

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Fibre</th>
<th>Pmin [dBm]</th>
<th>Pmax [dBm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass-ST</td>
<td>HFBR-2412-T</td>
<td>100/140µm NA=0,3</td>
<td>-24,0</td>
<td>-10,0</td>
</tr>
<tr>
<td>Glass-SMA</td>
<td>HFBR-2402</td>
<td>200µm HCS</td>
<td>-20,0</td>
<td>0,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200µm HCS</td>
<td>-22,0</td>
<td>-2,0</td>
</tr>
<tr>
<td>POF_ST</td>
<td>HFBR-2515B</td>
<td>1mm POF</td>
<td>-21,6</td>
<td>-2,0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200µm HCS</td>
<td>-23,0</td>
<td>-3,4</td>
</tr>
</tbody>
</table>

4. General information about the connections

The regulator has three circuit boards / connection levels.

![Internal structure of REG-DPA](image)

On level 1 the auxiliary voltage, input voltage and currents, as well as the relay outputs, binary inputs, etc. are connected.

Level II contains the hardware for all control system connections is contained. The appropriate connection elements on Level II must be used for RS232 or RS485 connections. If an Ethernet connection is used, the corresponding connection on Level II is also available (must be connected for IEC 61850 or IEC 60870-5-104!).

The connection elements for fibre-optic cables (send and receive diodes as ST or FSMA connection) are mounted directly on the flange plate and can be connected there without having to open the device.

![Fiber optic (ST-connection)](image)
In total, two connection points are available and they can be equipped with the following modules:

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modul 1</td>
<td>6 binary inputs AC/DC 48V...250V</td>
</tr>
<tr>
<td>Modul 1</td>
<td>6 relay outputs</td>
</tr>
<tr>
<td>Modul 1</td>
<td>2 x 20 mA- inputs</td>
</tr>
<tr>
<td>Modul 1</td>
<td>2 x 20 mA- outputs</td>
</tr>
</tbody>
</table>

Level III contains the connections for the individual COM, E-LAN, the analogue inputs and outputs and the PT100 input.

**Figure 10:** Fibre optic (FSMA-connection)

Furthermore, additional binary inputs and outputs as well as mA inputs and outputs can also be accommodated on Level II.

**Figure 11:** Location of the connector terminals
5. Terminal blocks

5.1 Level I

5.1.1 Binary outputs

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td></td>
<td>R3</td>
<td>NOC</td>
</tr>
<tr>
<td>34</td>
<td></td>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>R4</td>
<td>NOC</td>
</tr>
<tr>
<td>36</td>
<td></td>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td></td>
<td>R5</td>
<td>NOC</td>
</tr>
<tr>
<td>38</td>
<td></td>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td></td>
<td>R2</td>
<td>NCC</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>Terminal</td>
<td>Higher</td>
</tr>
<tr>
<td>41</td>
<td></td>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td></td>
<td>NOC</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td></td>
<td>R1</td>
<td>NCC</td>
</tr>
<tr>
<td>44</td>
<td></td>
<td>Terminal</td>
<td>Lower</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td></td>
<td>NOC</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td></td>
<td>R6</td>
<td>NOC</td>
</tr>
<tr>
<td>48</td>
<td></td>
<td>R7</td>
<td>NOC</td>
</tr>
<tr>
<td>49</td>
<td></td>
<td>R8</td>
<td>NOC</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>R9</td>
<td>NOC</td>
</tr>
<tr>
<td>51</td>
<td></td>
<td>R10</td>
<td>NOC</td>
</tr>
<tr>
<td>52</td>
<td></td>
<td>R11</td>
<td>NOC</td>
</tr>
<tr>
<td>53</td>
<td></td>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td></td>
<td>R13</td>
<td>NOC</td>
</tr>
<tr>
<td>55</td>
<td></td>
<td>Terminal</td>
<td>closes at fault</td>
</tr>
<tr>
<td>56</td>
<td></td>
<td>NCC r</td>
<td>opens at fault</td>
</tr>
<tr>
<td>57</td>
<td></td>
<td>R12</td>
<td>NOC</td>
</tr>
<tr>
<td>58</td>
<td></td>
<td>Terminal</td>
<td>HAND</td>
</tr>
<tr>
<td>59</td>
<td></td>
<td>NOC</td>
<td>AUTO</td>
</tr>
</tbody>
</table>

All of the REG-DPA’s are freely programmable, but have default settings.
We take care of it.

### 5.1.2 Binary inputs

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Binary inputs</td>
<td>E1 + Endswitch high</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>E2 + Endswitch low</td>
</tr>
<tr>
<td>13</td>
<td>Terminal E1..E2</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>E3</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>15</td>
<td>E4</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>16</td>
<td>E5</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>17</td>
<td>E6</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>18</td>
<td>E7</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>19</td>
<td>E8</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>20</td>
<td>Terminal E3..E8</td>
<td>-</td>
</tr>
<tr>
<td>23</td>
<td>E9</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>24</td>
<td>E10</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>25</td>
<td>E11</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>26</td>
<td>E12</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>27</td>
<td>Terminal E9..E11</td>
<td>-</td>
</tr>
<tr>
<td>28</td>
<td>E13</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>29</td>
<td>E14</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>30</td>
<td>E15</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>31</td>
<td>E16</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>32</td>
<td>Terminal E13..E16</td>
<td>-</td>
</tr>
</tbody>
</table>
5.1.3 \( U_{\text{ne}}, U_{\text{Sync}}, I_p \) and auxiliary voltage

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Configuration</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Synchronisation voltage ( U_{\text{sync}} )</td>
<td>L1</td>
<td>( U_{12} )</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>L2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Zero sequence voltage ( U_{\text{ne}} )</td>
<td>n</td>
<td>( U_{\text{NE}} )</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>e</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Stromeingang ( I_p )</td>
<td>k</td>
<td>( I_p )</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>l</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Auxiliary voltage ( U_{\text{H}} )</td>
<td>L/(+/-)</td>
<td>( U_{\text{H}} )</td>
</tr>
<tr>
<td>126</td>
<td>Coil position ( I_{\text{pos}} )</td>
<td>Pot +</td>
<td></td>
</tr>
<tr>
<td>127</td>
<td></td>
<td>Pot -</td>
<td></td>
</tr>
<tr>
<td>128</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.2 Level II (additional inputs and outputs)

5.2.1 Scada module

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scada module</td>
<td></td>
<td>IEC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LON</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DNP 3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SPA Bus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Modbus</td>
</tr>
</tbody>
</table>

5.2.2 Feature C01

6 additional binary inputs AC/DC 48...250V

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Binary inputs</td>
<td>E17</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td>E18</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>E19</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td>E20</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>E21</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>E22</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>Terminal E17..E22</td>
<td>-</td>
</tr>
</tbody>
</table>
### 5.2.3 Feature C02

12 additional binary inputs AC/DC 48…250V

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Binary inputs</td>
<td>E17</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td>E18</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>E19</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td>E20</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>E21</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>E22</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>Terminal E17..E22</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>107</td>
<td>Binary inputs</td>
<td>E23</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>108</td>
<td></td>
<td>E24</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>109</td>
<td></td>
<td>E25</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td>E26</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>111</td>
<td></td>
<td>E27</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>112</td>
<td></td>
<td>E28</td>
<td>+ freely programmable</td>
</tr>
<tr>
<td>113</td>
<td></td>
<td>Terminal E23..E28</td>
<td>-</td>
</tr>
</tbody>
</table>

### 5.2.4 Feature C03

6 additional relays (NO contacts)

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
<td>R14</td>
<td>NOC freely programmable</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td>R15</td>
<td>NOC freely programmable</td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>R16</td>
<td>NOC freely programmable</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td>R17</td>
<td>NOC freely programmable</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>R18</td>
<td>NOC freely programmable</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>R19</td>
<td>NOC freely programmable</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>R14..R19</td>
<td>Terminal</td>
</tr>
</tbody>
</table>
5.2.5 Feature C04
12 additional relays (NO contacts)

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
<td>R14 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td>R15 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>R16 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td>R17 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>R18 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>R19 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>R14..R19</td>
<td>Terminal</td>
</tr>
<tr>
<td>107</td>
<td></td>
<td>R20 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>108</td>
<td></td>
<td>R21 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>109</td>
<td></td>
<td>R22 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td>R23 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>111</td>
<td></td>
<td>R24 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>112</td>
<td></td>
<td>R25 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>113</td>
<td></td>
<td>R20..R25 Terminal</td>
<td></td>
</tr>
</tbody>
</table>

5.2.6 Feature C05
6 additional binary inputs AC/DC 48…250V
6 additional relays (NO contacts)

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Binary inputs</td>
<td>E17 +</td>
<td>freely programmable</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td>E18 +</td>
<td>freely programmable</td>
</tr>
<tr>
<td>102</td>
<td></td>
<td>E19 +</td>
<td>freely programmable</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td>E20 +</td>
<td>freely programmable</td>
</tr>
<tr>
<td>104</td>
<td></td>
<td>E21 +</td>
<td>freely programmable</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td>E22 +</td>
<td>freely programmable</td>
</tr>
<tr>
<td>106</td>
<td></td>
<td>E17..E22 Terminal (-)</td>
<td></td>
</tr>
<tr>
<td>107</td>
<td></td>
<td>R14 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>108</td>
<td></td>
<td>R15 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>109</td>
<td></td>
<td>R16 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>110</td>
<td></td>
<td>R17 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>111</td>
<td></td>
<td>R18 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>112</td>
<td></td>
<td>R19 NOC</td>
<td>freely programmable</td>
</tr>
<tr>
<td>113</td>
<td></td>
<td>R14..R19 Terminal</td>
<td></td>
</tr>
</tbody>
</table>
We take care of it.

5.2.7 Feature C06
2 additional analogue 20mA inputs

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Analogue input</td>
<td>E10</td>
<td>+</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>102</td>
<td>Analogue input</td>
<td>E11</td>
<td>+</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

5.2.8 Feature C07
4 additional analogue 20mA inputs

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Analogue input</td>
<td>E10</td>
<td>+</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>102</td>
<td>Analogue input</td>
<td>E11</td>
<td>+</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>104</td>
<td>Analogue input</td>
<td>E12</td>
<td>+</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>106</td>
<td>Analogue input</td>
<td>E13</td>
<td>+</td>
</tr>
<tr>
<td>107</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

5.2.9 Feature C08
2 additional analogue 20mA outputs

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Analogue output</td>
<td>A10</td>
<td>+</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>102</td>
<td>Analogue output</td>
<td>A11</td>
<td>+</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

5.2.10 Feature C09
4 additional analogue 20mA outputs

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Description</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Analogue output</td>
<td>A10</td>
<td>+</td>
</tr>
<tr>
<td>101</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>102</td>
<td>Analogue output</td>
<td>A11</td>
<td>+</td>
</tr>
<tr>
<td>103</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>104</td>
<td>Analogue output</td>
<td>A12</td>
<td>+</td>
</tr>
<tr>
<td>105</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>106</td>
<td>Analogue output</td>
<td>A13</td>
<td>+</td>
</tr>
<tr>
<td>107</td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>
6. Block diagrams

Figure 12: Overview of default configuration REG-DPA
7. Housing technology

Figure 13: Mechanical dimensions REG-DPA

Figure 14: Mechanical dimensions, Panel mount housing
Figure 15: Mechanical dimensions, standard DIN-rail assembling

Figure 16: Mechanical dimensions, wall-mounting version
8. Interfaces

RS232 Interfaces

The REG-DPA regulator has two RS 232 serial interfaces (COM1, COM2); COM 1 is accessible on the front panel and COM 2 on the terminal strip. COM 2 is used to connect the regulator system to higher level control systems. Customer-specific protocols can be implemented through COM 2.

### Connection elements

<table>
<thead>
<tr>
<th>Connection element</th>
<th>Pin strip, sub min D on the front of the device, pin allocation as PC multipoint terminal connector plug connector (Level III) plug connector (Level III) plug connector (Level III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM 1</td>
<td>Pin strip, sub min D on the front of the device, pin allocation as PC multipoint terminal connector plug connector (Level III) plug connector (Level III) plug connector (Level III)</td>
</tr>
<tr>
<td>COM1S</td>
<td>Pin strip, sub min D on the front of the device, pin allocation as PC multipoint terminal connector plug connector (Level III) plug connector (Level III) plug connector (Level III)</td>
</tr>
<tr>
<td>COM 2</td>
<td>Pin strip, sub min D on the front of the device, pin allocation as PC multipoint terminal connector plug connector (Level III) plug connector (Level III) plug connector (Level III)</td>
</tr>
</tbody>
</table>

### Connection options

- PC, terminal, modem, PLC

### Number of data bits/protocol

- Parity 8, even, off, odd

### Transmission rate bit/s

- 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115000

### Handshake

- RTS / CTS or X\textsubscript{ON} / X\textsubscript{OFF}

RS485 interfaces

- Connection to E-LAN
- Dual interface RS 485 with repeater function

E-LAN (Energy Local Area Network)

### Characteristics

- 255 addressable participants
- Multi-master structure
- Integrated repeater function
- Open ring, bus or a mixture of bus and ring
- Protocol is based on SDLC/HDLC frames
- Transmission rate 62.5 kbit/s or 125 kbit/s
- Frame length 10 ... 30 Bytes
- medium-throughput approx. 100 frames/s

9. Basic REG-DPA connection to Petersen coil

![Figure 17: Connecting REG-DPA to a Petersen coil](image)
10. Optional current injection

There are situations in the grid in which classic regulation cannot be used to successfully tune the Petersen coil.

**Figure 18: Flickering zero sequence voltage**
- Flickering zero sequence voltage
- Very symmetrical grids (balanced)

We developed the optional current injection specifically for these cases.

The current injection creates a signal that is fed into the grid through the power auxiliary winding in the Petersen coil. The REG-DPA calculates a resonance curve based on the grid’s response (zero sequence voltage).

**Figure 19: Current feed-in controller (CCI Controller)**

10.1 Four connections to retrofit the current injection

The following connections have to be established if the current feed-in is to be retrofitted:

- **Power supply 230 V AC** (internally fused with 16 A)
- **Communication connection** between REG-DPA (COM3) and CCI controller; 4-wire RS 485 shielded telephone cable; distance CCI to REG-DPA up to 200 m
- **Connection to the power auxiliary winding** designed for 16 A; voltage-proof up to 500 V AC
- **U<sub>em</sub> measurement** parallel to REG-DPA; Ex. see next pages

10.2 Technical specifications

**10.2.1 CCI Controller power supply**

<table>
<thead>
<tr>
<th>Power supply AC Version</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage (U&lt;sub&gt;n&lt;/sub&gt;)</td>
<td>100...240 V AC</td>
</tr>
<tr>
<td></td>
<td>100...350 V DC</td>
</tr>
<tr>
<td>Overload capacity</td>
<td>1.3 * U&lt;sub&gt;n&lt;/sub&gt;</td>
</tr>
<tr>
<td>Overload for 1s</td>
<td>2 * U&lt;sub&gt;n&lt;/sub&gt;</td>
</tr>
<tr>
<td>Power consumption</td>
<td>≤ 15 VA</td>
</tr>
<tr>
<td>Frequency</td>
<td>DC or 50/60 Hz</td>
</tr>
<tr>
<td>Voltage dip (100%)</td>
<td>&lt; 50 ms</td>
</tr>
</tbody>
</table>

**Power supply DC Version**

| Nominal voltage (U<sub>n</sub>) | 110 V DC ±20% |
| Overload capacity              | 1.3 * U<sub>n</sub> |
| Overload for 1s                 | 2 * U<sub>n</sub> |
| Power consumption               | ≤ 15 VA |
| Voltage dip (100%)              | < 50 ms |

**10.2.2 CCI Controller measurement inputs**

**AC voltage inputs U<sub>1</sub>...U<sub>3**

<table>
<thead>
<tr>
<th>Voltage range U&lt;sub&gt;nom&lt;/sub&gt;</th>
<th>with jumper</th>
<th>without jumper</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0...120 V</td>
<td>0...500 V</td>
</tr>
<tr>
<td>Shape of the curve</td>
<td>Sine</td>
<td></td>
</tr>
<tr>
<td>Frequency range</td>
<td>45...50...55 Hz</td>
<td></td>
</tr>
<tr>
<td>Input resistance</td>
<td>60 kΩ</td>
<td>280 kΩ</td>
</tr>
<tr>
<td>Permanent overload</td>
<td>U&lt;sub&gt;nom&lt;/sub&gt; *1.2</td>
<td></td>
</tr>
</tbody>
</table>

**AC voltage inputs L<sub>1</sub>...L<sub>3**

| Voltage range U<sub>nom</sub> | 0...250 V |
| Shape of the curve            | Sine     |
| Frequency range               | 45...50...55 Hz |
| Input resistance              | 140 kΩ |
| Permanent overload            | U<sub>nom</sub> *1.2 |
We take care of it.

### AC power inputs I1...I3

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current range $I_{\text{nom}}$</td>
<td>with jumper: 0...5 A</td>
</tr>
<tr>
<td></td>
<td>without jumper: 0...25 A</td>
</tr>
<tr>
<td>Shape of the curve</td>
<td>Sine</td>
</tr>
<tr>
<td>Frequency range</td>
<td>45...50...55 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>$\leq 0.1$ VA</td>
</tr>
<tr>
<td>Permanent overload</td>
<td>$I_{\text{nom}} \times 1.2$</td>
</tr>
<tr>
<td>Permanent</td>
<td>$10$ A</td>
</tr>
<tr>
<td>$\leq 10$s</td>
<td>$30$ A</td>
</tr>
<tr>
<td>$\leq 1$s</td>
<td>$100$ A</td>
</tr>
<tr>
<td>$\leq 5$mS</td>
<td>$500$ A</td>
</tr>
</tbody>
</table>

### 10.2.3 CCI Controller binary inputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>AC and DC</td>
</tr>
<tr>
<td>H - Level</td>
<td>$&lt; 80$ V AC/DC</td>
</tr>
<tr>
<td>E1...E2</td>
<td>$&lt; 10$ V AC/DC</td>
</tr>
<tr>
<td>E3...E4</td>
<td>$&lt; 65$ V AC/DC</td>
</tr>
<tr>
<td>L - Level</td>
<td>$&lt; 40$ V AC/DC</td>
</tr>
<tr>
<td>E1...E2</td>
<td>$&lt; 5$ V AC/DC</td>
</tr>
<tr>
<td>E5...E6</td>
<td>$&lt; 45$ V AC/DC</td>
</tr>
<tr>
<td>Signal frequency</td>
<td>DC...55 Hz</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>Optocoupler</td>
</tr>
<tr>
<td>Input resistance</td>
<td>E1, E2: ca. 100 kΩ</td>
</tr>
<tr>
<td></td>
<td>E3, E4: ca. 5 kΩ</td>
</tr>
<tr>
<td></td>
<td>E5, E6: ca. 100 kΩ</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>Optocoupler; all inputs</td>
</tr>
<tr>
<td></td>
<td>galvanically isolated</td>
</tr>
<tr>
<td></td>
<td>from each other</td>
</tr>
</tbody>
</table>

### 10.2.4 CCI Controller binary inputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. switching frequency</td>
<td>$\leq 1$ kHz</td>
</tr>
<tr>
<td>Contact load</td>
<td>AC: 250 V, 5 A (cos $\varphi = 1.0$)</td>
</tr>
<tr>
<td></td>
<td>AC: 250 V, 3 A (cos $\varphi = 0.4$)</td>
</tr>
<tr>
<td></td>
<td>DC switching capacity:</td>
</tr>
<tr>
<td></td>
<td>$250$ V$_{DC}$: $\leq 75$ W</td>
</tr>
<tr>
<td></td>
<td>$30$ V$_{DC}$: $\leq 150$ W</td>
</tr>
<tr>
<td>Switching operations</td>
<td>$&gt; 10^7$ electrical</td>
</tr>
<tr>
<td>Potential isolation</td>
<td>galvanically isolated</td>
</tr>
<tr>
<td></td>
<td>from all device-internal potentials</td>
</tr>
</tbody>
</table>

### 10.3 Inductance (derating)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>2</td>
</tr>
<tr>
<td>Inductance</td>
<td>104 mH</td>
</tr>
<tr>
<td>Nominal frequency</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Voltage range</td>
<td>up to 550 V AC</td>
</tr>
</tbody>
</table>
10.4 Connection options for current injection to REG-DPA and Petersen coil

A magnetic coupling between the power auxiliary winding and the measuring transducer for Uo directly on the P-coil can affect the calculation results. We recommend the following interconnection options when measuring Uo in conjunction with the current injection.

Figure 20: Example of in-panel mounting: Current injection mounted directly into the motor drive box of the Petersen coil

10.4.1 Connections to measure Uo at open delta winding

Figure 21: REG-DPA connection, current injection and Petersen coil;
We take care of it.

10.4.2 Connections to measure $U_o$ through separate/external measuring transducer

Figure 22: $U_o$ measurement over external or remote voltage transducer

10.4.3 Connections for current injection when the power auxiliary winding is missing

In this case, the power section of the current feed-in is connected to a separate feed-in transducer.

Figure 23: External power auxiliary winding and use of internal voltage transducer for the Petersen coil
10.4.4 Example of external feed-in transducer as spare power auxiliary winding (PAW)

**NOTE!** This transducer can only be used with the current injection. It is not a full replacement for a standard power auxiliary winding.

![Spare power auxiliary winding (PAW) for current injection](image)

The technical data for the transducer for a 20 kV grid are as follows:

<table>
<thead>
<tr>
<th>Technical data for transducer for spare PAW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Primary nominal voltage</td>
</tr>
<tr>
<td>Secondary nominal voltage</td>
</tr>
<tr>
<td>Class</td>
</tr>
<tr>
<td>Nominal output/Nominal burden</td>
</tr>
</tbody>
</table>

10.5 Design of current injection controller (CCI)

![Dimensions of current feed-in controller (CCI)](image)
We take care of it.

Figure 26: Terminal connections CCI
10.6 Terminal configuration CCI

10.6.1 Terminal strip – X1 binary inputs

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1:1</td>
<td>Input</td>
<td>Root E1..E2</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X1:2</td>
<td>Input</td>
<td>E2: SE-FUSE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fuse monitoring</td>
<td>max. 110 V DC</td>
</tr>
<tr>
<td>X1:3</td>
<td>Input</td>
<td>E5: End switch low</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X1:4</td>
<td></td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>X1:5</td>
<td>Relay</td>
<td>R6: Binary output</td>
<td>Pot. 12 V DC</td>
</tr>
<tr>
<td>X1:6</td>
<td>Relay</td>
<td>+12 V Output</td>
<td>Pot. 12 V DC</td>
</tr>
<tr>
<td>X1:7</td>
<td>Input</td>
<td>E4: Binary input</td>
<td>max. 12 V DC</td>
</tr>
<tr>
<td>X1:8</td>
<td>Input</td>
<td>E3: Binary input</td>
<td>max. 12 V DC</td>
</tr>
<tr>
<td>X1:9</td>
<td>Input</td>
<td>Root E3...E4</td>
<td></td>
</tr>
</tbody>
</table>

10.6.2 Terminal strip – X2 potentiometer

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2:1</td>
<td>AO</td>
<td>Potentiometer +</td>
<td>ca. +3 V</td>
</tr>
<tr>
<td>X2:2</td>
<td>AI</td>
<td>Potentiometer loop</td>
<td></td>
</tr>
<tr>
<td>X2:3</td>
<td>AO</td>
<td>Potentiometer -</td>
<td></td>
</tr>
<tr>
<td>X2:4</td>
<td></td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>X2:5</td>
<td>AI</td>
<td>reserved</td>
<td></td>
</tr>
<tr>
<td>X2:6</td>
<td></td>
<td>reserved</td>
<td></td>
</tr>
<tr>
<td>X2:7</td>
<td>AO</td>
<td>reserved</td>
<td>+/- 5 V</td>
</tr>
<tr>
<td>X2:8</td>
<td></td>
<td>reserved</td>
<td></td>
</tr>
</tbody>
</table>

10.6.3 Terminal strip – X3 AC switch (Thyristor)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X3:1</td>
<td>L1+</td>
<td>ca. +3 V</td>
<td></td>
</tr>
<tr>
<td>X3:2</td>
<td>(L2+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3:3</td>
<td>L1-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3:4</td>
<td>(L2-)</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>X3:5</td>
<td>Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3:6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3:7</td>
<td>+5 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3:8</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10.6.4 Terminal strip – X4 COM3 (RS 485) connection

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X4:1</td>
<td>GND_1a</td>
<td>Isolated</td>
<td></td>
</tr>
<tr>
<td>X4:2</td>
<td>DO</td>
<td>Tx +</td>
<td></td>
</tr>
<tr>
<td>X4:3</td>
<td>DO</td>
<td>Tx -</td>
<td></td>
</tr>
<tr>
<td>X4:4</td>
<td>DI</td>
<td>Rx +</td>
<td>NC</td>
</tr>
<tr>
<td>X4:5</td>
<td>DI</td>
<td>Rx -</td>
<td></td>
</tr>
<tr>
<td>X4:6</td>
<td>GND_1</td>
<td>Isolated</td>
<td></td>
</tr>
</tbody>
</table>

10.6.5 LEDs on current feed-in controller

![Figure 27: LED definitions current injection controller CCI](image)

<table>
<thead>
<tr>
<th>LED</th>
<th>Function</th>
<th>Status OK</th>
<th>Status error</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$U_{\text{sync}}$ measurement $&lt;&lt; 15$ V</td>
<td>0</td>
<td>RED</td>
</tr>
<tr>
<td>2</td>
<td>$U_{\text{sync}}$ Thyristors $&lt;&lt; 30$ V</td>
<td>0</td>
<td>RED</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Current injection active</td>
<td></td>
<td>GREEN</td>
</tr>
<tr>
<td>5</td>
<td>PLL synchronized</td>
<td></td>
<td>GREEN</td>
</tr>
<tr>
<td>6</td>
<td>Status current injection controller (CCI)</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

10.6.6 PE

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PE</td>
<td></td>
<td>Protective earth</td>
</tr>
</tbody>
</table>
10.6.7 Terminal strip – X5: Power supply

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X5:1</td>
<td>L1 / +110 V DC</td>
<td>Supply voltage</td>
<td></td>
</tr>
<tr>
<td>X5:2</td>
<td>N / -110 V DC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10.6.8 Terminal strip – X6: Synchronisation voltage Thyristor block

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X6:1</td>
<td>Connection L1</td>
<td>U_L1: 230 V AC</td>
<td></td>
</tr>
<tr>
<td>X6:2</td>
<td>Connection N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6:3</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6:4</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6:5</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6:6</td>
<td>Not used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
Cabinets that we prefabricate come equipped with the connections.

10.6.9 Terminal strip – X7 relay range 1

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X7:1</td>
<td>Input</td>
<td>E6: End switch high</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X7:2</td>
<td>Input</td>
<td>Root end switch signal (E5..E6)</td>
<td></td>
</tr>
<tr>
<td>X7:3</td>
<td>Input</td>
<td>E5: End switch low</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X7:4</td>
<td>Relay</td>
<td>R7: freely programmable</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X7:5</td>
<td>R7: Root</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X7:6</td>
<td>Relay</td>
<td>R5: Motor lower</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X7:7</td>
<td>R5: Root</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X7:8</td>
<td>Relay</td>
<td>R4: Motor higher</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X7:9</td>
<td>R4: Root</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X7:10</td>
<td>R4: Not used</td>
<td>Default: OFF</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
The connections to X7 and X8 are redundant to the connections on the REG-DPA.

The wiring for the end switch and the motor contacts are directly done on the REG-DPA. This is why the connections for the current injection controller so not have to be configured.

10.6.10 Terminal strip – X8 relay range 2

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X8:1</td>
<td>Relay</td>
<td>R3: opens upon failure</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X8:2</td>
<td>Relay</td>
<td>R3: closes upon failure</td>
<td></td>
</tr>
<tr>
<td>X8:3</td>
<td>Input</td>
<td>E5: End switch low</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X8:4</td>
<td>Relay</td>
<td>R7: freely programmable</td>
<td>Default: OFF</td>
</tr>
<tr>
<td>X8:5</td>
<td>R7: Root</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X8:6</td>
<td>Relay</td>
<td>R5: Motor lower</td>
<td>Default: OFF</td>
</tr>
</tbody>
</table>

10.6.11 Terminal strip – X9 inputs for voltage measurement

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X9:1</td>
<td>Usync_1</td>
<td>0...100...500 V AC</td>
<td></td>
</tr>
<tr>
<td>X9:2</td>
<td>Usync_2</td>
<td>Default: 500 V</td>
<td></td>
</tr>
<tr>
<td>X9:3</td>
<td>Une_GND</td>
<td>0...100...500 V AC</td>
<td></td>
</tr>
<tr>
<td>X9:4</td>
<td>Une</td>
<td>Default: 100 V</td>
<td></td>
</tr>
<tr>
<td>X9:5</td>
<td>Uod_Tr_GND</td>
<td>0...100...500 V AC</td>
<td></td>
</tr>
<tr>
<td>X9:6</td>
<td>Uod_Tr</td>
<td>Default: 100 V (Only for extended algorithm)</td>
<td></td>
</tr>
</tbody>
</table>

10.6.12 Terminal strip – X10 current inputs

<table>
<thead>
<tr>
<th>Pin</th>
<th>Type</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>X10:1</td>
<td>PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X10:2</td>
<td>I1_a s1 I</td>
<td>0...1...5...10...25 A AC</td>
<td></td>
</tr>
<tr>
<td>X10:3</td>
<td>I1_b s2 I</td>
<td>Default: Current measured directly at CCI output</td>
<td></td>
</tr>
<tr>
<td>X10:4</td>
<td>I2_a s1 I</td>
<td>0...1...5...10...25 A AC</td>
<td></td>
</tr>
<tr>
<td>X10:5</td>
<td>I2_b s2 I</td>
<td>(Only for extended algorithm)</td>
<td></td>
</tr>
<tr>
<td>X10:6</td>
<td>I3_a s1 I</td>
<td>0...1...5...10...25 A AC</td>
<td></td>
</tr>
<tr>
<td>X10:7</td>
<td>I3_b s2 I</td>
<td>(Only for extended algorithm)</td>
<td></td>
</tr>
</tbody>
</table>
11. WinEDC configuration and configuration software

The WinEDC software is used to configure and program the system. It can be used in three different modes.

In **Panel mode**, the regulator can be displayed and controlled using the mouse. All of the settings, which can be made directly on the regulator using its membrane keyboard, can be carried out centrally in WinEDC.

**Parameter mode** enables each of the components to be quickly and easily configured. The parameters are set in a straightforward tree structure, saved for later use or transferred to a bus participant. This guarantees an easy and clear operation and is particularly useful when E-coil controllers and EOR-D earth fault detection relays in the REGSys™ product line are used together in a plant component.

**Terminal mode** enables direct communication with the system.

The WinEDC Terminal is much easier to use than conventional terminal programs and makes programming the system a lot easier.

WinEDC runs on all versions of Windows from Windows95 to Windows 8 in 32-bit and 64-bit.

*Figure 28:  EORSys product range deployment*
12. Order specifications

Please observe the following when placing an order:

- Only one unit can be ordered for codes with the same capital letter.
- When a code's capital letter is followed by the number 9, additional information in plain text is required.
- When a code's capital letter is followed only by zeroes the code may be omitted.
- X characteristics such as XL1 cannot be combined with all of the other characteristics. Please read the notes and explanations.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resonance regulator for Petersen coil</strong></td>
<td>REG-DPA</td>
</tr>
<tr>
<td>resistance control, parallel control,</td>
<td></td>
</tr>
<tr>
<td>Long-term recording and log book</td>
<td></td>
</tr>
<tr>
<td>16 binary inputs (freely programmable)</td>
<td></td>
</tr>
<tr>
<td>12 relay outputs (freely programmable), status relay,</td>
<td></td>
</tr>
<tr>
<td>Current input (1 A or 5 A), COM 1, COM 2, COM 3 to connect a current injection</td>
<td></td>
</tr>
<tr>
<td>WinEDC configuration software and connection cable (null modem)</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** COM2 is used for protocol communication. Hence available for external use without interface cards only

<table>
<thead>
<tr>
<th>Model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In-panel mounting housing/ Wall-mounting housing (H x B x T) 307 x 250 x 102 mm</td>
<td>B01</td>
</tr>
<tr>
<td>DIN-Rail adapter</td>
<td>B02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial interface COM1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232</td>
<td>I0</td>
</tr>
<tr>
<td>USB</td>
<td>I1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power supply</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>external AC 85 V...110 V...264 V / DC 88 V...220 V...280 V</td>
<td>H1</td>
</tr>
<tr>
<td>external DC 18 V...60 V...72 V</td>
<td>H2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parallel control</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>communication over E-LAN</td>
<td>K0</td>
</tr>
<tr>
<td>Distributed controller and communication without E-LAN</td>
<td>K1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement input</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>additional current channel I2 (1 A or 5 A)</td>
<td>X18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analogue outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>without</td>
<td>E00</td>
</tr>
<tr>
<td>(please specify measurement range or scaling when placing the order)</td>
<td>E90</td>
</tr>
<tr>
<td>- Output 1: Zero sequence voltage U_o</td>
<td></td>
</tr>
<tr>
<td>- Output 2: Position of Petersen coil I_pos</td>
<td></td>
</tr>
<tr>
<td>- Output 3: Current through the P-coil Ip</td>
<td></td>
</tr>
<tr>
<td>- with two analogue inputs, freely configurable.</td>
<td>E91</td>
</tr>
<tr>
<td>- two analogue inputs, freely configurable (via background program)</td>
<td>E900</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Code</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Control system connection</strong></td>
<td></td>
</tr>
<tr>
<td>● without</td>
<td>(continue with characteristic &quot;L&quot;) XW00</td>
</tr>
<tr>
<td>● IEC 60870-5-104/RJ45</td>
<td>(continue with characteristic &quot;G&quot;) XW90</td>
</tr>
<tr>
<td>● IEC 60870-5-104 with Fiber Optic-connection</td>
<td>(continue with characteristic &quot;G&quot;) XW92</td>
</tr>
<tr>
<td>● IEC 61850/RJ45</td>
<td>(continue with characteristic &quot;G&quot;) XW91</td>
</tr>
<tr>
<td>● IEC 61850 with Fibre Optic-ST connection</td>
<td>(continue with characteristic &quot;G&quot;) XW93</td>
</tr>
<tr>
<td>● IEC 61850 with Fibre Optic-LC connection</td>
<td>(continue with characteristic &quot;G&quot;) XW93.1</td>
</tr>
<tr>
<td>● IEC 61850 with 2xRJ45 connection</td>
<td>(continue with characteristic &quot;G&quot;) XW94</td>
</tr>
<tr>
<td>● IEC 61850 with 2xFibre Optic ST connection</td>
<td>(continue with characteristic &quot;G&quot;) XW95</td>
</tr>
<tr>
<td>● IEC 61850 with 2xFibre Optic-LC connection</td>
<td>(continue with characteristic &quot;G&quot;) XW95.1</td>
</tr>
<tr>
<td>● IEC 61850 with 1xRJ45 und 1xFibre Optic-ST connection</td>
<td>(continue with characteristic &quot;G&quot;) XW96</td>
</tr>
<tr>
<td>● IEC 61850 with 1xRJ45 und 1xFibre Optic-LC connection</td>
<td>(continue with characteristic &quot;G&quot;) XW96.1</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 1xRJ45 connection</td>
<td>(continue with characteristic &quot;G&quot;) XW97</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 2xRJ45 connection</td>
<td>(continue with characteristic &quot;G&quot;) XW94.1</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 1xFibre Optic connection</td>
<td>(continue with characteristic &quot;G&quot;) XW98</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 1xFO-LC connection</td>
<td>(continue with characteristic &quot;G&quot;) XW98.1</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 2xFO-ST connection</td>
<td>(continue with characteristic &quot;G&quot;) XW95.2</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 2xFO-LC connection</td>
<td>(continue with characteristic &quot;G&quot;) XW95.3</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 1xRJ45;1xFO-ST connection</td>
<td>(continue with characteristic &quot;G&quot;) XW96.4</td>
</tr>
<tr>
<td>● DNP 3.0 via Ethernet with 1xRJ45;1xFO-LC connection</td>
<td>(continue with characteristic &quot;G&quot;) XW96.5</td>
</tr>
</tbody>
</table>

**Note:**
If you want a differing protocol for delivery, please choose an additional hardware variant "XWxx" (then continue with feature "Vxx").

<table>
<thead>
<tr>
<th>Integrated protocol interface (IEC 60870-5-101/103, DNP...)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>● without (continue with characteristic &quot;G&quot;)</td>
<td>L0</td>
</tr>
<tr>
<td>● to connect the REG-DPA to a control center</td>
<td>L2</td>
</tr>
<tr>
<td>● to connect several devices to a control center (REG-DPA/D/DA/DP etc.)</td>
<td>L9</td>
</tr>
</tbody>
</table>

**Note:**
Characteristic L9 can only be combined with Z15..Z19

<table>
<thead>
<tr>
<th>Connection type:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>● Copper</td>
<td></td>
</tr>
<tr>
<td>▪ RS 232</td>
<td>V10</td>
</tr>
<tr>
<td>▪ RS 485 2-wire operation only</td>
<td>V11</td>
</tr>
<tr>
<td>● Fibre optic cable with FSMA connection technology, incl. fibreglass module</td>
<td></td>
</tr>
<tr>
<td>▪ Fibreglass (Wave length 800...900 nm, range 2000 m)</td>
<td>V13</td>
</tr>
<tr>
<td>▪ Plastic (wave length 620...680 nm, range 50 m)</td>
<td>V15</td>
</tr>
<tr>
<td>● Fibre optic cable with ST connection technology, incl. fibreglass module</td>
<td></td>
</tr>
<tr>
<td>▪ Fibreglass (Wave length 800...900 nm, range 2000 m)</td>
<td>V17</td>
</tr>
<tr>
<td>▪ Plastic (wave length 620...680 nm, range 50 m)</td>
<td>V19</td>
</tr>
</tbody>
</table>
We take care of it.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol</td>
<td></td>
</tr>
<tr>
<td>- IEC 60870-5-103 for ABB</td>
<td>Z10</td>
</tr>
<tr>
<td>- IEC 60870-5-103 for Areva</td>
<td>Z11</td>
</tr>
<tr>
<td>- IEC 60870-5-103 for others</td>
<td>Z90</td>
</tr>
<tr>
<td>- IEC 60870-5-101 for ABB</td>
<td>Z15</td>
</tr>
<tr>
<td>- IEC 60870-5-101 for IDS</td>
<td>Z17</td>
</tr>
<tr>
<td>- IEC 60870-5-101 for SAT</td>
<td>Z18</td>
</tr>
<tr>
<td>- IEC 60870-5-101 for Siemens (LSA/SAS)</td>
<td>Z19</td>
</tr>
<tr>
<td>- IEC 60870-5-101 für others</td>
<td>Z91</td>
</tr>
<tr>
<td>- DNP3</td>
<td>Z20</td>
</tr>
<tr>
<td>- SPABUS</td>
<td>Z22</td>
</tr>
<tr>
<td>- Modbus RTU</td>
<td>Z23</td>
</tr>
<tr>
<td>- DCF Simulation via NTP and / or E-LAN extansion via Ethernet (CSE)</td>
<td>DCF / E-LAN</td>
</tr>
</tbody>
</table>

**Note:**
only for IEC-61850 – other protocols on request

<table>
<thead>
<tr>
<th>User Manual</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>● German</td>
<td>G1</td>
</tr>
<tr>
<td>● English</td>
<td>G2</td>
</tr>
<tr>
<td>● Russian</td>
<td>G6</td>
</tr>
<tr>
<td>● Czech</td>
<td>G8</td>
</tr>
<tr>
<td>● other</td>
<td>G9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display language</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>● same as the operating manual</td>
<td>A0</td>
</tr>
<tr>
<td>● German</td>
<td>A1</td>
</tr>
<tr>
<td>● English</td>
<td>A2</td>
</tr>
<tr>
<td>● Russian</td>
<td>A6</td>
</tr>
<tr>
<td>● Czech</td>
<td>A8</td>
</tr>
<tr>
<td>● other</td>
<td>A9</td>
</tr>
<tr>
<td>ACCESSORIES</td>
<td>CODE</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Current injection with two fixed frequencies (Supply voltage AC 230 V)</td>
<td>CIF</td>
</tr>
<tr>
<td>Peak current injection with two fixed frequencies with additional use of pulse locating (Supply voltage AC 230 V)</td>
<td>HPCI</td>
</tr>
<tr>
<td>consists of Thyristor actuator, controller and inductance on mounting panel for 19” cabinet mounting</td>
<td>C1</td>
</tr>
<tr>
<td>consists of Thyristor actuator, controller and inductance in standard mounting for indoor installation ca. 800 x 800 x 300 mm</td>
<td>C2</td>
</tr>
<tr>
<td>consists of Thyristor actuator, controller and inductance in standard mounting for outdoor installation ca. 800 x 800 x 300 mm</td>
<td>C3</td>
</tr>
<tr>
<td>consists of Thyristor actuator, controller and inductance in standard mounting for outdoor installation (wall mounting) ca. 800 x 800 x 300 mm</td>
<td>C4</td>
</tr>
<tr>
<td>Housing version is negotiable!</td>
<td>C9</td>
</tr>
</tbody>
</table>

**NOTE!**
The current injection can only be used without restrictions if the measurement for the zero sequence voltage and the current are derived from the coil’s primary winding. This means that the zero sequence voltage should not be measured on the E-coil itself.

<table>
<thead>
<tr>
<th>ACCESSORIES</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female multipoint connector 1 (electrical connector model F)</td>
<td></td>
</tr>
<tr>
<td>Female multipoint connector (for power input with advanced contacts)</td>
<td></td>
</tr>
<tr>
<td>Female multipoint connector 3 (mixed connector model F24 + H7)</td>
<td></td>
</tr>
<tr>
<td>Dummy panel 28 TE</td>
<td></td>
</tr>
<tr>
<td>Dummy panel 14 TE</td>
<td></td>
</tr>
<tr>
<td>Dummy panel 7 TE</td>
<td></td>
</tr>
<tr>
<td>Dummy panel 8 TE</td>
<td></td>
</tr>
<tr>
<td>PC connection cable (null-modem cable)</td>
<td></td>
</tr>
<tr>
<td>Modem connection cable</td>
<td></td>
</tr>
<tr>
<td>1 pack microfuses T2 L 250 V</td>
<td></td>
</tr>
</tbody>
</table>

**Time synchronisation:**
- Radio clock DFC 77: 111.9024.01
- GPS radio clock NIS time, RS 485, Uh: AC 85...110 V...264 V / DC 88 V...220 V...280 V: 111.9024.45
- GPS radio clock NIS time, RS 485, Uh: DC 18...60 V...72 V: 111.9024.46
- GPS radio clock NIS time, RS 232, Uh: AC 85...110 V...264 V / DC 88 V...220 V...280 V: 111.9024.47
- GPS radio clock NIS time, RS 232, Uh: DC 18...60 V...72 V: 111.9024.48

**Communication:**
- Develo MicroLink 56Ki analogue modem, DIN rail device incl. 230 V AC power supply: 111.9030.03
- TCP/IP adapter 10 Mbit REG-COM; DIN rail device including power supply 230 V AC: A01
- TCP/IP adapter 10 Mbit REG-COM; plug-in module 8TE, 3HE; Power supply AC 85...110 V...264 V / DC 88 V...220 V...280 V: A02
- TCP/IP adapter 10 Mbit REG-COM; plug-in module 8TE, 3HE; Power supply DC 18...60 V...72 V: A03
We take care of it.

Notes
A. Eberle GmbH & Co. KG

Frankenstr. 160
D-90461 Nuremberg

Tel.: +49 (0) 911 / 62 81 08-0
Fax: +49 (0) 911 / 62 81 08 99
E-Mail: info@a-eberle.de

http://www.a-eberle.de

Your sales partner:

_________________________________

Copyright 2014 by A. Eberle GmbH & Co. KG
Subject to change without prior notice.

Regler für Petersen-Spulen – REG-DPAA