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Specifications for voltage-regulator

UVR (Unima Voltage Regulator)

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1. Purpose of the Equipment

Digital voltage regulator (thereinafter only UVR) is designed for synchronous generator exciting. UVR regulates the output voltage of the generator to the desired value, and regulates the power factor (parallel connection of the generator to the power grid). Request for correction of the required voltage (power factor) can be transmitted to the UVR via data line, analog or digital signals more and less.

2. Operating Conditions

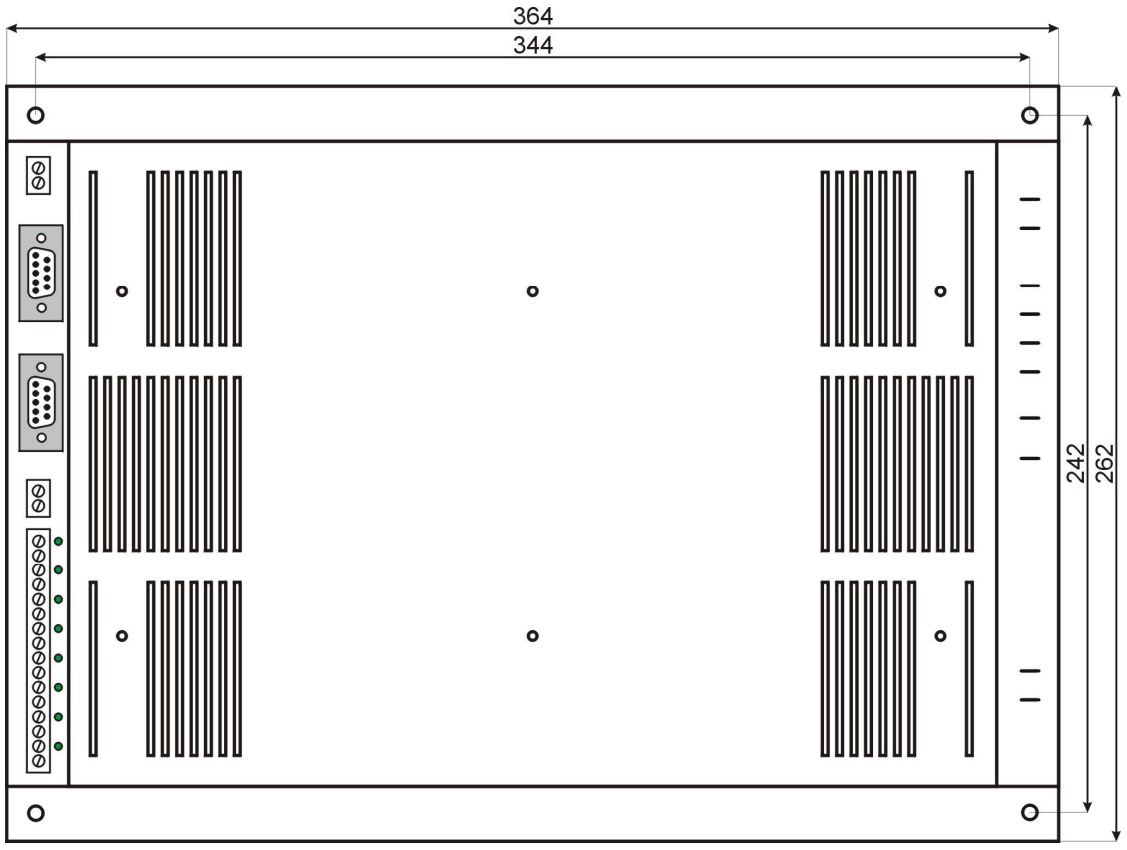
To enjoy the faultless operation it is necessary to observe the fundamental operating conditions which are defined in the following sections:

a) Proper connecting of Input / Output connectors
b) Power supply which meets the allowed tolerances
c) Proper parameter setting of the controlling SW
d) Observance of the operating temperature in surroundings within the range up to 60°

3. Mechanical Design

The UVR is fixed in a detached metal box having dimensions 364x262x90mm. Mounting holes pitch is 344x242mm, diameter 5mm.

On both short sides the connectors are located. On the one side are the CANNON connectors for communications and PA256 connectors (pitch 5.08mm) to connect the control signals and power. On the other side are located faston connectors (6.3 mm) for connection UVR to the generator.



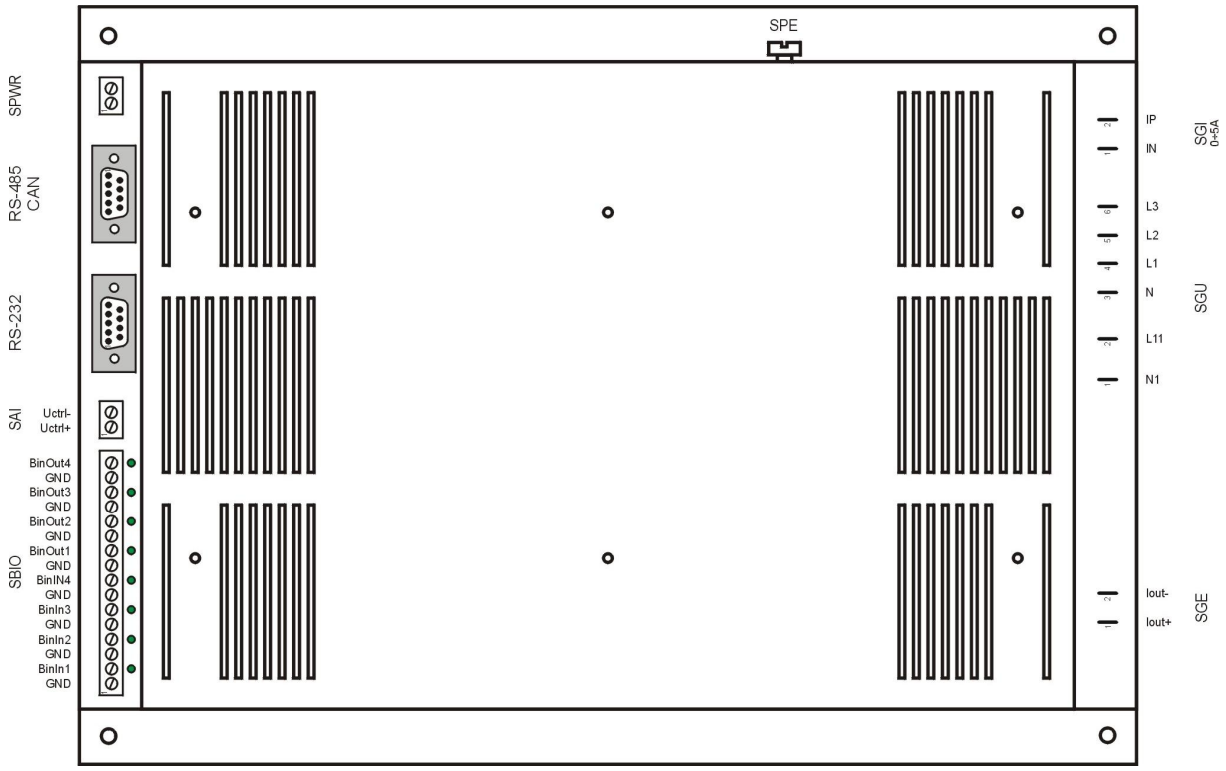
4. Electrical design

To connect the signals of the UVR is used connectors SBIO (inputs and outputs), SAI (analog control voltage) and SPWR (power). The generator is connected via connectors SGE (excitation current), SGU (voltage generator) and SGI (optional information from current transformer).

One connector CANNON is used for connecting UVR to PC via RS-232 (monitoring, configuration, diagnostics) and second connector CANNON include communication RS-485 (UniGEN connection) and CAN.

On the side of UVR is the screw thread (SPE) used for connecting of ground wire. It is recommended to use wire min. 2.5 mm^2.

Position of connectors:



4.1 Connector SPWR

	Name	Description	Working values
SPWR.1	Power	UVR supply	10÷33V DC or 8÷24V AC
SPWR.2			

Connector span: 5,08mm
Max. wire cross-sect.: 2,5mm^2

4.2 Connector SAI

	Name	Description	Working values
SAI.1	Uctrl+	UVR control via analog signal	-5÷5V or 0÷10V
SAI.2	Uctrl-		

Connector span: 5,08mm
Max. wire cross-sect.: 2,5mm^2

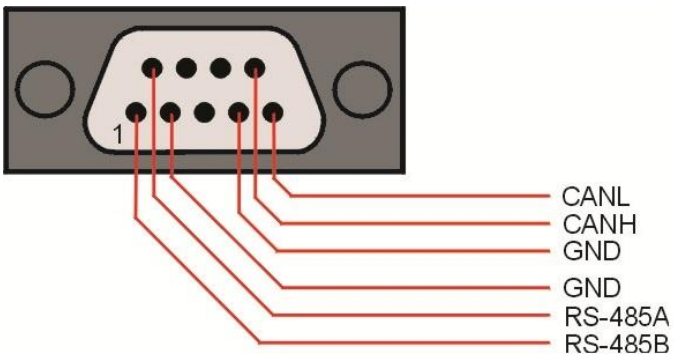
4.3 Connector SBIO

	Name	Description	Working values
SBIO.1	GND	Binary input 1	Inputs are activated by closing to GND.
SBIO.2	BinIn1		
SBIO.3	GND	Binary input 2	
SBIO.4	BinIn2		
SBIO.5	GND	Binary input 3	
SBIO.6	BinIn3		
SBIO.7	GND	Binary input 4	
SBIO.8	BinIn4		
SBIO.9	GND	Binary output 1	Open collector switching to GND Max 50mA/60V DC
SBIO.10	BinOut1		
SBIO.11	GND	Binary output 2	
SBIO.12	BinOut2		
SBIO.13	GND	Binary output 3	
SBIO.14	BinOut3		
SBIO.15	GND	Binary output 4	
SBIO.16	BinOut4		

Connector span: 5,08mm
Max. wire cross-sect.: 2,5mm^2

4.4 Connector RS-485, CAN

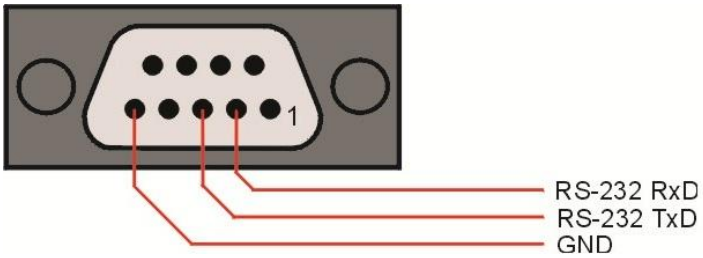
Communication interfacing RS-485 (for connection to the CU UniGEN) and CAN interfacing.



	Name	Description	Working values
S485.1	485B	Comm.interfacing RS-485	Levels compatible with RS-485 and CAN Both interfaces are galvanically separated from UVR and also mutual
S485.2	GND		
S485.3	NC		
S485.4	GND	Comm.interfacing CAN	
S485.5	CANL		
S485.6	485A	Comm.interfacing RS-485	
S485.7	NC		
S485.8	NC		
S485.9	CANH	Comm.interfacing CAN	

4.5 Connector RS-232

Communication of UVR with PC (service program Manager) is implemented by means of the serial interface RS-232 (9-pins connector CANNON). For connection to PC it is necessary to use a cross-cable (2-3, 3-2, 5-5).



	Name	Description	Working values
S232.1	NC		Levels compatible with RS-232
S232.2	RxD	Receive of serial data	
S232.3	TxD	Sending of serial data	
S232.4	NC		
S232.5	GND	Ground	
S232.6	NC		
S232.7	NC		
S232.8	NC		
S232.9	NC		

4.6 Connector SGE

	Name	Description	Working values
SGE.1	Iout+	Exciting current	0÷7,5A 0÷80V (Pmax 400W) R_z 2÷15Ω
SGE.2	Iout-		

Faston dimension: 6,3mm

4.7 Connector SGU

	Name	Description	Working values
SGU.1	N1	Generator voltage (single-phase)	max. 280V
SGU.2	L11		
SGU.3	N	Generator voltage (three-phase)	
SGU.4	L1		
SGU.5	L2		
SGU.6	L3		

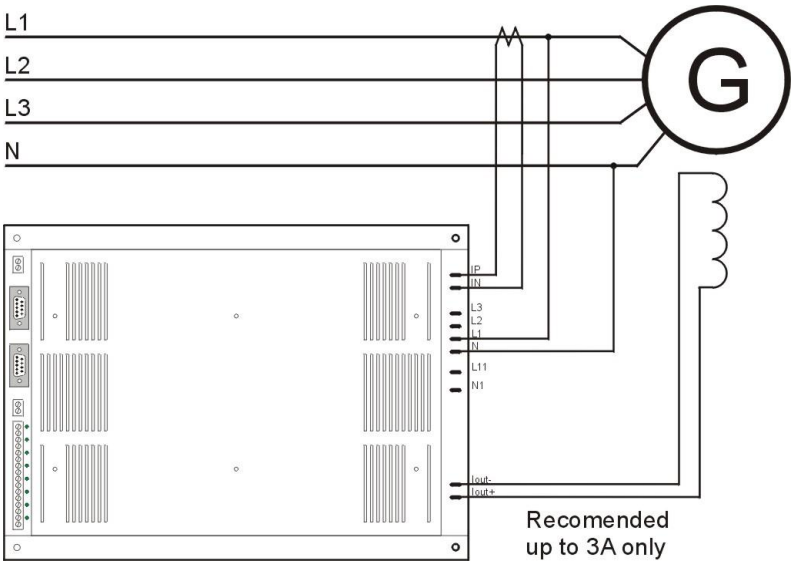
Faston dimension: 6,3mm

4.8 Connector SGI

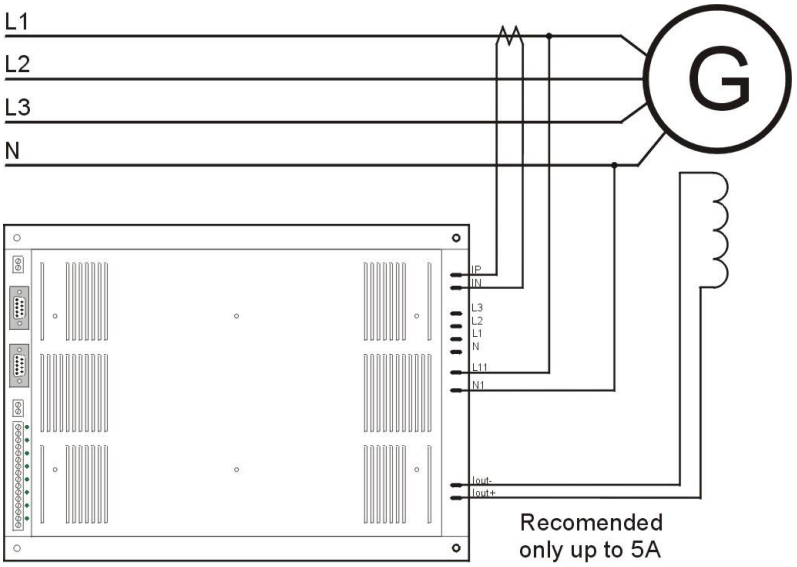
	Name	Description	Working values
SGI.1	IN	Input for generator current measurement	0÷5A
SGI.2	IP		

Faston dimension: 6,3mm

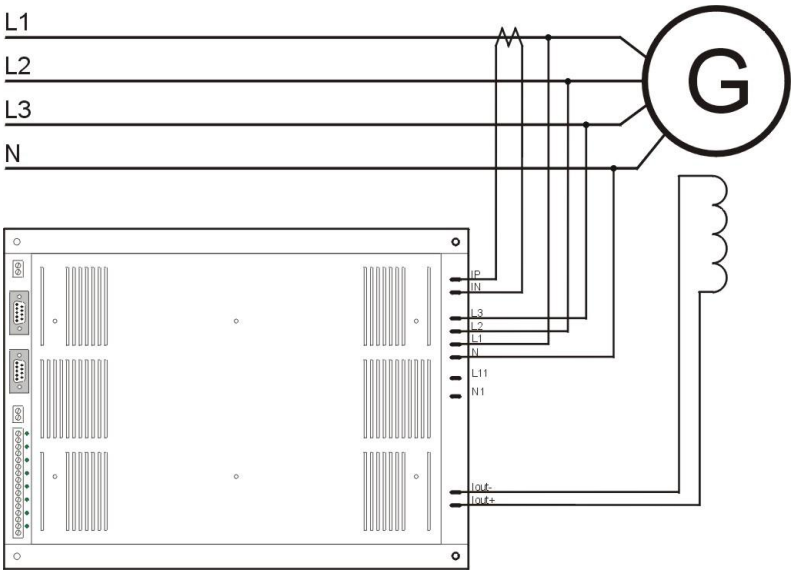
4.9 Single-phase one-way rectification connection (exciting up to 3A)



4.10 Single-phase two-way rectification connection (exciting up to 5A)



4.11 Three-phase connection



5. Configuration

UVR configuration consists from mapping (relation between logical signals and physical inputs/outputs) and the parameter setting.

Individual settings for mapping and parameters can be saved/loaded into/out of a file (a binary or in case for parameter also as a text file).

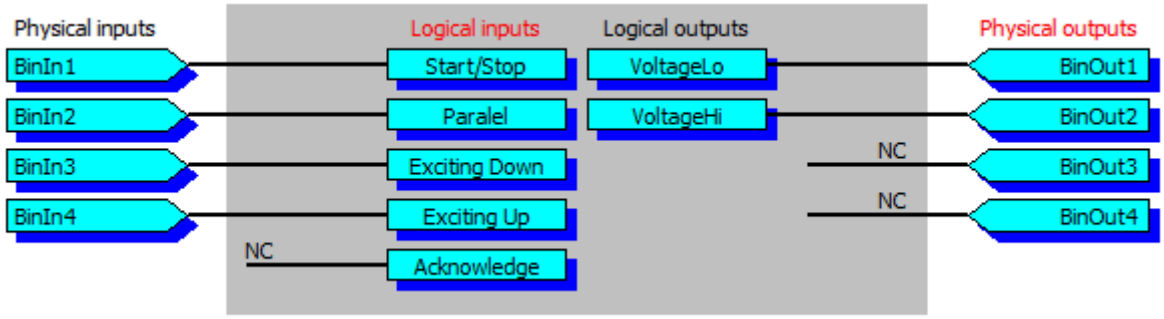
The overall UVR configuration (parameters and mapping) can be saved ("Service/Create configuration backup") or restored ("Service/Restore configuration backup") into if you like one and only file. In case of the configuration restoring it is possible for restoring to select only the demanded blocks (implicitly only calibration parameters remain unselected, which can be different for various ignitions).

5.1 Mapping

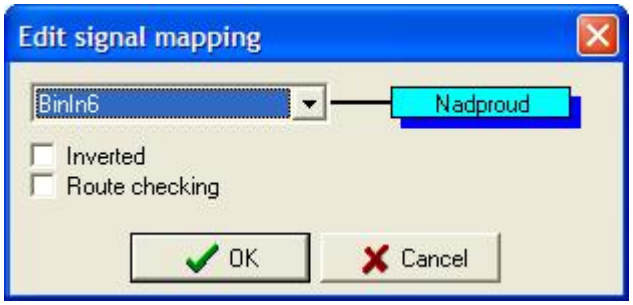
The meaning of physical inputs as well as outputs is configurable. UVR algorithm uses logical inputs as well as outputs, and by means of mapping there is defined the relation between logical as well as physical inputs and outputs. The assigning a physical input to a logical input (a logical output to physical output) will be hereinafter called mapping.

In the bottom part of the window for Mapping there are buttons to be used for selection, whether we want to assign logical, analogical or all signals.

Using the only one physical input can control a few of logical inputs, logical signals can be constantly deactivated with setting to 0 (False) as well as constantly activated with setting to 1 (True).



Having clicked on the name of the logical input (Logical inputs) or physical output (Physical outputs) in the Mapping window (I/O Mapp) of the service program Manager there will appear the window for selection where the signal in question is to be connected.



It is possible to connect the signal also inverted (Inverted) and if it is available for HW it is possible at input to activate the route checking (Route checking).

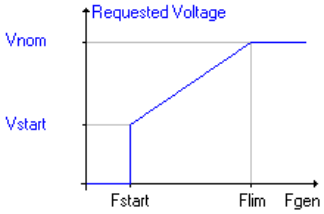
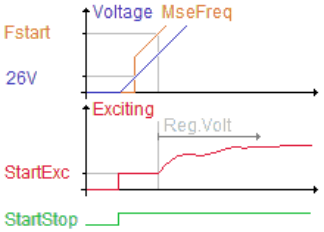
5.2 Adjustable parameters

There are presented all UVR parameters in this section. To set parameters you have to use service program

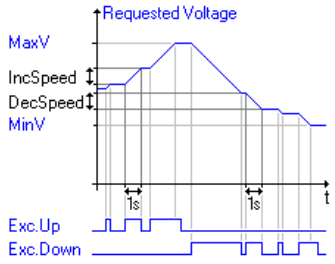
5.2.1 Configuration

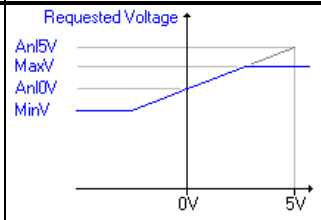
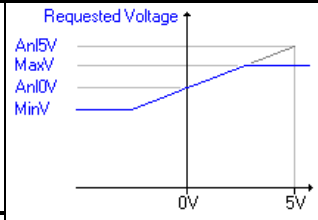
Name	Description	Options
Vreg	Regulated voltage	• By phase A value • By average of all phases
ChanSup	Changer supply	• 3-phase (N) • 1-phase (N1)

5.2.2 Start

Name	Description	Min/ Max	Step	
Fstart	Activation frequency Generator frequency higher than Fstart cause regulator activation. The required voltage is reduced as shown.	10/ 60Hz	1Hz	
Flim	Frequency with restriction If the generator frequency is less than "Flim" is the desired voltage linearly constrained as shown	40/ 60Hz	1Hz	
Vstart	Voltage at activation frequency If the generator frequency is less than "Flim" is the desired voltage linearly constrained as shown	20/ 200V	1V	
StartExc	Start exciting If "Start/Stop" signal is active and frequency of generator is less than the activation level, generator exciting is given by this parameter. To evaluate non-zero frequency must be the generator output voltage is greater than 26V. In the event that the output voltage of non-excited generator is higher than 26V, we recommend setting this parameter to 0%. Otherwise, this parameter must be set such value to ensure that the generator output voltage greater than 26V.	0/ 10%	0.1%	

5.2.3 Generator exciting

Name	Description	Min/ Max	Step	
		Options		
Vnom	Nominal voltage If the generator frequency is less than "Flim" is the desired voltage linearly constrained as shown	20/ 400V	1	
CtrlV	Requested voltage correction Requested voltage correction way	• Switched-off • Bin.signals Down/Up • Analog.signal 0÷10V • Data control from CU		
CtrlCos	Requested power-factor correct Requested power-factor correction way	• Switched-off • Bin.signals Down/Up • Analog.signal 0÷10V • Data control from CUAutomatic		
IncSpeed	Voltage up correction speed If is activated the correction of the requested output voltage via the bin signals, the output value can be then corrected by signals "Exciting Up" and "Exciting Down". The speed of voltage increase (change of the requested voltage during the input impulse persisting for 1 sec.) is given by this parameter. Having reached thevoltage "MaxV" (or if the exciting is at the upper limit) there occurs no voltage increasing even if the signal "Exciting Up" is persisting. Works the engine in the mode of power regulation (signal parallel is active) you can, using this signal, correct power-factor. The requested voltage is, via the parameter "Droop" converted to the exciting.	0/ 25	0.1 V/s	
DecSpeed	Voltage down correction speed	0/	0.1	

	If is activated the correction of the requested output voltage via the bin signals, the output value can be then corrected by signals "Exciting Up" and "Exciting Down". The speed of voltage decrease (change of the requested voltage during the input impulse persisting for 1 sec.) is given by this parameter. Having reached the voltage "MinV" (or if the exciting is at the zero) there occurs no voltage decreasing even if the signal "Exciting Down" is persisting. Works the engine in the mode of power regulation (signal parallel is active) you can, using this signal, correct power-factor. The requested voltage is, via the parameter "Droop" converted to the exciting.	25	V/s	
Anl0V	Voltage on 0V If is activated the correction of the requested output voltage via the analog signal, the output voltage can be corrected by the input signal -5÷5V. What requested voltage corresponds to the 0V is defined by parameter "Anl0V" the minimal possible value is but "MinV".	80/ 400	1V	
Anl5V	Voltage on 5V If is activated the correction of the requested output voltage via the analog signal, the output voltage can be corrected by the input signal -5÷5V. What requested voltage corresponds to the 5V is defined by parameter "Anl5V" the maximal possible value is but "MaxV".	80/ 400	1V	
MinV	Minimal requested voltage "MinV" it is a minimal value of the requested voltage that can be achieved by virtue of correction signal ("Exciting Down" or analogical signal). After having reached this requested voltage level, the input signal for requested voltage correction will be ignored.	80/ 400	1V	
MaxV	Maximal requested voltage "MaxV" it is a maximal value of the requested voltage that can be achieved by virtue of correction signal ("Exciting Up" or analogical signal). After having reached this requested voltage level, the input signal for requested voltage correction will be ignored.	80/ 400	1V	
MaxExcI	Maximal exciting (island) Exciting value (maximal current) in isnald mode can be restricted by this parameter	10/ 100	1%	
MaxExcP	Maximal exciting (paralel) Exciting value (maximal current) in paralel mode can be restricted by this parameter	20/ 100	1%	

Droop	Droop This parameter is of use in case the input signal "Parallel", by use of that the voltage regulation is switched over to power-factor regulation (the parallel operation with net). The parameter gives, for how many percents must be changed the apparent requested voltage to change the exciting value by one 100%. The initial point is given by the moment of the "Parellel" signal activating, at this moment the current voltage value is assigned to the current exciting. Exciting value iis limited by maximal value "MaxExc".	5/ 50	1%	
Vwin	Voltage window If the absolute value of the difference between the nominal and the actual voltage in paralel mode is higher than this parameter, it follows the regulator switch from power-factor regulation mode to voltage regulation mode for the time of VoutTime	0/ 50	1V	
VoutTime	Voltage regulation renewal Delay before return to power-factor regulation when voltage gets outside of window and continule run in paralel mode	1/ 25	1s	

5.2.4 PID regulation

Name	Description	Options
Texc	Voltage regulation period	• T=20ms • T=40ms • T=50ms • T=80ms • T=100ms
PIDexc	Exciting regulation PID parameters	K, 1/Ti, Td

5.2.5 Power factor regulation (auto)

Name	Description	Min/ Max	Step	
ReqCos	Requested power-factor Requested power-factor in automatic control (use only when generator current is measured and correction of requested power-factor set to "Auto")	-1/ 1	0.01	
RegCosT	Power factor regulation period Power factor regulation period in automatic control (use only when generator current is measured and correction of requested power-factor set to "Auto")	0/ 10	0.1s	
RegCosP	Power factor regulation speed Power factor regulation speed in automatic control (use only when generator current is measured and correction of requested power-factor set to "Auto")	0/ 100	1%	

5.2.6 Current measurement

Name	Description	Min/ Max	Step	
CTr	Current transformer Current transformer to 5A for current measurement	5/ 3000	1	

5.2.7 Cooling

Name	Description	Min/ Max	Step	
TfanOn	Fan start temperature Driver temperature for cooling fan activation	40/ 100 °C	1°C	
TfanOff	Fan stop temperature Driver temperature for cooling fan deactivation	40/ 100 °C	1°C	

5.2.8 Diagnostics

Name	Description	Min/ Max	Step	
Vlo	Undervoltage Unvervoltage level	80/ 400V	1V	
Vhi	Overvoltage Overvoltage level	80/ 400V	1V	
Rlo	Short circuit Resistance of the exciting coil for evaluation of the short circuit	1/ 100 Ω	1Ω	
Rhi	Open circuit Resistance of the exciting coil for evaluation of the open circuit	1/ 100 Ω	1Ω	
Overheat	Overheat Driver overheat level	50/ 120 °C	1°C	

5.2.9 Service

Name	Description	Min/ Max	Step	
Address UVR	Address UVR !! Attention !! The change of the device address will be of use only than after the device has been reseted (switch off and switch on of supply voltage).	0/ 15	1	
CntRes	Resets counter Parameter values are uploaded out of the regulator only after the communication has been opened. And therefore for gaining of the updated value of this parameter it is necessary to identify the equipment again ("Connection / Open") or to show the parameters by means of the extended option "Up-load and Edit UVR Parameters"	0/ 255	1	

6. Binary inputs

6.1 Physical binary inputs

The UVR disposes of 4 physical binary inputs. The state of each of them corresponds to the state of short-circuiting (disconnection) of the relevant terminal on the ignition terminal-block SBIO.

6.2 Logical binary inputs

Logic inputs are binary variables controlled by physical input by parameters settings that affect the function of UVR. Each logical input can be assigned to physical input control, or may be permanently set as inactive or active. A physical input can handle multiple logic inputs.

Logical input	**Purpose**
Start/Stop	Regulator activation
Paralel	Information about run in parallel mode
Acknowledge	
Exciting Down	Control via binary signals
Exciting Up	

6.2.1 Start/Stop

Activation of this input (together with the generator voltage> 26V and exceeded the limits of the activation frequency generator) is a necessary condition to activate the regulator.

When used with the control system UniGEN signal can be mapped to the "CU-solenoid" (not "CU-Start/Stop).

6.2.2 Paralel

Information about run in parallel mode (switching between voltage and power-factor regulation).

6.2.3 Acknowledge

6.2.4 Exciting Down / Up

Generator exciting control (control of requested voltage or power-factor) via binary signals. Parameters „Requested voltage correction" or *„Requested power-factor correction"* have to be set to *„Bin.signals Down/Up".*

7. Binary outputs

7.1 Physical binary outputs

The state of physical outputs (closing/opening of the output transistor on the terminal block SBIO) is given according to the parameter setting of the logical output state. There can be set polarity with each of the physical outputs (the output transistor closes/opens when activating).

7.2 Logical binary outputs

Operation of the UVR as well as input signals evaluation and two-valued inputs are affected by the state of the 7 binary magnitudes.

Logical output	Description
Overheat	Overheat of the UVR DC/DC convertor
Short	Short circuit detection
Open	Open circuit detection
VoltageLo	Low generator voltage
VoltageHi	High generator voltage
ExcitingLo	Exciting reach zero level
ExcitingHi	Exciting reach its high level

7.2.1 Overheat

DC/DC convertor temperature overstep the parameter *„Overheat“*

7.2.2 Short

The calculated resistance of exciting coil is under the parameter *„Short circuit“*.

7.2.3 Open

The calculated resistance of exciting coil is over the parameter *„Open circuit“*.

7.2.4 VoltageLo

The measured generator voltage is under the parameter *„Undervoltage“*

7.2.5 VoltageHi

The measured generator voltage is over the parameter *„Overvoltage“*

7.2.6 ExcitingLo

The exciting current reach during regulation the zero value.

7.2.7 ExcitingHi

The exciting current reach during regulation the value of parameter *„Maximal exciting (island)“* when voltage regulation or value *„Maximal exciting (paralel)“* when power factor regulation.

8. Analog inputs

Analog inputs are not configurable in UVR.

UVR contains analog input -5÷5V for requested voltage (power factor correction correction) control. For UVR control via this signal must be parameter *„Requested voltage correction“* or *„Requested power-factor correction“* set to *„Anl.signal“.*

Other inputs of UVR are generator voltage, from which UVR supplies DC / DC converter for generator exciting and also measure the actual voltage and frequency of generator.

Optional analog input is also information about current generator from the current transformer, based on the UVR measured active and reactive power so he can maintain a constant power factor (the parameter. *"Requested power-factor correction"* is set to *"Auto".)*

9. Function description

If the signal "Start / Stop" is inactive, the UVR is turned off. When this signal "Start / Stop" is activated, UVR sets the minimum value of exciting (parameter *„StartExc“*). Then the controller waits to reach the starting frequency *"Fstart"* that leads to the opening of voltage regulation.

UVR measure the frequency, if the generator voltage exceeds 26V. If the voltage of non-excited generator is higher than this value, you should set the parameter *"StartExt"* to zero. In this case may be the activation signal "Start / Stop" still active, the UVR will activate / deactivate only on the presence of the generator frequency.

After starting the control voltage generator is desired linear constraints frequency generator. After reaching the nominal frequency may be required to correct voltage (binary signals, analog control input, data from the UniGEN or via CAN)

After activation of signal "Paralel" (generator synchronized to the network) UVR switches from voltage control to power factor control. By the same way as in voltage control is change of "apparent" voltage through the parameter "Droop" translated to change the exciting change. In parallel mode is via required voltage direct-proportional controlled generator exciting so as to achieve the desired power factor.

UVR measured in one phase also the current generator, through which can determine the actual power factor. If the parameter *„CtrlCos"* is set to *"Auto"* will regulate the power factor of UVR to the desired value of the parameter *"ReqCos"* alone (without external correction signal).

In addition to frequency, voltage and current generator UVR also evaluating additional variables for the diagnosis of UVR:

- Active and reactive power
- Supply voltage and current
- Input and output voltage, current and power of DC/DC convertor, convertor efficiency
- Convertor temperatures
- Exciting coil resistance

On the basis of this measured values may UVR evaluate overheat, short circuit, open circuit, overvoltage, undervoltage and limits of the exciting current.

10. CAN

UVR is equipped with a communication interface CAN (SAE J1939) with which you can read the status of UVR. With the CAN commands can also control the UVR.