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Specification for the Control Unit

UniGEN

General-Purpose Firmware

June 2010
Firmware V1.74

TABLE OF CONTENTS:

1. Purpose of the Equipment

The labour of the described UniGEN Control Unit (hereafter CU) is the control over Combustion Motor System as well as Generator.

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) CU-power supply which meets the allowed tolerances
c) Proper parameter setting of the master SW
d) Observance of the operating temperature in surroundings of up to 60°C

3. Mechanical Design

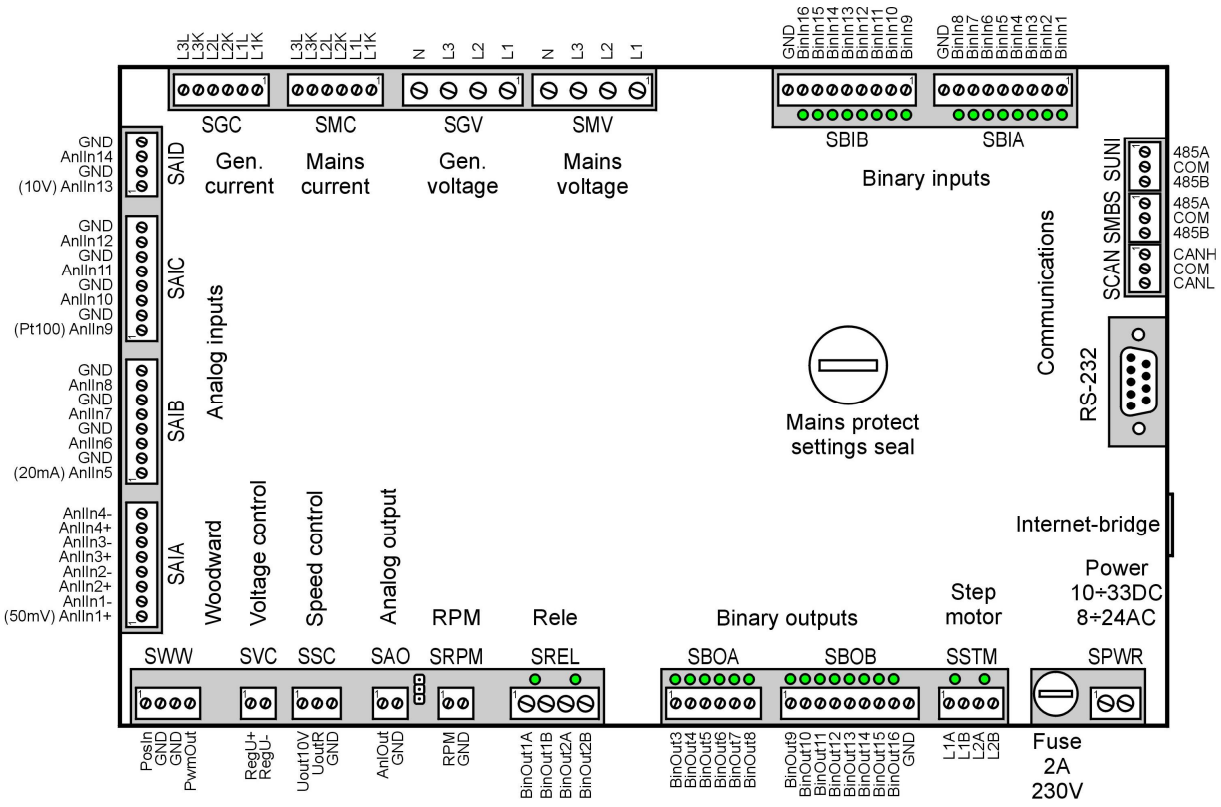
CU is placed in an independent metal enclosure having dimensions 290x185mm (+5mm sealing rubber on periphery), height 95 mm. The size of assembly hole is 175x275. Connectors for connection of all signals are placed along the rear part of CU periphery, connector for ethernet connection is situated abeam, in ca 30mm distance from the front panel inside.

4. Electrical Design

CU is connected to the switch board by means of connectors PA256 (spacing 5,08), ARKZ 1550 (spacing 3,81) and BLZ7,62/90 (spacing 7,62). The CU is energized either with DC voltage of 10-33V or with AC voltage of 8-24V.

CANNON-connector is used for connection of CU to PC (monitoring, setting, diagnostics), for the same purpose is used also the Ethernet socket by use of which it is possible to communicate via the network

Connector lay-out:



4.1Connector SREL (binary relay outputs)

Pin	Name	Description
SREL.1	BinOut1A	Configurable physical binary output
SREL.2	BinOut1B	(Relay contacts for binary output 1)
SREL.3	BinOut2A	Configurable physical binary output
SREL.4	BinOut2B	(Relay contacts for binary output 2)

Connector span: 5,04mm
Max. conductor cross-sect.: 2,5mm^2
El. Parameters of contact : 8A/250V AC

4.2Connector SBOA (binary outputs the open collectors)

Pin	Name	Description
SBOA.1	BinOut3	Configurable physical binary outputs
SBOA.2	BinOut4	
SBOA.3	BinOut5	
SBOA.4	BinOut6	
SBOA.5	BinOut7	
SBOA.6	BinOut8	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. Parameters of output : Open collector 50mA/60V DC

4.3Connector SBOB ((binary outputs the open collectors+ PWM)

Pin	Name	Description
SBOB.1	BinOut9	Configurable physical binary outputs
SBOB.2	BinOut10	
SBOB.3	BinOut11	
SBOB.4	BinOut12	
SBOB.5	BinOut13	
SBOB.6	BinOut14	
SBOB.7	BinOut15	Configurable physical binary output or PWM
SBOB.8	BinOut16	Configurable physical binary output or PWM
SBOB.9	GND	Common contact

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of output : Common collector 50mA/60V DC

4.4Connector SSTM (step motor)

Pin	Name	Description
SSTM.1	L1A	Coil L1 of the step motor
SSTM.2	L1B	
SSTM.3	L2A	Coil L2 of the step motor
SSTM.4	L2B	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of output : Optional value of the optional current 40mA÷600mA

4.5Connector SBIA (binary inputs)

Pin	Name	Description
SBIA.1	BinIn1	Configurable physical binary inputs
SBIA.2	BinIn2	
SBIA.3	BinIn3	
SBIA.4	BinIn4	
SBIA.5	BinIn5	
SBIA.6	BinIn6	
SBIA.7	BinIn7	
SBIA.8	BinIn8	
SBIA.9	GND	Common contact

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of inputs :
- Isolated input with line control Rv=3K3
- Uout =12V/5V output voltage
- Uext =+/- 50V max. ext. voltage (which does not harm input)

4.6Connector SBIB (binary inputs)

Pin	Name	Description
SBIB.1	BinIn9	Configurable physical binary inputs
SBIB.2	BinIn10	
SBIB.3	BinIn11	
SBIB.4	BinIn12	
SBIB.5	BinIn13	
SBIB.6	BinIn14	
SBIB.7	BinIn15	
SBIB.8	BinIn16	
SBIB.9	GND	Common contact

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of inputs :
- Isolated input with line control Rv=3K3
- Uout =12V/5V output voltage
- Uext =+/- 50V max. ext. voltage (which does not harm input)

4.7Connector SAIA (analogical inputs 50mV)

Pin	Name	Description
SAIA.1	AnlIn1+	Configurable physical analogical inputs 50mV
SAIA.2	AnlIn1-	
SAIA.3	AnlIn2+	
SAIA.4	AnlIn2-	
SAIA.5	AnlIn3+	
SAIA.6	AnlIn3-	
SAIA.7	AnlIn4+	
SAIA.8	AnlIn4-	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
Electrical parameters: Convertor resolution 13 bits, symmetric measuring

4.8Connector SAIB (analogical inputs 20mA)

Pin	Name	Description
SAIB.1	AnlIn5	Configurable physical analogical inputs 20mA
SAIB.2	GND	
SAIB.3	AnlIn6	
SAIB.4	GND	
SAIB.5	AnlIn7	
SAIB.6	GND	
SAIB.7	AnlIn8	
SAIB.8	GND	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
Electrical parameters: Convertor resolution 13 bits, symmetric measuring

4.9Connector SAIC (analogical inputs Pt100)

Pin	Name	Description
SAIC.1	AnlIn9	Configurable physical analogical inputs Pt100
SAIC.2	GND	
SAIC.3	AnlIn10	
SAIC.4	GND	
SAIC.5	AnlIn11	
SAIC.6	GND	
SAIC.7	AnlIn12	
SAIC.8	GND	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
Electrical parameters: Convertor resolution 13 bits

4.10Connector SAID (analogical inputs 10V)

Pin	Name	Description
SAID.1	AnlIn13	Configurable physical analogical inputs 10V
SAID.2	GND	
SAID.3	AnlIn14	
SAID.4	GND	

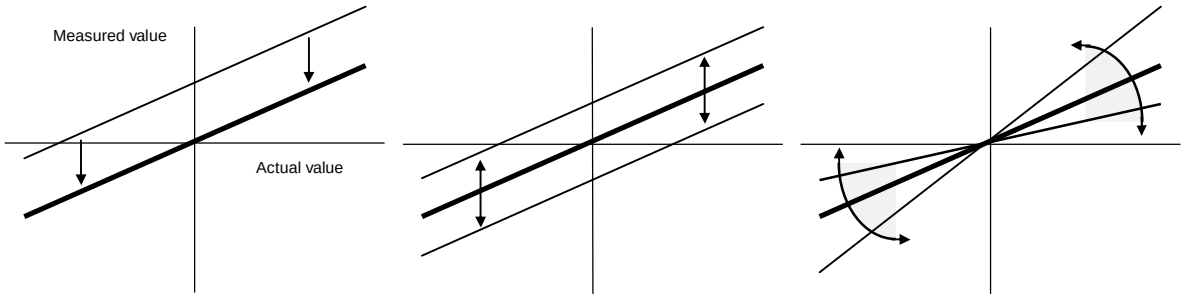
Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
Electrical parameters: Convertor resolution 13 bits, symmetric measuring

4.10.1Analogue Inputs Calibration

All analogue inputs (20mA, Pt100, actuator position….) can be calibrated digitally without interference with CU (trimmer setting).

Calibration is carried out by connecting of CU to PC by means of RS-232. After having selected menu “Service/Calibration” in program “MANAGER.EXE” the dialogue window for calibration will appear. The selected parameter can be accurately set to desired value using press buttons for offset change and amplitude change:

Offset resetting Offset change Amplitude change



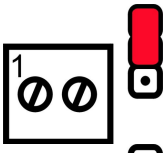
Recommended procedure for calibrating:

a) Disconnecting of the calibrated input (zero setting)
b) Offset zero setting “Offset 0”
c) Connecting the input to the defined value
d) Setting of the required value using press-buttons “Amplitude +” and “Amplitude –“

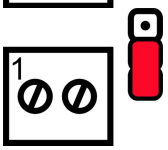
4.11Connector SAO (analogical output)

Pin	Name	Description
SAO.1	AnlOut	Configurable physical analogical output 10V/20mA
SAO.2	GND	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of output : Through shorting jumper optional output 10V/20mA, Voltage output shows a max. output current of 5 mA



Position of the shorting jumper for selection output 20mA



Position of the shorting jumper for selection output 10mA

4.12Connector SWW (actuator Woodward)

Pin	Name	Description
SWW.1	PosIn	Feed-back measuring for position of act. Woodward
SWW.2	GND	
SWW.3	GND	PWM-output for control over position of act. Woodward
SWW.3	PwmOut	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
Insulation strength 2,5kV

4.13Connector SVC (voltage regulation)

Pin	Name	Description
SVC.1	RegU+	Output for direct control over the voltage regulator
SVC.2	RegU-	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
Insulation strength 2,5kV

4.14Connector SSC (rotation speed control)

Pin	Name	Description
SSC.1	Uout10V	Output for analogical speed control regulator (provided Speedcon not assigned)
SSC.2	UoutR	
SSC.3	GND	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2

4.15Connector SRPM (rpm measuring)

Pin	Name	Description
SRPM.1	RPM	Input for measuring rotation speed of the aggregate. In case of connecting of the rpg-regulator SpeedCON the data transfer is possible (another sensor for doing this is needless)
SPRM.2	GND	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2

4.16Connector SGV (generator voltage)

Pin	Name	Description
SGV.1	L1	Inputs for connection of the generator three phase voltage
SGV.2	L2	
SGV.3	L3	
SGV.4	N	

Connector span: 7,62mm
Max. conductor cross-sect.: 2,5mm^2
El. parameters of input : Max.voltage 600V

4.17Connector SMV (net voltage)

Pin	Name	Description
SMV.1	L1	Inputs for connection of the net three phase voltage
SMV.2	L2	
SMV.3	L3	
SMV.4	N	

Connector span: 7,62mm
Max. conductor cross-sect.: 2,5mm^2
El. parameters of input : Max. voltage 600V

4.18Connector SGC (generator current)

Pin	Name	Description
SGC.1	L1K	Inputs for connection of the generator three phase current
SGC.2	L1L	
SGC.3	L2K	
SGC.4	L2L	
SGC.5	L3K	
SGC.6	L3L	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of input : Max. current 8A

4.19Connector SMC (net current – consumption measuring)

Pin	Name	Description
SMC.1	L1K	Inputs for connection of the net three phase current
SMC.2	L1L	
SMC.3	L2K	
SMC.4	L2L	
SMC.5	L3K	
SMC.6	L3L	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2
El. parameters of input : Max. current 8A

4.20Connector SCAN (communication interfacing CAN)

Pin	Name	Description
SCAN.1	CANH	Communication interfacing CAN
SCAN.2	COM	
SCAN.3	CANL	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2

4.21Connector SMBS (Communication RS-485 ModBUS)

Pin	Name	Description
SMBS.1	485A	Communication interfacing RS-485 for data communication with an master unit as well as info-???? from the CU
SMBS.2	COM	
SMBS.3	485B	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2

4.22Connector SUNI (Communication RS-485 UnimaBUS)

Pin	Name	Description
SUNI.1	485A	Communication interfacing RS-485 for connecting of other devices UNIMA-KS (Speedcon, TMC12, etc.)
SUNI.2	COM	
SUNI.3	485B	

Connector span: 3,81mm
Max. conductor cross-sect.: 1,5mm^2

4.23Connector SPWR (power supply)

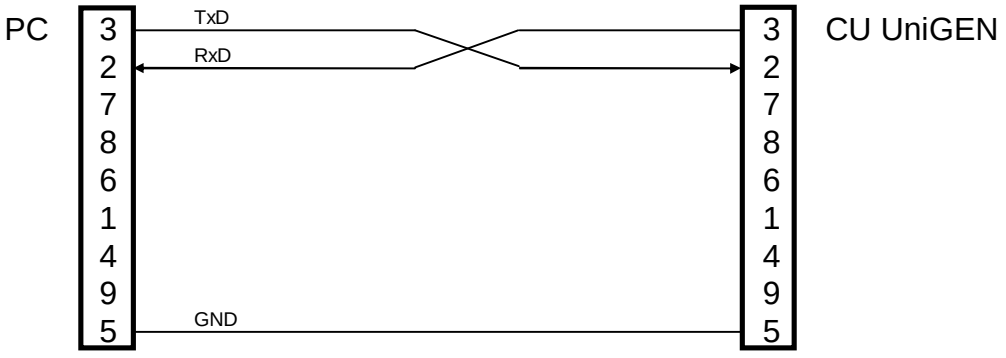
Pin	Name	Description
SPWR.1	POWER	Supply voltage 10÷33V DC or 8÷24V AC. Next to the supply connector is situated a safety-fuse 2A, 230V.
SPWR.2		

Connector span: 5,04mm
Max. conductor cross-sect.: 2,5mm^2

4.24Connector CANNON (RS-232)

Pin	Name	Description
CAN.2	RxD	Communication interfacing RS-232 for CU to PC (visualization, setting, calibration with Manager-program). For connection can be also used the net-cable and ethernet-sockets.
CAN.3	TxD	
CAN.5	GND	

Cable connection to connect CU to PC:



5. Actuating of the CU

5.1Control panel

Control panel includes 26 control keys, graphic display 240x128 pixels and 6 two-colour LEDs for state indication.

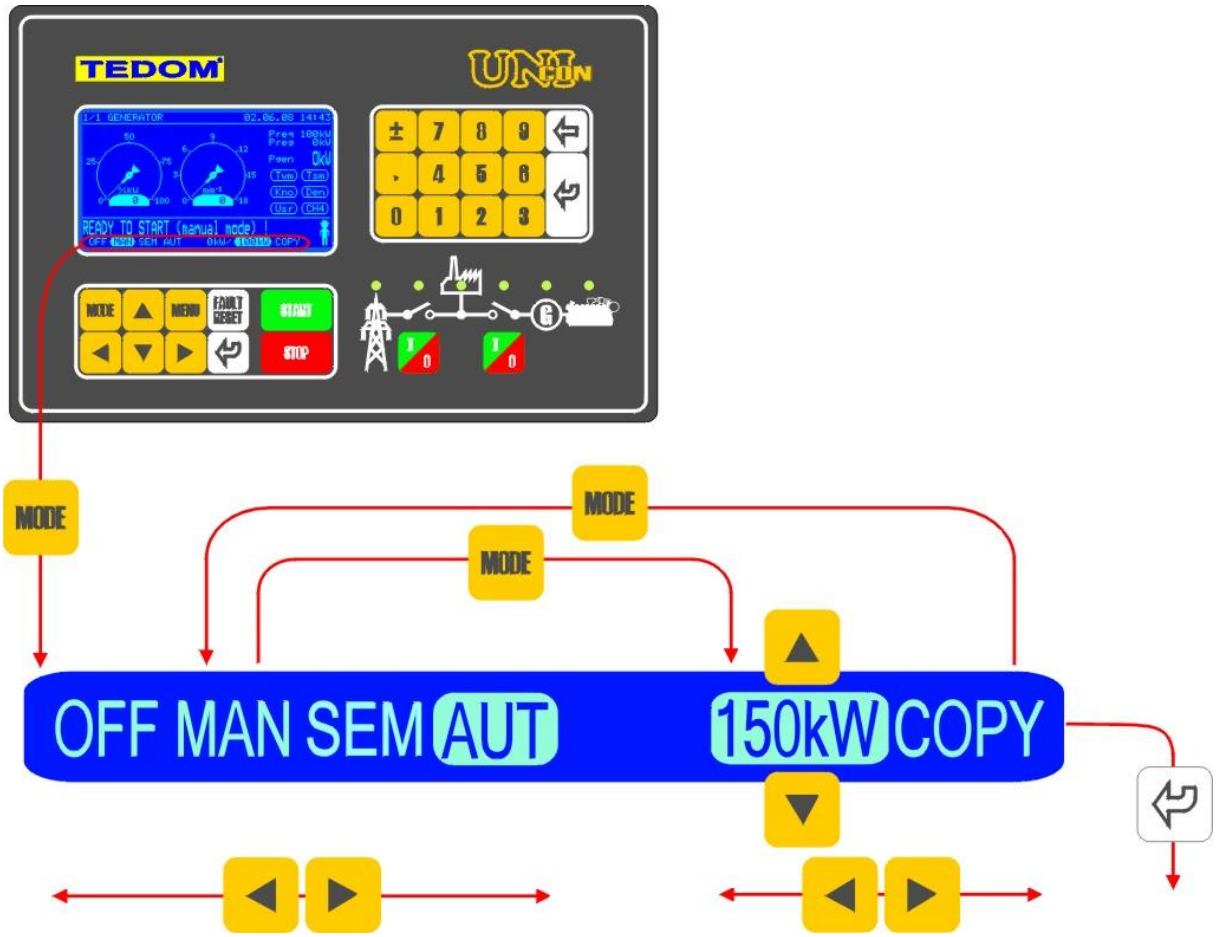
MODE	Selection of CU mode, control mode and output mode (see section 5.2).
MENU	Input for menu CU (selection of displayed information, parameter, history, setting of net protections, menu for service and diagnostics). **MENU**: Re-press of menu causes return to main screen **PARAMETER:** Return to main screen.
	Keys upwards and downwards, on the main screen are used to select displayed information. **MENU:** In menu is used to select required items. **HISTORY:** Listing through the history (scrolling) **PARAMETERS:** Parameter selection.
	Keys left and right, On main screen they serve for switching of sub-screens. Press and hold of the right key enables to pass over to the list of alarms (1/5). Press and hold of the left key enables to pass over to the home screen of the generator (1/1). **HISTORY:** Scrolling through the history (moving of recorded and displayed values). **PARAMETERS:** Value change of selected programme.
FAULT RESET	Key for fault deactivation after the fault source has gone off
	"Enter"- Key **MENU:** Selection of desired airbrush **HISTORY:** Return to main screen. **PARAMETERS:** Return to main screen (confirmation of parameter value entered by numerical keyboard).
START	Start of the aggregate in manual or semi-automatic mode – activating the demand for aggregate run. Is there a start lock, the start is taking place immediately after the reason for blocking has gone off. In case there is a semi-automatic mode set, CU will either pass on to parallel operation (net deion is shows on-state) or pass on into operation under load (net deion shows off-state). If there is a manual mode actual, CU goes over immediately after start only to nominal speed operation mode. Keystroke during the relieving phase (i.e. the demand for successive unloading) causes the return to the parallel (solitary) operation.
STOP	Initiation of shat-down and semi-automatic mode transition (provided this was actual in automatic mode). It activates releasing and after a time-out expiry desynchronizes (in parallel mode) or disengages generator contactor (in solitary mode) and after cooling evokes Stop. Keystroke during the relieving phase results in immediate contactor disengaging and cooling run transition. Keystroke during the cooling run results in immediate stopping of cooling run and unit halt. Keeping the key pressed for at least 1 s. in automatic mode during

	the limp-home operating mode (units like “E” a “P+E, see sections 17.1.4 and 17.1.5) produces fault shutdown caused by the user (i.e. the unit during the emergency mode is not governed by normal keystroke “START” and “STOP” but by state of electrical power network).	
 MCB (left)	Operating of net deion. Controlling of net deion is possible in manual mode only, and in only a few modes under net cooperation (E, P+I and P+E). In cooperation modes P and I is this key blocked, panel LED indicator of the net deion in P-mode is lighting constantly, in I-mode is not lighting constantly. In cooperation mode P+I can be selected by means of key whether the generator will be working in solitary or parallel operation (unless the deion-controlling is blocked through the parameter “MCBCrtlPI” from the CU-key board), automatic mode does not actuate the deion status. In E and P+E cooperation mode as well as in CU-automatic mode is the output governed according to CU-algorithm.	
		Touch of button activates the deion-grids (irrespective the generator operation status).
		Touch of button deactivates the deion-net (irrespective the generator operation status).
		Touch of button activates backwards synchronizing towards the net and subsequently parallel operation with the net. The retouch during the backwards synchronizing towards the net will defeat the backwards synchronizing. Overrun of warning or emergency limits of some of the net or generator parameters (U, f, phase) will block deion contact making which can lead to malfunction of the “not in time synchronized”.
		Touch of button deactivates the deion-net and causes generator transition from parallel to solitary operation (operation on-load).
 GCB (right)	Operating of generator deion. It is possible to govern the deion in manual mode only (it is governed automatically according to CU-algorithm in the automatic mode).	
		If the generator is running with nominal speed the touch of button causes attachment of load and passing on into operating on-load
		If the generator is running with nominal speed the touch of button activates synchronization toward the net (provided emergency limits of net parameters are not exceeded). The re-touch during the synchronizing will annul the synchronizing. Overrun of warning or emergency limits of some of the net or generator parameters (U, f, phase) will block contact making for deion which can lead to malfunction of the “not in time synchronized”.
		Touch of button will disconnect the load and courses transition from running on-load into unloaded run at nominal speed.
		Touch of button causes generator desynchronizing and transition to parallel operation with unloaded run at nominal speed.

	Numerical key-board. **MENU:** Within the menu it is used for prompt selection of a menu-item (it replaces the item selection by means of keys upwards/downwards & “Enter”-touch). **PARAMETERS:** Entering the parameter directly, with the numerical value (it replaces the selection of parameter value by means of keys upwards/downwards). **CU-RESET** : CU-reset followed by key combination 2&7 activates the data terminal for setting of the internet-bridge parameters (see section 8.1 “Setting of internet-bridge per CU). **MODEM DIAGNOSTICS**: Keys 0, 1, 2, 3 and 9 are used to send off a command in case of modem diagnostics (see section 9.2 Modem diagnostics per CU).
	Keys plus (minus). **PARAMETERS:** Selection of parameter sign when parameter entering directly, through numerical key-board. **HISTORY:** Switches over the history of 8 display recordings without description (there are also 4 display recordings description the aggregate state).
	**PARAMETERS:** Entering of decimal point when entering directly through numerical key-board.
	The key “backwards”: **PARAMETERS:** Deleting of the last digit when parameter entering directly using the numerical key-board.

5.2CU-Mode Selection

Selection of this mode is activated by key-stroke “MODE”. After having press this key for the fist time it follows the flashing of the machine mode indicating arrows left and right and you can make your selection among “OFF-MAN-SEM-AUT” (meaning: set off - manual mode – semi-automatic mode – automatic mode). Another press of MODE-key causes flashing of the machine performance mode “150kW-COPY”, selection is made using the arrows left and right. Provided the fix performance is selected (no “COPY”), the desired performance can be set using the arrows up-and-down. For mode confirmation it is necessary to press the key “ENTER”.

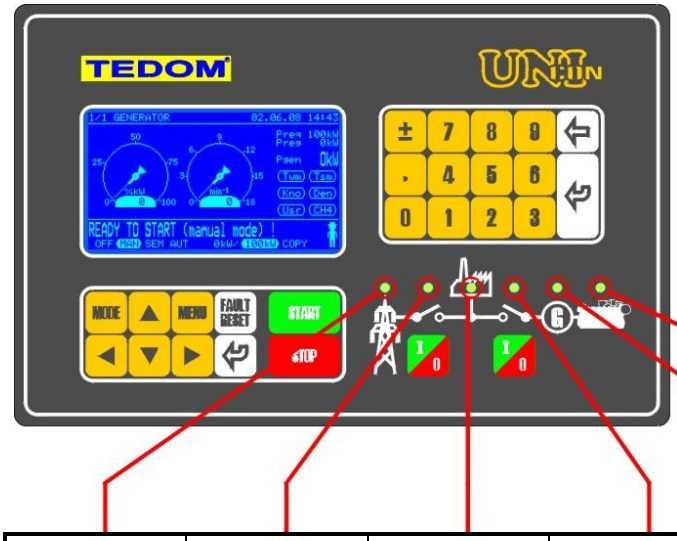


CU-mode	OFF	CU is not active; signal “Ready” will not be released, even if there would be no blocking or malfunction. CU does not respond to any “START”-stroke (neither in manual nor in semi-automatic mode). There is the logic sign “ModeOFF” active.
	MAN	Manual Mode; FHP is starting however it is not passing on to synchronizing stage automatically. From CU key-board it is possible to operate manually GCB and MCB. Provided “COPY” mode is selected at the same time, the unit can be started irrespective the value of desired performance; if the desired level is low the FHP is running with the min. power (in parallel).
	SEM	Semi-automatic Mode; Start and Stop of the unit occurs using the keys START/STOP, nevertheless further it is running fully automatic, i.e. in the same way as in automatic mode. GCB and MCB operation from the CU key-board is locked.. Provided the “COPY” mode is selected at the same time and the net deion is switched ON the starting and stopping of the unit occurs in accordance with the power desired.

	AUT	Automatic Mode; The FHP is running fully automatic, based on Entry operational requirement (input logical signal HDO). Provided the “COPY” mode is selected at the same time and the net deion is switched ON the starting and stopping of the unit occurs in accordance with the power desired.
Power-mode	150kW	Constant power mode; the FHP is running based on the set-power (provided no power limited protection is active).
	COPY	Copy Mode; the FHP is imitating the entity consumption (i.e. the value of the power desired).

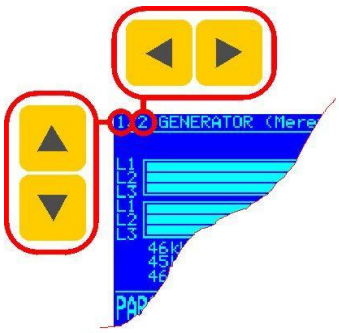
Key-stroke of STOP in automatic mode will cause the unit transition into the semi-automatic mode.

5.3Description of the indicating LEDs



Net	MCB	Consumer	GCB	Generator	Motor	LED-colour
Net voltage is lower than 25V in all phases (measured by CU) and there are no external net protections active	Deion disconnected, back coupling OK	Neither MCB nor GCB are connected	Deion disconnected, back coupling OK	Generator voltage is lower than 25V in all phases	Motor in Stop, ready to operate	**Not emitting**
Net parameter OK	Deion connected, back coupling OK	There is connected either MCB or GCB	Deion connected, back coupling OK	Generator parameters OK	Motor in operation	**Green**
-	Back synchronizing towards the net is running	-	Synchronizing towards the net is running	-	-	**Green (blinking)**
Warning net parameters have been exceeded	Feedback failure, deion disconnected (despite of requirement to connect)	-	Synchronizing towards the net is running	Warning generator parameters have been exceeded	Motor blocking, shutting down, the other operating states	**Orange**
Emergency net parameters have been exceeded (measured by CU) or there are external net protections active	Feedback failure, deion connected (despite of no requirement to connect)	-	Feedback failure, deion connected (despite of no requirement to connect)	Emergency generator parameters have been exceeded	Motor failure	**Red**

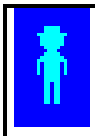
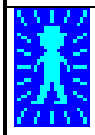
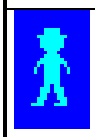
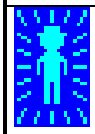
6. In the CU-Display indicated info

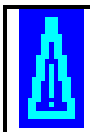


Info in the CU-display can be switched over using cursor-keys or by selecting Menu/Display. The main CU-screens (Generator – Net – Synchronizing towards net – Measuring) are switched over by cursor-keys up-and-down. After that you can open a supplementary screen accordingly to the already selected main one.

Info referring to current date, time, aggregate state as well as actual mode are being indicated constantly, irrespective the above mentioned selection.

The “figure” you can see in the right corner below is indicating the requirement for aggregate “Operation”:

	This figure is showing the state of the FHP shut down, there is even no start demand active (START-key has not been pressed in manual or semi-automatic mode, and there is either no HDO-signal in automatic mode active). If the start of the FHP is blocked, the FHP will not start after the reason for blocking is gone off either.
	Flickering image of the walking figure means the existing requirement for aggregate operation (i.e. the key START has been pressed the reason for blocking is gone off. or HDO-signal in automatic mode active), nevertheless the operation of FHP is blocked. The unit will start as soon as the reason for blocking has gone off. This indication occurs also in automatic-mode, if the FHP is in breakdown state and HDO-signal is persisting (in the event of breakdown in manual or semi-automatic mode the requirement for operating will be broken off). In such a case the FHP start occurs as soon as the breakdown is confirmed (provided no failure or no blocking signal active).
	This figure is showing the fact that the aggregate is in operation and there is also continuing requirement for its operation/=run. (i.e. STOP-key has not been pressed in manual or semi-automatic mode, or HDO-signal in automatic mode is active).
	Flickering image of the still standing figure means that there is aggregate´s shutting down in progress because requirement for its operation has been put to an end (i.e. the key STOP has been pressed in manual or semi-automatic mode, or HDO-signal in automatic mode is not active). The still standing figure stops its flickering after the aggregate has run down. If there is aggregate´s shutting down in progress and the operation continues to be indicated (not flickering image of the walking figure), it means that the FHP´s shutting down is in progress and at the same time requirement for operation continues to be active (e.g. for the reason of a requirement downtrend in “COPY”-mode). This figure can also indicate unit emergency operation in mode “P+E”, i.e. the unit is running for the reason of supply failure and not for the reason of operation requirement.
	There is “no figure” displayed in the virgin emergency operation of the unit “E”. Requirement for aggregate operation arises only in case of power loss and the key START or HDO are without any effect on unit´s operation.

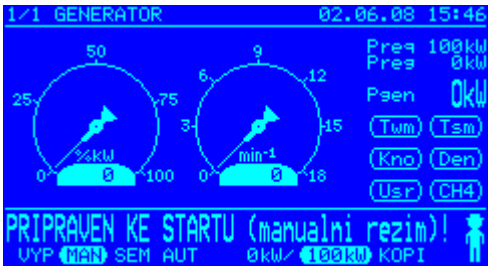
	Flickering warning triangle in the lower right corner just next to the “figure” indicates that the alarm list (warnings and non-confirmed failures) is not blank. Alarm list can be put into display by pressing the key-sequence MENU, 1, 1, 5 or by press and hold the cursor key right.

Communication language on the CU-display can be switched over by using parameter. At present the CU supports Czech, English and Russian language.

6.1Generator

Basic information as well as measuring on generator.

6.1.11/1 GENERATOR



Generator´s main screen involves two “alarm-clocks”. Proportionate power (i.e. percentage expression of current power compared with rated power) and aggregate´s rotation speed.

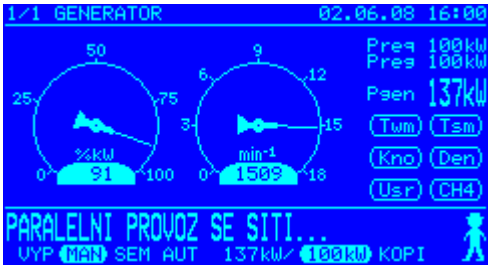
Info on the right are:

- Preq: Required power (consumption)
- Preg: Power level to be regulated on
- Pgen: Current power of the generator in kW
- Twm: Indicator of power restriction from motor high temperature
- Tws: Indicator of power restriction from secondary water high temperature
- Kno: Indicator of power restriction for detection of detonations
- Den: Indicator of power restriction for detection of non-burning
- Usr: Indicator of power restriction based on user´s algorithm
- CH4: Indicator of power restriction from low methane content in fuel

The power required value can be represented either by a fixed value entered through an intern parameter (mode XXXkW) or an extern requirement which is entering into CU through logical analogue input “Power Copy”. The variable “Power Copy” can be mapped e.g. to the variable “WatMns” (in such a case it will follow the power value measured in CU net), to physical current power 20mA, to power of user functions and so on.

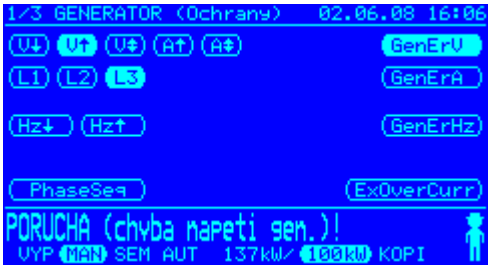
If there is during operation no power restriction active, the Preg value will equal the Preq. In case of power restriction the Preg value defines the value on which the power is reduced.

6.1.21/2 GENERATOR (Measuring)



Information concerning voltage, current, idle and active powers during the individual generator phases, total idle and active power and generator frequency. There are displayed nominal value of net voltage as well as warning and emergency limits for under-voltage (overvoltage) in bar-graph for voltage. There are displayed generator warning and emergency limits for over-current in bar-graph for current.

6.1.31/3 GENERATOR (Protections)



Generator protection. Blinking pilot lamps indicate breaking warning limits, constant lighting means breaking emergency limits.

- V↓: Failure under-voltage (without delay)
- V↑: Failure overvoltage (without delay)
- V↕: Failure of voltage unbalance (without delay)
- A↑: Generator overvoltage (without delay)
- A↕: Failure of generator current unbalance (without delay)
- L1-L3: Indicates the phase in which the breaking has occurred
- Hz↓: Under-frequency (without delay)
- Hz↑: Over-frequency (without delay)
- ExOverCurr: External info concerning generator over-current (external input)

- GenErV: Generator voltage gross error (the sum of partial voltage failures with delay)
- GenErA: Generator current gross error (the sum of partial current failures with delay)
- GenErHz: Generator frequency gross error (the sum of partial frequency failures with delay)
- PhaseSeq: Indication of incorrect sequence of generator phases.

6.1.41/4 GENERATOR (Statistics)

Statistical info on generator operation

- Generated energy: Generated energy counting, based on power-measuring measured by the CU on generator
- Supplied energy: Supplied energy counting, based on power-measuring measured by the CU on net
- Reset number of the CU (counting up to 255)
- Number of generator starts (counting up to 65535)
- Electrometer (Gas-meter): User defined pulse counters. Through charting of log. bin. inputs “ImpMetA(B)” it is possible to count input impulses. Names of the counters, unit as well as value of one impulse can be user-set (“Parameters/test gear”).

Resetting of all kinds of energy as well as counters can be done from the CU-keyboard using option “Menu/Service/Counter Reset”. To enable the selection accessible it is necessary to login the user with the access password L2

6.1.51/5 GENERATOR (Alarms)

Summary of warning as well as non-confirmed emergency states of the generator (unit). Blinking warning triangle in the below right corner (visible on all screens) indicates that the alarm-list is not blank.

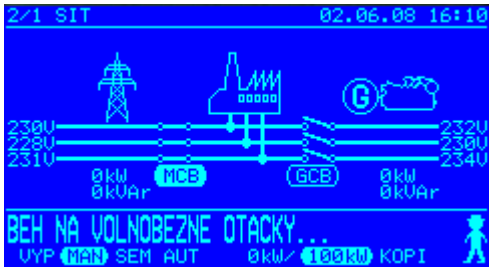
Emergency states (breakdowns) can be deleted from the alarm-list through its confirmation (provided the course is no more taking effect), the warning will disappear from the alarm-list automatically after the reason has gone off.

Alarm-list can be put quickly into indication through pressing and holding the cursor key right.

6.2Net

Basic info on measuring on the net, deion states ...

6.2.12/1 NET



Summary information on net voltage, voltage of the generator, info on active as well as idle powers measured on generator as well as on net..

- MCB: demand for contact making of net contactor (contact maker state indicates the actual state).
- GCB: demand for contact making of generator contactor (contact maker state indicates the actual state).

6.2.22/2 NET (Measuring)

Information stating voltage, currents, real as well as idle powers in the individual net phases, info on summary active as well as idle powers and net frequency. In the bar-graph can be seen nominal voltage value on net and also warning and emergency limits for under- and over-voltage.

6.2.3 2/3 NET (protections)

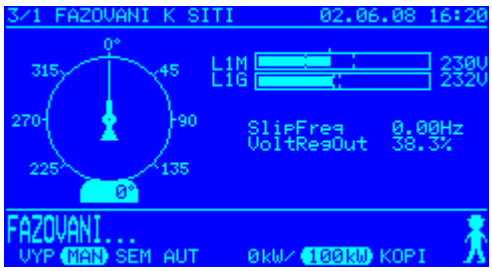
Net protections. Blinking pilot lamps indicate breaking warning limits, constant lighting means breaking emergency limits.

- V↓: Failure net under-voltage (without delay)
- V↑: Failure net overvoltage (without delay)
- V↕: Failure of net voltage unbalance (without delay)
- L1-L3: Indicates the phase in which the breaking has occurred
- Hz↓: Net under-frequency (without delay)
- Hz↑: Net over-frequency (without delay)
- ExErrMns: External info concerning voltage or frequency failure
- VJmp: Indication concerning exceeding of vector jump limit, numerical indication under the pilot light shows vector jump current size (the value is indicated for the period of 5 s after detection of the vector jump maximum).
- MnsErV: Net voltage gross error (the sum of partial voltage failures with delay).
- MnsErHz: Net frequency gross error (the sum of partial frequency failures with delay).
- PhaseSeq: Indication of incorrect phase sequence

We refer to section 16 for more details describing features of the net protection.

6.3Phasing towards the net

6.3.13/1 PHASING TOWARDS THE NET



Info regarding generator phasing towards the net.

"Alarm-clock" on the left shows the phase difference between the net-phase L1 and generator. Bar graphs are indicating value of voltage in net-phase L1 (L1M) and generator phase (L1G). In the voltage bar graph of net there are indicated emergency voltage limits while in the generator voltage bar graph there are indicated generator voltage limits which are required (the middle section corresponds to the net voltage + parameter "RegVgD"

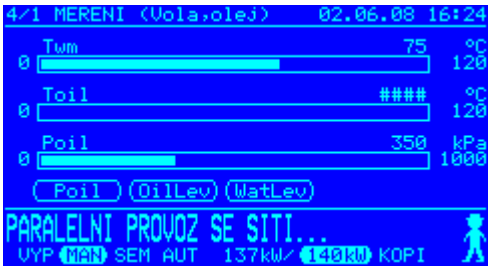
SlipFreq means slip frequency (i.e. difference between generator and net frequency), during the phasing process the slip frequency is regulated to achieve value of 0.1 Hz.

VoltRegOut means action intervention on voltage regulator, in case of pulse control the info UP/DOWN (demand for increase/decrease of generator voltage) is displayed instead of action intervention.

6.4Measuring

Info concerning the measured main analogue as well as binary inputs

6.4.14/1 MEASURING (water, oil)



Analogical inputs concerning primary water and oil:

- Temperature of primary water (Twm)
- Oil temperature (Toil)
- Oil pressure (Poil)
- TlOlej: State of the logical binary input for oil pressure „Oil Press Bin“
- HlOlej: State of the logical binary input for oil level „Oil Level“
- HlVoda: State of the logical binary input for water level „Water Level“.

If there is instead of information concerning the value indicated purely the „####” it means that the relevant value of the logical analogical input has not been mapped in any physical input.

6.4.2 4/2 MEASURING (Sec. water)

Analogical inputs concerning cooling water temperature on the secondary side:

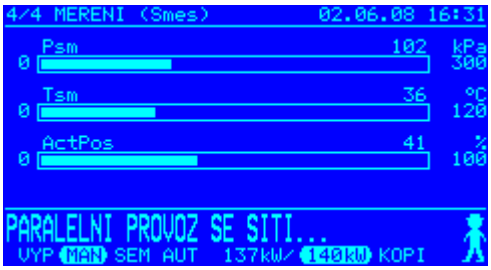
- Secondary water (Tws) measured by CU
- Input water (Twi) measured by CU
- Output water (Two) measured by CU

6.4.3 4/3 MEASURING (Temp. of combustion products):

Analogical inputs concerning temperature measuring of combustion products.

- Section 1 (Tesc1): section 1 temperature
- Section 2 (Tesc1): section 2 temperature
- Outpur (TescOut): outlet temperature

6.4.4 4/4 MEASURING (fuel mixture)



Analogical inputs and actuator position concerning mixture regulation.

- Mixture pressure (Psm)
- Mixture temperature (Tsm)
- Actuator position (ActPos): actuator position of woodward or step motor
- Voltage on Lambda-explorer (Ulambda): Voltage on Lambda-explorer is displayed during the mixture regulation on the Lambda-explorer.

6.4.5 4/5 MEASURING (Bin I/O CU)

States of physical binary inputs and outputs on CU-terminals.

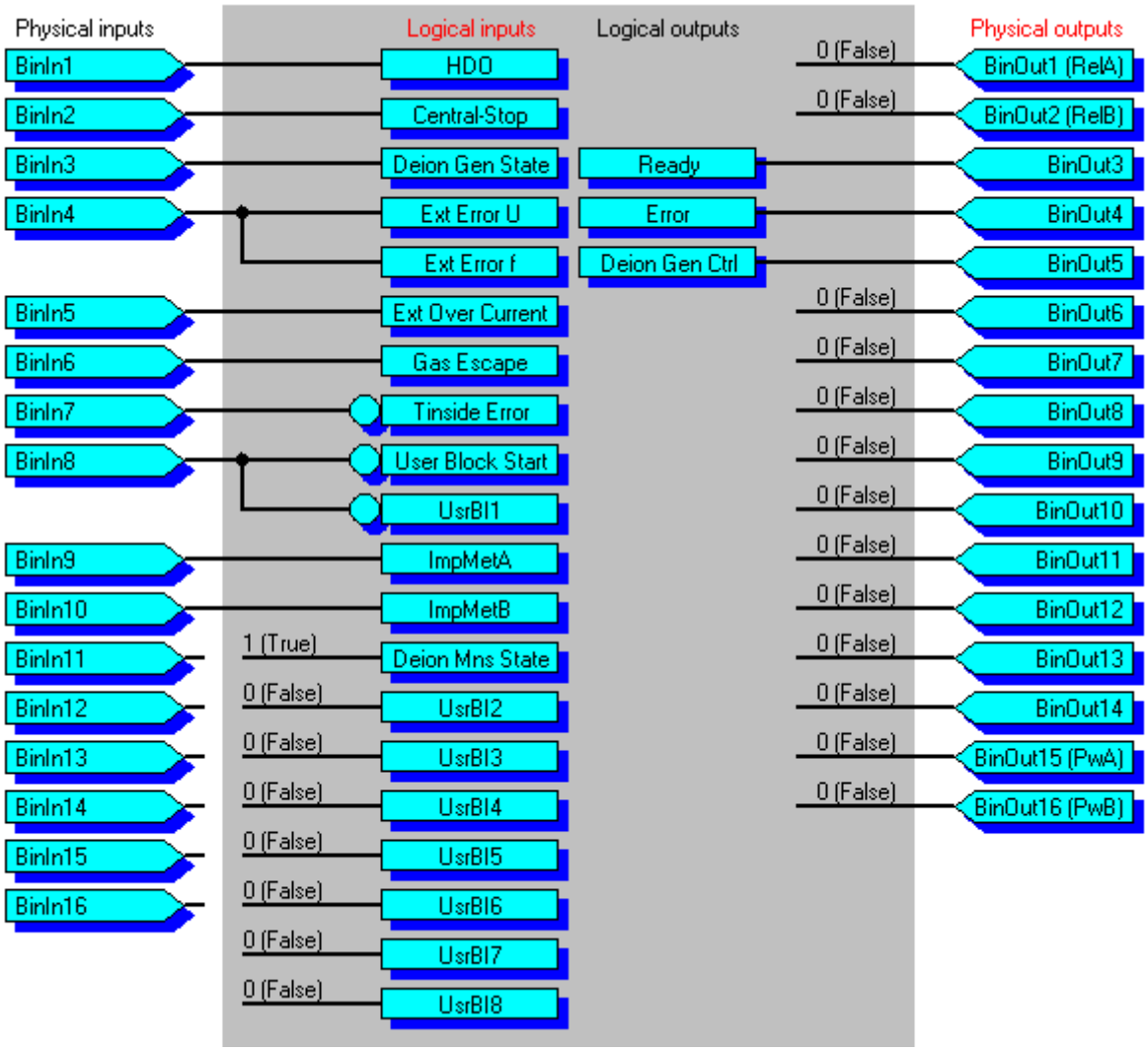
7. Configurations

7.1Mapping

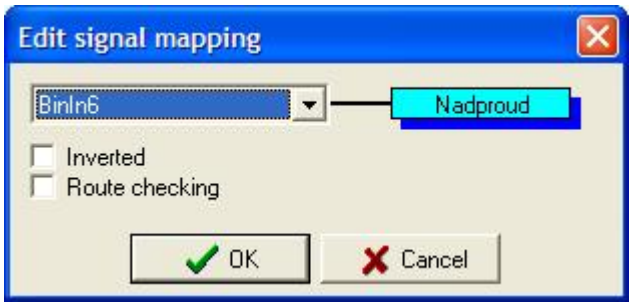
Signification of physical inputs and outputs is configurable. CU algorithm handles logical inputs and outputs. Relation between logical and physical inputs and outputs is defined by means of mapping. Assigning a logical input to a physical input (a physical output to a logical output) will be, from now on, called mapping.

In the lower part of the mapping window, there are buttons enabling the selection, whether logical, analogue or all signals are to be assigned.

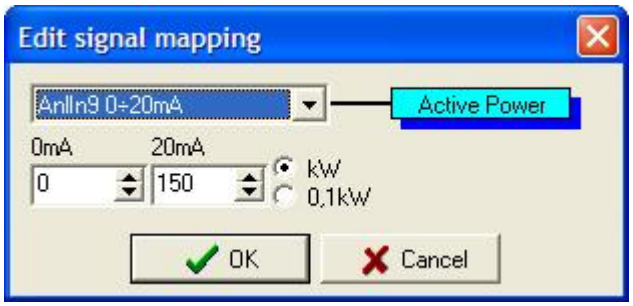
Several logical inputs can be governed by a physical input. It is possible to deactivate constantly logical signals by setting to 0 (False) or to activate them constantly by setting to 1 (True). Analogue inputs can be left unconnected (NC).



. A window with selection will appear when clicking on the logical input name or physical output in mapping-window (I/O Mapp) in service program manager, to connect the signal accordingly.



Signal can be also connected as inverted signal and if the HW available, it is possible to activate a route checking at input



With analogue inputs there can also be defined (in selection window) quantity limits (what a value corresponds to max. and min. value of the physical input).

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7.2Functions

By means of functions we can create from logical inputs and outputs additional signals which can be used for control of CU-algorithm (governing other logical inputs) or for mapping them to turn into physical outputs.

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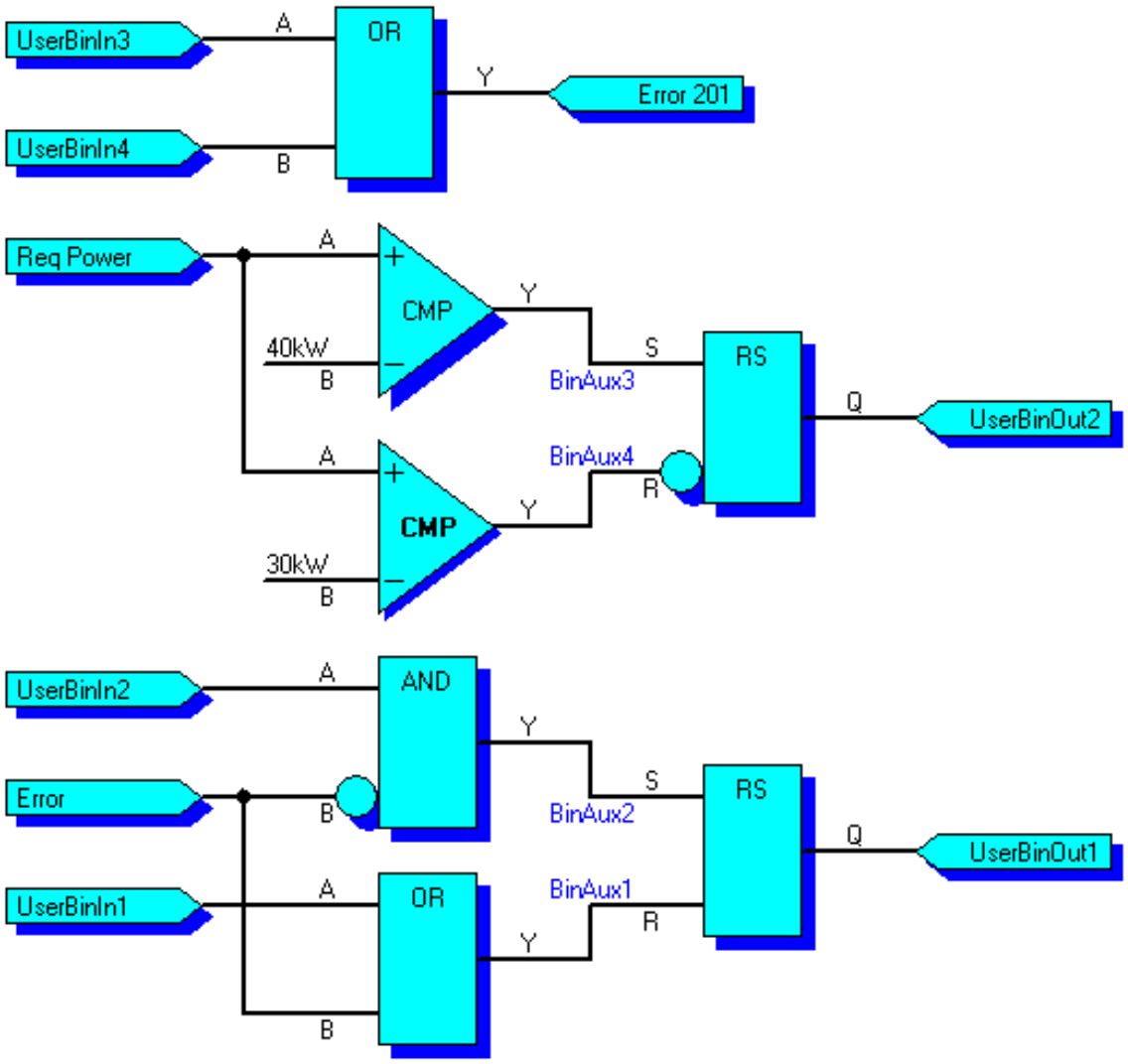


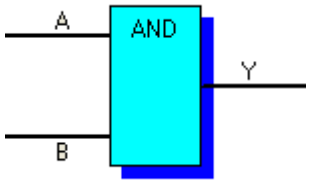
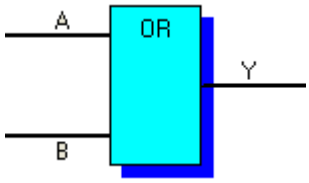
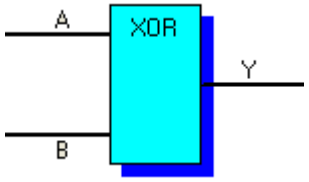
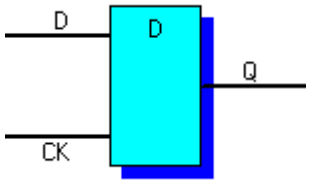
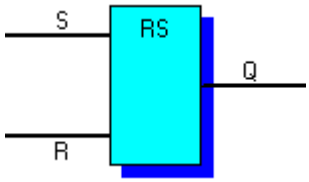
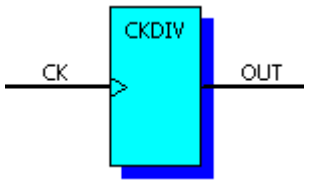
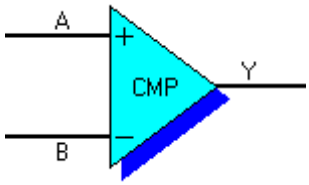
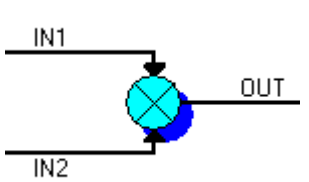
There can be connected all logical inputs and outputs to inputs of function blocks. Onto block outputs there can be connected logical outputs as well as user´s troubles.

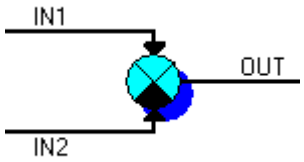
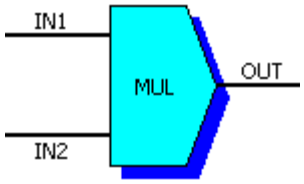
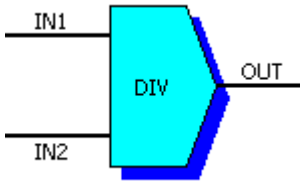
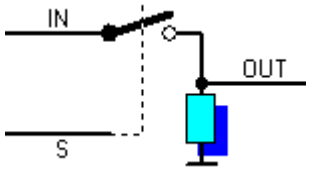
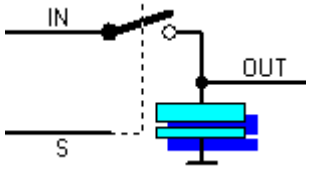
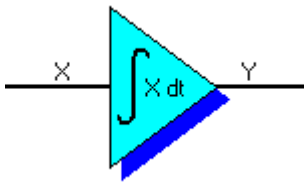
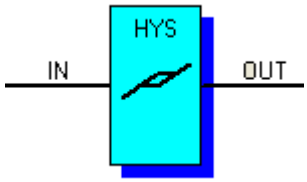
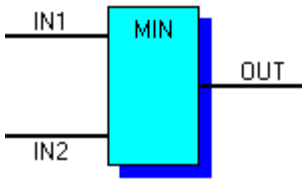
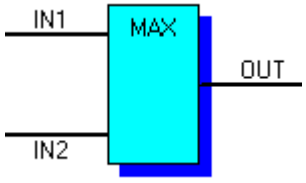
If the output of one function block merely enters into another one (i.e. it is not used for physical output), it is possible (after having connected the block through) to take advantage of subsidiary signals (BinAuxN, AnlAuxN). When using these auxiliary values the respective blocks will be already depicted as engaged.

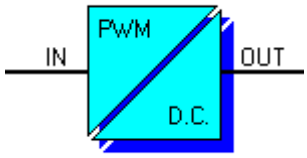
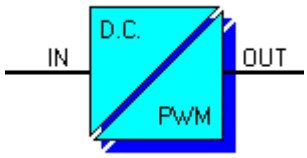
After having changed the structure of functions (addition of a block, alteration of the output or input signal) it is necessary, for securing the proper function, to re-start the CU (it occurs initial start-up the blocks). Should you fail to re-start it, the initial value of e.g. integrators or time-lags as well as the state of CU-flip-flop circuits only a chance.

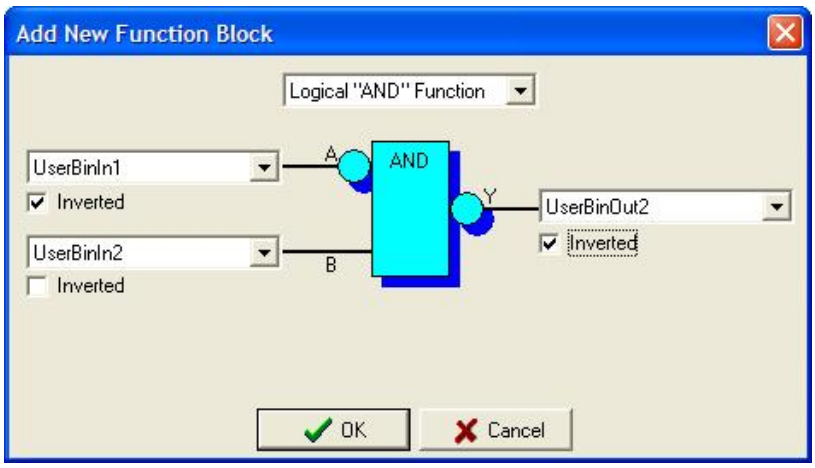
Arithmetic of “analogue” functions is with 16-bits and it counts with one decimal position. The result of analogue operations must not therefore be larger than 3276,7 or less than -3276,8.

7.2.1Review of available function blocks

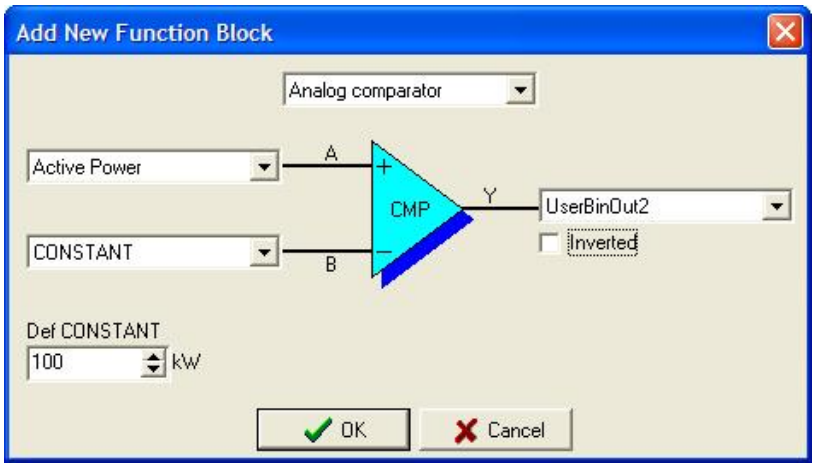
Logical „AND“ function		Logical conjunction of input signals Y = 1 provided A=1 and together B=1 Y = 0 provided A=0 or B=0
Logical „OR“ function		Logical conjunction of input signals Y = 1 provided A=1 or B=1 Y = 0 provided A=0 and together B=0
Logical „XOR“ function		Logical exclusive total of input signals Y = 1 provided A=B Y = 0 provided A<>B
Flip-flop circuit „D“		Flip-flop circuit, of the type D Q = D provided CK=1 Q = Q_{t-1} provided CK=0 In case of CU-reset the state of KO is zero filled
Flip-flop circuit „RS“		Flip-flop circuit, of the type RS Q = 1 provided S=1 Q = 0 provided R=1 Q = Q_{t-1} provided S=0 and R=0 In case of CU-reset the state of KO is zero filled
Signal Delay		Makes the starting edge of logical signal later (by defined time). After CU-reset Y=A; irrespective the delay which is set .
Pulse Divider		Divides the input frequency in a defined ratio. Every N-th positive pulse appears at the output.
Analog Comparator		Analogical comparator Y = 1 provided A>=B Y = 0 provided A<B
Analog Addition		Sum total of analogical signals OUT = IN1 + IN2

Analog Subtraction		Difference of analogical signals OUT = IN1 - IN2
Analog multiplicat.		Multiplying of analogical signals OUT = IN1 * IN2
Analog division		Dividing of analogical signals OUT = IN1 / IN2
Analog Switch		Analogical switch OUT = IN provided S=1 OUT = 0 provided S=0
Analog Memory		Analogical memory (Analogy of flip-flop circuit type “D” in analog-form) OUT = IN provided S=1 OUT = OUT_{t-1} provided S=0 At CU-reset turns output zero filled
Analog Integrator		Analogical integrator; input signal gets time-integrated at function output. At CU-reset turns integrator output zero filled
Hysteresis		Hysteresis OUT = IN+Hys provided OUT>IN+Hys OUT = IN-Hys provided OUT<IN-Hys Where Hys is a selectable size of hysteresis
Minor of two		Minimum from both inputs OUT = IN1 provided IN1<=IN2 OUT = IN2 provided IN1>IN2
Major of two		Maximum from both inputs OUT = IN1 provided IN1>=IN2 OUT = IN2 provided IN1<IN2

PWM to D.C. convertor		It transfers output binary signal to analog value of 0÷100% corresponding to signal class at input. Input signal period has to be minor than 4s, measuring accuracy is to be given in ms.
D.C. to PWM convertor		It transfers input analogical value of 0÷100% to output binary signal having corresponding class. Input binary signal period is 2s.

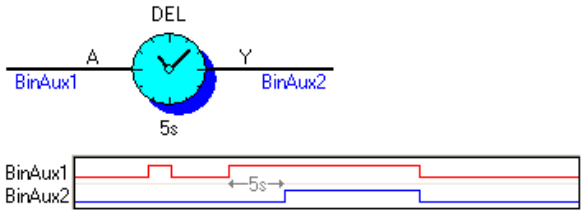
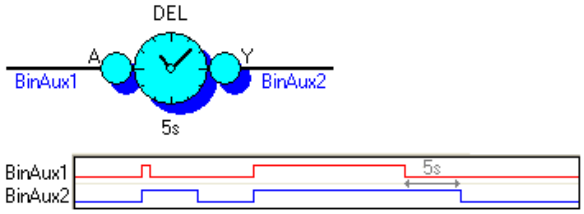
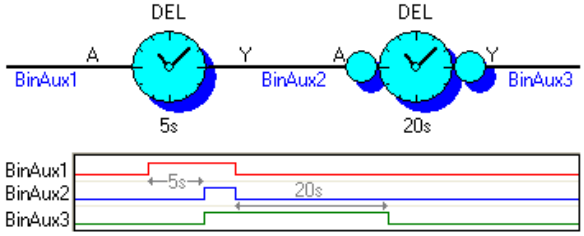
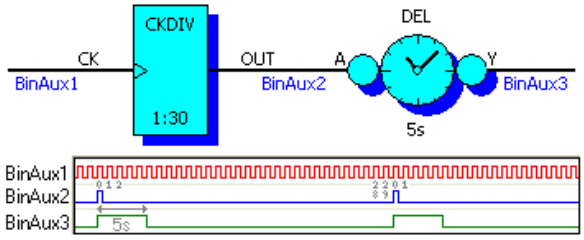


All logical signals (inputs and outputs of the blocks) can be configured as direct or inverted (from ANDu can be therefore easily created NAND and so on).



To one of the analogue block inputs it is possible to connect a signal with constant level (comparison of the analogue value to the constant, constant adding) etc. The constant can be either a direct defined value or one of the parameters.

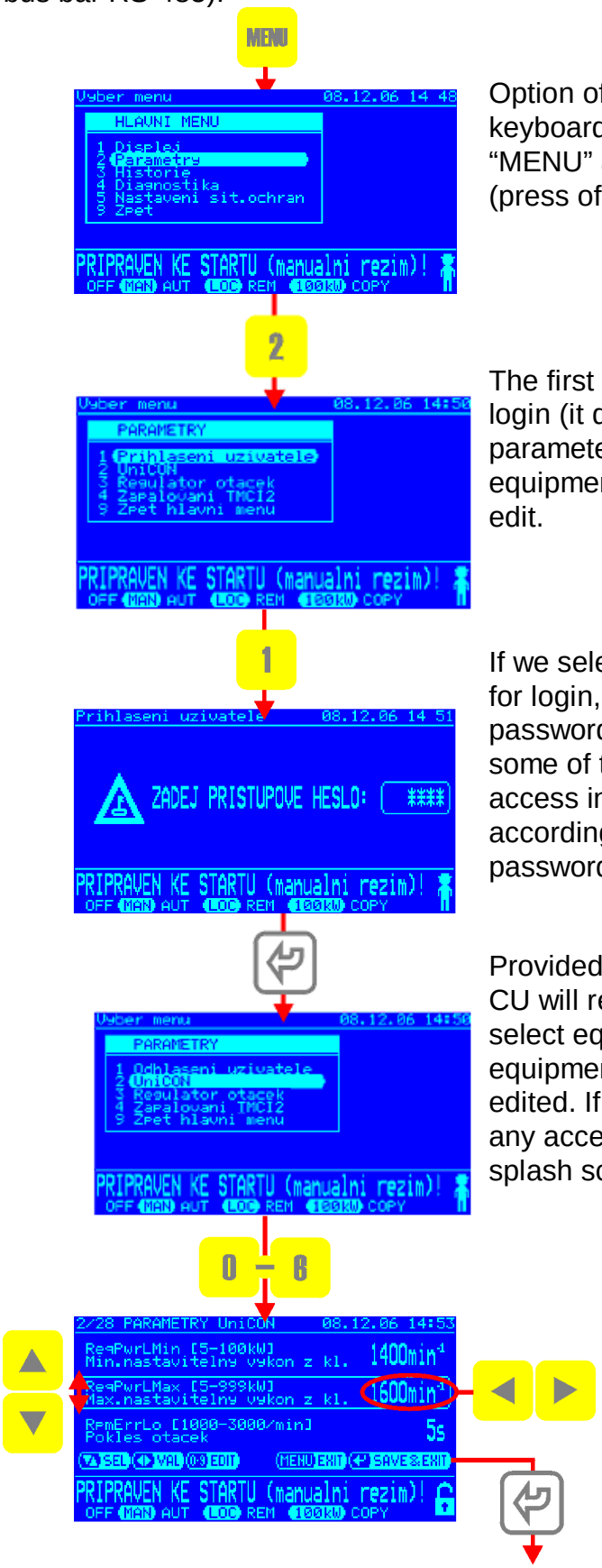
7.2.2Examples showing the use of function blocks

	Delay with direct input (as well as output) holds off the starting edge of the output signal compared to the input one. It can be used to filter out the impulses which are shorter than delay or to defer the input signal response.
	Delay with inverted input as well as output holds off the descending edge of the output signal compared to the input one (monostable circuit). It can be used e.g. to prolong the input signal response.
	By placing of non-inverted and inverted delay can be governed the delay of starting as well as descending edge. It can be thus defined e.g. the delay of certain protection and its persistence after the reason has gone off.
	Place monostable flip-flop circuit in behalf of divider "CLK" signal is possible to generate a periodic signal with an any duty-cycle ratio, or you can deduct a number of events (pulses) to activate other events.

7.3Parameters

All of the CU parameters can be set by means of SW “Manager”. Most of parameters include help in the form of a text or picture.

Exclude switches can be set even directly from the CU-keyboard. CU enables to set parameters not only “of its own” but also those of speed controller SpeedCON or of ignition TMCL2 (provided these equipments are connected to CU through the bus bar RS-485).



Option of parameter editing from the CU-keyboard is activated through the button “MENU” and the item selection “2 Parameters” (press of the button “2”).

The first item of parameter-menu is user´s login (it defines access rights to individual parameters). Further items are used to select equipment, the parameters of which we want to edit.

If we select in “PARAMETER”-menu the item for login, the CU will ask after the access password. Without entering the password only some of the parameters can be reconfigured, access into the other parameters is given according to password-level. The entered password must be confirmed by “ENTER”-key.

Provided the entered password is correct, the CU will return to the “PARAMETER”-menu (to select equipment) and we select an equipment, the parameters of which are to be edited. If the password does not conform to any access level, CU will return back to the splash screen.

After having selected the equipment, parameters can be edited. Travelling up and down by means of keys you may select a parameter, moving to the left and right the selected parameter value can be modified. It is also possible to set the parameter-value directly by entering a number on the CU-numerical keyboard. Parameters are stored with “ENTER”. Using “MENU”-key will finish the parameter editing without parameter up-dating.

The padlock-symbol indicates if for a parameter actually entered access code is really made available. After having finished the parameter editing it is advisable to log off (MENU/Parameters/Log off) in order to avoid changing the parameters by an unauthorised person.
If no parameter or no modification of its value is carried out for a period longer then 25s the return on the main screen will be done without storage of the alterations already made.

8. Internet-bridge

The CU includes an integrated “internet-bridge” (further called as IB) – ethernet outlet for communication through local net or internet. By means of IB it is also possible to carry out connection (through a crossed ethernet-cable) to a computer to which there is no possibility of connection through RS-232. In case of the connection through IB all operation with CU can be carried out in the same way as when connected through RS-232 (including implementation of upgrade firmware). Connecting of PC to CU via IB is of advantage because of possibility of more PCs communication with CU at the same time .

To insure the correct IB-operation it is necessary to carry out its configuration. Configuration can be done directly from the CU-keyboard using web interface or telnet. Following chaps describe the first two mentioned ways of IB-configuration..

8.1Setting of Internet-bridge by means of CU

IB-configuration can be done directly using a simple data terminal implemented into CU. Data terminal for IB-setting can be activated only immediately after having brought the driving voltage to the CU and pressing and holding pressed the keys “2” and “7” (pressing of key-combination is tested ca 1s after projection of splash screen with CU-logo).

After the terminal has started up a message appears on display showing MAC-address and SW IB version (as e.g.).

```
MAC address 00204A8F67F0
Software version V6.1.0.0 (051122) XPTEXE
Press Enter for Setup Mode
```

CU is awaiting in this moment (within about 5s) a confirmation of entry which is to be done by pressing the Enter-key (if no Enter-key-press follows, CU remains blocked, pending switching OFF and ON the driving voltage). After having pressed the Enter key the IB set-listing appears (as e.g.)

```
*** basic parameters
Hardware: Ethernet TPI
IP addr 192.168.1.195, no gateway set,
netmask 255.255.255.0

*** Security
SNMP is              enabled
SNMP Community Name: public
Telnet Setup is      enabled
TFTP Download is     enabled
Port 77FEh is        enabled
Web Server is        enabled
Web Setup is         enabled
ECHO is              disabled
Enhanced Password is disabled
Port 77F0h is        enabled

*** Channel 1
Baudrate 57600, I/F Mode 4C, Flow 00
Port 10195
Connect Mode : CC
Datagram Type 01
Pack Cntrl:   20
Remote IP Adr: 192.168.2.255, Port 10195

*** Expert
TCP Keepalive    : 45s
ARP cache timeout: 600s
High CPU performance: disabled
Monitor Mode @ bootup : enabled
HTTP Port Number : 80
SMTP Port Number :
MTU Size: 1400
Alternate MAC: disabled
Ethernet connection type: auto-negotiate

*** E-mail
Mail server: 0.0.0.0
Unit       :
Domain     :
Recipient 1:
Recipient 2:
```

```
- Trigger 1
Serial trigger input: disabled
  Channel: 1
  Match: 00,00
Trigger input1: X
Trigger input2: X
Trigger input3: X
Message :
Priority: L
Min. notification interval: 1 s
Re-notification interval  : 0 s

- Trigger 2
Serial trigger input: disabled
  Channel: 1
  Match: 00,00
Trigger input1: X
Trigger input2: X
Trigger input3: X
Message :
Priority: L
Min. notification interval: 1 s
Re-notification interval  : 0 s

- Trigger 3
Serial trigger input: disabled
  Channel: 1
  Match: 00,00
Trigger input1: X
Trigger input2: X
Trigger input3: X
Message :
Priority: L
Min. notification interval: 1 s
Re-notification interval  : 0 s


Change Setup:
  0 Server
  1 Channel 1
  3 E-mail
  5 Expert
  6 Security
  7 Defaults
  8 Exit without save
  9 Save and exit           Your choice ?
```

The last 16 lines will remain on display (using cursor-keys up-and-down you can browse through the listing). Alterations in setting can be done by using the menu at the end of listing (pressing 0 – 9 and Enter). The key-press for menu-selection will return the listing on actual screen (provided it was shifted before then).

0 Server	**IP Address**	IP CU-adress
	Gateway IP addr	Gateway IP address (it is necessary to enter for e-mail sending only; as far as communication with manager is concerned this address is not necessary)
	Netmask	Subnetwork mask, default setting 8 conforms to the mask 255.255.255.0 ((mask bit number is to be entered))
	Telnet config password	Password for IB configuration through telnet
1 Channel 1	**Baudrate**	To communicate with CU the speed must be set on the value 57600
	I/F Mode	4C
	Flow	00-without data flow control (it is enough for communication with one PC) 02-hardware controlled data flow control (necessary to set for comm. with more than one PC)
	Port No	Port-No. is to be set in Manager for comm. with CU. Default setting is 10195
	ConnectMode	CC
	Datagram Type	01
	Remote IP Address	IP address of PC, setting on 0.0.0.0. enables access from any PC (more in “Setting connection through web-interface).
	Remote Port	Port-No of response, must be set pursuant to “Port No”
	Pack Cntrl	20
	SendChar 1	00
	SendChar 1	00
3 E-mail	Mail server	IP address of the mail server
	Unit name	
	Domain name	
	Recepient 1	e-mail address of receiver 1
	Recepient 2	e-mail address of receiver 2
	Trigger 1÷3	It is used to set activation for sending the mails; CU uses starting by

	Serial trigger Trigger input 1÷3 Message Priority Min.notofication interval Re-notification interval	means of signals CP0 and CP1
5 Expert	TCP Keepalive time ARP Cache timeout Enable High Performance Disable Monitor Mode & bootup HTTP Port Number SMTP Port Number MTU Size Enable alternative MAC Ethernet connection type	
6 Security	Disable SNMP SNMP Community Name Disable Telnet Setup Disable TFTP Firmware Update Disable Port 77FE Disable Web Server Disable Web Setup Disable ECHO ports Enable Enhanced Password Disable Port 77F0	To be able to configure IB by means of web interface it must be entered “N” (see the following section).
7 Defaults		
8 Exit without save		
9 Save and exit		

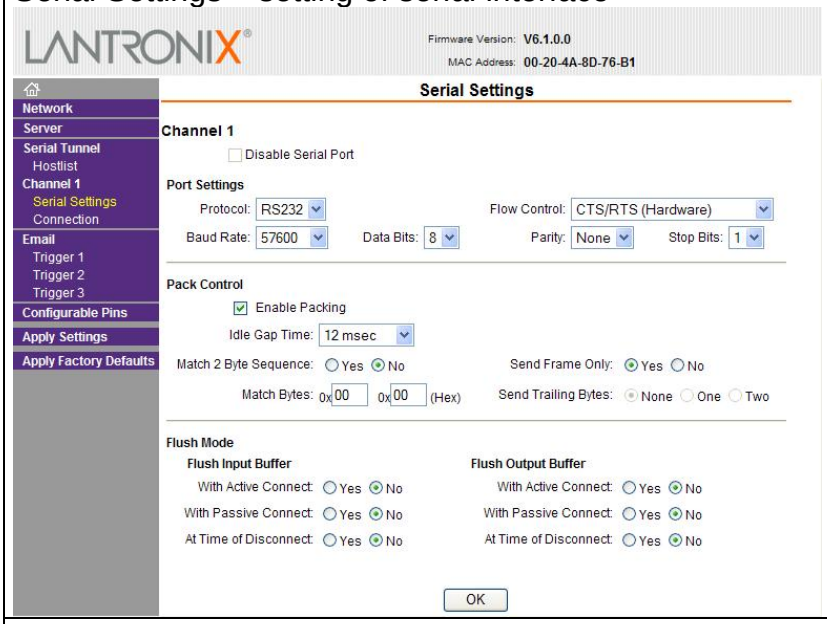
Towards to the CU-key board it is possible to alter numerical parameters only. Pressing of the left key stands for pressure of “N”, the right key stands for “Y”. Internal terminal serves first of all for ascertaining (the setting) of IP address (port) which must be set in Manager in order to enable connection to CU through IB or to carry out the IB-configurating more comfortable via the web-interface. For CU-communication with Manager it is moreover necessary to set the communication speed correctly.

After having finished the IB configuration (press 8 or 9) it is necessary to restart the CU which is to be done by supply potential switch OFF and ON.

8.2Setting of Internet-bridge through the medium of Web-interface

Configuration via web-interface can be carried out by means of Internet Explorer (entering IP address IB) or by using the Manager (menu “Servis/XPort settings”, whereas the correct IP address has to be entered in the window “Connection/Open Connection /connect through: Ethernet UDP”). In either of these cases the configuration window will be started up.

Serial Settings – setting of serial interface

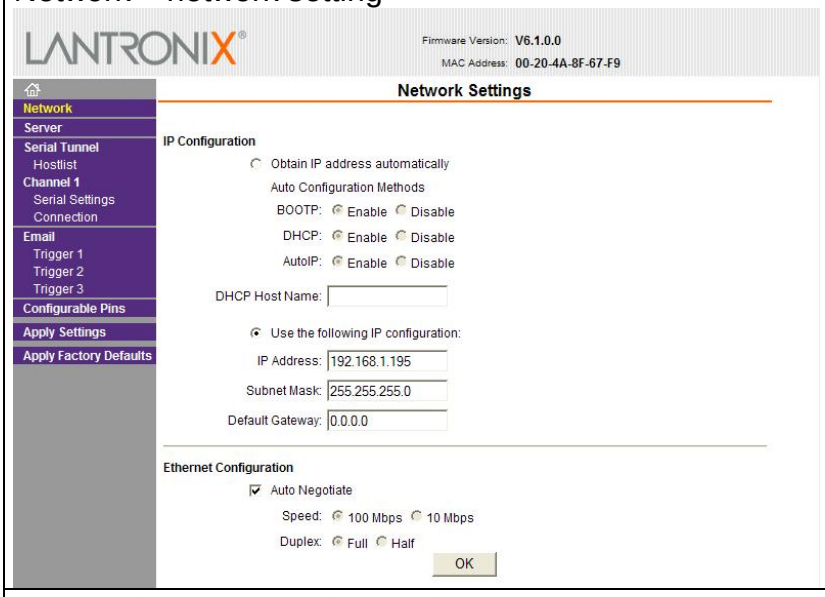


Configuration speed has to be set on 57600bit/s, 8 data bits + 1 stop bit, without parity. Should more than one computer approach the CU, the hardware Data Flow Control must be ON at the same time

Configurable pins – setting of configurable pins

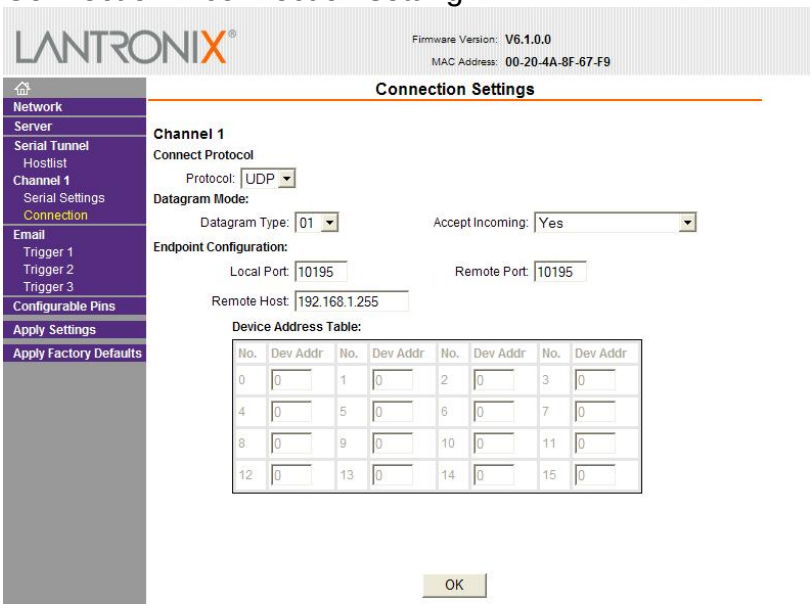
All pins have to be configured as inputs.
If the hardware Data Flow Control (see above) is ON, the pin CP2 must be set on “Flow Control In (RTS)”. Signal CTS is not used.
Pins CP0 and CP1 can be operated by CU-functions. Through activating of these functions it is possible e.g. to activate sending of an e-mail from the IB

Network – network setting



Setting of IP-address and Sub-net mask. To get successful connection the IP-address is after that to enter into manager. IP default setting is 192.168.1.195,
default setting of the Sub-net mask is 255.255.255.0,
provided e-mail sending is used too, it is necessary to set also the Default Gateway.

Connection – connection setting



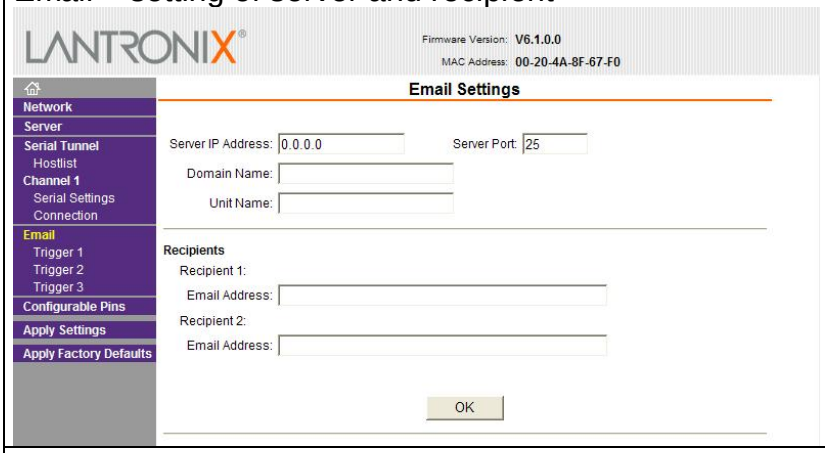
CU makes use of UDP (Datagram type 01).
Here it is necessary to set up the port (Local as well as Remote accordingly), this port has to be entered in manager to obtain a successful connexion. Default setting is 10195. Through the setting of Remote Host can be affected communication – it is possible to set the specific IP
of the computer coupled on. In such a case there is possible no connection of another computer with CU. Is the lower part of the address set into “1” (in compliance with subnet mask e.g. 192.168.1.**255**), the response from CU is floating by “broadcast” into the entire subnet and any subnet computer can communicate with CU (even at the same time). In case the Remote Host is set to 0.0.0.0 any PC can get connection to CU, nevertheless the CU can not communicate with more than one PC at the same time.

Moreover alterations made in each of the windows and confirmed with “OK”-key have to be stored in IB using the selection “Apply Settings”!

8.3Setting of e-mails sending

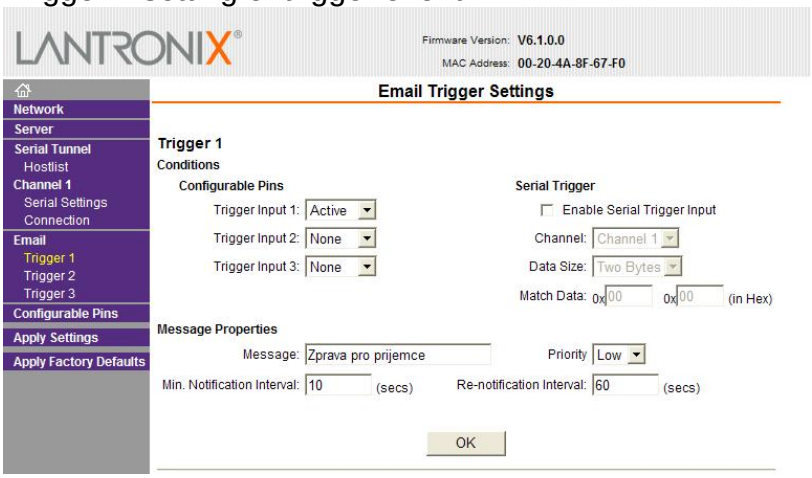
Using the integrated Internet-bridge you may send off e-Mails depending upon various events defined by user. When configuring it is necessary the due setting of IB as well as due definition of the management of signals XPort CPO and CP1 in CU functions.

Email – setting of server and recipient



Hereto data concerning the server are to be set (IP address of server, server port no. and domain name) as well as e-mail addresses of the recipients. Unit Name means user´s name to be used by Internet-bridge for sending off the e-mail

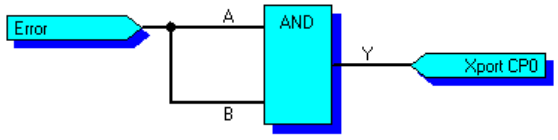
Trigger – setting of trigger event



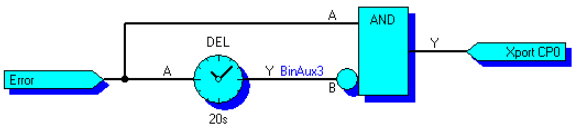
By means of Triggers 1-3 is defined what signal combination is needed to send off the e-mail; accordingly three various signals can be sent off. Trigger input 1 corresponds to XPort CP0-signal, Trigger input 2 corresponds to CP1-signal, Trigger input 3 (signal CP2) can not be used for sending of e-mails (it is used for governing of data-flow). Signals XPort CP0 and CP1 can be governed by functions in CU which enables to define the reason for sending off the message.
"Min .Notification Interval" is a minimal period between two activatings of e-mail sends-off, should starting event occur in a shorter interval consecutively, it will be disregarded. "Re-notification interval" defines an interval for sending-off the e-mails provided the starting event continues to be active

Alterations made in each of the windows and confirmed with "OK"-key have moreover to be stored in IB using the selection "Apply Settings"!

Using the functions in CU and using the management of signals XPort CPO and CP1 it is necessary to define the starting event for sending the E-mail off:



Is the IB set the same way as in the above mentioned table, the e-mail will be sent off every 60s until the failure is confirmed.



Is this setting of functions actual the e-mail concerning the failure will not be sent off periodically but only once on genesis of failure.

Signals XPort CPO and CP1 can naturally be governed by any logical signal (not only by that of failure) enabling so sending of e-mails by any event

9. Modem connection

9.1Modem setting

A modem can be linked to CU. In order to insure proper operation of this modem it is necessary to configure it prior to connection to CU:

- A fix communication speed of 57600 bit/s
- 8 data-bits without parity
- One Stop-bit
- Hardware data flow control must be in off position (modem is connected with 3 conductors only)
- Automatic modem response

AT-commands using for modem configuring may differ depending on the modem type. The following table shows listing of possible AT-commands which must be used for configuring. For harmonizing the modem processing as well as SMS-sending has been used modem Maestro 100 (this one we advise for CU-connecting).

AT+IPR=57600	Setting of modem communication speed. It is necessary to connect modem at first at the level of its starting communication speed and to enter this AT command (after that modem ceases to respond to AT commands, it is necessary the connection on new level of communication speed).
AT&S0	Control of signals DSR, DTR and DCD
AT&D0	
AT&C0	
AT+IFC=0,0	Disconnecting of data flow control (modem Maestro 20,100)
AT\Q0	Disconnecting of data flow control (modem TC 35)
AT+CMGF=1	It activates text format of SMS-messages (it is necessary to set when the CU is governed by means of SMS-messages)
AT+CBST=7,0,1 AT+CBST=70,0,1 AT+CBST=7,0,0 AT+CBST=70,0,0	In case there are problems with linking it is possible to try to set fixed (=non-adjustable) the mode of transfer using some of these commands
ATS0=1	It defines after how many ringing the modem should accept connection. An automatic response must be set (so nonzero number)
AT+CRC=0	It disconnects report back-sending from modem (modem Maestro 100)
AT+CR=0	
AT&W	Storing of configuring into modem-memory (it must necessary follow, failing this, modem will come back to original parameters after power failure)

9.2Modem diagnostics using CU

Using menu -Modem diagnostics- (pressing Menu-4-1) the modem-state display will appear in CU. On the display is shown modem on line state and using selected keys it is possible to check the proper modem connection, signal strength (GSM-modem) etc. CU will send AT-command only in the event of “ComEn”=1 and “Busy”=0. Indicator “ComEn” detects if the RS-232 line is free (no other apparatus is communicating with CU over RS-232 or over IB), “Busy” indicator is activated on sending off the AT-command and deactivated after having received the modem-response.

The text in the right upper corner informs on SMS sending state in case of a failure (ready for sending, SMS inactive, time remaining to send off in the event of failure).

Kl.	AT command	Description	
0	-	Will display help concerning modem-diagnostics	
1	ATI	Command to verify the duly modem setting. If the modem is set properly the name of modem has to be displayed.	
2	AT+CSQ	Modem will give back strength to the signal. Is used for checking sufficient strength of the GSM-modem signal. To enjoy reliable connection the modem has to give back the value of 18 at least (the first of figure pairs in response). At the value of 15 their follows already modem-logout. In the figure can be seen an example of a weak signal.	
3	AT&V	Modem will restore its setting. With some parameters there can be checked correctness of their setting (when comparing with the above mentioned table).	
9	-	It will interrupt the counting down of the time remaining up to SMS-send off (SMS concerning the last failure will not be sent off).	

9.3SMS-sending during the failure event

Provided there is a GSM-modem connected to CU it is possible to set SMS-sending if the unit is in breakdown. This setting is carried out in the menu “Servis/SMS messaging setup” (the user entered must have granted access to configuration).

SMS can be sent to two various numbers (eventually two times to one number only with various time delays if no failure confirmation occurs). After *“Delay1”* expiration (counted since the moment of the failure origin) the SMS will be sent to the *“Recepient#1 number”* (provided the number is ticked and the failure has not been confirmed since). After *“Delay1”* + “Delay 2” expiration (counted since the moment of the failure origin) the SMS-sending to the number *“Recepient#2 number”* will take place (provided the number is ticked and the failure has not been confirmed since)

It is also possible to allow, within the scope of setting of SMS-sending, the possibility, that the CU is governed by SMS-sending *“Enable device control via SMS commands”* see the following section.

Pattern of the sent SMS is (e.g.):

UniGEN Message (#UC000001/56 V 1.16), Instalace Jince, PORUCHA (central stop)!, P= 0kW

UniGEN Message is a constant chain; it follows CU-serial No, SW-version, designation of the station (wording entered in “SMS massaging setup”) and lastly description of the failure.

SMS is sent off only then, when there is no communication running with CU via internet-bridge or via RS-232..

9.4CU-control by means of SMS-messages

If there is allowed to govern the CU by means of SMS-messages, the CU will respond to following commands:

Command	Meaning
START	3s after receipt the SMS will activate start (keystroke START)
STOP	Immediately on receipt SMS will activate stop (keystroke STOP)
ACK	Immediately on receipt SMS will deactivate failure (keystroke FAULT RESET)
MODE=OFF MODE=MAN MODE=SEM MODE=AUT	Setting of the relevant CU-mode
MSG	Demand for back-SMS concerning CU-state. 10s after receipt the SMS will be sent back to CU to the no. of SMS-applicant together with the info on the state of the aggregate as well as the main measured values.

Individual commands can be merged into one SMS, it is therefore possible to send SMS in the following forms: ACK, MODE=SEM, START, MSG

After having received this SMS the CU will confirm possible failure (if any), CU will set CU-semi-automatic mode, it will start CU and it will send back confirming information on the aggregate state (on starting in progress).

10.RS-485

CU involves two pieces of interfaces RS-485. One of them (UnimaBUS) is used to interconnect the UNIMA-KS components (CU, speed regulator SpeedCON, ignition TMC12 etc.). In the other interface RS-485 is implemented protocol ModBUS for data reading from CU by a protocol on regular basis.

10.1ModBUS

Parameters RS-485 for ModBUS:

- Speed of communication 9600bit/s
- 8 data bits without parity
- One Stop-bit

CU supports function 4 of the ModBUS (“Read Input Registers”). Addresses of registers are defined in the following table:

Register address	Register contents	Size
0x00	*Not used*	
0x01	Real power supplied into net (reg. total 0A+0B+0C)	0.1kW
0x02	Idle power supplied into net (reg. total 0D+0E+0F)	0.1kVAr
0x03	Net frequency	0.01Hz
0x04	Rms-voltage of net-phase A	0.1V
0x05	Rms-voltage of net-phase B	0.1V
0x06	Rms-voltage of net-phase C	0.1V
0x07	Rms-current of net-phase A	0.1A
0x08	Rms-current of net-phase B	0.1A
0x09	Rms-current of net-phase C	0.1A
0x0A	Real power of net-phase A	0.1kW
0x0B	Real power of net-phase B	0.1kW
0x0C	Real power of net-phase C	0.1kW
0x0D	Idle power of net-phase A	0.1kVAr
0x0E	Idle power of net-phase B	0.1kVAr
0x0F	Idle power of net-phase C	0.1kVAr
0x10	*Not used*	
0x11	Real power of generator (reg. total 1A+1B+1C)	0.1kW
0x12	Idle power of generator (reg. total 1D+1E+1F)	0.1kVAr
0x13	Net frequency	0.01Hz
0x14	Rms-voltage of generator-phase A	0.1V
0x15	Rms-voltage of generator -phase B	0.1V
0x16	Rms-voltage of generator -phase C	0.1V
0x17	Rms-current of generator -phase A	0.1A
0x18	Rms-current of generator -phase B	0.1A
0x19	Rms-current of generator -phase C	0.1A
0x1A	Real power of generator -phase A	0.1kW
0x1B	Real power of generator -phase B	0.1kW
0x1C	Real power of generator -phase C	0.1kW
0x1D	Idle power of generator -phase A	0.1kVAr
0x1E	Idle power of generator -phase B	0.1kVAr
0x1F	Idle power of generator -phase C	0.1kVAr

0x20	Temperature of primary water in inlet	0.1°C
0x21	Temperature of primary water in outlet	0.1°C
0x22	Temperature of secondary water in inlet	0.1°C
0x23	Temperature of secondary water in outlet	0.1°C
0x24	Mixture temperature	0.1°C
0x25	Mixture pressure	0.1kPa
0x26	Methane quantities	0.1%
0x27	Exhaust temperature	0.1°C
0x28	Temperature of section 1	0.1°C
0x29	Temperature of section 2	0.1°C
0x2A	Oil temperature	0.1°C
0x2B	Oil pressure	0.1kPa
0x2C	Voltage on Lambda-explorer	0.1mV
0x2D	Supply voltage (battery voltage)	0.01V
0x2E	*Not used*	
0x2F	*Not used*	
0x30	*Not used*	
0x31	*Not used*	
0x32	*Not used*	
0x33	*Not used*	
0x34	*Not used*	
0x35	*Not used*	
0x36	*Not used*	
0x37	*Not used*	
0x38	*Not used*	
0x39	*Not used*	
0x3A	*Not used*	
0x3B	*Not used*	
0x3C	*Not used*	
0x3D	*Not used*	
0x3E	*Not used*	
0x3F	*Not used*	
0x40	Produced active energy (positive), high word (gen.)	6553.6kWh
0x41	Produced active energy (positive), low word (gen.)	0.1kWh
0x42	*Not used*	
0x43	*Not used*	
0x44	*Not used*	
0x45	*Not used*	
0x46	*Not used*	
0x47	*Not used*	
0x48	Supplied active energy (positive), high word (gen.)	6553.6kWh
0x49	Supplied active energy (positive), low word (gen.)	0.1kWh
0x4A	*Not used*	
0x4B	*Not used*	
0x4C	*Not used*	
0x4D	*Not used*	
0x4E	*Not used*	
0x4F	*Not used*	
0x50	Pulse counter A, high word	MetAStep*65536
0x51	Pulse counter A, low word	MetAStep
0x52	Pulse counter B, high word	MetBStep*65536
0x53	Pulse counter B, low word	MetBStep

0x54	*Not used*	
0x55	*Not used*	
0x56	*Not used*	
0x57	*Not used*	

10.1.1Reading of input registers (Function 4)

Function 4 – enquiry

Address	1 Byt	0x00 ÷ 0x0F (MBSaddr)
Function code	1 Byt	0x04
Address of the1th register	2 Byty	0x0000 ÷ 0x00NN
Number of registers for reading (N)	2 Byty	0x0001 ÷ 0x00NN
Control sum	2 Byty	CRC16

Function 4 – response

Address	1 Byt	0x00 ÷ 0x0F (MBSaddr)
Function code	1 Byt	0x04
Number of data bits	1 Byt	2*N
Values of red registers *)	2*N Bytů	
Control sum	2 Byty	CRC16

*) Register qualities are 2-bytes values, higher byte goes first

Function 4 - Example (Address CU=1)

Reading enquiry from the address 4 to read 2 registers (real and idle generator power)

01	04	00	11	00	02	21	CE

Response
P = 0x05F5 = 1525 = 152,5kW
Q = 0xFF22 = -222 = -22,2kVAhr

01	04	04	05	F5	FF	22	2A	93

Should the CU return content of the register 0x7XXX when reading, it means that the relevant value is not measured (not assigned to any physical input when mapping, but to “NC”).

11. Binary inputs

11.1Physical binary inputs

Physical binary inputs BinIn1-BinIn16 are reflecting the state of short circuiting (disconnection) of the CU input terminals SBI.1- SBI.16. Short circuiting of the terminal enables activating of the relevant physical input

11.2 Logical binary inputs

Logical binary inputs represent binary values exercising an influence on CU-algorithm. Using mapping it is possible to define the way of the governing of these binary values (through physical input, by another binary value or they can be eventually constantly set on active or inactive level).

The under-mentioned examples of configuring logical binary inputs are showing possible input connections using mapping and generating the signals in demand by means of functions

11.2.1UsrBI1÷UsrBI8

These user inputs are exercising no influence on CU-algorithm and they can be used as inputs into user functions. Outputs of functions (UsrBO1-UseBO8) can be then used for governing of further CU-logical inputs (physical outputs) by means of mapping.

Designations of these user signals can be edited

11.2.2HDO

Input for external governing/=control in the automatic mode

11.2.3Deion Mns State

State of the net deion (contactor).

11.2.4Deion Gen State

State of the generator deion (contactor).

11.2.5User Block Start

Starting interlock of CU through user signal. If the signal is active the CU-Start is blocked. (“Ready” signal is inactive).

11.2.6Gas Escape

Inputs activating causes an immediate shutting off the gas-valve, thus consequently an immediate failure shut-down of the CU.

11.2.7Oil Press Bin

Input activating causes, together with the parameter defined by delay, an immediate motor shut down. Input state is tested only when motor protections are active (after expiration the time defined that is counted since there was an exceeding the minimal speed of the starter).

11.2.8Oil Level

Input activating causes, having a delay of 2s, an immediate motor shut down.

11.2.9Water level

Input activating causes, having a delay of 2s, an immediate motor shut down.

11.2.10 PID A/B

Option of the PID parameter set. Information is merely re-sent to the speed regulator SpeedCON

11.2.11Fuel A/B

Option of fuel type. Information becomes re-sent to the speed regulator SpeedCON (various extreme positions of actuator according to fuel). In case of fuel B the CU-algorithm takes into account the quantity of methane (correction of mixture position, power limiting when small amount of methane and so on…).

11.2.12Choked Filter

Signal activating causes a slow emergence failure shut-down for the reason of filter clogging.

11.2.13Ext Error Mns

Activating of this external input causes (similar as the acceding of emergency voltage detected inside CU) the immediate CU-shut-down for the reason of net failure

11.2.14Central-Stop

Causes an immediate CU-shut-down including pump-off.

11.2.15Fuel Press

Signal activating causes an immediate emergence failure shut-down for the reason of fuel pressure drop

11.2.16ImpMetA(B)

CU includes 2 configurable pulse-counter. Using the possibility of parameter setting you can define the worth corresponding with one impulse as well as the unit of the measured magnitude. Counter registration can be shown in the CU-display (Generator/Statistics) which enables e.g. monitoring generated power measured by external energy meter, gas consumption etc.

Using the function “Edit name” you can assign name to the counter which, for the reason of transparency, will be displayed.

12.Binary outputs

12.1 Physical binary outputs

Physical Binary Outputs BinOut1 or if you like BinOut2 are governing relay contacts on CU terminals SRE.1, SRE.2 or if you like SRE.3, SRE.4.
Physical Binary Outputs BinOut3 - BinOut16 are governing switching output transistors
on CU terminals ŘS SBO.1 – SBO.14. Output activation engages the appropriate output transistor.

Binary Outputs BinOut15 or if you like BinOut16 can be used for generating of PWM-signals, PwmA or if you like PwmB (more in section 14.1.2 PwmA (PwmB), page 57). Thanks to this alternative functions these outputs have their response time by 0 – 40 ms longer. It is therefore recommended to use them for mapping of signals with high requirements on speedy actions (as e.g. output of net protections etc., control over generator or net deion etc.).

12.2Logical binary outputs

Logical binary outputs are binary magnitudes generated by CU-algorithm. Using mapping you can define in what way these magnitudes will control physical outputs (which logical output governs which physical output.

12.2.1UsrBO1 ÷ UsrBO8

These user inputs are not generated directly by CU-algorithm but they come into being as outputs of user functions which can be subsequently used for control over further logical CU-inputs or physical outputs by means of mapping.

The names of these user signals can be edited.

12.2.2Ready

This signal indicates that CU is ready-to-operate (provided no failure or blocking message is active)

12.2.3Error

This signal indicates a non-confirmed CU-failure

12.2.4ModeOff

This signal indicates that CU is shutdown – OFF mode. This signal enables e.g. control over energizing of some sub-circuits which can be therefore disconnected in OFF-mode.

12.2.5Start/Stop

Information demanding for unit running (HDO-state in automatic mode, pressing START/STOP in manual or semi-automatic mode).

12.2.6 Idle/Rated

Control over the idle (nominal) rpm of the unit. After having started the unit the signal is active (demand for nominal rpm), after expiring of a defined time interval the signal turns inactive (demand for nominal rpm).

12.2.7Starter

Control over starter operation

12.2.8 Ignition

It activates ignition

12.2.9Solenoid

Activates gas valves

12.2.10Pump

Actuates pump operation

12.2.11Mot.Prot.Enable

Info on the fact that motor protections are active (oil pressure…..). The signal turns activated through defined time which elapsed after the motor start

12.2.12Emergency

The output is controlled only with units having emergency mode of the collaboration with the net (units “E” and “P+E”) and moreover in the “AUT”-mode. In the other modes the output continues to be constantly inactive.
The output gets activated either immediately after the CU has detected emergency net parameters or the signal of external net protection has been activated.
The output gets inactivated if the net parameters have been persisting within the tolerance longer time than the time defined in parameter “EmChkDel” (and no external net protections are taking effect during this time either).
The necessary condition for breaking up the emergency signal is also the connected net deion (the net is renewed and the load is energized from the net as well).
At the moment of activating the emergency signal there occurs an immediate disconnecting of the net deion.

Emergency signal activates the demand for machine running irrespective the load mode “XXXkW/COPY” and the demand for running (pressing of START/STOP in manual or semi-automatic mode or HDO-signal in automatic mode).

12.2.13Deion Mns Ctrl

Output for control over the net contactor

12.2.14Deion Gen Ctrl

Output for control over the generator contactor

12.2.15Load Off Req

It gets activated during the solitary operation prior to disconnection of the generator deion. It is used for automatic gradual detachment of load prior to disconnection of the generator deion.

12.2.16Vgen Up (Down)

Outputs for pulse regulation of the generator voltage

12.2.17Twp Open (Close)

Outputs for governing of the 3-way valve for primary water temperature control.

12.2.18Tws Open (Close)

Outputs for governing of the 3-way valve for secondary water temperature control.

12.2.19Vgen Down (Up)

Outputs for governing generator voltage (power factor), provided pulse control of voltage generator is selected by parameter

12.2.20Speed Down (Up)

Outputs for governing generator rotation speed (power), provided pulse control is selected by parameter.

12.2.21XPort CP0 (CP1)

These user outputs are not generated directly by CU-algorithm either, they can be generated as outputs of user functions. Signals are governing inputs of IB CPO and CP1, on the basis of which the e-mail sending from CU can be activated.

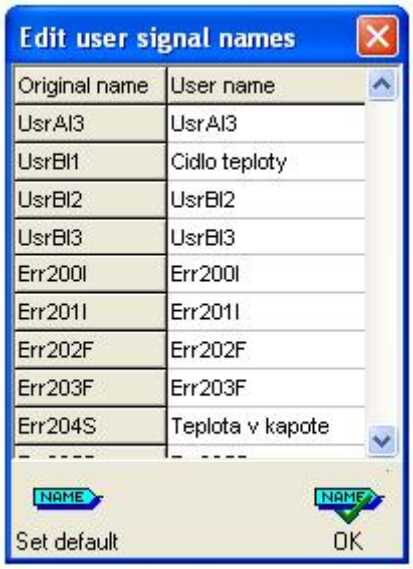
12.2.22Err200 ÷ Err205

These user outputs are not generated directly by CU-algorithm either, they can be generated as outputs of user functions. Through activating of one of these signals follows a failure shut-down of the motor (as well as through activating of the "Error" logical output) with the result that a record with an adequate report "Failure 20X" will be stored in the CU-history.
Failures "Error 200 – 201" (marked "I") cause an immediate failure shut-down (immediate motor Stop), failures 202 – 203 (marked "F") cause a speedy shut-down (immediate desynchronizing and cooling idle-run prior to Stop), failures 204 – 205 (marked "S") cause a graduate failure shut-down (power down up to the cooling value, idle-run prior to Stop).
Failure (signal Error 20X) is persisting (signal continues to be active) also after the reason has gone off (reason which had activated Error 20X). The failure is confirmed (deactivating signal Error 20X) by pressing the key "Fault Reset".

Using "Edit name" in mapping or in functions the name of signal can be changed from "Err20X" to an arbitrary text (e.g. "Temperature in the guard-hood"). Therefore on activating the failure no standard message "Failure (20X)!" will take place, but there will be directly indicated the entered text (e.g. "Failure - Temperature in the guard-hood")"!.

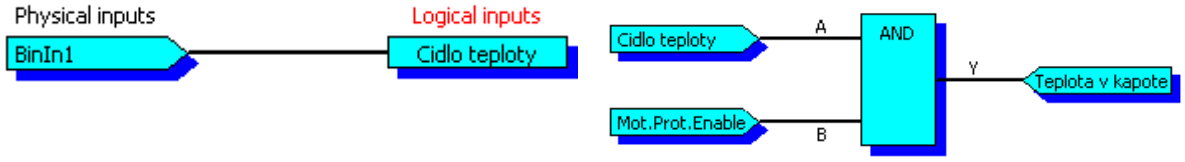
Examples for usage of the logical outputs Err20X

Entering of wordings as well as functions for generating of the slow failure (Temperature in the guard-hood") from the binary input. The failure in our example is activated by motor protections.

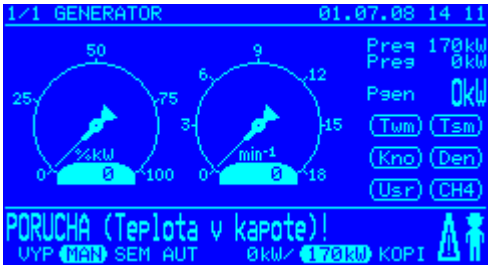


Foremost it is suitable to denominate user logical signal for connection of the failure binary input (UsrBI1) and failure nameErr204S).
When editing the name the Czech letter are not to be used (wedges and dashes). ASCI-codes above 192 are used for coding of Russian language.

Afterwards can be mapped a logical binary input to the relevant physical input to which is connected the temperature sensor as well as it can be set failure generating in functions:



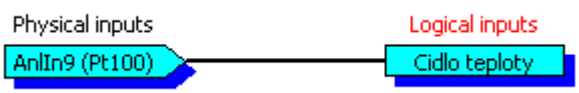
.After binary input BinIn1 being activated, activating of the signal Err204S (Temperature in the guard-hood) takes place (provided motor protections activated) and it means consequently the slow failure-shutdown accompanied with the message "FAILURE/=porucha (Temperature in the guard-hood)! Provided in "Edit user signal names" no name to Err204S assigned (it has its original value), the message FAILURE/=porucha (204)! will be indicated.

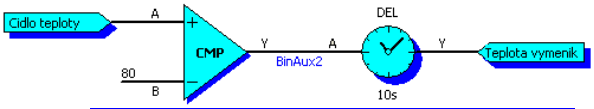


Setting of wordings and functions for generating of speedy failure “Exchanger temperature” which is measured by analogue input Pt100.

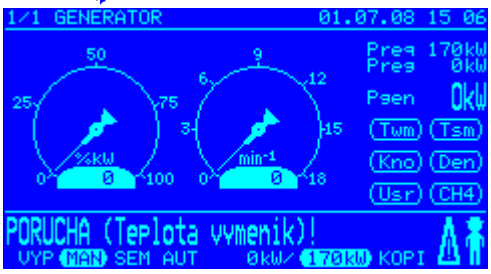
Foremost again denominate the logical input signal used for failure processing (UsrAI1) as well as failure name (Err202F).

Afterwards the logical binary input can be mapped to the relevant physical input to which the temperature sensor is connected as well as it can be set failure generating in functions:





If there is overrun with the analogue input AnIInP (Pt100) above the value of 80°C it will be (with delay of 10 s) activated the Err202F signal (failure exchanger) and therefore speed failure shut-down takes place accompanying with the message “FAILURE/=porucha (temperature exchanger)!Provided in “Edit user signal names” no name to Err202S assigned (it has its original value), the message “FAILURE/=porucha (202)!” will be indicated.



13. Analogical inputs

13.1 Configurable physical analogue inputs

CU incorporates 14 configurable analogue inputs (4x Pt100, 4x voltage input 0-50mV, 2x 2x voltage input 0-10V a 4x current input 0 – 20mA) in connectors SAIA-SAID.

13.2 Logical analogue inputs

.Logical analogue inputs are analogue values exerting an influence on CU-algorithm. Using mapping you can assign to a logical input an desired physical input as well as a criterion meaning, -what a value of logical analogue input complies with a value of physical analogue input (e.g. 0mA=0kW, 20mA=150kW)

13.2.1UsrAI1÷3

These user analogue inputs are not exerting direct influence on the CU-algorithm. After having mapped them in physical inputs they can be used as inputs for entering into user functions.

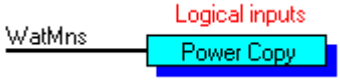
The names of these user signals may be edited

13.2.2Power Copy

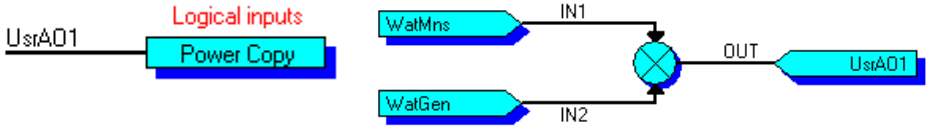
This logical analogical input defines, in “COPY”-mode and parallel operation with the net, the level/=value of the desired power on which will follow the generator power regulating.

Examples for Power Copy Input Configuring :

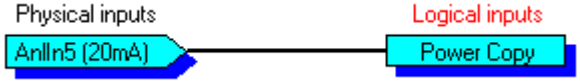
Mapping of logical input concerning internal measuring of active power. Power of the unit in the “Copy”-mode will be regulated in that way that no power is supplied onto net. This way of mapping can be used only then if for CU is current measured towards the entity not towards the net (regulating on value)



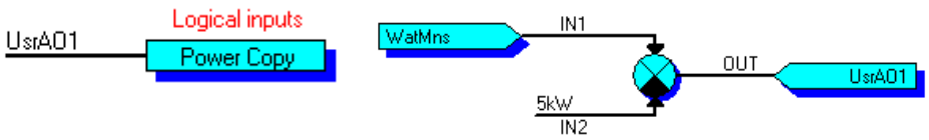
If the CU measures the current supplied for net, it is necessary to map logical input for the regulation to be done on zero (the required power is given by the total of the generator power plus power supplied from net)



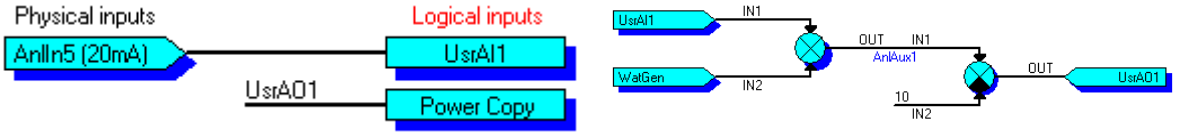
Mapping of logical input to become a physical input (e.g. for current), the power is measured by an external measuring instrument. During the process of mapping the required power can be assigned corresponding with the value of input current. This configuring comes up to the adjustment directed on value (current signal carries the info on the entity consumption, not on what how much the net takes off)



If there is required e.g. exhausting out of the net (generator power is adjusted a little less than is the need of the entity) the functions can be used as follows (CU measures the current towards the entity, it becomes exhausted 5 kW):



If the following configuring is used is the into the net supplied power measured in external way (regulation on zero, info into CU gets by means of current signal) and it is exhausted 10 kW out of the net.



In all these cases the positive sign of current (power), when measured from the net, means exhausting (= consumption) from the net, if it be to the contrary the signal “WatMns” would be necessary.

13.2.3Water temper.

Cooling water temperature. The temperature outside the limited range results in blocking of machine start, increased temperature reduces the power, high temperature causes the failure shut-down.

13.2.4Out water temp.

Outlet water temperature of secondary circle.

13.2.5In water temp.

Entering water temperature of secondary circle.

13.3Gas-air mix.press.

Pressure of fulfilling mixture. Based on this pressure the fulfilling mixture can be optionally regulated (either actuator Woodward or step motor).

13.4Gas-air mix.temp.

Temperature of fulfilling mixture. Increased temperature reduces the power, high temperature causes the failure shut-down.

13.5Escape temp.

Exhaust temperature .

13.6Escape temp.S1 (S2)

Exhaust temperature section 1 and 2. Temperature exceeding of sections (absolute values of their differences) will cause the failure shut-down of the machine.

13.7Oil temp.

Oil temperature .

13.8Oil press anl.

Oil pressure (analogue measured). High pressure during the idle state of aggregate is blocking its starting, low pressure during its operation will cause its failure shut-down. If this signal is not connected (mapped on NC) oil pressure will be supervised by binary signal only.

13.9Methane Level

Methane quantity in fuel. It is used to rectify the power, to regulate the richness, low methane quantity will cause failure shut-down. If this signal is not engaged (mapped on NC) the CU is acting in the same way as if there would be 100% methane.

13.10Power Lim User

User signal for limiting the power.

13.11Ulambda

The voltage on the Lambda-explorer used to regulate mixture richness.

13.12 The other analogical inputs

They are used for measuring of all phases of generator as and net voltages as well as current measurements.

By using another non-configurable analogical input is detected the position of the actuator Woodward (SWW.1).

14.Analogical outputs

14.1Physical analogical outputs

14.1.1AnlOut (V/mA)

The CU involves one full-featured analogical output (it is configurable by means of shorting jumper to 10V and in case of need to 20mA) on terminals SAO.1 and SAO.2.

14.1.2PwmA (PwmB)

The CU enables the usage of the physical binary outputs BinOut15 (PwmA) and BinOut16 (PwmB) using them as they "would-be analogical" ones (wia generating of PWM signal).

Through mapping of physical analogical signals PwmA and PwmB to a logical analogue output it is possible to generate a signal, the pulse ratio of which corresponds to the required analogue value.

Physical binary signals BinOut15 and BinOut16 must be set to logical 1 (log. 0 locks the generating of the relevant PWM).

If the PwmA and PwmB signals are not mapped (no NC assigned) the outputs BinOut15 and BinOut16 can be used as common binary outputs.

14.1.3StM Position

Required position of the step-motor. Logical magnitude, to which this physical output is mapped, has to show the value within the range of 0 – 100%. Number of steps corresponding to 100% is defined by the parameter StMMax.

The output can be used for mapping on e.g. logical output "FuelPos" which controls wellness of mixture via the step-motor. After having brought the power supply to CU the reset of the step-motor position will take place which occurs by its closing up to the bottom mechanical dog (in disregard of actual position the step-motor will close by 255 steps,

14.1.4WW Position

Required position of the actuator Woodward. Logical magnitude to which is this physical output mapped must show the value in the range of 0 – 100%. The demand for the position of 0% corresponds with the output of PWM signal 10%. The demand for the position of 100% corresponds with the output of PWM signal 90%. The demand for the position of 0% will disengage the PWM-signal.

The output can be used for mapping of e.g. logical output "FuelPos" for control over the richness of the mixture via the actuator Woodward.

If the position of Woodward is mapped to a certain logical magnitude (if it is not assigned to "NC"), the CU supervises also the return information about the actuator position. If there is deviation between required and real position more than 10% for the time 5s at least, there will be given an error message concerning the failure of actuator Woodward back-coupling.

14.2 Logical analogical outputs

Logical analogical outputs are binary magnitudes generated via CU-algorithm. Using mapping it can be defined in what way these magnitudes will govern physical output.

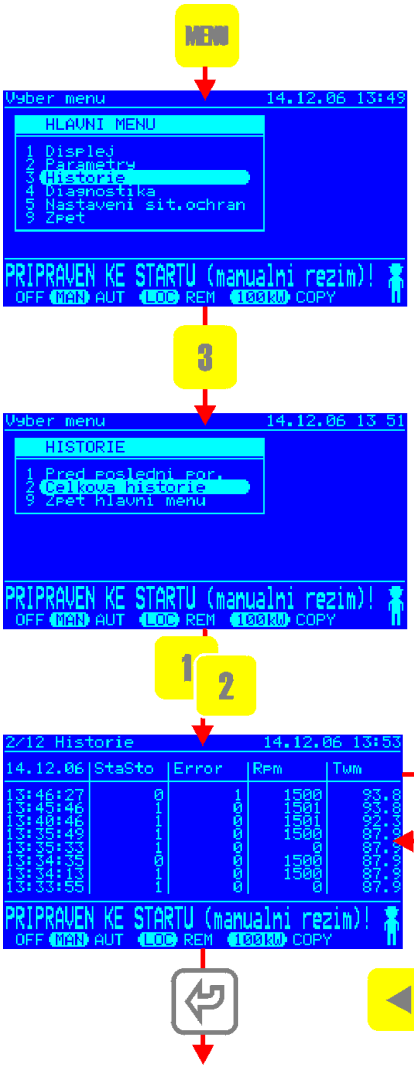
14.3 The other analogical outputs

The other analogical outputs enable analogical regulation of voltage as well as generator rotation speed. These outputs are not configurable.

15.History

The CU includes a configurable history (it can be defined magnitudes which are to be stored in this history as well as the interval for their storage) by means of a pre-trigger (if there is a fault condition there will be recorded also the events which preceded the fault condition).

You can browse the records in history on the CU-display:



After having pressed the “MENU”-key we shall select “History”. There will appear another submenu asking us, whether we want to disply the history of some records prior to the last failure (pre-trigger) or whether the overall history including all failures and all events recorded are to be shown. We shall make our choice using the keys “1” or “2” or using cursor-keys and confirm with „ENTER“.

We can browse through the history using the keys up/down (displacements in time, sequence of records are to be seen in the left upper edge) left/right (option of shown magnitudes).

The history display can be switched over using key “+/-“. There can be visualized either 8 lines of history at the same time or 4 lines only but with the state-description (reason of their recording in history)

The date of the first displayed record you can see in the table heading

The upload and depicting of records in CU can be carried out through the service program Manager (the key “History”). The records are ordered in the table according to date and time (the newest ones above) and they are divided in two groups. The records in the beginning of the table (marked as „LAST ERROR WITH RECORDS BEFORE“) are the records that preceded the latest failure (pre-trigger), the following records (marked „ALL ERRORS AND RECORDS“) are records concerning all other failures and states.

The records can be stored using the key „Save“ (the records saved before are to be opened using „Load“).

Using the key “Clear” you can delete all records from history. .The delete as well as change in the history-configuration is enabled only then if the competent user has logged in to manager.

15.1 History characteristics

Total capacity of history memory amounts 32768 bytes, hereof 255 bytes are determined for pre-trigger records and the rest for the other records, which are saved in the history when the following events occur:

- System-Reset (connection of the supply potential).
- Motoru-start
- Initiation of shut-down
- Motoru-stop
- Change of the operation the state (idle-run, nominal rpm-run, operation parallel to the net, rotation drop)
- State of failure (pre-trigger records are saved in the history together)
- Record during the operation after elapse of minutes which are defined via the parameter “Records”. If the parameter “Records” is set to 0, there are no records saved during the operation.

Number of bytes used for one record is floating and it depends on the number and type of magnitudes which are saved in the history. The length of one record in bytes is given by the relation (rounded to the bytes up)

*RecLen = 8 + BinCount/8 + AnlCount*2* (zaokrouhleno na byty nahoru)

where

BinCount … number of the binary magnitudes saved in the history

AnlCount … number of the analogical magnitudes saved in the history

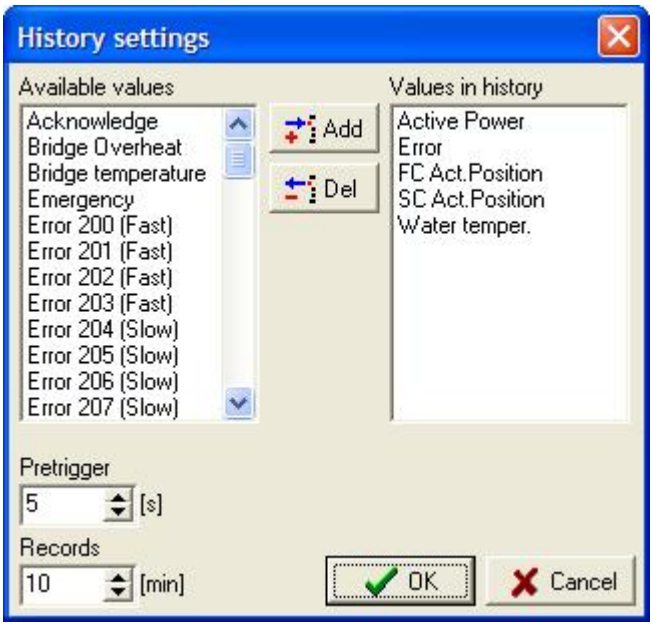
If there will be saved e.g. 8 binary and 8 analogical magnitudes, the total history memory capacity amounts to 19123 records + 15 records which preceded the latest failure.

If the memory capacity is full, it will be re-written subsequently beginning with the oldest records.

Beside from configured magnitudes every record contains the date and time of record registration as well as a wording description concerning the CU-state at the moment of registration.

15.2 History settings

History configuring is done with the key-press „Settings“ in history window.



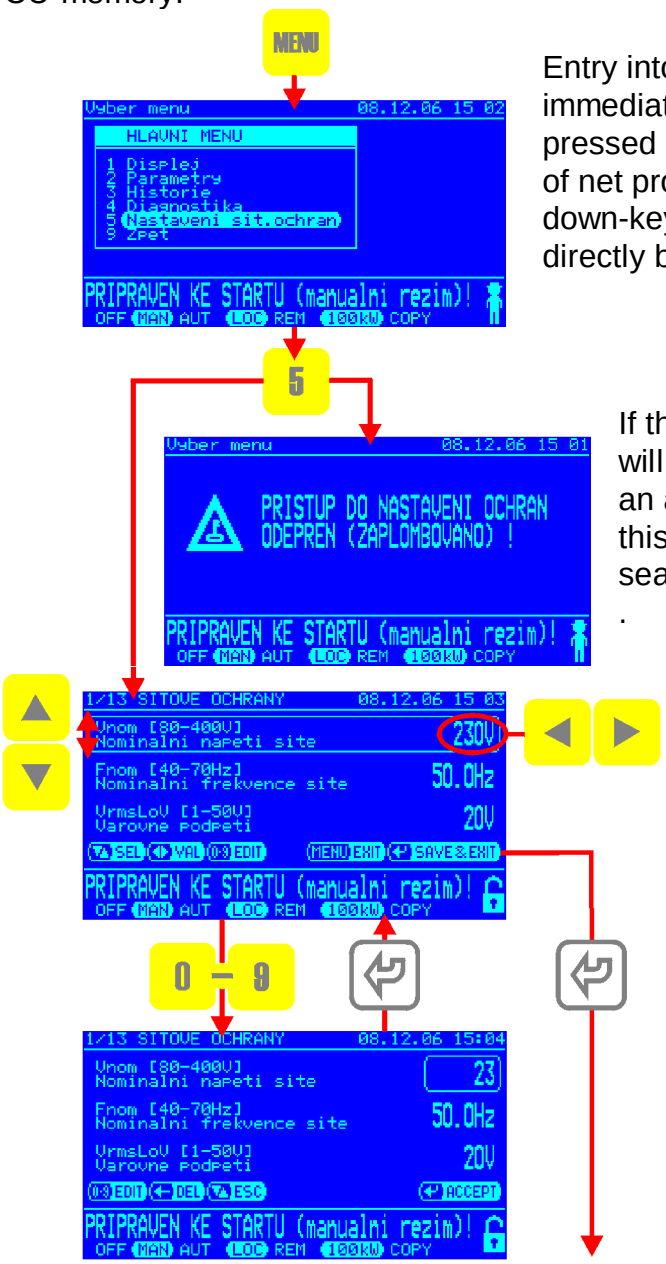
Any magnitude (analogical or binary) can be entered in history from the list of available values, you select and press “Add” (but only 56 magnitudes as a max.). From the list of magnitudes (Values in history) you may withdraw by selecting one and key-press “Del”. The “Add” or “Del” from the history (change of configuration) will cause the delete of all records from history. Parameter pre-trigger defines the interval for saving the pre-trigger record, parameter “Records” defines interval for saving records in history during operation.

Change of history configuration has to be confirmed by OK-key.

16. Integrated net protections

The CU involves Integrated net protections the setting of which can be “locked” using a seal. Integrated net protections have two stages.

The protections are easily to set directly from the CU-keyboard. If these protections are not sealed they can be adjusted also by means of service SW, if it be to the contrary the setting change via the service program will not be saved in the CU-memory.



Entry into the setting of net protections is immediately in the main menu. After having pressed “MENU”-key we shall select “Setting of net protections” (by item-selection with the down-key and pressing the “ENTER” or directly by pressing the key “5”).

If the entry into setting is sealed, there will be displayed this message. To gain an access into the protection setting in this case it is necessary to release the seal.

.

As soon as the access is free the protection parameters can be changed. Using the key up (down) you will select the parameter, keys left and right may alter the value of the selected parameter.

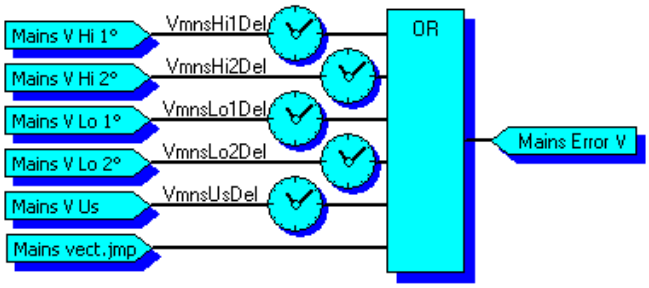
Using “ENTER”-key you will save the parameters, and using the “MENU”-key you can finish the parameter editing without updating them.

Parameter value can be also adjusted directly per entering the number using the CU-numerical key-board. .

If there is during the period of 25s or more no parameter selected or changed its value it will occur the return to the main display without saving the changes carried out.

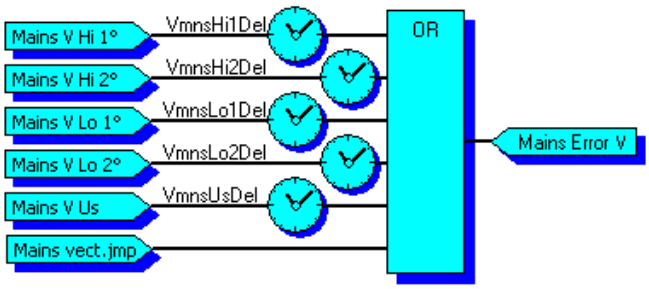
Unsealing of protections you will achieve by turning and running out of the control element on the CU-backside.

16.1Overvoltage protection (↑V)



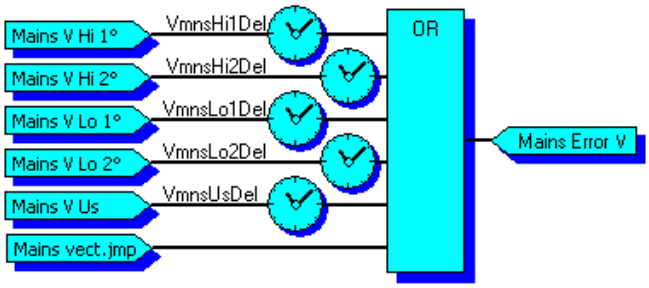
It is activated in case of increase of the effective voltage value over the defined limit (in two stages). The rising of the net-voltage over the value of „Vnom“+„VmnsHi1Lev“ with the delay of „VmnsHi1Del“ or rising over the value of „Vnom“+“VmnsHi2Lev“ with the delay of VmnsHi2Del will activate the net voltage failure („Mains Error V“).

16.2Under-voltage protection (↓V)

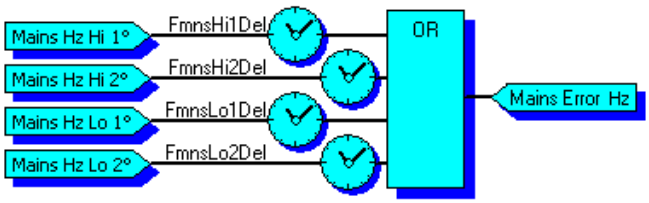


It is activated in case of decrease of the effective voltage value under the defined limit (in two stages). The decline of the net-voltage under the value of „Vnom“-„VmnsLo1Lev“ with the delay of „VmnsLo1Del“ or decline under the value of „Vnom“-“VmnsLo2Lev“ with the delay of VmnsLo2Del will activate the net voltage failure („Mains Error V“).

16.3Protection against voltage imbalance (↕V)



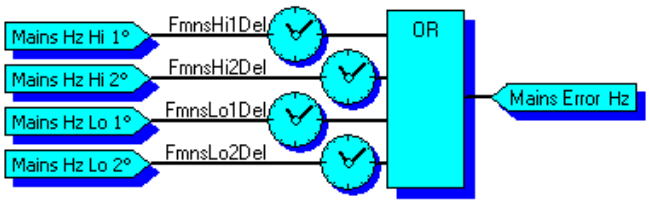
It is activated when the voltage difference between any two phases increases over the defined limit (in one stage only). The difference between any two phases bigger than „VmnsUsLev“ with delay of „VmnsUsDel“ will activate the net voltage failure („Mains Error V“).



16.4Over-frequency protection (↑Hz)

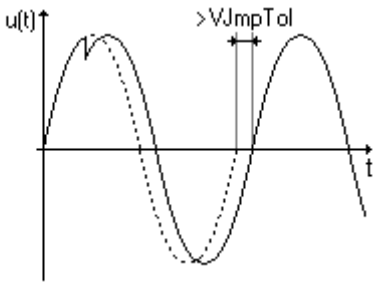
It gets activated if there is a frequency increase (signal in phase A) over the defined limit (in two stages). The increase of net frequency over the value of „Fnom“+„FmnsHi1Lev“ with delay of „FmnsHi1Del“ or increase over „Fnom“+“FmnsHi2Lev“ with delay FmnsHi2Del will activate the net voltage failure („Mains Error V“)

16.5Under-frequency protection (↓Hz)



It gets activated if there is a frequency decline (signal in phase A) under the defined limit (in two stages). The decline of net frequency under the value of „Fnom"-„FmnsLo1Lev" with delay of „FmnsLo1Del" or the decline under „Fnom"-"FmnsLo2Lev" with delay FmnsLo2Del will activate the net voltage failure („Mains Error V")

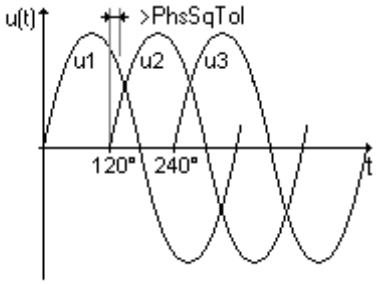
16.6protection against vector jump (VJmp)



It gets activated provided there is a vector jump in the net having its anger greater than that through a parameter defined angle "VjmpTol". The signal persists to be active for a period of 5 s (provided there occurs no subsequent detection of a more greater jump).

The signal activates immediately a net voltage error.

16.7protection of phase sequence (PhaseSeq)



It gets activated provided the phase of B signals or let us say that of C signals differs more from the expected value of 120° or 240° as defined angle.

The protection is blocking the connection possibility of generator deion as well as net deion..

16.8External info concerning net failure

If there is a coverage of signal „Ext Error V" or let us say „Ext Error Hz" it is enabled to activate immediately signal „Mains Error V" or let us say „Mains Error Hz" as well as the subsequent CU-response, the same way as it is the case with internal protections.

The signals enable to link external net protections..

16.9CU-response to net protections

Breaking bounds of some of net protections, an improper phase sequence or incidence of external voltage (frequency) protection, this all is blocking the connection of the unit with net.

With the units „P" („PI") and net deion in on-state in CU automatic mode is blocked the start of the unit if there are taking effect breakage bounds of some of net protections, an improper phase sequence or incidence of external voltage (frequency) protection.

Breakage of bounds of some of net protection with delay or activating of external voltage (frequency) protection immediately (so activating of signal „Mains Error V" or „Mains Error Hz") will evoke during the unit parallel operation with the net an immediate generator disconnecting from the net because of voltage or frequency failure.

If the unit of type "E" is operating in CU-automatic mode, activating of the signal „Mains Error V" or „Mains Error Hz" will not cause the unit failure shut-down but only disconnecting of net deion. After that the unit will start (continue operation) in accordance with emergency mode algorithms.

17. CU-algorithms

Besides from algorithms for control and monitoring of the engine (control over motor parameters, regulation of power, rpm and mixture..), the CU-algorithms contain also the algorithms for net protection, generator electrical protection (over-current, power for starting, back-power, power not adhered), further they are supervising regulation of generator voltage and generator power factor, they control rpm, temperature regulation of outlet water as well as further protections which are not directly concerning the motor.

The CU-can be further used for governing of neighbourhood technologies, either based on its firmly defined algorithms or on the basis of user configured function blocks.

17.1Modes concerning the net co-operation

For automatic operation in all modes the CU must be found in the mode “AUT”. Using “AUT” mode it is impossible to control the net as well as generator contactors manually (actuating of these is controlled automatically from the CU).

17.1.1Mode „P“

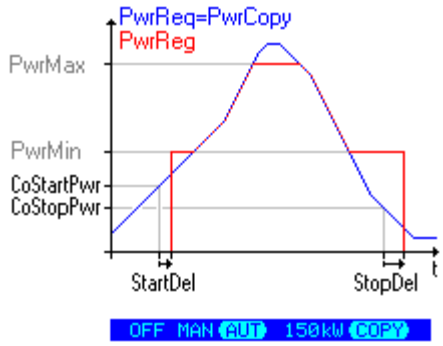
Parallel mode serves exclusively for co-operation with net. To work in automatic operation the CU.mode must be set to “AUT”.

The net contactor is permanently engaged and governing is impossible in manual mode too. Control over net contactor is always active, measured state of contactor is set to log. 1 (disregarded where it is mapped). From the formal viewpoint the state of this contactor (“deion Mns State) should be mapped to “1 (True)”.

After having pressed the key “START” (in manual or semi-automatic mode) or having activated the HDO-signal (in automatic mode) the unit will be started. After warming run expiry with nominal speed (parameter “LoadDel”) there will be started phasing of unit towards the net. After having been connected to the net the unit will step by step increase its power, accordingly to ramp-function, up to the required value (if there is no power limitation active). If the generator or net parameters (voltage, frequency, phase sequence) out of order after warming run expiry with (e.g. breakage of warnings limits only), the unit connection to the net will be blocked. If the parameters are exceeded constantly, there occurs no phasing of the unit but there will occur failure shut-down.

After having pressed the key “STOP” (in manual or semi-automatic mode) or having deactivated the HDO-signal (in automatic mode) the unit will be stopped. First of all power of unit will be step by step reduced from the actual value down up to the cooling power (parameter “PwrTwm”). After the relief time has been expired (CU-parameter “UnloadTime”) the unit will be disconnected from the net, -generator contactor disengaging. After that the unit will run with nominal speed for a defined time (parameter “WrmDwnDel”) for the reason of cooling and afterwards it stops.

By the generator delivered power is defined by the power mode (“XXXkW/COPY”). The unit can run with a fixed defined power (“XXXkW”) or in the copy-mode (“COPY”).



In the copy-mode the power of the unit is given by the logical signal “Power Copy” and the power will in the ramp function follow the shown required value.

Provided “Power Copy” is less than that of “CoStartPwr” (and further “StartDel” after the growth over this value), the unit-start is blocked. If demand for power will decline during operation under “CoStopPwr” for a period which is longer than “StopDel”, there will occur a successive shut-down of the unit. The unit power is always limited to the minimum value of “PwrMin” and to max.value of the “PwrMax”).

Signal “Power Copy” can be mapped e.g. to physical input 20mA or, for defining of the required power, the power value can be used which is measured by CU on the net and processing of this value occurs by means of functions (consumption regulation to zero, to value …).

If the unit-start is blocked because of the too low requirement, the figure-symbol in the right bottom corner shows if there is as demand for run of the unit. If the figure symbol is standing there is no demand for operation. After the demand has been increased over the limit defined, the unit will notify the state of being ready to start (but it will not start). The fleshing symbol of walking figure in the right bottom corner means that there is demand for machine running. After the growth of the demand over a defined limit the unit will begin to start.

If the CU-mode is set to “MAN” the unit will conduct itself in the same way but only with one difference, namely there occurs no automatic start of the generator phasing contactor. After having been started the unit continues to run with its nominal speed and the phasing can be initiated (discontinued, subsequently disconnect from the net) pressing the generator contactor key.

In the CU-manual mode there is no start blocking in case of overrun the emergency net parameters (if net parameters are out of order there is no phasing possible).

In the CU-manual mode as well as copy-mode there is no blocking due to a low requirement for power (if there is only low power requirement will the unit run, after having been phased, with the power “PwrMin” regardless the value of the signal “Power Copy”).

17.1.2Mode „I“

In the solitary mode the unit operates without the net co-operation. For automatic operation the CU-mode must be set to “AUT”. The power mode “XXXkW/COPY” as well as the state of the net exercise no influence on the algorithm.

The net contactor is permanently disengaged without the possibility to actuate it even in the manual mode. Actuating of the net contactor is always inactive, the measured state of the net contactor is set to zero (no matter how it is mapped). From the formal viewpoint the state of this contactor (“deion Mns State) should be mapped to “1 (True)”.

After having pressed the key “START” (in manual or semi-automatic mode) or having activated the HDO-signal (in automatic mode) the unit will be started. After warming run is finished (parameter “LoadDel”) the generator contactor will be switched on and the satellite load will be linked (if the generator parameters are OK). Generator contactor closure should connect only a small load, connecting of more load should occur by successive switching on (it can occur using the CU-functions, see thereinafter). If the generator parameters are not in order (voltage, frequency, phase sequence) after the warming run has gone off (overrun e.g. warning limits only), it will occur, before the contact making, the unit failure shut-down caused by error of the generator parameters.

After having pressed the key “STOP” (in manual or semi-automatic mode) or having deactivated the HDO-signal (in automatic mode) the unit will be stopped. In the moment of generator contactor disconnection only the primary small load should be harnessed.

Should the successive attachment and detachment of the satellite load occur “automatic” and the parameter “LoOfRqTime” differs from zero there will be, in case of requirement for shut-down, at first activated the logical output “Load Off Request”, on the base of which the circuits for successive load disengagement should in some steps reduce the satellite load to a minimum. After the time of “LoOfRqTime” has been expired it will follow the generator contactor disconnection and accordingly the rest of satellite load.

Is the parameter “LoOfRqTime” equal to zero, the generator contactor will disconnect immediately after the demand for operation is finished.

After the generator contactor has been disconnected the unit will be running with nominal speed for a defined cooling time (parameter “WrmDwnDel”) and afterwards it will stop.

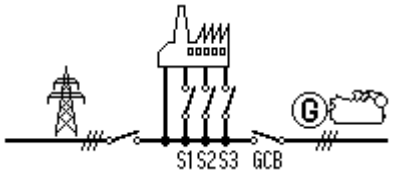
If the CU-mode is set to “MAN” the unit will conduct itself in the same way but only with one difference, namely there occurs no automatic connecting of the generator contactor. After having been started the unit continues to run with its nominal speed and the load can be connected (disconnected) pressing the generator contactor key.

In the CU-manual mode the generator contactor is actuated immediately in disregard of the greatness of the satellite load connected.

17.1.2.1 Successive attachment and detachment of loads in the mode “I” using CU

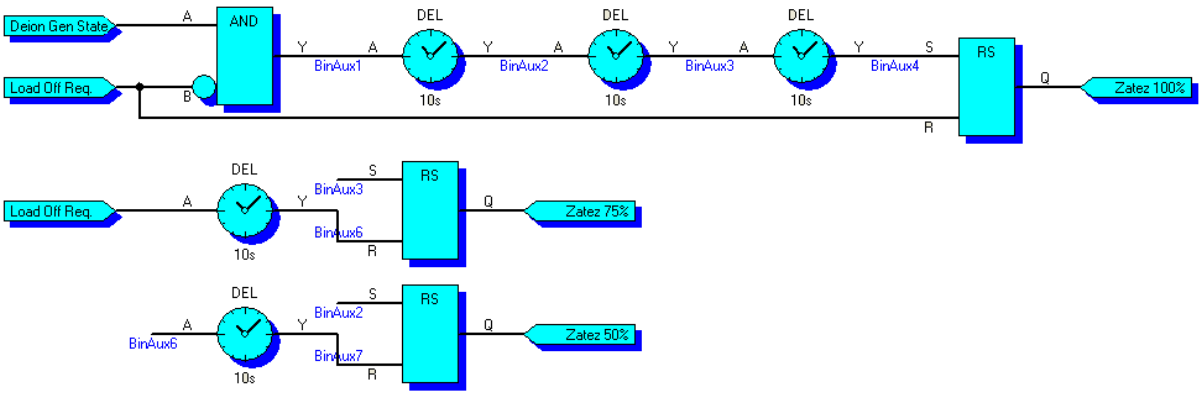
In order to ensure the attachment of only an initial small load at the moment of the generator contact making during the solitary mode, it is necessary to attach and detach the loads step by step. This process can be governed automatically using directly the functions defined in the CU.

Let us take the following wiring::



The generator contactor will engage only ¼ of the satellite loads. Using the contactors S1-S3 the rest of loads will be attached gradually in three further steps; each of the contactors actuates ¼ of the solitary loads.

Afterwards it can be ensured successive attachment and detachment of the loads using the linking of the following functions (signal “Zatez 50%” actuates the contactor S1, signal “Zatez 75%” actuates the contactor S2, signal “Zatez 100%” actuates the contactor S3):



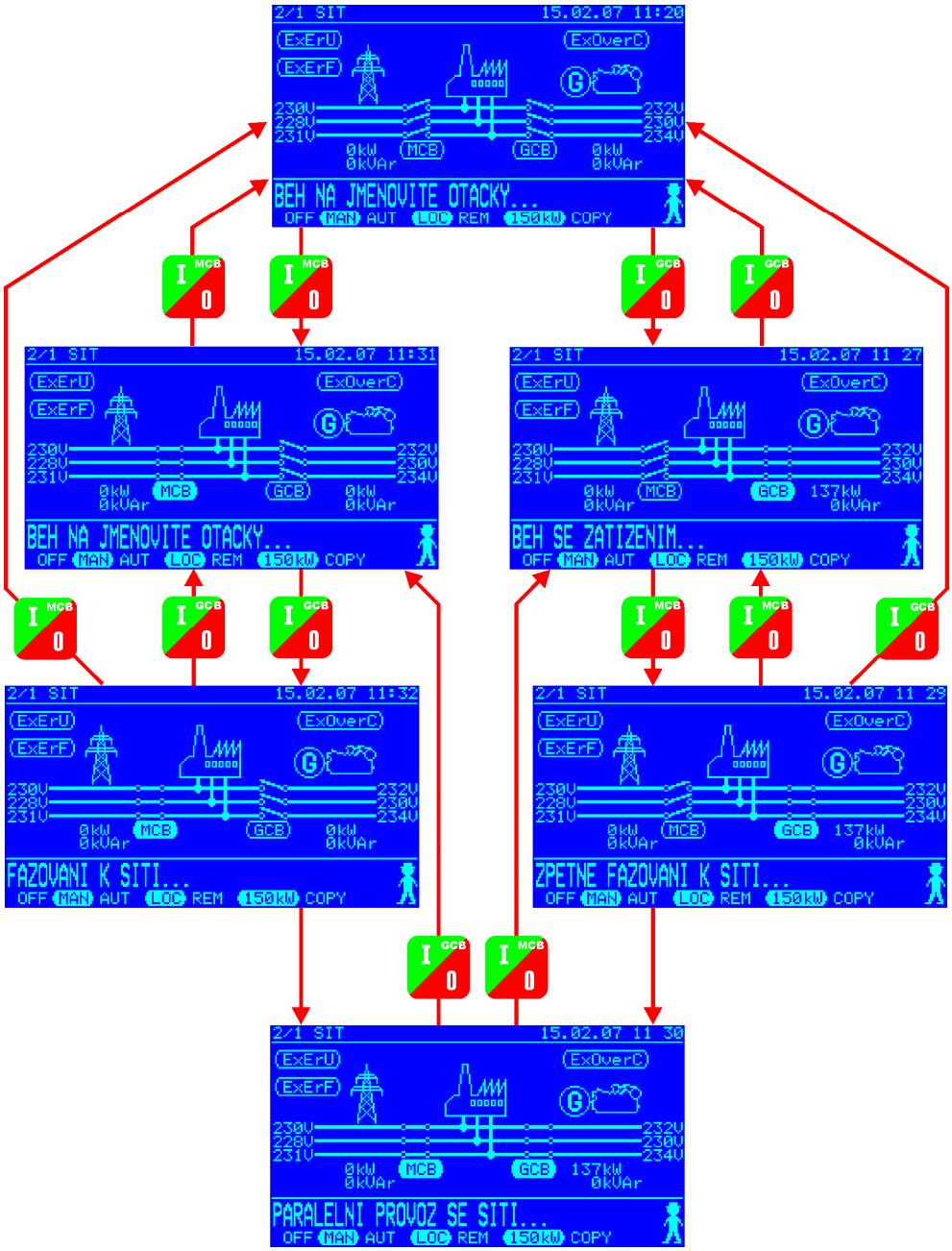
The delay, the contactors become successively switched ON (and OFF) can be set to various time intervals according to the setting of the delay-links. Algorithm can be adapted accordingly as necessary, e.g. with the links “P+I” the contactors S1 – S3 can switch on irrespective the delay if there will occur contact making of the net

contactor (to the inputs S of the CU flip-flop circuits are to be connected besides the OR signal “Deion Mcb State”).

17.1.3Mode „P+I“

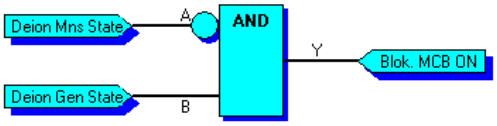
In this mode the unit can operate both parallel with the net and solitary. The option between parallel and solitary mode is not performed automatically. The mode “P” / “I” can be over switched only then if the CU-mode is set to MAN using the key for actuating of the net-contactor. If the net contactor is switched on, the unit will react in the same way as if in the “I” mode.

Is the CU-mode set to “MAN” and there is no blockage of the MCB actuating from the CU-keyboard through the parameter “MCBCtrlPI”, it is possible, using contactors actuating keys, to govern manually all the operational status of the unit.



If the MCB-governing in manual mode is blocked through parameter from the keyboard, then the measured state of the MCB deion will decide, if the unit will be operated in solitary or parallel mode (signal “Deion Mns State)”. To avoid the feed-back failure the MCB duplicates in such a case the demand for connection (signal “Deion Mns Ctrl”) input state.

If the MCB is governed manually (not via the CU-output) it has to be secured, that there can not occur its switching ON at the same time when the GCB deion is switched on as well.



User generated signal “Block. MCB ON” should block the unfavourable net contact making if any.

17.1.4Mode „E“

In the emergency mode “E” the generator is used as a back-up power supply. The CU-mode has to be set to “AUT”. The power mode “XXXkW/COPY” is in this case without any influence on the algorithm.

Provided the net is OK, the net-contactor will get active, the CU is in the stand-by mode indicating “PRIPRAVEN KE STARTU”! (if there is no unconfirmed failure). Neither the pressure of START (in manual or semi-automatic mode) nor activating of the signal HDO (in automatic mode) will start the unit.

If there is a CU-blackout the net connector gets disconnected and the unit begins its starting in the same way as in the solitary mode. After the warming run with the nominal speed the generator contactor will automatically engage the satellite loads. The generator starts supplying power into load.

If there occurs the net restoring and the net is as the minimum for a period given by the parameter “EmChkDel” in good order prior to generator contactor switches on, the demand for the unit emergency operation will be put to its end and the net-contactor will switch on. The net will supply its power into the load again. This enables to resume the energy supply sooner than it would be in case of generator supply.
If the net restoring occurs only as late as unit operation in solitary mode, the unit will still run for the period of “EmLoadDel” missing up to solitary load and the CU-system controls whether there is not a new blackout occurred.

Is the net OK and there are no further blackouts, the process of re-passing the load to the net will be started. Depending on the parameter set this process can be carried out in two different ways.

The CU will start the process of the back phasing, after the contactor has been switched ON the unit passes on to the parallel operation mode with the net and the unit begins step by step hold down its power according to ramp function from the power value supplied to solitary load down up to the cooling power. After the defined time for release has expired (parameter “WrmDwnDel”) the unit will disconnect the generator contactor, will cool and shut-down.

Another way how to re-pass the load on to the net is the contactor dubbing. As soon as the minimum time for solitary operation has gone off and the net is OK, the CU will switch the generator contactor off and immediately (as soon as the return information about disconnected state arrives into CU) it will connect the net contactor. Using this less regardful way, the parallel operation with net will fail and the unit can shut down even from the full power (it is from the power which had been supplied into the solitary load).

Press and hold of the key STOP in the “AUT”-mode for the time of 1s as a minimum during the emergency operation will evoke failure shut-down of the unit.

If the CU-mode is set to “MAN” the function of the unit back-up power supply will be eliminated and the unit does not respond to the drop of net voltage and the contactors can be operated manually as well as the unit can be started by “START”-key in the same way as it is the case with “P + I” unit in manual mode.

If there is set in the emergency mode the return connection of the power to net, based on the connector dubbing, it is impossible to connect manually the net contactor and the generator contactor at the same time (because the activating of phasing and of return phasing are blocked).

In the CU manual mode (or in case of emergency shut-down) there follows no disconnection of the net contactor in case of power fail (but it can get connected after the delay is expired) ! Energy restoring towards the load occurs therefore immediately after the net has been restored.

17.1.5Mode „P+E“

This mode is using the combination of the unit for parallel net cooperation together with the function of back-up power supply. CU-mode has to be set to “AUT”.

If the net is OK, the unit is operating in the same way as in mode “P”.

If there is a power loss and the unit is idle at that moment, the unit will operate in the same way as if it were in emergency operation. After the net has been retored the unit will put the load to the net again and shuts-down.

If there is a power loss during the parallel operation of the unit with net, there will occur no shut-down because of net failure. The CU will disconnect the net contactor and continues to supply the power into the load in solitary mode without breaking the electrical power supply. After the net has been restored the unit will put through the back phasing towards the net and follows on parallel operation with net.

Provided the unit was out of operation prior the power loss a during the emergency operation occurred the demand for its running (“START”-press or activating of HDO-signal), after net restoring the unit will remain in parallel operation with net.

Was the unit prior the net power loss in operation and during the emergency operation the demand for running of unit came to its end (short press of “STOP” or deactivating of HDO-signal), the unit will shut-down after the net has been restored and the load has been passed on back to net.

The blinking standing figure in the bottom right corner in the display (or if you like not blinking walking figure) indicates, if the unit will shut down after the net has restored.

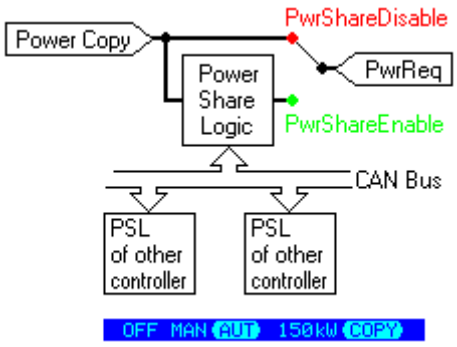
Press and hold of the key STOP in the “AUT”-mode for the time of 1s as a minimum during the emergency operation will evoke failure shut-down of the unit.

If the CU-mode is set to “MAN” the function of the unit back-up power supply will be eliminated. The unit operates in the same way as if it were in manual mode “P+I”. If the unit is operating parallel to the net and there will occur the power loss during the manual CU-mode, the unit will immediately disconnect the generator contactor and will gradually shut-down for the reason of net-failure.

If there is set in the emergency mode the return connection of the power to net, based on the connector dubbing, it is impossible to connect manually the net contactor if the generator contactor is connected at the same time (because the activating of return phasing is blocked).

In the CU manual mode (or in case of emergency shut-down) there follows no disconnection of the net contactor in case of power fail (but it can get connected after the delay is expired) ! Energy restoring towards the load occurs therefore immediately after the net has been restored.

17.2Power share



In the parallel mode it is possible to activate through the “PwrShare”-parameter the function of “virtual concentrator”. The units connected one with another (by means of bus bar CAN) will automatically share, according to priorities, the power in demand, without the necessity of using another controlling HW or SW. There is a mutual information exchange concerning the state of their own (incl. motohours), and based on these information each unit will define for itself, if it will operate and at what power. There is no unit to be the “Brain” of the algorithm. Algorithm is operating independent in all CUs, and therefore in case of fallout of any unit the power sharing does not cease to operate..

To activate the algorithm, there is a condition, namely: Together with activating of the “PwrShare”-parameter it is necessary to use the CU-mode “AUT/COPY” as well as there has to be an activated demand for running of the aggregate (press of “START” key in manual or semi-autom. mode or an active HDO-signal in autom. mode). The units have to be interconnected by bus bar CAN, each of the units has to dispose of individually set address within the scope of 0-9 (the power can be therefore mutually shared by up to 10 units). Info concerning the power in demand may be fed into only one of the CUs (to eliminate the danger of CU-failure it is recommended to bring up this info to two CU as at least).

Algorithm of power sharing is able to operate with units of different powers. The quotient of nominal power of the greatest and smallest unit should not exceed the double. Power shearing among the units with a higher difference of nominal powers is also possible and it is described hereunder in a special section.

17.2.1Fundamental principles of power-sharing

. The units are ordered according to priorities (in this sequence they are also shown in the diagnostics display for power share). The unit having the highest priority is in the given moment the master unit (hereinafter MU), the other units are evening up units (hereinafter EU).

EUs are operating only in three (or 4) power states: State off, 1/3 of nominal power, 2/3 of nominal power, nominal power.

MU cuts-off its power in that way, that the power of each individual unit satisfies the request.

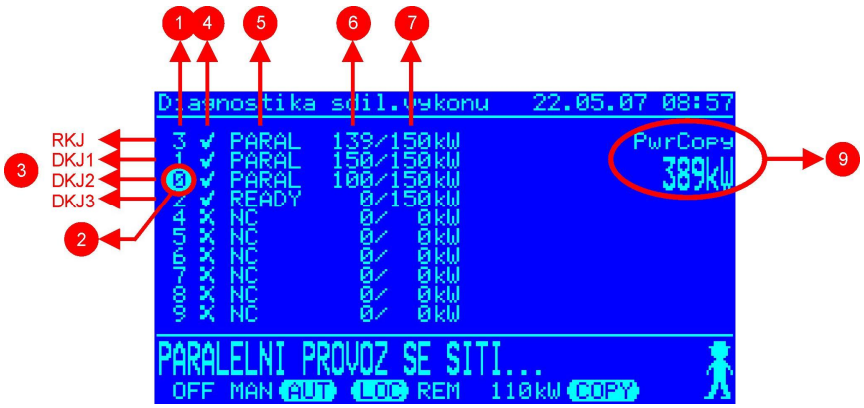
Between activating (deactivating) EU (as well as between switching over of EU power stages) is acting hysteresis of ca 6% of the nominal MU-power. If there are e.g. the units having nominal power of 150 kW and the power in demand will increase up to 150kW, the MU will be operating only. If the demand will exceed the boundary of 150kW, there will be activated DU (EU will be operated with 50kW, MU will even up the power requested). If the power in demand will then decrease under the 150kW, MU as well as EU continue to be in operation (in spite of the MU possibility to cover the demand by itself). The EU shutdown occurs as late as power in demand will be decreased under the limit of 141kW. Hysteresis is operating in the same way when regulating the EU – in case of demand up to 200kW the EU will run with 50kW, after the demand has been increased over 200kW, the EU will increase its power up to 100kW. As soon as power in demand will be decreased under the limit of 200kW, the EU continues its operation using the higher power stage. Only when there is further decrease in demand, under 191kW, the EU will return down to 50kW.

For the starting delay as well as MU and EU shutdown are the same parameters of use as that for “solo” power copying (“CoStartDel”, “CoStopDel”). Similarly the power for MU-starting and MU-shutdown is given by the parameters “CoStartPwr”, “CoStopPwr”. To ensure that the overall system is conducting in the same way, disregarding what of the units is MU, the above mentioned parameters should be set equally in all interconnected units.

If there is a failure with some of the units (loss of communication, power failure, increase of motohours, change of mode, shutdown) it will automatically occur the change of units´ priorities and thus reallocation of units´ functions MU (EU).

17.2.2 Diagnostic of the power-share function

In any CU it is enabled, using the diagnostic menu (press menu 4-1), to display the power share info of all interconnected unitsI



1) Adresa ŘS CU-address .
2) Highlighting of the local CU (the unit I am looking at)
3) Function of the unit. The units are ranged according to priorities, in the first line there is MU, in further lines there are EU in accordance with their priorities.
4) Confirmation saying, if the unit can be used for automatic power-sharing (unit is within “AUT/COPY”-mode, “PwrShare=ON/=Zapnuto” , the demand for running is active).
5) State of the unit
6) Power, to which is the unit regulated
7) Nominal power of the unit
8)
9) The demanded total power

17.2.3Examples for configuring of power share

Let us take e.g. four units, each of them with nominal power of 150kW:

CU-address	Diagnostic showing power share on display of the relevant CU	
#0		The unit with the 3rd highest priority is operating in three (or four) power states (0, 1/3, 2/3, 3/3). The total power gets evened up by the unit with highest priority.
#1		The unit with the 2nd highest priority is running in full power. If the demand will decrease so far that it will shutdown all the units with lower priority, the unit starts power decreasing by steps of 1/3.
#2		Starting of the unit with the lowest priority is blocked for the reason of low consumption. The unit should begin its starting only in case that the demand exceeds the limit of 450kW (provided all other units are running at 100%).
#3		The unit with the highest priority evens up fluently the power according the demand. If the unit operates with power of 100%, it will increase, with the priority followed, its power by 1/3. Provided all units are operating at 100%, there will occur starting of another unit.

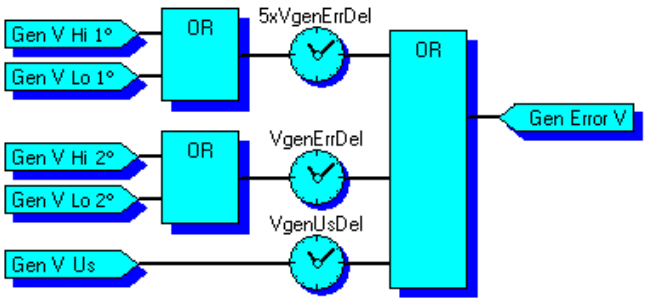
17.2.4Power share among the units of considerably different nominal powers

For power share among the units of considerably different nominal powers can be used the fact that the power share algorithm will include into the calculation of generated power also that units which are having the parameter “PwrShare” inactive. Provided all units with low nominal power have the parameter active, but the parameter of the unit with high nominal power will be inactive (and the starting power will be set e.g. at the value of Phi), the total demanded power will be lower than Phi, and only “small” units will be operating. Provided the demand will exceed the Phi, there will occur the start of the “great” unit and accordingly the total demanded power for sharing will be reduced by the power value of this unit (this unit will copy the demand by using independent algorithm). In such a case the “small” units will gradually start only as late as the “great” unit will reach the nominal power of its own.

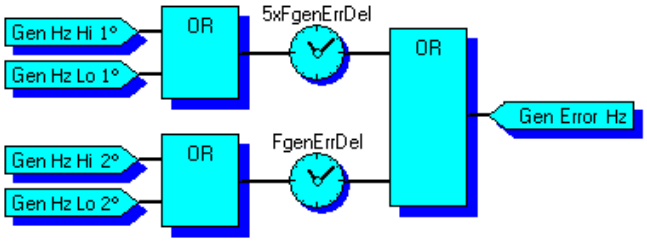
17.3Generator protections

17.3.1Fundamental generator parameters

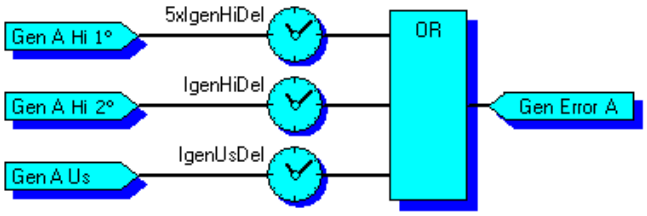
Analogous to the way of testing the net parameters through the internal net protections (under-voltage, overvoltage, over-frequency, under-frequency) there are also tested the generator parameters (having hereby the possibility of setting different tolerances and delays).



The failure of generator voltage occurs with the delay of “5xVgenErrDel” after having exceeded the limit of 1° generator voltage or with the delay of “VgenErrDel” after having exceeded the limit of 2° the generator voltage or with delay of “VgenUsDel” after having exceeded the generator voltage imbalance.



The failure of the generator frequency occurs with a delay of “5xFgenErrDel” after having exceeded the limit of 1° generator frequency or with the delay of “FgenErrDel” after having exceeded the limit of 2° of the generator frequency.



. The failure of generator over-current occurs with the delay of “5xIgenErrDel” after having exceeded the limit of 1° generator current or with the delay of “IgenErrDel” after having exceeded the limit of 2° the generator current or with delay of “IgenUsDel” after having exceeded the generator current imbalance

Exceeding the limit of some of the generator protections as well as incorrect succession of phases will block contact making of the generator deion.

Exceeding the limit of voltage or frequency at the moment of the generator deion being ON causes with a delay an immediate generator deion disconnecting followed by the generator failure shutdown because of the voltage or frequency failure.

Exceeding the limit of the over-current or activity of the external over-current signal causes with a delay the generator over-current failure as well as generator shutdown regardless of the deion state.

Exceeding the limit of the current imbalance will cause with a delay the generator current imbalance failure as well as generator shutdown regardless of the deion state.

Provided the unit of type “E” is operating in automatic CU-mode and running parallel to the net, the generator over current signal (internal or external) will cause, with delay “lovrErrDel”, firstly generator disconnecting from the net (transition to emergency solitary operation). Over-current failure and generator shutdown occurs as late as only in case, when there was no drop of current under the emergency limit (deactivating of external over-

current signal) even then occurred, when there was repeatedly laps of time “lovrErrDel” counted from disconnection the unit from net.

17.3.2Starting power

After having connected the unit to the net there must follow, within the time given with parameter “StaPwrLev”, the reaching of min. power value. If there is after the laps of this time the power lower, it will occur the emergency shut-down of the unit.

17.3.3Back power

If there will be, during the parallel operation with net, the unit power drop under the level of “BckPwrLev” for a period longer than “BckPwrDel”, there will occur emergency shutdown of the unit because of back power.

17.3.4Power not observed

If there is during the parallel operation with net the power in demand higher than parameter “UnvPwrLev” and the absolute value of the difference between wanted .and real power is greater than “UnvPwrTol” for a period longer than “UnvPwrDel”, there will occur emergency shutdown of the unit because of power not observed.

17.4Motor protection

Protection	Protection activating	Action
Reduction of power via the mixture temperature	Paralel=1 Emergency=0 *)	Power decreasing
Emergency temperature of mixture	Permanent	Instantaneous shutdown
Starting lock out via low temperature of the primary water	CU in idle state Emergency=0 *)	Starting lock out
Power limitation via low temperature of the primary water	Paralel=1 Emergency=0 *)	Power limitation
Power reduction via high temperature of the primary water	Paralel=1 Emergency=0 *)	Decreasing of power
Emergency temperature of primary water	Permenent	Instantaneous shutdown
Power limitation based on methane level	Paralel=1 Fuel A/B=1 Emergency=0 *)	Power limitation
Emergency methane level	Permanent	Instantaneous shutdown
Oil pressure, binary	MotProtEn=1	Instantaneous shutdown
Oil pressure, analogical	MotProtEn=1	Instantaneous shutdown
High temperature of combustion products – section 1 and 2	Permanent	Instantaneous shutdown
High temperature of combustion products – difference in sections	P > Pmin	Instantaneous shutdown
User start blocking (UserBlockStart=1)	CU in idle state	Starting lock out
User protections Error 200÷201 (Error 20X=1)	Permenent	Instantaneous shutdown
User protections Error 202÷203 (Error 20X=1)	Permenent	Rapid shutdown
User protections Error 204÷205 (Error 20X=1)	Permenent	Gradual shutdown

*) Provided Emergency=1, protection can be deactivated via the relevant parameter

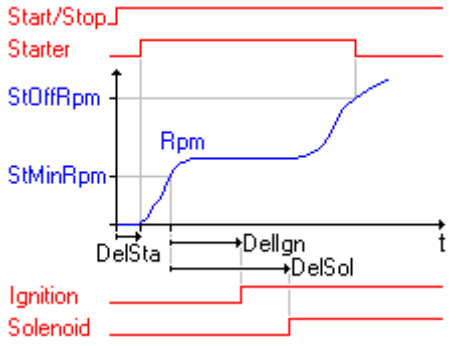
Should the relevant power limiting protection distinguish a power lower than the requested one (“PwrReq”), the relevant indicator lamp will light up (what protection has caused the power limitation) and the power to which it is regulated (“PwrReg”) will be decreased from the value of the demanded power, down to the power of relevant protection. Provided there are more reasons for power decrease, the protection with the largest power limitation will be decisive.

17.5Control algorithms

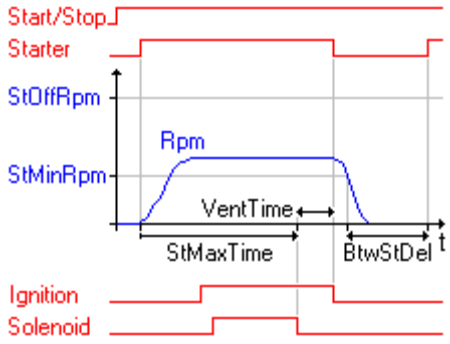
17.5.1Starting phase

Starting of the aggregate is possible if there is no failure or blockage signal taking effect and the last failure is confirmed (logical output “Error” is not active, it is active logical output “Ready”)

The aggregate is taking into operation by the signal „Start/Stop“ (signal HDO in automatic mode or press „START“ in manual or semi-automatic mode). From the starting edge of this signal is then, according to parameter setting, step by step taking place the activating of logical outputs “Starter”, “Ignition” and “Solenoid” (gas valve). With the time delay “DelSta”, counting from activating the signal ”Start/Stop” there will be activated starter. If the motor speed will exceed the value of “StMinRpm” there will be initiated the counting down the time ”DelIgn” remaining to the activation of the signal ”Ignition” as well as counting down the time “DelSol” remaining to the activation of the signal ““Solenoid” (gas valve). If there will occur an rpm increase over the value of the parameter “StOffRpm”, the starter will be deactivated and starting phase will be put to its end.



Max. time for the starting phase persistence is given by the parameter “StMaxTime”. Should from the moment of starter activating up to elapse of this time the motor rpm not exceed “StOffRpm”, the start will be evaluated as unsuccessful. If there is at this moment already open the gas valve (rpm exceeded the limit of “StMinRpm” at least), this gas valve will be closed at first and after the time of “VentTime” has been elapsed there will follow deactivating of ignition and starter. Should at the moment of unsuccessfully evaluated starts the gas valve still not be open (rpm has not either exceeded the value “StMinRpm”) the logical outputs for starter, ignition as well as gas valves are deactivated immediately, without the “VentTime” delay. If the max. number of starting trials has not still been exhausted (parameter “StTryCount”). There will follow, after the elapse of “BtwStDel” after the starter having been deactivated, another start-trial. If the number of all possible trials has been exhausted, there will occur an failure because of unsuccessful start.



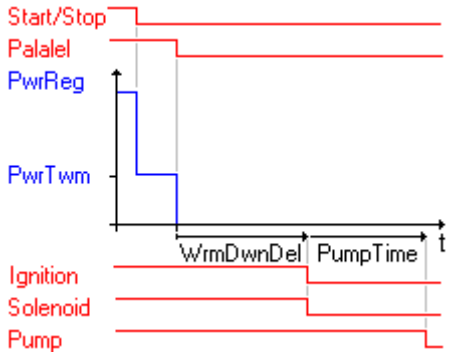
17.5.2Aggregate operation

If there will not come into being the state causing emergency shutdown, the aggregate continues to operate up to the moment of the signal deactivation “Start/Stop” (signal HDO in automatic mode or press „START“ in the other modes).

On the basis of generator and net contactor state is given the type of operation (operation without load at nominal rpm, parallel operation with net, solitary operation).

17.5.3Shut-down

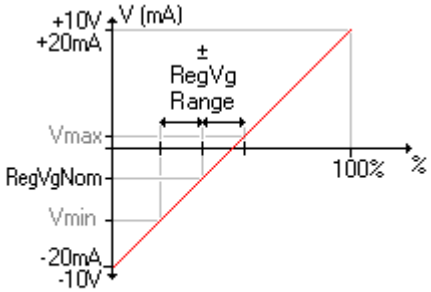
Shut-down of the aggregate has been started after deactivating of the signal Start/Stop (deactivating of signal HDO in automatic mode or press „START“ in manual or semi-automatic mode). After deactivating of this signal the generator power has been limited to the cooling value “PwrTwm” and on this value it will persist up to the moment of de-phasing from net (time of relief). After having been de-phased the motor is running, for the time of “WrmDwnDel”, with nominal rpm. After the cooling time has been expired there will occur the motor-stop and only cooling pumps remain in operation, namely for the time given in the “PumpTime”.



17.5.4Regulation of generator voltage (power factor)

Generator voltage regulator is operated directly in analogical way using the output SVC (positive/negative – increasing/decreasing of the control voltage increases the generator voltage) or on the basis of pulses via logical outputs “Vgen Up” and “Vgen Down”.

If there is the analogue way of controlling the output value “RegVgNom” of the output for the generator voltage regulator has to be defined (the said value should correspond with the nominal generator voltage) in percentage. The range of the generator output is +/-10V whereas the output value of 50% comes up to the zero control voltage. The range of regulator “RegVgRange” defines the max. operating range (min. and max. output control voltage). The speed of the control voltage change bears a proportion to the deviation of the generator wanted and real voltage and the parameter “RegVgP”. Provided the regulation will reach the extreme position (it is impossible to reach wanted voltage) the warning will be shown in Alarms).



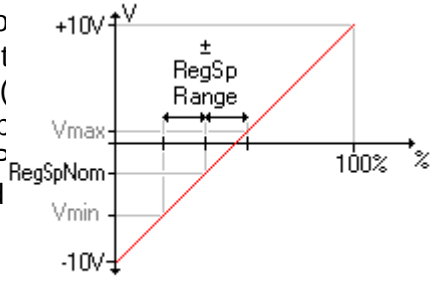
If the pulsating way of operating with the rerun cycle “RegVgT” is in action there are generated pulses for the voltage increase/decrease. The length of the said pulses is proportional to the deviation of the wanted and real voltage as well as to the parameter “RegVgP”.

17.5.5 Speed control

If there is connected the rpm regulator SpeedCON, the rpm as well as power control are fully secured by data communication via RS-485 from the CU only

If the SpeedCON is not connected, the rpm regulator can be operated in the analogical way using SSC- output (positive/negative – increasing/decreasing of the control voltage increases the generator rpm) or on the basis of pulses via logical outputs “Speed Up” and “Speed Down”.

If there is the analogue way of controlling the output value “RegSpNom” of the output for the generator rpm regulator has to be defined (the said value should correspond with the nominal generator rpm) in percentage. The range o whereas the output value of 50% comes up to the zero cont regulator “RegSpRange” defines the max. operating range (voltage). The speed of the control voltage change bears a p generator wanted and real rpm and the parameter “RegSpP reach the extreme position (it is impossible to reach wanted in Alarms).



If the pulsating way of operating with the rerun cycle “RegSpT” is in action there are generated pulses for the rpm increase/decrease. The length of the said pulses is proportional to the deviation of the wanted and real rpm as well as to the parameter “RegSpP”.

17.5.6Power control

In the parallel mode is the unit power regulated by governing the flap of the rpm regulator via the date communication RS-485 from CU into the rpm regulator SpeedCON using an analogical signal or pulses (see the foregoing section)
The value of the power in demand is given by the signal “Power Copy” in COPY-mode or by a fixed set parameter.

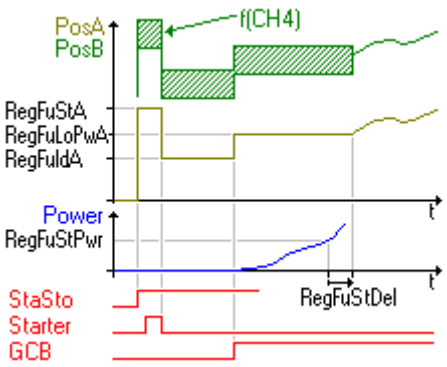
If there is no protection limiting the power in action, then the power to which follows the regulation (PwrReg) corresponds with the power in demand (PwrReq). Provided the (PwrReg) < (PwrReq) the detector will indicate at the same time the reason for power limitation

17.5.7Control of primary and secondary water temperature

An integrated part of the standard FW UniGEN are two control regulators for three way valve which is used for governing the temperature of primary and secondary water. Using parameters you can set the temperature requested. It is possible to regulate to a constant the temperature of primary (secondary) water either at inlet or at outlet. Into control over the three-way valve for primary water gets in addition also the temperature derivation of primary water.

17.5.8Control of fuel mixture

The mixture is regulated voluntary, based on voltage information from the Lambda-sonde or based on mixture pressure. Irrespective of the regulation type there are distinguished three different position of the actuator. Into the starting position the actuator will be laid open at the moment of operation request, idle position follows after the starter has been disconnected and after the net deion has been connected (until the initiation of regulation) the actuator is in position for low output.



. Having selected the fuel A, the above-mentioned positions are firmly given by parameter. Using fuel B, there has to be involved also the methane volume according to the definition tables

Provided the generator power has been for longer time than “RegFuStDel” higher than the power of the “RegFuStPwr”, there will be started the regulation.

In case of regulation based on the voltage on the Lambda-sonde the position gets corrected with a view to achieve the requested voltage. In case of fuel A the requested voltage value is given in accordance with the table, taking into account the generator power and methane volume.

If the regulation occurs based on the pressure of the mixture, the position gets corrected with a view to achieve the requested pressure of fuel mixture. The said pressure is defined by the generator power curve. There can be defined up to 5 points in the said curve. If not all of the said 5 points are used, the field out of use has to remain blank in the table. The requested pressure from the table is further corrected according to the mixture temperature using the relation:

$$PsmRqCor = PsmRq * (273,15 + Tsm) / (273,15 + 40)$$

Where “PsmRqCor” is the pressure to be regulated, “PsmRq” is the pressure defined by the power curve and the “Tsm” is fuel mixture temperature.
Correcting unit for the mixture control can be in compliance with mapping either the actuator Woodward controlled by the PWM-signal (connector SWW) or the step-motor (connector SSTM).

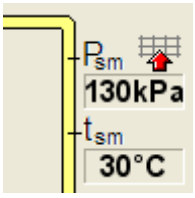
If during the mixture regulation the correction unit/=actuator will reach an extreme position (“RegFuLo”, “RegFuFi”), there will be indicating a warning. Is the correction unit in one of its extreme positions for a period longer than that defined in the parameter “RegFuErDel”, there will occur machine emergency shut-down.

For exact specification of the requested fuel pressures it is possible to use a “Guide”. At first are to be set requested power values, in which the relation will be defined. This is to be done in the table showing the requested pressure depending on the power:

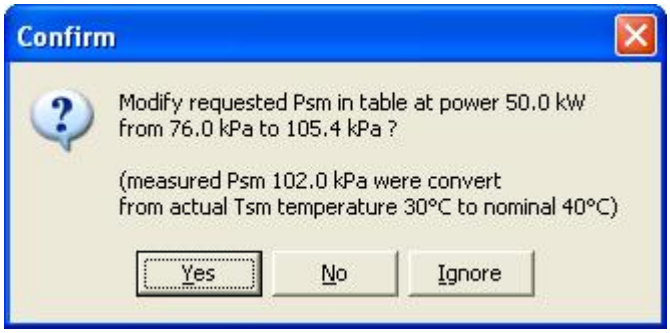
	1	2	3	4	5
Pel [kW]	50.0	80.0	130.0	180.0	225.0
Psm [kPa]	76.0	105.0	150.0	196.0	240.0

Provided the dependence of requested pressure on power will be given e.g. with three points only, it is not necessary to complete all the 5 powers. In such a case you shall leave columns 4 and 5 blank.

After having synchronized the unit you have to enter the requested power from the column 1 as well as activate the actuator manual control. As soon as the FHP has reached the requested power, the flap position will be set in manual control mode in that way, to meet the emissions standards.



After having pressed the key with the arrow as well as the table symbol next to the measured pressure value you will find a dialogue, which is to be used for saving the new value of the requested fuel pressure (average of the ten lastly measured pressures). This value will be saved using the corresponding column of this requested pressure table.



If, using the parameter „RegPsmCor“, there will be activated the correction of the fuel pressure so as to reach the nominal temperature, it will be offered the pressure already corrected to be saved in table, in accordance to the above mentioned relation
After having pressed the „Yes“ the new pressure value will be up-dated in the table. Should the “No” be pressed, the original value remains in force. In both cases the requested power will be automatically changed to the next one in the table. If you press “Ignore” there will be no change concerning either the table or the requested value.

After the requested power has been changed, it is necessary to wait until the power is stabilized (the FHP will reach the demand) and afterwards repeat the measuring procedure with the next power value.

17.5.9 SW modification concerning the CU

SW	Date	Changes