UNIMA-KS

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Specification

CHP firmware

for controllers of AP version

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1. Using

The described CHP firmware is contained in the UNIMA-KS control systems used to control of cogeneration units:

- UniGEN-CHP
- MicroGEN-CHP
- MiniGEN-CHP

Depending on the type of control system, the range of functions described may vary.

2. Logical signals

Logic signals are inputs and outputs of control system algorithm.
Description logic signals may different for each control system type (for example, depending on whether the control system has a keyboard, Modbus etc.). This list describes all signals, some smaller ŘS not all such signals in its firmware contain.

2.1 Alphabetical list of abbreviations of analog logic signals

"AirTemIns" - Inside temperature
"AirTemInt" - Intake air temperature
"AnlAuxNN" - Auxiliary signals for interconnecting function blocks
"ConTem" - Controller temperature
"CylTemNN" - Cylinder tempetarure NN
"CylTemAvg" - Cylinder average temperature
"ExhTem" - Exhaust temperature
"GasCH4" - Methane content in gas
"GasPre" - Gas pressure
"GasTem" - Gas temperature
"GenCos" - Generator power factor
"GenCosReq" - Requested power factor
"GenCurA" - Generator current in phase A
"GenCurB" - Generator current in phase B
"GenCurC" - Generator current in phase C
"GenFreq" - Generator frequency
"GenPhs" - Angle difference beetwen first phase of mains and generator
"GenVar" - Generator reactive power
"GenVarA" - Generator reactive power in phase A
"GenVarB" - Generator reactive power in phase B
"GenVarC" - Generator reactive power in phase C
"GenVarReg" - Requested generator reactive power
"GenVoltA" - Generator voltage in phase A
"GenVoltB" - Generator voltage in phase B
"GenVoltC" - Generator voltage in phase C
"GenVoltReg" - Voltage regulation
"GenVoltReq" - Requested generator voltage
"GenWat" - Generator active power
"GenWatA" - Generator active power in phase A
"GenWatB" - Generator active power in phase B
"GenWatC" - Generator active power in phase C
"GenWatExt" - External power request (copy)
"GenWatHrs" - Produced active energy
"GenWatLimDis" - Power limitation by distributor
"GenWatLimUsr" - User limitation of power
"GenWatReg" - Power regulation
"GenWatReq" - Power request
"Lambda" - Lambda probe voltage
"MetA" - Pulse meter A
"MetB" - Pulse meter B
"MixCorMan" - Manual correction of mixture controll
"MixPre" - Mixture pressure
"MixRegPos" - Mixture regulator position
"MixReqVal" - Requested value of controlled variable for mixture regulation
"MixTem" - Mixture temperature
"MnsCurA" - Mains current in phase A
"MnsCurB" - Mains current in phase B
"MnsCurC" - Mains current in phase C
"MnsFreq" - Mains frequency
"MnsVar" - Mains reactive power
"MnsVarA" - Mains reactive power in phase A
"MnsVarB" - Mains reactive power in phase B
"MnsVarC" - Mains reactive power in phase C
"MnsVoltA" - Mains voltage in phase A
"MnsVoltB" - Mains voltage in phase B
"MnsVoltC" - Mains voltage in phase C
"MnsWat" - Mains active power

"MnsWatA" - Mains active power in phase A
"MnsWatB" - Mains active power in phase B
"MnsWatC" - Mains active power in phase C
"MnsWatHrs" - Supplied active power
"ModBUSx100" - ModBUS [0x100]
"ModBUSx101" - ModBUS [0x101]
"ModBUSx102" - ModBUS [0x102]
"ModBUSx103" - ModBUS [0x103]
"MotoHrs" - Motohours
"OilLev" - Oil level
"OilPre" - Oil pressure
"OilTem" - Oil temperature
"PwrShrGenWatExt" - Total requested power of virtual concentrator
"PwrShrWatSum" - Total regulated power of virtual concentrator
"Rpm" - Speed
"RpmRamp" - Speed regulation ramp
"RpmReg" - Speed regulation
"RpmReq" - Requested speed
"SigTest" - Testing signal
"StMPos" - Step-motor position
"UsrAINN" - User analog input NN
"UsrAONN" - User analog output NN
"WWpwm" - PWM for Woodward
"WtrTemPriIn" - Prim.input water temperature
"WtrTemPriOut" - Prim.output water temperature
"WtrTemSecIn" - Sec.input water temperature
"WtrTemSecOut" - Sec.output water temperature

2.2 Alphabetical list of abbreviations of binary logic signals

"Ack" - Acknowledge
"AckExt" - External acknowledge by user
"AirFiltCho" - Air filter choked
"BinAuxNN" - BANN
"BlSyncUsr" - Synchronization blocking by user
"BlsUsr" - Blocking start by user
"CentralStop" - Central stop
"Clk1s" - Periodic signal 1s
"Emergency" - Emergency mode
"Error" - Error
"Fire" - Smoke detector
"FuelAB" - Fuel A/B
"FuncRes" - Functions reset
"GasEscI" - Gas escape level I
"GasEscII" - Gas escape level II
"GasPreLo" - Low gas pressure
"GasSol" - Gas solenoid
"GenCurOvr" - Generator overcurrent
"GenCurOvrExt" - Generator overcurrent (external)
"GenDeionCtrl" - Generator deion control
"GenDeionState" - Generator deion state
"GenFreqDown" - Generator frequency down
"GenFreqErr" - Generator frequency error
"GenFreqUp" - Generator frequency up
"GenSeqErr" - Generator phase sequence error
"GenVoltDown" - Generator voltage down
"GenVoltErr" - Generator voltage error
"GenVoltUp" - Generator voltage up
"GenWatLimCh4" - Power limitation by low methane level
"GenWatLimDis" - Power limitation by distributor
"GenWatLimMix" - Power limitation by high mixture temperature
"GenWatLimOil" - Power limitation by oil temperature
"GenWatLimUsr" - User limitation of power
"GenWatLimWtr" - Power limitation by primary water temperature
"Ignition" - Ignition
"KeyF1" - Function key F1
"KeyF2" - Function key F2

"KeyF3" - Function key F3
"KeyF4" - Function key F4
"KeySta" - Key START
"KeySto" - Key STOP
"ManCoolDown" - Manual cool-down
"MetAIn" - Pulse meter A input
"MetBIn" - Pulse meter B input
"MnsDeionCtrl" - Mains deion control
"MnsDeionState" - Mains deion state
"MnsErr" - Mains mismatch
"MnsFreqErr" - Mains frequency error
"MnsPlomb" - Mains protection settings seal
"MnsSeqErr" - Mains phase sequence error
"MnsVjmpErr" - Mains vector jump error
"MnsVoltErr" - Mains voltage error
"ModeAuto" - Automatic mode
"ModeCU0" - Controller mode 0
"ModeCU1" - Controller mode 1
"ModeManual" - Manual mode
"ModeOffline" - Mode OFF
"ModeSemi" - Semiautomatic mode
"ModeUserA0" - User mode A0
"ModeUserA1" - User mode A1
"ModeUserB0" - User mode B0
"ModeUserB1" - User mode B1
"OilLevLo" - Low oil level
"OilOldHi" - Dirty oil high level
"OilPreLo" - Low oil pressure
"OilPreLube" - Prelube
"OilRefLo" - Clear oil low level
"OilRefNo" - No clear oil
"OilRefSig" - Oil refil signalization
"Preheat" - Preheating
"Prestart" - Prestart
"PumpOilRef" - Clear oil refiling pump
"PumpPri" - Prim.cicruit pump
"PumpSec" - Sec.circuit pump
"Ready" - Ready
"RpmIdle" - Idle speed
"Run" - Run
"RunReq" - Run request
"RunReqMan" - Manual run request
"StMLoPos" - Step-motor closed
"StartRem" - Remote start request
"Starter" - Starter
"StopExt" - External stop by user
"Timer1" - Timer 1
"Timer2" - Timer 2
"UsrBINN" - User binary input NN
"UsrBONN" - User binary output NN
"Warning" - Warning
"Wtr3wPriClose" - Primary circuit 3 way valve close
"Wtr3wPriOpen" - Prim.circuit 3 way valve open
"Wtr3wSecClose" - Secondary circuit 3 way valve close
"Wtr3wSecOpen" - Sec.circuit 3 way valve open
"WtrLevLoPO" - Low water level in primary circuit
"WtrLevLoSO" - Low water level in secondary circuit

2.3 Logical binary inputs

2.3.1 “Cool” (Cooling)

2.3.1.1“WtrLevLoPO/SO” (Low water level in primary/secondary circuit)

Activation of this signal for longer than 2 seconds causes an immediate shutdown fault with the message "ERROR (Low water level)" and Appendix "primary circuit" or "secondary circuit" according to which of the inputs has been activated. Low water level also causes deactivation of the pump in the corresponding circuit.

2.3.2“Ctrl” (Control)

2.3.2.1“AckExt” (External acknowledge by user)

The rising edge of this signal causes the fault acknowledgment (not last if the reasons disorders) as well as keystroke "FAULT RESET".
After acknowledgment fault the logic binary output "Ack" 2s generates a pulse, which can be e.g. usef for fault acknowledgment in other devices (ignition, speed governor e.t.c.).

2.3.2.2 “BlsUsr” (Blocking start by user)

When this signal is active, start genset is blocked with the message "BLOCKING START (User)". Activation signal during operation of Genset has no effect.

2.3.2.3 “BlSyncUsr” (Synchronization blocking by user)

When this signal is active, it blocked phasing generator to the network. Activation signal during parallel operation cause unloading and generator contactor switch-off.
In manual mode, you can start genset, but GCB button for phasing is blocked.
In semi-automatic and automatic mode is genset when activating this signal stopped and if there is an request to run, start is blocked with the message "BLOCKING START (Synchronization blocking)."
On the genset in island mode does not affect the status of the signal.

2.3.2.4 “CentralCtop” (Central Stop)

Activation of this signal causes an immediate genset shutdown without cooling down with the message "ERROR (Central stop)". When this signal is active, deactivated is also oil prebube (shut down of the oil prelube pump), preheating, antifreeze function, primary and secondary pumps (regardless of water temperature) and control the primary and secondary 3-way valve.

2.3.2.5 “ModeCU0_1” (Controller mode 0_1)

Controller mode

- VYP (switched-off)
- MAN (manual)
- SEM (semiautomatic)
- AUT (automatic)

You can choose from the controller keyboard or from the PC by parameter "ModeCU". Using these binary inputs can also change the mode of controller using external signals or using an algorithm in the function. Signals activation changes the mode of the controller in accordance with the following table:

ModeCU1	ModeCU0	Reaction
0	0	Retain current controller mode
0	1	Switch controller mode to MAN
1	0	Switch controller mode to SEM
1	1	Switch controller mode to AUT

If the control system is in OFF mode, the status of these signals are ignored.
If control system is not in OFF mode, setting of these signals priority over the settings from the keyboard or from a PC. Thus, if one (or both) of the signals is active, the controller mode can not be changed from the keyboard or from PC.

2.3.2.6 “StartRem” (Remote start request)

The signal controls the requirement to operate in "AUT". If the signal is active and the CU mode is "AUT", genset starts. After deactivation a signalgenset start unloading and stop. Reactivation signal during the shutdown will cause interruptions shutdown and return genset back into operation.

2.3.2.7 “StopExt” (External stop by user)

Activation signal (pulse) cause slow genset shutdown as well as the "STOP" key. If the genset is in mode "AUT", will switch to the "SEM". If the signal is active even after the shutdown, the start of genset is blocked with the message "BLOCKING START (User)" as in the case of the active signal "BlsUsr".
The control system in "SEM" and "MAN" mode automatically starts after a power outage if the genset were in operation before. If this signal is mapped on the "Functions Reset" signal from the "System" group, make sure, that the control system will never start automatically after power restoring.

2.3.3“Eng” (Engine)

2.3.3.1 “AirFiltCho” (Air filter choked)

Activating of this signal cause slow genset shutdown with the message "ERROR (Air filter chocked)"

2.3.3.2 “OilLevLo” (Low oil level)

This is the engine oil level.
Activation signal for longer than 2 seconds causes an immediate genset shutdown with the message "ERROR (Low oil level) " with the note “Binary sensor".

2.3.3.3 “OilPreLo” (Low oil pressure)

Deactivating of this signal at the non-running genset (after genset run-down) causes blocking start with the message "BLOCKING START (High oil pressure)". CU by this way checks the pressure sensor, which must be on stopped genset detect as low oil pressure.
After the genset start signal must be deactivated at the latest until the expiry of the parameter "ProtDel" from the genset start.
Activation signal for longer than parameter "OilPreErrDel" cause immediate genset shut down with the message "ERROR (Low oil pressure)" with the note "Binary sensor".

2.3.3.4 “OilRefLo” (Clear oil low level)

It is the oil level in the refill container.
Activation of this signal causes the warning "WARNING (Clear oil low level)".

2.3.3.5 “OilOldHi” (Dirty oil high level)

It is the level of oil in the waste container.
Activation of this signal causes the warning "WARNING (Dirty oil high level)."

2.3.3.6 “OilRefNo” (No clear oil)

It is the oil level in the refill container.
Activation of this signal causes the warning "WARNING (Out of pure oil)."
Active signal blocks the activation of the pump for refilling oil.

2.3.3.7 “OilRefSig” (Oil refill signalization)

Processes indicating signal from a device for automatic replenishment of oil (OilMaster). If the signal oscillates with a period of at least 2s for more than 20 seconds a warning message appears "WARNING (Oil refill signalization)."
Permanent activation of the signal for longer than 5 seconds causes a slow genset shut down with the message "ERROR (Oil refill signalization)."

2.3.4“Fuel” (Fuel)

2.3.4.1 “FuelAB” (Fuel A/B)

Select the fuel type:

FuelAB	Reaction
0	Fuel A selected (usually natural gas)
1	Fuel B selected (other gas, where e.g. CH4 content can affect the mixture regulation)

Fuel type chosen, for example, a table used for controlling the mixture. The signal can further be transmitted to the ignition (advance for correction by fuel) or speed controller (for selecting sets of PID parameters).

2.3.4.2 „GasEscI“ (Gas escape level I)

Activating of this signal cause slow genset shutdown with the message "ERROR (Gas escape)" with the note "Low level".

2.3.4.3 „GasEscII“ (Gas escape level II)

Activating of this signal cause an immediate genset shutdown with the message "ERROR (Gas escape)" with the note "High level".
Active signal blocks further operation of prelube pump also.

2.3.4.4 „GasPreLo“ (Low gas pressure)

Activating of this signal cause fast genset shutdown with the message "ERROR (Gas pressure)" with the note "Low level".

2.3.5 “Gen” (Generator)

2.3.5.1 “GenCurOvrExt” (Generator overcurrent (external))

In addition to overcurrent, which evaluates its measurement control system, you can use this signal to use overload information e.g. from Deion.
Activating this signal cause fast genset shutdown with the message "ERROR (generator overcurrent)" with the note "External".

2.3.5.2 “GenDeionState” (Generator deion state)

Signal defines the actual position of the generator contactor (auxiliary contact information). If the actual status of the contactor is different from the required state-controlled signal "GenDeionCtrl" longer than the time given by the parameter "DeionDelMax" will occure shutdown with the message "ERROR (Generator deion feedback)."

2.3.6 “Mns” (Mains)

2.3.6.1 “MnsDeionState” (Mains deion state)

Signal defines the actual state of the network contactor (auxiliary contact information). If the actual status of the contactor is different from the required state-controlled signal "GenDeionCtrl" longer than the time given by the parameter "DeionDelMax" will immediately fault shut-down with the message "ERROR (Mains deion feedback)."
Deion network status determines the mode of the unit P (parallel), or I (island)

2.3.6.2 “MnsErr” (Mains mismatch)

Serves for optional connection of a signal from an external network protection (except for network errors that evaluates their measurements CU)
Activation signal during operation will cause fast genset shutdown with the message "ERROR (Mains mismatch)" active signal in the "AUT" or "SEM" mode causes blocking start with the "BLOCKING START (Mains mismatch)". In the "MAN" mode start of genset is not blocked, but active signal blocking the genset synchronization. If a network fault is evaluated by internal protections, the message "BLOCKED START / FAULT (error frequency / voltage error)" will appear.

2.3.7“ModBUS” (ModBUS)

2.3.7.1 “ModBUSx100_0/3” (ModBUS [0x100.0/3])

Signals "ModBUSx100_0", "ModBUSx100_1", "ModBUSx100_2" and "ModBUSx100_3" are the four lowest bits Modbus register address 0x100 sent to the control system. Using these signals can genset controlled via Modbus register (eg. send a request to the run, if any of these signals leads to an external request runtime).

2.3.8 „Other“ (Other)

2.3.8.1„MetAIn“ (Pulse meter A input)

Rising edge of the pulse signal increments the counter value A of the parameter "MetAStep".

2.3.8.2 „MetBIn“ (Pulse meter B input)

Rising edge of the pulse signal increments the counter value B of the parameter "MetBStep".

2.3.8.3 „StMLoPos“ (Step-motor closed)

Signal is only available at the RS, which has outputs for controlling the stepper motor.
Active signal defines the low end position of the stepper motor. At the reset position of the stepper motor after the activation of this signal, interrupts the closing of the stepping motor and set to its zero position. If during the closing activation of this signal, the stepping motor closes the number of steps given range KM (number of steps to move from one end position to another), which should certainly reach the lower mechanical stop.

2.3.9“Unit” (Unit common)

2.3.9.1 “Fire” (Smoke detector)

Activating of this signal cause an immediate genset shutdown with the message "ERROR (Smoke detector)". When this signal is activated, prelube pumo is deactivated also.

2.3.10“User” (User)

2.3.10.1 “UsrBI_n” (User binary input n)

User digital inputs 1 ÷ 28 (depending on device type). Serves to bring the signals of physical inputs, expansion modules, or other devices attached on the UNIMA RS-485 bus to the device PLC functions, where you can use function blocks to create custom algorithms.

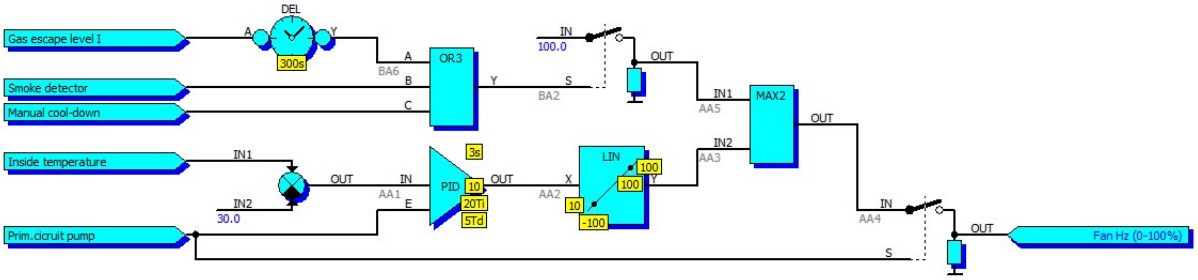
2.4 Logical binary outputs

Some logical binary outputs can be mapped directly to physical outputs, some can only be used in functions. If we need to connect a logical signal that is only available in the functions, we create a logical output that is available in mapping using the "REP" block.

2.4.1"Cool" (Cooling)

2.4.1.1"ManCoolDown" (Manual cool-down)

The signal is activated when manual cooling is selected in the menu. In addition to automatic activation of internal cooling algorithms (pump activation, pre-lubrication), this signal can be used to activate other user devices in functions (inside fan, emergency cooling) that can provide faster engine cooling.



2.4.1.2"PumpPri" (Primary circuit pump)

The signal controls the operation of the primary pump.
The pump is activated during pre-start and deactivates after cooling down (after the "PumpTime" time after stopping the genset).
The pump is activated further when requested for manual cooling, preheating, or if the primary temperature is higher than a warning.
The pump is always deactivated when the "CentralStop" signal is active, when the "WtrLevLoPO" signal is active or when the "OFF" mode is selected.

2.4.1.3"PumpSec" (Secondary circuit pump)

The signal controls the operation of the secondary pump.
The pump is activated during pre-start and deactivates after cooling down (after the "PumpTime" time after stopping the genset).
The pump is activated further when required for manual cooling, preheating (if the secondary 3-way valve is pre-heated) or if the primary temperature is higher than the warning.
The pump is always deactivated when the "CentralStop" signal is active, when the "WtrLevLoSO" signal is active or when the "OFF" mode is selected.

2.4.1.4"Wtr3wPriOpen/Close" (Primary circuit 3-way valve open/close)

Three-way valve position control signals for primary water temperature control. During the operation of the primary pump, pulses are generated to open / close the three-way valve so that the desired temperature in the primary circuit (optional at the inlet or outlet) is reached. The length of the control pulses is the direct deviation of the measured and desired temperature and the proportional and derivative components of the control. In the unloaded run, a lower setpoint can be set to reduce the temperature before stopping. The behavior of the valve during prestart or preheating can be affected by the parameter. In idle state, the valve is always closed.

2.4.1.5"Wtr3wSecOpen/Close" (Secondsry circuit 3-way valve open/close)

Three-way valve position control signals for primary water temperature control.

During the operation of the secondary pump, pulses are generated to open / close the three-way valve so that the desired temperature in the secondary circuit (optional at the inlet or outlet) is reached. The length of the control pulses is the direct deviation of the measured and desired temperature and the proportional and derivative components of the control. Valve idle behavior or valve behavior in prestart of preheating can be affected by the parameter.

2.4.2"Ctrl" (Control)

2.4.2.1"Ack" (Acknowledge)

When you press the "FAULT RESET" key or the "ActExt" signal edge rises, a 2s long pulse is generated on this signal. The signal can be used to acknowledge of the faults in nearby devices (connected via RS-485).

2.4.2.2"Emergency" (Energency mode)

The signal defines the mode of emergency running of the unit in "E" mode. It activates when a network failure occurs and deactivates when the emergency genset returns the load back to the network after it resumes.

2.4.2.3"KeyF1-F4" (Function key F1-F4)

You can create custom buttons in the Monitor of Service SW. Pressing the button generates a pulse on the appropriate signal. Can be used in functions to control user functions with buttons in the monitor.

2.4.3"Eng" (Engine)

2.4.3.1"Ignition" (Ignition)

The signal controls the ignition.
It is activated with the delay "IgnDel" from the moment when the speed of the genset exceeds the minimum speed of the start "StaRpmMin".

2.4.3.2"OilPreLube" (Prelube)

The signal controls the oil prelube pump.
It is activated at the start and deactivates after a successful start. It is inactive during the run of the genset. It is also activated for 20 minutes after the genset has stopped. Pre-lubrication is always deactivated when the "CentralStop", "Fire" or "GasEscII" signal is active.
When the genset is not running, pre-deletion can be activated or deactivated from the controler menu by manual prelubrication or manual cooling item.

2.4.3.3"Preheat" (Preheating)

The signal controls the preheating of the engine (if "PreheatEn" and / or "AntifreezeEn" are enabled).
It is activated at the time of the start request if the temperature is lower than the start temperature (the "PreheatEn" parameter is activated). Deactivated when the preheat temperature is reached - "PrehearTemOff".
It is activated at any time on a stationary genset if the temperature is below "AntifreezeTemOff" parameter (the "AntifreezeEn" parameter is activated). Deactivated after reaching the preheating temperature "AntifreezeTemOff".
To deactivate the preheating with the "FAULT (Preheat)" fault message will occur if the pre-heating activation temperature does not rise by at least 5 ° C over the time given by the "Preheat5sC" parameter.
If the primary circuit of the genset is not equipped with a heat source for preheating, and the genset is not the only heat source, the primary and secondary 3-way valve can be set to "Active (open)" during preheating. The genset can thus be preheated through the exchanger from the secondary circuit.

2.4.3.4"Prestart" (Prestart)

The signal indicates the prestart phase of the genset.
It is activated at the time of the start command for the time given by the "PreStaTim" parameter. After this time it is deactivated (simultaneously with activation of the starer).

2.4.3.5"PumpOilRef" (Clear oil refiling pump)

The signal controls the clean oil refill pump (pumping the oil from the refilling tank to the engine).
The oil refill pump is automatically activated only on the running genset if the engine oil level is lower than the value given by the "OilLevRefSta" parameter to start refueling and the "OilRefNo" signal is not active (clean oil is available in the refilling tank). However, activation can only take place once every 24 hours, and the temperature of the oil is higher than warming.
Deactivation of the pump occurs when the oil level in the engine reaches the value given by the "OilLevRefSto" parameter for completing the replenishment, then if the "OilRefNo" signal is reached (the oil in the refilling tank has run out) or if the refilling of the oil continues for 20 minutes.
The oil refilling pump can also be manually activated or disabled from the controller menu. The pump is manually activated for up to 20 minutes (then switches off

automatically). After the oil has been manually replenished, the automatic replenishment can take place at the earliest 24 hours.

2.4.3.6"RpmIdle" (Idle speed)

The signal indicates idle speed genset running.
It is activated after a successful start of 2 seconds after deactivation of the starter.
Deactivated after changing the genset to nominal speed.
The signal can be used in the USC Speed Controller to synchronize the idling speed.

2.4.3.7"Starter" (Starter)

The signal controls the starter.
It is activated after the pre-start.
Deactivated after a successful start (the speed of the genset exceeds the "StaRpmOff" value for starter disconnection) or after a failed start (the starter goes longer than "StaMaxTim").

2.4.4"Fuel" (Fuel)

2.4.4.1"GasSol" (Gas solenoid)

The signal controls the gas valve. It is activated with the delay "SolDel" from the moment when the speed of the genset exceeds the minimum speed of the start "StaRpmMin".

2.4.5"Gen" (Generator)

2.4.5.1"GenCurOvr" (Generator overcurrent)

The signal detects overcurrent of the generator.
Activated in the following cases:

- without delay when the "GenCurOvrExt" (external overcurrent) signal is active.
- if the overcurrent generator is higher than "GenCurHi1" for longer than five times the "GenCurHiDel"
- if the overcurrent generator is higher than "GenCurHi2" for longer than "GenCurHiDel"
- if the generator current asymmetry is greater than "GenCurUn" for longer than "GenCurUnDel"

It will deactivate automatically after the cause of activation has disappeared, but the fault message on the CU display must be acknowledged.

2.4.5.2"GenDeionCtrl" (Generator deion control)

Signal for generator contactor control.

2.4.5.3"GenFreqDown" (Generator frequency down)

Speed reduced drive signal in the case of setting the speed correction by binary signals +/-.

2.4.5.4"GenFreqErr" (Generator frequency error)

The signal is activated at generator frequency error (overfrequency, underfrequency)

2.4.5.5"GenFreqUp" (Generator frequency up)

Speed incremental drive signal in the case of setting the speed correction by binary signals +/-.

2.4.5.6"GenSeqErr" (Generator phase sequence error)

The signal is activated in the event of phase failure on the generator.

2.4.5.7"GenVoltDown" (Generator voltage down)

Signal to reduce the generator voltage in the case of voltage correction is set by +/- binary signals.

2.4.5.8"GenVoltErr" (Generator voltage error)

Signál se aktivuje při chybě napětí generátoru.

2.4.5.9"GenVoltUp" (Generator voltage up)

Signal for increasing the generator voltage in the case of voltage correction by binary signals +/-.

2.4.5.10"GenWatLimCh4" (Power limitation by low methane level)

It is activated if the power of the genset is limited due to the low amount of methane.

2.4.5.11"GenWatLimDis" (Power limitation by distributor)

It is activated if the power of the genset is limited by the distributor dispatch through the RTU.

2.4.5.12"GenWatLimMix" (Power limitation by mixture temperature)

Activates if the power of the genset is limited due to the high temperature of the mixture.

2.4.5.13"GenWatLimOil" (Power limitation by oil temperature)

Activates if the power of the genset is limited due to the low oil temperature.

2.4.5.14"GenWatLimUsr" (User limitation of power)

Activates if the power of the genset is limited based on the user signal.

2.4.5.15"GenWatLimWtr" (Power limitation by primary water temperature)

It is activated if the power of the genset is limited due to the low or high temperature of the cooling water.

2.4.6"Mns" (Mains)

2.4.6.1"MnsDeionCtrl" (Mains deion control)

Signal for control of the network contactor.

2.4.6.2"MnsFreqErr" (Mains frequency error)

The signal is activated when the network frequency is failury (overfrequency, underfrequency)

2.4.6.3"MnsSeqErr" (Mains phase sequence error)

The signal is activated when a phase sequence error occurs on the network.

2.4.6.4"MnsVjmpErr" (Mains vector jump error)

The signal is activated for a defined time with a vector leap.

2.4.6.5"MnsVoltErr" (Mains voltage error)

The signal is activated in the event of a network voltage fault (overvoltage, undervoltage).

2.4.7"Sta" (State)

2.4.7.1"Error" (Error)

It is activated in the event of any genset failure. The signal is deactivated only when the error is acknowledged (if no fault is already present)

2.4.7.2"ModeAuto" (Automatic mode)

The signal is active when auto mode is selected ("AUT")

2.4.7.3"ModeManual" (Manual mode)

The signal is active when manual mode is selected ("MAN")

2.4.7.4"ModeOffline" (Mode OFF)

The signal is active when OFF mode is selected ("OFF")

2.4.7.5"ModeSemi" (Semiautomatic mode)

The signal is active when semi-auto mode is selected ("SEM")

2.4.7.6"ModeUserA0/A1" (User mode A0/A1)

The signals are set according to the selected user item in the controler menu (it can be controlled via the Monitor od service SW also) as follows:

A1	A0	User Mode A (menu name A)	The menu name and menu items can be defined in the display configuration
0	0	User Mode A0 (item 1 menu A)	
0	1	User Mode A1 (item 2 menu A)	
1	0	User Mode A2 (item 3 menu A)	
1	1	User Mode A3 (item 4 menu A)	

2.4.7.7"ModeUserB0/B1" (User mode B0/B1)

The signals are set according to the selected user item in the controler menu (it can be controlled via the Monitor od service SW also) as follows:

B1	B0	User Mode B (menu name B)	The menu name and menu items can be defined in the display configuration
0	0	User Mode B0 (item 1 menu B)	
0	1	User Mode B1 (item 2 menu B)	
1	0	User Mode B2 (item 3 menu B)	
1	1	User Mode B3 (item 4 menu B)	

2.4.7.8"Ready" (Ready)

The signal is active when the genset is ready to start (it is standing, it does not cause a fault or a start blocking signal)

2.4.7.9"Run" (Run)

The signal is active when the genset is in operation

2.4.7.10"RunReq" (Run request)

The signal is active when the run request is active (RunReqMan is active in manual and semi-automatic mode or the "StartRem" remote start signal is in automatic mode).
If a fault or a start blocking signal is not active, the genset will start pre-start when the signal is activated.

2.4.7.11"RunReqMan" (Manual run request)

The signal is activated by pressing the "START" key.
The signal is deactivated in the following cases:

- pressing "STOP"
- setting genset mode to "OFF"
- after restoring the network to an "E" type unit in automatic mode

The signal status is maintained even when the power supply voltage is turned off.
If the unit is in manual or semi-automatic mode and there is no malfunctioning or start-blocking signal, the set will start the prestart when this signal is activated.

2.4.7.12"Warning" (Warning)

The signal is active if there is a message on the alarm list (warning triangle flashes)

2.4.8"Sys" (System)

2.4.8.1"Clk1s" (Periodic signal 1s)

Signal with 1s period and 1:1 alternating. Using a frequency divider, a delay or a monostable flip-flop, it can be used in functions to generate time user functions.

2.4.8.2"FuncRes" (Functions reset)

The signal is active at the first functions calculation after the CU reset. It can be used in functions, for example, to ensure the required state of user logic after a CU reset.

2.4.8.3"Timer1/2" (Timer 1/2)

The "Timer1" and "Timer2" signals are activated according to the user-defined weekly, half-hour plan.

2.4.9"User" (User)

2.4.9.1"UsrBO_n" (User binary output n)

User binary outputs 1÷16

2.5 Logical analog inputs

2.5.1"Comb" (Combusion)

2.5.1.1"CylTem_n" (Cylinder temperature n)

Cylinder temperature 1 ÷ 24 (depending on the type of controller). Depending on the average cylinder temperature, the richness of the mixture can be controlled.

2.5.1.2"ExhTem" (Exthoust temperature)

Exthoust temperature.

2.5.1.3"Lambda" (Lambda probe voltage)

Voltage on lambda probe. Depending on the voltage at the lambda probe, the richness of the mixture can be controlled.

2.5.2"Cool" (Cooling)

2.5.2.1"WtrTemPriIn" (Primary input water temperature)

Coolant water temperature at engine inlet. The temperature of the water in the engine can be optionally adjusted based on this temperature.

2.5.2.2"WtrTemPriOut" (Primary output water temperature)

Coolant water temperature at the engine outlet. Based on this temperature, engine protection and power limitations work with the primary water temperature. The temperature of the water in the engine can be optionally adjusted based on this temperature.

2.5.2.3"WtrTemSecIn" (Secondary input water temperature)

Coolant water return temperature. The water temperature in the secondary cooling circuit can be optionally adjusted based on this temperature.

2.5.2.4"WtrTemSecOut" (Secondary output water temperature)

Cooling water outlet temperature. The water temperature in the secondary cooling circuit can be optionally adjusted based on this temperature.

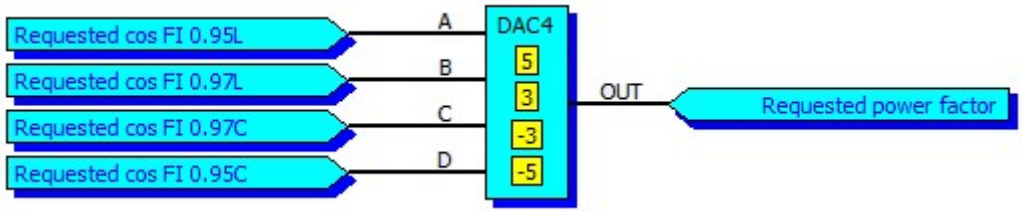
2.5.2.5"Ctrl" (Control)

2.5.2.6"GenCosReq" (Requested power factor)

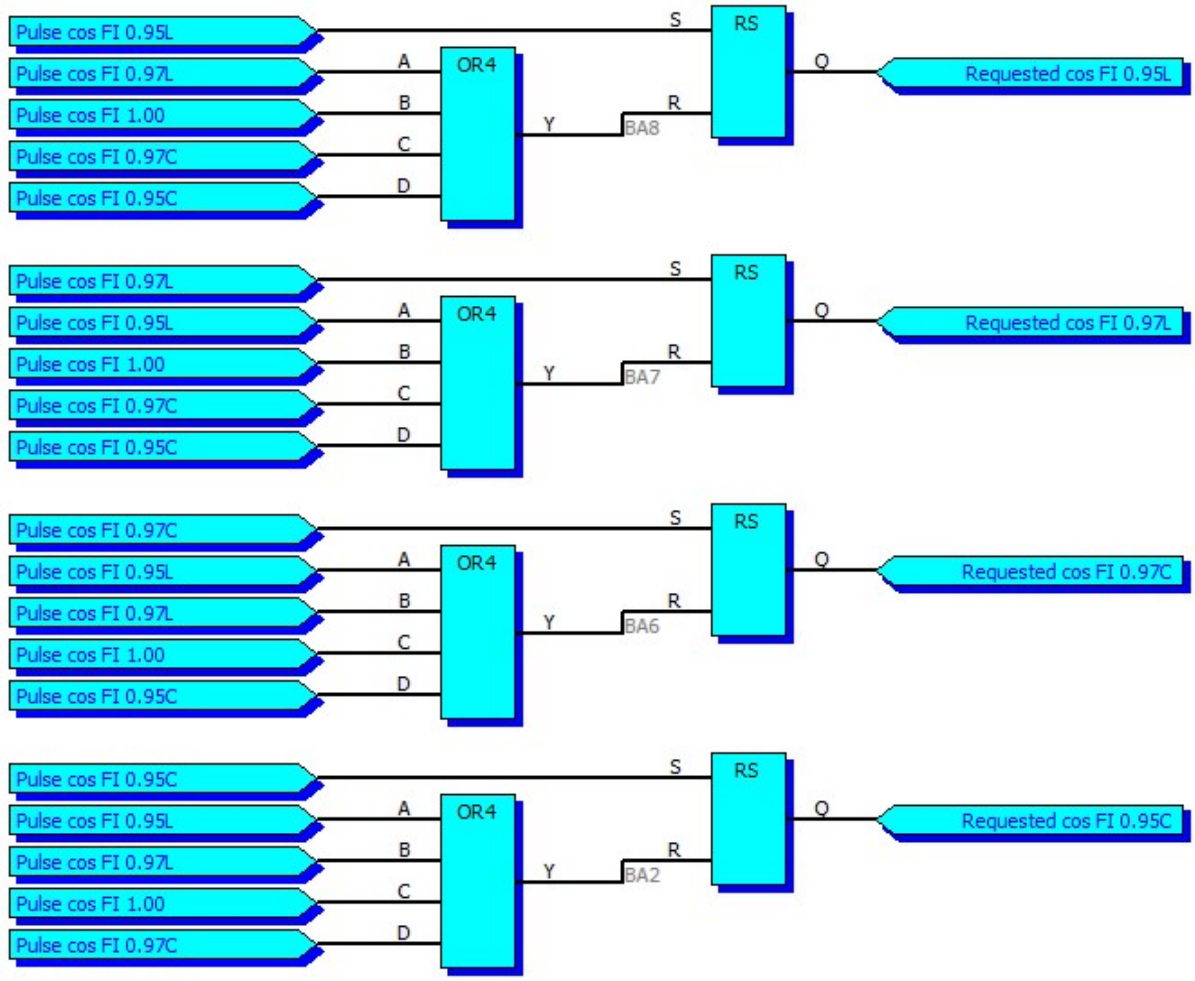
The logic input is for power factor regulation.
If the input is not connected (unapproved), the value of the power factor to be controlled is given by the value of the "GenCosReq" parameter.
If this logic input is connected, the "GenCosReq" parameter is lost and the required power factor is controlled by this signal (in the range -20 ÷ 20) according to the following table:

„GenCosReq“ signal value	<= -20	-10	0	10	>= 20
Requested power factor	-0.80	-0.90	1.00	0.90	0.80

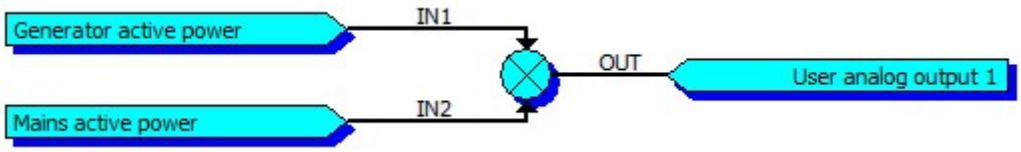
The logic input can be used in the case of dispatching control of the required power factor. Based on the binary signals with the required power factor, a "alcatel" output is created with the "DAC4" block, which is mapped to the "GenCosReq" signal.



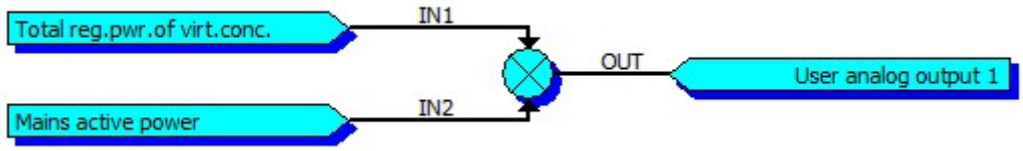
If the control signals for the power factor are only pulses, it is first necessary to convert these pulses to permanent requirements:



"GenWatExt" (External power request (copy))
This logical signal indicates the required power in copy mode. By means of it you can define the required power eg by an analogue signal or create a power control to "zero", when no parallel power supply is supplied or taken to the network.
If the measurement of the power supplied to the network is connected so that the positive sign means a take-off, then the power control to zero will be achieved by locking the user output created by the following function with this input:



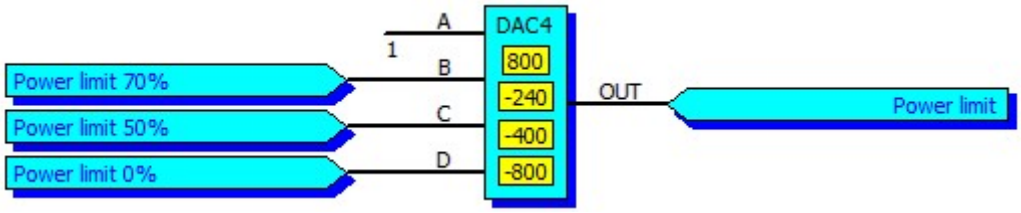
If more controllers is connected to each other, the virtual concentrator parameter is activated and in the "AUT" and "COPY" mode, it is sufficient to bring the required power information into only one control unit and the operation (start, stop, power) automatically on request. The control to zero function must then be created as follows:



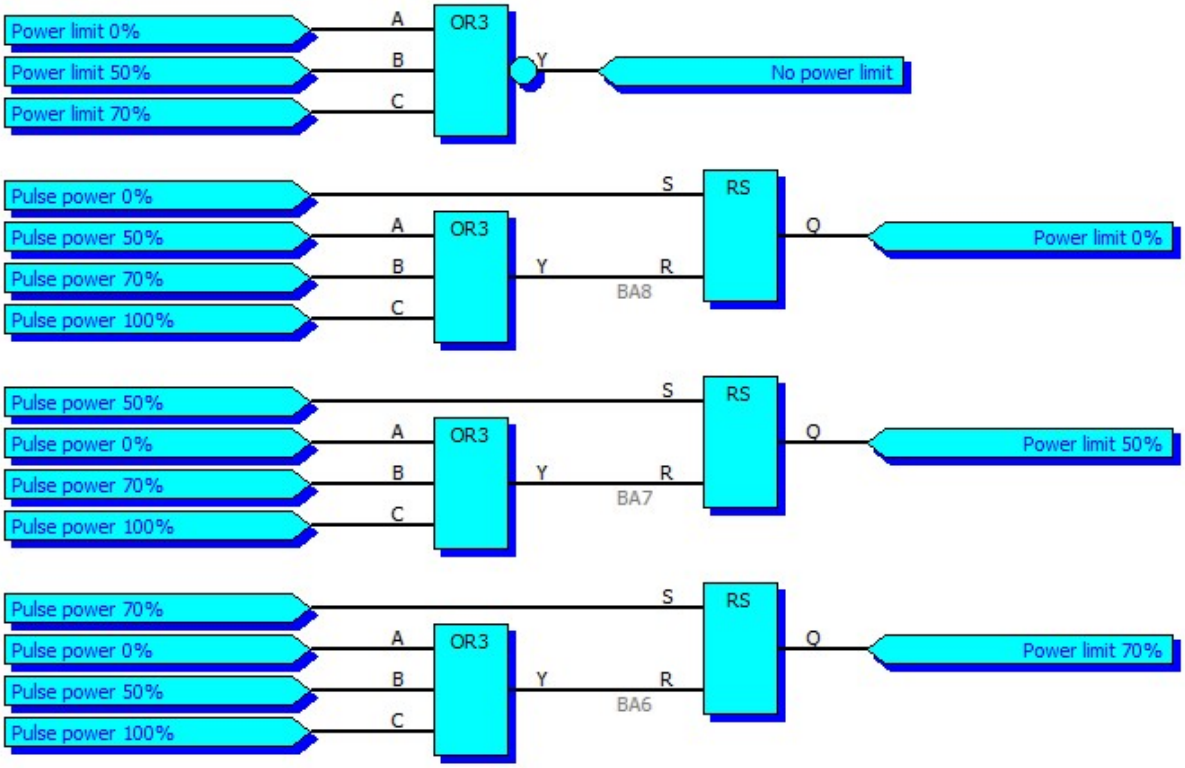
"Total Regulated Virtual Concentrator Power" is the total power of all units (the power all units control). The generated user signal defines the total required power divided by the virtual concentrator between the units.
By connecting this signal to, for example, "ModBUSx100_N", you can enter the required communication power via ModBUS.

2.5.2.7"GenWatLimDis" (Omezení výkonu distributorem)

The signal defines the power limitation by the distributor (the maximum power allowed by the distributor).
If the power limitation is zero by the distributor, the unit will shut down slowly and then lock the start until the limit is re-raised.
If the power limit is higher than the required power, there is no interference in performance control.
Based on binary inputs, the value of the performance limitation by the distributor can be made by the following function (and by locking the user output "Power limit" to this logical input):

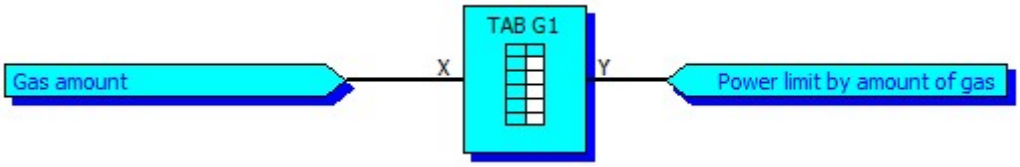


The example calculates the nominal power of the 800kW unit.
If the control signals for power limitation by the distributor are only impulses, it is first necessary to convert these pulses into permanent requirements:



2.5.2.8"GenWatLimUsr" (User limitation of power)

The signal defines power limitations based on any signal or user function (for example, depending on the amount of gas):



Mapping the user output „Power limit by amount of gas“ on this logic input and defining the "TAB G1" table with power limitation depending on the amount of gas will reduce the output of the unit according to the amount of gas.

Table G1 Y=f(X) "FuncTabG1" #12

Input X	Output []
40.0	300.0
50.0	300.0
60.0	400.0
70.0	500.0
80.0	600.0
85.0	700.0
90.0	800.0
100.0	800.0

If the power limit is higher than the required power, there is no interference in performance control.
If the power limit is lower than the minimum power, performance is limited to the minimum power value.

2.5.3"Eng" (Engine)

2.5.3.1"AirTemIn" (Intake air temperature)

Intake air temperature. If the temperature rises above the limit given by the "AirTemIntVar" parameter, a warning is triggered. Crossing the limit given by the "AirTemIntHi" parameter will cause a slow failure shutdown. The emergency temperature limit is monitored only after the "ProtDel2" has elapsed since the start.

2.5.3.2"OilLev" (Oil level)

Oil level in the engine.
If the oil level drops below the minimum limit ("OilLevLo"), an engine fault will be immediately malfunctioning with the message "FAILURE (Low oil level)".
If the oil level rises above the maximum limit ("OilLevHi"), an engine fault will be immediately malfunctioning with the message "FAILURE (Oil overloaded)".
Based on this logic input, the clean oil pump is also started in the engine (see logic output "PumpOilRef")

2.5.3.3"OilPre" (Oil pressure)

Lubricating oil pressure in the engine.
Decreasing the pressure during engine run under a defined delay time limit will cause an immediate malfunction of the engine with the message "FAILURE (Low Oil Pressure)" and "Analog Sensor".
The pressure drop during engine running below the warning threshold will cause the warning message "WARNING (Low Oil Pressure)".
For the last 5 seconds, the oil pressure must be higher than the minimum pres- sure pressure. The minimum pre-lubrication pressure is not tested if the pre-start time is less than 10 s or when the minimum pre-lubrication pressure ("OilPrePre") is set to 0 kPa (for example, if an electric oil pre-oil pump is not installed).
If there is high pressure when the engine is stationary, the start is blocked (oil pressure sensor error)

2.5.3.4"OilTem" (Oil temperature)

Engine oil temperature. Increased oil temperature causes a warning "WARNING (High oil temperature)", high oil temperature, gradual malfunctioning with cooling down, and "FAILURE (High oil temperature)". The low oil temperature limits power to the heating value and blocks the operation of the pure oil refill pump

2.5.3.5"Rpm" (Rpm)

Speed of the set. Based on measured speeds, the speed is adjusted to the required value, the starter is disconnected, the overrun and the deceleration are monitored.

2.5.4"Fuel" (Fuel)

2.5.4.1"GasCH4" (Methane content in gas)

The level of methane in the fuel. If "B" ("FuelAB" = 1) is selected, the amount of methane can affect the mixer's start position and consequently the richness control (the value of the quantity to regulate the richness of the mix depends on the amount of methane).
If the "B" fuel is selected and the "TabGenWatLimCh4" table is active, the power reduction in this table occurs when the methane level drops. If the amount of methane drops below the value defined in the first line of the table, a "FAULT (Low Methane)" error message will occur.

2.5.4.2"GasPre" (Gas pressure)

Gas pressure is only for monitoring. The low gas pressure fault is caused only by the logical binary input "GasPreLo".

2.5.4.3"GasTem" (Gas temperature)

The temperature of the mixture is for monitoring purposes only.

2.5.4.4"MixPre" (Mixture pressure)

Pressure of the filling mixture. According to the pressure of the filling mixture, the richness of the mixture can optionally be controlled.

2.5.4.5"MixTem" (Mixture temperature)

Temperature of the filling mixture. If an emergency temperature is exceeded ("MixTemErr"), an emergency breakdown occurs with the message "FAILURE (Mix Temperature)". If the temperature of the mixture is higher than "MixTemLim", performance is limited.

2.5.5"Gen" (Generator)

2.5.5.1"GenCos" (Generator power factor)

Current power factor of the generator. The value ranges from -20 to 20, which corresponds to the power factor of -0.80 ÷ 0.80. Power factor values less than -0.80 and greater than 0.80 are not displayed. If the power factor is longer than -0.75 (higher than 0.75) for longer than the "GenCosRegErrDel" parameter, slow shutdown failure and "FAULT (underserved power factor)" will occur.

2.5.5.2"GenCurA/B/C" (Generator current in phase A/B/C)

Generator currents in individual phases. It is used for overcurrent protection of the generator, when the protection is applied, there is an immediate malfunctioning with cooling down and the fault (overcurrent generator).
For proper measurement of currents (power), it is necessary to correctly set the value of the current transformer for measurement on the generator ("GenCurTr").

2.5.5.3"GenFreq" (Generator frequency)

Generator frequency calculated from the alternating voltage period in phase "A" of the generator. Frequency is measured if the generator voltage is greater than 25V. It serves to protect the generator frequency and to phase the generator to the grid. If the protection is applied, an immediate failure occurs with the message "FAULT (Generator Frequency Error)"

2.5.5.4"GenPhs" (Angle difference beetwen first phase of mains and generator)

Phase difference between grid voltage and generator.

2.5.5.5"GenVar" (Generator reactive power)

Total reactive power of the generator (sum of "GenVarA" + "GenVarB" + "GenVarC").
The voltage ratio ("VoltTr") must be set correctly for correct power measurement.

2.5.5.6"GenVarA/B/C" (Generator reactive power in phase A/B/C)

Reactive power of the generator in individual phases.

2.5.5.7"GenVarReg" (Requested generator reactive power)

Required reactive power of the generator. The CU calculates this value based on the required power factor and the current active generator power.

2.5.5.8"GenVoltA/B/C" (Generator voltage in phase A/B/C)

Voltage in the individual phases of the generator. It is used for voltage protection of the generator, when the protection is applied, there is an immediate malfunction with the message "FAILURE (Generator voltage error)". The voltage transformer ratio setting for the VN generator does not affect the voltage measurement (power only). Therefore, the nominal network voltage must be set to the value of the voltage transformer.

2.5.5.9"GenWat" (Generator active power)

Total Generator Active Power (Sum of "GenWatA" + "GenWatB" + "GenWatC")
For the correct power measurement, the ratio of the voltage transformer ("VoltTr") and current transformer ("GenCurTr") must be correctly set.

2.5.5.10"GenWatA/B/C" (Generator active power in phase A/B/C)

Active power in the individual phases of the generator.

2.5.6"Mns" (Mains)

2.5.6.1"MnsCurA/B"C (Mains current in phase A/B/C)

The current supplied to the network in each phase.
For the correct measurement of currents (outputs), it is necessary to set the current value of the current transformer for measurement on the generator ("MnsCurTr").

2.5.6.2"MnsFreq" (Mains frequency)

Network frequency calculated from the alternating voltage period in phase "A" of the generator. Frequency is measured if the network voltage is higher than 25V. For frequency protection of the grid and phasing of the generator to the grid, an immediate malfunctioning with "FAULT (network frequency error)" occurs when the protection is applied.

2.5.6.3"MnsVar" (Mains reactive power)

Total reactive power delivered to the network (sum of "MnsVarA" + "MnsVarB" + "MnsVarC").
The voltage ratio ("VoltTr") must be set correctly for correct power measurement.

2.5.6.4"MnsVarA/B/C" (Mains reactive power in phase A/B/C)

Reactive power delivered to the network in each phase.

2.5.6.5"MnsVoltA/B/C" (Mains voltage in phase A/B/C)

Voltage at each phase of the network. It is used for voltage protection of the mains, when the protection is applied, there is an immediate malfunction with the message "FAILURE (Network voltage fault)". The voltage transformer ratio setting for the VN generator does not affect the voltage measurement (power only). Therefore, the nominal network voltage must be set to the value of the voltage transformer.

2.5.6.6"MnsWat" (Mains active power)

Total active power delivered to the network (sum of "MnsWatA" + "MnsWatB" + "MnsWatC")
The voltage ratio ("VoltTr") and current transformer ("MnsCurTr") must be correctly set for correct power measurement.

2.5.6.7"MnsWatA/B/C" (Mains active power in phase A/B/C)

Active performances at each phase of the network.

2.5.7"ModBUS" (ModBUS)

After ModBUS, four analog values can be written to the controller, which can then be mapped, for example, to ordered performance or other user functions.

2.5.7.1"ModBUSx100" (ModBUS [0x100])

The value written by command „6“ (Write Single register) throught ModBUS to 0x100.

2.5.7.2"ModBUSx101" (ModBUS [0x101])

The value written by command „6“ (Write Single register) throught ModBUS to 0x101.

2.5.7.3"ModBUSx102" (ModBUS [0x102])

The value written by command „6“ (Write Single register) throught ModBUS to 0x102.

2.5.7.4"ModBUSx103" (ModBUS [0x103])

The value written by command „6“ (Write Single register) throught ModBUS to 0x103.

2.5.8"PwrShr" (Virtual concentrator)

2.5.8.1"PwrShrGevWatExt" (Total requested power of virtual concentrator)

The total required power with the cooperation of more CU. The virtual concentrator will automatically divide this value between individual gensets.

2.5.8.2"PwrShrWatSum" (Total regulated power of virtual concentrator)

Total controlled power with the cooperation of more CU (the sum of all regulated unit outputs).

2.5.9"Unit" (Unit common)

2.5.9.1"InsTem" (Inside temperature)

Temperature inside the unit. If the temperature rises above the limit given by the "AirTemInsVar" parameter, a warning is triggered. Exceeding the limit given by the "AirTemInsHi" parameter will cause a slow failure shutdown. The emergency temperature limit is monitored only after the "ProtDel2" has elapsed since the start.

2.5.9.2„ConTem“ (Controller temperature)

Temperature inside the control system. It can be used, for example, to control the ventilation of the switchboard.

2.5.9.3"User" (User)

2.5.9.4"UsrAI_n" (User analog input n)

User analog inputs 1 ÷ 16 (depending on device type). It is used to provide signals from physical inputs, expansion modules, or other UNIMA devices connected to the RS-485 into functions where user algorithms can be created using function blocks.

2.6Logical analog outputs

Some logical analog outputs can be mapped directly to physical outputs, some can only be used in functions. If we need to connect a logical signal that is only available in the functions, we create a logical output that is available in mapping using the "REP" block.

2.6.1"Comb" (Combusion)

2.6.1.1"CylTemAvg" (Cylinder average temperature)

Average value of all measured cylinder temperatures that are connected (mapped). Based on the deviation of the individual cylinder temperatures and this average value, the temperature difference of the cylinder causing an immediate failure shutdown with cooling is evaluated. According to the pressure of the filling mixture, the richness of the mixture can optionally be controlled.

2.6.2"Eng" (Engine)

2.6.2.1"RpmRamp" (Speed regulation ramp)

The speed value, which is regulated after the start. After activating the speed control, the value at which the speed is controlled gradually increases to the nominal speed. The speed control ramp is only used if the speed is controlled directly by the integrated PID controller ("RpmRegSel" = "Internal PID control").

2.6.2.2"RpmReg" (Speed regulation)

Output for speed and power control.
With analogue control of the external speed controller ("RpmRegSel"), this signal is mapped to the output that controls the speed controller (usually the SSC output). The default value corresponds to the "RpmCorDef" parameter and varies between RpmCorDef - "RpmCorRng", "RpmCorDef" + "RpmCorRng"> during the speed and phase control. During parallel operation, this signal controls the power of the genset. The value can be within the maximum range <-100,100>%, which corresponds to the output control voltage <-10,10> V.
When controlling the internal PID controller ("RpmRegSel" = "Internal PID control"), the output value is within the range of <0,100>% and corresponds to the flap opening request.
For speed control with the USC controller ("RpmRegSel" = "USC Control"), the Heinzmann AC position is read from the speed controller via the data communication. USC regulates to the desired speed value sent by the RMS signal "RpmReq".

2.6.2.3"RpmReq" (Requested speed)

In addition to phasing, the required speed is identical to the nominal speed. During phasing, the value is calculated from the frequency of the grid and the number of poles of the generator.

2.6.3"Fuel" (Fuel)

2.6.3.1"MixRegPos" (Mixture regulation position)

Required mixer position. When the start request is opened, it opens to the start position. After starting, it switches to the idle and low-power positions. Once the conditions are met (power to start the control, delay), the mixture's richness control is started. Both the starting positions as well as the way of controlling the richness of the mixture are determined by the tables. By activating the appropriate table (the required lambda probe voltage depending on the power, the required pressure of the mixture depending on the power, the required average cylinder temperature depending on the power), the way of controlling the richness of the mixture is automatically selected. Without any firmware intervention (adding only a table with dependencies of any max. Value), you can add any way of controlling the richness (for example, only by the position of the power flap). Two tables (both for start and for control) can be activated, which can be switched by "FuelAB" during operation. In this way, it is possible to choose not only the various parameters of the table, but also to switch the way of control of the mixture.

2.6.3.2"MixReqVal" (Requested value of controlled variable for mixture regulation)

The setpoint to which the variable is controlled to regulate the mixture's richness (required voltage on the Lambda probe, required mix pressure, required cylinder temperature, etc.)

2.6.4"Gen" (Generator)

2.6.4.1"GenVoltReg" (Voltage regulation)

Output for voltage control and generator excitation.
With analog voltage control ("GenVoltRegSel"), this signal is mapped to the output that controls the voltage regulator (usually the SVC output). The default value corresponds to the "GenVoltCorDef" parameter and varies between the "GenVoltCorDef" - "GenVoltCorRng", "GenVoltCorDef" + "GenVoltCorRng"> during voltage and phase control. During parallel operation, this signal controls the generator power factor. The value can be within the maximum range <-100,100>%, which corresponds to the output control voltage <-10,10> V.
When regulating the voltage of the UVR controller ("GenVoltRegSel" = "UVR control"), the output signal from the UVR controller in the range <0.100>% is read through the data communication. The UVR regulates to the desired voltage value sent by the DC signal "GenVoltReq".

2.6.4.2"GenVoltReq" (Requested generator voltage)

Outside Phase, the voltage value is identical to the nominal network voltage. During phasing, the value given by the network voltage (possibly increased by the value of the parameter "SyncGenVoltDif")

2.6.4.3"GenWatReg" (Power regulation)

The value of the regulated power (the power at which the genset is regulated). After a defined ramp follows the required power value "GenWatReq", it may be reduced due to protection or limitations.
If the absolute value of the actual power and output difference is higher than "GenWatRegErrTol" for longer than "GenWatRegErrDel", a slow failure with cooling down occurs.

2.6.4.4"GenWatReq" (Power request)

The required power is given by the fixed value of "GenWatMan" or in the "COPY" mode by the value of the logical input "GenWatExt".

2.6.5"Other" (Other)

2.6.5.1"MetA/BIn" (Pulse counter A/B)

Pulse gauge input. For each pulse, the value of the appropriate gauge A or B is increased by "MetA / BStep". It can serve as a power counter (gas consumption, etc.) from pulse output meters.

2.6.5.2"SigTest" (Testing signal)

The test signal can be used in functions or mapped to physical output for test purposes. The logical output value can be defined in the ManagerAP service menu.

2.6.5.3"WWpwm" (PWM for woodward)

PWM signal value at SWW output (required position Woodward AD).

2.6.6"User" (User)

2.6.6.1"UsrAO_n" (User analog output n)

User analogue outputs 1 ÷ 16 (depending on device type).

3. Messages list

READY
PREHEATING
PRESTART
START
RUN
RUN (Idle speed)
RUN (Rated rpm)
RUN (Paralel with mains)
RUN (Loaded)
RUN (Back synchronization)
RUN (Synchronization)
RUN (Unloading)
RUN (Warming down)
RUN (Load off request)
VENTILATION
BEETWEN START DELAY
SLOWING DOWN
BLOCKING START (Mains voltage mismatch)
BLOCKING START (Mains frequency mismatch)
BLOCKING START (Phase sequencs)
BLOCKING START (User)
BLOCKING START (Low load request)
BLOCKING START (Low primary water temperature)
BLOCKING START (High oil pressure)
BLOCKING START (High primary water temperature)
BLOCKING START (Low load)
BLOCKING START (Mains mismatch)
BLOCKING START (Preheating)
BLOCKING START (Power limitation distributor)
BLOCKING START (Synchronization blocking)
BLOCKING START (Mode OFF)
BLOCKING START (Service)
UNSUCCESS START
ERROR (Mains voltage mismatch)
ERROR (Mains frequency mismatch)
ERROR (Generator voltage mismatch)
ERROR (Generator frequency mismatch)
ERROR (Generator overcurrent)
ERROR (Generator current unbalance)
ERROR (MCB backloop)
ERROR (GCB backloop)
ERROR (Synchronization timeout)
ERROR (Back power)
ERROR (Unavailable power)
ERROR (Unavailable power factor)
ERROR (Generator mismatch)
ERROR (Mains mismatch)
ERROR (Voltage error on bus)
ERROR (Mixture temperature)
ERROR (Prim.water temperature)
ERROR (Sec.water temperature)
ERROR (Preheating)
ERROR (Prelube)

ERROR (Oil overcrowded)
ERROR (Low oil pressure)
ERROR (Low oil level)
ERROR (Low water level)
ERROR (Mixture regulator error)
ERROR (Low methane level)
ERROR (Communication error)
ERROR (Speed fault)
ERROR (Speed overrun)
ERROR (Speed fall)
ERROR (Smoke detect)
ERROR (Central stop)
ERROR (Gas escape)
ERROR (Low gas pressure)
ERROR (Air filter choked)
ERROR (CRC check-sum)
ERROR (Speed governor USC)
ERROR (Voltage regulator UVR)
ERROR (Ignition UIS)
ERROR (High inside temperature)
ERROR (High cylinder temperature)
ERROR (High cylinder temperature difference)
ERROR (Service motohours)
ERROR (High intake temperature)
ERROR (High oil temperature)
ERROR (Oil refil signalization)
ERROR (Stopped by user in emergency mode)
ERROR (200)
ERROR (201)
ERROR (202)
ERROR (203)
ERROR (204)
ERROR (205)
ERROR (206)
ERROR (207)
WARNING (Voltage regulator limit)
WARNING (Speed regulator limit)
WARNING (Mixture regulator actuator limit)
WARNING (Unavailable power)
WARNING (Unavailable power factor)
WARNING (Service motohours)
WARNING (Synchronization blocking)
WARNING (Dirty oil high level)
WARNING (Low oil pressure)
WARNING (High intake temperature)
WARNING (High inside temperature)
WARNING (High oil temperature)
WARNING (No clear oil)
WARNING (Clear oil low level)
WARNING (Oil refil signalization)
WARNING (240)
WARNING (241)
WARNING (242)
WARNING (243)
WARNING (244)

WARNING (245)
WARNING (246)
WARNING (247)

4. Algoritms

4.1 Mixture regulation

Mixture regulation control the position of gas-air mix flap. Available is different ways how to control mixture:

- base on lambda probe
- base on mixture pressure
- base on cylinders temperature.

In each case can be regulation affected by other signal (e.g. level of CH4) which can change the requested value of controlled variable. There is as well as possible fuel selection by binary signal “Fuel A/B”.

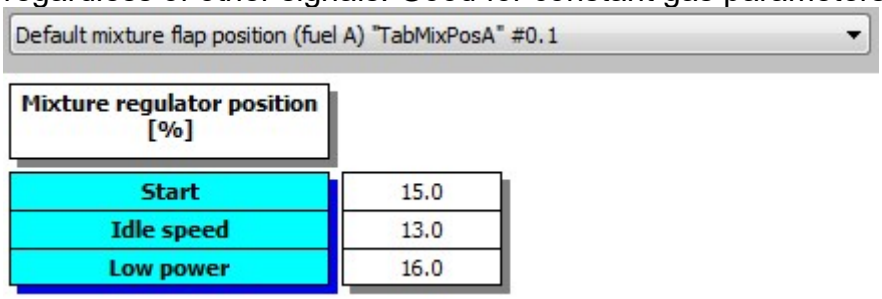
4.1.1 Initial position

Mixture valve initial positions is given by table. During prestart is mixture flap opened to “Start” position. When the engine starts (rpm go over speed for starter-off), position of flap is given by “Idle speed”. After load (switch-on generator contactor) is flap opened to “Low power” position in which the mixer will remain until the conditions for initiating regulation.
Initial values from the table can be fixed or can be affect by other signal (depend on selected table for default mixture flap position). Is possible at the same time to enable two tables, the table selection is performed by logical input “Fuel A/B”. When “Fuel A/B” is false, fuel A tables is selected. When “Fuel A/B” is true, fuel B table is selected.

Available is following tables for initial position:

4.1.1.1 Default mixture flap position (fuel A)

When this table is selected (and “Fuel A/B” is false), initial positions is constant regardless of other signals. Good for constant gas parameters.



4.1.1.2 Default mixture flap position (fuel A) with manual correction

When this table is selected (and “Fuel A/B” is false), initial positions is affected by parameter “MixCorMan”. This parameter can be adjusted from ManagerAP as well by user from controller display. Range of parameter is -20÷20%. For adjusting from controller display is required login of user with low access level (parameter “PswL1)”. For adjusting from ManagerAP is required login with custom assess level for parameters. Table defines what percentage change of parameter causes as a percentage change of flap position (in this example, the parameter value directly added to the initial position of the flap). This table can be used in case of gas with various parameters (without CH4 level measurement).

Default mixture flap position (fuel A) with manual correction "TabMixPosAManCor" #0

Mixture regulator position [%]	Manual correction of mixture controll 0,00				
	-20.0%	-10.0%	0.0%	10.0%	20.0%
Start	10.0	20.0	30.0	40.0	50.0
Idle speed	8.0	18.0	28.0	38.0	48.0
Low power	13.0	23.0	33.0	43.0	53.0

4.1.1.3 Default mixture flap position (fuel B)

When this table is selected (and “Fuel A/B” is true), initial positions is affected by level of CH4. Level of CH4 can be measured value (the analog input for CH4 level is mapped) or parameter “GasCH4” (the analog input for CH4 is not mapped).

Default mixture flap position (fuel B) "TabMixPosB" #1

Mixture regulator position [%]	Methane content in gas 97,00		
	60.0%	80.0%	100.0%
Start	25.0	30.0	35.0
Idle speed	23.0	28.0	33.0
Low power	28.0	33.0	38.0

4.1.2 Mixture flap position regulation on load

After engine load (switch-on generator contactor) and and fulfillment of other conditions (“MixRegStaDel” after power go over “MixRegStaPwr”) occurs regulation start. Furthermore, regulation already goes according to the selected table for regulation. As in the case of starting positions can be activated two tables for regulating, the table selection is made a signal "Fuel A / B".

4.1.2.1Mixture regulation according to the filling pressure (fuel A)

When this table is selected (and “Fuel A/B” is false), mixture regulation will works base on mixture pressure according the actual active power.

4.1.2.2Mixture regulation according to the Lambda probe (fuel A)

When this table is selected (and “Fuel A/B” is false), mixture regulation will works base on mixture Lambda probe according the actual active power.

4.1.2.3Mixture regulation according to the cylinder temperature (fuel A)

When this table is selected (and “Fuel A/B” is false), mixture regulation will works base on average cylinder temperature according the actual active power.

4.1.2.4Mixture regulation according to the filling pressure (fuel B)

When this table is selected (and “Fuel A/B” is false), mixture regulation will works base on mixture pressure according the actual active power and level of CH4.

4.1.2.5Mixture regulation according to the Lambda probe (fuel B)

When this table is selected (and “Fuel A/B” is false), mixture regulation will works base on mixture Lambda probe according the actual active power and level of CH4

4.1.2.6Mixture regulation according to the cylinder temperature (fuel B)

When this table is selected (and “Fuel A/B” is false), mixture regulation will works base on average cylinder temperature according the actual active power and level of CH4.

4.1.3 Mixture regulation fault

If the regulator can not achieve the desired value for controlling the mixture (a mixer position is longer than "MixRegErrDel" on top of the maximum position "MixRegPosMax" respectively lower minimum position "MixRegPosMin") will slowly fault shutdown due to a faulty mixture control.

5. ModBUS RTU

Parameters of RS-485 line for ModBUS:

- Speed of communication 9600bit/s
- 8 data bits without parity
- One Stop-bit
- ModBUS address is given by controller address (0÷15)

CU supports following functions of ModBUS RTU protocol:

- 4 - Read Input Registers
- 6 - Write Single register

5.1 Read Input Registers function

5.1.1 Enquiry

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

5.1.2 Response

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

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

5.1.3 Example

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 0x7FFF when reading, it means that the relevant value is not measured (not assigned to any physical input when mapping, but to “NC”).

5.2 Write Single Register function

5.2.1 Enquiry

Address	1 Byte	0x00 ÷ 0x0F (MBSaddr)
Function code	1 Byte	0x06
Address of the register	2 Bytes	0x0100 ÷ 0x0103
Value of register	2 Bytes	0x0000 ÷ 0xFFFF
Control sum	2 Bytes	CRC16

5.2.2 Response

Address	1 Byte	0x00 ÷ 0x0F (MBSaddr)
Function code	1 Byte	0x06
Address of the register	2 Bytes	0x0100 ÷ 0x0103
Value of register	2 Bytes	0x0000 ÷ 0xFFFF
Control sum	2 Bytes	CRC16

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

5.2.3 Example

Writing enquiry of value 0x929 = 234,5 to address 0x0101							
01	06	01	01	09	29	1E	78

Response							
01	06	01	01	09	29	1E	78

5.3 List of ergisters

5.3.1 Read Registers

Register address	Register contents	Dimension
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	Oil pressure	0.1kPa
0x25	Oil temperature	0.1°C
0x26	Oil level	0.1%
0x27	Mixture pressure	0.1kPa
0x28	Mixture temperature	0.1°C
0x29	Gas pressure	0.1kPa
0x2A	Gas temperature	0.1°C
0x2B	Methane quantities	0.1%
0x2C	Inside temperature	0.1°C
0x2D	Voltage on Lambda	0.1mV
0x2E	Exhaust temperature	0.1°C

0x2F	Input air temperature	0.1°C
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	User analog input 1	0.1
0x39	User analog input 2	0.1
0x3A	User analog input 3	0.1
0x3B	User analog input 4	0.1
0x3C	User analog input 5	0.1
0x3D	User analog input 6	0.1
0x3E	User analog input 7	0.1
0x3F	User analog input 8	0.1
0x40	User analog input 9	0.1
0x41	User analog input 10	0.1
0x42	User analog input 11	0.1
0x43	User analog input 12	0.1
0x44	User analog input 13	0.1
0x45	User analog input 14	0.1
0x46	User analog input 15	0.1
0x47	User analog input 16	0.1
0x48	*Not used*	
0x49	*Not used*	
0x4A	Motohours (high word)	65536s
0x4B	Motohours (low word)	1s
0x4C	Produced active energy (positive), high word (gen.)	6553.6kWh
0x4D	Produced active energy (positive), low word (gen.)	0.1kWh
0x4E	Supplied active energy (positive), high word (mains)	6553.6kWh
0x4F	Supplied active energy (positive), low word (mains)	0.1kWh
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	User logical binary inputs	
0x55	Logical binary inputs A	
0x56	Logical binary inputs B	
0x57	*Not used*	
0x58	User logical binary outputs	
0x59	Logical binary outputs A	
0x5A	Logical binary outputs B	
0x5B	*Not used*	
0x5C	*Not used*	
0x5D	Rpm	min^{-1}
0x5E	State + Mode	
0x5F	Average cylinder temperature	0.1°C
0x60	Cylinder 1 temperature	0.1°C
0x61	Cylinder 2 temperature	0.1°C
0x62	Cylinder 3 temperature	0.1°C
0x63	Cylinder 4 temperature	0.1°C

0x64	Cylinder 5 temperature	0.1°C
0x65	Cylinder 6 temperature	0.1°C
0x66	Cylinder 7 temperature	0.1°C
0x67	Cylinder 8 temperature	0.1°C
0x68	Cylinder 9 temperature	0.1°C
0x69	Cylinder 10 temperature	0.1°C
0x6A	Cylinder 11 temperature	0.1°C
0x6B	Cylinder 12 temperature	0.1°C
0x6C	Cylinder 13 temperature	0.1°C
0x6D	Cylinder 14 temperature	0.1°C
0x6E	Cylinder 15 temperature	0.1°C
0x6F	Cylinder 16 temperature	0.1°C
0x70	Cylinder 17 temperature	0.1°C
0x71	Cylinder 18 temperature	0.1°C
0x72	Cylinder 19 temperature	0.1°C
0x73	Cylinder 20 temperature	0.1°C
0x74	Cylinder 21 temperature	0.1°C
0x75	Cylinder 22 temperature	0.1°C
0x76	Cylinder 23 temperature	0.1°C
0x77	Cylinder 24 temperature	0.1°C

5.3.1.1 Register "Logical binary inputs A" (0x55) details

Logical binary inputs A (0x55)	
Bit 0	Blogking start by user
Bit 1	*Not used*
Bit 2	*Not used*
Bit 3	*Not used*
Bit 4	*Not used*
Bit 5	External fault acknowledge
Bit 6	Fuel A/B selection
Bit 7	External run request
Bit 8	GCB state
Bit 9	MCB state
Bit 10	*Not used*
Bit 11	*Not used*
Bit 12	*Not used*
Bit 13	*Not used*
Bit 14	External over-current
Bit 15	External mains error

5.3.1.2 Register "Logical binary inputs B" (0x56) details

Logical binary inputs B (0x56)	
Bit 0	Central-stop
Bit 1	*Not used*
Bit 2	Gas pressure low
Bit 3	Oil pressure low
Bit 4	Oil level
Bit 5	Water level
Bit 6	*Not used*
Bit 7	Air filter choked
Bit 8	Gas escape I
Bit 9	Gas escape II
Bit 10	Smoke sensor
Bit 11	Oilmaster signalization input
Bit 12	Low clear oil level
Bit 13	No clear oil
Bit 14	*Not used*
Bit 15	Stepper in closed position

5.3.1.3 Register "Logical binary outputs A" (0x59) details

Logical binary outputs A (0x59)	
Bit 0	Preheating
Bit 1	Prestart
Bit 2	Ready
Bit 3	Run
Bit 4	Error
Bit 5	Warning
Bit 6	Request for run
Bit 7	Manual request for run
Bit 8	GCB control
Bit 9	MCB control
Bit 10	*Not used*
Bit 11	*Not used*
Bit 12	*Not used*
Bit 13	*Not used*
Bit 14	*Not used*
Bit 15	Emergency mode

5.3.1.4 Register "Logical binary outputs B" (0x5A) details

Logical binary outputs B (0x5A)	
Bit 0	Starter
Bit 1	Ignition
Bit 2	Gas valve
Bit 3	*Not used*
Bit 4	*Not used*
Bit 5	*Not used*
Bit 6	Run idle
Bit 7	Acknowledge
Bit 8	Clear oil refill pump
Bit 9	Pre-lube
Bit 10	Primary pump
Bit 11	Secondary pump
Bit 12	3-way regulation of primary water (open)
Bit 13	3-way regulation of primary water (close)
Bit 14	3-way regulation of secondary water (open)
Bit 15	3-way regulation of secondary water (close)

5.3.1.5 Register "State + mode" (0x5E) details

State + mode (0x5E)	
Bit 0	State code (see state code table)
Bit 1	
Bit 2	
Bit 3	
Bit 4	
Bit 5	
Bit 6	
Bit 7	
Bit 8	Mode
Bit 9	0=Off, 1=manual, 2=semi-automat, 6=automat
Bit 10	
Bit 11	0=requested power, 1=power copy
Bit 12	*Not used*
Bit 13	*Not used*
Bit 14	*Not used*
Bit 15	*Not used*

State code	
0	READY
1	PREHEATING
2	PRESTART
3	START
8	RUN
9	RUN (Idle speed)
10	RUN (Rated rpm)
11	RUN (Paralel with mains)
13	RUN (Loaded)
14	RUN (Back synchronization)
15	RUN (Synchronization)
17	RUN (Unloading)
18	RUN (Warming down)
19	RUN (Load off request)
20	VENTILATION
21	BEETWEN START DELAY
32	SLOWING DOWN
33	BLOCKING START (Mains voltage mismatch)
34	BLOCKING START (Mains frequency mismatch)
35	BLOCKING START (Phase sequencs)
36	BLOCKING START (User)
37	BLOCKING START (Low load request)
38	BLOCKING START (Low primary water temperature)
39	BLOCKING START (High oil pressure)
40	BLOCKING START (High primary water temperature)
41	BLOCKING START (Low load)
42	BLOCKING START (Mains mismatch)
43	BLOCKING START (Preheating)
44	BLOCKING START (Power lim.distributor)
45	BLOCKING START (Synchronization blocking)
46	BLOCKING START (Mode OFF)
128	UNSUCCESS START

129	ERROR (Mains voltage mismatch)
130	ERROR (Mains frequency mismatch)
131	ERROR (Generator voltage mismatch)
132	ERROR (Generator frequency mismatch)
133	ERROR (Generator overcurrent)
134	ERROR (Generator current unbalance)
135	ERROR (MCB backloop)
136	ERROR (GCB backloop)
137	ERROR (Synchronization timeout)
138	ERROR (Back power)
139	ERROR (Unavailable power)
140	ERROR (Unavailable power factor)
141	ERROR (Generator mismatch)
142	ERROR (Mains mismatch)
143	ERROR (Voltage error on bus)
144	ERROR (Mixture temperature)
145	ERROR (Prim.water temperature)
146	ERROR (Sec.water temperature)
148	ERROR (Preheating)
150	ERROR (Prelube)
151	ERROR (Oil overcrowded)
152	ERROR (Low oil pressure)
153	ERROR (Low oil level)
154	ERROR (Low water level)
162	ERROR (Mixture regulator error)
163	ERROR (Low methane level)
164	ERROR (Communication error)
171	ERROR (Speed fault)
172	ERROR (Speed overrun)
173	ERROR (Speed fall)
175	ERROR (Smoke detect)
176	ERROR (Central stop)
177	ERROR (Gas escape)
180	ERROR (Low gas pressure)
181	ERROR (Air filter choked)
187	ERROR (CRC check-sum)
188	ERROR (Speed governor USC)
189	ERROR (Voltage regulator UVR)
190	ERROR (Ignition UIS)
192	ERROR (High inside temperature)
193	ERROR (High cylinder temperature)
194	ERROR (High cylinder temperature difference)
195	ERROR (Service motohours)
196	ERROR (High intake temperature)
197	ERROR (High oil temperature)
198	ERROR (Oil refill signalization)
199	ERROR (Stopped by user in emergency mode)
200÷207	ERROR (User error 200÷207) (User errors def by functions)
208	ERROR (User error from expansion module)

5.3.2 Write Registers

UniGEN AP have four general purpose registers for writing. They can be used for any purpose in UniGEN by functions (requested power, start/stop control e.t.c.).

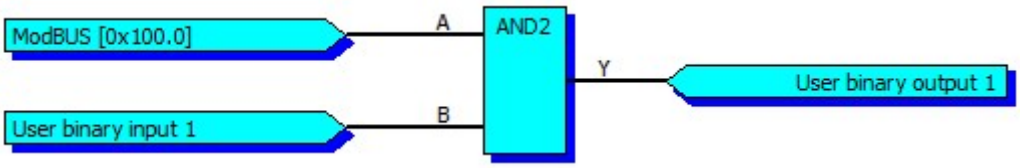
Registers can be used as four analog values, or the lowest four bits from register 0x100 as a binary signal.

Register address	Register Contents	Dimension
0x100	General purpose register ModBUS [0x100]	0.1 / binary
0x101	General purpose register ModBUS [0x101]	0.1
0x102	General purpose register ModBUS [0x102]	0.1
0x103	General purpose register ModBUS [0x103]	0.1

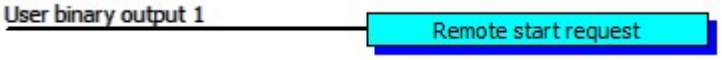
5.4Configuration examples

5.4.1Example of configuration for unit start/stop via ModBUS

Using functions can be signal from ModBUS register connected to “User binary output 1” signal (and can be e.g. blocked by second start enable signal “User binary input 1” as in this case:



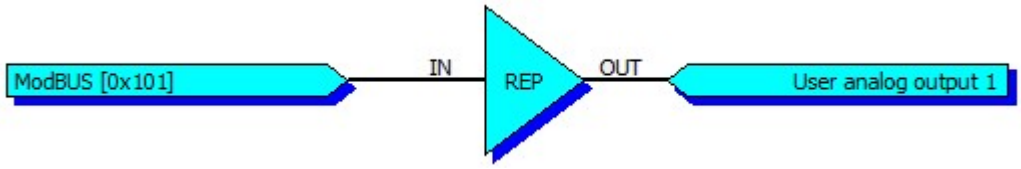
Than is this signal in mapping connected to “Remote start request”:



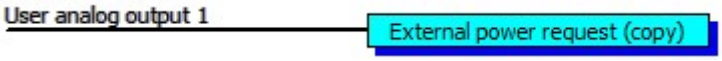
With this configuration will be request for start given by lowest bite in ModBUS register 0x100 (if unit will be in Automatic mode and User binary input 1 will be active).

5.4.2 Example of requested power control via ModBUS

Using functions can be signal from ModBUS register connected to “User analog output 1” signal:



Than is this signal in mapping connected to “External power request (copy)” signal:



With this configuration will be requested power given by ModBUS register 0x101 content (if the “Power Mode” parameter will be set to “External request”).

6. Definitions

Slow genset shutdown – slow genset shutdown with unloading, switch-off GCB, warm-down (short engine run without load) and cool-down by pumps

Fast genset shutdown – immediatelly switch-off GCB without unloading, warm-down (short engine run without load) and cool-down by pumps

Immediatelly genset shutdown – immediatelly switch-off GCB without unloading and stop engine, cool-down by pumps

Immediatelly genset shutdown without cool-down - immediatelly switch-off GCB without unloading and stop engine, immediatelly deactivation of pumps