2017

Instruction manual CHP OEKO series installation

Sommer energy

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1. General safety instructions

I. Explanation of symbols

Danger

The symbol indicates operating instructions which can lead to injury or death.

Warning

This symbol indicates operating instructions which can lead to damage to the equipment.

Information

This symbol indicates important information about the handling of the entire system.

II. Glossary

machine operator

… are employees who are not specially trained, but can carry out simple tasks such as simple control tasks at the operator panel, check the status of the system and inform the technical customer service in the event of faults.

qualified technician

… are professionally trained workers who have received specific training courses in the areas of heating systems, heat generators, electrical engineering, electrical power generation systems, internal combustion engines. The qualification is obtained only directly from Sommer energy itself.

maintenance staff

… are persons who are trained and authorized by Sommer energy to maintain the facilities.

Personal protective equipment (PPE)

... includes the following equipment:

- Gehörschutz (Kapselgehörschützer, Bügelgehörschützer, Gehörschutzstöpsel o.ä.) bei Untersuchungen am laufenden Aggregat, welche von notwendig sein können
- Work gloves when working with batteries, glycol containing fluids or engine lubrication oils
- Protective shoes

PPE ist während einer Wartung an der SH-Anlage immer zu tragen.

Energy supply companies (RUs)

… represents the company responsible for the local energy supply. This company is the contact person for connecting the plant to the public utility network.

III. Safety instructions

Safety instructions are used for occupational health and safety and accident prevention. You should always be respected. In order to protect you and your work colleagues from harm, your cooperation is also necessary. Always work with caution. Be constantly aware that dangers are not always "obvious".

This CHP is built for safe operation. However, responsibility lies with the persons who operate and maintain this CHP. The following safety precautions are guidelines to prevent the risk of accidents during operation.

The operating instructions and the safety instructions must be kept in a safe place for the operating personnel. The relevant accident prevention regulations and other, generally recognized safety and health rules and regulations of the respective country of use must be observed and followed.

The cogeneration unit may only be operated and maintained by trained and authorized persons who have read and understood these operating instructions. Failure to observe these instructions and safety precautions may result in burns, other injuries or killing by electricity and / or damage to the machine and other property of the customer.

If the CHP is not in a safe condition:

1) **Never start the CHP!**
2) **Press emergency stop button!**
3) **Attach the warning sign to the CHP!**
4) **Set the key switch on the control cabinet to "0" and remove it!**

IV. Potential safety risks

Movable parts

- Keep hands, arms, and other parts of the body away from moving parts.
- Wear close-fitting clothing and hearing protection when working on the CHP.
- Wearing wristwatches, rings, chains or similar jewelery is not permitted.
- Ensure that there are no personnel in the immediate vicinity of the CHP before starting.
- Stop the engine before oil or coolant is filled.
- Adjustments and maintenance must only be carried out with the motor stopped.
- Keep hands, shoes, floor and other treads clean and free of oil, water, antifreeze and other fluids.

Hot surfaces, sharp edges and corners

Protect yourself by wearing proper protective clothing!

- Keep away from hot exhaust and exhaust pipes.
- Wear protective clothing, gloves and head protection when working on the CHP.
- Avoid skin contact with hot oil, coolant, surfaces and sharp edges and corners.
- Provide a dressing box. In case of injuries, consult a doctor immediately.

For burns:

- Immediately cool the injured parts with cold, clean water
- Immediately give medical treatment to burns.

Electric voltage / current

- The CHP may only be connected to the load by trained and qualified electricians.
- Keep in mind that no cables are pinched or squeezed and that they are laid so that they do not form any obstacles and can not be damaged. All cables, which are unprotected outside the machine / system, must be regularly checked for damage.
- Do not touch any voltage-carrying parts of the cogeneration unit, connecting cables or cables. Pay attention to dry treads.
- Before electrical connections to consumers are made or interrupted, ensure that the consumers and the CHP are connected to the protective measures of the electrical power grid.
- Before switching on electrical connections at the CHP, the CHP must be switched off.
- The cogeneration unit must not be operated without covers on voltage-carrying parts.
- Provide suitable fire extinguishers approved for electrical

installations.

- Only connect the CHP to loads and electronic systems that are compatible with the specification and are within the rated power.

Damage caused by electricity can have the following effects:

- Muscle contraction, as long as the electrical action persists
- At the current entry and exit points, so-called "current marks" occur during the current flow, possibly also fire wounds
- including unconsciousness, breathing space
- Danger of life by circulatory system

Measures:

- Interruption of the power supply by disconnection, disconnect the plug, disconnect the fuses, switch off the main switch
- If this is not immediately possible, the person who is injured is disconnected from the live parts by a non-conducting object
- Stand up in isolation and do not touch voltage-carrying parts
- Establish immediate rest position
- Check breathing and pulse:
- in the case of respiratory distress: respiratory donor
- in case of unconsciousness and breathing: stable lateral position
- Cover burns without germs
- Call the emergency

In emergency situations of any kind, the CHP is to be put out of operation immediately.

For this purpose, either the main switch or, where available, the EMERGENCY STOP switch, or other known safety devices which serve to shut down the machine / system press.

Danger of confinement
If work is carried out at the CHP, it must be ensured that the access doors can not be closed by other persons.

Maintenance of the cogeneration plant
The maintenance of the CHP unit is to be carried out only by authorized maintenance personnel. The maintenance instructions and instructions are available to the maintenance personnel.

If you smell gas:

- Close the gas shut-off valve
- Ventilate the room
- Avoid the use of electrical appliances, mobile phones included
- Leave the room and notify a qualified technician or a person of the responsible gas supplier. If neither the technician nor the responsible person of the gas supplier is reachable and is a distress, call the fire brigade
- If the road is equipped with leakage monitoring, and if this is disturbed, the technician must be informed

In case of burned smell:

- Switch off the system
- Ventilate the room
- Notify a qualified technician
- If the room is equipped with a smoke detector and / or a gas alarm, report any malfunction to the technician

For liquid leaks:

- Switch off the system
- Notify a qualified technician
- Lock both the gas and the external water supply via the valves

The installation, calibration and adjustment of the gas supply system, the electrical installation and the water pipe system may only be carried out by qualified technicians in accordance with the applicable national and regional standards and regulations.

Before commissioning the system, the exhaust system must be checked for leaks and approved by local authorities.

The operator is advised to keep his system in a good condition in order to keep plant availability high and to not endanger the safety of all employees.

The operator has to ensure that only qualified technicians maintain and maintain the system according to the maintenance schedule.

Before the first start, all connections must be checked and checked for tightness and, if necessary, retightened.

This manual is an important part of the system and should be accessible to all operators, technicians and other persons involved in the installation. Should the system change its owner / location, it is strongly recommended to hand over this manual.

2. Product Description

I. General information

A combined heat and power plant (CHP) is a modular system for generating electricity and heat.

The higher overall utilization ratio compared to the conventional combination of local heating and central power plant results from the utilization of the waste heat of the electricity generation directly at the place of origin. Depending on the plant size, the efficiency of the electricity generation is between about 30 and 40%. However, the local primary use of the waste heat is 75 to over 90%. Combined heat and power plants can save up to 40% of primary energy.

Originally, CHP plants are based on combustion engines whose heat from the exhaust gas and the cooling water circuit is used to heat heating water. In the meantime, other systems such as the Stirling engine, fuel cell, microturbine or steam engine are also used to generate electricity in CHP plants. Depending on the type of internal combustion engine, the use of combined heat and power plants is not limited to providing room heat, but also serves to generate process heat via water vapor, hot air or thermal oil or air-conditioning by use of an absorption heat pump.

II. Module Design

The motor and the generator are rigidly flanged and connected by a flexible coupling.

This unit is stored on a vibration absorbing base. To avoid sound transmission by vibration, the connection to the heating is via compensators. Furthermore, the basic frame is placed on Sylomers. Thus, no vibrations are transmitted to the building.

The heat exchanger block is installed in front of and below the engine base unit. The cooling water heat and the exhaust gas heat are extracted via heat exchangers and delivered to the heating system.

For sound insulation, the unit can be supplied with a sound-proof capsule, the supply and exhaust air is supplied and removed via fans, including air mufflers.

The electrical monitoring and control units as well as the power section are housed in a control cabinet.

III. Module Data

Continuous power of the unit	
Rated electrical power parallel to the mains @ cosPhi = 1.0	550 kW
Thermal performance	761 kW
Voltage	480 V
Motor water temperature max	88 °C / 190,4 °F
Exhaust gas temperature after heat exchanger	120 °C / 248 °F
Heating forflow max.	90°C / 194 °F
Heating return max.	70°C / 158 °F
CHP Dimensions (L x W x H)	In Container – 12.000 mm x 2.950mm x 3.050 mm 39,37 ft x 9,68 ft x 10,01 ft

Technical data of the engine	
Manufacture	MAN
Continuous power mech. (ISO 3046)	580 kW
number of cylinders	12
Rated speed	1800 RPM
Drilling	132 mm
Stroke	157
Capacity	25,8 l

Technical data of the generator	
Manufacture	Leroy Somer
Type	LSA 49.1 M6
Power	743 kVA
Rated speed	1800 RPM
Voltage	480 V
Frequenzy	60 Hz
Cooling	Self cooled
cos Φ	1.0
Altitude	≤ 1000 m above sea level

IV. Electrical connection

For mains parallel operation, the connection to the switchgear is to be made, to check the rotating field for clockwise rotation, to lay out the cross section to a permanent electrical rated load and to connect it to the connections provided for this purpose.

There are different connection possibilities:

1.) Connection to terminals and the circuit breaker
2.) Connection to terminals
3.) onnection to circuit breaker and busbar
4.) Project-specific variant

As a rule, the connection is located at the bottom left of the switchgear. For project-specific connections, the connection with the manufacturer must be clarified in advance.

3. Operation and control

I. Before the first start

All sensors must be checked for plausibility. All limit values are set at the factory. Before the first start, the circuits are tested.

II. Operator Panel

Figure 1 - KTP 700 as standard display [1]

General information	
Product type designation	SIMATIC HMI KTP700 Basic color PN
Display	
Design of the display	TFT
screen size	7,0 in
display width	154,1 mm
display height	85,9 mm
number of colors	65 536
Resolution (pixels)	
● horizontal image resolution	800 Pixel
● vertical image resolution	480 Pixel

[1] Gesonderte Displays auf Anfrage

III. Mains parallel operation

In order to implement the parallel system, the motor is started and then controlled to the nominal speed. The generator is connected in parallel with the mains by means of the synchronizer. The voltage, frequency and the delay time of the switching element are taken into account in order to ensure a "gentle" engagement. After a short gas-air mixture settling time, a stepless regulation between P_N and 50% of P_N is possible.

Mode selection switch	
Hand	The manual mode starts the unit without the specific starting conditions such as a low return temperature have to be met. The possible alarm / warning messages are acknowledged via the interference button. In this mode, the operator is required to manually power the mains supply and prevent the entire system from being disturbed. Possible foreseeable switch-off conditions are not considered.
Auto	In the automatic mode, the controller decides whether the system starts or not. Only when all start conditions are met, the system is started. In this case, the operator is only required in the event of a fault. However, it is responsible for the settings that can be set for the operator via the HMI. By using a modular controller, project- / customer-specific signals can be transferred and integrated into the logic of the control system. Experience has shown that the following signals can be added with: • External start / stop signal • Performance specification as analogue value request • Power requirements of the RU

IV. Trend curves

Standard motor, energy, temperature and pressure data are available as a trend curve.

The data is cyclically recorded in a non-retentive memory and displayed. For storage reasons, only the past hour can be considered.

Trend curves generally serve to gain information and help diagnose errors or identify imprecise deficits at an early stage. They are therefore an important tool for machine operators and technicians.

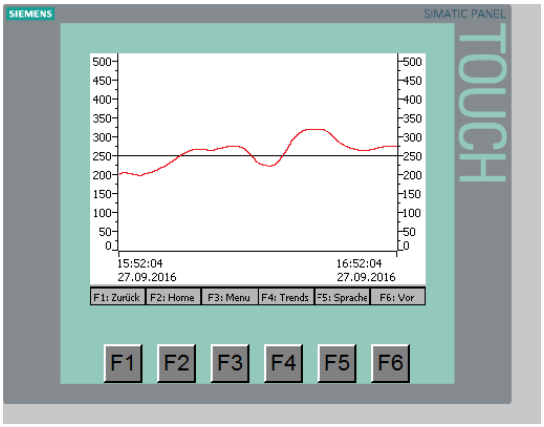


Figure 2 - Example of a performance curve

V. Settings

Basically, setting values on black fields can be recognized with white characters.

By pressing the finger on the corresponding field, an input mask opens.

Depending on the declaration of the field, you can now enter numbers and letters or only numbers. This prevents the wrong data formats from being entered. The limit values of the input are rechecked by the controller itself and corrected to the intended range if necessary.

In Figure 4 - you see such a number entry in the input field already described.

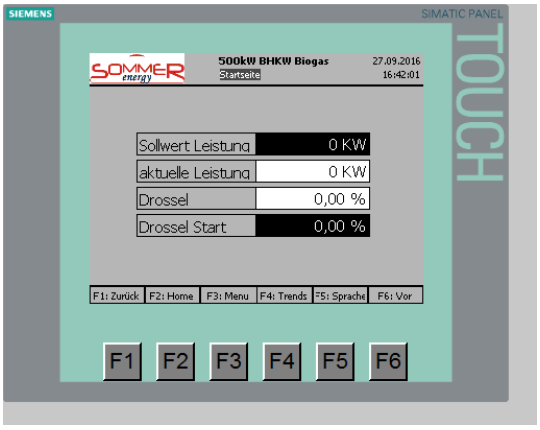


Figure 3 - Beispiel Eingabefelder

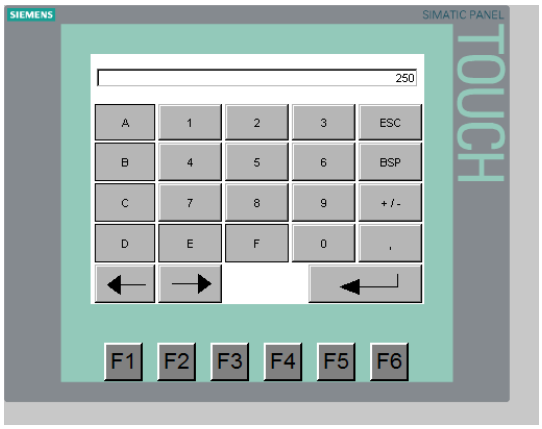


Figure 4 - Example input screen with numbers

VI. Emergency stop function and stop

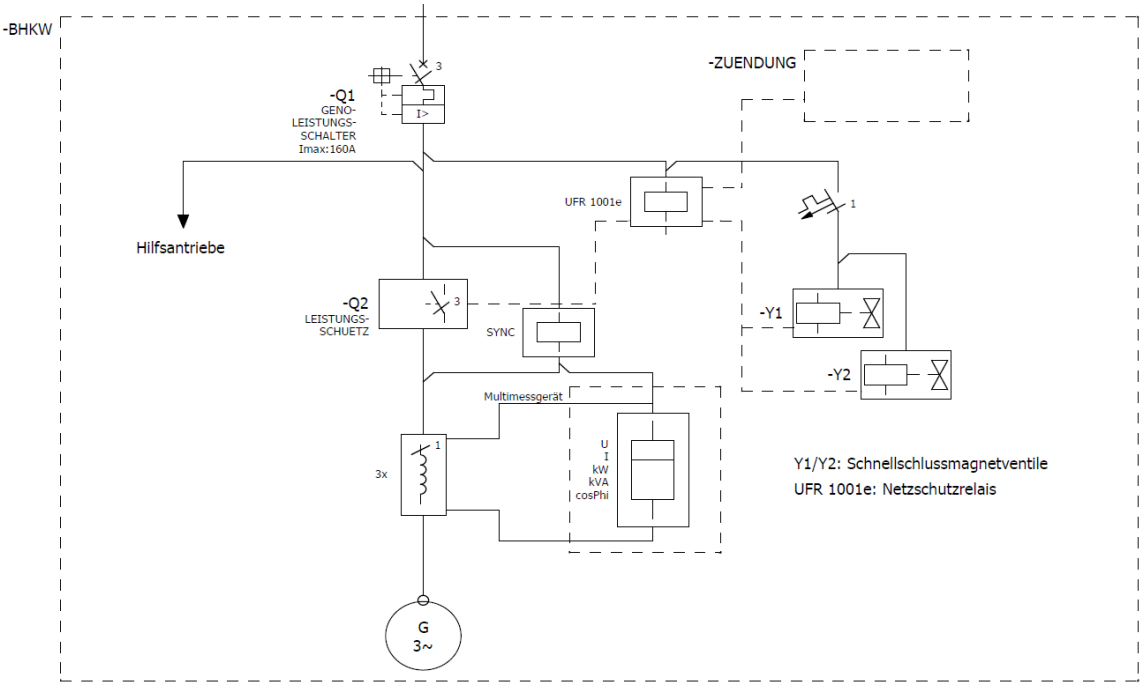


Figure 5- Emergency stop function and stop

The fail-safe power failure protection device (mains failure protection) and the installed safety switch provide the highest protection for man and machine.

With the safety switch, we reach a safety integrity level (SIL) according to IEC 62061 of SIL 1 and thus comply with the machinery guideline of 2006. After this, it is also necessary that a manual reset is necessary after triggering the emergency stop chain. The green operating button is used for this purpose. The switching device recognizes a long acknowledgment as well as a short acknowledgment and responds accordingly not to the inputs.

Upon detection of the emergency deactivation, switch off the ignition, gas valves and the generator switch as shown in Figure 5- Emergency stop function and stop . All components are selected in such a way that when there is no voltage, there is no danger for man or machine.

It should be pointed out that when the machine rotates and the emergency stop function is triggered, the machine still runs out for a few seconds.

An active brake is not installed!

VII. Error and diagnosis

ID		Class	Reason	Elimination
1	ALARM: EMERGENCY STOP	error	- Emergency chain interrupted (upper LED on K100 does not light up) - Missing acknowledgment (lower LED on K100 does not light up)	- Unlock all emergency stop switches - Push the green Button on the Front door
3	ALARM: OIL PRESSURE START	error	- Oil pressure switch defective	- Check the oil pressure switch
4	ALARM: MOTOR PROTECTION SWITCH	error	- Motor protection switch tripped	- Check the motor branches and eliminate the fault
5	ALARM: EVU INTERFERENCE	error	- Fault in the power supply network	- a stable power supply is disconnected for more than 2 min
6	ALARM: OVER TEMP. STARTER TRANSFORMER	error	- thermocontact on the mains power system	- Check the starter transformer and eliminate the fault
7	ALARM: OVER TEMP. MOTOR (95 ° C)	error	- Air in the heating system Circulation pump (internal pump) defective	- Check the circulating pump
8	ALARM: OVER TEMP. OIL (98 ° C)	error	- Faults in the lubrication system too little motor oil	- Check oil level
9	ALARM: OIL PRESSURE TOO LOW	error	- too little motor oil	- Check oil level
10	ALARM: OILSTAND MINIMUM	error	- Oil reservoir empty Defective oil level control contact	- Check for leaks
11	ALARM: OIL TANK	error	- Water or oil leaks	- Check the tightness
12	ALARM: GAS PRINT MINIMUM	error	- Gas supply failed	- Check the stopcocks on the opening
13	ALARM: CAPSULE TEMP. MAX	error	- Temperature in the sound insulation hood too high	- Check the capsule fan
14	WARNING: TROUBLESHOOTING. EXHAUST	error	- Exhaust gas temperature warning reached	- Motor reduces its power automatically
15	ALARM: TEMP.MAX EXHAUST	error	- Exhaust gas temperature too high	- Check air filter, spark plugs
16	ALARM: OVERRIDE	error	- Motor speed above 115% of nominal speed	- Restart the CHP with other start parameters
17	ALARM: WATER PRESSURE MIN	error	- Leakage in the cooling system	- Check the cooling system
18	ALARM: REVERSE POWER	error	- EVU grid drives generator	- Restart with higher Lambda Mixture at Synchpoint
19	ALARM: PERFORMANCE DIFFERENCE	error	- Setpoint and actual value deviate too much	- Check the lambda setting

20	ALARM: OVER TEMP. MIXTURE	error	-	no mixture cooling	-	Check the mixture cooling system
21	ALARM: SPEED DIFFERENCE	error	-	Faulty ignition - Outdated lambda deer - Ignition strip defective	-	Check ignition distance
22	ALARM: LAMBDA DIFFERENCE	error	-	Lambda control defective / at control limits	-	Check the lambda setting
23	ALARM: COS PHI DIFFERENCE	error	-	CosPhi controller defective	-	Check wiring for the CosPhi controller
24	ALARM: REFILL OIL	error	-	Oil reservoir empty	-	Add oil to the container
25	ALARM: SYNCHRONIZATION	error	-	No mains connection within 7 min	-	Check Generators Circuit breaker - Restart
26	ALARM: START SPEED (STARTER)	error	-	Starter has been set but engine does not rotate	-	Check the speed sensor
27	ALARM:> 3 STARTS	error	-	CHP has not started	-	Check the starting settings
28	WARNING: MAINTENANCE REQUIRED	warning	-	the maintenance period has expired in the next 50 operating hours	-	Notify maintenance service
29	ALARM: MAINTENANCE TIME EXCEEDED	error	-	Maintenance time has expired	-	Carry out maintenance work (let)
30	ALARM: OVER TEMP. HEATING PROCEDURE	error	-	Heating over 98 ° C	-	Check the circulating pump externally and the water pressure
31	ALARM: SMOKE DETECTED	error	-	Smoke gas detected	-	Locate and eliminate smoke
32	ALARM: GAS OVER LIFT (40%)	error	-	Gas warning system has detected gas	-	Locate and eliminate the gas
33	ALARM: FU 1 EXTERNAL PUMP	error	-	Pending error in the frequency converter for the external pump	-	Observe the display of the drive and correct the diagnosis via the error list of the drive
34	ALARM: FU 2 MIXED COOLER FAN 1	error	-	Incident on the frequency converter	-	Observe the display of the drive and correct the diagnosis via the error list of the drive
35	ALARM: FU 3 MIXED COOLER FAN 2	error	-	Incident on the frequency converter	-	Observe the display of the drive and correct the diagnosis via the error list of the drive
36	ALARM: FU 4 MIXED COOLER FAN 3	error	-	Incident on the frequency converter	-	Observe the display of the drive and correct the diagnosis via the error list of the drive
37	ALARM: FU 5 OTHERS	error	-	Incident on the frequency converter	-	Observe the display of the drive and correct the diagnosis via the error list of the drive
38	ALARM: HEATING RETURN TO WARM	error	-	Cooling water for control outside the permissible temperature range	-	Observe the limit values
39	ALARM: PRESSURE WATER EXTERNAL	error	-	Leakage at the external circuit	-	Observe the limit values

40	ALARM: Biogas temperature	error	-	Temperature of the fuel biogas too high	-	Observe the limit values
41	ALARM: Pressure mixture	error	-	leakage at the mixture cooling circuit	-	Observe the limit values
42	ALARM: Pressure Biogas Analog	error	-	Absence of gas pressure measured analogously	-	Observe the limit values
43	ALARM: ERROR AVR GENERATOR	error	-	General fault of the voltage regulator	-	Check the regulator
46	ALARM: COMMUNICATION PARTNER 1	error	-	Lost connection to partner	-	Check the connection cable
47	ALARM: COMMUNICATION PARTNERS 2	error	-	Lost connection to partner	-	Check the connection cable
48	ALARM: COMMUNICATION PARTNER 3	error	-	Lost connection to partner	-	Check the connection cable
49	ALARM: COMMUNICATIONSPARTNER 4	error	-	Lost connection to partner	-	Check the connection cable
50	ALARM: COMMUNICATION PARTNER 5	error	-	Lost connection to partner	-	Check the connection cable
51	ALARM: COMMUNICATIONSPARTNER 6	error	-	Lost connection to partner	-	Check the connection cable
52	ALARM: COMMUNICATION PARTNERS 7	error	-	Lost connection to partner	-	Check the connection cable
65	SENSOR ERROR: TEMPERTUR MOTOR INPUT	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
66	SENSOR ERROR: TEMPERATURE MOTOR OUTPUT	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
67	SENSOR ERROR: TEMPERTURE CAPSULE	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
68	SENSOR ERROR: TEMPERATURE MIXTURE	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
69	SENSOR ERROR: TEMPERATURE HEATING PROCEDURE	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
70	SENSOR ERROR: TEMPERATURE HEATING RETURN	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
71	SENSOR ERROR: TEMPERATURE BUFFER 1	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
72	SENSOR ERROR: TEMPERATURE BUFFER 2	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
73	SENSOR ERROR: TEMPERATURE BUFFER 3	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
74	SENSOR ERROR: TEMPERATURE BUFFER 4	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary

75	SENSOR ERROR: TEMPERATURE BUFFER 5	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
76	SENSOR ERROR: TEMPERTURAL GAS A	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
77	SENSOR ERROR: TEMPERATURE EXHAUST B	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
78	SENSOR ERROR: OIL PRESSURE	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
79	SENSOR ERROR: WATER PRESSURE	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
80	SENSOR ERROR: LAMBDA A	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
81	SENSOR ERROR: LAMBDA B	error	-	Sensor defective outside the display range Cable breakage	-	Check encoder if necessary
102	WARNING: TEMPERATURE MOTOR INPUT	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
103	WARNING: TEMPERATURE MOTOR OUTPUT	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
104	WARNING: TEMPERATURE CAPSULE	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
105	WARNING: TEMPERATURE HEATING VL	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
106	WARNING: TEMPERATURE HEATING RL	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
107	WARNING: TEMPERATURE MIXTURE	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
108	WARNING: TEMPERATURE OF GAS A	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
109	WARNING: TEMPERATURE EXHAUST B	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
110	WARNING: PRESSURE OIL	warning	-	Pre-warning of pressure outside the permissible range	-	Check plausibility of encoder if necessary
111	WARNING: INTERNAL PRESSURE WATER	warning	-	Pre-warning of pressure outside the permissible range	-	Check plausibility of encoder if necessary
112	WARNING: PRESSURE WATER EXTERNAL	warning	-	Pre-warning of pressure outside the permissible	-	Check plausibility of encoder if necessary

				range		
113	WARNING: PRESSURE MIXTURE	warning	-	Pre-warning of pressure outside the permissible range	-	Check plausibility of encoder if necessary
114	WARNING: Temperature biogas	warning	-	Pre-warning the temperature outside the permissible range	-	Check plausibility of encoder if necessary
115	WARNING: PRESSURE BIOGAS	warning	-	Pre-warning of pressure outside the permissible range	-	Check plausibility of encoder if necessary
116	WARNING: FILL OIL	warning	-	Pre-warning oil level low	-	Check plausibility of encoder if necessary
117	WARNING: Gas	warning	-	Gas warning system has detected gas and gives warning	-	Locate and remove the gas outlet Ventilate the room well Immediately stop in doubt machine

4. Remote maintenance

Remote maintenance for the system is made via a PC installed in the control cabinet. This is equipped with the necessary hardware and software for monitoring and controlling the entire system. The system can also be operated without remote maintenance. If interference occurs in remote maintenance, the module can also be removed for diagnostic purposes without disturbing the system.

If prolonged access to the system is not initiated, the PC automatically protects itself with logout from the Windows. To reactivate, the user name ***Viewer*** with the password ***bhkw*** is necessary.

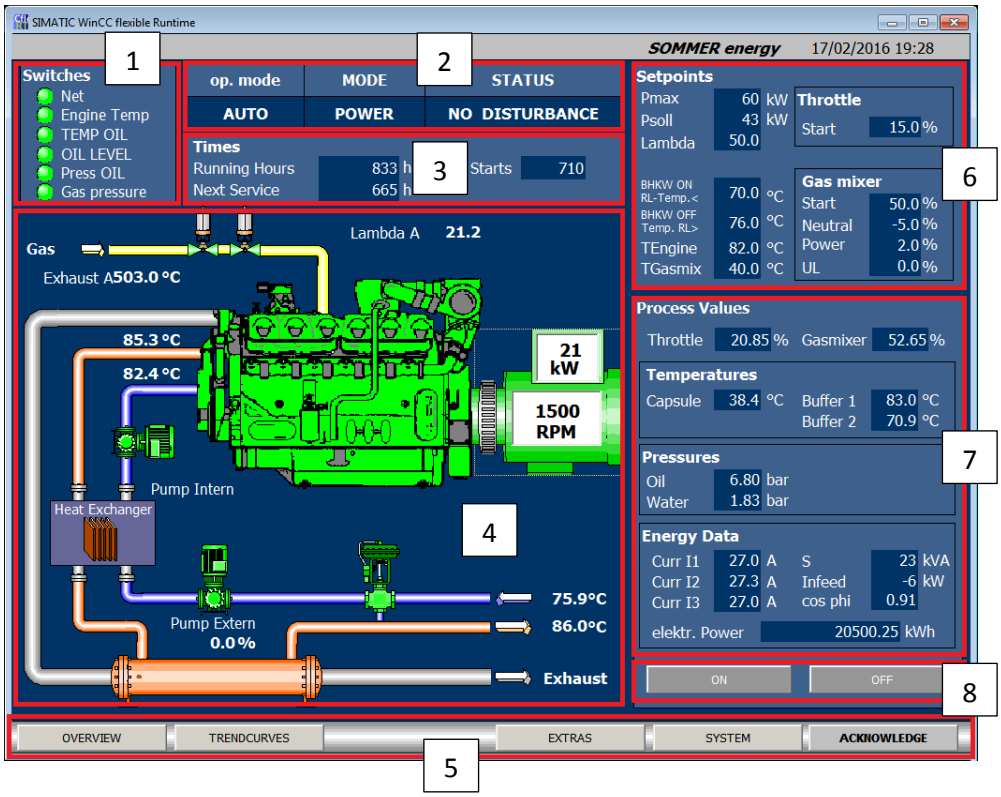
This interface can vary from plant to plant and allows access to several plants in the entire plant.

A prerequisite for access is a DSL line which must be created by the customer. There are also substitute solutions which are then dependent on the respective location and have to be clarified project-specifically prior to connection.

The internal network is separated from the hardwares for reasons of communication in order to eliminate error communications.

The connection is made via TeamViewer to the system. The connection data are to be requested from the manufacturer after the connection test has been carried out. Other third party remoteconnections must declared with the manufacturer.

Example of remote monitoring



Area	Description
1	Brief overview of the switching states of the encoders
2	Switch states of the preselector switches on the control cabinet
3	Overview of the times of the CHP
4	Plant view with the most important analog data at the installation location
5	Menu for other areas / plants Call up extra functions such as emergency cooling, etc. from chapter 5 Call up the error history Acknowledgment of a corrected error
6	Adjustable values for controlling the CHP
7	Overview of the analog actual values
8	Power on / off via the PC-HMI

5. Operation Additional modules

I. Power output ramp

Figure 6 - Beispiel HMI Leistungsstellwertrampe

The option of the power setting value ramp allows operators to easily decide with which return temperature the analog setpoint control should start. This provides the option of not only switching off and restarting CHPs but also automatically switching them down before power down in order to prevent them from switching off and thus preventing them from standing still.

If the ramp is set correctly and the return temperatures at the CHP start falling again, the system automatically increases its setpoint again to the set maximum capacity.

The curve can be adapted by the operator and edited at any time. An analogue control between 100% and 50% of the maximum power is permissible. Incorrect input parameters are automatically corrected.

II. Regulation - mixture cooler temperature

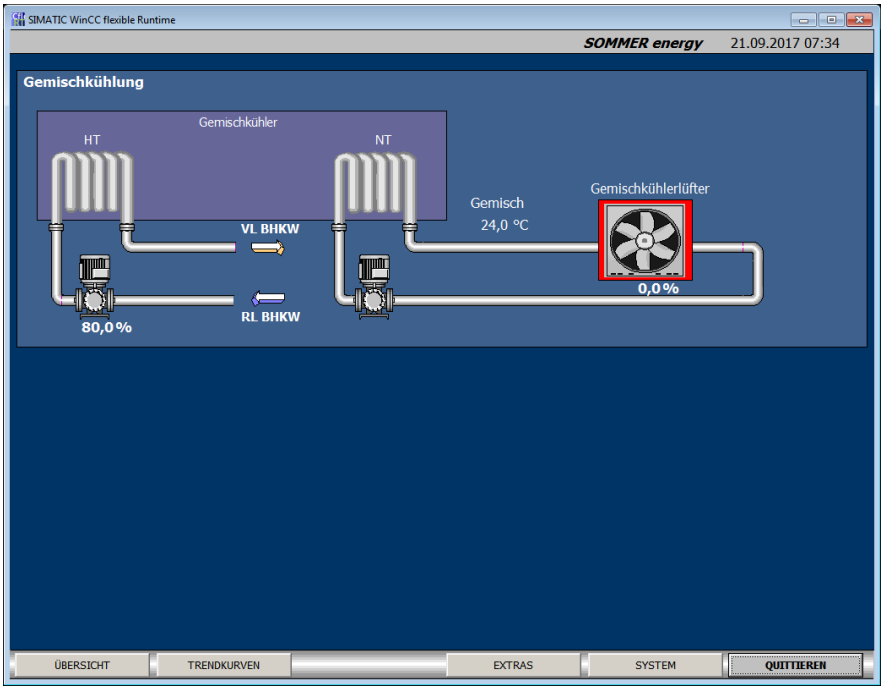


Figure 7 – Example two-stage mixture cooling

It must be differentiated between single-stage and two-stage mixture cooling.

In single-stage mixture cooling, there is only one HT circuit. The pump to be controlled is designed in such a way that a mixture temperature of 80 ° C. is reached in full load operation.

The two-stage, on the other hand, is more complex. The NT circuit is fed by a preceding pump. In the HT-circuit it, then the active control of the mixture to 50 ° C over the prepared mixture table radiator fan. This circuit is equipped with a pressure transducer as well as an expansion vessel and an overpressure valve. Since the range of the mixture cooler fan is installed in the open air, a maximum of 30% glycol is used as medium for heat transfer in order to prevent freezing when not in use. The mixture cooling fans are frequency-controlled. In special conduits, the pump can also be frequency-regulated to compensate for poor control behavior.

If there are faults on the mixture cooling circuit, they are displayed as a clear text in the display. The control is firmly programmed and tested during commissioning.

III. Control - return cooling (emergency cooling)

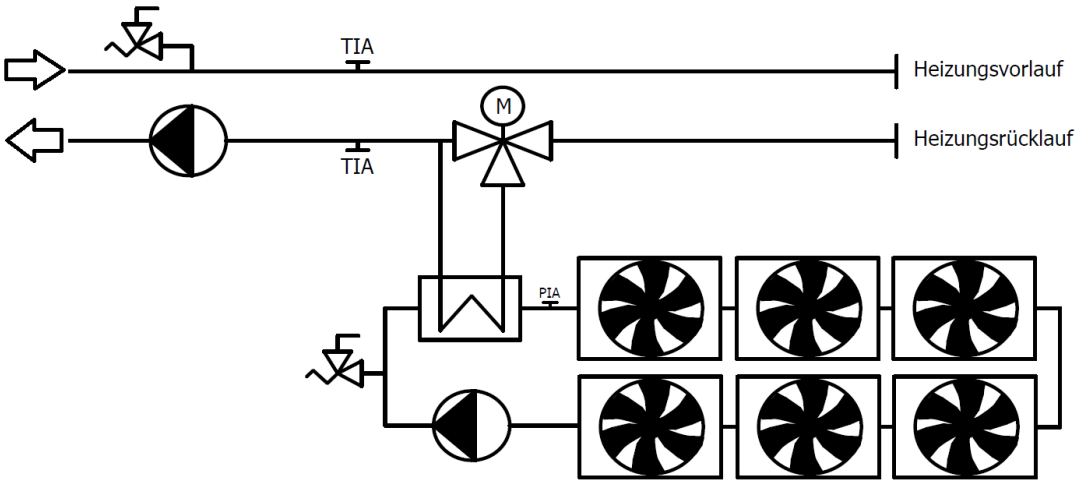


Figure 8 – Reflux condenser

The so-called return or emergency cooler provides the possibility to react actively to the return from the heating. Equipped with a black-white valve, a plate heat exchanger, emergency cooling can be activated from the control.

The control electronics react to the return with a continuous PI controller and can usually switch up to 6 stages for active cooling. This version is also available on request.

The sensitive table cooler is equipped with protective equipment and is permanently monitored.

IV. Communication of several SH plants

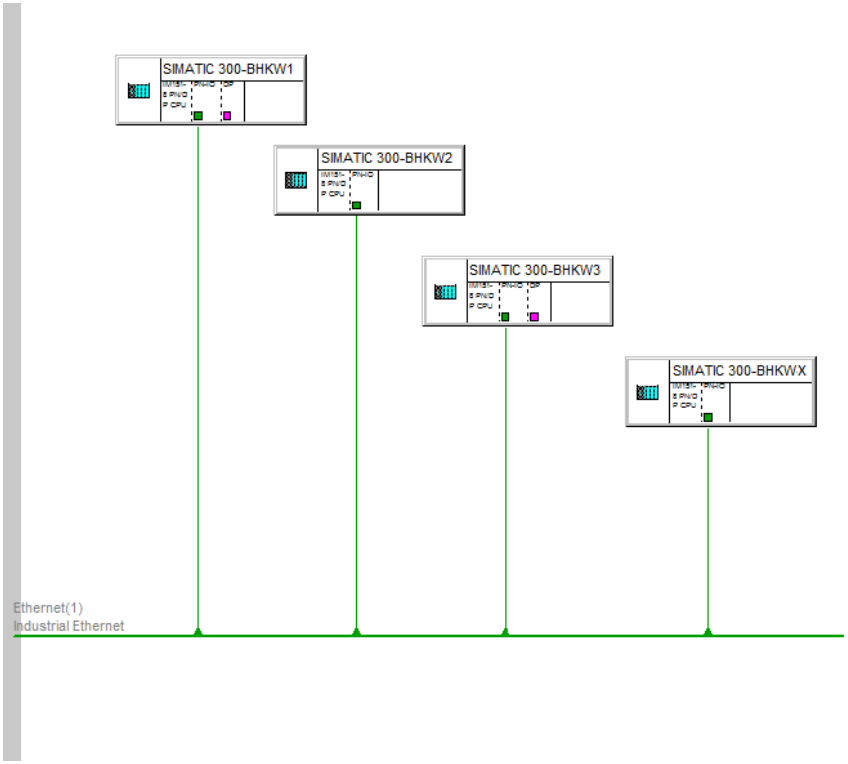


Figure 9 - Profinetcommunication

If several modules are operated together as an overall system, it is advisable to create a link between them. This offers advantages in the regulation, the use of data and in the control of actuators in the different individual units.

Through the type of communication, signals can be distributed and the hardware effort can be reduced to a minimum. If the communication fails, the switches should be controlled in the network level. Network diagnostics may also be necessary.

V. Profibus communication

Third-party systems can be connected to the controller either directly or via a DP-DP coupler. The individual data points must be matched beforehand and a function test must take place.

The following is an example of such a communication:

Appendix: CHP 500 kW Example

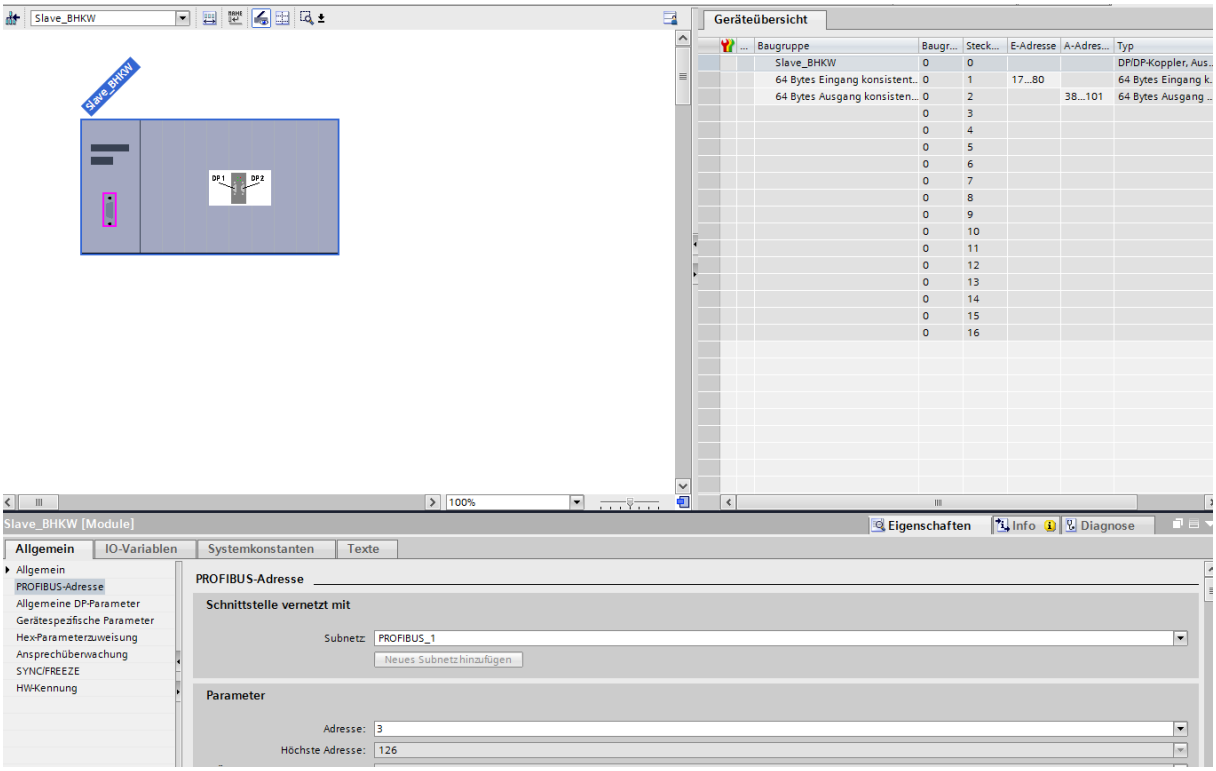


Figure 10- Hardware overview

Interface overview:

Input				
64 Bytes consistent	Value	Formate	Accuracy	Unit
DWord 0	SP_P_EXTERNAL	Real	1	kW
DWord 4	Reserve	Real		
DWord 8	Reserve	Real		
DWord 12	Reserve	Real		
DWord 16	Reserve	Real		
DWord 20	Reserve	Real		
DWord 24	Reserve	Real		
DWord 28	Reserve	Real		
DWord 32	Reserve	Real		
DWord 36	Reserve	Real		
DWord 40	Reserve	Real		
DWord 44	Reserve	Real		
DWord 48	Reserve	Real		
DWord 52	Reserve	Real		
DWord 56	Reserve	Real		
DWord 60	Reserve	Real		
DWord 64	Reserve	Real		

Output					
64 Bytes consistent		Value	Formate	Accuracy	Unit
DWord 0		generated electric power	Real	0,00	kWh
DWord 4		operating hours	Int	1	Oph
DWord 8		gas consumption	Real	0,1	m³/h
DWord 12		current performance	Real	0,1	kW
DWord 16		generated heat quantity	Real	0,0	kWh
Word 20		reports			
	Bit 0	operation	Bool		
	Bit 1	disorder	Bool		
	Bit 2	Reserve	Bool		
	Bit 3	Reserve	Bool		
	Bit 4	Reserve	Bool		
	Bit 5	Reserve	Bool		
	Bit 6	Reserve	Bool		
	Bit 7	Reserve	Bool		
	Bit 8	Reserve	Bool		
	Bit 9	Reserve	Bool		
	Bit 10	Reserve	Bool		
	Bit 11	Reserve	Bool		
	Bit 12	Reserve	Bool		
	Bit 13	Reserve	Bool		
	Bit 14	Reserve	Bool		
	Bit 15	Reserve	Bool		
	Bit 16	Reserve	Bool		
DWord 22		Reserve			
DWord 26		Reserve			
DWord 30		Reserve			
DWord 34		Reserve			
DWord 38		Reserve			
DWord 42		Reserve			
DWord 46		Reserve			
DWord 50		Reserve			
DWord 54		Reserve			
DWord 58		Reserve			
Word 62		Reserve			
Byte 64		Reserve			

VI. Modbus RTU Schnittstelle

16 Bit Register Nr.	Description	
0		**Reports**
	0.0	Hand operated
	0.1	Generator on the mains (operation)
	0.2	internal pump
	0.3	external pump
	0.4	Gas solenoid valve 1 open
	0.5	Gas solenoid valve 2 open
	0.6	Capsule fan
	0.7	Reserve
	0.8	Reserve
	0.9	Reserve
	0.10	Reserve
	0.11	Reserve
	0.12	Reserve
	0.13	Reserve
	0.14	Reserve
	0.15	Reserve
1		**Alarms**
	1.0	Emergency stop switch
	1.1	collective fault
	1.2	Warning Maintenance
	1.3	Reserve
	1.4	Reserve
	1.5	Reserve
	1.6	Reserve
	1.7	Reserve
	1.8	Reserve
	1.9	Reserve
	1.10	Reserve
	1.11	Reserve
	1.12	Reserve
	1.13	Reserve
	1.14	Reserve
	1.15	Reserve
2	**Analogue value Current power (kW)**	
3	**Analog value generated electrical energy (MWh)**	
4	**Analog value setpoint Motor temperature (° C)**	
5	**Analog value Time to maintenance (h)**	
6	**Analogue value Operating hours (h)**	

VII. Modbus TCP interface

The CHP control acts as a Modbus TCP master on port 502. The IP address is to be requested during the function test.

	Coils		FC 01
CHP 1		**500**	operation
		501	disorder
		502	Internal pump
		503	External pump
		504	Pump mixture
		505	key switch
		506	Hand
		507	Off
		508	Auto
		509	Emergency stop switch
		510	Exhaust gas Overtemperature
		511	Overheating Heating flow
		512	Water pressure min
		513	Oil min
		514	Mixture pressure min
		515	FI Fault
		516	RU disorder
		517	Warning Maintenance
	Read Holding Register		**FC 03**
CHP1		0	current performance
		1	rotation speed
		2	oil pressure
		3	water pressure
		4	engine temperature
		5	Heating Return
		6	Heating Forflow
		7	active power
		8	Time to maintenance

6. Emergency function

I. Basic Principle

In the event of a failure of the local power supply network, all electrical loads in the field of application will inevitably occur. However, a CHP has the possibility to remedy this problem by providing the CHP with the required energy in the form of a rotating field network. Here there is now no power regulation parallel to the grid, but to an autonomous energy supply of the site itself – it is called island mode.

For an automatic turn-off and turn-on for island mode must be ensured that a utility breaker switch which decouples the public grid by the end users grid can be controlled. The power failure or single-phase failure in front of this coupler switch is detected via a protective relay in the CHP module and can therefore react automatically to the mains failure. A strict separation from the public utility grid is essential throughout the entire island network.

If there is no possibility of automatic control of the dome coupling switch, a circuit can also be effected by hand. However, a feedback from the network coupling switch must always be present for safety reasons and must be connected to the CHP control unit. The messages are either closed or open.

To implement the island operation by hand, the instructed operator of the system must strictly adhere to a flow chart.

There is a simple switching sequence:

Sequence 1 - Isolated on:

1. Mains coupling switch Off
2. Feedback Check the network coupling switch on the CHP monitor
3. CHP start via selection hand
4. Switch the CHP generator switch

Sequence 2 - Isolated from:

1. Disconnect the CHP generator switch
2. Switch off the CHP
3. Reconnect the mains dome switch

Chapter - Emergency function

During island operation, care must be taken to ensure that a maximum load jump of 15% of the maximum power of the module can be applied to a gas-operated CHP unit. Powermanagement must be designed in such a way that the load steps do not exceed this value. A time delay of 20 seconds from jump to jump is to be ensured. In addition, the maximum output in island operation must not exceed 70% of the aggregate maximal power.

While the chp is running in island operation no power factor can be set and the module requires a settling range for other load jumps.

After the network returns, the CHP will automatically switch back and can now start again in the parallel mode.

Requirements Emergency power:

1. Remote switchable undelayed mains connection switch (for Auto mode)
2. Energy management during island management is provided with the maximum specified load jumps and delay times
3. Provision of a mains supply with pre-fuses (6A) in front of the mains connection switch for mains monitoring
4. Gas supply must be ensured during a power failure. A UPS is to be installed for evaporators in liquid gas operation
5. Flowchart must be created in a project-specific manner
6. Test circuit must pass through / if necessary. can be adapted

7. Maintenance Schedule

Maintenance schedules and maintenance records

Service intervals for E3268 LE212, E3262 LE202 "Natural gas"

	After start-up and R1-R2	All	All	All	up to	up to	up to
Interval after operating hours at 1500 rpm	20-50	Tbd.	800	1,600	15,000	25,000	50,000
Interval after operating hours at 1800 rpm	20-50	Tbd.	600	1,200	12,000	20,000	40,000
Service interval	**E1**	**O1**[7]	**E2**	**E3**	**R1***)**	**R2***)**	**R3***)**
Check steel wire mesh hoses	X			X	X	X	X
Carry out a leak test	X		X				
Check bolt connections	X		X				
Change engine oil; oil analysis*)	X	X					
Change engine oil filter*)	X	X					
Record operating data****)	X		X				
Check start procedure	X		X				
Adjust/check throttle valve	X			X			
Clean/check gas filter	X			X			
Clean/check air filter	X			X			
Clean/replace pickups	X			X			
Check coolant concentration	X			X			
Check ignition time	X			X			
Check coolant circuit / system pressure	X			X			
Measure crankcase pressure	X			X			
Measure exhaust back pressure including catalytic converter	X			X			
Check emissions and Lambda	X			X			
Check exhaust system for air leaks / external soiling	X						
Check intake vacuum			X				
Check spark plugs, replace if necessary			X				
Check combustion chamber[9]				X			
Check valve clearance and adjust if necessary				X			
Replace spark plugs	X			X			
Check compression pressure				X			
Check/replace oil separator				X			
Check/clean mixture cooler	X			X			
Check/calibrate sensors				X			
Check exhaust system bolt connections				X			
Replace coolant					X		
Measure crankshaft axial play					X		
Replace charge mixture hose					X		
Replace turbo charger					X		
Replace cylinder liner						X	
Check/replace connecting rods						X	
Replace piston rings						X	
Check/replace pistons						X	
Replace cylinder heads						X	
Complete engine overhaul							X

[9] First check after 6000 operating hours

8. Declaration of conformity

Blockheizkraftwerke
Notstromaggregate
Automation + Prozessvisualisierung
Rationelle Energieanwendung + Energiemanagement

Beratung, Planung, Programmierung, Herstellung, Lieferung, Montage, Service

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US - Konformitätserklärung
US - Declaration of confirmity

Wir erklären in alleiniger Verantwortung, dass die Produkte
We declare under our responsibility that the products

-Blockheizkraftwerke (BHKW) Typ OEKO – inkl. Schaltschrank
-Cogeneration Unit (CHP) Type OEKO – incl. Control Unit

konform sind mit den Anforderungen der Richtlinien
are in confirmity with the requirements of the directives

- **90/396 EEC : gas appliance directive ***
- **2006/42 EG : machinery directive**
- **2014/35/EU : low voltage directive**
- **2014/30/EU : EMC directive**

*Berücksichtigung der grundlegende Anforderungen nach Anhang I
Considering oft the essential requirements of annex I

Angewandte Normen :

Standard	*EN*	*DE*
ISO 12100	Safety of machinery	Sicherheit von Maschinen
ANSI/NFPA 79	Electrical Standard for Industrial Machinery	Elektrischer Standard für Industriemaschinen
UL 508A	Standard for Industrial Control Panels	Standard für industrielle Bedienfelder
UL 489	Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures	US genormte Leistungsschalter
ISO 8528	Power generating units with reciprocating piston combustion engines	Stromerzeugungsaggregate mit Hubkolben-Verbrennungsmotoren
IEC 60204-1	Safety of machinery -electric equipment of machines - Part 1: General requirements	Sicherheit von Maschinen -elektrische Ausrüstung von Maschinen - Teil 1: Allgemeine Anforderungen
IEC 60034-1/-3	Rotating electrical machines	Drehende elektrische Maschinen

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	- Part 1: Design and operation behavior Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines	- Teil 1: Bemessung und Betriebsverhalten - Teil 3: Besondere Anforderungen an Synchrongeneratoren angetrieben durch Dampfturbinen oder Gasturbinen
IEC 60364	Construction of low voltage systems	Errichtung von Niederspannungs-anlagen
IEC 61439-1	Low-voltage switchgear assemblies - Part 1: General requirements	Niederspannungs-Schaltanlagen - Teil 1: Allgemeine Anforderungen VDE 660/600 VDE 0100 Bb1.1, Teile 410 -460
NFPA-70	US safety standard for electrical Installations	US-amerikanischen Sicherheitsstandard für Elektroinstallationen.
CSA-IEC 61000-6-2-08	Electromagnetic Compatibility (EMC) - Part 6-2: Generic Standards - Immunity for Industrial Environments	Elektromagnetische Verträglichkeit (EMV) - Teil 6-2: Fachgrundnormen - Störfestigkeit für Industrieumgetungen
IEC 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Interference emission for industrial areas	Elektromagnetische Verträglichkeit (EMV) - Teil 6-4: Fachgrundnormen Störaussendung für Industriegebiete

Deuna, den 06.09.2017

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