Released

easYgen-3000XT Series

Option Manual | Genset Control

easYgen-3000XT LITE

Release 2.11-0

Document ID: B37927, Revision A - Build 50798

Manual (original)

This is no translation but the original Technical Manual in English.

Designed in Germany.

Woodward GmbH

Handwerkstr. 29

70565 Stuttgart

Germany

Telephone: +49 (0) 711 789 54-510

Fax: +49 (0) 711 789 54-101

E-mail: stgt-info@woodward.com

Internet: http://www.woodward.com

Brief Overview

NOTICE!

This option manual must be used together with the device standard manual. A option manual only describes the additional functionality of the device. Please refer to “Reduced functionality” for details.

Please use the suitable standard manual to install, commission and operate the device:

- easYgen-3100/3200XT-P1 manual (37574)

The easYgen-3000XT series are control units for engine-generator system management applications.

The control units can be used in applications such as: co-generation, stand-by, AMF, peak shaving or distributed generation.

The easYgen-3000XT series is also applicable for islanded and mains parallel operations.

Sample application setup

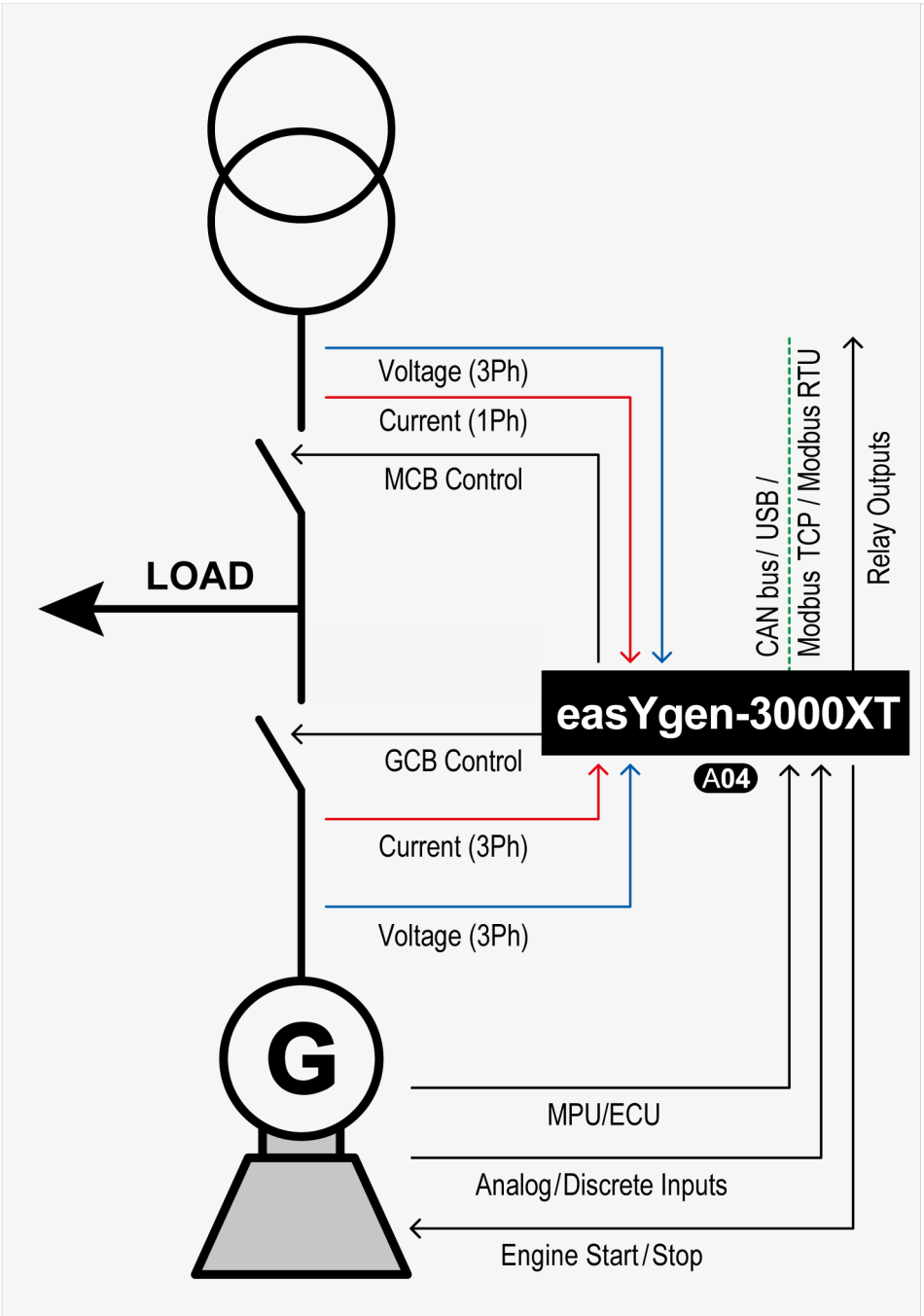


Fig. 1: Sample application setup

A typical application mode for the control unit is the use for mains parallel operation application.

- In this case, the easYgens-XT will function as an engine control with generator, mains and engine protection.
- The control unit can open and close the generator circuit breaker (GCB) and the mains circuit breaker (MCB).

For a listing of all available application modes please refer to the "Chapter: Application Field" in easYgen-3000XT manual.

Reduced functionality

The easYgen-3000XT **LITE** controllers have some reduced functions compared to the 'standard' easYgen-3000XT controllers. The differences are listed below.

- Busbar measurement

  Refer to

  ↳ “2.1 Busbar measurement” for details.

- Import/Export control

  Refer to

  ↳ “2.2 Import/Export control” for details.

- Load dependent start/stop (LDSS)

  Refer to

  ↳ “2.3 Load dependent start/stop (LDSS)” for details.

- Load sharing

  Refer to

  ↳ “2.4 Load sharing” for details.

Table of Contents

1 General Information

1.1 About This Manual

1.1.1 Revision History

Rev.	Date	Editor	Changes in chronological descending order
A	2021-02	AS	**Option Manual - 1st issue** • Describing device software release 2.11-0

1.2 Depiction Of Notes And Instructions

Safety instructions

Safety instructions are marked with symbols in these instructions. The safety instructions are always introduced by signal words that express the extent of the danger.

DANGER!

This combination of symbol and signal word indicates an immediately-dangerous situation that could cause death or severe injuries if not avoided.

WARNING!

This combination of symbol and signal word indicates a possibly-dangerous situation that could cause death or severe injuries if it is not avoided.

CAUTION!

This combination of symbol and signal word indicates a possibly-dangerous situation that could cause slight injuries if it is not avoided.

NOTICE!

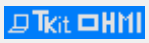
This combination of symbol and signal word indicates a possibly-dangerous situation that could cause property and environmental damage if it is not avoided.

Tips and recommendations

This symbol indicates useful tips and recommendations as well as information for efficient and trouble-free operation.

Additional markings

To emphasize instructions, results, lists, references, and other elements, the following markings are used in these instructions:

Marking	Explanation
⚙	Start of a procedure list
>	Prerequisite for a procedure list
▷	Step-by-step instructions
▶	Results of action steps
	References to sections of these instructions and to other relevant documents
•	Listing without fixed sequence
☼	Example
»Buttons«	Operating elements (e.g. buttons, switches), display elements (e.g. signal lamps)
»Display«	Screen elements (e.g. buttons, programming of function keys)
[Screen xx / Screen xy / Screen xz] ...	Menu path. The following information and setting refer to a page on HMI screen or ToolKit located as described here.
	Some parameters/settings/screens are available only either in ToolKit **or** in HMI/display.

Dimensions in Figures

All dimensions shown with no units specified are in **mm**.

1.2.1 Copyright And Disclaimer

Disclaimer

All information and instructions in this manual have been provided under due consideration of applicable guidelines and regulations, the current and known state of the art, as well as our many years of in-house experience. Woodward assumes no liability for any damages due to:

- Failure to comply with the instructions in this manual
- Improper use / misuse
- Willful operation by non-authorized persons
- Unauthorized conversions or non-approved technical modifications

- Use of non-approved spare parts

The originator is solely liable for the full extent for damages caused by such conduct. The obligations agreed-upon in the delivery contract, the general terms and conditions, the manufacturer's delivery conditions, and the statutory regulations valid at the time the contract was concluded, apply.

Copyright

1.2.2 Service And Warranty

Our Customer Service is available for technical information.

For regional support, please refer to: ⟹ http://www.woodward.com/Support_pgd.aspx.

In addition, our employees are constantly interested in new information and experiences that arise from usage and could be valuable for the improvement of our products.

Warranty terms

Please enquire about the terms of warranty from your nearest Woodward representative.

For our contact search webpage please go to: ⟹ http://www.woodward.com/Directory.aspx

1.3 Safety

NOTICE!

Damage due to improper use!

Improper use of the device may cause damage to the device as well as connected components.

Improper use includes, but is not limited to:

- Storage, transport, and operation outside the specified conditions.

1.3.1 Personnel

WARNING!

Hazards due to insufficiently qualified personnel!

If unqualified personnel perform work on or with the control unit hazards may arise which can cause serious injury and substantial damage to property.

- Therefore, all work must only be carried out by appropriately qualified personnel.

This manual specifies the personnel qualifications required for the different areas of work, listed below:

Personnel:

- **Qualified electrician**

  The qualified electrician is able to execute tasks on electrical equipment and independently detect and avoid any possible dangers due to his training, expertise and experience, as well as knowledge of all applicable regulations.

  The qualified electrician has been specially trained for the work environment in which he is active and is familiar with all relevant standards and regulations.

- **User**

  The user operates the device within the limits of its intended use, without additional previous knowledge but according to the instructions and safety notes in this manual.

The workforce must only consist of persons who can be expected to carry out their work reliably. Persons with impaired reactions due to, for example, the consumption of drugs, alcohol, or medication are prohibited.

When selecting personnel, the age-related and occupation-related regulations governing the usage location must be observed.

1.3.2 General Safety Notes

Electrical hazards

DANGER!

Life-threatening hazard from electric shock!

There is an imminent life-threatening hazard from electric shocks from live parts. Damage to insulation or to specific components can pose a life-threatening hazard.

- Only a qualified electrician should perform work on the electrical equipment.
- Immediately switch off the power supply and have it repaired if there is damage to the insulation.
- Before beginning work at live parts of electrical systems and resources, cut the electricity and ensure it remains off for the duration of the work. Comply with the five safety rules in the process:
  - cut electricity;
  - safeguard against restart;
  - ensure electricity is not flowing;
  - earth and short-circuit; and
  - cover or shield neighboring live parts.
- Never bypass a fuse or render it inoperable. Always use the correct amperage when changing a fuse.
- Keep moisture away from live parts. Moisture can cause short circuits.

Prime mover safety

WARNING!

Hazards due to insufficient prime mover protection

The engine, turbine, or other type of prime mover should be equipped with an overspeed (over-temperature, or over-pressure, where applicable) shutdown device(s), that operates totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

Device implemented self test

this Woodward device has a self test check implemented. Permanently under control are:

- processor function and
- supply voltage.

The internal signal "self check" is aligned in series with the inverse signal »Ready for op. OFF« parameter 12580. Per default (factory settings) discrete output R01 is energized/ closed if device itself is OK.

LogicsManager (LM) equation parameter 12580 allows to customize this safety relay. You can use the result of this equation: LM command variable 99.01 .

Be careful in changing safety relevant settings!

Modifications

WARNING!

Hazards due to unauthorized modifications

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment.

Any unauthorized modifications:

- constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage
- invalidate product certifications or listings.

Use of batteries/alternators

NOTICE!

Damage to the control system due to improper handling

Disconnecting a battery from a control system that uses an alternator or battery-charging device whilst the charging device is still connected causes damage to the control system.

- Make sure the charging device is turned off before disconnecting the battery from the system.

Unit includes a lithium backup battery for Real Time Clock. Field replacement of the battery is not allowed.

In case of battery replacement please contact your Woodward service partner.

Electrostatic discharge

Before working with terminals please read the following instructions.

⚙ **Preventing electrostatic discharge damage (ESD)**

>

- Protective equipment: ESD wrist band

NOTICE!

Damage from electrostatic discharge

- All electronic equipment sensitive to damage from electrostatic discharge, which can cause the control unit to malfunction or fail.
- To protect electronic components from static damage, take the precautions listed below.

1. ▷ Avoid build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as easily as synthetics.

2. ▷ 

Before working on terminals on the control unit, ground yourself by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.) to discharge any static electricity.

Alternatively wear an ESD wrist band connected to ground.

3. ▷ 

Before any maintenance work on the control unit, ground yourself by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.) to discharge any static electricity.

Alternatively wear an ESD wrist band connected to ground.

4. ▷ Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, etc.) away from the control unit, modules and work area.

5. ▷ Opening the control cover may void the unit warranty. Do not remove the printed circuit board (PCB) from the control cabinet unless instructed by this manual.

If instructed by this manual to remove the PCB from the control cabinet, follow these precautions:

- Ensure that the device is completely voltage-free (all connectors have to be disconnected).
- Do not touch any part of the PCB except the edges.
- Do not touch the electrical conductors, connectors, or components with conductive devices or with bare hands.
- When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

For additional information on how to prevent damage to electronic components caused by improper handling, read and observe the precautions in:

- "Woodward manual 82715, Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules".

1.3.3 Protective Equipment And Tools

Protective gear

Personal protective equipment serves to protect risks to the safety and health of persons as well as to protect delicate components during work.

Certain tasks presented in this manual require the personnel to wear protective equipment. Specific required equipment is listed in each individual set of instructions.

The cumulative required personal protective equipment is detailed below:

Protective equipment: ESD wrist band

The ESD (**e**lectro**s**tatic **d**ischarge) wrist band keeps the user's body set to ground potential. This measure protects sensitive electronic components from damage due to electrostatic discharge.

Tools

Use of the proper tools ensures successful and safe execution of tasks presented in this manual.

Specific required tools are listed in each individual set of instructions.

The cumulative required tools are detailed below:

1.3.4 Intended Use

The genset control unit has been designed and constructed solely for the intended use described in this manual.

The easYgen-... devices are available in two different enclosures. They are designed to be installed either on the back plate of a switch gear cabinet (e.g. easYgen-x100.../...-x400...) or on the front plate of a switch gear panel (e.g. easYgen-x200.../...-x500...).The terminals are always located on the inner side of the housing.

The genset control unit must be used exclusively for engine-generator system management applications.

- Intended use requires operation of the control unit within the specifications listed in the "Technical Data".
- All permissible applications are outlined in the "Application Modes".
- Intended use also includes compliance with all instructions and safety notes presented in this manual.
- Any use which exceeds or differs from the intended use shall be considered improper use!
- No claims of any kind for damage will be entertained if such claims result from improper use.

2 Reduced functionality

General notes

This chapter describes the reduced functionality only: this option device compared to the standard device of the product series.

Please be aware that:

- some LogicsManager and AnalogManager variables
- some Communication interface protocols contents
- some Configuration settings

are not available or not complete supported accordingly to the reduced functionality.

2.1 Busbar measurement

The busbar measurement is not available and the related measured values/parameter are hidden.

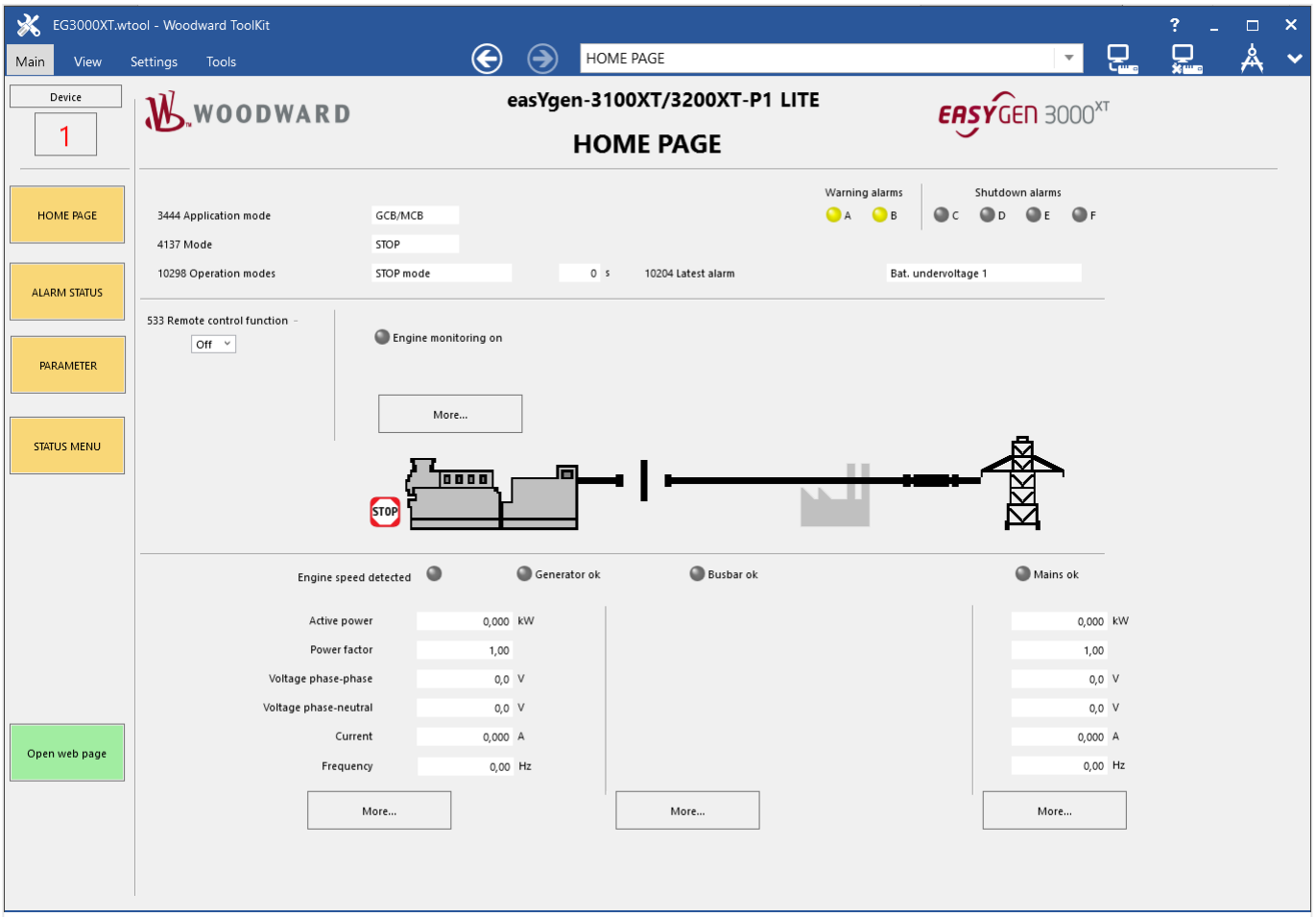


Fig. 2: Toolkit HOME PAGE

The status and necessary references from the busbar (*in range* or *dead*) depends now from the breaker feedback of the GCB and MCB

- GCB and MCB are open
  - Busbar is dead
- GCB is closed and MCB is open
  - Busbar status is equal to the Generator status
  - The synchronization (Synchronization MCB) uses the values from the Generator and Mains.
- GCB is open and MCB is closed
  - Busbar status is equal to the Mains status
  - The synchronization (Synchronization GCB) uses the values from the Generator and Mains.

Phase angle for synchronization

The phase angle between Mains and Generator is used for the synchronization from the GCB and MCB

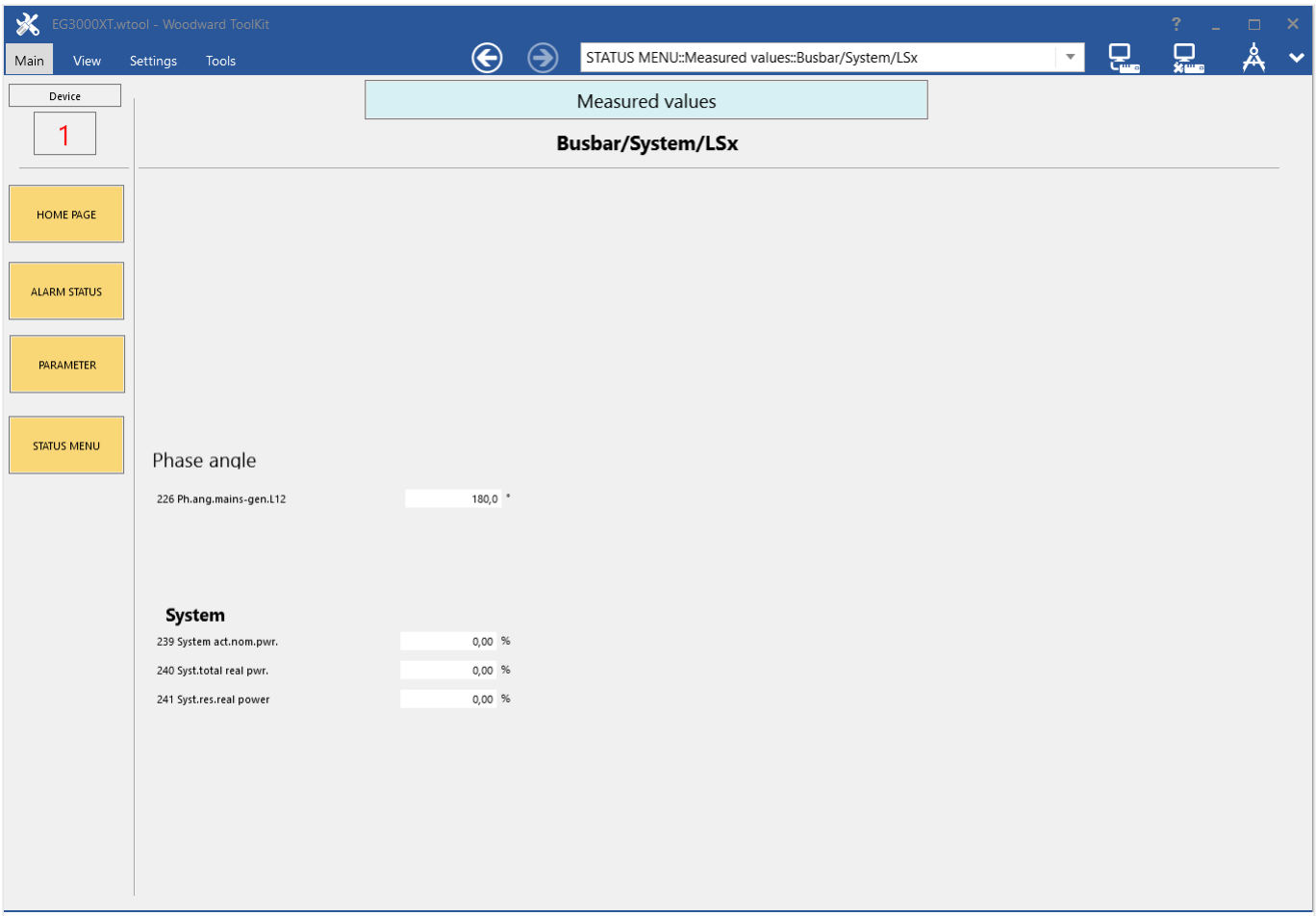


Fig. 3: Toolkit Busbar/System/LSx

2.2 Import/Export control

The Import/Export control is not available in the device

- Load control

  The control argument (selection) "Import/Export/Steady" for the four active power setpoints is hidden. The active power controller is internaly fixed to "Steady".

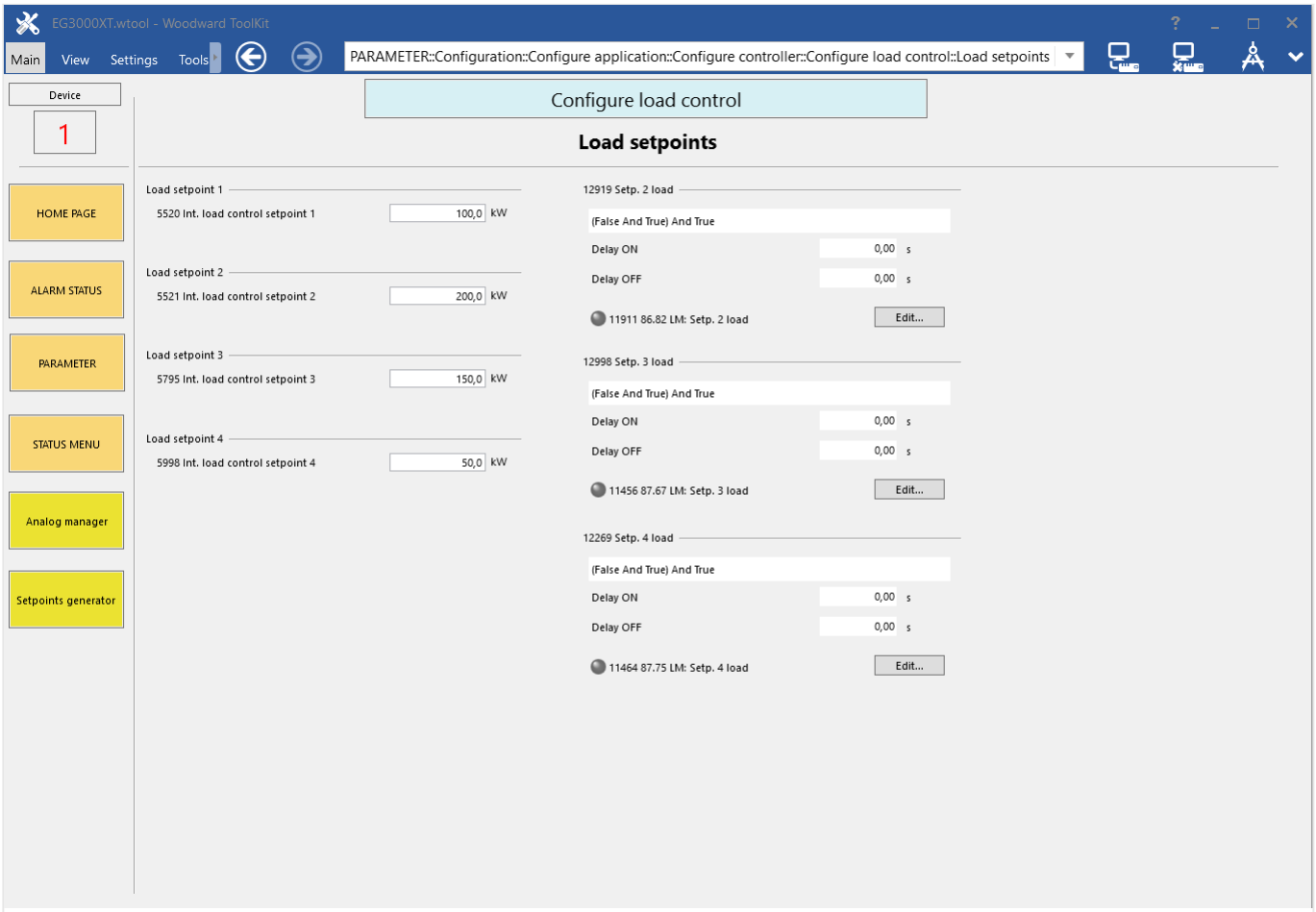


Fig. 4: Toolkit Load setpoints

- PF/kvar control

  The enumeration for the two PF/kvar setpoint modes are still visible, but there is an internal limitation from the control argument active.

  - PF setpoint

    Gen. PF → Gen. PF

    Mains PF → Gen PF is internal used

  - kvar setpoint

    Gen. kvar → Gen. kvar

    Mns. Export kvar → Gen kvar is internal used

    Mns. Import kvar → Gen kvar is internal used

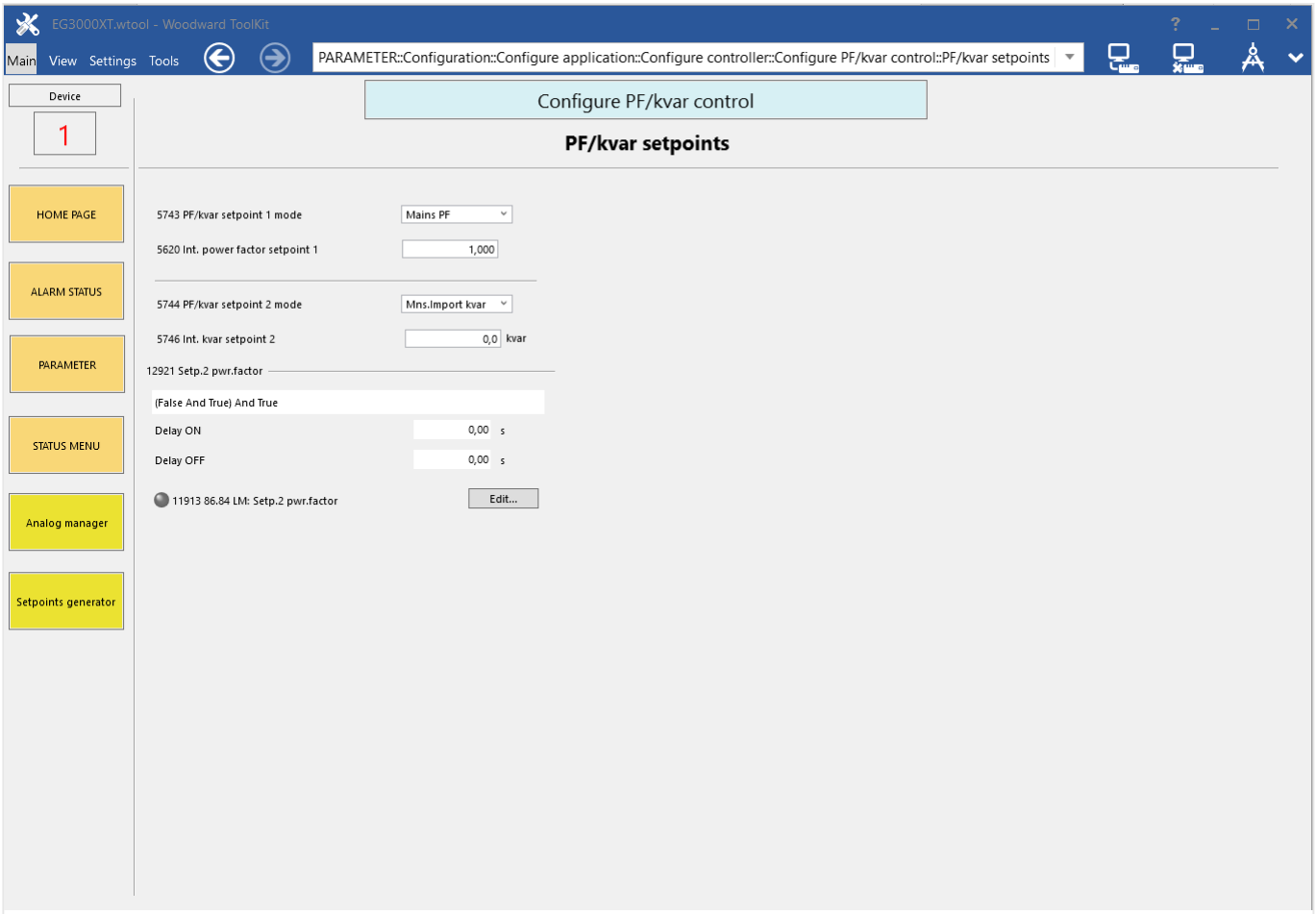


Fig. 5: Toolkit PF/kvar setpoints

2.3 Load dependent start/stop (LDSS)

The load dependent start/stop functionality is internal disabled and not available.

All related configuration and sequencing pages are hidden and not visible.

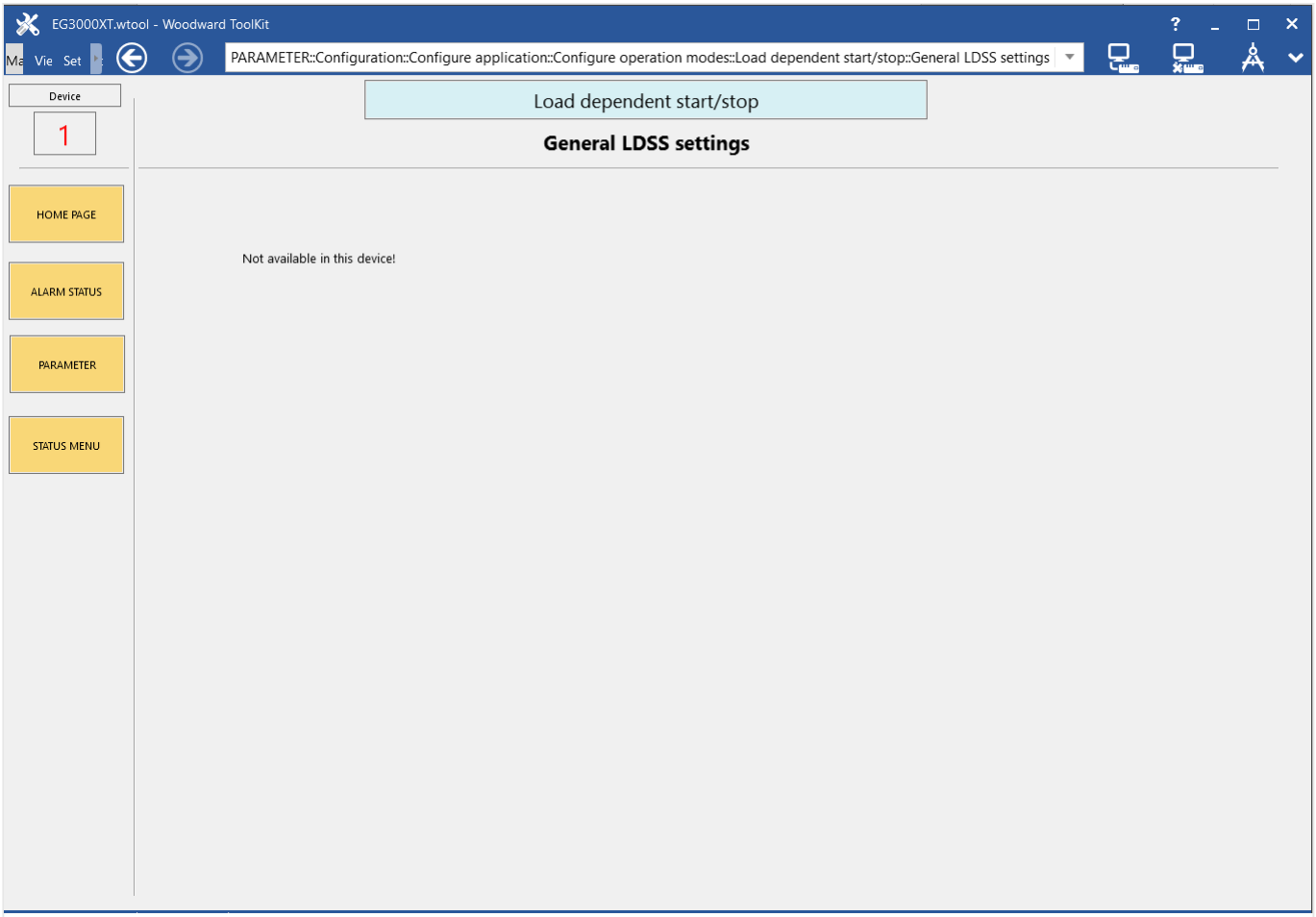


Fig. 6: Toolkit LDSS

2.4 Load sharing

The LITE version can operate only as a single device in isolated and parallel operation and the load sharing with other devices is not available.

All related configuration and multi unit pages are hidden and not visible.

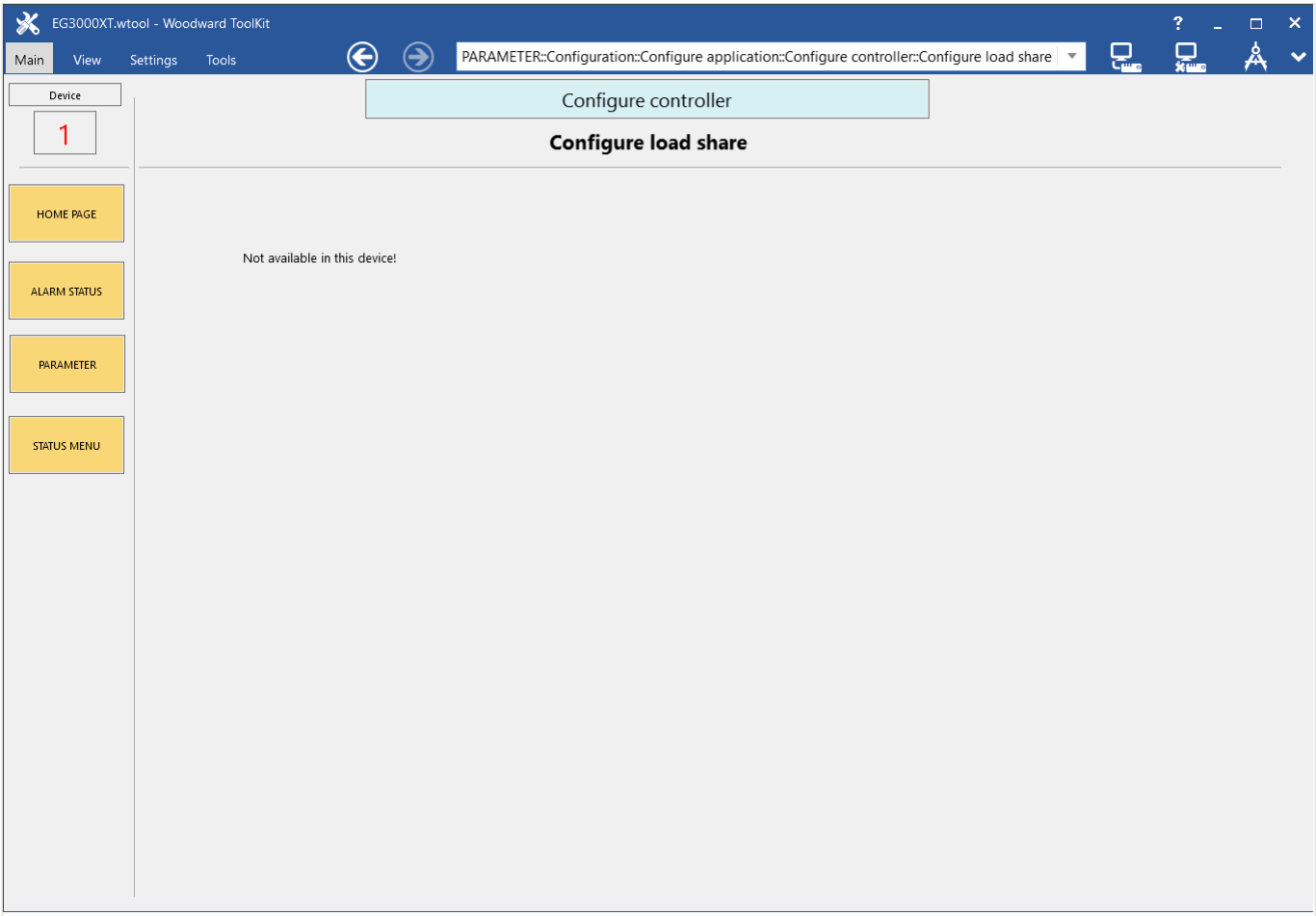


Fig. 7: Toolkit Load share

3 Configuration

3.1 Inputs And Outputs

3.1.1 Discrete Outputs

- Programmable
  - The discrete output has been assigned a default function using the LogicsManager.
  - The following text describes how these functions are assigned using the LogicsManager.
  - It is possible to change the function of the discrete output if required.
  - The following description of the outputs, labeled with "programmable", refers to the pre-configuration.
- Fixed
  - The discrete output has a specific function that cannot be changed depending upon the configured application mode.
  - The discrete output cannot be viewed or changed in the LogicsManager.
  - However, the discrete output may be programmable in some application modes.

The discrete outputs can be "programmable" or "fixed" depending on the application mode.

CAUTION!

Uncontrolled operation due to faulty configuration

The discrete output "Ready for operation" must be wired in series with an emergency stop function.

This means that it must be ensured that the generator circuit breaker is opened and the engine is stopped if this discrete output is de-energized.

If the availability of the plant is important, this fault must be signaled independently from the unit.

CAUTION!

Uncontrolled operation due to unknown configuration

The circuit breaker commands must be checked before every commissioning because the relays can be used for different applications and can be assigned to various functions.

- Make sure that all relay outputs are configured correctly.

Output	Type/Preset	Description
Relay output [R 01]	Programmable Fixed to "Ready for operation" **CAUTION!** Only relay [R 01] has an inverse logic. The relay opens (all other relays close), if the logical output of the LogicsManager becomes TRUE.	This discrete output is used to ensure that the internal functions of the controller are operating properly. It is possible to configure additional events, which cause the contacts of this discrete output to open, using the LogicsManager.
Relay output [R 02]	Programmable Preconfigured to "Centralized alarm (horn)"	When a centralized alarm is issued, this discrete output is enabled. A horn or a buzzer maybe activated via this discrete output. Pressing the button with the "✔" symbol will acknowledge the centralized alarm and disable this discrete output. The discrete output will re-enable if a new fault condition resulting in a centralized alarm occurs. The centralized alarm is initiated by class B alarms or higher.
Relay output [R 03]	Programmable Preconfigured to "Starter"	The generator starting circuit is engaged when this discrete output is enabled. This discrete output will enable depending on the start sequence (refer to the start sequence description in the easYgen-3000XT manual). The starter energize for the configured starter time (parameter 3306).
Relay output [R 04]	Programmable Preconfigured to "Start/Gas"	**Fuel solenoid** The fuel solenoid for the diesel engine is energized when this discrete output is enabled. If the engine is given a stop command or engine speed drops below the configured firing speed, this discrete output is disabled immediately. **Gas valve** The gas valve for the engine is energized when this discrete output is enabled. If the engine is given a stop command or engine speed drops below the configured firing speed, this discrete output is disabled immediately.
Relay output [R 05]	Programmable Preconfigured to "Preglow"	**Preglow** When this discrete output is enabled, the diesel engine's glow plugs are energized. This function only occurs if the control has been configured for diesel engine start/stop logic. **Ignition** When this discrete output is enabled, the gas engine's ignition is enabled. This function only occurs if the control has been configured for gas engine start/stop logic. **Notes** Refer to Configure Engine (general) in the easYgen-3000XT manual.
Relay output [R 06]	Fixed to "Command: close GCB"	Only applicable for application modes A03 and A04. The "Command: close GCB" output issues the signal for the GCB to close. This relay may be configured as an impulse or steady output signal depending on parameter "3414 GCB close command". **Impulse**

Output	Type/Preset	Description
		If the output is configured as "Impulse", the discrete output will enable for the time configured in parameter "3416 GCB time pulse". An external holding coil and sealing contacts must be installed into the GCB closing circuit if this discrete output is configured for an impulse output signal. **Steady** If the relay is configured as "Steady", the relay will energize and remain enabled as long as the discrete input "Reply GCB" remains de-energized and the generator and busbar voltages are identical. If a class C or higher alarm occurs, this discrete will disable and the GCB will open immediately.
Relay output [R 07]	Fixed to "Command: open GCB" Programmable	Not applicable for application mode A01. The parameter 3403 defines how this relay functions. • If this output is configured as "N.O.", the relay contacts close resulting in the GCB opening circuit energizing. • If this output is configured as "N.C.", the relay contacts open resulting in the GCB opening circuit de-energizing. • If this output is configured as "Not used", this relay is freely configurable. The LogicsManager for Relay 7 is preconfigured to "04.70 Opening GCB active" (This pre-configuration is similar to the "N.O." logic).
Relay output [R 08]	Fixed to "Command: close MCB"	Only applicable for application mode A04. The discrete output "Command: close MCB" is an impulse output signal. This discrete output is enabled for the time configured in parameter "3417 MCB close command". An external holding coil and sealing contacts must be utilized with the MCB closing circuit.
Relay output [R 09]	Fixed to "Command: open MCB" Programmable	Only applicable for application mode A04. The parameter 3398 defines how this relay functions. • If this output is configured as "N.O.", the controller enables this discrete output when the MCB is to be opened for switching operations. If the discrete input "Reply MCB" is energized, the discrete output "Command: open MCB" is disabled. • If this output is configured as "Not used", this relay is freely configurable. The LogicsManager for Relay 9 is preconfigured to "04.22 Opening MCB active" (This pre-configuration is similar to the "N.O." logic).
Relay output [R 10]	Programmable Preconfigured to "Auxiliary services"	The auxiliary services output (LogicsManager 03.01) will be enabled with the start command (prior to the engine start because of the prerun time) and remains enabled as long as the engine is running. It will be disabled after the engine has stopped and the postrun time has expired. The auxiliary services output (LogicsManager 03.01) is always enabled in MANUAL operation mode.
Relay output [R 11]	Programmable Preconfigured to "Warning alarm"	This discrete output is enabled when a warning alarm (class A or B alarm) is issued.

Output	Type/Preset	Description
		After all warning alarms have been acknowledged, this discrete output will disable.
Relay output [R 12]	Programmable Preconfigured to "Shutdown alarm"	This discrete output is enabled when a shutdown alarm (class C or higher alarm) is issued. After all shutdown alarms have been acknowledged, this discrete output will disable.
LogicsManager Relay		All discrete outputs not assigned to a defined function, may be freely configured via the LogicsManager.

3.2 Configure Engine

3.2.1 Configure Engine (general)

ID	Parameter	CL	Setting range [Default]	Description
12885	**Bypass preglow time**	2	Determined by LogicsManager 86.50 **[(0 & 1) & 1]** = 11558	Once the conditions of the LogicsManager have been fulfilled the diesel engine starts without preglow.
				Notes This LogicsManager is only used if the "start/stop mode logic" is configured to Diesel in combination with "preglow mode" Always or Analog. An active preglow mode will be interrupted if the LogicsManager becomes active.

3.3 Configure Breakers

3.3.1 Configure Breakers: GCB

ID	Parameter	CL	Setting range [Default]	Description
3403	**GCB open relay**	2	**[N.O.]**	Normally open: The relay "command: GCB open" will be energized to open the GCB and will be de-energized again after the discrete input "Reply GCB" is energized to signal the control that the GCB is open. **Notes**

ID	Parameter	CL	Setting range [Default]	Description
				This setting **only** applies to application mode A02 to A04.
			N.C.	Normally closed: The relay "command: GCB open" will be de-energized to open the GCB and will be energized again after the discrete input "Reply GCB" is energized to signal the control that the GCB is open. **Notes** This setting **only** applies to application mode A02 to A04.
			Not used	The LogicsManager relay R7 is freely programmable. The pre-configuration "04.70 Opening GCB active" works similar to the "N.O." logic. **Notes** The "GCB open" functionality **only** applies to application mode A02 to A04.
12887	**Enable GCB**	2	Determined by LogicsManager 86.95 **[(1 & 1) & 1]** = 12051	Once the conditions of the LogicsManager have been fulfilled the closing from the GCB is released. The "Enable GCB" is necessary for the deadbus closure and synchronization as well.
				Notes The "Enable GCB" is valid for all application and operating modes. Removing the release of the GCB has an impact on the GCB closure not on opening the GCB.
12886	**Open GCB immediately**	2	Determined by LogicsManager 86.51 **[(0 & 1) & 1]** = 12052	Once the conditions of the LogicsManager have been fulfilled the GCB will be opened immediately.
				Notes The "Open GCB immediately" has a higher priority than the Enable GCB function and is valid for all application and operating modes.

3.3.2 Configure Breakers: MCB

General notes

The following parameter is **only** applicable for application mode A04.

ID	Parameter	CL	Setting range [Default]	Description
3398	**MCB open relay**	2	**[N.O.]**	Normally open: The relay "command: MCB open" will be energized to open the MCB and will be de-energized again after the discrete input "Reply MCB" is energized to signal the control that the MCB is open.
			Not used	The LogicsManager relay R9 is freely programmable. The pre-configuration "04.22 Opening MCB active" works similar to the "N.O." logic.

4 Glossary And List Of Abbreviations

AM	AnalogManager
BDEW	German community of 1,800 companies represented by the German Association of Energy and Water Industries (Bundesverband der Energie- und Wasserwirtschaft)
CB	Circuit Breaker
CL	Code Level
CT	Current Transformer
DI	Discrete Input
DO	Discrete (Relay) Output
ECU	Engine Control Unit
EX-10	Woodward excitation module “easYgen | exciter 10"
FMI	Failure Mode Indicator
GAP	Graphical Application Programming (GAP™)
GC	Group Controller
GCB	Generator Circuit Breaker
GCP	Woodward device series (Genset Control) - not preferred for new design!
GGB	Generator Group Breaker
GOV	(speed) Governor; rpm regulator
HMI	Human Machine Interface e.g., a front panel with display and buttons for interaction
I	Current
IOP	Island Operation
LDSS	Load-Dependent Start/Stop operation
LM	LogicsManager©
LSG	Woodward device: Load Share Gateway (communication converter)
MCB	Mains Circuit Breaker
MFR	Woodward device series (multifunctional relays) - not preferred for new design!
MOP	Mains Operation in Parallel
MPU	Magnetic Pickup Unit
N.C.	Normally Closed (break) contact
N.O.	Normally Open (make) contact
NC	Neutral Contactor

OC	Occurrence Count
Operation	In (general) operation. State when the genset is running according to the selected mode, all parameters are in allowed values and ranges, and without OPEN requests or alarms. Somehow "waiting for next occurrence".
P	Real power
P/N	Part Number
PF	Power Factor
PID	Proportional Integral Derivative controller
PLC	Programmable Logic Control
PT	Potential (Voltage) Transformer
PV	Photovoltaic
Q	Reactive power
S	Apparent power
Sequencer	A sequencer file is carrying specific settings e.g. to enable communication with and/or control of an expansion module. Such files can be prepared by Woodward.
S/N	Serial Number
SPN	Suspect Parameter Number
V	Voltage

Index

Woodward GmbH
Handwerkstraße 29 — 70565 Stuttgart — Germany
Phone +49 (0) 711 789 54-510
Fax +49 (0) 711 789 54-101
stgt-info@woodward.com