easyYgen-3200 Overview

Genset Control for Multiple Unit Operation
ONE UNIT - INFINITE POSSIBILITIES: the easYgen™- 3000
Introduction

The easYgen-3000 platform offers a new level of technology for power generation customers. New software and hardware capabilities enable users to customize this control to their exact requirements and adapt it to numerous genset applications. The functions needed to run applications from very basic to the advanced have been incorporated into a single part number and at an exceptionally competitive price.

The easYgen-3000 is the result of Woodward’s leading edge, global experience in the genset control business. Communications with our global market have enabled Woodward to optimize a control that meets technical and commercial aspects for the market today and in the future.

The easYgen-3000 will permit our customers to differentiate themselves in their respective markets and will assist them in maintaining a competitive advantage in the coming years.

This presentation is to introduce the easYgen-3200 as the first model available from the easYgen-3000 platform line.
# Current and future Part Numbers

<table>
<thead>
<tr>
<th>easYgen-3000 Platform</th>
<th>Terminal Blocks</th>
<th>Comm. Ports</th>
<th>1A CT</th>
<th>5A CT</th>
<th>1A CT P2</th>
<th>5A CT P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP-3000 (Remote Panel)</td>
<td>2</td>
<td>1</td>
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**RP-3000**  
**easYgen-3100**  
**easYgen-3200**
Market

Genset application
- Diesel and gas engines.
- Synchronous Generators
- Single unit island/mains parallel operation
- Multiple unit island/mains parallel operation

Typical Field applications
- Emergency mode - AMF (Automatic Mains Failure)
- Stand-by application
- Cogeneration – CHP (Combined Heat and Power)
- Peak shaving
- Prime mover application
- Export/Import control
- Load or process dependend start/stop for single/multiple units
Single Unit Mains Parallel

- Engine start / stop
- Generator protection
- AMF (auto mains failure)
- Generator control
- Frequency / active power
- Voltage / power factor
- Parallel to mains
- Full Generator Breaker Control
- Full Mains Breaker Control
No external mains breaker control module required. Mains CT and PT will connected to all easYgen-3000.

=> Full redundant protection/control over the Mains Breaker.

Multiple Unit Mains Parallel

Up to 32 units in island and mains parallel apps.
Overview

- **FlexApp™**
  Multiple breaker operation application setups in one unit:
  No breaker, GCB o/, GCB o/c, GCB & MCB o/c*

- **FlexRange™**
  Allows for the control to operate on a wide range of PT voltage inputs and CT configurations

- **FlexIn™**
  The controller analog inputs are compatible with both resistive and mA signals permitting the use of a wide range of sending units

- **LogicsManager™**
  Configurations, operating sequences, and operating modes can be modified through the use of logical operators, timers, internal and external status

- **Analog Manager™**
  Analog signals can be monitored and sent to an output (metered values, bias signals for control purposes)

- **FlexLimits™**
  Free running and programmable analog limit switches extend the quantity of trip levels or actuation triggers

- **FlexCAN™**
  Allows for CANopen and J1939 protocols

* o/ = open; o/c = open/synch./close
Features – Overview

Engine control
• Diesel or gas engines
• Start/Stop management
• ECU interconnection

Breaker control
• GCB
• MCB
• No breaker application

Power Management
• kW-, kVAR-, f-, V-, pow.fact.-Control
• kW-, kvar-, Sharing

Protection
• Engine protection
• Generator protection
• Mains monitoring
• Breaker monitoring

Customization
• High flexibility via LogicsManager
• Multiple languages
• Customized front foils/face panels
Features – Engine Control

- Stop, Manual, Automatic modes
- Start / stop by discrete inputs, interface, frontpanel, analog inputs ...
- ECU CAN J1939 connection for
  - Monitoring
  - Visualization
  - Control
- Override mode for critical operation
- Speed sensing/monitoring by MPU
- Redundant relay outputs for safety considerations (breaker, gas valves,...) via LogicsManager

- Crank control and protection
- Aux. excitation for alternator via D+ terminal
- Aux. services for pre- and postrun
- Counters for running hours, service requests,...
Features – Engine Control

Start-Stop-Management

- Load-Dependent Start/Stop (LDSS) up to 32 generator sets based on:
  - Fuel efficiency
  - System reserve power
  - Service hours
  - Different sized engines/generators
- Fault conditions on genset “X” in the network (Next genset starts)
- Process data; e.g. temperature, fuel level, or any other measured state
- Loss of mains detection for supplying emergency power
Features – Breaker

Breaker

- No breaker, GCB, MCB

Breaker modes

- Parallel
- Open transition
- Closed transition
- Interchange (Soft transfer)
- External (No breaker ops.)

Synchronization Modes

- Phase matching
- Slip frequency synch.
- Synch. check option

Protection

- Synch Time Out
- Close Time Out
- Open Time Out
- Field rotation monitoring
Features – Controllers

AVR and Governor Control Signals

Frequency
- Load sharing
- Isochronous
- Droop

Voltage
- Reactive (var) sharing
- Isochronous
- Droop

Load control
- Baseload
- Export/Import

Power Factor
- Constant

Two setpoints for each controller
- Internal setpoints
- Interface
- Discrete Inputs (discrete raise/lower)
- Analog inputs (by mA, by potentiometer)

Bias outputs (for AVR & Governor)
- Adjustable analog bias signal between +/-20 mA or +/-10 V
- PWM output
- Relay outputs raise/lower (3-step-Logic)
- Analog bias and raise/lower outputs are separately configurable for V, var, f and kW. (=> dual fuel capability)

Droop can be dynamically activated/deactivated via LogicsManager.
Features - **LogicsManager™**

Configuration and modification of sequences and operation modes by using logical operators, timers, internal and external status conditions.

### Digital Signals
- Discrete inputs
- Relay status
- External discrete inputs
- External relays
- Control messages via CAN, Modbus, ...

### Internal Conditions
- CB status
- Operating mode
- Engine status
- Alarms
  - Warning alarm
  - Shutdown alarm
- Time / Date

### Assignment
- With timer ON-delay and OFF-delay
- 16 additional/internal flags or logical operations

### Relay Outputs
- Operate free configurable outputs

### Internal Conditions
- Start/stop engine
- Change operation mode
- Acknowledge of alarms
- Inhibit emergency mode
- Creating internal flags for cascading multiple dependencies
**Discrete I/O**

**12 x Relay Outputs**
- Alarm and control
- 6 single-pole contacts
- 6 two-pole contacts
- Max 2A @ inductive load

**12 x Discrete Inputs**
- Alarm and control (isolated)
- Configurables: Timers, alarm classes, text

**Expansion with external DI/DO boards**
- Max. 16 DI/16 DO
- Woodward IKD 1
- Phoenix

![Image of Discrete inputs and outputs interface](image)
**3 x Analog Inputs**
- 0 to 500 Ohm or 0/4 to 20 mA
- Change between different senders via parameter
- 1- and 2-wire senders supported
- 11 bit resolution
- Configurables: Timers, alarm classes, text

**1 x Battery Voltage**
- Monitoring of power supply 8 to 40 Vdc

**1 x Magnetic Pickup Unit (MPU)**
- Switching or inductive
- Configurable for number of teeth

**Expansion with external analog boards**

![Image of analog I/O setup](image_url)
2 x Analog Outputs

- Maximum +/- 20 mA or +/- 10 V or PWM (500 kHz)
- Preconfigured for speed and voltage bias and configurable as scalable output for measured values (kW) (ext. analog meters)
- Change between voltage and current by using simple jumpers
- 11/12 bit resolution

1 x Auxiliary Excitation D+

- Input: Sensing and monitoring of excitation voltage
- Output: Supplying excitation voltage (via internal shunt resistor)
Voltage and Current sensing
Generator and Mains

3Ph4W (3phase, 4wire)
1-, 2- and 3-phase CT arrangement possible & configurable for each phase

3Ph3W (3phase, 3wire)

1Ph3W (1phase, 3wire)
only 2-phase CT possible

1Ph2W (1phase, 2wire)
only 1-phase CT possible

FlexRange™
AC Generator sensing

True RMS Voltage Sensing
- 4-phase (L1, L2, L3, Neutral)
- 100 and 400 V input
- Frequency measurement
- Field rotation detection
- Class 1 accuracy
- Phase-to-Phase measurement
- Phase-to-Neutral measurement
- 3ph3w, 3ph4w, 1ph2w, or 2ph3w

True RMS Current Sensing
- 3-phase
- Non-returning slave pointer
- Class 1 accuracy

Power Sensing
- Class 2 accuracy
- True RMS power measuring
- Real and reactive power
- Power factor
- Energy counters Wh and varh

True RMS Auxiliary Current Sensing
- Configurable as mains CT or Generator ground fault CT
AC Mains sensing

**True RMS Voltage Sensing**
- 4-phase (L1, L2, L3, Neutral)
- 100 and 400 V input
- Frequency measurement
- Field rotation detection
- Class 1 accuracy
- Phase-to-Phase measurement
- Phase-to-Neutral measurement
- 3ph3w, 3ph4w, 1ph2w, or 2ph3w

**Power Sensing**
- Real, reactive and apparent power

**True RMS Current Sensing**
- Non-returning slave pointer
- Class 1 accuracy
AC Bus sensing

True RMS Voltage Sensing

- 2-phase sensing (phase-to-phase or phase-to-neutral)
- Phase angle between mains / bus and generator / bus
- Dead bus detection
Multiple languages – 10 standard

- English  - Turkish
- German   - Portuguese
- Italian  - Russian
- French   - Chinese
- Spanish  - Japanese
DynamicsLCD™

Italian

Configurare lingua
/ orologio

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French

config langue/horloge

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Spanish

Configurar idioma/reloj

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Turkish

Saat/Dil Ayarları

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Portuguese

Configurar Idioma/Relógio

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### DynamicsLCD™

#### Chinese

<table>
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<tr>
<th>语言/时钟</th>
<th>参数系统纵览</th>
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<tr>
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<td>月</td>
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<td>年</td>
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#### Russian

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#### Japanese

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<th>パラメータシステム概要</th>
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<td>時計 分設定</td>
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<td>時計 秒設定</td>
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<td>日付設定</td>
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<tr>
<td>月設定</td>
<td>07</td>
</tr>
<tr>
<td>年設定</td>
<td>07</td>
</tr>
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</table>
The 320x240 pixel graphic interactive LC display provides soft keys whose functionality changes depending on application (see FlexApp™) and operation.

- Delta / Wye Voltage
- Automatic
- Manual
- STOP
- Change operation modes
- Engine start / stop
- Breaker control
- Alarm Screen
- Configure Parameter
- Additional measured values
- Acknowledge/ reset centralized alarm
The display sections:

- **Current operation**, i.e. cranking, loading, start pause, etc.
- **Last alarm**
- **Single line diagram and operation mode**
Operating modes

- **Automatic mode**
- **Manual mode**
- **Stop mode**
Symbol meanings in the single line diagram

- **Voltage detected**
- Rotation field clockwise (CW)
- Rotation field counter clockwise (CCW)
- Import/export mains power
- Delayed engine monitoring expired
- Engine speed detected
DynamicsLCD™

Unit is trying to close the breaker

Stop command issued

Start/run command issued

Unit is trying to open the breaker
DynamicsLCD™

Examples for measuring screens
DynamicsLCD™

Alarm screen
- Visible active state
- Date and time stamp
- With totally 16 entries

Event History
- In-/ out coming events (+ / -)
- Date and time stamp
- 300 entries (FIFO)

Alarms will stay active until acknowledged, even if power is cycled.
# Alarm Classes

Alarm Classes are free configurable for most monitorings

<table>
<thead>
<tr>
<th>Class</th>
<th>Action</th>
<th>Result</th>
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<tbody>
<tr>
<td>A</td>
<td>Display</td>
<td>Warning</td>
</tr>
<tr>
<td>B</td>
<td>Display and Horn</td>
<td>Warning</td>
</tr>
<tr>
<td>C</td>
<td>Display and Horn</td>
<td>Unload Gen. and open GCB</td>
</tr>
<tr>
<td>D</td>
<td>Display and Horn</td>
<td>Open GCB immediate</td>
</tr>
<tr>
<td>E</td>
<td>Display and Horn</td>
<td>Unload Gen. and open GCB</td>
</tr>
<tr>
<td>F</td>
<td>Display and Horn</td>
<td>Open GCB immediate</td>
</tr>
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</table>

**Control**

For control purposes via LogicsManager to change/modify sequencing or discrete outputs
## Generator Protection

<table>
<thead>
<tr>
<th># of Trip Levels</th>
<th>ANSI Code</th>
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<tbody>
<tr>
<td>Over-/undervoltage 2/2</td>
<td>[59/27]</td>
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<tr>
<td>Voltage asymmetry 1</td>
<td>[47]</td>
</tr>
<tr>
<td>Over-/underfrequency 2/2</td>
<td>[81O/U]</td>
</tr>
<tr>
<td>Overload (IOP/MOP) 2</td>
<td>[32]</td>
</tr>
<tr>
<td>Reverse/reduced power 2</td>
<td>[32R/F]</td>
</tr>
<tr>
<td>Unbalanced load 2</td>
<td>[46 measured]</td>
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<tr>
<td>Definite time-overcurrent 3</td>
<td>[50/51]</td>
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<tr>
<td>Inverse time-overcurrent 1</td>
<td>[IEC 255]</td>
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<tr>
<td>Overspeed (MPU) 2</td>
<td>[12]</td>
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<td>Measured ground current 2</td>
<td>[50G]</td>
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<tr>
<td>Calculated ground current 2</td>
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</table>
Generator Protection

# of Trip Levels | ANSI Code
---|---
Power factor (PF) lagging | 2
PF leading – loss of excitation | 2
Phase rotation field CW/CCW | 1
\( P_{\text{setpoint}} \leftrightarrow P_{\text{actual}} \) mismatch | 1
Unload mismatch (time out monitoring) | 1
Operating range failed | 1

* plausibility monitoring features
Engine Protection

- Maintenance days exceeded
- Maintenance hours exceeded
- Over-/Underspeed (MPU)
- Unintended Stop
- Engine Stop malfunction
- Speed/frequency mismatch
- Start failure
- Charge alternator low voltage
- Red stop lamp (J1939)
- Amber warning lamp (J1939)
- Battery over-/undervoltage
# Mains Monitoring and decoupling

## # of Trip Levels

<table>
<thead>
<tr>
<th>Condition</th>
<th># of Levels</th>
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<tr>
<td>Over-/underfrequency</td>
<td>2/2</td>
<td>[81O/U]</td>
</tr>
<tr>
<td>Import/Export power</td>
<td>2</td>
<td>[32]</td>
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<tr>
<td>Power factor leading</td>
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<tr>
<td>Power factor lagging</td>
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<td></td>
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<tr>
<td>Phase shift</td>
<td>1ph/3ph</td>
<td>[78 ]</td>
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<td>Field rotation</td>
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</tbody>
</table>

![Diagram](image-url)
GCB / MCB fail to close
GCB / MCB fail to open
Synch. Time Out GCB / MCB
Phase rotation mismatch generator / busbar / mains
Mains decoupling
CAN bus communications monitoring (J1939, CANopen)
Parameter alignment (multiple units)
Missing members (multiple units)
EEPROM failure (internal CPU)
Wire break analog inputs
Discrete inputs
\textit{FlexLimits}^\text{TM} for analog values
Interfaces

- Load share
- CANopen

**CAN 1**
- Extension cards (IKD 1, Phoenix)
- J1939 ECU

**CAN 2**
- ToolKit
- Modbus

**Serial 1**
- RS-485
  - Modbus

**Serial 2**
- RS-232

All interfaces are galvanically isolated!
Interface Overview CAN bus

**Guidance level**
- Load share
- CANopen

**Engine level**
- J1939 (ECU)
- Extension cards

Total 32 units

**Digital expansion modules**
- 2x IKD 1
- Phoenix

**Analog expansion modules**
- Phoenix
- J1939
Interface Overview Serial Ports

- Serial 1 (RS-232)
  - ToolKit
  - Modbus
  - Peer-to-peer

- Serial 2 (RS-485)
  - Modbus
  - Multiple units
Configuration via ToolKit

RS-232 or CAN
Miscellaneous

• CE marked, UL listed, Marine Approval (LR)
• IP54 (NEMA 2) from front with clamp fasteners
• IP66 (NEMA 4) from front with screw kit
• IP20 from back
• Operating temperature range –20 to +70°C
• Weight approx. 1,850 g
• UL
• CERTIFICATE of Design Assessment by ABS
Complete Product Package

- Control unit easYgen-3200-5 (5A CT model)
- 12 x Screws for IP66 front panel mounting 8923-1262
- 4 x clamp fasteners brackets and screws for IP56 front panel mounting 8923-1263
- 1 x CD with
  - PC Configuration ToolKit Version 2.0
  - ToolKit *.WTOOL files (English and German)
  - ToolKit *.SID files (English and German)
  - Manuals
Planned Remote Panel

Remote Panel RP-3000

- CANopen connected panel to all easYgen-3000 controls
- Point-to-point connection
- Same look and feel as easYgen-3200
- Target release: 2008
easYgen-3100 (1A CT and 5A CT model)

- Metal housing: no display, HMI via interfaces and DI
- Same functionality as easYgen-3200
Planned Release easYgen-3500

easyGen-3200 I/O and functionality plus:

- 11 x Discrete Inputs (onboard, freely configurable)
- 11 x Discrete Outputs (onboard, freely configurable)
- 2 x Sinking Outputs (onboard, kWh metering)
- 9 x Analog Inputs (onboard, freely configurable)
- 4 x Analog Outputs (onboard, scalable)
- 1 x Ethernet port (load sharing, SCADA connection, Modbus TCP/IP)
- Release date: mid-2009
New Features Package P2

Extended I/O via external terminals – graphical Overview
New Features Package P2

Extended I/O via external terminals

- 48 x Analog Inputs
  - 32 x Inputs via predefined J1939 engine messages in 10 languages
  - 16 x Inputs via CANopen terminals

- 4 x Analog Outputs (CANopen, scalable, 0-20 mA or 0-10V)

- 16 x Discrete Inputs (CANopen terminals) additional → 32 total
- 16 x Discrete Outputs (CANopen terminals) additional → 32 total

- Some terminals I/O will be mapped to act like a central terminal (single point connection and message broadcast to every control e.g.: central room temperature, central fuel tank level, gas leakage detection, ….)

- The J1939 terminals need to be configured by the PC tools of the terminal manufacturers.

- The CANopen terminals can be configured via ToolKit directly
New Features Package P2

Free running PID loops

3 x Independent freely programmable PID control loops

- Configurable as Analog Outputs (0-20 mA) or 3-step-outputs (Relay Outputs)
- Proportional, Integral and Derivative adjustment
- Programmable for activation/deactivation via LogicsManager
- External and internal set points can be used
  - Usable for water heat cycle control, dual-fuel control, room temperature control …
3rd Party Accessories

Accessories easYgen-3000/P2

- **CANopen bus coupler**
  
  **IL CAN BK-TC-PAC** (#2718701) [max 3 possible]

- **Analog inputs**
  
  **IB IL AI 2/SF-PAC** (#2861302) 2x analog (0-20 mA, 4-20 mA, ±20 mA, 0-10 V, ±10 V)
  
  **IB IL TEMP 2 UTH-PAC** (#2861386) 2x thermocouples
  
  **IB IL TEMP 2 RTD-PAC** (#2861328) 2x RTDs, resistive senders

- **Analog outputs**
  
  **IB IL AO 2/SF-PAC** (#2863083) 2x analog outputs (0-20 mA, 4-20 mA, 0-10 V)

Phoenix order # numbers in brackets
3rd Party Accessories

Accessories easYgen-3000/P2

- **J1939 Analog inputs**
  - **TC 4 (#AXTC4)** 4x thermocouples
  - **TC 20 (#TC20)** 20x thermocouples

**Analog input 10 (#AX030100)** free configurable, for advanced J1939 users only

Axiomatic order # numbers in brackets
Accessories easYgen-3000 all types

- IKD 1 Digital Expansion Card [P/N 8440-1041]

- Terminal Strip Kit – Plug Set [P/N 8923-1314]
3rd Party Accessories

Accessories easYgen-3000 all types

- CANopen bus coupler
  **IL CAN BK-TC-PAC** (#2718701) [max 3 possible]

- Discrete inputs / outputs
  **IB IL 24/230 DOR4/W** (#2836421) 4x discrete output, PDT (5-253V, 3 A)
  **IB IL 24 DO2-2A-PAC** (#2861263) 2x discrete output, (24V, 2A)

  Supports **IB IL 24 DO 8; IB IL 24 DO 16** and **IB IL 24 DO 32** types

  **IB IL24 DI 2-PAC** (#2861221) 2x discrete input (24V)

  Supports **IB IL24 DI 4; IB IL24 DI 8; IB IL24 DI 16** and **IB IL24 DI 32** types

Phoenix order # numbers in brackets
Product Documentation

Product Specification


Product Presentation

- [P/N 37397]

Manual

- Installation Manual
  - [P/N 37223]
- Configuration Manual
  - [P/N 37224]
- Operation Manual
  - [P/N 37225]
- Interface Manual
  - [P/N 37383]
- Application Manual
  - [P/N 37226]

P2

- Installation Manual
  - [P/N 37414]
- Configuration Manual
  - [P/N 37515]
- Operation Manual
  - [P/N 37416]
- Interface Manual
  - [P/N 37418]
- Application Manual
  - [P/N 37417]
Note:

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