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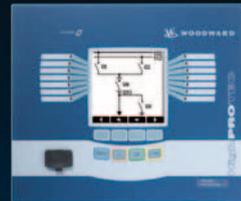
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# Product Catalogue

2011

POWER GENERATION  
AND DISTRIBUTION



POWER GENERATION  
AND DISTRIBUTION

Controlling the Power of Energy





GENSET

CONTROLLERS

SYNCHRONIZER &  
LOAD SHARE CONTROLLERS

AUTOMATIC TRANSFER  
SWITCH CONTROLLERS

TRANSDUCERS

MULTIFUNCTION  
RELAYS

PROTECTION  
RELAYS

POWER GENERATION  
ENGINE CONTROL PRODUCTS

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Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# Controlling the Power of Energy

Each day, we apply our knowledge and our resources to create systems that perform under incredible demands. We solve, improve, and address the challenges our customers face, and ultimately deliver solutions that are an essential part of the technology that is changing the world.



## ABOUT WOODWARD

Woodward delivers lasting contributions to energy control, always innovating for a better future. Woodward integrates leading-edge technologies into fuel, combustion, fluid, actuation, and electronic control systems for the aerospace and energy markets. We also convert wind energy into reliable and safe electrical power through converter systems. Our growth is driven by the increasing demand for fuel-efficient, low-emission, and high-performance energy management.

We have a clear vision and follow carefully planned long-term strategies. With multiple locations all over the world, Woodward can respond quickly with solutions tailored to the local demands of our customers. Our leadership in energy control and optimizations solutions is built on a strong foundation, dating back to 1870. We are driven by the needs of our customers and guided by our tradition of integrity, values, and principles.

## SERVING ENERGY MARKETS

Woodward enhances the global quality of life and sustainability by optimizing energy use through improved efficiency and lower emissions. Our technologies and services enhance energy conversion of renewable and fossil fuels, energy extraction and distribution, and electric power generation and distribution.

With Woodward's combination of combustion control, motion control, and electronic controls technologies, we enable more responsible energy use by reducing emissions, improving fuel utilization, and enabling power system integration.

## SOLUTIONS FOR ELECTRICAL POWER GENERATION

Enabling cleaner, more efficient power: Woodward provides complete engine management systems, genset controllers for the major power generation OEMs worldwide, as well as power converters for CO<sub>2</sub>-free renewable energy generation.

Our power management systems for diesel, natural gas, and alternative-fueled engines are key enablers to address the strict EPA emissions regulations while providing reduced overall cost of system ownership.



Woodward has maintained a preferred-supplier position in diesel- and gas-fueled power generation, also in complete plant control systems and wind power generation. Based on decades of experience with generator controls, load sharing, synchronization and power protection technologies, Woodward's power generation product line sets standards worldwide.

## SOLUTIONS FOR ELECTRICAL POWER DISTRIBUTION

Woodward designs, manufactures, and supports a complete line of intelligent multifunctional protection and control relays. They are utilized in a wide field of power generation and distribution applications (e.g. utility, industrial, renewable, and generator sets). Our customers appreciate the integrated concept of protection functions in one device tailored to their application needs. This results in a cost-effective solution for reliable state-of-the-art protection systems.

Woodward products are designed based on latest market trends and reflect our long-term expertise in the energy market. We fully understand customer needs for reliable, save, and robust multifunctional protection relays to provide the highest degree of overall system performance.



# Always Innovating for a Better Future



## WOODWARD HISTORY

Amos W. Woodward was dedicated, inventive, and hard-working. He applied those traits, along with outstanding craftsmanship, service, and integrity when he founded what was to become Woodward, Inc. in 1870.

Those very qualities remain the basis of our business philosophy today. Woodward's leadership in energy control and optimization solutions is built on that foundation of strategic vision, quality performance, and core values. We build on our proven successes with technologies that redefine the way our

customers' engines, turbines, and electrical power equipment operate. We are guided by our strong tradition of integrity, and hold fast to our core values and principles. We are driven by the needs of our customers, and aligned by our strategic vision and goals.



**We call it the Woodward Way.**

## WOODWARD SOCIAL RESPONSIBILITY

Woodward promotes an ethical environment that fosters growth, encourages self-development, and provides meaningful work. Through our employees and technology, our goal is to provide the highest value and quality systems, components, and services that contribute to our customers' success.

We believe Woodward does more than provide jobs in the communities in which we operate. We are deeply committed to supporting programs and organizations that ensure our communities are desirable places to live and work. We cultivate a spirit of volunteerism by encouraging our employees to be involved in their communities.

**"We are firm in our belief that our employees do with integrity, what is right for the business because the interests of Woodward and our employees are inseparable."**

**Tom Gendron,**  
*Chairman and CEO*



## WOODWARD WORLDWIDE

Woodward knows that its customers need to locate in growth areas, so we are right there with them – designing, manufacturing, and servicing our products. Careful consideration of environmental and cultural differences is the key to establishing Woodward as a concerned global citizen.

Our internal teams are comprised of employees from many locations as well – encouraging fresh ideas, offering a variety of views on how to meet new challenges, and providing our employees the opportunity to make a worldwide impact.

Woodward's plants, offices, and service centers span the globe:

**North and Central America, South America, Europe, Middle East and Africa, Russia, China, India, ASEAN and Oceania.**

Our global presence allows us to respond quickly to the needs of our customers. Customers and the industry at large recognize our people as a competitive advantage through their diverse representation of the global community. Additionally, as a company and as employees, we respond to the needs of our local communities by donating our time, talent, and money.

# Integration of Electrical Power Systems

PowerConnect™ is a strategy that addresses the two main trends in the electrical power industry: 1) Distributed Energy Resource (DER) integration and 2) smart electrical power distribution grids. Woodward's PowerConnect provides solutions for the electrical power industry's Security, Quality, Reliability, and Availability (SQRA). PowerConnect enables the integration of electrical power systems, which means distributed generation, medium- and low-voltage distribution, and use of electrical energy in an IT-connected infrastructure.

## FROM TODAY'S GRID TO SMART GRID

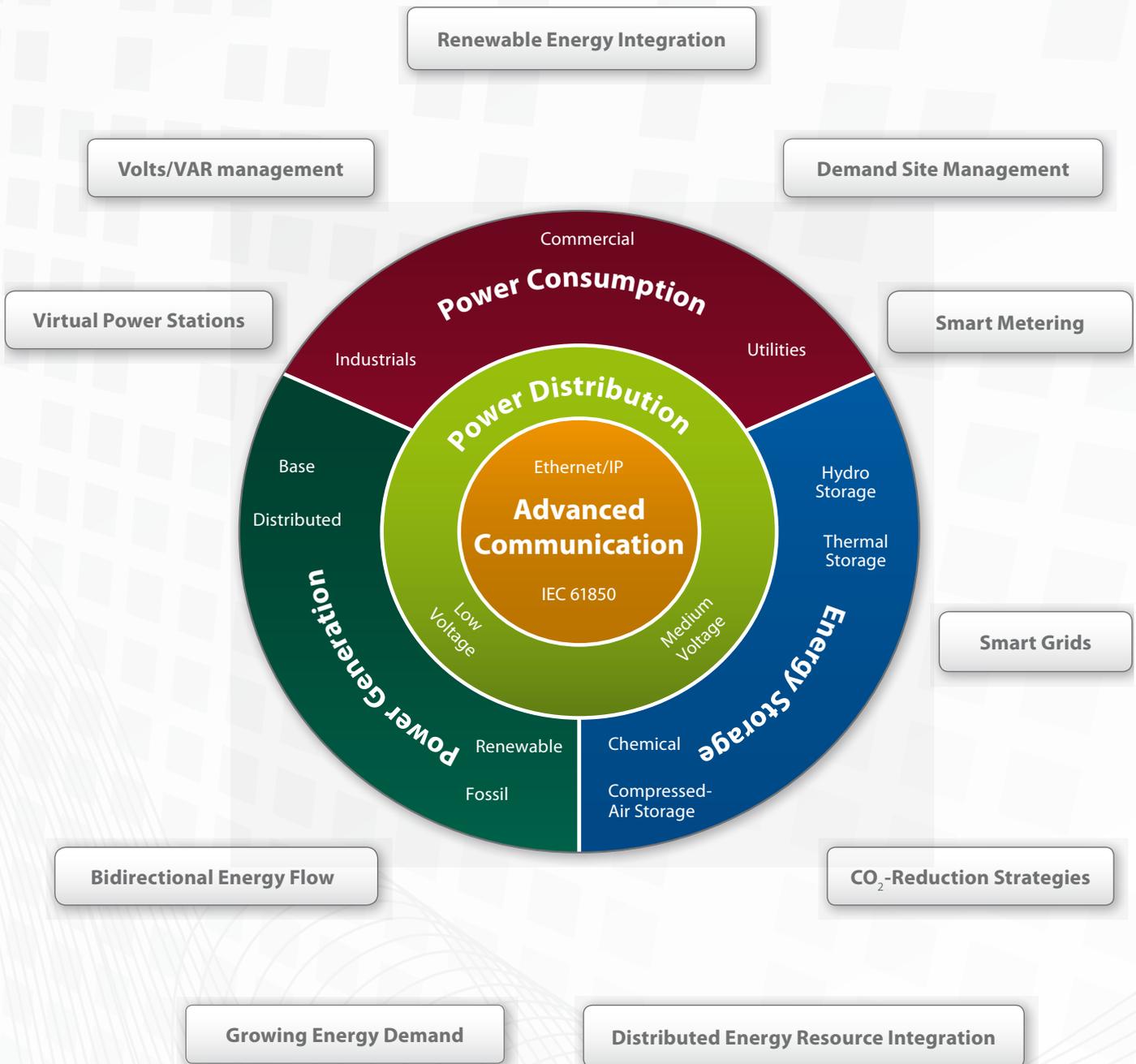
The shift to distributed generation is changing long-established concepts about how electricity should be produced, transmitted, and used. Power flow through the grid is becoming more decentralized and bidirectional. Local measurement, fault detection, and remote control are now essential for stability and intelligent load management. A new approach is needed: one that encourages greater use of renewable sources and facilitates interconnection of distributed power generation using advanced monitoring, communication, and control.

Woodward is recognized as a leader in the field of advanced power generation and distribution control products. We continue to build on our legacy by creating cutting-edge control and protection devices, designed to work in complex systems to meet the needs of tomorrow's smart grids. Our global strategy for melding all aspects of power generation and distribution to enable electrical power systems integration is called PowerConnect.

- Woodward's Electrical Power Systems products are backed by a network of sales support, technical support, and applications engineering personnel at over two dozen locations across the globe.
- Product training courses are offered in our plants worldwide. Please contact your sales representative.
- Product development is executed by an international team of experienced engineers, who can be called on to design tailor-made, innovative solutions to meet specific requirements for OEM manufacturers in the switchgear, wind power, marine switchboard, and genset packagers.
- Please visit [www.woodward.com](http://www.woodward.com) for more information, or contact your sales representative to discuss how to enable electrical power systems integration in your application.



Enabling Electrical Power Systems Integration



# GENSET CONTROLLERS



## Genset Controllers for Your Power Generation Systems

Woodward offers a wide variety of controllers for the generator set market. You will find the right solution regardless of whether you are looking for controllers to run simple none-parallel application or to service multiple generator set applications. If you are faced with complex breaker and load flow conditions where loss of power would be critical to your customers, invested assets or even lives, you can feel safe by using Woodward genset controllers.

Our controllers have undergone detailed and stringent verification and validation processes, so we are proud to say that we offer reliable and proven controllers. Our global application engineering and support teams complement our portfolio in case you need specific support for your application.



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# easYgen-300™ Series | FOR STANDARD SOLUTIONS

The easYgen-300 Series are affordable, value-packed genset controllers for auto-start and transfer switch operations. They provide all the essential functionality for standby diesel genset applications with monitoring, protection, and event recording options common to high-end controls.

A compact, fully enclosed molded housing, removable terminal connectors, and fast, easy PC programmability make it the smart control choice for serial standby genset production.

The easYgen-300 Series has a serial interface for PC configuration and connection with an external modem. Optional CAN bus communication provides monitoring of common J1939 alarms from supported engine ECU's breaker. The easYgen-300 Series is an affordable, value-packed genset controller for auto-start and transfer switch operation. It provides all the essential functionality for standby diesel genset applications with monitoring, protection, and event recording options common to high-end controls. Position inputs are used to interlock the GCB and MCB internally, ensuring that both cannot be closed at the same time and eliminating the need for external relays.

## FEATURE OVERVIEW

- Single-breaker or two-breaker options
- Configurable for open-and-close breaker control
- Breaker position monitoring
- 1-phase and 3-phase configurable voltage sensing options
- Generator protection
- CAN option for common J1939 alarms
- Digital display for voltage and frequency measured values, alarm annunciation, and counters
- Password-protected PC and front-face programmability

## PACKAGES



	easYgen-320		easYgen-350	
<b>Package</b>	-	X	-	X
GCB control / MCB control	●/-	●/-	●/●	●/●
Generator voltage measuring	1-phase / 2-wire	3-phase / 4-wire	1-phase / 2-wire	3-phase / 4-wire
Relay outputs	1	1	2	2
CAN bus interfaces	-	1	-	1
<b>Part No.</b>	8440-1798	8440-1800	8440-1799	8440-1801

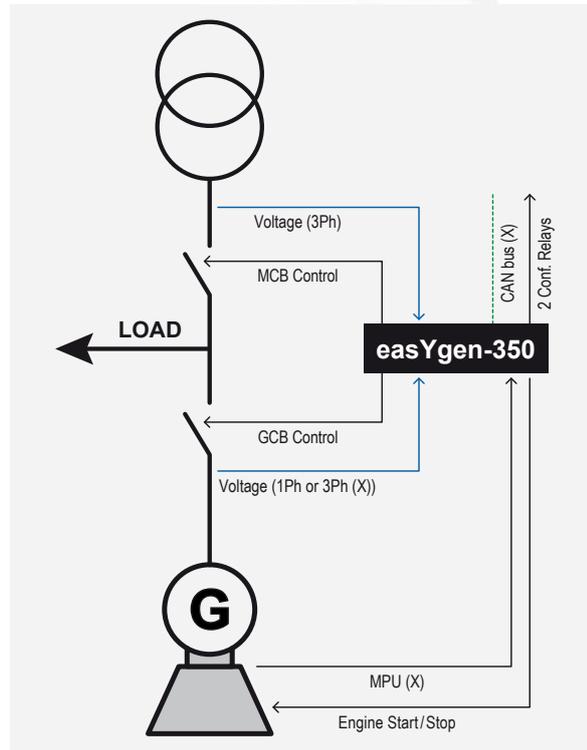
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## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (6.5 to 32 VDC)
Consumption	max. 10 W
<b>Ambient temperature (storage)</b>	-20 to 80 °C / -4 to 176 °F
<b>Ambient temperature (operation)</b>	-20 to 70 °C / -4 to 158 °F
<b>Ambient humidity</b>	95%, non-condensing
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS, isolated
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (8 to 40 VDC)
<b>Relay outputs</b>	Relays, dry contacts
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	0 to 500 ohms, 0 to 20 mA
<b>Analog outputs (isolated)</b>	±10 V / ±20 mA / PWM
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimensions (WxHxD)	158 x 158 x 40 mm
<b>Sealing (front / back)</b>	IP54 / IP20
<b>Weight</b>	approx. 450 g

## APPLICATIONS



<b>Approvals</b>	<b>Software</b>	<b>Expansion Modules</b>	<b>Detailed Information</b>
	LeoPC 1	Spare Connector Kit	Product specification 37217 at <a href="http://www.woodward.com">www.woodward.com</a>

- Genset Controllers
- Synchronizer & Load Share Controllers
- Automatic Transfer Switch Controllers
- Transducers
- Multifunction Relays
- Protection Relays
- Power Generation Engine Control Products

# easYgen-1000™ Series | FOR SINGLE UNIT APPLICATIONS

The innovative features of the easYgen-1000 Series, including flexible breaker configuration and start/stop logic, real and reactive power sensing, and remote-start capability make it the intelligent choice for specialized mobile power and emergency standby applications.

Advanced CAN communication provides control of most common engine ECUs and allows connection to the Woodward IKD 1 module for expansion of the onboard I/O set, and to the easylite-100 remote annunciation panel for NFPA-compliant installations.

## FEATURE OVERVIEW

- Configurable for one or two breakers in open transition
- Flexible start/stop logic for diesel and gas engines
- True RMS voltage and current sensing for generator and mains
- Complete engine/generator protection, metering and mains monitoring
- LogicsManager™ to combine measured values, internal conditions, and I/O states with Boolean operators and programmable timers, allowing for complex controls
- Communication to engine ECUs, Programmable Logic Controls (PLC), external terminals (I/O expansion)
- Support of CAN open, J1939, Modbus RTU, and modem connection
- Selectable display languages

## PART NUMBERS



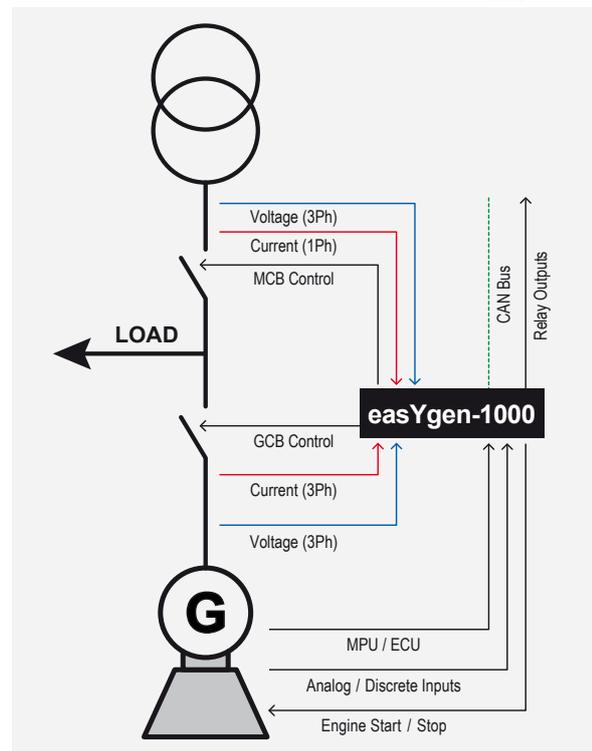
easYgen-1000 Series	
Part No.	
1 A	8440-1810
5 A	8440-1809



## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)
Consumption	max. 15 W
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS, isolated
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (6.5 to 40 VDC)
<b>Relay outputs</b>	Relays, dry contacts
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	0 to 500 ohms, 0 to 20 mA
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	219 × 171 × 61 mm
<b>Sealing (front / back)</b>	IP65 / IP20
<b>Weight</b>	approx. 800 g

## APPLICATIONS



- Genset Controllers
- Synchronizer & Load Share Controllers
- Automatic Transfer Switch Controllers
- Transducers
- Multifunction Relays
- Protection Relays
- Power Generation Engine Control Products

Approvals	Software	Expansion Modules	Detailed Information
	Toolkit	IKD 1 Digital Expansion Cards · easYlite-100 Annunciator · Spare Connector Kit · GW 4 Gateway	Product specification 37180 at <a href="http://www.woodward.com">www.woodward.com</a>

# easYgen-2000™ Series | IMPROVING SYSTEM EFFICIENCY

The easYgen-2000 Series is a compact, affordable genset control and protection package for load sharing up to 16 gensets in island operation, or parallel operation of a single unit with a utility. Its integrated load-dependent start/stop programming allows you to define how gensets are brought on- and off-line to support changing load demands. It even works with a mix of different sized engines, so you can maintain the spinning reserve you need while optimizing fuel efficiency.

Advanced interface capability provides communication at the genset control level, up to the system network level, and to your desktop half a world away. The easYgen-2000 Series works with many common industrial interfaces: CANopen for peer-to-peer load sharing; J1939 for engine ECU; Modbus RTU for PLC, HMI, and SCADA; and modem for remote control and programming using Woodward ToolKit software.

## YOUR BENEFITS AT A GLANCE

Realize even cost-driven projects with a genset control that gives you maximum flexibility and advanced functionality to fulfill your customers' requirements.

## FEATURE OVERVIEW

- Load share 16 gensets in island mode, or parallel a single genset to a utility
- Control of generator, and mains breaker, open or closed transition, synchronization and soft load/unload
- LogicsManager™ Boolean programmability for complex system control
- Process-dependent start/stop logic
- Multilingual capability: selectable display languages
- Complete engine and generator protection and mains monitoring
- Asynchronous (inductive) and synchronous generator support



## PACKAGES

Package	easYgen-2200		easYgen-2500
	P1	P2	P1
MPU input	•	-	•
Discrete inputs	8	8	10
Relay outputs	6	6	11
Analog inputs	3	3	4
Analog outputs	1	1	4
CAN bus interfaces	1	1	2
RS-485 interfaces	-	-	1
<b>Part No.</b>			
1 A	8440-1856	8440-1858	8440-1860
5 A	8440-1855	8440-1857	8440-1884

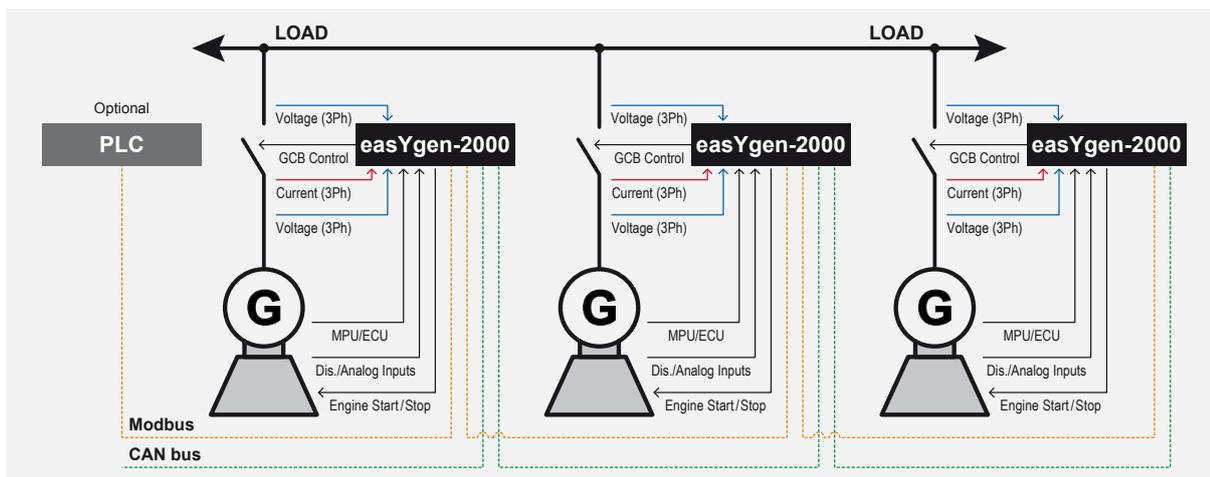
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## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)	<b>Relay outputs</b>	Relays, dry contacts
Consumption	max. 8/12 W (depending on model)	Load (resistive)	2 A at 24 VDC and 250 VAC
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F	<b>Analog inputs</b>	0 to 500 ohms, 0 to 20 mA
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F	<b>Analog outputs (isolated)</b>	±10 V / ±20 mA / PWM
Ambient humidity	95%, non-condensing	<b>Housing</b>	
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS	Front panel mounting	Plastic housing
Accuracy	Class 1	Dimension easYgen-2200 (WxHxD)	219 x 171 x 61 mm
<b>Current AC input</b>	1 A or 5 A true RMS, isolated	Dimension easYgen-2500 (WxHxD)	219 x 171 x 98 mm
Accuracy iac	Class 1	<b>Sealing (front / back)</b>	IP65 / IP20
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (8 to 40 VDC)	<b>Weight</b>	approx. 800 g (easYgen-2200) approx. 1,100 g (easYgen-2500)

## APPLICATIONS



<b>Approvals</b>	<b>Software</b>	<b>Expansion Modules</b>	<b>Detailed Information</b>
	Toolkit	IKD 1 Digital Expansion Cards · easYI-ite-100 Annunciator · LSG Load Share Gateway · Spare Connector Kit	Product specification 37448 at <a href="http://www.woodward.com">www.woodward.com</a>

Genset Controllers

Synchronizer & Load Share Controllers

Automatic Transfer Switch Controllers

Transducers

Multifunction Relays

Protection Relays

Power Generation Engine Control Products

# easYgen-3000™ Series | ONE UNIT – INFINITE OPPORTUNITIES

The easYgen-3000 is an exceptionally versatile genset control and protection package with all the flexibility and features needed to fit a wide range of power generation applications. It allows the user to standardize on a single, affordable control for many uses – from stand-alone emergency generators to isochronous parallel operation of up to 32 gensets. Common applications include emergency standby, cogeneration, marine ship/shore power, island prime power or utility paralleling with peak shaving, and import/export control.

## YOUR BENEFITS AT A GLANCE

Gain full flexibility with just one control that is suitable for the full range of genset power applications from standard island power plants to highly customized cogeneration units in mains parallel mode.

## AVAILABLE IN TWO VERSIONS

- The back-panel-mounted easYgen-3100/3400 has a rugged aluminum chassis for use in harsh environments or confined spaces
- The front-panel-mounted easYgen-3200/3500 has sealed soft keys and a large, easy-to-read backlit LCD multilingual graphical display

## FEATURE OVERVIEW

- True RMS voltage and current sensing for generator, bus and mains
- Complete engine/generator protection, metering, and mains monitoring
- LogicsManager™ to combine measured values, internal conditions, and I/O states with Boolean operators and programmable timers, allowing for complex controls
- Load share 32 gensets in island mode or paralleled to the utility
- Different load or process-dependent start/stop sequencing with kW/kvar load sharing
- Configurable generator, mains, and generator
- Communication to engine ECUs SCADA, external I/O and RP-3000 remote panel
- Support of CAN open, J1939, Modbus RTU and modem support
- Easy-to-read graphical display
- Selectable display languages (easYgen-3200 / easYgen-3500)

## PACKAGES



Package	easYgen-3100		easYgen-3200		easYgen-3400		easYgen-3500	
	P1	P2	P1	P2	P1	P1 (Marine)	P1	P1 (Marine)
LCD display	-	-	• (color)	• (color)	-	-	• (color)	• (color)
Mounting	Back panel	Back panel	Front panel	Front panel	Back panel	Back panel	Front panel	Front panel
External discrete inputs/outputs	16/16	32/32	16/16	32/32	32/32	32/32	32/32	32/32
External analog inputs/outputs	-	16/4	-	16/4	16/4	16/4	16/4	16/4
<b>Part No.</b>								
1 A	8440-2055	8440-2057	8440-2049	8440-2051	8440-1956	8440-2044	8440-1935	8440-2046
5 A	8440-2054	8440-2056	8440-2050	8440-2052	8440-1945	8440-2045	8440-1934	8440-2047

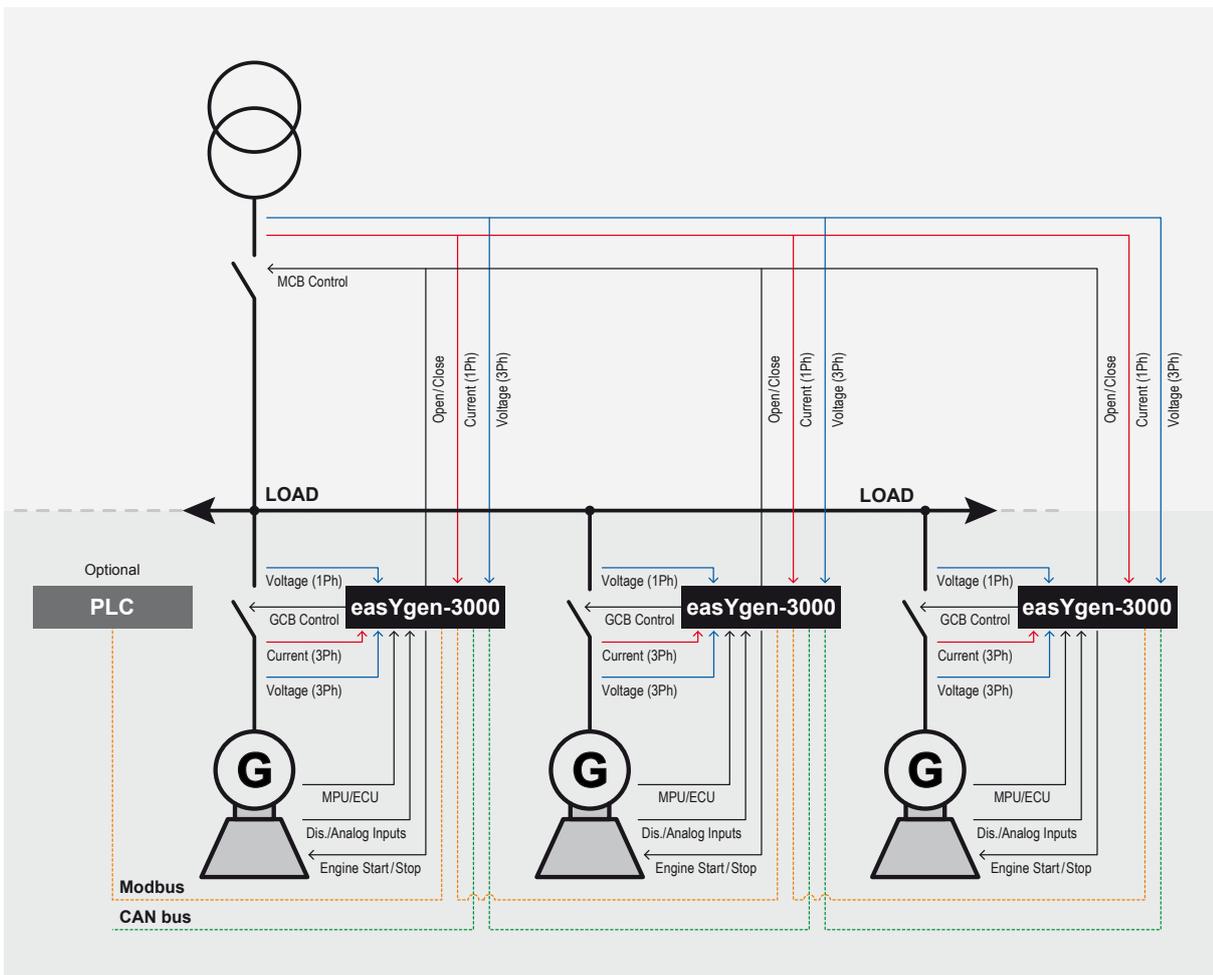
• = Standard



easYgen-3400

easYgen-3500

## APPLICATIONS (EASYGEN-3000 SERIES)



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

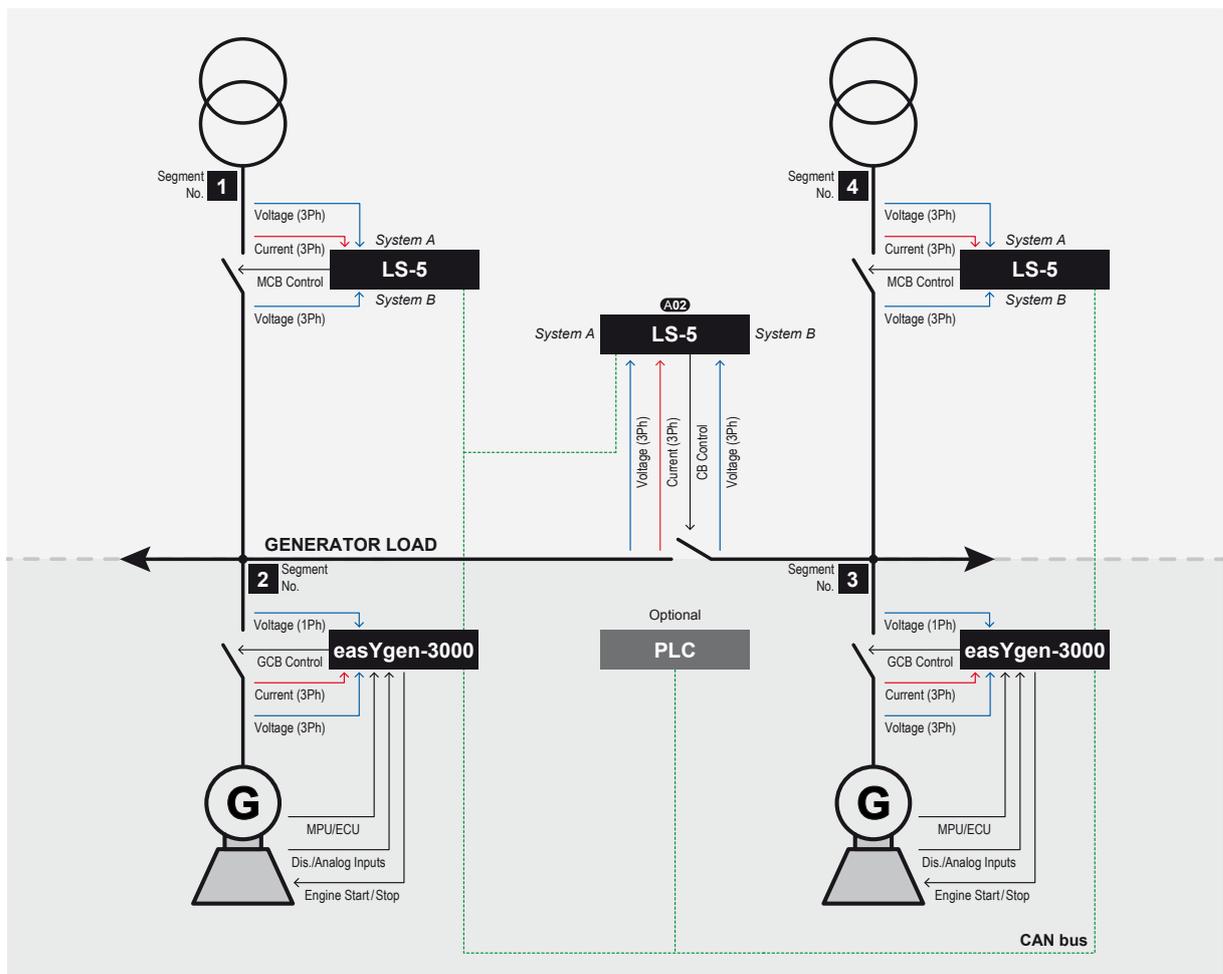
Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

The LS-5 circuit breaker control, when used with the easYgen-3400/3500™, enables complex control of distribution systems having multiple mains and bus tie breakers. The integrated LogicsManager™ links internal states and input signals with logical operators and time elements to implement complex control tasks.

## APPLICATIONS (EASYGEN-3400/3500 WITH LS-5)





LS-5

easYgen-3500

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)	Load (resistive)	2 A at 24 VDC and 250 VAC
Consumption	max. 17 W	<b>Analog inputs</b>	0 to 500 ohms, 0 to 20 mA
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F	<b>Analog outputs (isolated)</b>	±10 V / ±20 mA / PWM
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F	<b>Housing</b>	
Ambient humidity	95%, non-condensing	easYgen-3200:	
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS	Front panel mounting	Plastic housing
Accuracy	Class 1	Dimension (WxHxD)	282 × 217 × 99 mm
<b>Current AC input</b>	1 A or 5 A true RMS, isolated	easYgen-3100:	
Accuracy iac	Class 1	Back panel mounting	Sheet metal housing
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (8 to 40 VDC)	Dimension (WxHxD)	250 × 228 × 84 mm
<b>Relay outputs</b>	Relays, dry contacts	<b>Sealing (front / back)</b>	IP66 / IP20
		<b>Weight</b>	approx. 1,850 g (plastic housing) approx. 2,150 g (sheet metal housing)

## EASYGEN-3100/3200

Approvals	Software	Expansion Modules	Detailed Information
	Toolkit	IKD 1 · easYlite-100 · RP-3000 Remote Panel · Spare Connector Kit	Product specification 37258 at <a href="http://www.woodward.com">www.woodward.com</a>

## EASYGEN-3400/3500

Approvals	Software	Expansion Modules	Detailed Information
	Toolkit	IKD 1 · easYlite-100 · RP-3000 Remote Panel · Spare Connector Kit · LS 5	Product specifications 37523, 37533 at <a href="http://www.woodward.com">www.woodward.com</a>

\* DNV approval is only valid for easYgen-3400/3500 package P1 (Marine).

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# LS 4 | MULTIPLE CIRCUIT BREAKER CONTROL AND PROTECTION

The LS 4 is a breaker control and protection module used to expand the number of controlled breakers in a power generation and distribution system. The LS 4 will be used in an application where you need to control and protect multiple main feeders or bus tie breakers. By programming the configuration of your application into the LS 4 you are able to synchronize mains sites (fixed frequency and voltage source) with generator set sites (variable frequency and voltage).

According to the settings in the LS 4 and the current breaker states in your systems, the LS 4 will auto-detect what site is fixed and what site is variable. An automatic adjustment in frequency, voltage, and load is handled by the LS 4 and the connected GCP-30 genset controls. You are able to operate with up to 14 GCP genset controllers and eight LS 4 circuit breaker controllers in one networked application.

## FEATURE OVERVIEW

- True RMS current and voltage sensing
- Sync-check and synchronization features
- Dead bus start functionality
- Soft loading and unloading sequencing
- Breaker monitoring features
- Mains decoupling features

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (18 to 30 VDC)
Consumption	max. 12 W
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS, isolated
Accuracy iac	Class 1
<b>Discrete inputs</b> (isolated)	Range: 18 to 250 VAC / DC
<b>Relay outputs</b>	Relays, dry contacts
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing</b> (front / back)	IP21
<b>Weight</b>	approx. 800 g

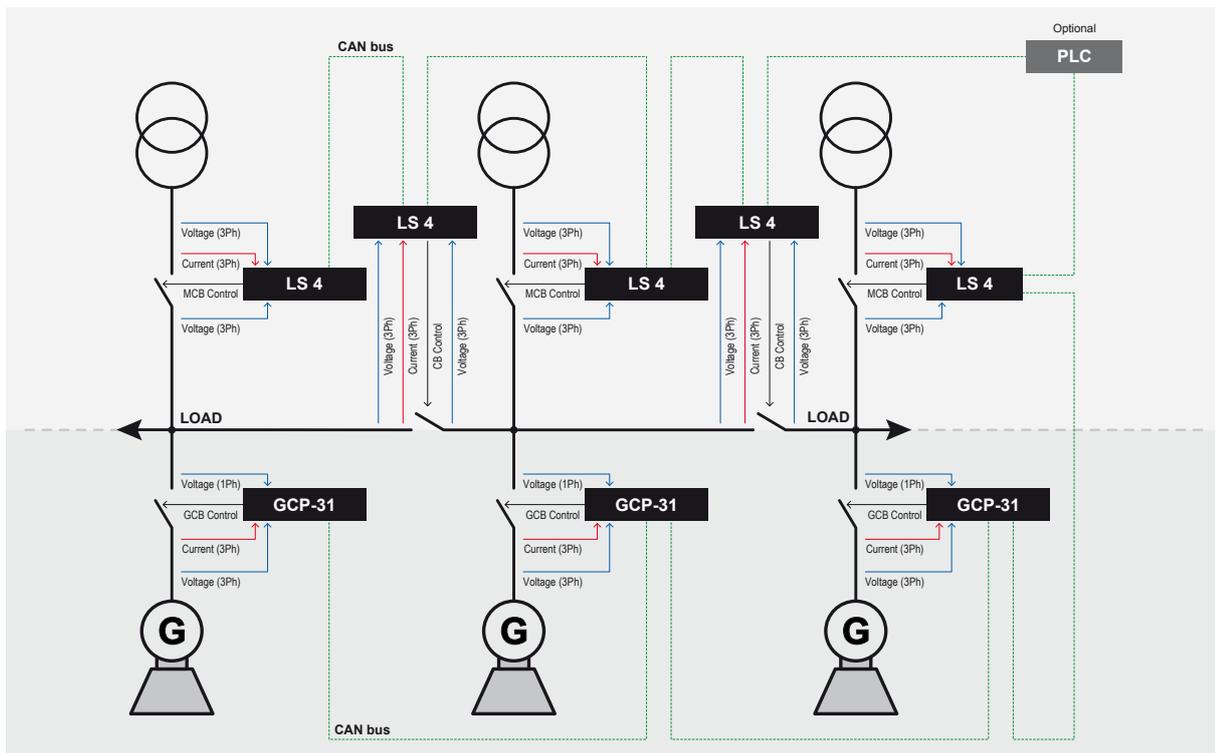


## PART NUMBERS

	LS-4			
<b>Configuration</b>				
Voltage input	100 VAC	100 VAC	400 VAC	400 VAC
Current input	../ 1 A	../ 5 A	../ 1 A	../ 5 A
<b>Part No.</b>				
	8440-1032	8440-1031	8440-1030	8440-1006



## APPLICATIONS



Approvals	Software	Detailed Information
	LeoPC 1	Product specification 37167 at <a href="http://www.woodward.com">www.woodward.com</a>

- Genset Controllers
- Synchronizer & Load Share Controllers
- Automatic Transfer Switch Controllers
- Transducers
- Multifunction Relays
- Protection Relays
- Power Generation Engine Control Products

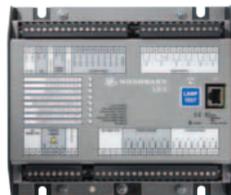
# LS 5 | CIRCUIT BREAKER CONTROL AND PROTECTION

The LS 5 Series are synchronizer and load share controllers with integrated protective functions. They are designed to enable complex power management applications with multiple incoming mains and bus breakers in combination with easYgen-3400/3500 equipped genset controllers.

The LS 5 devices will manage synchronization, loading, and unloading on each bus segment and send the required voltage and frequency references via CAN bus to the easYgen-3400/3500 genset controllers. LS 5 devices which are located on the incoming mains breakers will automatically detect mains failures and start the corresponding gensets accordingly. Wiring efforts are reduced to a minimum, since only one CAN bus connection is required between all LS 5 and easYgen-3400/3500 controllers. It is not required to wire any AC measurement signals or discrete inputs/outputs between the LS 5 and easYgen-3400/3500 controllers.

Extensive remote control capabilities via discrete inputs or interfaces are provided to easily integrate the LS 5 into each application environment.

The LS 5 Series is available in two different housing versions. The LS 521 with a plastic housing and graphic LCD display is designed to be mounted on the cabinet's front door. The LS 511 with an aluminum powder-coated housing without display is designed to be DIN-rail-mounted on the back panel.



## PACKAGES

	LS-511	LS-521
Package	P1	P2
LCD display	-	●
Mounting	Back panel	Front panel
Part No.		
1 A	8440-1951	8440-1952
5 A	8440-1946	8440-1947

● = Standard



## FEATURE OVERVIEW

- Up to 16 LS 5 units can be operated in one network with up to 32 easYgen-3400/3500
- Phase match or slip frequency synchronization with voltage matching
- Full protection package (including df/dt (ROCOF), phase shift and mains voltage increasing protection according to new German grid code requirements in VDE-0126-1-1)
- Segment control for the load sharing
- Event log with up to 300 entries
- Automatic date and time synchronization between the LS 5 units and the connected easYgen-3400/3500 controls
- LS 5 stand-alone mode without the easYgen-3400/3500 is possible
- Preconfigured application modes for the most common applications in the field (MCB or MCB/GGB application)
- Automatic and manual mode
- Full remote control via CAN or RS-485 interface
- In case transformers are used in the application, vector group adjustment is available
- Multilingual capability
- Lock keypad feature
- Eight freely configurable LEDs are available on the LS 511 back panel mountable device

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)
Consumption	max. 5 W (LS-511) / max. 6 W (LS-521)
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing

### Housing

Front panel mounting (LS 521)	Plastic housing
Dimension (WxHxD)	219 × 171 × 61 mm
Back panel mounting (LS 511)	Sheet metal housing
Dimension (WxHxD)	190 × 167 × 47 mm

### Sealing (front / back)

IP66 / IP10

### Weight

approx. 850 g (plastic housing)  
approx. 840 g (sheet metal housing)

## APPLICATIONS (PLEASE SEE PAGE 20)

<b>Approvals</b>	<b>Software</b>	<b>Detailed Information</b>
	ToolKit	Product specification 37522 at <a href="http://www.woodward.com">www.woodward.com</a>

Genset Controllers  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

# GCP-30 Series | GENSET CONTROLLERS FOR MULTIPLE/PARALLEL OPERATION

The GCP-30 Series genset controllers are designed to provide total control for multiple, medium- to large-sized applications. A network of the compact, versatile GCP-30 controls is capable of controlling up to 14 gensets with automatic sequencing. Load management features include automatic base load, peak shaving, import/export control, and emergency power / backup power generation. The GCP-30 Series is well known in the market for highly reliable software and hardware.



## PACKAGES

Package	GCP-31					GCP-32				
	BPQ	XPD	XPQ	XPQ+SB03	XPQ+SC10	BPQ	XPD	XPQ	XPQ+SB03	XPQ+SC10
GCB control / MCB control	•/-	•/-	•/-	•/-	•/-	•/-	•/-	•/-	•/-	•/-
External CB control	•	•	•	•	•	-	-	-	-	-
Real-time clock	-	•	•	•	•	-	•	•	•	•
Event recorder	-	•	•	•	•	-	•	•	•	•
External mains power measurement (0 to 20 mA)	-	•	•	•	•	-	•	•	•	•
Active power setpoint (0/4 to 20 mA)	-	•	•	•	•	-	•	•	•	•
Analog inputs/outputs	-	7/2	7/2	7/2	7/2	-	7/2	7/2	7/2	7/2
External operation model selection (DI)	-	•	•	•	•	-	•	•	•	•
Analog/PWM controller for speed/kW and V/var control	•	-	•	•	•	•	-	•	•	•
CAN bus interfaces	1	1	1	1	2	1	1	1	1	2
RS-232 interfaces	-	-	-	1	-	-	-	-	1	-
Caterpillar CCM protocol	-	-	-	•	-	-	-	-	•	-
J1939 protocol	-	-	-	-	•	-	-	-	-	•
<b>Part No.</b>										
100 VAC (5 A)	8440-1609	8440-1554	8440-1558	8440-1562	8440-1560	8440-1613	8440-1570	8440-1574	8440-1578	8440-1576
400 VAC (5 A)	8440-1610	8440-1555	8440-1559	8440-1563	8440-1561	8440-1614	8440-1571	8440-1575	8440-1579	8440-1577

• = Standard



## FEATURE OVERVIEW

- True RMS voltage and current sensing for generator, bus, and mains
- Complete engine/generator protection + mains monitoring
- Relay manager for programming relay outputs according to selectable discrete and analog conditions
- Load share 14 gensets in island mode or paralleled to the utility
- Different load or process-dependent start/stop sequencing modes with load and var sharing
- Communication to engine ECUs (based on CAT, MDEC, J1939 protocols), PLCs, external I/O expansion cards
- Connection to Woodward LS 4 to run multiple breaker applications
- Configurable discrete inputs and relay outputs

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (9.5 to 32 VDC)	<b>Discrete inputs</b> (isolated)	Range: 12/24 VDC (6 to 32 VDC)
Consumption	max. 20 W	<b>Relay outputs</b>	Relays, dry contacts
Ambient temperature (storage)	-30 to 80 °C	Load (resistive)	2A at 24 VDC and 250 VAC
Ambient temperature (operation)	-20 to 70 °C	<b>Analog inputs</b>	0/4 to 20 mA
Ambient humidity	95%, non-condensing	<b>Analog outputs</b> (isolated)	0/4 to 20 mA (freely scalable)
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS	<b>Housing</b>	
Accuracy	Class 1	Front panel mounting	Plastic housing
<b>Current AC input</b>	1 A or 5 A true RMS, isolated	Dimension (WxHxD)	144 x 144 x 118 mm
Accuracy iac	Class 1	<b>Sealing</b> (front / back)	IP42 / IP21
		<b>Weight</b>	approx. 1.850 g (depending on model)

## APPLICATIONS (PLEASE SEE PAGE 23)

Approvals	Software	Expansion Modules	Detailed Information
	LeoPC 1	IKD 1 · LS 4 · GW 4 Gateway	Product specification 03240 at <a href="http://www.woodward.com">www.woodward.com</a>

Genset Controllers

Synchronizer & Load Share Controllers

Automatic Transfer Switch Controllers

Transducers

Multifunction Relays

Protection Relays

Power Generation Engine Control Products

# GCP-31 Rental | RENTAL GENSET CONTROLLER

The GCP-31 Rental genset controller (Package RPQ+SC09) is especially designed to meet the needs of the generator rental market. Discrete inputs are provided to select between different sets of rated voltages and frequencies. Phase matching synchronization and unloading the mains without the need for mains circuit breaker reply signals.

Up to eight GCP-31 Rental controllers can be interconnected with each other via CAN bus interface to offer load management features including active and reactive power load sharing, load-dependent start/stop and emergency power / back up power generation. The Woodward SYNCONpanel is the perfect accessory for the GCP-31 Rental genset controller in case the mains coupling point is located distant from the genset controller and mains/busbar measuring systems cannot be wired to the GCP-31 Rental controller directly. The SYNCONpanel provides increased flexibility and simplicity and reduces wiring efforts, since all measured values are transmitted to the GCP-31 Rental genset controller via CAN bus.

## FEATURE OVERVIEW

- Discrete inputs are provided to select between four rated voltages and two rated frequencies
- Phase matching and slip synchronization
- Unloading mains without the need for mains circuit breaker reply signals
- CAN bus communication to engine control units by J1939
- Load-dependent start/stop and load sharing between up to eight generators
- LED synchronoscope
- kWh/operation hours/start/maintenance counter
- Configurable discrete inputs and outputs
- Language manager (English/German selectable)

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (9.5 to 32 VDC)
Consumption	max. 20 W
Ambient temperature (storage)	-40 to 80 °C / -40 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	400 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (6 to 32 VDC)
<b>Relay outputs</b>	Potential free
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	0/4 to 20 mA, PT100, VDO
<b>Analog outputs (isolated)</b>	0/4 to 20 mA
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 144 x 118 mm
<b>Sealing (front / back)</b>	IP42 / IP21
<b>Weight</b>	approx. 1,000 g

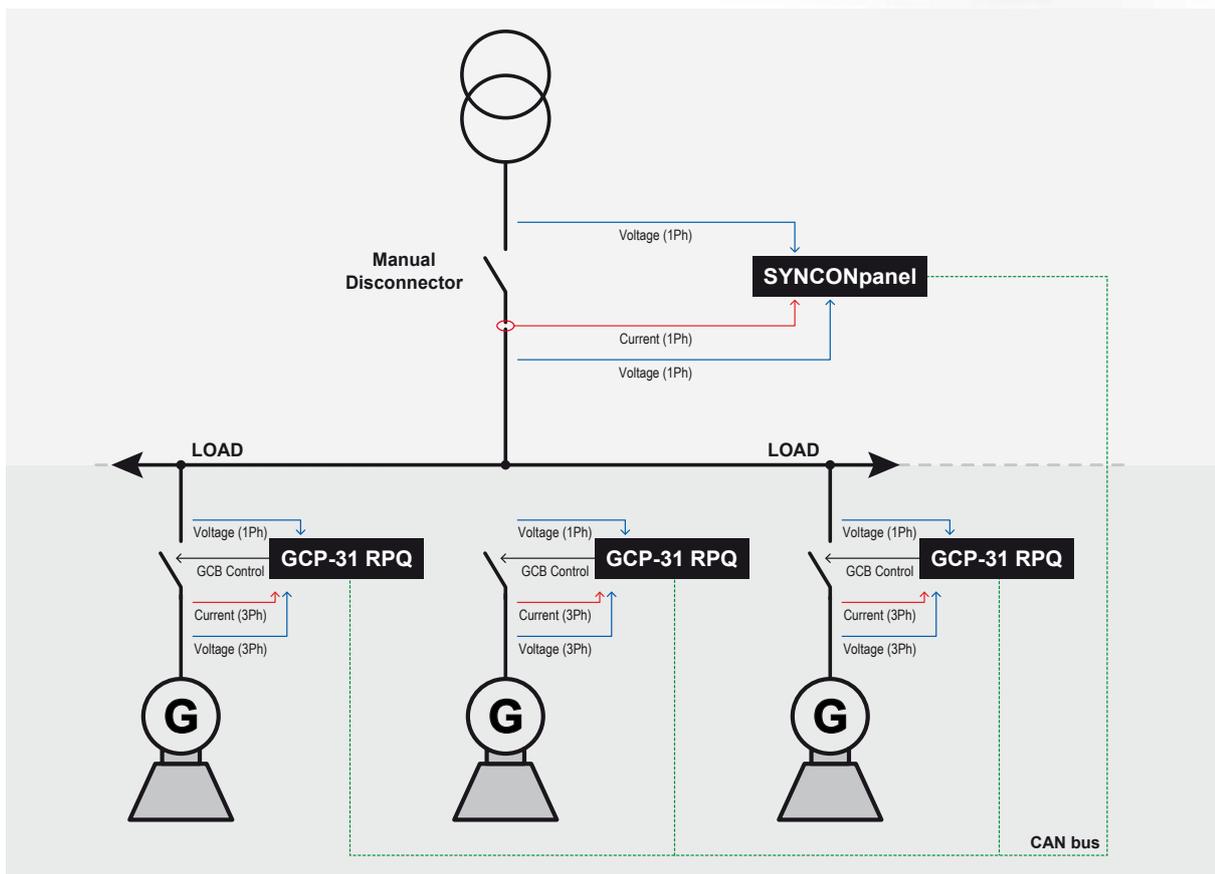


## PART NUMBER

<b>Part No.</b>	<b>GCP-31 Rental</b>
	8440-1764



## APPLICATIONS



Approvals	Software	Expansion Modules	Detailed Information
	LeoPC 1	SYNCONpanel · IKD 1 Digital Expansion Card · GW4 Gateway	Product specification 37316 at <a href="http://www.woodward.com">www.woodward.com</a>

- Genset Controllers
- Synchronizer & Load Share Controllers
- Automatic Transfer Switch Controllers
- Transducers
- Multifunction Relays
- Protection Relays
- Power Generation Engine Control Products

# EGCP-2 | GENERATOR CONTROL AND ENGINE MANAGEMENT PACKAGE

The EGCP-2 is a microprocessor-based complete generator control and engine management package. It is designed for use with an automatic voltage regulator and a speed control to automate and protect diesel- or gas-engine-based generator sets. Designed for small- to medium-size generator sets, the EGCP-2 can be configured to operate stand-alone or utility paralleled sets. A network of EGCP-2 controls is capable of controlling up to eight unmanned generator sets for base load, peak shaving, or backup power generation.

## FEATURE OVERVIEW

- Engine control
- Genset synchronizing
- Automatic sequencing of multiple units
- Automatic start/stop control
- Digital display of engine and generator data
- Real kW load control
- Reactive kvar control
- Genset protection
- Engine protection
- Modbus® communications

## SPECIFICATIONS

<b>Power supply</b>	12 or 24 VDC nominal (9 to 32 VDC)
Ambient temperature (storage)	-20 to 70 °C
Ambient temperature (operation)	95% non-condensing at 20 to 55 °C
<b>Voltage AC input</b>	150–300 VAC true RMS (Part Number 8406-120) 50–150 VAC true RMS (Part Number 8406-121)
<b>Current AC input</b>	0 to 6 A true RMS
Front panel mounting	Sheet metal housing
Dimension (WxHxD)	358 x 282 x 69 mm (14.1" x 11.1" x 2.7")

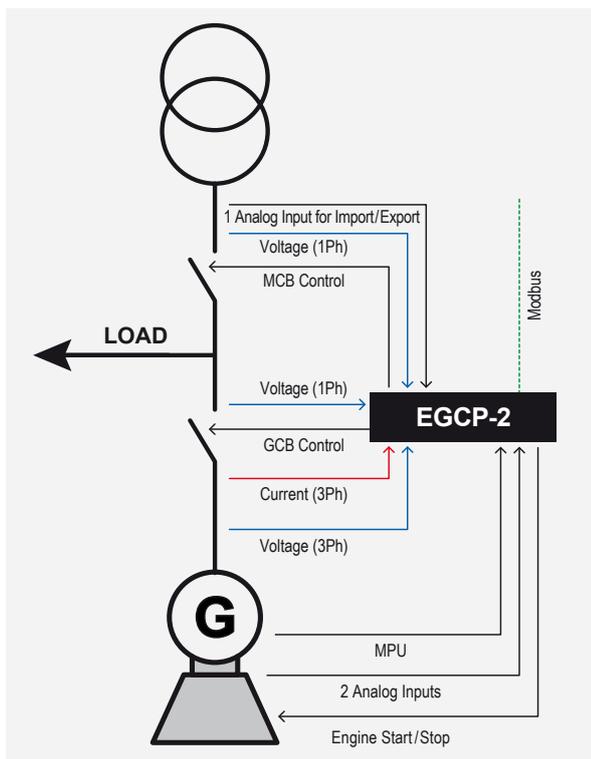
## PART NUMBERS



Part No.	EGCP-2
150 to 300 VAC	8406-120
50 to 150 VAC	8406-121



## APPLICATIONS



### Approvals



### Expansion Modules

Connector Kit · RS-422 Interface Cable

### Detailed Information

Product specification 03219  
at [www.woodward.com](http://www.woodward.com)

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# EGCP-3 | CONTROLLER FOR MEDIUM- AND LARGE-SIZED GENERATOR SETS

Designed for medium- and large-sized generators, the EGCP-3 is a genset controller series, providing advanced IEEE protection algorithms, revenue-grade metering, and individual control of utility and inter-tie breakers. The EGCP-3 also offers backward compatibility with Woodward DSLC/MSLC synchronizers. A network of up to 16 EGCP-3 controls can handle your most sophisticated base-load, peak shaving or backup power generation applications.

Based on Woodward's powerful GAP™ application programming tools, the EGCP-3 can be easily customized by Woodward. The EGCP-3 LS combines engine, generator, power system, switchgear, bus and generator monitoring, protection, and control functions in a single, compact, and cost-effective package. Perfect for medium- and large-sized generation systems, the EGCP-3 LS is designed for use in stand-alone, peaking, or utility paralleled systems. The EGCP-3 MC combines power system, switchgear, bus and utility monitoring, protection, and control functions in a single, compact, and cost-effective package. Perfect for medium and large-sized generating systems, the EGCP-3 MC is designed for use in ATS, peaking, or utility paralleled systems. The MC is a supervisory control system that works with EGCP-3 LS units to provide total system control, including multiple utility tie applications.

## FEATURE OVERVIEW

- Automatic load demand sequencing of multiple units
- Synchronization of breakers or contactors
- Comprehensive system protection – engine, bus, and generator
- Utility monitoring
- Revenue-grade power and energy metering
- Digital display of engine, bus, generator, utility, and system data
- Real kW and reactive kvar load sharing and control
- Advanced network communications with Echelon® and Modbus® networks
- DSLC™ compatible (not compatible with manually bound DSLC units)
- Built-in system diagnostics

## SPECIFICATIONS

<b>Power supply</b>	24 VDC (9 to 40 VDC)
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95% at 60 °C non-condensing

<b>Voltage AC input</b>	70 to 300 VAC true RMS
<b>Current AC input</b>	5 A true RMS
<b>Housing</b>	
Back panel mounting	Sheet metal housing
Dimension (WxHxD)	358 x 282 x 134 mm (14.1" x 11.1" x 5.275")

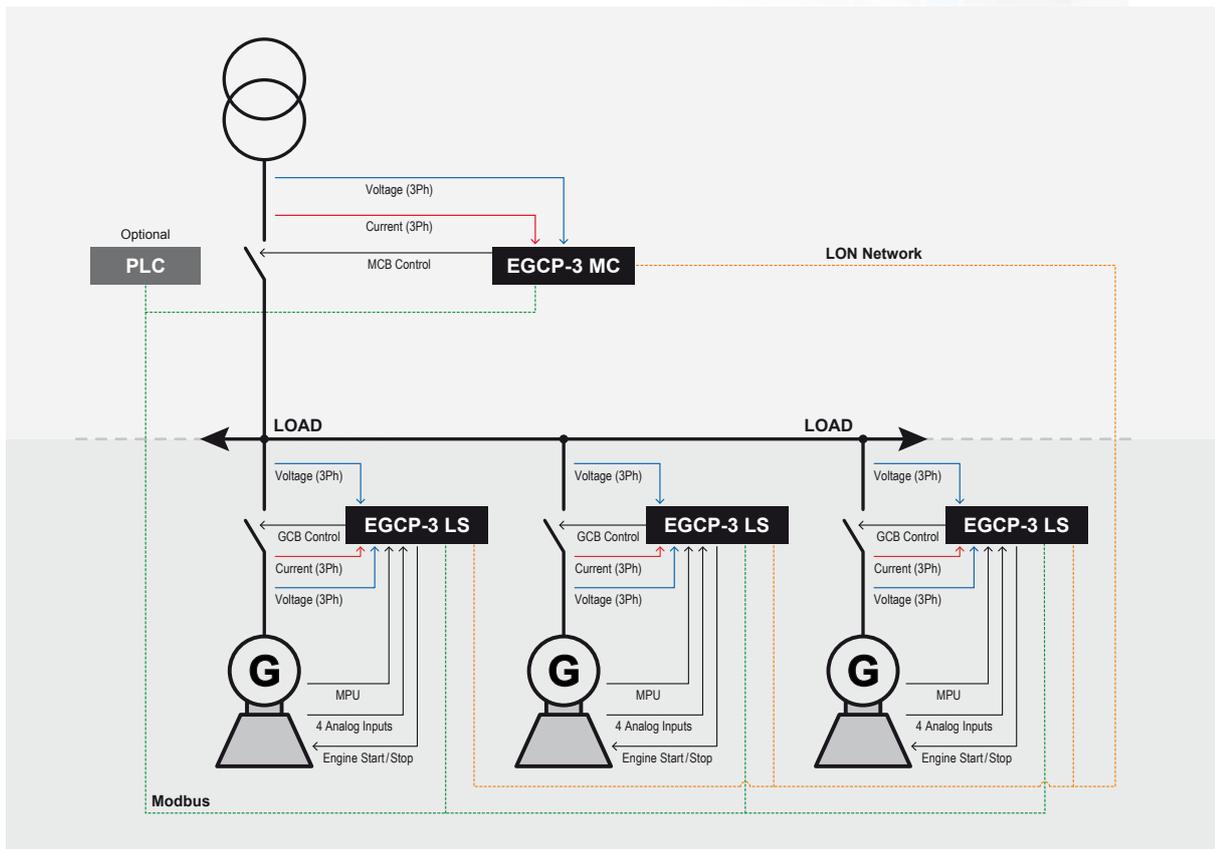


## PART NUMBERS

	EGCP-3 LS	EGCP-3 MC
<b>Part No.</b>	8406-113	8406-114
	(multi-unit load sharing, control for 1 breaker)	(master unit, for use with EGCP-3 LS)



## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

### Approvals



### Software

Windows  
Standard 1.6

### Detailed Information

Product specifications 03300, 03301 at [www.woodward.com](http://www.woodward.com)

# RP-3000 | REMOTE PANEL

The RP-3000 is a remote control and annunciation panel for use with the back-panel mounted easYgen-3100/3400 or door-mounted easYgen-3200/3500 genset controllers. The RP-3000 is an ideal solution for door-mounted applications, providing control from the front panel with greatly reduced wiring to the access door, while keeping high-voltage connections located safely on the back panel. The RP-3000 allows remote control and visualization.

It has the same look and feel as the easYgen-3200 or easYgen-3500 genset controller, enabling user-friendly transition between genset controller sources. Each RP-3000 remote panel communicates with a single easYgen-3000 Series genset controller.

## YOUR BENEFITS AT A GLANCE

Provide best remote control and accessibility to your customers genset and a maximum of safety, reducing the wiring of high-power lines in the cabinet.

## FEATURE OVERVIEW

- Remote annunciation and remote control of the easYgen-3000 Series generator controls
- Password-protected remote configuration for all parameter settings
- Same look and feel as the easYgen-3200/3500 display
- CAN communication to genset control
- Ready for operation relay output

## PART NUMBERS



RP-3000

Accessories		
easYgen-3100/3200	❖	-
easYgen-3400/3500	❖	-
easYgen-3400/3500 (Marine)	-	❖
Part No.		
	8446-1048	8446-1046



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)
Consumption	max. 12 W
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	282 x 217 x 99 mm
<b>Sealing</b> (front / back)	IP66 / IP10
<b>Weight</b>	approx. 1,300 g (plastic housing)

Remote Panel  
RP-3000



\* Only one easYgen can be connected at once.

**Approvals**

**Detailed Information**

Product specification 37446 at [www.woodward.com](http://www.woodward.com)

# easYlite-100 | CAN-BUS-BASED REMOTE ANNUNCIATOR



The easYlite-100 is designed to remotely display the status of a generator control system through a CAN BUS Interface. The easYlite-100 may be used where an additional status display is required, which is directly controlled by the generator control unit.

With a standard height and width of 138 mm, the compact design permits easy mounting. The ergonomically designed display allows easy identification of the system status. The easYlite-100 LEDs change their state if the assigned warning / alarm condition occurs or the status conditions change.

## FEATURE OVERVIEW

- 14 configurable status displays using red LEDs
- Four preassigned engine alarm LEDs
- Self-diagnostic checks
- One relay output to operate an external horn or alarm
- Panel configuration via PC and RS-232 interface

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (6.5 to 32 VDC)
Consumption	max. 3 W
Ambient temperature (storage)	-20 to 85 °C / -4 to 185 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	158 x 158 x 40 mm
<b>Sealing</b>	IP54
<b>Weight</b>	approx. 300 g



## PACKAGES

	easYlite-100	
Software Version	1.0001	1.0006
Freely configurable LED output display	14	16
Configurable preassigned LED output display	4	2
Fixed LED output display	-	2
Configuration software tool	LeoPC1	ToolKit
Supported genset controller	easYgen-1000 Series	entire easYgen Series (easYgen-1000/2000/3000)
Number of parallel-connected easYlite-100 devices	128	2
Part No.	8446-1006	8446-1023

Approvals	Software	Detailed Information
	LeoPC1 (Software Version 1.0001) ToolKit (Software Version 1.0006)	Product specification 37279 at <a href="http://www.woodward.com">www.woodward.com</a>

# IKD 1 | I/O EXPANSION BOARD



The IKD 1 is an I/O expansion board. It allows an additional eight discrete inputs and eight relay outputs to be connected via CAN bus to the Woodward generator set controllers series GCP-30 and easYgen. It is possible to connect multiple IKD 1 cards to each of the genset controllers. The IKD1 will be programmed via a PC configuration tool. Configuration of text name for the I/O, alarm classes, Normally Open (NO) and Normally Closed (NC) relay contact configuration and delay timers are possible. The I/O will be displayed in clear text messages on the genset controllers HMI and can be used for further processing.

## FEATURE OVERVIEW

- Eight configurable discrete alarm inputs
- Eight configurable relay outputs (dry, two-pole isolated)
- Configurable delays for each input
- CAN bus communication
- PC configurable

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (6 to 36 VDC)
Consumption	max. 3 W
Ambient temperature	-20 to 70 °C
Ambient humidity	95%, non-condensing
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	168 x 128 x 51 mm
<b>Sealing</b> (front / back)	IP20
<b>Weight</b>	approx. 360 g

## PART NUMBER



IKD 1

<b>Part No.</b>	8440-1041
-----------------	-----------

Approvals	Software	Detailed Information
	LeoPC 1	Product specification 37171 at <a href="http://www.woodward.com">www.woodward.com</a>

Genset Controllers  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

**LSG** | LOAD SHARE GATEWAY



The Load Share Gateway (LSG) is a communication converter specifically designed to operate the easYgen-2000 / easYgen-3000 Series and any other industrial legacy devices in a load share network. You are able to connect any analog load share controller to the easYgen genset controllers. This feature supports you for retrofit business by expanding your existing load share technology by our genset controller lines. Due to the flexibility in our software you are also able to maintain basic-load-dependent start/stop sequences, if needed.

**YOUR BENEFITS AT A GLANCE**

Experience an easy way to extend existing power plants with new gensets and state-of-the-art technology and process such projects in minimum time with a maximum of performance.

**FEATURE OVERVIEW**

- Easy configuration via easYgen-connected genset controller line
- Compatible to most important analog load share line systems
- Status LEDs for CAN and RS-485 communication
- Robust metal housing

**SPECIFICATIONS**

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)
Consumption	max. 3 W
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	60 °C, 95%, non-condensing, five days
<b>Housing</b>	
Back panel mounting	Aluminum
Dimension (WxHxD)	141 × 98.5 × 21 mm
<b>Sealing</b>	IP20
<b>Weight</b>	approx. 280 g



**PART NUMBERS**

Part No.	LSG
Active power load share gateway (P)	8444-1075
Reactive power load share gateway (Q)	8444-1074

<b>Approvals</b>	<b>Detailed Information</b>
CE	Product specification 37451 at <a href="http://www.woodward.com">www.woodward.com</a>

# SYNCONpanel | TRANSPORTABLE REMOTE SYNCHRONIZING PANEL



The SYNCONpanel is used to connect a mobile generator set to a mains coupling point (MCP). The mains coupling device in this application is a manual operated breaker, connector, or fuses. For connecting the mobile generator set, integrated current sensing at the SYNCONpanel offers the feature to transfer the load from the mains to the generator set by soft loading. This enables the user to remove fuses or connectors without load. For disconnecting the mobile generator set, the SYNCONpanel will phase-match the frequency and voltage between the mains and the mobile generator set at the MCP, so that a manual operation of the mains breaker or fuses is possible.

A built-in synchronous scope gives clear indication about phase shifts to the operator. The users can configure wiring schemes for a one-phase synchronization system up to a three-phase synchronization system. Three-phase is recommended due to better safety conditions. The SYNCONpanel is used in conjunction with our genset controller package GCP-31 Rental (Package RPQ + SC09).

## FEATURE OVERVIEW

- True RMS voltage (A and B site)
- True RMS current (A site)
- Sync-check functionality
- Remote control of frequency, voltage, real power, and power factor
- Zero-phase-angle control
- Power transfer zero control (softload)
- Two-line LCD display

## PART NUMBER

<b>Part No.</b>	<b>SYNCONpanel</b>
	8440-1276

<b>Approvals</b>	<b>Detailed Information</b>
CE	Product specification 37185 at <a href="http://www.woodward.com">www.woodward.com</a>

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (18 to 32 VDC)
Consumption	max. 12 W
Ambient temperature	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	230 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A true RMS
Accuracy iac	Class 1
<b>Relay outputs</b>	Potential free
<b>Housing</b>	
Portable case	Plastic
Dimension (WxHxD)	270 × 174 × 246 mm
<b>Sealing</b>	IP65 / IP20
(closed case / open case)	
<b>Weight</b>	approx. 3,300 g



Genset Controllers  
 Synchronizer & Load Share Controllers  
 Automatic Transfer Switch Controllers  
 Transducers  
 Multifunction Relays  
 Protection Relays  
 Power Generation Engine Control Products

## GW 4 | GATEWAY INTERFACE CONVERTER

The GW 4 interface converter is used to convert the CAN bus protocol to one of several available bus or interface protocols. A single GW 4 connected to the CAN network will transmit data from the available controls on the network to an external device, such as a PC or PLC. The GW 4 is able to adapt the physical interface for different transmission protocols including the transmission rates, data formats, and operations. Thus it is possible to view the data with an HMI package as well as configure a broad range of Woodward controls by using the LeoPC1 software.

### FEATURE OVERVIEW

- Converting from CAN bus (CAL2.0) to one of the following protocols:
  - RS-232
  - RS-485
  - Modbus RTU slave
  - Profibus DP slave
  - External modem
- Setting of various interfaces, buses, and protocols
- Transmission of process data of an autonomous network coupled via CAN bus
- Intervention into processes using a PC, a PLC, or a control system
- Amplifier serving to bridge large sections in popular networks
- Visualization of the process image
- Remote configuration of named Woodward units and devices
- Interface to the LeoPC1 software program used for configuration, visualization, remote control, data logging, event recorder, and user management
- Two-line LCD display
- Communication networks are electrically isolated



### PART NUMBERS

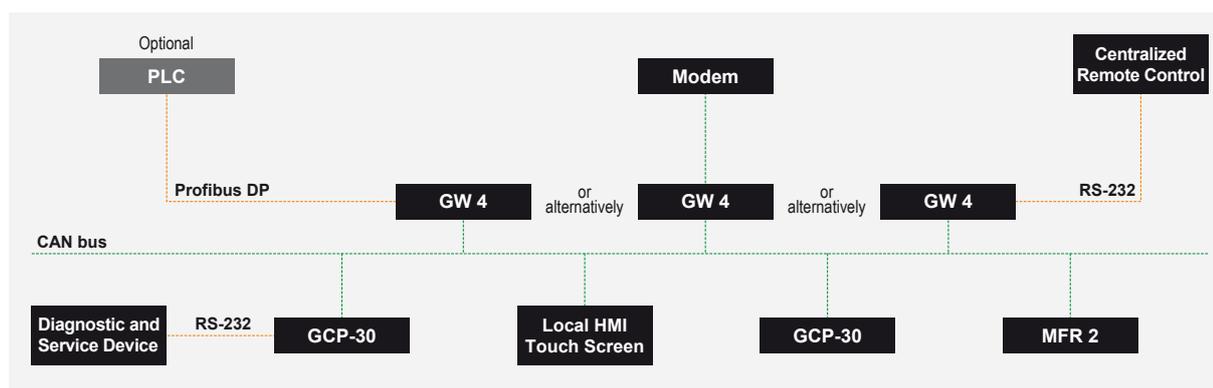
Part No.	GW 4
GW 4B / 485 / MOD (RS-485 / Modbus)	5448-901
GW 4B / 232 / MOD (RS-232 / Modbus)	5448-895
GW 4B / PRO (Profibus DP Slave)	5448-902
GW 4B / 232 / LDP / MDM02 (external modem)	8445-1013
GW 4B / 232 / LDP (RS-232 / LDP)	5448-910



## SPECIFICATIONS

<b>Power supply</b>	24 VDC (18 to 32 VDC)
Consumption	max. 12 W
Ambient humidity	95%, non-condensing
<b>Housing</b>	
Front panel mounting	APRANORM DIN 43 700
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing</b> (front / back)	IP45 / IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



**Approvals**

**Detailed Information**

Product specification 37170 at [www.woodward.com](http://www.woodward.com)

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# SYNCHRONIZER & LOAD SHARE CONTROLLERS



## Quality and Reliability for Power Distribution Systems

Woodward offers a wide variety of controllers for the synchronization and load share market. Our basic controllers offer standard features for parallel or load share applications, easy to set up and use. If you need to handle more complex load flows and even protection schemes, we can also offer you products with integrated protection features and communication interfaces to your Supervisory Control and Data Acquisition (SCADA) system.

You will be able to eliminate programming effort in your SCADA, just send our controls a run or stop command and they will take care of the synchronization and load share sequencing across generator, mains- and tie breakers. We offer you decades of experience in connecting and load balancing power generation sources and distribution systems, so use the products and feel safe.


 Genset  
Controllers

 Synchronizer &  
Load Share  
Controllers

 Automatic  
Transfer Switch  
Controllers

Transducers

 Multifunction  
Relays

 Protection  
Relays

 Power  
Generation Engine  
Control Products

The DSLC control is a microprocessor-based synchronizer and load control designed for use on three-phase ac generators equipped with Woodward or other compatible speed controls and compatible automatic voltage regulators. The DSLC control is a synchronizer, a load sensor, a load control, a dead bus closing system, and optionally a VAR/PF and process control, all integrated into one powerful, yet convenient package.

## FEATURE OVERVIEW

- Synchronizer and load control in one box
- Automatic generator loading and unloading for bumpless load transfer
- Isochronous load sharing with other DSLC-equipped sets
- Process import/export control
- Var and power factor control
- Dead bus closing
- Accurate control of non-linear and distorted generator wave forms
- Digital communications network for information exchange between controls
- Programmable load switch or reverse power trip output



## PACKAGES

DSLCTM			
Configuration	Voltage Input	Speed Bias	Part No.
Wye	120/240	0.5 to 4.5 VDC	9905-355
Open Delta	120	0.5 to 4.5 VDC	9905-367
Wye	120/240	1 to 5 VDC	9905-603
Open Delta	120	1 to 5 VDC	9905-708
Wye	120/240	3.0 VDC	9905-795
Open Delta	120	3.0 VDC	9905-797
Open Delta	240	3.0 VDC	9905-363
Wye	120/240	500 Hz PWM	9905-799
Open Delta	120	500 Hz PWM	9905-373
Open Delta	240	500 Hz PWM	9905-704



## SPECIFICATIONS

<b>Power supply</b>	8 to 32 VDC
Consumption	max. 18 W
Ambient temperature (storage)	-55°C to 105°C / -67 to 221°F
Ambient temperature (operation)	-40°C to 70°C / -40 to 158°F
Ambient humidity	95% at 38°C
<b>Voltage AC input</b>	120 VAC / 240 VAC true RMS
Accuracy	Class 0.1
<b>Current AC input</b>	5 A true RMS
Accuracy iac	Class 0.5
<b>Discrete inputs</b>	18 to 40 VDC at 10 mA
<b>Relay driver outputs</b>	18 to 40 VDC at 200 mA sink
<b>Analog inputs</b>	4 to 20 mA / 1 to 5 VDC
<b>Analog outputs</b>	Speed bias: $\pm 2.5$ VDC, 0.5–4.5 VDC, 1–5 VDC across 243 ohms, or 500 Hz PWM Voltage bias: high in $\pm 9$ VDC, low in $\pm 3$ VDC
<b>Housing</b>	
Back panel mounting	Sheet metal housing
Dimension (WxHxD)	264 x 461 x 58 mm

Genset Controller  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

Approvals	Expansion Modules	Detailed Information
	Handheld Programmer	Product specification 02006 at <a href="http://www.woodward.com">www.woodward.com</a>

The MSLC control is a microprocessor-based load control designed for three-phase electric power generation sites equipped with Woodward DSLC Digital Synchronizer and Load Control units which operate in parallel with the utility. The MSLC is a synchronizer, a utility load sensor, an import/export load level control, a power factor control, and a master process control.

## FEATURE OVERVIEW

- Synchronizer and load control in one box
- Automatic plant loading and unloading for bumpless load transfer to and from the utility
- Controls plant-wide import/export levels against the utility
- Overall power factor control
- Accurate control of non-linear and distorted utility line wave forms
- Digital communications network for information exchange between MSLC and individual DSLC controls



## PART NUMBERS

Part No.	MSLC
Wye, 120 or 240 VAC	9907-004
Open Delta, 120 VAC	9907-005
Open Delta, 240 VAC	9907-006
MSLC / DSLC Handheld Programmer	9907-205



## SPECIFICATIONS

<b>Power supply</b>	8 to 32 VDC
Consumption	max. 18W
Ambient temperature (storage)	-55 °C to 105 °C / -67 to 221 °F
Ambient temperature (operation)	-40 °C to 70 °C / -40 to 158 °F
Ambient humidity	95% at 38 °C
<b>Voltage AC input</b>	120 VAC / 240 VAC true RMS
Accuracy	Class 0.1
<b>Current AC input</b>	5 A true RMS
Accuracy iac	Class 0.5
<b>Discrete inputs</b>	18 to 40 VDC at 10 mA
<b>Relay driver outputs</b>	18 to 40 VDC at 200 mA sink
<b>Analog inputs</b>	4 to 20 mA / 1 to 5 VDC
<b>Analog outputs</b>	Speed Bias: $\pm 2.5$ VDC, 0.5–4.5 VDC, 1–5 VDC across 243 ohms, or 500 Hz PWM Voltage Bias: high in $\pm 9$ VDC, low in $\pm 3$ VDC,
<b>Housing</b>	
Back panel mounting	Sheet metal housing
Dimension (WxHxD)	264 x 461 x 58 mm

### Approvals



### Expansion Modules

Handheld Programmer

### Detailed Information

Product specification 02021 at [www.woodward.com](http://www.woodward.com)

Genset Controller

Synchronizer & Load Share Controllers

Automatic Transfer Switch Controllers

Transducers

Multifunction Relays

Protection Relays

Power Generation Engine Control Products

The Woodward DSLC-2 control is a microprocessor-based synchronizer and load control de-signed for use on three-phase AC generators. The DSLC-2 control combines synchronizer, load sensor, load control, dead bus closing system, var, power factor and process control, all integrated into one powerful package. Applications allow up to 32 generators to be precisely paralleled and controlled. A dedicated Ethernet system provides seamless communications between DSLC-2 and MSLC-2 units. A second Ethernet port is provided for customer remote control and monitoring capability using Modbus TCP allowing easy DCS and PLC interfacing. Modbus RTU is available through a separate RS-485 port.

Woodward blended the original solid DSLC with another decade of application experiences in developing the new DSLC-2. The DSLC-2 excels in either simple generator or complex generator system applications. The DSLC-2 / MSLC-2 combination provides multiple unit, segment, utility and intertie breaker control for complex power systems.

## FEATURE OVERVIEW

- Synchronizer and load control in one box
- Phase match or slip frequency synchronization with voltage matching
- Applications for up to 32 generators using 32 DSLC-2 units and up to 16 MSLC-2 controls
- Complex applications with up to 8 bus segments are possible
- One Ethernet port for unit to unit communications
- Second Ethernet port for remote control and monitoring via Modbus TCP
- Automatic generator soft loading and unloading for bumpless load transfer
- Process control
- Isochronous load sharing with other DSLC-2 equipped sets
- Application range up to 999 MW

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)
Consumption	max. 15 W
Ambient temperature (storage)	-40 °C to 85 °C / -40 to 185 °F
Ambient temperature (operation)	-40°C to 70 °C / -40 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS
Accuracy	Class 0.5
<b>Current AC input</b>	1 A or 5 A true RMS, isolated
Accuracy iac	Class 0.5
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (8 to 40 VDC)
<b>Relay outputs</b>	Relays, dry contacts
Load (resistive)	2A at 24VDC and 250VAC
<b>Analog inputs</b>	0 to 500 ohms, 0 to 20 mA
<b>Analog outputs (isolated)</b>	±10 V / ±20 mA / PWM
<b>Housing</b>	
Back panel mounting	Sheet metal housing
Dimension (WxHxD)	250 x 227 x 84 mm
<b>Sealing</b>	IP20
<b>Weight</b>	approx. 1,900 g

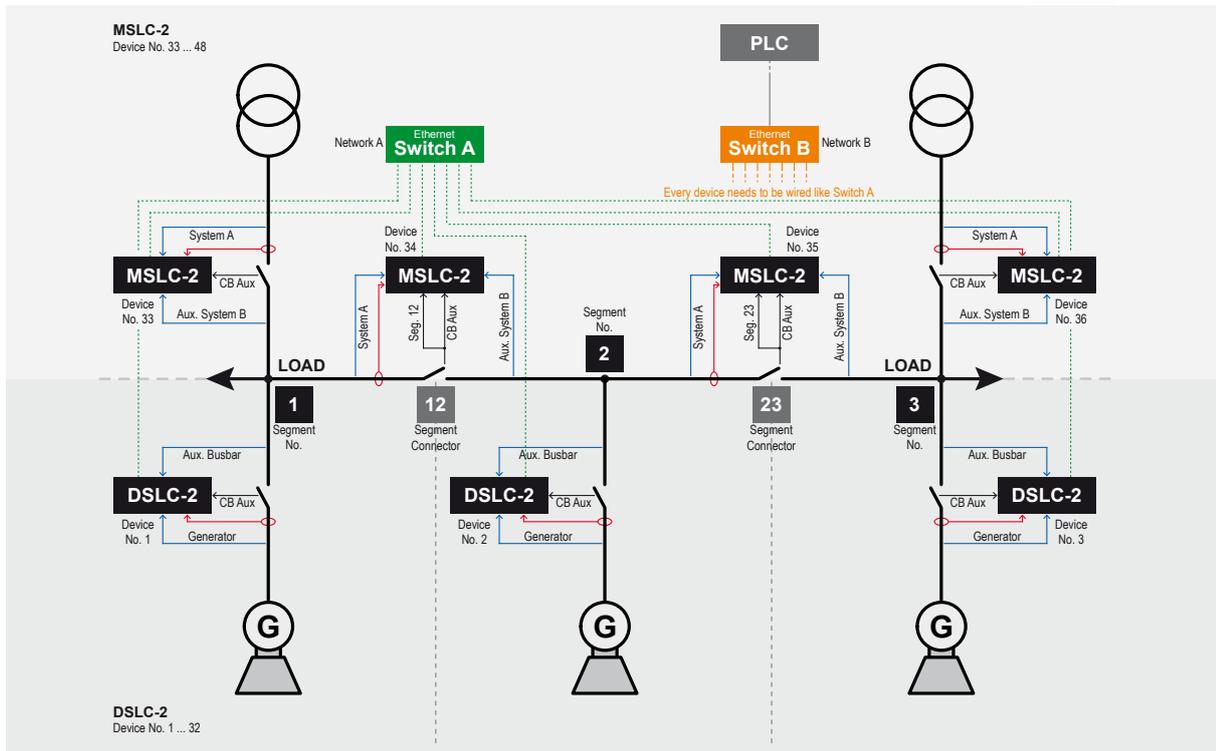


## PART NUMBERS

Part No.	DSLCTM-2
1 A	8440-1978
5 A	8440-1878



## APPLICATIONS



Approvals	Software	Detailed Information
	Toolkit	Product specification 37493 at <a href="http://www.woodward.com">www.woodward.com</a>

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# MSLC™-2 | MASTER SYNCHRONIZER AND LOAD CONTROL

The Woodward MSLC-2 is a microprocessor-based load control designed for three-phase electric power generation sites equipped with Woodward DSLC-2 Digital Synchronizer and Load Control. The original MSLC has been blended with another decade of application experiences to develop the new MSLC-2. The MSLC-2 is a synchronizer, a utility load sensor, an import/export load level control, a power factor control, and a master process control. Applications include power systems which operate in parallel with the utility with single or multiple utility feeds as well as new capabilities for multiple segment and inertia breaker control.

For utility parallel systems, the MSLC-2 provides either phase matching or slip frequency automatic synchronizing of the local plant bus to the main power grid through one or several main breakers. The MSLC-2's load sensor and load control sense true RMS power and provide bumpless loading and unloading against the power grid. Operating modes can either be base load or import/export/process power levels against the utility. Inertia breakers are controlled and synchronized through individual MSLC-2s actively communicating with the individual DSLC-2s and the other MSLC-2s on the system. For isolated multiple generator systems, the MSLC-2 can be used to operate tie breakers between groups of generators using the DSLC-2 controls.

- Controls plant-wide import/export levels against the utility
- Overall plant power factor control

## FEATURE OVERVIEW

- Synchronizer and load control in one box
- Ethernet communication for information exchange between max. 32 DSLC-2 and 16 MSLC-2 controls
- Automatic segment recognition
- Supports and communicates with up to eight bus segments
- One Ethernet port for unit to unit communication
- Second Ethernet port for remote control and monitoring via Modbus TCP
- Automatic plant loading and unloading for bumpless load transfer to and from the utility

## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8 to 40 VDC)
Consumption	max. 15 W
Ambient temperature (storage)	-40 °C to 85 °C / -40 to 185 °F
Ambient temperature (operation)	-40 °C to 70 °C / -40 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS
Accuracy	Class 0.5
<b>Current AC input</b>	1 A or 5 A true RMS, isolated
Accuracy iac	Class 0.5
<b>Discrete inputs</b> (isolated)	Range: 12/24 VDC (8 to 40 VDC)
<b>Relay outputs</b>	Relays, dry contacts
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	0 to 500 ohms, 0 to 20 mA
<b>Analog outputs</b> (isolated)	±10 V / ±20 mA / PWM
<b>Housing</b>	
Back panel mounting	Sheet metal housing
Dimension (WxHxD)	250 × 227 × 84 mm
<b>Sealing</b>	IP20
<b>Weight</b>	approx. 1,900 g



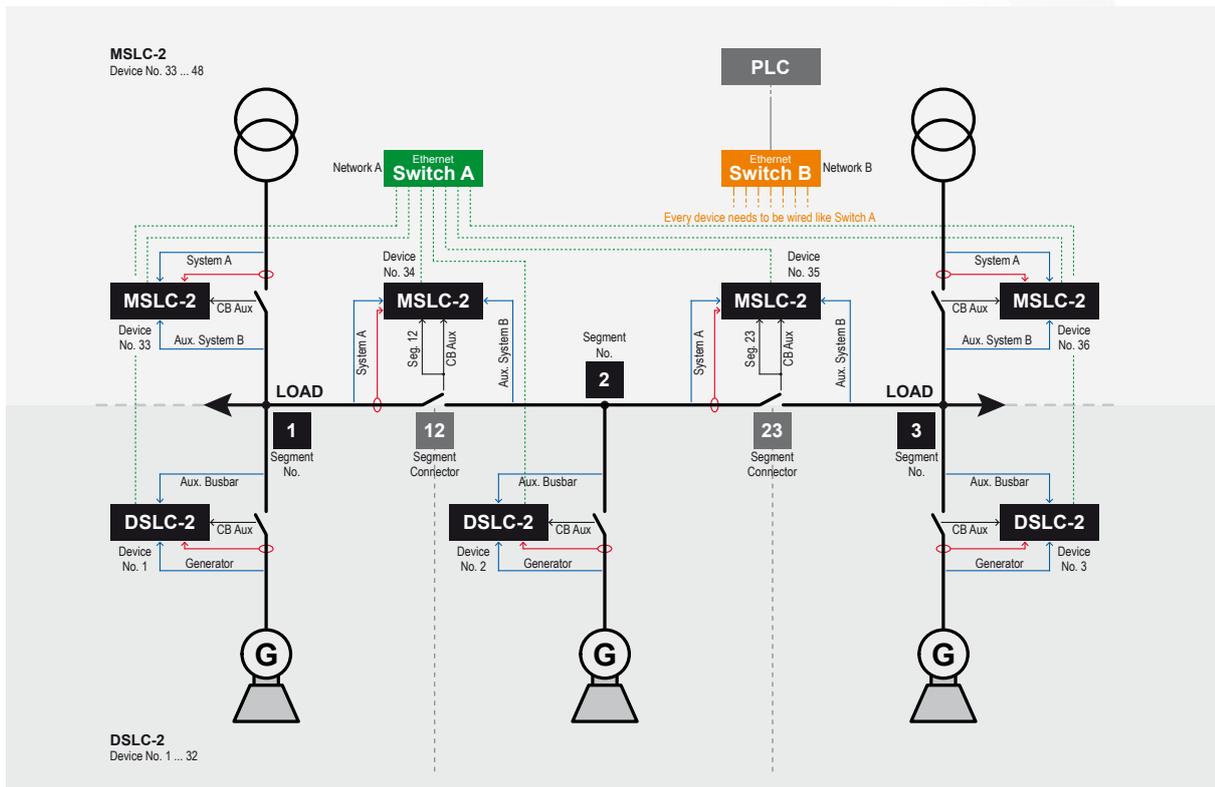
MSLC-2

## PART NUMBERS

Part No.	MSLC-2
1 A	8440-1977
5 A	8440-1877



## APPLICATIONS



Approvals	Software	Detailed Information
	Toolkit	Product specification 37494 at <a href="http://www.woodward.com">www.woodward.com</a>

- Genset Controllers
- Synchronizer & Load Share Controllers
- Automatic Transfer Switch Controllers
- Transducers
- Multifunction Relays
- Protection Relays
- Power Generation Engine Control Products

# SPM-D10 Series | SYNCHRONIZER WITH RELIABILITY

The SPM-D10 Series are microprocessor-based synchronizers designed for use on three-phase AC generators equipped with Woodward or other compatible speed controls and automatic voltage regulators. The SPM-D10 Series synchronizers provide automatic frequency, phase, and voltage matching using either analog or discrete output bias signals.



## PACKAGES

Package	SPM-D10						
	-	X	N	XN	HJV	YB	NYB
Generator voltage measuring	1-phase / 2-wire	3-phase / 4-wire	3-phase / 4-wire				
Busbar voltage measuring	1-phase / 2-wire	3-phase / 4-wire	3-phase / 4-wire				
Mains voltage measuring	-	-	-	-	3-phase / 4-wire	-	-
Enhanced deadbus start functionality	-	-	-	-	-	•	•
Mains over-/under-voltage protection	-	-	-	-	•	-	-
Mains over-/under-frequency protection	-	-	-	-	•	-	-
Mains phase / vector shift	-	-	-	-	•	-	-
Three-step controller (voltage bias)	1	1	1	1	1	1	1
Three-step controller (speed bias)	1	1	1	1	1	1	1
Analog controller (voltage bias)	-	1	-	1	-	-	-
Analog controller (speed bias)	-	1	-	1	-	-	-
24 VDC power supply	•	•	-	-	•	•	-
90 to 250 VAC / DC power supply	-	-	•	•	-	-	•
PC configuration – LeoPC 1	•	•	•	•	•	-	-
<b>Part No.</b>							
100 VAC	5448-890	5440-893	8440-1432	8440-1667	8440-1600	5448-906	8440-1434
400 VAC	8440-1019	8440-1301	8440-1433	8440-1668	8440-1458	8440-1021	8440-1435

• = Standard



## FEATURE OVERVIEW

- Synchronization for one circuit breaker
- Phase match or slip frequency synchronization with voltage matching
- Outputs for speed and voltage bias signals
- Mains protection available in special versions
- Discrete inputs for operating mode selection
- Two-line LCD display for operation, alarm indication, and visualization of measuring values
- LED synchronoscope
- Wide range power supply option available
- PC and front panel configurable

## SPECIFICATIONS

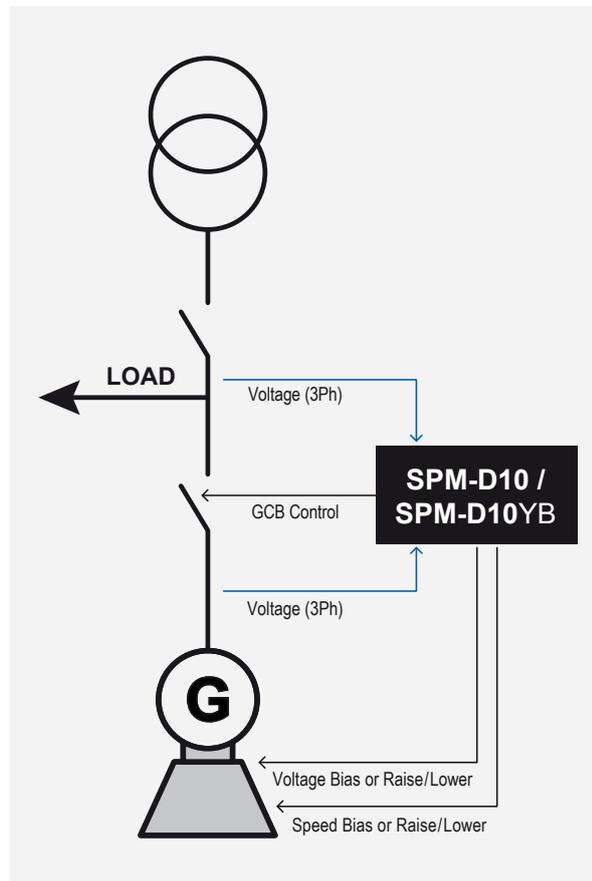
<b>Power supply</b>	24 VDC (±25%) / 90 to 250 VAC / DC (depending on package)
Consumption	max. 10 W
Ambient temperature	-20 to 70 °C / -20 to 60 °C (depending on package)
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	115 VAC or 400 VAC true RMS
Accuracy	Class 1
<b>Discrete inputs (isolated)</b>	Range: max. 250 VAC or DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 × 72 × 122 mm
<b>Sealing (front / back)</b>	IP42 / IP21
<b>Weight</b>	approx. 800 g

<b>Approvals</b>

<b>Software</b>
LeoPC 1

<b>Detailed Information</b>
Product specifications 37297, 37298 at <a href="http://www.woodward.com">www.woodward.com</a>

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# SPM-D11 Series | COMPREHENSIVE SYNCHRONIZER AND LOAD SHARE UNIT

The SPM-D11 Series are microprocessor-based synchronizers designed for use on one- or three-phase AC generators equipped with Woodward or other compatible speed controls and automatic voltage regulators. The SPM-D11 Series synchronizers provide automatic frequency, phase, and voltage matching using either analog or discrete output bias signals. It combines synchronizing for one circuit breaker, load and power factor control, or isochronous load sharing and generator protection.

## FEATURE OVERVIEW

- Synchronization for one circuit breaker
- Phase match or slip frequency synchronization with voltage matching
- Outputs for speed and voltage bias signals
- Active power and power factor control
- Two analog load share lines for active and reactive power load sharing
- Analog input to control active power setpoint externally
- Generator protection included
- Discrete inputs for operating mode selection
- Two-line LCD display for operation, alarm indication, and visualization of measuring values
- LED synchronoscope
- PC and front panel configurable

## PACKAGES



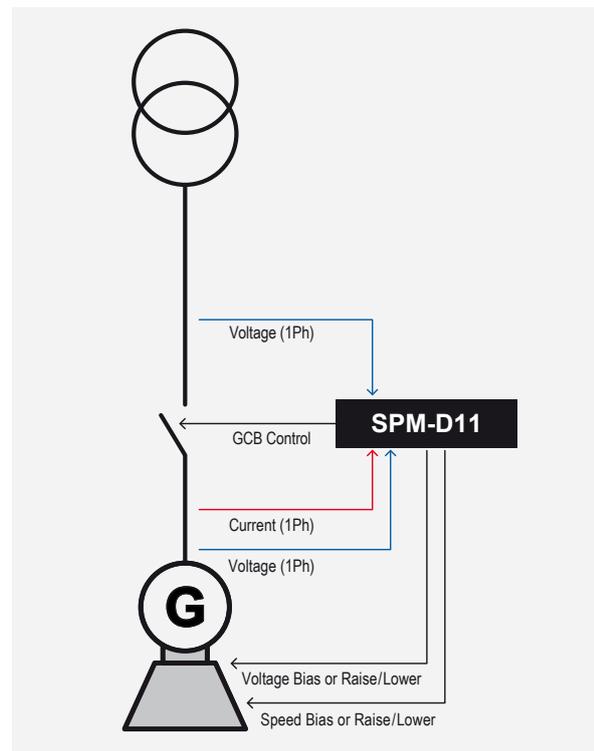
Package	SPM-D11			
	LSR	LSXR	LSR	LSXR
Three-step controller (voltage bias)	1	1	1	1
Three-step controller (speed bias)	1	1	1	1
Analog controller (voltage bias)	-	1	-	1
Analog controller (speed bias)	-	1	-	1
Power supply	12/24 VDC	12/24 VDC	24 VDC	24 VDC
Discrete input rating	12/24 VDC	12/24 VDC	18 to 250 VAC / DC	18 to 250 VAC / DC
Part No.				
Measuring inputs 100 VAC, .. / 1 A	8440-1702	8440-1705	8440-1708	-
Measuring inputs 100 VAC, .. / 5 A	8440-1703	8440-1706	-	8440-1713
Measuring inputs 400 VAC, .. / 1 A	-	-	-	8440-1714
Measuring inputs 400 VAC, .. / 5 A	8440-1686	8440-1666	8440-1711	8440-1715



## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (9.5 to 32 VDC) / 24 VDC (18 to 32 VDC) (depending on package)
Consumption	max. 10 W
Ambient temperature	-20 to 70 °C
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	115 VAC or 400 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC or 18 to 250 VAC / DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 72 x 122 mm
<b>Sealing (front / back)</b>	IP42 / IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

### Approvals



### Software

LeoPC 1

### Detailed Information

Product specification 37292 at [www.woodward.com](http://www.woodward.com)

# SPM-D21 Series | SYNCHRONIZER WITH MAINS DECOUPLING

The SPM-D21 Series are microprocessor-based synchronizers designed for use on three-phase AC generators equipped with Woodward or other compatible speed controls and automatic voltage regulators. The SPM-D21 Series provides automatic frequency, phase, and voltage matching using either analog or discrete output signals. It combines synchronizing for a Generator Circuit Breaker (GCB) and a Mains Circuit Breaker (MCB), load and power factor control, and generator and mains protection.

## FEATURE OVERVIEW

- Synchronization for one or two circuit breakers
- Phase match or slip frequency synchronization with voltage matching
- Outputs for speed and voltage bias signals
- Active power and power factor control
- Analog input to control active power setpoint externally
- Generator and mains protection included
- Discrete inputs for operating mode selection
- Two-line LCD display for operation, alarm indication, and visualization of measuring values
- LED synchronoscope
- PC and front panel configurable

## SPECIFICATIONS

<b>Power supply</b>	24 VDC (±25%)
Consumption	max. 10 W
Ambient temperature	-20 to 70 °C
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	115 VAC or 400 VAC true RMS
Current AC input	1 A or 5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs</b> (isolated)	Range: max. 250 VAC / DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 72 x 122 mm
<b>Sealing</b> (front / back)	IP42 / IP21
<b>Weight</b>	approx. 800 g

## PACKAGES



Package	SPM-D21	
	PSV	PSVX
Analog controller (voltage bias)	-	1
Analog controller (speed bias)	-	1
<b>Part No.</b>		
Measuring inputs 100 VAC, .. / 1 A	8440-1022	8440-1026
Measuring inputs 100 VAC, .. / 5 A	8440-1023	8440-1027
Measuring inputs 400 VAC, .. / 1 A	8440-1024	8440-1028
Measuring inputs 400 VAC, .. / 5 A	8440-1025	8440-1029



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

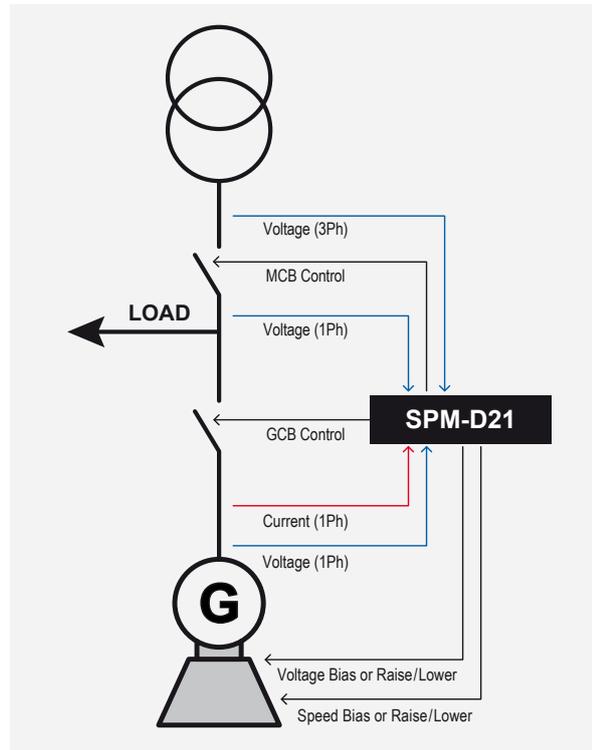
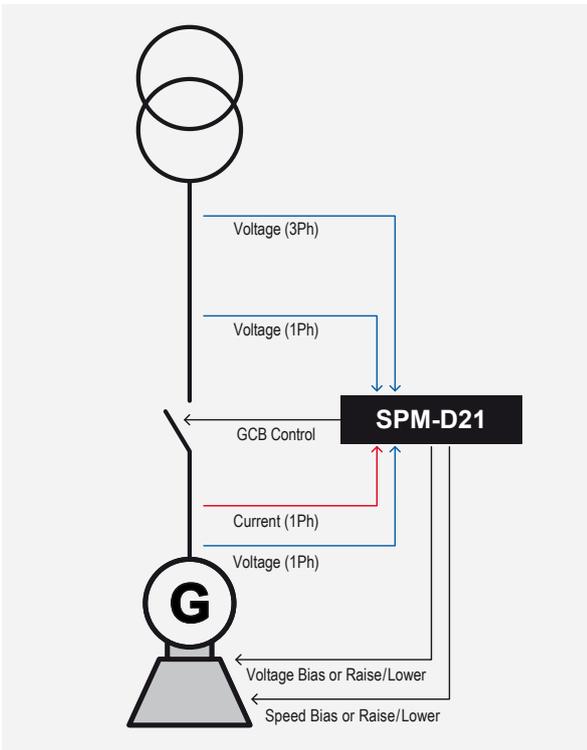
Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

## APPLICATIONS



### Approvals



### Software

LeoPC 1

### Detailed Information

Product specification 37293 at [www.woodward.com](http://www.woodward.com)

# SPM-A | SYNCHRONIZER MODULE



Woodward's SPM-A speed and phase matching synchronizer provides automatic frequency and phase matching when used with 2301, 2301A, and Electrically Powered Governor (EPG) electric load sharing control systems.

## FEATURE OVERVIEW

- Automatic synchronization of generators
- Adjustable dynamics
- Frequency, phase, and optional voltage matching
- Selectable match-up time
- Automatic circuit breaker closure
- Selectable output impedance

## SPECIFICATIONS

<b>Power supply</b>	115 or 230 VAC, 50/60 Hz, from generator input
Consumption	max. 5 W
<b>Ambient temp. (operation)</b>	-54 to 66 °C / -65 to 150 °F
<b>Voltage AC input</b>	115 or 230 VAC, 50/60 Hz
Accuracy	Class 1
<b>Relay outputs</b>	<p><b>Resistive loads</b></p> <p>10 A at 28 VDC</p> <p>3 A at 115 VAC, 50/60 Hz</p> <p>1.5 A at 230 VAC, 50/60 Hz</p> <p><b>Inductive loads</b></p> <p>6 A at 28 VDC</p> <p>2 A at 115 VAC, 50/60 Hz</p> <p>1 A at 230 VAC, 50/60 Hz</p>

<b>Analog outputs</b>	<p><b>High-impedance output</b></p> <p>for 2301 electronic load sharing control systems</p> <p><b>Low-impedance output</b></p> <p>for 2301A, EPG, and 2500 load sharing control systems and EGA or EGM with external resistor</p> <p>EPG output for Electrically Powered Governor (EPG) without load sharing</p>
<b>Housing</b>	Sheet metal housing
Back panel mounting	
Dimension (WxHxD)	315 × 210 × 44 mm
<b>Weight</b>	approx. 2,000 g

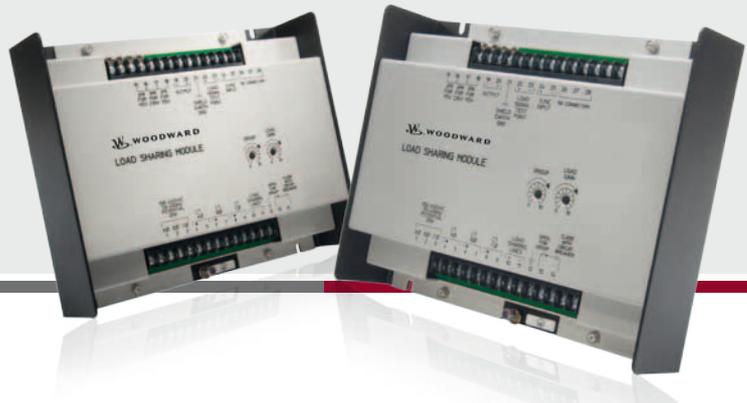


## PACKAGES

Model	SPM-A Part No.
Synchronizer	9907-028
Synchronizer with 1% voltage matching	9907-029
Synchronizer with 5% voltage matching	9905-003
Synchronizer with 1% voltage matching (Lloyd's appr.)	9906-121

<b>Approvals</b>	<b>Software</b>	<b>Detailed Information</b>
	LeoPC 1	Product specification 82383 at <a href="http://www.woodward.com">www.woodward.com</a>

# LSM | LOAD SHARING MODULE



The Load Sharing Module (LSM) provides isochronous and droop load sharing capability for engines in generator set applications. Additional equipment in the control system can include the Woodward SPM-A synchronizer, import/export control, automatic generator loading control (AGLC), and automatic power transfer and loading control (APTL).

Woodward makes models of its Load Sharing Module for use with engines equipped with speed controls that accept a  $\pm 3$  VDC speed setting input, a 0.5 to 4.5 VDC input, or a PWM (pulse-width-modulated) input. The Load Sharing Module allows use of Woodward power generation accessories and allows load sharing between engines equipped with speed controls that are not manufactured by Woodward and engines controlled with Woodward electronic controls, or controls using other Woodward load sharing modules.

## FEATURE OVERVIEW

- Allows load sharing with Woodward and non-Woodward equipped engines
- Isochronous and droop load sharing
- Easy to set up

## SPECIFICATIONS

<b>Power supply</b>	DC models: 8 to 32 VDC AC models: 95 to 130 VAC or 190 to 260 VAC (line-to-line) generator input
Consumption	DC models: max. 5 W AC models: max. 10 W
Ambient temperature (operation)	-40 to 70 °C / -40 to 158 °F
Ambient humidity	95%, at 65 °C non-condensing
<b>Voltage AC input</b>	95 to 130 VAC or 190 to 260 VAC (line-to-line), 50 to 400 Hz
<b>Current AC input</b>	3 to 7 arms at full load
<b>Analog outputs</b>	0.5 to 4.5 VDC, $\pm 3$ VDC, PWM
<b>Housing</b>	
Back panel mounting	Sheet metal housing
Dimension (WxHxD)	274 x 214 x 59 mm
<b>Weight</b>	approx. 1,500 g

## PACKAGES



LSM		
Output Type	Supply Voltage	Part No.
$\pm 3$ VDC analog	115/230 VAC	9907-173
0,5 to 4.5 VDC analog	24 VDC	9907-252

<b>Approvals</b> 	<b>Detailed Information</b> Product specification 82686 at <a href="http://www.woodward.com">www.woodward.com</a>
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Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# AUTOMATIC TRANSFER SWITCH CONTROLLERS



## Load Transfer with Confidence

Our Automatic Transfer Switch (ATS) controllers enable you to reduce complexity in terms of hardware, spacing, and component cost for new builds and retrofits. This is feasible because our configurable software allows running mains-generator, generator-to-generator, and mains-to-mains applications out of one controller. This also includes delayed and closed-transition modes among other typical ATS-specific features.

By using our products you will be able to handle all ATS-relevant features by ordering one single device. This is maximum value for your automatic transfer switch application. For more simple applications we can also offer you a basic version of an ATS controller.

Genset  
ControllersSynchronizer &  
Load Share  
ControllersAutomatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
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RelaysPower  
Generation Engine  
Control Products

# DTSC-50 | ATS CONTROLLER

The DTSC-50 digital transfer switch controller is an economical controller for open-transition (break before make) automatic transfer switch (ATS) control for emergency standby applications with a single generator. When it detects a utility failure it commands the generator to start and transfers the load to the emergency source. When utility power is restored it performs an open-transition retransfer and allows the engine to cool down before stopping. It can be utilized in 1Ph2W, 1Ph3W, 3Ph3W, and 3Ph4W systems.

The DTSC-50 displays voltage and frequency values for each phase, as well as engine hours, maintenance hours, and number of transfers. Active alarms are annunciated via the seven-segment LED display. Separate LEDs show breaker status and source availability. Sealed soft keys enable the user to start the generator and operate the transfer switch manually.

## YOUR BENEFITS AT A GLANCE

Realize ATS applications with a cost-effective controller that provides you a full range of functionality and suits all possible applications.

## FEATURE OVERVIEW

- Open-transition transfer
- Utility-to-generator application
- Auto/manual operation
- "Remote start" input
- "Lock in AUTO mode" input
- "Lock in MANUAL mode" input
- Internal breaker interlock utilizing discrete inputs for breaker position detection
- Adjustable timers
- Event/Alarm log system
- Freely configurable discrete I/O
- PC and/or front display configuration
- Six seven-Segment LED display
- True RMS voltage sensing
- LEDs for source availability and breaker status
- Password protection
- Fully enclosed housing
- Removable terminal blocks
- 6.5 to 40.0 VDC powered

## PART NUMBER



DTSC-50

Part No.

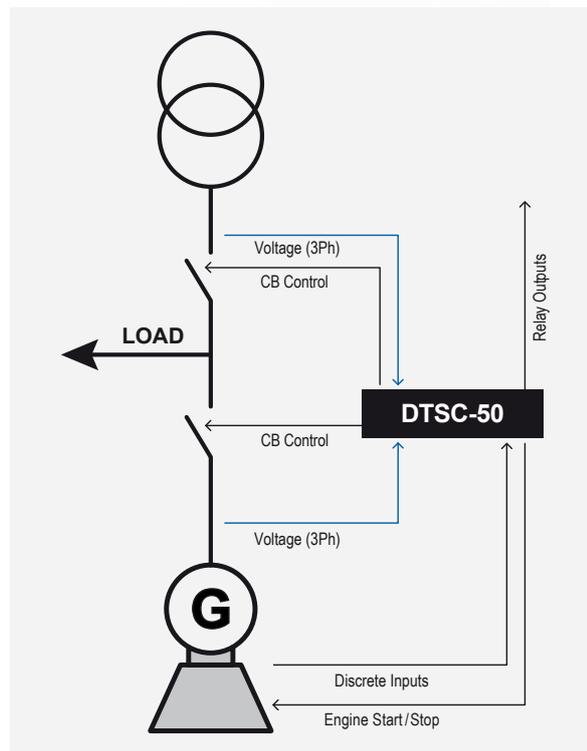
8440-1894



## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (6.5 to 32 VDC)
Consumption	max. 10 W
Ambient temperature (storage)	-30 to 85 °C / -22 to 185 °F
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	480 VAC true RMS
Accuracy	Class 1
<b>Discrete inputs</b> (isolated)	Range: 12/24 VDC (6.5 to 32 VDC)
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	158 x 158 x 40 mm
<b>Sealing</b>	IP54
<b>Weight</b>	approx. 450 g

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

<b>Approvals</b>	
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<b>Software</b>	LeoPC 1
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<b>Detailed Information</b>	Product specification 37455 at <a href="http://www.woodward.com">www.woodward.com</a>
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# DTSC-200 | ATS CONTROLLER

The DTSC-200 is the ultimate control for new ATS (automatic transfer switch) builds and retrofits. A complete measurement and protection package, it easily configures to utility-to-generator, generator-to-generator, or utility-to-utility systems for open-, delayed- or closed-transition transfer with sync-check to ensure the smoothest possible transfer.

High-end features like transfer inhibit, source priority selection, load shed, motor load disconnect, elevator pre-signal, and engine exerciser timers come standard in this incredibly versatile, cost-effective control.

## YOUR BENEFITS AT A GLANCE

The advanced functionality of the DTSC-200 offers you a maximum of performance for ATS applications. This enables you to realize all possible project requirements and to offer the best reliability of your ATS switchgear.

## FEATURE OVERVIEW

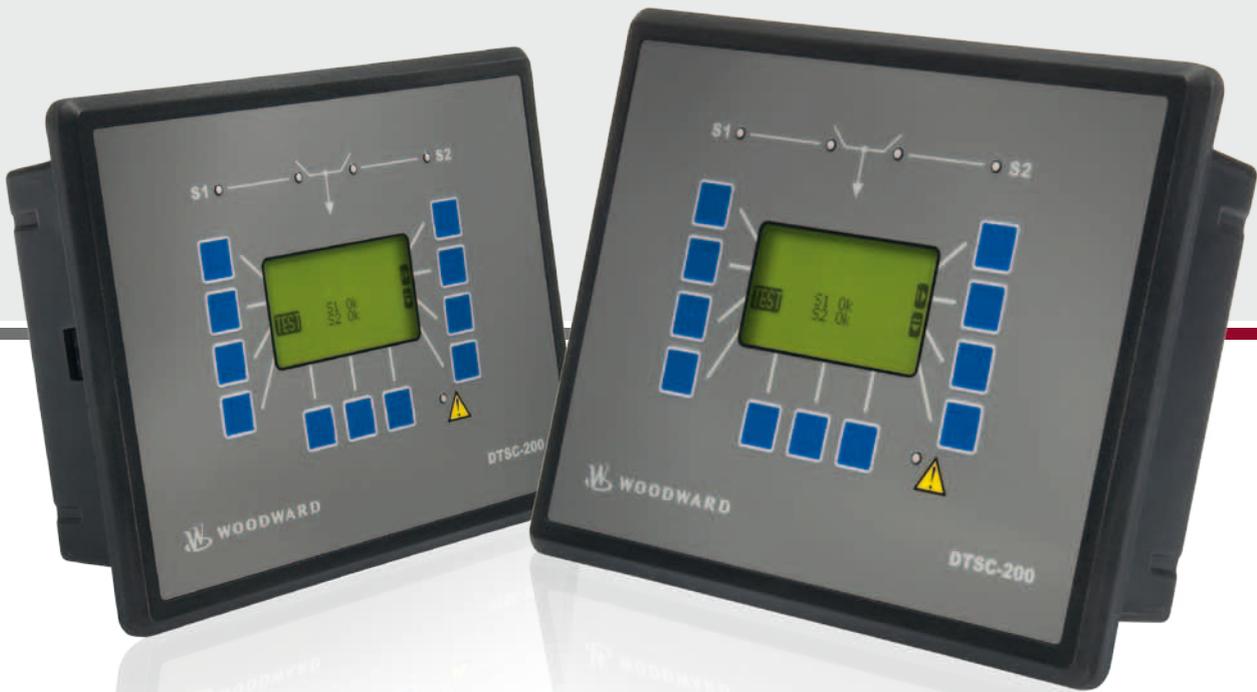
- Configurable for open-, delayed- and closed-transition transfer
- Configurable for utility-to-generator, generator-to-generator, and utility-to-utility applications
- Closed-transition transfers can be accomplished in <100 ms
- In-phase monitoring (sync-check)
- Load / no-load test functionality
- Engine exerciser (load / no-load test) routine with fully adjustable interval

- Peak shaving mode
- Load shedding
- Extended parallel time (for closed-transition transfers that take longer than 100 ms)
- Transfer and/or retransfer inhibit
- Source priority selection
- Elevator pretransfer and motor load disconnect timers
- Event/alarm log system with real-time clock
- Internal breaker interlock utilizing discrete inputs for breaker position detection
- Freely configurable discrete I/O with support for external I/O expansion units (e.g. Woodward IKD 1)
- RS-232, RS-485, and CAN bus interfaces for remote control and visualization purposes
- Supports CANopen and Modbus RTU protocols
- PC and/or front display configuration
- 128 x 64 pixels graphic LCD display
- LogicsManager provides programmable logic functions that eliminate relay logic or PLCs
- True RMS voltage, current, and power sensing
- LEDs for source availability and breaker status

## PART NUMBERS



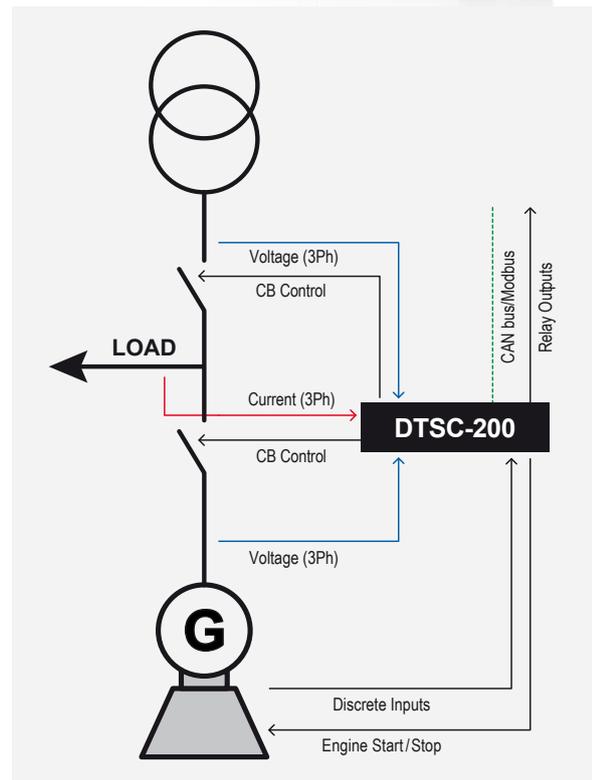
Part No.	DTSC-200
1 A	8440-1778
5 A	8440-1779



## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (6.5 to 40 VDC)
Consumption	max. 8 W
Ambient temperature (storage)	-30 to 80 °C / -22 to 176 °F
Ambient temperature (operation)	-20 to 60 °C / -4 to 140 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	120 VAC and 480 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS, isolated
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	Range: 12/24 VDC (8 to 40 VDC)
<b>Relay outputs</b>	Isolated
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	219 x 171 x 61 mm
<b>Sealing (front / back)</b>	IP65 / IP20
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset Controllers  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

<b>Approvals</b>	<b>Software</b>	<b>Detailed Information</b>
	LeoPC 1 Toolkit	Product specification 37398 at <a href="http://www.woodward.com">www.woodward.com</a>

# TRANSDUCERS



## Information Conversion

Woodward offers transducers to transform measured values into process information. The transformed values can either be issued by analog outputs or via interfaces to a higher level control system (e.g. PLC). Transducers are needed where electrical power, temperatures, pressure, and other process data are needed to feed the upper level control system for monitoring and/or control purposes.

For example: transducers are used in turbine or engine generator set applications where the prime mover control needs information about the electrical load of the application.

Woodward also offers specific transducers with integrated monitoring and protection features for renewable energy sources to comply with the latest grid code standards.



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# TUG 4 Series | TEMPERATURE MONITORING UNIT

The TUG 4 Series temperature monitoring devices provide up to 16 PT100 RTD (resistance temperature detector) inputs for temperature measurement and monitoring. Two individually configurable trip levels can be programmed for each sensor input. If a measured temperature exceeds its configured trip levels, alarm and shutdown relays will be energized accordingly. An additional relay is provided for indicating a wire break fault.

A two-line LC display shows the configured names of the analog measuring inputs. If an alarm occurs, an alarm message is displayed as well as the value of the input that caused the alarm.

Communication interfaces are available in case measuring values and trip levels need to be transmitted to a PC or PLC system.

## FEATURE OVERVIEW

- Up to 16 PT100 RTD sensor inputs for temperature measurement and monitoring
- Individually configurable tripping levels for each measuring input
- Configurable sensor input names
- Relay outputs are provided for "Alarm", "Shutdown", "Wire break" and "Readiness for operation"
- Front panel configurable
- Available interfaces: CAN bus, RS-485 Modbus, or Profibus DP

## PACKAGES



Package	TUG 408		TUG 412			TUG 416		
	B	B	B/SU	B/SU	B/SU	B	B/SU	B/SU
Measuring inputs (PT100)	8	12	12	12	12	16	16	16
CAN bus	-	-	•	-	-	-	-	-
RS-485 (Modbus)	-	-	-	•	-	-	•	-
Profibus DP	-	-	-	-	•	-	-	•
<b>Part No.</b>	8441-1128 8441-1127		8441-1142	8441-1137	8441-1130	8441-1133	8441-1013	8441-1136

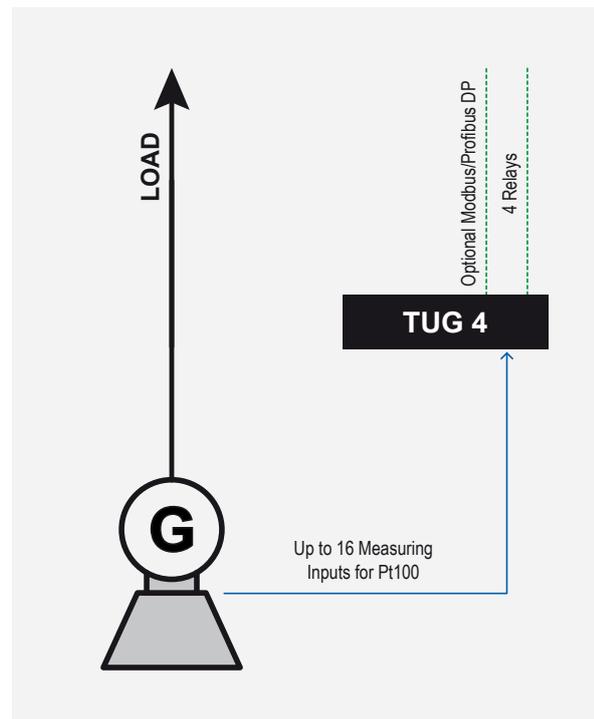
• = Standard



## SPECIFICATIONS

<b>Power supply</b>	24 VDC (±25%)
Consumption	max. 10 W
Ambient temperature	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Discrete inputs</b> (isolated)	Range: max. 250 VAC / DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	PT100 (resistance temperature detector)
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 72 x 118 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

### Approvals



### Detailed Information

Product specification 37169 at [www.woodward.com](http://www.woodward.com)

# UMT 1 Series | MEASURING TRANSDUCER

The UMT 1 Series are measuring transducers that feature true RMS sensing. Measured values are calculated and displayed on a two-line, 16 character LCD Display, and can either be assigned to analog outputs (configurable as -20 to 20 mA, 0 to 20 mA, or 4 to 20 mA) or transmitted to a higher-level control system via RS-485 or Profibus DP interface.

The primary measured values of voltage and current are used to calculate the values for active, reactive, and apparent power, power factor ( $\cos \phi$ ), kWh, and kvarh. Impulse output is also provided to output kWh or kvarh values.

## FEATURE OVERVIEW

- True RMS sensing
- Class 0.5 accuracy
- RS-485 Modbus RTU slave or Profibus DP communication
- Configurable measuring system for either single-phase, three-phase or a combination of both
- Front panel configurable

## SPECIFICATIONS

<b>Power supply</b>	24 VDC (8 to 30 VDC)
Consumption	max. 10 W
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	115 VAC or 400 VAC true RMS
Accuracy	Class 0.5
<b>Current AC input</b>	1 A or 5 A true RMS
Accuracy iac	Class 0.5
<b>Analog outputs (isolated)</b>	-20/0/4 to 20 mA
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing (front / back)</b>	IP42 / IP21
<b>Weight</b>	approx. 800 g

## PACKAGES

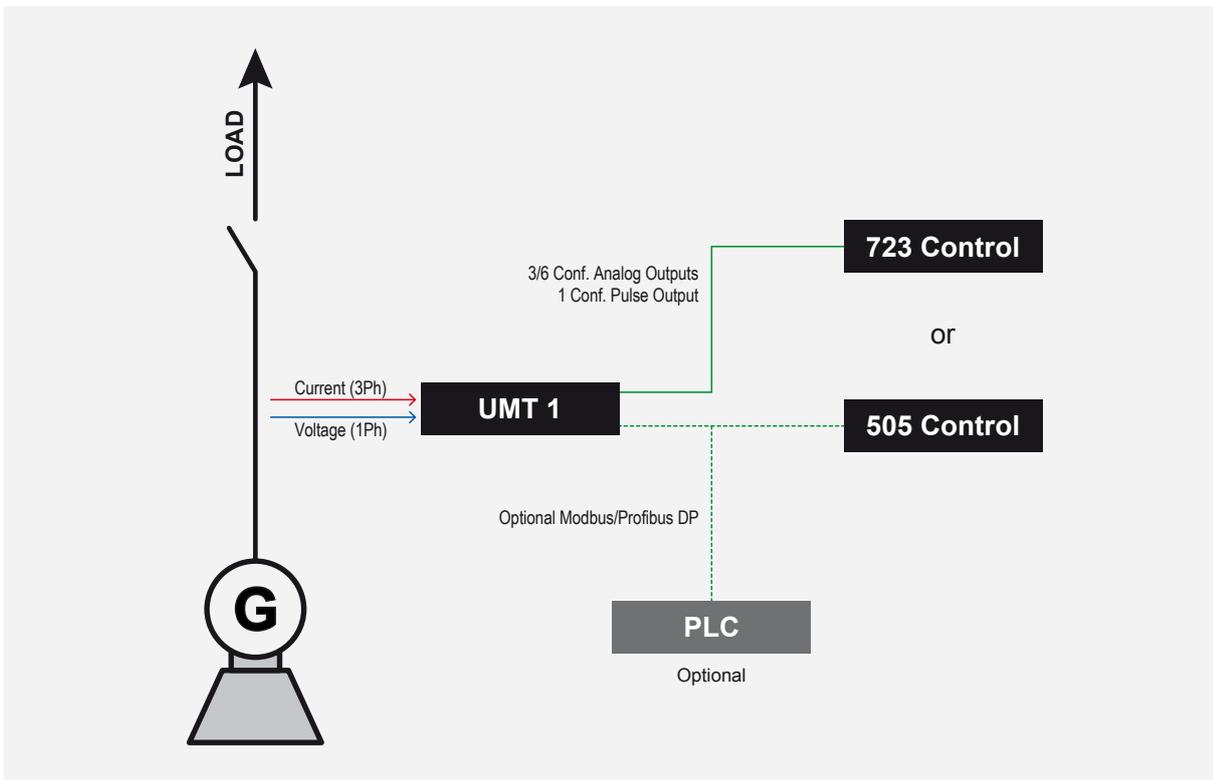


	UMT 1			
Package	A3	A3SU	A3SU	A6
Analog outputs	3	3	3	6
RS-485 (Modbus)	-	●	-	-
Profibus DP	-	-	●	-
Part No.				
100 V, .. / 1 A	LR 20411	8444-1022	8444-1027	LR 21296
100 V, .. / 5 A	5448-909	8444-1002	-	8444-1019
400 V, .. / 1 A	-	8444-1043	-	LR 21159
400 V, .. / 5 A	LR 20949	8444-1009	-	8444-1057
700 V, .. / 1 A	8444-1084	-	-	-

● = Standard



## APPLICATIONS



### Approvals



### Detailed Information

Product specification 37168 at [www.woodward.com](http://www.woodward.com)

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# MULTIFUNCTION RELAYS



## Protection Meets Control

Woodward offers multifunction relays (MFR) which combine industrial-grade protection with synchronization and load share features. The MFR takes care of protecting your power sources like hydro generator sets or sets driven by turbines or reciprocating engines, in isolated or mains parallel applications. Generator protection and mains monitoring features are configurable. Load balancing between multiple power sources and mains connection through synchronization are possible by using speed and voltage bias outputs.

The highly integrated protection packages with configurable alarm settings and remote control capabilities allow you to simply integrate the MFR into your system environment and to connect the controllers to your supervisory control and data acquisition (SCADA) system. The MFR products can be remote controlled to adapt protection and load flow schemes to your specific needs.



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# MFR 15 Series | MULTIFUNCTION RELAY – SYNCHRONIZER AND PROTECTION

The MFR 15 Series multifunction relays offer a comprehensive package of industrial-grade protection and basic power management features. Whether isolated or in parallel with the utility this device was designed for generators and switchgear equipment that require independent protection. Metering features via interface and analog outputs complement the MFR 15 Series.

The compact size and multiple functions of the MFR 15 Series help to simplify switchgear design. The MFR 15 Series, proven in the field, has for many years been a reliable solution for protection of low- and high-scale power generation applications.

## FEATURE OVERVIEW

- Analog load share line for active power load sharing between MFR 15 devices
- Front panel display for visualization and configuration
- PC configuration
- Discrete raise/lower outputs to control voltage, frequency, kW, and kvar
- True RMS sensing for industrial-grade generator protection
- Synchronization and sync-check features for generator breaker
- Counters for kWh and kvarh
- Three freely configurable relay outputs (setpoints and delay timers)
- Password protection



## PACKAGES

Package	MFR 15		
	SY	SYN	SYN-I
Analog kW load sharing line	-	●	●
Analog outputs (-20/0/4 to 20 mA; configurable)	3	3	-
Pulse outputs (kWh)	1	1	-
RS-485 interfaces	1	1	-
Part No.			
Measuring inputs 120 VAC, .. / 5 A	5448-899	5448-887	8440-1016
Measuring inputs 400 VAC, .. / 5 A	8440-1592	8440-1257	8440-1448
Measuring inputs 400 VAC, .. / 1 A	-	8440-1722	-

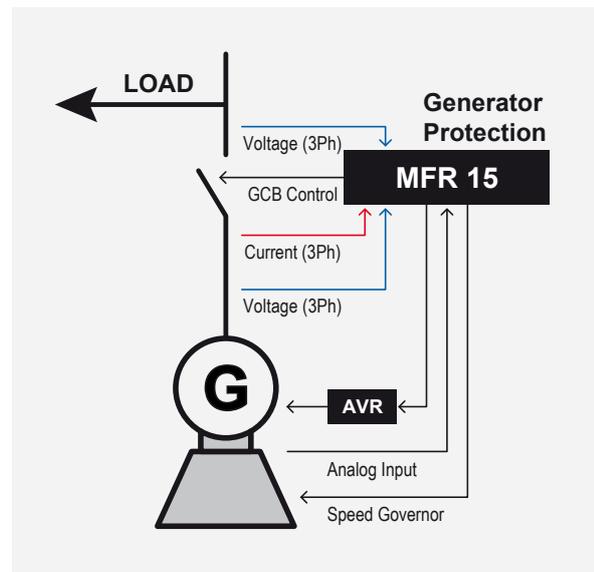
● = Standard



## SPECIFICATIONS

<b>Power supply</b>	24 VDC (18 to 30 VDC)
Consumption	max. 12 W
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	110 VAC and 400 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	18 to 250 VAC / DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	0 to 20 mA
<b>Analog outputs (isolated)</b>	0/4 to 20 mA
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

<b>Approvals</b>	<b>Software</b>	<b>Detailed Information</b>
	LeoPC 1	Product specification 03247 at <a href="http://www.woodward.com">www.woodward.com</a>

# MFR 2 Series | MULTIFUNCTION RELAY – SYNCHRONIZER AND PROTECTION

The MFR 2 Series multifunction relays offer a comprehensive package of industrial-grade protection and power management features. Whether isolated or in parallel with the utility these devices were designed for generators and switchgear equipment that require independent protection. Closed PID control loops by analog or discrete bias outputs offer control of voltage, frequency, active, and reactive power.

Analog inputs, metering features via interface, and analog outputs complement the MFR 2 Series, which can be easily integrated and remote controlled in a PLC (programmable logic controller) environment. This could be hydro or engine generator-set-driven applications among others.

## YOUR BENEFITS AT A GLANCE

Gain a high level of availability and reliability with the MFR 2 synchronization and protection features. The proven system design and durable hardware will convince your customers even under rough conditions.

## FEATURE OVERVIEW

- Front panel, a clearly readable two-line LCD Display with embedded synchronoscope
- True RMS sensing for generator protection and mains monitoring features
- Synchronization including breaker monitoring
- Profibus communication (optional)
- Active and reactive power load sharing for up to eight participants by CAN bus communication
- Counters for kWh, kvarh, operating hours, maintenance call
- Four configurable discrete inputs and relay outputs
- Communication based on CAN bus
- Password protection

## PACKAGES



Package	MFR 2S		MFR 2A
	PSV	PSVA	PSV
Synchronization	•	•	-
Isolated single-unit operation	•	•	-
Mains phase / vector shift	•	•	-
Mains df/dt (ROCOF)	-	•	-
Discrete controller (V; Q)	•	•	-
Active power setpoint (0/4 to 20 mA)	-	•	-
Analog inputs	-	2	-
Analog outputs	-	2	-
Impulse output	-	1	-
<b>Part No.</b>			
100 VAC	8440-1286	8440-1287	-
400 VAC	8440-1734	8440-1735	8440-1452

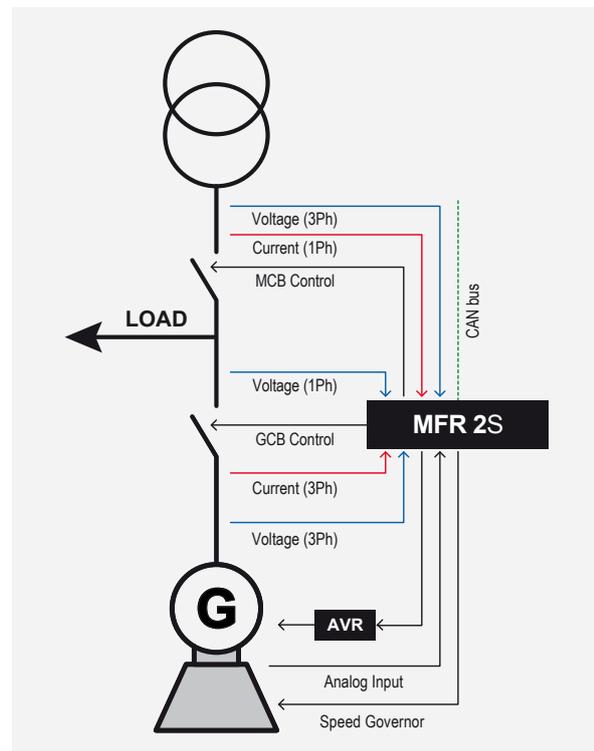
• = Standard



## SPECIFICATIONS

<b>Power supply</b>	24 VDC ( $\pm 30\%$ )
Consumption	max. 15 W
<b>Ambient temperature (operation)</b>	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	115 VAC or 400 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	18 to 250 VAC / DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog outputs (isolated)</b>	0/4 to 20 mA
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 72 x 122 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 1,000 g (depending on model)

## APPLICATIONS



<b>Approvals</b>	
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<b>Software</b>	LeoPC 1
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<b>Detailed Information</b>	Product specification 03248 at <a href="http://www.woodward.com">www.woodward.com</a>
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\* GL and UL approval is not valid for all MFR 2 packages.

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# MFR 3 Series | MULTIFUNCTION RELAY – SYNCHRONIZER AND PROTECTION

The MFR 3 Series multifunction relays offer a comprehensive package of industrial-grade protection and power management features. Whether isolated or in parallel with the utility these devices were designed for generators and switchgear equipment that require independent protection.

Closed PID control loops by analog or discrete bias outputs offer control of voltage, frequency, active, and reactive power. The MFR 3 Series can be remote controlled via interface and digital inputs. Analog inputs, metering features via interface, and analog outputs complement the MFR 3 Series.

## YOUR BENEFITS AT A GLANCE

Gain a high level of availability and reliability with the MFR 3 synchronization and protection features. The proven system design and durable hardware will convince your customer even under rough conditions.

## FEATURE OVERVIEW

- Front panel with dedicated push buttons and a clearly readable two-line LCD Display and embedded synchronoscope
- True RMS sensing for generator protection and mains monitoring features
- Synchronization including breaker monitoring
- Automatic load transfer schemes like open and closed transition, soft loading
- Mains export/import control
- Active and reactive power load sharing for up to 14 participants by CAN bus communication
- Counters for kWh, kvarh, engine starts, operating hours, maintenance call
- Freely configurable discrete and analog inputs/outputs
- Communication based on CAN bus
- Password protection



## PACKAGES

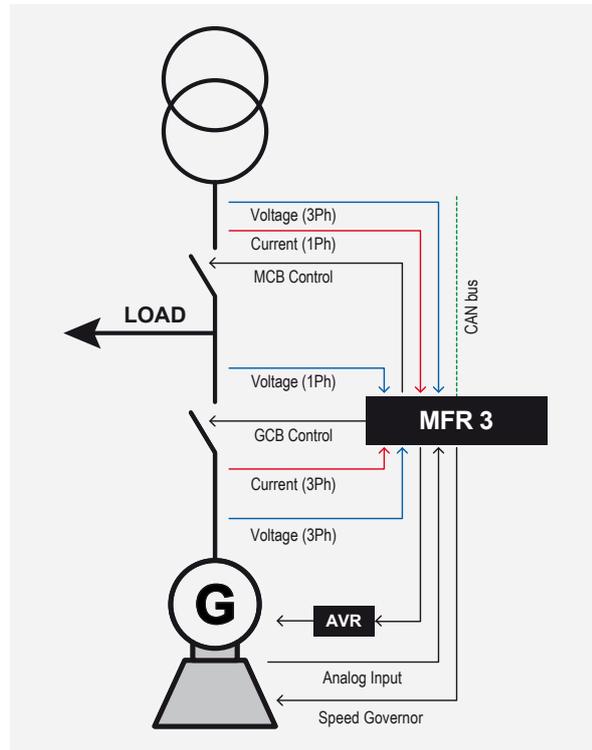
	MFR 31	MFR 32
<b>Package</b>	<b>PSVX+Q</b>	<b>PSVX+Q</b>
CB control	1	2
<b>Part No.</b>		
100 VAC	8440-1631	8440-1633
400 VAC	8440-1632	8440-1634



## SPECIFICATIONS

<b>Power supply</b>	12/24 VDC (8.5 to 32 VDC)
Consumption	max. 15 W
<b>Ambient temperature (operation)</b>	-20 to 70 °C / -4 to 158 °F
<b>Ambient humidity</b>	95%, non-condensing
<b>Voltage AC input</b>	115 VAC or 400 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs (isolated)</b>	18 to 250 VAC / DC
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A at 24 VDC and 250 VAC
<b>Analog inputs</b>	0/4 to 20 mA, PT100
<b>Analog outputs (isolated)</b>	0/4 to 20 mA
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 144 x 118 mm
<b>Sealing (front / back)</b>	IP42 / IP21
<b>Weight</b>	approx. 1,000 g (depending on model)

## APPLICATIONS



<b>Approvals</b>	

<b>Software</b>	
LeoPC 1	

<b>Detailed Information</b>	
Product specification 37166 at <a href="http://www.woodward.com">www.woodward.com</a>	

Genset Controllers  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

# PROTECTION RELAYS



## Find the Right Protection Relay for Your Application

Woodward is an independent supplier of systems and components for the power generation and distribution market. Many decades of experience combined with continuous improvement of our protection relays benefit our customers. The modular design of our product families provide our customers with an array of solutions for mains decoupling, feeder, motor, transformer, generator, and line protection. Due to our solution-oriented consultancy, our customers find precisely the right products or systems to meet their requirements.

Woodward offers you unsurpassed control and protection system solutions for every type of power generation and distribution application, from the simplest to the most complex.



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Power  
Generation Engine  
Control Products

The HighPROTEC line is fully equipped with all functions required by the corresponding application, feeder, mains decoupling, motor, and transformer protection. High usability, flexibility, precision, and reliability of the relays are the hallmarks of this product. The big protection package of each device covers all applications without additional price. Easy to use, fully equipped protection package with control and communication protocols.

To equip incoming or outgoing feeders, to realize the mains decoupling of renewable energy sources, or to protect motors or transformers with differential protection, HighPROTEC is the most convenient solution for your application. If you want to control your circuit breaker or to supervise the net values via SCADA, all necessary communication protocols are available.

device, SmartView updates automatically to ensure that the work can continue. The combination of these advantages saves commissioning and maintenance cost and confidence of providing the correct protection. SmartView is connected via RS-232 to the front panel, or you can use an Ethernet connection via the RJ45 interface.

## SUSTAINABLE TECHNOLOGY

When developing the HighPROTEC line we reacted to our customers' requirements and the latest standards. The HighPROTEC as a new product line will offer a long term availability to the market. In this process our nearly 40 years of experience and the advantages of our existing product lines have been successfully combined.

## SIMPLE AND INTUITIVE OPERATION

**Device menu:** The menu text and operating concept are consistent throughout the complete product line. The neatly, clearly, and unambiguously structured device menu enables safe operation. The intuitive menu navigation is backed by hotkeys and shortcuts as operating elements. The device menu is structured in the same way as the PC tool SmartView. If you do not know the function of a parameter, a help text to each parameter is shown on the device display and at the SmartView.

**SmartView:** In the device planning you can select only the protection modules necessary to protect the equipment. This function guarantees the optimal handling and overview of the complete setting. The parameter setting will be supported by plausibility checks. You can comfortably set all relay types offline. If you connect SmartView to a newer or unknown HighPROTEC

## FLEXIBLE FUNCTIONALITY

Each device fulfills all necessary requirements with a high level of flexibility. The hardware, like the digital inputs, are similar in each device. The digital input thresholds can be individually set to different nominal values. The current inputs are designed for 1 A and 5 A in one device, sensitive earth current inputs are additionally available. The wide-range power supply enables a connection to each auxiliary voltage. The phase and voltage measuring inputs are suitable for all nominal phase voltage up to 600 VAC (50/60 Hz). The current terminals have integrated short-circuit contacts. All plugs are removable and allow a pre-installation of the cabinet.

## COMMUNICATION

HighPROTEC supports all common SCADA communication protocols such as IEC61850, Modbus RTU, Modbus TCP, Profibus DP, and IEC60870-5-103.

## PROTECTION AND CONTROL

The protection functionality of each device is a full package, all in one without additional price. The different protection functions are very flexible and standardized over the complete line. Protec-

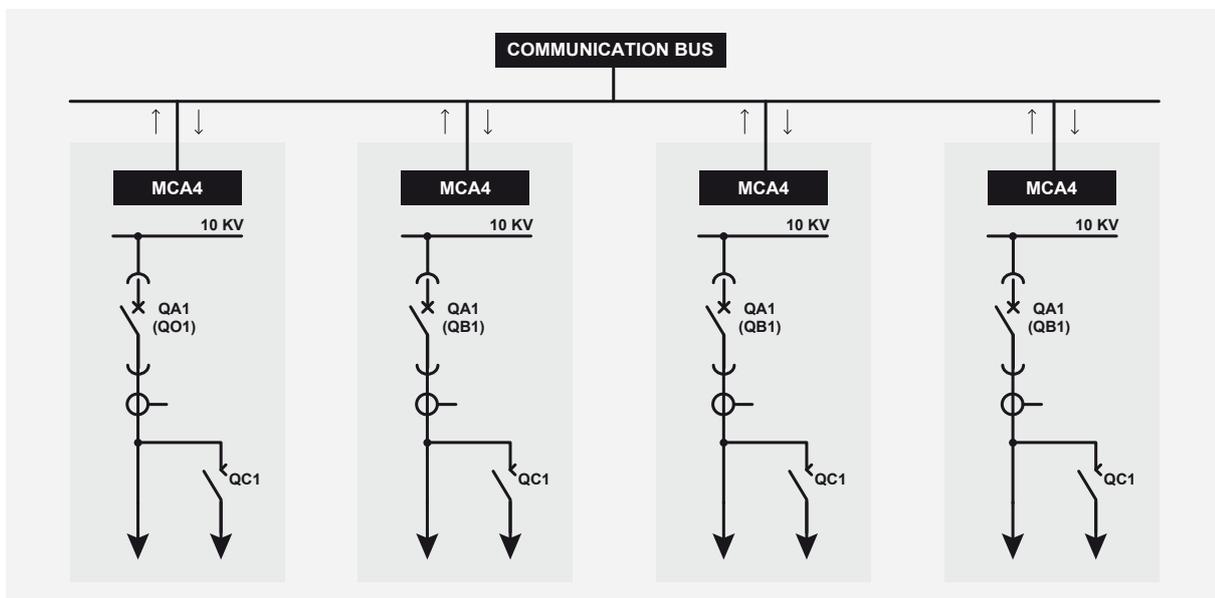


tion functions which are not needed for the application can be simply hidden. A plausibility check ascertains if assignments from the hidden functions are projected to LEDs or other modules. With this functionality the optimal protection function overview helps users to save time, gain assurance, and help to find failures. An integrated time management, supervision, and interlocking system provides full supervision of the system. The design of the single line scheme can easily be carried out by our support team. The additional switchgear wear module calculates the operations and total of interrupted short-circuit currents. A breaker wear function interpolate based on interrupted currents and operations the breaker wear health.

## FEATURE OVERVIEW

- Intuitive operation with help texts
- Plausibility checks prevent inadmissible inputs
- SCADA connection for all standard protocols
- International certification KEMA, UL, Gost-R
- Wide-range power supply for all standard aux. voltage ranges
- Current inputs are designed for 1 A and 5 A
- Nominal voltages and switching thresholds are adjustable

## APPLICATIONS



Approvals	Software	Detailed Information
  	SmartView	For more information go to <a href="http://www.woodward.com">www.woodward.com</a>

Genset  
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Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products



MRA4

MCA4

Protection Functions	ANSI	MRA4	MCA4
Phase current elements (nondirectional)	50/51	-	-
Phase current elem. (nondirectional and directional)	50/51/67	6	6
Transformer differential protection (two windings)	87T	-	-
Restricted earth fault elements	87G (64REF)	-	-
Voltage controlled current protection	51C	•	•
Voltage restraint current protection	51V	•	•
Earth current elements (nondirectional)	50N/51N	-	-
Earth current elem. (nondirectional and directional)	50N/51N/67N	4	4
Negative sequence elements (current / DEFT / INV)	46	2	2
Negative sequence elements (current / IEC / ANSI curves)	51Q	•	•
Overload protection with thermal replica	49	•	•
Voltage protection elements	27/59	6	6
Residual voltage elements	59N	2	2
Frequency protection elements	81 U/O	6	6
Inrush detection IH2 (2nd harmonic)		1	1
Voltage transformer supervision / loss of potential	60FL	•	•
Current transformer supervision	60L	•	•
Auto reclosing	79	•	•
Negative/positive sequence elements (voltage)	47	6	6
Circuit breaker failure protection	50 BF	•	•
Trip circuit supervision	74TC	•	•
Frequency gradient (ROCOF)	81R	•	•
Vector surge	78	•	•
Power protection: P, Q, Qr, S, Pr	32F, 37F, 32Q, 37Q, 37QR, 32S, 37S, 37R	6	6
Power factor: cos φ	55	2	2
QU protection (undervoltage-directional reactive power protection)	-	•	•
Sync-check	25	-	•
Motor start supervision	-	-	-
Locked rotor protection	-	-	-
JAM protection	-	-	-
I< underload protection steps	-	-	-
Overexcitation V/Hz	24	-	-
Loss of excitation	40	-	-
100% stator earth fault protection, sensitive input necessary	59TN/27TN	-	-
Protection parameter sets	-	4	4
Reverse interlocking	-	•	•
Event, failure, and disturbance recorder	-	•	•
Start / trend recording	-	-	-
<b>Control</b>			
Control function for up to six switchgears		-	•
Control function for one switchgear		-	-
<b>Measuring Functions</b>			
Currents		•	•
Thermal overload θ		•	•
Voltages		•	•
Frequency f		•	•
Power: P, Q, S, Pr, PF (cos φ), Wp+, Wp-, Wq+, Wq-		•	•
<b>Statistic Measuring Functions (Min., Max., and Avg. Values)</b>			
Currents		•	•
Voltages		•	•
Frequency f		•	•
Power: P, Q, S, PF (cos φ)		•	•
Thermal overload θ		•	•
Energy		•	•

**Order codes and part numbers overview:** For detailed information enter CAT-PDPARTNO-EN at [www.woodward.com](http://www.woodward.com)



# System Line | MORE THAN PROTECTION

Protection, control, supervision – are you looking for a complete solution for switchboards up to 132 kV instead of numerous individual units? The System Line devices are variable protection and control systems which offer you feeder, line, transformer, and bus bar protection. All these functions can be adjusted with ease and comfort.

## FROM WHERE DO YOU WANT TO CONTROL?

It is up to you whether you choose local control via the separate operating unit CMP, or remote control via either digital input or SCADA system. Woodward System Line will control almost all commonly available medium-voltage switchgears. Of course, the devices take into account the panel and system interlocking functions. All operating or fault messages are given a date and time stamp. You may rest assured – nothing will happen without you knowing about it.

## PROTECTION? ALL-INCLUSIVE

The feeder protection already includes 18 protective functions. All you need to do is activate them. Even with the line and transformer differential protection all backup protection functions are already on board.

## COMPACT, UNIVERSAL, FLEXIBLE

The compactly designed protection and control system fits into the smallest low-voltage niches and, thanks to its flexible field configurations, can be installed in all common switchboards irrespective of the manufacturer. But flexibility also means:



Base unit: CSP2



Operating unit: CMP1

- a wide-range power supply and universal in- and outputs
- the current transformer inputs are designed for both 1 A or 5 A
- you switch over between four different protective parameter sets

## OFF TO THE NEW CELL

With the optionally available parameter setting and evaluation software SL-Soft you can copy complete parameter sets and single line diagrams from a PC to the CSP or vice versa. This way you simply load new single line diagrams with the relevant interlocking logic into your System Line unit. For customer-specific requirements, individual functions can be generated by an internal programmable logic function called SL-LOGIC.

## MEASURING, EVALUATION, DIAGNOSIS

System Line devices record electrical values such as current, voltage, power, etc. But they also offer you numerous statistical and counting functions. For how many operating hours have your switchboards been running? How many switching cycles do your switching devices have? Energy metering, mean and maximum values? The answer is only a few clicks away.

## AND AFTER A FAULT EVENT?

Everything will be recorded by your System Line. You also have enough time to analyze a fault, even if it is only a matter of milliseconds. And if you want to know what events preceded the fault, the fault recorder will provide the answer. If that is not enough for you, you can simply carry out another analysis of the fault records via PC and copy this as a file. You can apply the same principle to take current flows over into your MS Office application or to zoom them into relevant time ranges. All this is made possible by the Data Recorder, a powerful software tool which provides you, visually and graphically, with valuable information and contributes to reducing costs within your company.

Standardized communication is a further highlight of Woodward's System Line. Regardless of whether you use process visualization, via station SCADA systems, or building automation or energy management systems, it is no problem! You can skillfully link your medium-voltage switchboard to other systems via IEC870-5-103, PROFIBUS DP, or MODBUS RTU using a standardized interface. This combined protection and control system integrates and helps to save costs because you do not require any expensive individual solutions. In addition, due to their great flexibility, the devices can be integrated step-by-step into existing or planned electrical energy distribution systems.

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

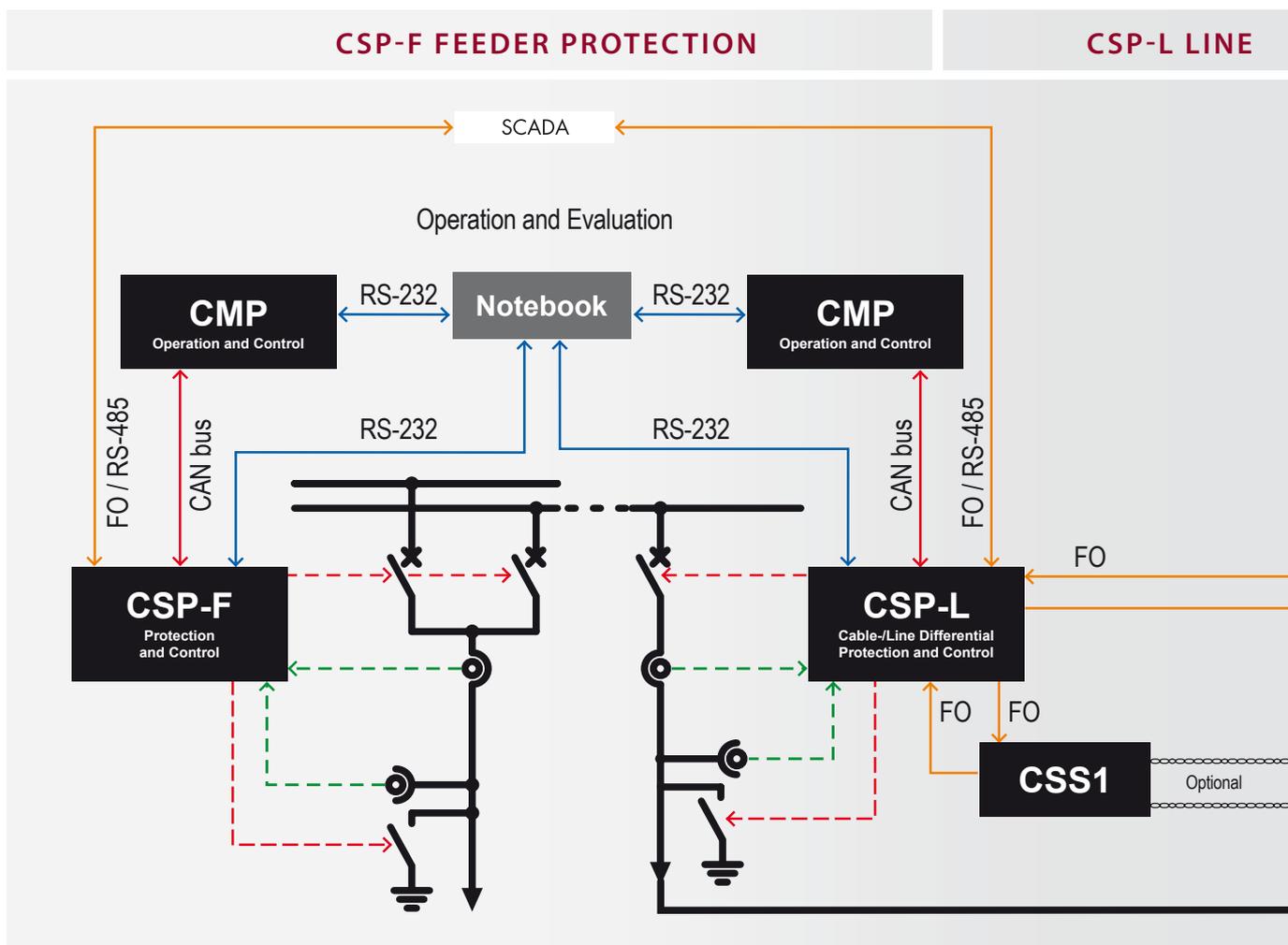
Power  
Generation/Engine  
Control Products

## SUPPLY? COUPLING? TRANSFORMER FEEDER?

The CSP-F will manage all relevant protection and control tasks and has not only stood the test as a flexible standard solution in new switchboards, but is also highly suited for retrofitting old switchboards. All inclusive – everything without extra charge, without expensive additional modules. With comfort and menu-guidance you can activate new device and protection functions with the tip of your finger – also later on in the switchboard.

## LINE PROTECTION

Do you require more than fast, selective line differential protection? In addition to complete line protection the CSP-L offers measuring and control functions as well as integrated backup protection. Since communication between the devices occurs via fiber-optic conductors, data transmission is not only especially fast, but also extremely safe.



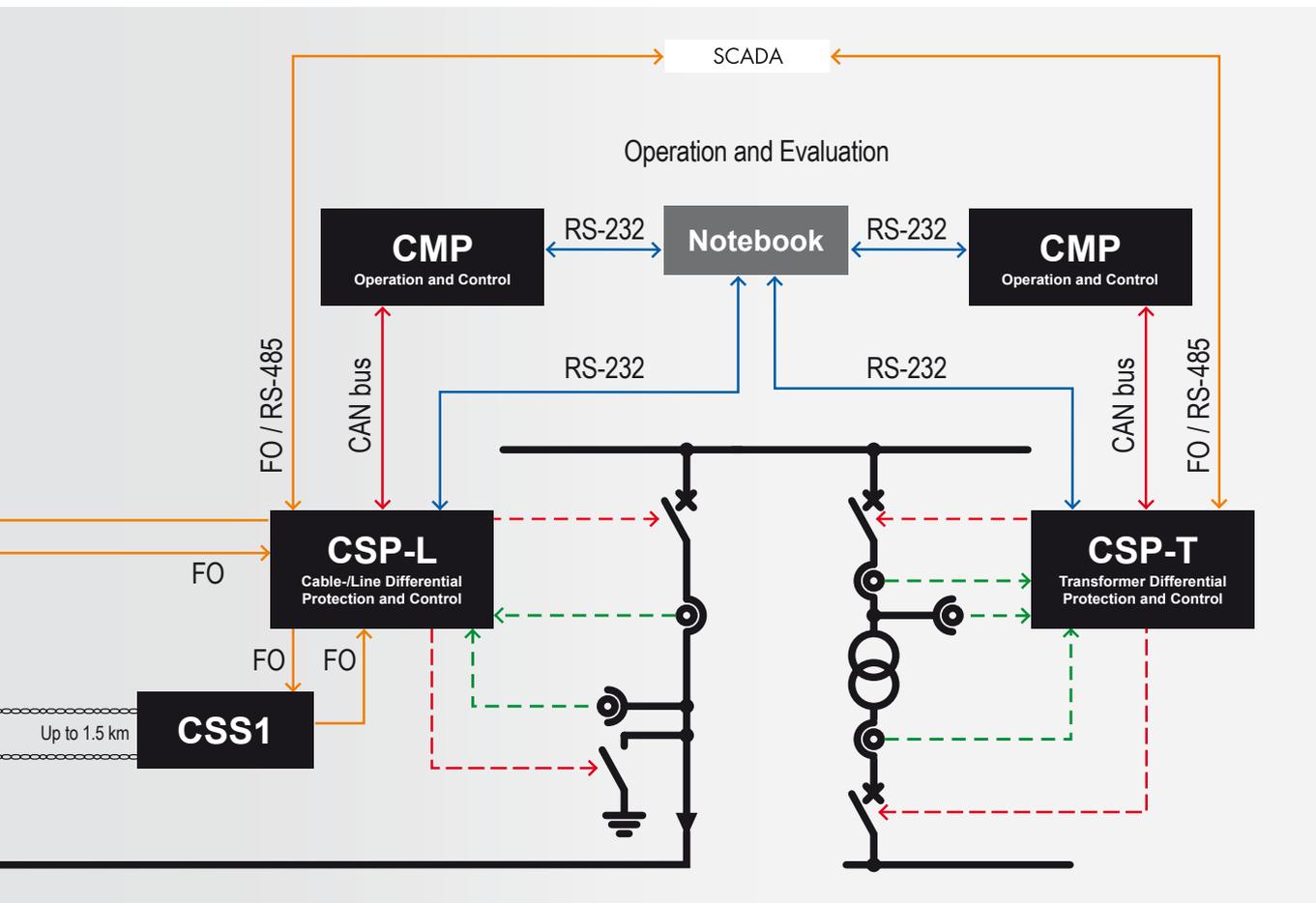
## TRANSFORMER PROTECTION

With this high-performance management system, two winding transformers can be protected and operated completely. In order to cover and satisfy different trip philosophies, Woodward has designed the CSP2-T in such a way that it provides various trip characteristics relating to trip commands, and therefore commands can be given to just one or both or none of the

circuit breakers. Also, the transformer protection is able to control up to five switching devices including power outputs or two circuit breakers.

### PROTECTION

### CSP-T TRANSFORMER PROTECTION



FO = Fiber Optic

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Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products



Base unit: CSP2



Operating unit: CMP1

## ANY FURTHER BENEFITS REQUIRED?

Control and operating comfort of the System Line are unbeatable. If, for example, you have to change the parameters of some panels of your switchboard, Woodward technology will offer you all the advantages our digital era can offer. It is up to you whether you wish to set the parameters of the respective panels locally, or adjust the parameters of other panels via the operating unit of one panel. Or you can link the operating unit CMP to your notebook via a serial cable and carry out changes by means of the keyboard. The internal bus allows central evaluation of up to 16 devices.

### Approvals



### Software

System Line  
Soft

### Detailed Information

For more information go to [www.woodward.com](http://www.woodward.com)

			CSP-F5	CSP-L	CSP-T
<b>Protection Functions</b>		ANSI	Feeder	Line	Transformer
Phase current	Number of elements	50/51	3	3	2
Phase current (directional)	Number of elements	50/51/67	3	3	2
Earth fault	Number of elements	50N/51N	2	2	2
Earth fault (directional)	Number of elements	67N	2	2	2
Negative sequence (current)	Number of elements	46	2	-	-
Overload protection with thermal replica		49	•	-	•
Voltage	Number of elements	27/59	2/2	2/2	2/2
Residual voltage	Number of elements	59N	2	2	2
Voltage transformer supervision (fuse failure)			•	•	•
Frequency	Number of elements	81	4	-	4
Power	Number of elements	32 F/R	2/2	-	-
Differential protection		87	-	cable/line	transformer
Auto reclosing (AR)		79	•	•	•
AR fast trip			•	•	•
Overexcitation		24	-	-	*
Switch on to fault protection (SOTF)			•	•	•
Look out function		86	•	•	•
Control circuit supervision (CCS)		74 TC	•	•	•
Circuit breaker failure protection (CBF)		50 BF	•	•	•
Programmable protection logic			•	•	•
Parameter switch			•	•	•
Backward interlocking			•	•	•
Disturbance recorder (optionally with extended storage range)			o	o	o
Restricted earth fault (REF)		64	-	-	*
Temperature measurement			-	-	*
<b>Measuring Functions</b>					
Phase currents			•	•	•
Earth currents			•	•	•
Negative sequence current			•	-	-
Differential currents			-	•	•
Stabilizing currents			-	•	•
Phase-to-phase voltages			•	•	•
Phase-to-neutral voltages			•	•	•
Frequency			•	-	*
Power			•	-	*
Power factor			•	-	*
Energy counter			•	-	*
<b>Statistic Measuring Functions</b>					
Currents			•	•	•
Voltages			•	•	•
Frequency			•	-	*
Power			•	-	*
CB operation counter			•	•	•
Sum of short-circuit currents			•	•	•
<b>Control Functions</b>					
Local/Remote control (key switch)			•	•	•
Number of controllable switching devices			5	3	5
Number of recognizable switching devices			5	5	5
Number of signal relays			10	6	6
Number of configurable inputs			16	12	16
<b>Supervision Functions</b>					
Fault/Differential position			•	•	•
Programmable field interlocking			•	•	•
<b>Communication</b>					
IEC60870-5-103 (option: fibre optic / RS485)			o	o	o
Profibus DP (option: fibre optic / RS485)			o	o	o
Modbus RTU (option: fibre optic / RS485)			o	o	o

o = Option • = Standard

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Control Products

**Order codes and part numbers overview:** For detailed information enter CAT-PDPARTNO-EN at [www.woodward.com](http://www.woodward.com)

# High Tech Line | SAFE, PRECISE, WELL-PROVEN

Complex protection functions are the special features of these devices for low-, medium-, and high-voltage applications. This well-proven, continuously developing line covers everything from basic overcurrent time protection via machine protection right down to high-quality differential protection.

## ARRANGEMENTS AS REQUIRED

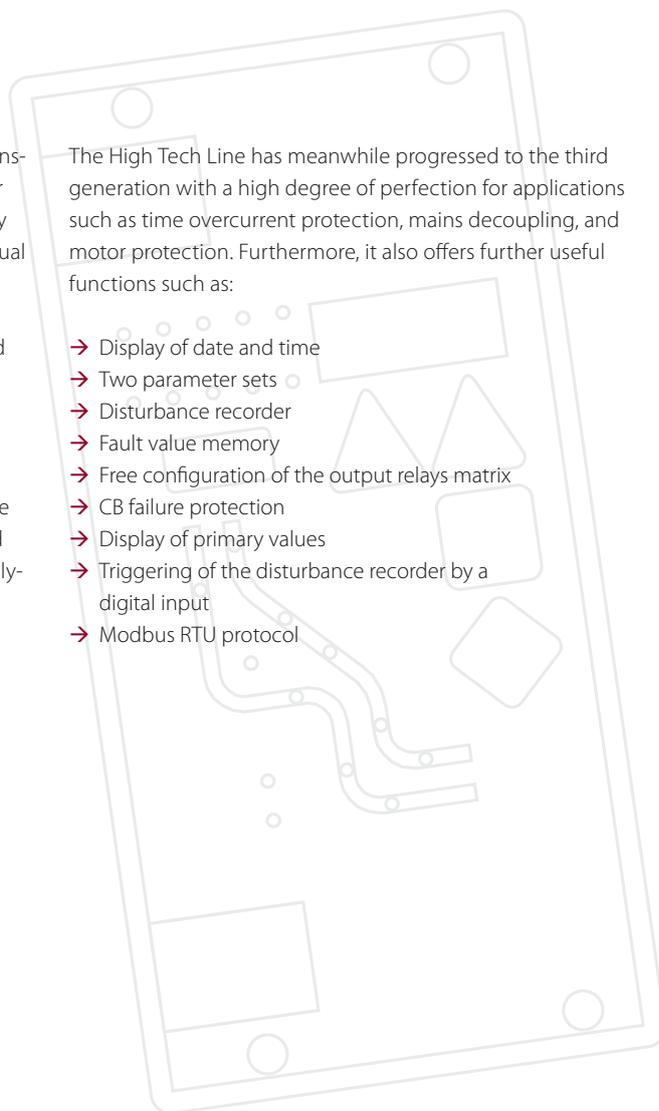
No matter whether you wish to protect grids, generators, transformers, or engines, the Woodward relays with their modular structure and thousand-fold applications will stand up to any task. And it does not matter whether you wish to use individual or combination relays.

Numerous additional functions have already been integrated into these relays and additionally offer you, among other functions, fault analysis and flexible adaptation to changing operating conditions.

The integrated communication interface provides the linkage to the higher-level SCADA system. The additional Woodward software makes parameter setting of the relays and fault analysis much easier.

The High Tech Line has meanwhile progressed to the third generation with a high degree of perfection for applications such as time overcurrent protection, mains decoupling, and motor protection. Furthermore, it also offers further useful functions such as:

- Display of date and time
- Two parameter sets
- Disturbance recorder
- Fault value memory
- Free configuration of the output relays matrix
- CB failure protection
- Display of primary values
- Triggering of the disturbance recorder by a digital input
- Modbus RTU protocol





## SPECIFICATIONS

<b>Power supply</b>	19–270 VAC / 19–360 VDC
<b>Ambient temperature</b> in storage	-25 °C to 70 °C
<b>Ambient temperature</b> in operation	-10 °C to 55 °C
<b>Voltage AC input</b>	100 VAC and 400 VAC, 0–2 xUn
<b>Current AC input</b>	1 A or 5 A
<b>Current DC input</b>	0 to 20 A
<b>Isolation measurement input</b>	1 kohm to 500 kohm
<b>Discrete inputs (isolated)</b>	19 to 270 VAC (9 to 360 VDC)
<b>Relay outputs</b>	250 VAC 6 A, 250 VDC 0.3 A, 24 VDC 6 A
<b>Housing (D-Housing)</b>	
<b>Dimension (WxHxD)</b>	147 x 72 x 265 mm
<b>Sealing</b>	IP54
<b>Weight</b>	approx. 2,000 g

Genset  
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Power  
Generation Engine  
Control Products

### Approvals



### Software

HTL/PL-Soft4

### Detailed Information

For more information go to [www.woodward.com](http://www.woodward.com)

\* Not valid for all part numbers

The intuitive operation of the High Tech Line relays deserves five stars for comfort. Thanks to its functional design, five keys, LEDs, and alphanumerical displays, it offers you a lot of flexibility in a minimum space. The simple operating surface combines functionality with comfort, with the integrated four-digit display serving as a clear text display for measured, fault, and adjustment values. The LEDs guide you intuitively through the adjustment process or signal the actual status of the relay.

The Woodward microprocessor technology and the highly integrated electronics, which guarantee top precision and reliability, will be as efficient as your speed of acquiring operating and parameter setting skills. Sophisticated solutions are, for example, offered by the double functions of the SELECT/RESET button. It allows you to call up all measured and adjustment values one after the other and to acknowledge fault signals. This is possible even when the housing lid is closed or sealed. Fast fault detection: If a protective function is triggered, the display level changes to the trigger level. Here the measured values at the moment of triggering can be seen, which makes fault diagnosis simpler.

The compact housing technology is the result of the 19"-compatible rack-mounting feature consistently used for rack installation. But we also offer you separate housings for flush mounting.

Compact and functional: Although the High Tech Line features numerous functions, the design of this series is compact. You get precision in a minimum of space. All units are designed for modular housing structures, based on 19" systems. Each relay is of plug-type design and therefore suited for front installation or installing on a mounting plate.

The High Tech Line with its extensive protection functions, numerous additional functions, intuitive operation, and its compact housing design guarantees high-tech protection wherever power is generated, converted, or distributed.





## PROTECTION FUNCTIONS AND FEATURES

### High Tech Line

Individual Functions	ANSI	
Phase current	50/51	MR I*
Phase current (directional)	67	MR I*
Earth current	50N/51N	MR I*
Earth current (directional)	67N	MR I*
Circuit breaker failure protection	BF	MR I*
Overcurrent voltage dependent	51V	MR I*
Negative sequence (current)	46	MR S
Voltage	27/59	MR U*
Residual voltage	59N	MR U*
Phase balance (voltage)	47	MR U*
Frequency	81	MR F*
Vector surge	78	MR G*
Power	32	MR P
Rotor earth fault (DC)	64	MR R
Auto reclosing	79	MR IK*
Lock-out function	86	MR L
Field failure (impedance)	40	MR Q
Exciter failure (DC)	37/40/64/76	MR R
Trip circuit supervision	74 TC	MR A
Phase sequence	47	MR U*
Combinations	ANSI	
Phase currents and earth current (directional or nondirectional)	50/51/67/50N/51N/67N	MR I*
Phase current, earth current, CB failure and AR (nondirectional)	50/51/50N/51N/BF/79	MR IK*
Phase current, earth current and thermal replica (nondirectional)	50/51/50N/51N/49	MR IT*
Mains decoupling (U/f/vector/df/dt)	27/59/81/78/81R	MR N3*
Motor protection (various functions)	37/46/48/49/50/51	MR M32*
Generator protection (various functions)	50/51/50N/51N/67N/ 27/59/59N/81/78	MR G3*
Line Features		
Housing technology 19" / Flush mounting	-	•
Panel mounting	-	○
Display (measuring values and parameters)	-	•
Indication of primary measuring values	-	• <sup>1</sup>
Interface	-	•
Setting via DIP switches	-	-
Fault memory	-	•
Disturbance recorder, clock, two parameter sets	-	• <sup>1</sup>
Number of output relays	-	5
Password protection	-	•
Parameter software HTL / PLSof4	-	○

\* = Various types with this code ○ = Option ● = Standard <sup>1</sup> = with High Tech Line devices type MR\*3 only

Genset  
Controller

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Transfer Switch  
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Control Products

	Time Overcurrent										
	MR13IRE	MR13IRER	MR13IRXR	MR13IE	MR13IX	MR13IXR	MR13E	MR13SR	MR13ITE	MR13IHE	
Current transformer inputs	4	4	4	4	4	4	1	1	4	4	
Voltage transformer inputs	3	3	3	-	-	3	-	3	-	-	
Binary inputs	2	2	2	2	2	2	2	2	2	2	
Output relays	4	4	4	4	4	4	4	4	4	4	
Watchdog relay	1	1	1	1	1	1	1	1	1	1	
<b>Protection Functions</b>											
Time overcurrent protection [50/51]	•	•	•	•	•	•	-	-	•	•	
Inrush stabilization (2nd harmonic)	-	-	-	-	-	-	-	-	-	•	
Directional time overcurrent protection [67]	•	•	•	-	-	-	-	-	-	-	
Earth fault protection standard [50N/51N]	•	•	-	•	-	-	•	-	•	•	
Sensitive EF isolated/compensated	-	-	•	-	•	•	-	-	-	-	
Resistance earthed / solidly earthed [50N/51N]	-	-	-	-	-	-	-	•	-	-	
Earth fault directional feature [67N]	-	•	•	-	-	•	-	•	-	-	
Thermal replica [49]	-	-	-	-	-	-	-	-	•	-	
Circuit breaker failure protection [50BF]	•	•	•	•	•	•	•	•	•	•	
Voltage protection [27/59]	-	-	-	-	-	-	-	-	-	-	
Residual voltage [59N]	-	-	-	-	-	-	-	-	-	-	
Phase balance [47]	-	-	-	-	-	-	-	-	-	-	
Frequency protection [810/U]	-	-	-	-	-	-	-	-	-	-	
Frequency gradient [81ROCOF]	-	-	-	-	-	-	-	-	-	-	
Vector surge [78]	-	-	-	-	-	-	-	-	-	-	
Active power direction [32/37]	-	-	-	-	-	-	-	-	-	-	
Rotor earth fault [64N], exciter current protection [40/76], diode failure	-	-	-	-	-	-	-	-	-	-	
Negative sequence protection [46]	-	-	-	-	-	-	-	-	-	-	
Field failure protection [40]	-	-	-	-	-	-	-	-	-	-	
Locked rotor [51], incomplete start [48], max. number of starts [66], undercurrent [37]	-	-	-	-	-	-	-	-	-	-	
<b>Special and Additional Functions</b>											
Auto reclosing	-	-	-	-	-	-	-	-	-	-	
Reset/Blocking	•	•	•	•	•	•	•	•	•	•	
Voltage-dependent function	-	-	-	-	-	-	-	-	-	-	
Time and date	•	•	•	•	•	•	•	•	•	•	
Parameter sets	2	2	2	2	2	2	2	2	2	2	
Fault recorder (non-volatile)	•	•	•	•	•	•	•	•	•	•	
Disturbance recorder	•	•	•	•	•	•	•	•	•	•	
Output relay matrix	•	•	•	•	•	•	•	•	•	•	
<b>Communication RS-485</b>											
RS-485 open data protocol	•	•	•	•	•	•	•	•	•	•	
Modbus RTU protocol	○	○	○	○	○	○	○	○	○	○	

**Order codes and part numbers overview:** For detailed information enter CAT-PDPARTNO-EN at [www.woodward.com](http://www.woodward.com)



# Professional Line | THE DIN RAIL TRENDSETTER IN MEDIUM-VOLTAGE APPLICATIONS

Gap in the market closed. Here you will find all common protective functions for low and medium voltage in individual or combined units. The special feature of the Professional Line products is their attractive price in conjunction with their intelligent DIN-rail design which is limited to essentials.

Small but efficient – fast and safe. These units manufactured using SMD technology and with universal architecture are used for grid, generator, and motor protection. Microprocessor technology used with our larger models ensures top precision and reliability. Especially important, too, the relays can process complex measured values, which include: the effective values, real power measuring, and communication capability in addition to characteristic curves.

Flexible adaptation: The Professional Line relays let you kill two birds with one stone. With the voltage and frequency relays you can easily select rated voltages and rated frequencies as well as some additional protective functions by means of a DIP switch. The current relays, for example, have a great number of standard characteristic curves which can be used to fit the individual application.





## UNIVERSAL SUPPLY

The protection relays can be operated with alternating or direct voltage, thanks to a wide-range power pack. This way you can have an electrical supply from the measured value itself or any other power source and therefore the product can be integrated into almost any operating environment.

Not only can important rated values be easily adjusted on the unit, but there is no need for a huge variety of associated equipment, which therefore optimizes logistics and warehousing. This underlines the cost efficiency of this product line.

Easy adjustment: DIP switches and potentiometers enable you to adjust the protective functions and tripping values quickly and safely. If you prefer to use a PC or a Notebook for this purpose, we offer you – as an option – an interface adapter plus the appropriate software. Active protection against changes in the settings is ensured by front covers that can be sealed and through adjustments using the software.

Compact design: The Professional Line protection relays are in many ways unique on the market. For example, the stan-

## SPECIFICATIONS X-TYPE

<b>Power supply</b>	36 to 275 VAC / 19 to 390 VDC
<b>Ambient temperature</b> (storage)	-40 °C to 85 °C
(operation)	-20 °C to 70 °C
<b>Voltage AC input</b>	100 VAC, 110 VAC, 230 VAC, 400 VAC
<b>Current AC input</b>	1 A or 5 A
<b>Discrete inputs (isolated)</b>	19–270 VAC / 19–360 VDC
<b>Relay outputs</b>	250 VAC 5 A, 250 VDC 0.1 A, 24 VDC 5 A
<b>Housing (DIN-Rail mount.)</b>	
Dimension (WxHxD)	75 x 65 x 110 mm
<b>Sealing</b>	IP40
<b>Weight</b>	approx. 500 g

## SPECIFICATIONS XR-TYPE

<b>Power supply</b>	19 to 270 VAC / 19 to 360 VDC
<b>Ambient temperature</b> (storage)	-20 °C to 70 °C
(operation)	-10 °C to 55 °C
<b>Voltage AC input</b>	100 VAC and 400 VAC, 0–2 xUn
<b>Current AC input</b>	1 A or 5 A
<b>Discrete inputs (isolated)</b>	19 to 270 VAC / 19 to 360 VDC
<b>Relay outputs</b>	250 VAC 6 A, 250 VDC 0.3 A, 24 VDC 6 A
<b>Housing (DIN-Rail mount.)</b>	
Dimension (WxHxD)	75 x 255 x 110 mm
<b>Sealing</b>	IP40
<b>Weight</b>	approx. 1,800 g

Approvals	Software	Detailed Information
 	HTL/PL-Soft4	For more information go to <a href="http://www.woodward.com">www.woodward.com</a>

\* Not valid for all part numbers.

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

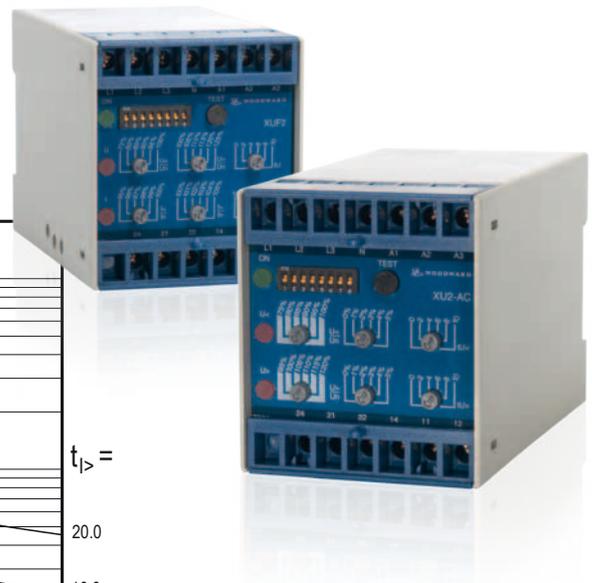
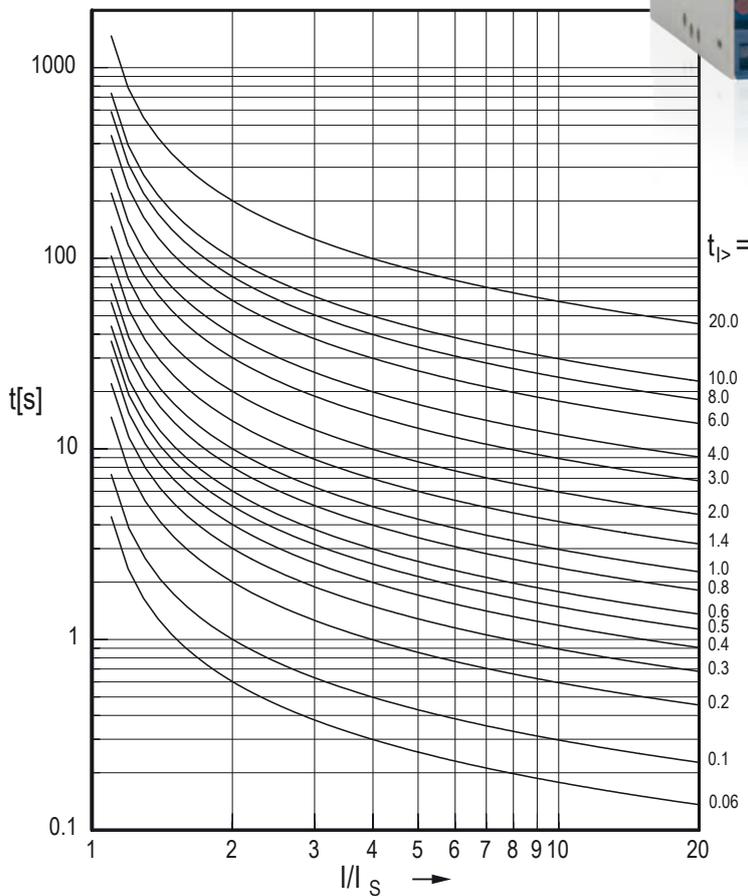
Protection  
Relays

Power  
Generation Engine  
Control Products

standard DIN-rail-mounted housings allow fast installation at an optimum cost. They have LV and MV practice-oriented terminals which are easily accessible and are suited for easy installation on DIN rails. They have a terminal cross section which is especially designed for the connected CTs so that they are first choice for those who are not obliged to use door installation.

Variety of applications: Woodward Professional Line devices not only prove themselves in the most varied stationary applications – such as in type-tested energy supply systems – but also in mobile applications: in construction site systems, container

systems, in supply systems for trains, and for the most varied maritime applications, they are GL certified. Woodward units fulfill the most stringent testing conditions. They are resistant to vibration and climate, and fulfill all requirements of IEC 60255.



The current relays of the Professional Line offer you a large number of selectable definite time inverse tripping characteristics.



### Professional Line

Individual Functions	ANSI	
Phase current	50/51	XI*
Phase current (directional)	67	XRI
Earth current	50N/51N	XI*
Earth current (directional)	67N	XI*
Circuit breaker failure protection	BF	-
Overcurrent voltage dependent	51V	-
Negative sequence (current)	46	XS
Voltage	27/59	XU*
Residual voltage	59N	XU*
DC voltage	27DC/59DC	XU*
Phase balance (voltage)	47	XA
Frequency	81	XF
Vector surge	78	XG
Power	32	XP
Differential protection	87	XD*
Rotor earth fault (DC)	64	XR
Exciter failure (DC)	37/40/64/76	XE
Phase sequence	47	XU*
Combinations	ANSI	
Earth current (directional)	50N/51N/67N	XRI1-ER
Phase current, CB failure (directional)	50/51/67/50BF	XRI1-IR
Phase current and earth current, CB failure (nondirectional)	50/51/50N/51N/50BF	XRI1-IE
Voltage and frequency	27/59/81	XUF
Voltage and negative sequence	27/59/47	XUA
Mains decoupling (U/f/vector/df/dt)	27/59/81/78/81ROCOF	XRW XRN XN*
Motor protection (various functions)	37/46/48/49/50/51	XM
Line Features		
DIN rail mounting	-	•
Panel mounting	-	only XRN XRW XRI
Display (measuring values and parameters)	-	only XRN XRW XRI
Interface	-	○
Setting via buttons	-	only XRN XRW XRI
Setting via potentiometer	-	•
setting via DIP switches	-	•
Fault memory	-	XRW XRI
Number of output relays	-	2/5
Password protection	-	with software
Parameter software HTL / PLSof4	-	○

\* = Various types with this code ○ = Option ● = Standard

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

### Time Overcurrent Protection

	X11I	X11E	X11S	X11ER	X11SR	XR11IR	XR11IE	XR11ER
Current transformer inputs	3	1	1	1	1	3	4	1
Voltage transformer inputs	-	-	-	1	1	3	-	3
Binary inputs	-	-	-	-	-	2	2	2
Output relay	2	2	2	-	2	4	4	2
Watchdog relay	-	-	-	-	-	1	1	1
<b>Protection Functions</b>								
Time overcurrent protection [50/51]	•	-	-	-	-	•	•	-
Directional time overcurrent protection [67]	-	-	-	-	-	•	-	-
Earth fault protection standard [50N/51N]	-	•	-	•	-	-	•	•
Resistance earthed / solidly earthed [50N/51N]	-	-	•	-	•	-	-	-
Earth fault directional feature [67N]	-	-	-	•	•	-	-	•
Circuit breaker failure protection [50BF]	-	-	-	-	-	•	•	-
Voltage protection [27/59]	-	-	-	-	-	-	-	-
Residual voltage [59N]	-	-	-	-	-	-	-	-
Phase balance [47]	-	-	-	-	-	-	-	-
Frequency protection [810/U]	-	-	-	-	-	-	-	-
Frequency gradient [78]	-	-	-	-	-	-	-	-
Vector surge [78]	-	-	-	-	-	-	-	-
Directional power [32/37]	-	-	-	-	-	-	-	-
Rotor earth fault [64]	-	-	-	-	-	-	-	-
Negative sequence protection [46]	-	-	-	-	-	-	-	-
Underexcitation protection [40]	-	-	-	-	-	-	-	-
Motor protection: locked rotor [51], thermal protection [49], undercurrent [37]	-	-	-	-	-	-	-	-
Differential protection [87T/87G/87L]	-	-	-	-	-	-	-	-
<b>Special and Additional Functions</b>								
Reset/Blocking	-	-	-	-	-	•	•	•
Voltage-dependent function	-	-	-	-	-	-	-	-
Parameter sets	-	-	-	-	-	1	-	1
Fault memory (non-volatile)	-	-	-	-	-	•	•	-
<b>Open Data</b>								
RS-485 open data protocol	o	o	o	o	o	•	•	•
RS-485 Modbus RTU	-	-	-	-	-	o	o	o
<b>Housing</b>								
75 x 65 x 110 mm (HxWxD)	•	•	•	•	•	-	-	-
75 x 224.7 x 110 mm (HxWxD)	-	-	-	-	-	•	•	•

**Order codes and part numbers overview:** For detailed information enter CAT-PDPARTNO-EN at [www.woodward.com](http://www.woodward.com)



Mains Decoupling/Protection										Machines			Diff-prot.			Misc.				
XN21	XN22	XRN21	XRN22	XRW1*	XUF2	XUA1	XU2AC	XU1DC	XU1E	XF2	XG2	XA1	XP2R	XS2	XE2	XR1	XD1T	XD1G	XD1L	XM1
-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	1	-	6	6	2	3
3	3	3	3	3	3	3	3	1	1	3	3	3	1	-	-	-	-	-	-	-
-	-	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
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-	-	•	•	•	-	-	-	-	-	-	-	-	-	-	-	-	•	•	•	-

• = Standard ○ = Option \* = Also available with undervoltage time characteristic acc. to BDEW guidelines

Genset Controllers  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

# WI Line | TRIPPING WITHOUT AUXILIARY VOLTAGE

Customer-oriented design: The protection relays we introduce to you in this line were developed in close cooperation with our customers. This cooperation has resulted in products which will match any circuit breaker commonly available on the market. Because these relays work independent of auxiliary voltage, they are well-suited for self-sustaining transfer and distribution stations, local grids, and ring main units.

## ALWAYS LIVE AND CLEVERLY

All the WI Line products are overcurrent time relays. The tripping characteristics range from the two-step independent time overcurrent protection (DEFT), dependent (INV) right down to specialist characteristic curves. As further options, we offer some relays with integrated earth current protection.

## CLEVERLY SOURCED

The WI protection relays receive their power supply from the measured current of the current transformers. By using the right combination of current transformer, low-power tripping coil (<0.5 Ws) and the appropriate protective device, you can gain enormous cost savings. Our contribution to this has been the development of a low-energy tripping principle which can be found in all WI devices. This low-energy tripping principle consists of an energy storage system which is integrated into the WI devices, and which considerably reduces the current transformer power.

Since we know how valuable and cost-intensive building space is, we are especially proud of the fact that our WI Line devices can be supplied even with smaller transformers.

Expensive connection via interposing transformers is therefore not necessary. The operating mode, which is independent from auxiliary voltage, guarantees you the greatest flexibility when it comes to using the devices. Of course, we also offer you solutions where standard 1 A or 5 A current transformers are required, or where specialist transformers in compact switch-gears are used.

## FOR ROUGH CONDITIONS

Day in, day out – even under the roughest environmental conditions – the WI Line relays prove their reliability. For over 15 years more than 23,000 WI relays have been installed and neither dirt, greatly fluctuating temperatures, nor high humidity have had any adverse effect on them. If you wish to employ superior technology even under the most unfavorable conditions, then the WI Line is the right choice for you.





	ANSI	WIM1	WIP1	WIC1	WIB1
<b>Single Functions</b>					
Phase overcurrent (multi-characteristic)	50/51	●	●	●	●
Short-circuit protection	50/51	●	●	●	●
Number of overcurrent elements		2	●	●	2
Earth overcurrent	50N/51N	-	○	○	●
Number of earth overcurrent elements		-	2	1	2
<b>Line Features</b>					
DIN-rail-mounting		-	●	-	-
Panel mounting		●	●	●	●
Display (measuring values and parameters)		-	●	-	-
Setting via buttons		-	●	-	-
Setting via hex switches		●	-	○	-
Setting via DIP switches		-	-	○	●
Standard CT (1 A / 5 A)		1 A or 5 A	1 A	-	-
Special CT (secondary rated current)		-	-	wide range	wide range
LED pickup		●	●	○	●
LED trip indicator		-	●	-	-
Flag-indicator output		●	●	●	2
Rated frequency Hz		50/60	50/60	50/60	50/60
Fault memory		-	●	●	●
Clock		-	●	-	-
Password protection		-	●	●	●
Electro-impulse / Relay contact output		R or E	both	E	E
Number of output relays (W = c.o. contacts)		2/3 W (R-type)	3 W	2**	2**
Input remote tripping		●	●	●	●
Interface		-	○	●	●
RS-485 interface with pro open data protocol		-	○	-	-
RS-485 interface with Modbus protocol		-	○	-	-
Additional power supply		-	○	-	-

● = Standard ○ = Option \* only WIC1-2 or WIC1-3 \*\* via WI1SZ5

**Order codes and part numbers overview:** For detailed information enter CAT-PDPARTNO-EN at [www.woodward.com](http://www.woodward.com)

## DID YOU KNOW ...

... that the WIP, flagship of the WI Line offers additional functions, which you would not normally expect from a current transformer powered relay? An optional, redundant voltage supply allows you to have the following additional features, regardless whether a primary current is flowing:

- Display of up-to-date measuring values
- Earth fault protection ( $I_{Es} \geq 0.05 \times I_N$ )
- Free configuration of the output signals
- Communication via RS-485

The communication interface allows you to set parameters online with WI-Soft, reading of the fault value memory, and connection to the SCADA system via the Modbus RTU protocol. One of our latest developments is the WIC1, which is used in compact ring main units – a device reduced to the essentials with an excellent price/performance ratio.

The WIC protects mains transformers against overcurrent and short circuits, in compact switchboards (ring main units) containing integrated circuit breakers. The DMT and IDMT tripping

Approvals	Software	Detailed Information
	WI-Soft2, WISoft1.0	For more information go to <a href="http://www.woodward.com">www.woodward.com</a>

\* WIB1 (NOC159)

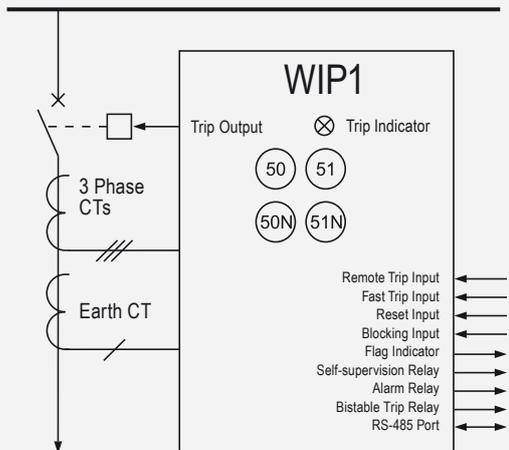
Genset Controllers  
 Synchronizer & Load Share Controllers  
 Automatic Transfer Switch Controllers  
 Transducers  
 Multifunction Relays  
 Protection Relays  
 Power Generation Engine Control Products

elements with their multi-characteristics allow you flexibility with your application. The WIC is also optionally available with integrated earth current supervision.

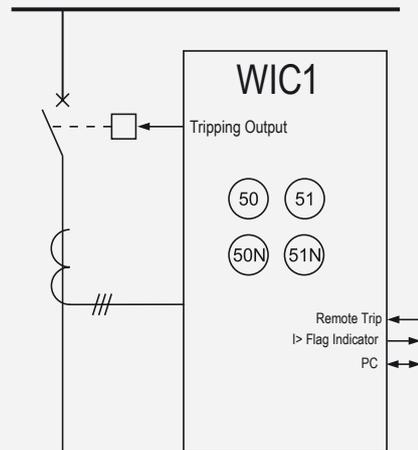
You will see that the WIC has benefits to offer even in the planning stage. Your work can be reduced so that you only need to select one of our four wide-range current transformers with secondary current adapted to the relay. In conjunction with these wide-range current transformers the WIC relay forms a system with an extremely wide operating-current range from 8–996 A. The complete system of transformer and relay has a primary short-circuit resistance of 62.5/25 kA 1 sec or respectively 52.5/21 kA 3 sec.

Its dimensions 170x40x125 mm make the WIC particularly suitable for installation in compact switchboards. The WIC system provides safe planning. As the system is universally applicable, the varieties you have in stock can be reduced to a minimum.

The choice is yours when it comes to parameter setting. Depending on the type, the WIC parameters can be set either by way of the communication interface via PC or simply via a DIP or HEX switch. Either supported by software or with a simple turn, you can simply adjust the tripping and excitation values as well as the tripping characteristic. The WIC is equipped with an integrated fault value memory which you can read via the communication interface. By means of the WIC Test Unit the processor's functions can be checked without any further auxiliary material.



Principle diagram WIP1

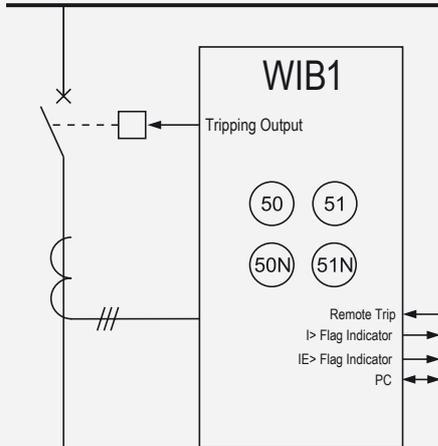


Principle diagram WIC1

When it comes to servicing and commissioning, additional test bushings on the top of the device make the direct secondary current testing of the complete converter much easier. Once put into operation, the WIC will remain maintenance-free for 25 years.

## BIG SELECTION

Hopefully you will find the protection relay to suit your requirements whilst browsing. In case you do not find a relay, please contact us. Chances are that we would be able to launch another member of the WI Line in a joint effort.



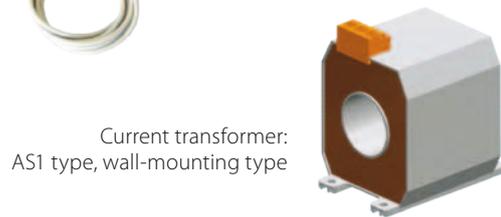
Principle diagram WIC1

## CURRENT AND SETTING RANGES

<b>WIM1</b>	<b>ct... / 1 A or ct... / 5 A</b>
$I_{>} = 0.8-2.3 \times I_n$	$I_{>>} = 2-18.5 \times I_n$
$t_{>} = 0.6-20 \text{ s}$	$t_{>>} = 0.05-1.5 \text{ s}$
<b>WIP1</b>	<b>ct... / 1 A</b>
$I_{>} = 0.5-2.5 \text{ A}$	$I_{>>} = 1-35 \times I_n$
$t_{>} = 0.06-300 \text{ s}$	$t_{>>} = 0.06-2 \text{ s}$
$I_{E>} = 0.05-2 \times I_n$	$I_{E>>} = 0.1-9 \times I_n$
$t_{IE>} = 0.06-300 \text{ s}$	$t_{IE>>} = 0.06-2 \text{ s}$
<b>WIC1</b>	<b>8 to 996 A</b>
$I_{>} = 0.9-2.5 \times I_s$	$I_{>>} = 1.0-20 \times I_s$
$t_{>} = 0.01-300 \text{ s}$	$t_{>>} = 0.04-3 \text{ s}$
$I_{E>} = 0.2-2.5 \times I_s$	-
$t_{IE>} = 0.1-20 \text{ s}$	-
<b>WIB1</b>	<b>8 to 480 A</b>
$I_{>} = 0.9-2.5 \times I_s$	$I_{>>} = 1.0-20 \times I_s$
$t_{>} = 0.1-2.0 \text{ s}$	$t_{>>} = 0.04-3.0 \text{ s}$
$I_{E>} = 0.2-2.5 \times I_s$	$I_{E>} = 1.0-7 \times I_s$
$t_{IE>} = 0.1-2 \text{ s}$	$t_{IE>>} = 0.1 \text{ s}$



Accessory: WIC1TU, suitable for on-site diagnostics



Current transformer: AS1 type, wall-mounting type



Accessory: WIC1PC3, needed for PC communication via USB port

Genset  
Controller

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# MFR 11 Series | MULTIFUNCTION RELAYS

The MFR 11 is an industrial-grade protective relay that offers voltage and frequency protective features in a single package. Using advanced true RMS measuring the MFR 11 offers a high degree of measuring accuracy regardless of harmonics, transients, or disturbing pulses. The MFR 11 model is suitable for generator or mains protection. Typical applications are generators and switchgear equipment that require independent protection architecture. Different packages offer additional functionality.

## FEATURE OVERVIEW

- True RMS sensing
- Sync-check
- Programmable relay outputs
- Discrete inputs for enabling or remote acknowledgment
- PC and front panel configurable
- Microprocessor technology for accurate, repeatable, and reliable operation
- Programmable threshold setpoints with individual time delays
- Voltage and frequency supervision
- Standard mains decoupling functions



## PACKAGES

Package	MFR 11						
	MP	NU	VDEW	G59	G59N	SC	SC+N
Voltage protection	•	•	•	•	•	•	•
Frequency protection	•	•	•	•	•	•	•
Vector shift	-	-	•	•	•	-	-
df/dt (ROCOF)	-	-	-	•	•	-	-
Sync-check	-	-	-	-	-	•	•
<b>Part No.</b>							
Measuring inputs 110 VAC	5448-884	LR20610	8441-1003	5448-885	8441-1004	8441-1005	8441-1110
Measuring inputs 400 VAC	8441-1023	8441-1027	8441-1049	LR20406	8441-1103	8441-1097	8441-1111
Measuring inputs 700 VAC	-	-	-	8441-1084	-	-	-

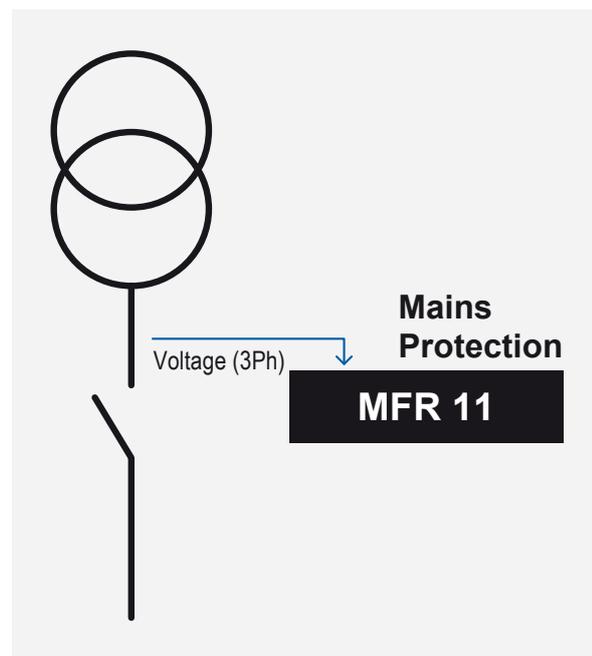
• = Standard



## SPECIFICATIONS

<b>Power supply</b>	24 VDC (18 to 30 VDC) 90 to 265 VAC / DC for NU / G59N / SC+N
Consumption	max. 12 W
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	110 VAC and 400 VAC true RMS
Accuracy	Class 1
<b>Discrete inputs</b>	18 to 250 VAC / DC (isolated)
<b>Relay outputs</b>	Isolated
Load (resistive)	2 A to 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset Controllers  
Synchronizer & Load Share Controllers  
Automatic Transfer Switch Controllers  
Transducers  
Multifunction Relays  
Protection Relays  
Power Generation Engine Control Products

**Approvals**

**Software**

LeoPC 1

**Detailed Information**

Product specification 03244 at [www.woodward.com](http://www.woodward.com)

\* Not valid for all MFR 11 packages

# MFR 12 Series | MULTIFUNCTION RELAYS

The MFR 12 is an industrial-grade protective relay that provides time overcurrent protection function. Using advanced true RMS measuring the MFR 12 offers a high degree of measuring accuracy regardless of harmonics, transients, or disturbing pulses. The MFR 12 model is a generator protection unit. Typical applications are generators and switchgear equipment that require independent protection architecture. Different packages offer additional functionality.

## FEATURE OVERVIEW

- True RMS sensing
- Three-phase independent time overcurrent protection ( $3 \times I_{\text{rated}}$ )
- Ground fault monitoring, 50–51GN
- Directional ground fault monitoring, lvkR
- Programmable relay outputs
- Discrete inputs for enabling or remote acknowledgment
- PC and front panel configurable
- Microprocessor technology for accurate, repeatable, and reliable operation
- Programmable threshold setpoints with individual time delays



## PACKAGES

	MFR 12			
Package	CP	51V	lvkR	50-51GN
Independent time overcurrent monitoring	•	•	-	-
Inverse time overcurrent monitoring	-	•	-	-
Ground fault monitoring	•	•	•	•
Part No.				
Measuring inputs 100 VAC	-	-	8441-1007	-
Measuring inputs .. / 1 A	8441-1106	-	-	8441-1132
Measuring inputs .. / 5 A	5448-883	-	-	8441-1008
Measuring inputs 100 VAC, .. / 1 A	-	8441-1082	-	-
Measuring inputs 100 VAC, .. / 5 A	-	8441-1006	-	-

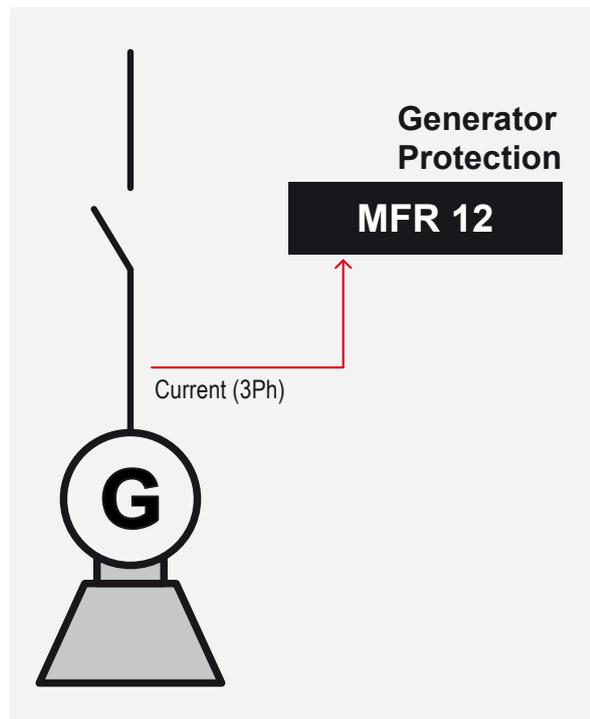
• = Standard



## SPECIFICATIONS

<b>Power supply</b>	24 VDC (18 to 30 VDC)
Consumption	max. 12 W
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	110 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs</b> (isolated)	18 to 250 VAC / DC
<b>Relay outputs</b>	isolated
Load (resistive)	2 A to 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

### Approvals



\* Not valid for all MFR 12 packages

### Software

LeoPC 1

### Detailed Information

Product specification 03249 at [www.woodward.com](http://www.woodward.com)

# MFR 13 Series | MULTIFUNCTION RELAYS

The MFR 13 is an industrial-grade protective relay that offers voltage, current, and power protection features in a single package. Using advanced true RMS measuring the MFR 13 offers a high degree of measuring accuracy regardless of harmonics, transients, or disturbing pulses. The MFR 13 model is a complete generator protection unit. Typical applications are generators and switchgear equipment that require independent protection architecture. Different packages offer additional functionality.

## FEATURE OVERVIEW

- Complete generator protection in one unit
- True RMS sensing
- Sync-check
- Discrete inputs for enabling and remote control
- Programmable relay outputs
- PC and front panel configurable
- Microprocessor technology for accurate, repeatable, and reliable operation
- Programmable threshold setpoints with individual time delays



## PACKAGES

	MFR 13					
Package	GP	GPX	GPX-I	GPY-I	GPY-I-N	K08
Independent time overcurrent monitoring	•	•	-	-	-	-
Inverse time overcurrent monitoring	-	•	-	-	-	-
Ground fault monitoring	•	•	•	-	-	•
<b>Part No.</b>						
Measuring inputs 100 VAC, .. / 1 A	-	8441-1083	8441-1075	-	-	-
Measuring inputs 100 VAC, .. / 5 A	5448-886	5448-898	8441-1009	8441-1086	8441-1092	8441-1087
Measuring inputs 400 VAC, .. / 1 A	-	8441-1108	-	-	-	-
Measuring inputs 400 VAC, .. / 5 A	LR21035	8441-1033	8441-1104	8441-1095	-	-

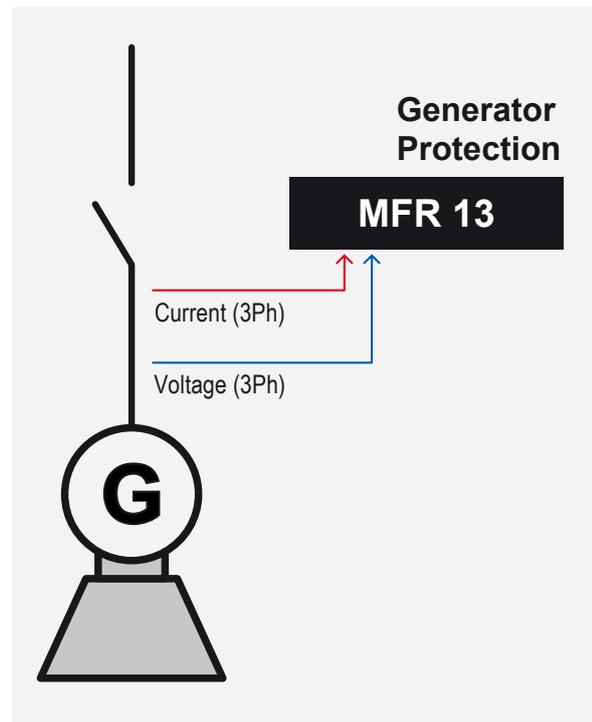
• = Standard



## SPECIFICATIONS

<b>Power supply</b>	24 VDC (18 to 30 VDC) 90 to 265 VAC / DC for GPY-I-N
Consumption	max. 12 W
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Voltage AC input</b>	110 VAC and 400 VAC true RMS
Accuracy	Class 1
<b>Current AC input</b>	1 A or 5 A true RMS
Accuracy iac	Class 1
<b>Discrete inputs</b> (isolated)	18 to 250 VAC / DC
<b>Relay outputs</b>	isolated
Load (resistive)	2 A to 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	96 x 72 x 130 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 800 g

## APPLICATIONS



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

### Approvals



\* Not valid for all MFR 13 packages

### Software

LeoPC 1

### Detailed Information

Product specification 03245 at [www.woodward.com](http://www.woodward.com)

# ESDR 4 Series | CURRENT DIFFERENTIAL PROTECTION RELAY

The ESDR 4/4T offers a three-phase current differential protection for generators, motors, and transformers that are interconnected. Two different versions offer a maximum of flexibility and protection for your equipment.

## FEATURE OVERVIEW

- Front panel configurable
- Microprocessor technology for accurate, repeatable, and reliable operation
- Programmable threshold setpoints with individual time delays
- Configurable transformer ratio and vector group (only ESDR 4T)
- Transformer inrush detection

## SPECIFICATIONS

<b>Power supply</b>	24 VDC (18 to 30 VDC)
Consumption	max. 6 W
Ambient temperature (operation)	-20 to 70 °C / -4 to 158 °F
Ambient humidity	95%, non-condensing
<b>Current AC input</b>	1 A or 5 A true RMS
Accuracy Iac	Class 1
<b>Discrete inputs</b> (isolated)	18 to 250 VAC / DC
<b>Relay outputs</b>	isolated
Load (resistive)	2 A to 24 VDC and 250 VAC
<b>Housing</b>	
Front panel mounting	Plastic housing
Dimension (WxHxD)	144 x 72 x 199 mm
<b>Sealing</b>	IP21
<b>Weight</b>	approx. 1,000 g

## PACKAGES

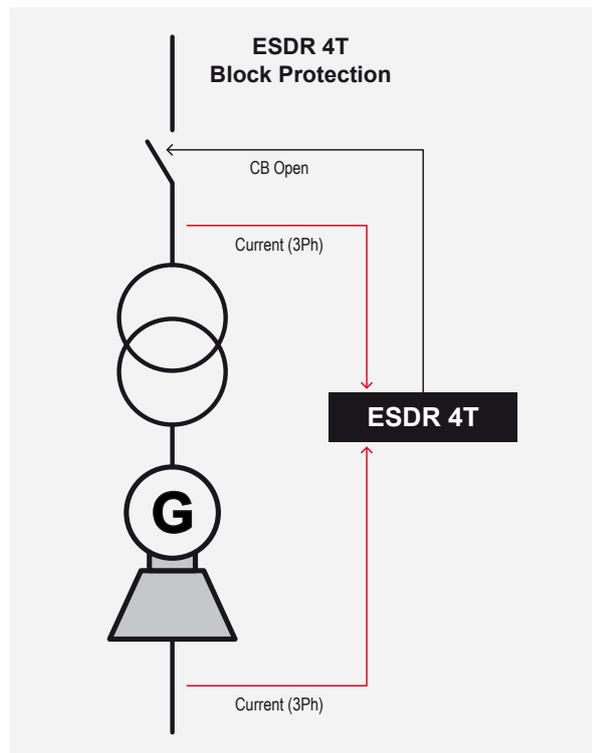
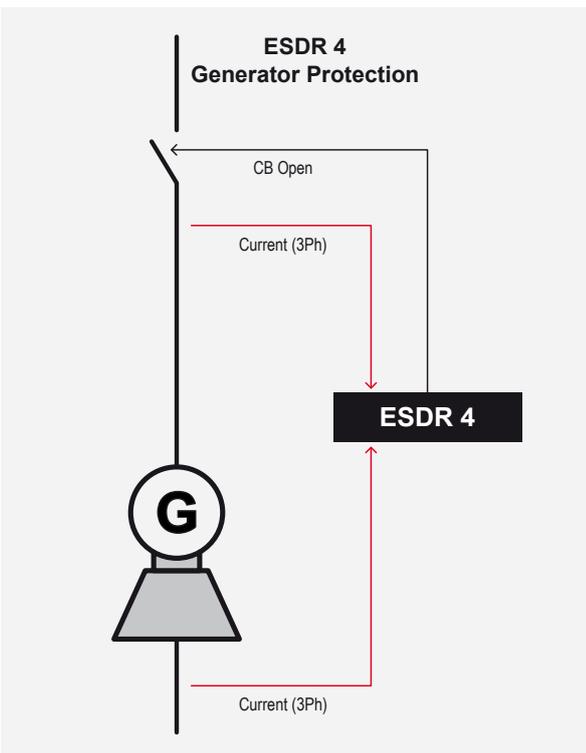


	ESDR 4	
Package	-	T
Configurable tripping characteristics and independent tripping values	●	●
Configurable transformer ratio	-	●
Configurable vector group	-	●
Transformer inrush detection	-	●
Part No.		
Measuring inputs .. / 1 A	LR20459	LR20021
Measuring inputs .. / 5 A	8441-1010	5448-897

● = Standard



## APPLICATIONS



**Approvals**

**Software**

LeoPC 1

**Detailed Information**

Product specification 03250 at [www.woodward.com](http://www.woodward.com)

\* Not valid for all ESDR 4 packages

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# POWER GENERATION ENGINE CONTROL PRODUCTS



## Optimizing Emissions, Efficiency, Reliability, Performance, and Value

Decades of experience managing and controlling engines of virtually every size, type, and application enables Woodward to offer a wide range of innovative control system solutions and rapid development tools for engines and engine-powered equipment.

Based on a systems-level approach to your control needs, Woodward systems comprise electronic control modules, software, actuators, valves, fuel delivery systems, and sensors that meet OEM requirements for emissions, efficiency, reliability, cost, and performance.



Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# Solenoids | HIGH-PERFORMANCE CONTROL COMPONENTS

From operating engine run/stop levers, throttles, chokes, valves, and clutches to protecting expensive diesel engines from overspeed, low lube pressure, and high temperature, you can rely on Woodward solenoids to meet the ever-changing technical demands of modern industry.



## 1500 SERIES

Models 1502, 1502ES, and 1504  
Pull force range: 10–12 lbs (44–53 N)  
Hold force range: 19–28 lbs (85–125 N)



## 1750 SERIES

Models 1751, 1751ES, 1753, and 1753ES  
Pull force range: 19–25 lbs (85–111 N)  
Hold force range: 38–43 lbs (169–191 N)



## 1750 PUSH SERIES

Models 1756ES, 1756ESDB, 1757ES,  
and 1757ESDB  
Push force range: 16–26 lbs (71–116 N)  
Hold force range: 35–37 lbs (156–165 N)



## FEATURES

- Dual-coil design for higher pull force in a smaller package than similar size single-coil solenoid
- Customer-specified option to switch from high-current “pull” operation to low-current “hold” operation with internal mechanical switch or external electronic switch
- Hold coil provides continuous duty operation
- Hard chrome-plated plunger and brass liner for smooth, reliable, wear-resistant operation, tested in one million cycles
- Corrosion-resistant plated steel housing and mounting base/flange
- Choice of flange, threaded, or base mountings
- Electrical connections available with choice of screw or spade terminals, or wire/connectors
- Two boot types available: bellows boot is tapered to eliminate expansion in tight spots; constant-volume boot has no breather hole and so provides contaminant protection of the plunger and bore



### 2000 SERIES

Models 2001, 2001ES, 2003, and 2003ES  
 Pull force range: 21–29 lbs (93–129 N)  
 Hold force range: 41–51 lbs (182–227 N)



### 2370 SERIES

Models 2370 and 2370ES  
 Pull force range: 37–39 lbs (165–173 N)  
 Hold force range: 88–92 lbs (391–409 N)



### CABLE SOLENOIDS

Remote cable link solenoid can be used for throttle advance or shutdown requirements. Ideal for applications with space restrictions, extremely hot environments, or excessive vibration.

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# Solenoid Control Electronics | INTERNAL AND EXTERNAL ELECTRONICS

Woodward's extensive line of solenoid protection products features either external or internal electronics. Coil Commanders™ and pull coil timer modules (PCTMs) are externally attached to the solenoid to prevent overheating of the pull coil. ICE (Integrated Coil Electronics) and AICE (Advanced ICE) solenoids have built-in electronics that prevent overheating of the pull coil.

## INTERNAL ELECTRONICS

Ideal for custom applications, Woodward's Integrated Coil Electronics (ICE) and advanced ICE solenoids have built-in electronics that prevent

overheating of the pull coil. The electronics on both products are totally encapsulated onto the solenoid to ensure reliability in the harshest environ-

ments. Both feature reverse-polarity protection.



## INTEGRATED COIL ELECTRONICS (ICE)

A printed circuit board mounted onto a dual-coil solenoid provides a timer circuit for the pull coil. The PCB functions as an internal timer that switches the pull coil ON and OFF so that the solenoid does not burn itself out.



## ADVANCED INTEGRATED COIL ELECTRONICS (AICE)

Electronics integrated into a single-coil solenoid control the solenoid's current to provide high initial starting force and a constant hold force. The microprocessor encapsulated onto the solenoid calculates the pull time and then generates a pulse-width-modulated signal to create the hold-coil function for single-coil solenoids. Under this reduced current, the hold force of the plunger is held constant over input voltage and temperature ranges.



## EXTERNAL ELECTRONICS

Dual-coil solenoids are constructed of two wound coils. The pull coil operates at high currents in order to provide maximum pull or push force. The hold

coil retains the plunger in place after it has completed its stroke. After energizing, the pull coil must be turned off as soon as possible to prevent burnout.

The protection modules energize the solenoid pull coil for approximately one second.



## COIL COMMANDERS™

Coil Commanders time out a solenoid's high amperage pull coil within approximately 1.5 seconds. The in-line cylindrical tube design comes in 5-, 6-, and 7-wire SSR configurations.



## PCTM PROTECTION SYSTEMS

Pull-coil timer modules protect externally switched solenoids by limiting the pull coil ON time to 0.5 second. Use of a PCTM enhances solenoid performance by providing functionality of an internally switched solenoid but with greater durability and reliability.

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

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Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# Speed Switches and Sensors | SPEED MONITORING AND ENGINE PROTECTION OPERATIONS

Woodward speed switches protect your engine or equipment against the damaging and dangerous conditions of overspeed and underspeed. Our speed switches offer many choices – from single-channel, manually adjustable models to multiple-channel, software-configurable models.



## DSS-2

### Two-channel electronic speed switch:

DSS-2 combines the convenience of manual adjustments with the flexibility of a computer-based calibration tool. This compact device is a powerful performer in speed-switch applications such as overspeed protection, underspeed protection, load control, or auto-start. The unit is fully potted for harsh environments and comes with Eurostyle connectors for easy installation. The DSS-2 universal input accommodates both 12 V and 24 V systems.

As an integrated sub-system for construction/commercial and industrial engine systems by OEMs and industrial plants, DSS-2 is well-suited for compressors, generator sets, construction machinery, and farm vehicles.

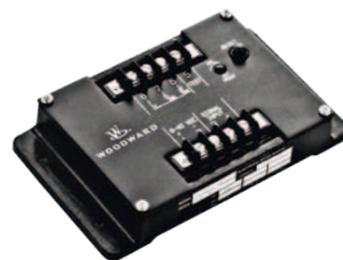


## EPS 1000

### Engine/equipment protection system:

This compact, lightweight module performs a variety of functions simultaneously. With one speed signal input, the EPS 1000 can control up to three onboard relays, or channels. The three channels can be configured independently to set and reset at various speeds. All features are easily configured with calibration software.

Its three-channel capability makes the EPS 1000 ideally suited for engine/equipment protection and unattended engine starting using autocrank and glow plug functions. It can also be used in sequenced operations and critical timing applications. Patented, reversible frame makes EPS 1000 easily adaptable for base or panel mounting.



## ESSE

### Single-channel and dual-channel speed switches:

ESSE switches monitor and control critical speed functions such as crank disconnect or overspeed protection, transmission shift inhibiting, and PTO protection. The switches are adaptive to most speed-related switching functions on diesel and gas engines and other rotating machinery.

Both single and dual setpoint models are potted for protection against harsh environments and have proven to be reliable and rugged as well as flexible and cost-effective.

In addition to generator sets, starter motors, and engines, ESSE switches are also used on diverse equipment such as conveyor belts, bus doors, and magnetic brake retarders.



## MAGNETIC PICKUPS

### Magnetic pickups and proximity switches for electronic controls:

Magnetic speed pickups (MPUs) are speed sensors that detect the speed of a prime mover, typically an engine or turbine. Used in conjunction with an engine ring gear or some other notched rotating wheel, an alternating voltage is developed. The frequency of this voltage is translated by the speed control into a signal that accurately depicts the speed of the prime mover.

Woodward's magnetic pickups can be used with most electronic speed controls, and models are available for hazardous location installation.



## MINI-GEN® SIGNAL GENERATORS

Woodward's Mini-Gen Signal Generator develops an AC sine wave that can be used to measure the speed of rotating machinery or engine RPM. Most notably, the Mini-Gen is used on over-the-road vehicles where the input is sent to either a tachometer or a speedometer for determining vehicle speed.

- Mount on standard SAE 7/8-18, and E1 and E2 DIN 75 532 tachometer outputs
- Compact, only 1-3/4" in diameter
- Long, reliable life under continuous speeds as high as 4,000 rpm
- Usable signal at speeds below 20 rpm (10 Hz)
- Output signal frequency half of shaft rpm
- Rugged zinc diecast construction
- Plated for protection against moisture, salt, and dirt
- Optional connectors available

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

# Electric Governing Systems | ACTUATORS AND CONTROLLERS

Woodward's worldwide reputation as a leading manufacturer of governor systems is enhanced by a full line of actuators and controllers for small industrial engines. These APECS (Advanced Proportional Engine Controls System) products provide isochronous or multispeed engine governing through a wide speed range. The complete APECS system consists of a powerful microprocessor-based controller driving a precision proportional actuator, which is connected to the engine's throttle or fuel pump speed lever to precisely control engine speed. APECS controller models are available for isochronous governing of generator sets or compressors, in single- or two-speed control. Other models provide single- or multispeed governing for construction and other industrial applications. They are readily configured using the APECS software calibration tool.

## APECS LINEAR ACTUATORS

Woodward APECS linear actuators provide proportional fuel control for construction, industrial, and agricultural equipment, forming the foundation of full electronic governing systems. These actuators are suitable for speed govern-

ing on generator sets, forklifts, pump sets, wood chippers, pleasure boats, and many types of off-road vehicles.

→ Ball bearing design for reduced friction and more precise engine control

→ Designed to minimize heat buildup, resulting in consistent force and improved position repeatability

→ Push or pull actuation

→ Spring return to minimum fuel

→ Mount in any position



### APECS 0175

This diameter spring-return actuator provides proportional fuel control for construction, industrial, and agricultural equipment.

→ Net force / 17.8 N (4.0 lbf)

→ Stroke / 20.3 mm (0.8") max.



### APECS 0225

Ball bearing design of the APECS 0225 linear actuator reduces friction and delivers more precise engine control.

→ Net force / 28.9 N (6.5 lbf)

→ Stroke / 26.03 mm (1.02") max.



### APECS 0275

APECS 0275 linear actuators provide precision fuel control of diesel, gasoline, or natural gas engines.

→ Net force / 57.8 N (13.0 lbf)

→ Stroke / 26.03 mm (1.02") max.

	Direction		Force <sup>+</sup>		Torque			Work		Travel	Controller
	Linear	Rotary	N	lbf	N-m	Lb-ft	Oz-in	J	Ft-lb		
APECS 0175	•	-	17.8	4.0	-	-	-	0.4	0.3	0.8" 20.32 mm	All *
APECS 0225	•	All *	28.9	5.6	-	-	-	0.34	0.25	1"	All *
APECS 0275	•	-	57.8	9.7	-	-	-	0.68	0.5	25.4 mm	

• = Standard    + = Force at 25 °C, nominal voltage, maximum recommended operating travel    \* = Except EPG controllers



### APECS ROTARY ACTUATORS

Woodward's DYNA line of rotary actuators for engines offers many choices of torque ranges – from 0.066 Nm of the small GBA actuator to 7.3 Nm of the large DYNA 8400 actuator. All

DYNA actuators are unidirectional (electrically driven in one direction and spring-returned in the opposite direction) and are available in clockwise and counterclockwise rotations.

### EPG ROTARY ACTUATORS

Electrically powered governor systems are designed for precise speed control of diesel, gas, gaso-line engines, and gas turbines.



### DYNA 7000

The DYNA 7000 actuator is suitable for gasoline, natural gas, and diesel engines. On carbureted and throttle body applications, a direct connection between actuator shaft and butterfly shaft is possible, thus eliminating external linkage.

### DYNA 8000 SERIES

Paired with a Woodward controller, DYNA 8000 actuators ensure precise isochronous or droop speed control of medium-sized engines depending on the type of fuel system used. Applications: speed and power control of piston, gas turbine engines, steam and water turbines.

### GBA (Golf ball actuator)

The GBA is a laminated, electric actuator that accurately controls fuel flow in diesel, gasoline, propane, and natural gas engines. Roughly the diameter of a golf ball, it is suitable for power generation (stationary and mobile gensets) and industrial equipment applications.

### EPG SERIES

EPG systems are typically used with linkage connecting them to a throttle or fuel pump and come in three basic output torques: 0.5, 1.7, and 4.0 ft-lbs. The three-component systems include an actuator, an electronic speed control, and a magnetic pickup.

	Direction		Force <sup>+</sup>		Torque			Work		Travel	Controller
	Linear	Rotary	N	lbf	N-m	Lb-ft	Oz-in	J	Ft-lb		
Dyna 7000	-	•	-	-	0.169	0.12	-	-	-	70°	All *
Dyna 8000	-	•	-	-	1.4	1.0	-	1.2	0.9	35°	All *
Dyna 8200	-	•	-	-	4.07	3.0	-	2.85	2.10	45°	All *
Dyna 8400	-	•	-	-	7.3	5.4	-	5.8	4.3	46°	All *
GBA	-	•	-	-	0.066	-	9.4	-	-	65°	All *
EPG 512/524	-	•	-	-	-	-	-	0.7/1.0	0.5/0.75	30°	EPG
EPG 1712/1724	-	•	-	-	-	-	-	2.0/2.3	1.5/1.7	35°	EPG

• = Standard + = Force at 25 °C, nominal voltage, maximum recommended operating travel \* = Except EPG controllers

Genset  
Controllers

Synchronizer &  
Load Share  
Controllers

Automatic  
Transfer Switch  
Controllers

Transducers

Multifunction  
Relays

Protection  
Relays

Power  
Generation Engine  
Control Products

## APECS CONTROLLERS

APECS controllers manage engine speed by adjusting the fuel control lever with an actuator. The core of the system is a powerful microprocessor-based controller that processes the signal received from a speed sensor and compares it to the desired speed setting. These con-

trollers are well-suited for generator sets, compressors/pumps, utility vehicles, and construction equipment

- Compatible with magnetic pickup, coil ignition, magneto ignition, and Hall-effect sensors
- CAN/J1939 bus interface

- Can be used for diesel, gasoline, propane, and CNG
- Compatible with Woodward and other PWM actuators
- Provides engine protection by monitoring engine coolant and oil pressure



### APECS 500

The APECS 500 controller combines the convenience of manual adjustments with the flexibility of a computer-based calibration tool. For most applications, APECS 500 can be connected and adjusted with simple hand tools. The APECS 500 single-speed controller is designed to meet the needs of the small genset market where simplicity, ease of operation, and low cost are key features.



### APECS 3000

APECS 3000 controllers are isochronous engine governors that control and limit engine speed by adjusting the fuel control lever with a proportional actuator. They are configurable for operation at up to four different speeds. There are no manual adjustments; all features are software configured with the APECS Calibration Tool.



### APECS 4500

Advanced electronics in APECS 4500 provide maximum control and optimal engine performance. Adaptive features include autocrank, droop governing, glow-plug control, and analog input (remote speed pot). CAN/J1939 bus interface allows communication and diagnostics among engine components. The APECS 4500 controller is integrated into commercial and construction vehicles, and industrial engine systems and compressors by OEMs and industrial plants.

	Position Request / Driver		Speed Signal Input				Terminals			Actuator			
	PWM	CAN	0-5 VDC	4-20 mA	Magnetic Pickup	Ignition	Magneto	Hall Effect	Screw	Wire Leads	Connector Kit	Rotary*	Linear
APECS 500	•	-	-	-	•	-	-	-	•	-	-	•	•
APECS 3100	•	-	-	-	•	-	-	-	-	•	-	•	•
APECS 3200	•	-	-	-	-	•	-	-	-	•	-	•	•
APECS 3300	•	-	-	-	-	-	•	-	-	•	-	•	•
APECS 3400	•	-	-	-	-	-	-	•	-	•	-	•	•
APECS 4500	•	•	-	-	•	•	•	•	-	-	•	•	•

• = Standard \* = Except EPG, L-Series, and F-Series actuators



## APECS DPG CONTROLLERS

Woodward DPG digital controllers for diesel- or gas-fueled engines perform across a wide speed range and allow adjustment of set speed and gain with a built-in user interface. Independent programmable proportional, integral, and derivative gains provide custom

governor response to diverse engine applications.

The COMM port provides access to all other controller settings, allowing adaptation to each application during service and initial configuration. Internal

FAILSAFE reacts instantly to loss of engine speed signal and allows the actuator to return to minimum fuel.



### DPG 2100

**Isochronous engine control:** DPG 2100 controllers offer exceptional performance in an economical package. All are fully digital and software configurable and permit manual speed and gain pot adjustments. Connector options are 7-wire Euro or 12-pin Molex. Speed sensor options are magnetic pickup or ignition sensor.



### DPG 2200

**Isochronous or droop control:** All adjustments on DPG 2200 controllers may be either software programmable or manually adjusted. Droop speed control, two discrete speeds, and a dedicated input for isochronous load sharing are available on all models in the series. Analog signal input on Model 2223 allows variable speed adjustment. Connections are 13-wire Euro.



### DPG 2300

**Off-highway applications:** DPG 2300 controllers combine analog signal input and two discrete speeds into one unit. Pedal hold feature locks in desired speed of analog signal. Connections are 13-wire Euro. Speed sensor options are magnetic pickup or ignition sensor.

	Position Request / Driver		Speed Signal Input				Terminals		Actuator				
	PWM	CAN	0-5 VDC	4-20 mA	Magnetic Pickup	Ignition	Magneto	Hall Effect	Screw	Wire Leads	Connector Kit	Rotary*	Linear
DPG 2101	•	-	-	-	•	-	-	-	•	-	-	•	•
DPG 2145	•	-	-	-	-	•	-	-	-	-	•	•	•
DPG 2146	•	-	-	-	-	•	-	-	•	-	-	•	•
DPG 2155	•	-	-	-	•	-	-	-	-	-	•	•	•
DPG 2201	•	-	-	-	•	-	-	-	•	-	-	•	•
DPG 2223	•	-	-	-	•	-	-	-	•	-	-	•	•
DPG 2302	•	-	-	-	•	-	-	-	•	-	-	•	•
DPG 2345	•	-	-	-	-	•	-	-	•	-	-	•	•

• = Standard \* = Except EPG, L-Series, and F-Series actuators

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Automatic Transfer Switch Controllers

Transducers

Multifunction Relays

Protection Relays

Power Generation Engine Control Products

# Integrated Electronic Governors | ROTARY BIDIRECTIONAL LAT ACTUATORS

Woodward's rugged L-Series, F-Series, and ProAct electronic actuators have the onboard software and intelligence to control and monitor many engine functions. These actuators are high-speed actuators based on the limited angle torque actuation technology. These Woodward actuators have no gear train and few moving parts. The L-Series, F-Series, and ProAct actuators are extremely durable, smart actuators that can be used in a variety of engine-mounted applications. They can be controlled by a variety of signal inputs, including CAN protocols, PWM, mA, and voltage inputs.



## F-SERIES

**The F-Series modular actuator** is a robust, bidirectional, electrical actuator with integral drive. It is designed to be engine-mounted for various position control functions on reciprocating engines used in industrial and on-highway service. Due to the minimal number of moving parts, the actuator provides long-life performance and withstands high vibration.

Position control application examples can include:

- Fuel rack positioning
- Throttle valve positioning
- Active waste-gate valve positioning
- Compressor bypass valve positioning
- Compressor recirculation valve positioning
- Other engine position control functions



## PROACT (PISC)

**The ProAct™ Integrated Speed Control (PISC)** is an electric actuator with an integrated electronic driver capable of diesel or gas engine speed control or positioning tasks. It can be mounted on-engine to control a diesel fuel rack, gas throttle, compressor bypass, or compressor recirculation via integrated throttle body.

The PISC control accepts a speed input from an MPU and can accept a position command signal from another device in the system such as an engine control module.



## L-SERIES

**These rotary bidirectional actuators** are fully integrated actuators available in three versions: a basic positioner, speed control, and process control. Commonly used by both OEMs and aftermarket, its many built-in features using digital, analog, and sensor inputs allow implementation in a wide variety of engine control strategies. It is easily programmable with a PC and downloadable software.

L-Series offers speed control with software-selectable speed setpoints, multiple dynamics including five-point dynamic curves, fuel limiting, and start-stop behavior. Besides the traditional bracket mount using external linkage, the L-Series

speed control is available in a variety of mechanical configurations, including one integrated into a rotary diesel fuel pump, one integrated with a throttle body or a throttle body-mixer combination and one as a gas fuel trim valve. The externally mounted systems can be configured for clockwise or counter-clockwise (standard) shaft rotation for increasing fuel.

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# Hydraulic-Mechanical Governors | FOR ENGINES

Woodward hydraulic-mechanical governors provide reliable and precise control of engine speed and output in virtually every type of engine application. Available in work output ratings from 10.8 in-lbs up to 500 ft-lbs, Woodward governors are used in power generation, marine, pump, compression, and vehicle applications.



## UG 25+ GOVERNOR

The universal governor UG-25+ is a microprocessor-controlled, mechanical-hydraulic amplified governor for controlling diesel, gas, or dual-fuel engines, and steam turbines. The governor offers enhanced control capabilities, such as start fuel and boost limiting schemes. The additional transient fuel limiting (jump rate) improves the engine load acceptance and reduces transient emissions significantly.

The UG-25+ offers a fast-acting and high-work-output governor without the need for any auxiliary devices such as a start booster.



## PSG GOVERNOR

The PSG governor is a pressure compensated, speed-droop or isochronous governor for controlling the speed of small diesel, gas, and gasoline engines, or small steam or industrial gas turbines. The governor is used to control engines or turbines driving alternators, DC generators, pumps, or compressors.

The PSG governor provides hydraulic-powered travel in the increase-fuel direction only. A return spring is used to provide travel in the decrease-fuel direction. The standard PSG cover provides for a vertical return spring in the governor. Governor models are available with horizontal return springs, or the governor can be fitted with a customer-supplied external return spring.



## SG GOVERNOR

The SG governor is a hydraulic speed droop type governor used on small diesel, gas, or gasoline engines where isochronous (constant speed) control is not required. The design of the speed droop governor is such that the governor operates at a slower speed as engine load increases. It is through this characteristic that stability of the governed system is achieved, and division of load between paralleled units made possible.

SG governors are available with 10.8 or 21.7 in-lbs (1.2 or 2.5 J) of work capacity over 36° of terminal shaft (output) travel.



## EGB GOVERNOR

The EGB governor/actuator is used with Woodward analog or digital electronic controls that provide a proportional 20–160 mA signal to control dual-fuel, diesel, and gasoline engines, and gas and steam turbines driving electrical or mechanical loads.

The governor/actuator is available for outputs of 1, 2, 10, 13, 29, 35, 58, 200, and 300 ft-lbs (1.4, 2.7, 14, 18, 39, 47, 79, 271, and 407 J) work capacity to position fuel racks or linkage. The self-contained hydraulic oil supply makes the governor easy to maintain in almost any installation environment.

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# Electronic Controls | ENGINE, GAS AND DIESEL

Woodward is a market and technology leader in the manufacture of prime mover controls from high-quality analog controllers to custom programmed or pre-programmed digital controllers. Our controllers are used in power generation, gas compression, marine propulsion, locomotives, and mobile and industrial equipment.

## ANALOG

Long established as one of Woodward's most successful speed control options, the 2301A and 2301A LSSC products

control the speed and load of diesel or gas engines, or steam or gas turbines. For OEM applications, consider the ad-

vantages of modern digital technology, including the 2301D controls.



## 2301A SPEED CONTROL

The 2301A speed control manages the speed or load of diesel or gas engines, or steam or gas turbines. The unit provides control in the isochronous mode, with droop available through an externally wired potentiometer. The isochronous mode is used for constant speed of the controlled prime mover as long as it is able to provide power to satisfy the load.



## 2301A LOAD SHARING AND SPEED CONTROL (LSSC)

Woodward's 2301A load sharing and speed controls are designed for use in electric generator systems where multi-unit load sharing is desired. 2301A controls may be used with diesel, gas, or gasoline engines, and steam or gas turbines.

Automatic, adjustable start fuel limiting regulates the maximum fuel setting while the engine is starting. This helps decrease emissions and engine wear. Each 2301A control has a self-contained load sensor. Most models provide a 0–200 mA output signal, designed to control Woodward EG, EGB, PB, TM, and 2301 actuators. 0–20 mA output is available for special applications. The output signal is proportional to the fuel setting needed to attain the desired speed/load. Position feedback from the actuator is not required.



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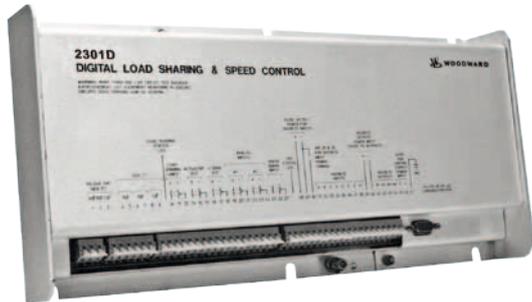
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**PRE-PROGRAMMED**

Woodward offers a variety of speed, speed/load, and detonation detection controls for use on electric generator systems, pumps, and off-highway vehicles.



**2301D / 2301D-EC DIGITAL LOAD SHARING AND SPEED CONTROLS**

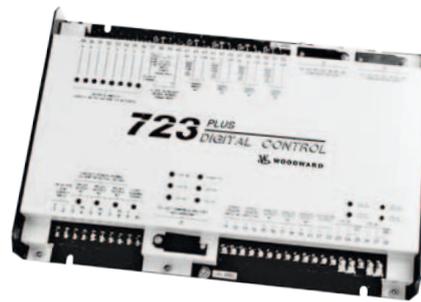
The 2301D digital load sharing and speed control is used in electric generator systems for which load sharing is desired. It can be used with diesel or gas engines, or steam or gas turbines and is compatible with all Woodward electronic controls. This control utilizes a 376 processor-based speed control and provides a single serial port for PC communications. The digital design eliminates the use of potentiometers for tuning and load control.

The 2301D-EC is capable of communicating using a Modbus® RTU protocol, functioning as a Modbus slave device, via RS-232 or RS-422 drivers.

® Modbus is a trademark of Schneider Automation Inc.

**PROGRAMMABLE**

Woodward's programmable digital controls are used to develop and deploy customer-specific control strategies with a Windows-based, block-oriented software program.



**723PLUS DIGITAL CONTROLS**

The 723PLUS digital control manages and controls reciprocating engines (gas, diesel, or dual-fuel) used in power generation, marine propulsion, and industrial engine and process markets. Standard application software is available which provides a variety of off-the-shelf control solutions for these markets.

Custom programming of the 723PLUS can provide specialized functions in process, generator plant, engine, and marine applications. The custom version may be a variation of standard control software or totally new. The custom version may be used as a unit control or as a system control for such things as sequencing, load shedding, heat recovery management, and system monitoring and alarming.

# Throttle and Mixer Systems | INTEGRATED THROTTLE BODY (ITB) ACTUATORS

Woodward's integrated throttle body actuators for gas engines are a direct combination of F-Series, L-Series, or ProAct actuators with a diecast aluminum throttle body. The integration of throttle and actuator results in excellent transient response and stability, and requires no hydraulics, pneumatics, or gear train. The ITB offers an efficient, long-lasting, and easily installed throttle option.



## L-SERIES ITB

L-Series ITBs integrate an L-Series actuator with a throttle body of 25 mm, 30 mm, 36 mm, 43 mm, or 50 mm bore size. Versions are available for speed control, position control, and air-fuel control. L-Series ITBs are designed for use in generator sets, welders, portable refrigeration units, irrigation pumps, chipper shredders, and mobile industrial gas or gasoline reciprocating engines.



## LC-50 MIXERS

The LC-50 integrates a gas mixer and throttle body with the L-Series speed control. The venturi mixer is available as an open-throat or crossbar throat design in sizes of 25 mm, 30 mm, 36 mm, 43 mm, or 50 mm. The LC-50 is designed for use on gas-fueled industrial engines between 5 and 100 kW (7 and 134 hp).

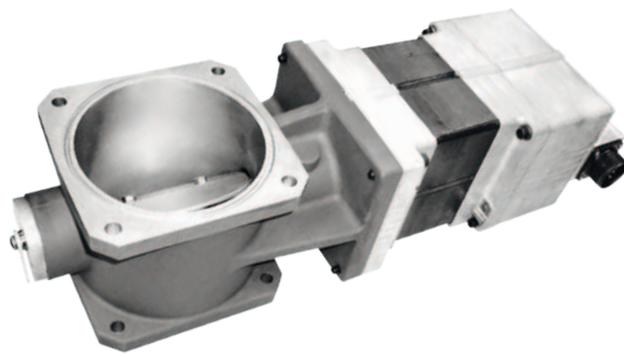
Applications include power generation, refrigeration units, pumps, irrigation, and mobile industrial equipment. The mixer can be used with propane and natural gas and requires a zero pressure regulator. The LC-50 can be programmed via the RS-232 port of a PC or laptop to a variety of configurations.



## F-SERIES ITB

F-Series ITBs integrate an F-Series actuator with a throttle body of 48 mm, 60 mm, or 68 mm bore size to cover a wide range of engines. F-Series ITBs are designed to operate on air and gases ranging from pipeline quality natural gas to specialty gas (such as landfill, digester, or other biogases). Long-lasting, small size, easy to install throttle option.

The F-Series ITBs are butterfly valves electrically actuated by an F-Series actuator to control flow output. Flow is a function of inlet and outlet pressure, throttle size, and throttle position. Throttle position is proportional to the position demand. The actuator drives the 0–70 degree output shaft to the demanded position based on an internal shaft position sensor.



## PROACT ITB

ProAct Integrated Throttle Bodies (ProAct ITBs) are butterfly valves electrically actuated by ProAct Analog and ProAct Digital Plus actuators to control flow output. With bore sizes ranging from 85 mm to 180 mm, these ITBs are designed for use with engines in the 1 to 2 MW range. The ProAct actuators are electromagnetic, 75 degree-of-travel devices, and therefore alleviate the problems associated with linkages on gas engines (such as setup, non-linearity, and wear). This direct combination of throttle and actuator results in excellent stability and transient characteristics, and requires no hydraulics, pneumatics, or governor gear train.

The ProAct ITB is designed to throttle air or air/fuel for gas engines. This system is designed for direct replacement of traditional throttle valves and requires no linkage between valve and actuator.

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# Air-Fuel Controls

OPTIMIZING EMISSIONS, EFFICIENCY, RELIABILITY,  
PERFORMANCE, AND VALUE

Woodward air-fuel ratio control solutions range from the L-Series A/F control working in conjunction with a three-way catalyst to the E3 systems comprised of an E3 controller, inlet air throttle, fuel trim valve, and oxygen sensor for all-encompassing engine and emissions control. Woodward's air-fuel ratio control solutions accommodate either small to medium-sized gas engines using single-point, mixture-charged gas admission technology or large gas engines depending on port inlet gas admission valves.

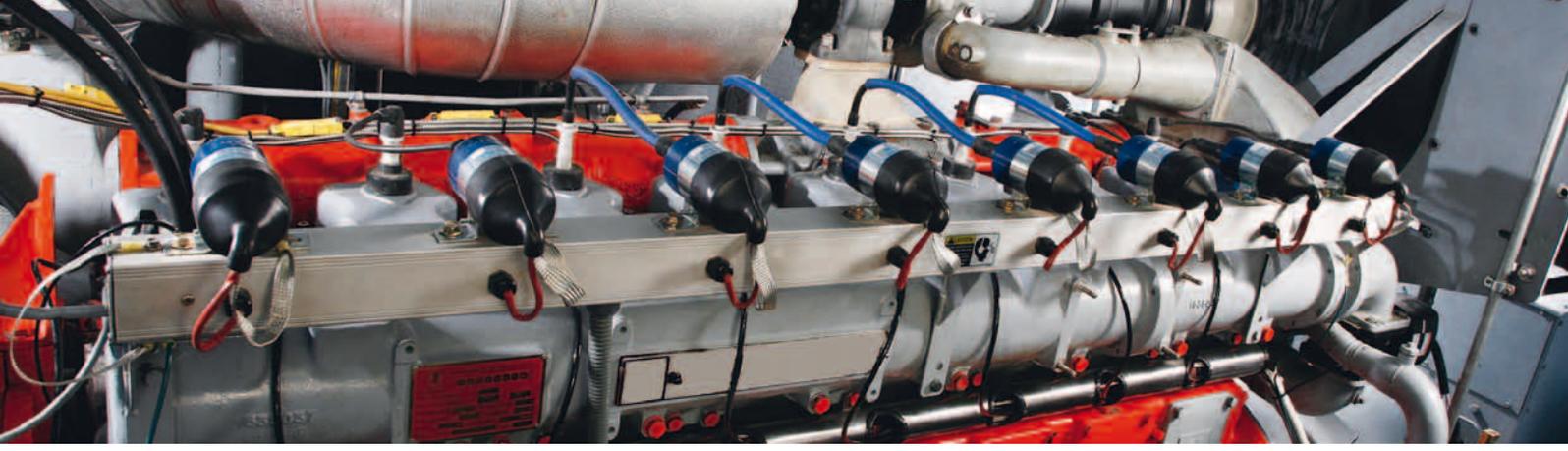


## L-SERIES A/F RATIO CONTROL

This control is a microprocessor-based air/fuel ratio control for four-stroke, gas-fueled engines operating with a near-stoichiometric air-fuel ratio. It is designed to work in conjunction with a three-way catalytic converter to efficiently reduce exhaust emissions.

The L-Series A/F with an LC-50 mixer with standard production (stoichiometric) fuel hole sizes will allow closed-loop stoichiometric operation with gaseous fuels from low-quality pipeline natural gas to HD-5 lpg (propane). The A/F Ratio Control and standard LC-50 configurations for mixer sizes 25 mm, 30 mm, 36 mm, 43 mm, and 50 mm will accommodate the full range of fuel types and fuel qualities.

- Fully integrated control and trim valve
- Reduced wiring and installation time
- Compatible with natural gas or propane or both
- Does not use vacuum hoses
- Easy setup and tuning using PC-based service tool
- Tamper-resistant
- Discrete output for fault indication
- Voltage output for position indication
- Configurable I/O



## E3 SYSTEMS

Woodward E3 systems (all-encompassing engine and emissions control) accurately control the air-fuel ratio to achieve and maintain high engine efficiency and low emissions levels.

Key applications are:

→ Full-authority, mass flow metering air-fuel ratio control, including the blending of two different gas fuels

→ Rich- and lean-burn air-fuel ratio trim systems  
 → Engine retrofit program provides customers with installation, service, and support of engine control system



### E3 RICH-BURN

The E3 rich-burn trim control system is designed for the most popular engines used in gas compression and many power generation or irrigation pump applications, where the energy quality of the fuel supply is stable.

The system analyzes and controls all of the functions of an engine and catalyst, and optimizes the amount of time the engine is in compliance. If the engine falls out of compliance the system has the ability to shut down or notify the user of the condition.

### E3 LEAN-BURN

The E3 lean-burn trim control system is designed to control lean-burn industrial gas engines used in many power generation, pumping, and other stationary applications ranging from 300 kW to 2,000 kW (400–2,700 hp).

The highly accurate, closed-loop control system helps customers meet regulated emissions levels, while maintaining engine performance over a very large range of fuel qualities.

### E3 FULL AUTHORITY

The E3 full authority system is a fully integrated engine control solution with full authority over spark, fuel, and air. Additionally, diagnostics such as detonation and misfire, as well as other health monitoring, are integrated into the system. This fully integrated approach permits precise governing and air-fuel ratio control while remaining flexible enough for large variations in fuel quality.

The system is designed for gas engines used in applications where the energy quality of the fuel supply is variable – such as engines used in landfills, wastewater treatment plants, or bio-gas recovery plants.

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# Gas Engine Ignition Systems | IGNITION CONTROLLERS WITH SERVLINK

Woodward's ignition systems offer a solution for all types of modern gas engines. They meet today's requirements for modern gas engines, ranging from smart inductive coil to high-energy AC ignition systems. The IC-920 CD (Capacitive Discharge) and IC-922 ignition systems provide the essential high-energy spark needed for lean-burn engines that operate at higher mean effective pressures and with larger cylinder bore sizes.



## IC-920 / IC-922 CONTROLLERS

The IC-920 and IC-922 are state-of-the-art capacitive discharge ignition system controllers especially designed for spark-ignited engines used in gas compression, electric power generation, and other industrial applications. The IC-920 controller provides standard-strike energy for up to 20 ignition coils, with an option for up to 24 coils available.

The IC-922 controller provides "big-strike" energy for up to 20 (or optionally 24) coils. The big-strike capability is well-suited for high-BMEP or other engines that are prone to misfire.

The IC-920 and IC-922 ignition controllers feature user-controlled energy levels, advanced diagnostics, and an RS-232 ServLink interface for easy programming with a Windows-

based service tool. The controller system consists of a 16-bit CPU, sensor signal conditioning circuitry, a high-voltage power supply, and 20 (or optionally 24) outputs. The system can be configured from two cylinders to 20 (or 24) cylinders. The unit software can be configured for any type of industrial engine.

# Imprint

# Key

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## Conformité Européenne

Countries: European Economic Area



## American Bureau of Shipping

Country: USA

Application area: marine



## Bureau Veritas

Country: France

Application area: marine



## C-Tick

Country: Australia



## Canadian Standards Association

Country: Canada



## Canadian Underwriters Laboratorie

Country: Canada



## Det Norske Veritas

Country: Norway

Application area: marine



## Germanischer Lloyd

Country: Germany

Application area: marine



## GOST-R

Country: Russia



## Lloyd's Register

Country: Great Britain

Application area: marine



## Underwriters Laboratories

Country: USA



## Independent Accredited Laboratory

Countries: Worldwide



## Korea Electrical Safety Corporation

Country: South Korea



## Energy Network Association

Country: United Kingdom

# General Terms and Conditions | LAST AMENDED 02.2011

## General Terms and Conditions of Business of Woodward Kempen GmbH, Woodward Power Solutions GmbH, Woodward GmbH, and Woodward Governor Germany GmbH.

### 1. General

1.1 All deliveries and other performances (assembly, commissioning, repair, maintenance, services, consulting services, etc.) of Woodward Kempen GmbH, Woodward Power Solutions GmbH, Woodward GmbH, and Woodward Governor Germany GmbH shall be based exclusively on these terms and conditions of business; we shall not recognize conflicting terms and conditions of business or terms and conditions of purchase of the customer unless we have given our explicit, written consent to their application. Our terms and conditions of business shall apply even if we execute delivery to the customer unconditionally, despite knowledge of terms and conditions of the customer that conflict with or deviate from our terms and conditions of business. The contract partner in all cases is the respective Woodward Company confirming.

1.2 We unrestrictedly reserve all ownership rights and copyright to illustrations, drawings, and other documents (hereinafter documents); these must not be made accessible to third parties unless we have given our explicit, written consent to this. Documents belonging to quotations must be returned to us without delay if no order is placed and we request handing over. Sentences 1 and 2 shall apply accordingly for documents of the customer; nevertheless, these may be made accessible to third parties to whom we have admissibly transferred deliveries or other performances.

1.3 We reserve the right to make partial deliveries and partial performances in a reasonable scope.

1.4 We are entitled to make use of other, reliable companies for the fulfillment of our obligations.

1.5 Following the provision of other performances, we shall have an entitlement to signature by the customer for the performances provided by us, in particular to signature of the corresponding time sheets; the necessary forms will be provided by us.

1.6 Should individual provisions of these General Terms and Conditions of Business be invalid,

the validity of the other rulings and of the contract itself shall remain unaffected. This shall not apply if insistence on the contract would constitute unreasonable hardship for one of the contracting parties.

### 2. Content of the Contract / Conclusion of Contract

2.1 In the absence of any written agreement to the contrary, pre-contractual notifications prepared by us such as quotations, cost estimates, and descriptions are without engagement.

2.2 Documents belonging to the quotation such as drawings, illustrations, technical data, reference to standards, as well as statements in advertising material are not quality statements, assurances of features, or guarantees, unless explicitly marked as such in writing.

2.3 In the absence of any written agreement to the contrary, information in catalogues and prospectuses, information sheets, use instructions and other information are not constituent parts of the contract.

2.4 Orders shall only be binding on us if confirmed in writing or delivered by us within two weeks of receipt. The party ordering shall be bound by his order for this period.

### 3. Prices / Terms and Conditions of Payment

3.1 In the absence of any statement to the contrary in our order confirmation, our selling prices shall apply as ex-works (incoterms 2010) place stated in our quotation or acceptance; if no place of destination is indicated in our quotation/acceptance, the prices shall apply as ex-works place of business of the Woodward company confirming. Our selling prices are to be understood as excluding packing; this will be invoiced separately. The same shall apply for other performances.

3.2 Invoicing for other performances will be on the basis of an agreed fixed price or, if no fixed price has been agreed, on the basis of time and cost in accordance with our service rates

applicable at the time of provision of the performance plus incidental costs (travel expenses, replacement parts, etc.). If application of the prices as per the current service rates results in a price increase of 10% or more compared with the prices/service rates agreed at the time of conclusion of the contract, the customer can withdraw from the contract prior to provision of the performance.

3.3 The performances provided for the issuing of a cost quotation can be invoiced to the customer if this has been agreed in writing in the individual case.

3.4 The respective terms and conditions of payment agreed shall apply for all payments. If no separate agreement has been made, all invoices shall be due immediately and payable strictly net cash within 14 days of the date of invoice.

3.5 All payments made to us must be by transfer to an account nominated by us and free of charges for us. Unconditional crediting to our account is authoritative for on-time payment.

3.6 We shall be entitled to partial payments for partial performances.

3.7 Our prices are exclusive of statutory turnover tax; this will be shown separately on the invoice at the rate applicable on the date of invoicing.

3.8 The acceptance of bills of exchange requires our consent; all corresponding charges and costs, as well as all risks of on-time presentation and protesting, shall be for the account of the customer.

3.9 In the event of default on payment by the customer we shall, subject to the reserve of assertion of farther reaching damages, charge normal bank interest, at least 8% above the respective base interest rate of the ECB.

3.10 In the event of default on payment and justified doubts concerning the ability to pay or credit-worthiness of the customer, we shall – without prejudice to our other rights as per § 321 BGB (German Civil Code) (objection of uncertainty) – be entitled to demand collateral or advance

payment for outstanding deliveries or other performances, to withhold the outstanding performances or deliveries and/or to render all claims from the business relation due immediately.

- 3.11 The customer is only entitled to offset or withhold claims that are undisputed or which have been determined as legally valid.

#### 4. Retention of Title

- 4.1 We shall retain title to the goods sold until such time as full payment of our claims from the business relation with the customer is received. The customer is entitled to dispose over the goods purchased during the ordinary course of business.
- 4.2 The retention of title shall also cover the products resulting from processing, mixing, or joining of our goods at their full value, whereby this shall not result in any obligation on our part. If, given processing, mixing, or joining with third-party goods, the ownership rights of the third parties continue to apply, we shall acquire joint ownership in the ratio of the invoice amounts of these processed goods.
- 4.3 The customer hereby assigns to us henceforth the claims against third parties resulting from the onward sale, in their full amount or in the amount of our joint ownership share (see § 4.2), as collateral. We hereby accept this assignment. The customer is authorized to collect these claims for our account until such time as this authorization is revoked or the customer ceases payments to us. The authorization shall end without the need for revocation if an application is made for insolvency proceedings against the assets of the customer. The customer is not entitled to assign these claims by way of factoring even for the purpose of collecting the claims, unless the factor is simultaneously obliged to make direct payment to us of the counter performance in the amount of our share in the claim for as long as we still have claims against the customer.
- 4.4 The customer is obliged to treat the goods with care; in particular, he is obliged to insure them at his own expense against fire, water, and theft with sufficient cover at replacement value. If maintenance and repair work is necessary, the customer will carry this out in good time at his own expense.
- 4.5 The customer must notify us immediately by registered letter of access by third parties, e.g. through attachment, to the goods and claims belonging to us.

4.6 The goods and the corresponding claims must not be pledged to third parties or transferred (by way of security) or assigned prior to complete payment of our claims.

4.7 At the request of the customer, we undertake to release the collateral to which we are entitled if the value of our collateral exceeds the claims to be secured by more than 10%. The choice of the collateral to be released shall lie with us.

4.8 Within the scope of the agreed performance characteristics, the customer is entitled to a non-exclusive right of use, not transferable without the corresponding device, to standard software in the agreed devices and in unchanged form. The customer is entitled to prepare two backup copies for data backup. Any extended right of use requires a separate, written agreement. In the event of violation of the rights of use granted to him, the customer shall be liable in full for the resulting damage.

#### 5. Delivery / Performance

- 5.1 Delivery and performance periods are only binding if explicitly confirmed as binding by us.
- 5.2 Delivery and performance periods shall begin on the date of the order confirmation. In the absence of any agreement to the contrary, the delivery period shall apply as adhered to if the customer has received the notification of availability of the delivered item for dispatch at the agreed time or within the agreed period; with other performances, if a start is made on the other performance within this period.
- 5.3 Adherence to delivery and performance periods presupposes clarification of all technical matters, in particular on-time receipt of all documents to be provided by the customer, necessary approvals and releases as well as adherence to the agreed payment terms and other obligations of the customer. If the above-mentioned preconditions are not met, the deadlines shall be extended by an appropriate amount unless we are responsible for the delay.
- 5.4 If we are prevented from on-time delivery or performance by official directives or measures, force majeure, mobilization, war, uprising, strike, lockout, incorrect or late delivery by suppliers, or the occurrence of unforeseen hindrances which are outside of our scope of influence or that of our suppliers, the deadline shall be extended by an appropriate period.
- 5.5 If the hindrances to delivery or performance set out under § 5.4 continue for an inappropriately

long time, both contracting parties shall be entitled to withdraw from the contract. The customer shall not be entitled to withdraw until following unsuccessful expiry of an appropriate period of grace, unless a commercial-law fixed-date transaction has been agreed in writing. The customer agrees that the remedy contained in this clause 5.5 will be its sole and exclusive remedy.

5.6 In the event of the deadline for delivery or performance being exceeded for reasons for which we are responsible, the customer shall be entitled to withdraw following expiry of an appropriate period of grace. Claims for damages shall be based on the provisions of § 11.

5.7 In the event of the customer causing a delay in delivery or service of the delivered items, or the provision of other performances, we shall be entitled to demand compensation for the damage resulting to us, including any additional expense. Farther-reaching claims or rights are reserved.

5.8 In the event of default on payment by the customer, we shall be entitled to assert a right of withholding to further deliveries or other performances.

#### 6. Obligations to Cooperate

If we provide other performances at a place other than our place of business or if our other performances are dependent on preliminary work of the customer or of a company appointed by him, the customer shall carry out or arrange all preparatory work/cooperation measures required for the performance of the work, at his own expense and in such good time that hindrance of us at the start of or during the provision of the other performances is not to be expected. In particular, the customer must provide us with all necessary documents (approvals, plans, etc.) automatically prior to performance of the work. In addition, the customer is obliged to provide necessary articles of daily use, protective devices, and any tools required as well as advising essential information.

#### 7. Passing of Risk

7.1 In the absence of any agreement to the contrary, ex-works (Incoterms 2010) place stated in our quotation or acceptance is also agreed for the passing of risk; if no place of destination is indicated in our quotation/acceptance, ex-works place of business of the Woodward company confirming shall apply as agreed. Accordingly, with deliveries, the risk of

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accidental perishing and of accidental deterioration of the delivered item shall pass to the customer as soon as the customer has received the notification of availability of the delivered item for dispatch at the agreed time or within the agreed period.

- 7.2 If the delivered item is dispatched at a later time than the agreed delivery date at the request of the customer, the risk of accidental perishing and of accidental deterioration shall pass to the customer with effect from the delivery date originally agreed.
- 7.3 In the absence of any separate agreement, the risk of accidental perishing and of accidental deterioration of other performances, as a whole and also for independent parts thereof, shall pass to the customer with effect from notification of completion. If trial operation is agreed, the risk shall pass to the customer upon successful completion of the trial operation, at the latest, however, 14 days from receipt of the notification of availability for trial operation.
- 7.4 In the event of interruption, delay, or discontinuation of the other performances or of the trial operation for reasons for which we are not responsible, the risk of accidental perishing and of accidental loss of the other services already provided shall pass to the customer upon receipt of notification of the hindrance.

## 8. Acceptance

- 8.1 Acceptance of other performances will only be carried out if this has been agreed in writing. If acceptance has been agreed, we are obliged to notify availability for acceptance.
- 8.2 If no agreement has been made concerning the precise time of the acceptance, acceptance must be carried out immediately following completion of the performance; with larger projects, within a period of 7 days from receipt of notification of availability for acceptance.
- 8.3 Acceptance cannot be refused on the basis of defects which do not impair the capacity to function or do so to an immaterial extent only.
- 8.4 If acceptance is not carried out within a period of 14 days from receipt of the notification of availability for acceptance for reasons for which we are not responsible, acceptance shall apply as having been made upon expiry of this period.
- 8.5 Acceptance shall also apply as made if the customer has used the item concerned prior to expiry of the period stated in § 8.4.

8.6 If acceptance has been agreed, the passing of risk shall – in deviation from § 7.3 – apply upon acceptance.

8.7 The costs of acceptance shall be for the account of the customer.

8.8 A certificate of completion by an expert assessor as defined by law shall have an equivalent status to acceptance.

## 9. Liability for Material Defects

- 9.1 All information concerning suitability, processing, and use of our products, technical advice, and other information will be provided to the best of our knowledge; it shall not release the customer from own checks and trials nor from the use or appointment of qualified personnel. We shall only be liable for special use of our products if we have been advised of this in writing in advance and have issued our confirmation.
- 9.2 The rights from the customer's liability for material defects presuppose that the customer has complied correctly with his obligations to examine and to notify defects as per § 377 HGB (German Commercial Code).
- 9.3 Our obligation within the scope of liability for material defects is restricted to repair or replacement delivery (subsequent fulfillment) whereby the choice shall lie with us.
- 9.4 Claims of the customer based on the expense required for the purpose of subsequent fulfillment, in particular transport, traveling, work, and material costs, are excluded insofar as the expense increases due to the fact that the delivered item has been brought to a place other than the customer's place of business.
- 9.5 The customer must grant us the necessary time and opportunity for subsequent fulfillment based on reasonably exercised discretion. If subsequent fulfillment fails twice, the customer shall be entitled to the statutory rights concerning liability for material defects; he shall only be entitled to damages subject to the preconditions of these terms and conditions.
- 9.6 Excepted from liability for material defects are, in particular, defects caused following the passing of risk by the customer or by third parties appointed by him, through incorrect transport, incorrect storage, unsuitable building ground, incorrect installation, incorrect assembly, incorrect use, incorrect connection, incorrect or non-intended operation, excessive strain, unforeseen operating conditions, in

particular, but not restricted to, non-manageable natural events (e.g. earthquake, storm), or electrochemical or electrical influences, or as a result of normal wear and tear. In addition, all liability for material defects shall be excluded in the event of deterioration or perishing of the goods delivered by us following the passing of risk, unless the material defect causing deterioration or perishing was already present prior to the passing of risk.

9.7 Claims based on liability for material defects shall also be excluded if operating, installation, or maintenance instructions are not observed, if changes or modifications are made to the delivered item, or if nonapproved replacement parts or expendable materials are used.

9.8 Goods which are the subject of complaint must only be returned with our explicit consent. In such cases, the customer must choose correct packing that is also suitable for transport.

9.9 Parts replaced in fulfillment of the obligations from liability for material defects shall become our property following removal.

9.10 We shall be liable for repairs or replacement deliveries in the same scope as for the original delivered item and, indeed, up until expiry of the period of limitation for material defects applicable for the original delivered item or performance.

9.11 The period of limitation for material defects to new delivered items and other performances is 12 months from the date of the passing of risk, unless we have caused the defect intentionally or longer liability on our part is mandatory under the law.

9.12 Used items will be supplied by us subject to exclusion of all liability for material defects, unless an agreement to the contrary has been made.

9.13 In the absence of any ruling to the contrary in § 11, the customer shall not be entitled to further-reaching claims or to claims other than those regulated in this § 9.

## 10. Industrial Property Rights and Copyright / Legal Defects

10.1 In the absence of any written agreement to the contrary, we are only obliged to make delivery free from industrial property rights and copyright of third parties in the country of the place of delivery. If use of the delivered item results in violation of industrial property rights or copyright of third parties in the country of the place

of delivery, we shall, at our own discretion and at our own expense, obtain a right of use for the customer, or modify the delivered item in a manner that is reasonable for the customer and such that the violation of protected privileges no longer applies, or replace the delivered item. The period of limitation corresponds to that set out in § 9.11 for material defects.

10.2 If the subsequent fulfillment described in § 10.1 is not possible at economically appropriate conditions or within an appropriate time, the customer shall be entitled to the statutory rights of withdrawal or to reduction in the selling price.

10.3 Our above-mentioned obligations shall only apply if the customer informs us immediately and in writing of the claims asserted by the third parties, if the customer supports us to an appropriate extent in our defense against the claims asserted or enables performance of the subsequent fulfillment by us as per § 10.1 does not acknowledge a violation and grants us the right to take all defense measures and to negotiate regarding composition agreements.

10.4 Claims of the customer based on liability for legal defects are excluded if he is responsible for the violation of industrial property rights and copyright of third parties, in particular if any such violation is caused by special requirements of the customer, by application not foreseeable by us, or by the customer making arbitrary alterations to the delivery or using it together with products not supplied by us, thus causing the violation of rights.

10.5 In the absence of any ruling to the contrary in § 11, the customer shall not be entitled to farther-reaching claims or to claims other than those regulated in this § 10.

## 11. Damages

11.1 Claims of the customer for damages, irrespective of their legal ground, in particular as a result of violation of duties from the obligation, and from tortious act, are excluded insofar as this is legally admissible.

11.2 Excepted from this are:  
- damages from injury to life, limb, or health based on a violation of obligations for which we are responsible, and  
- other damage based on intentional or grossly negligent violation of obligations on our part.

11.3 The limitation of liability in § 11.1 shall likewise not apply in the event of violation of an obligation whose fulfillment makes correct

performance of the contract possible at all, whose violation endangers achievement of the purpose of the contract and/or in adherence to which the customer can trust. In such cases, we shall be liable up to the amount of the foreseeable damage even in cases of slight negligence. Claims for loss of profits, expenditure saved, from damage claims of third parties, as well as claims for other direct and consequential damage cannot be asserted in such cases, unless a quality characteristic guaranteed by us was intended to protect the customer against precisely this type of damage. In the event of violation of other obligations, we shall not be liable in cases of slight negligence.

11.4 Any liability as a result of fraudulent concealment of a defect, the assumption of a guarantee or of a procurement risk, under the product liability law and under other mandatory legal regulations shall remain unaffected.

11.5 Violations of obligations by our legal representatives or vicarious agents shall have the same status as a violation of obligations by us.

11.6 We shall only be liable for the restoration of data as defined in § 11.1 if the customer has carried out the appropriate and normal procedures for data backup and, when so doing, has also taken care to ensure that reconstruction of the data and programs is possible at reasonable expense and effort.

## 12. Extended Lien

12.1 With regard to claims from an order whose contractual fundament is a work or performance, we are entitled to a contractual lien to the items coming into our possession as a result of the order.

12.2 We are also entitled to assert the contractual lien for claims from previous work, other performances and deliveries if these claims are related to the subject matter of the order. The contractual lien shall only apply concerning other claims if these are undisputed or a legally binding title exists and the customer is the owner of the subject matter of the order.

## 13. Place of Performance, Place of Jurisdiction, and Applicable Law

13.1 Place of performance for deliveries and other performances is our respective place of business.

13.2 If the customer is a businessman, a juristic person under public law, or a public-law special

fund, the place of business of the company confirming (see § 1.1) is hereby agreed as exclusive place of jurisdiction. Nevertheless, the latter is entitled to take legal action against the customer at the court in whose district the customer has his place of business.

13.3 If the customer has his place of business in a non-EU member state or a non-EFTA member state (EFTA member states are Iceland, Norway, Switzerland, and Liechtenstein), then § 13.2 shall not apply, but all disputes arising out of or in connection with the present contract shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce (ICC) by three arbitrators appointed in accordance with the said rules. The place of the arbitration procedure is our respective place of business / Germany. The applicable substantive law is the Law of the Federal Republic of Germany, subject to exclusion of the conflict of laws provisions of private international law and of the United Nations Convention on Contracts for the International Sale of Goods (CISG). The language of the arbitration procedure is English.

13.4 All contracts concluded with us concerning deliveries and other performances shall be governed exclusively by the Law of the Federal Republic of Germany, subject to exclusion of the conflict of laws provisions of private international law and of the United Nations Convention on Contracts for the International Sale of Goods (CISG).

## 14. Authoritative Version

In cases of doubt, the German version of these General Terms and Conditions of Business shall be authoritative.

# Also Available on CD

We are pleased to announce the first edition of the Woodward Power Generation and Distribution Product Catalog also on CD.



Our new catalog introduces genset controllers, synchronizer and load share controllers, automatic transfer switch controllers, transducers, multifunction relays, protection relays, and last but not least power generation engine control products. Be assured that the high quality you have come to expect from Woodward is included in all products of this catalog.

The CD is an excellent way to gain an overview of our products for the power generation and distribution market, and to gain initial technical information in a modern and convenient format.

Feel free to contact your sales representative to request a CD.