



## LS-5 Series V2

### LS-511/521 1breaker

## Circuit Breaker Control & Protection

#### New Features

- ✓ Two breaker control variants
- ✓ Separate incoming and outgoing current inputs per phase
- ✓ German grid code compliance (VDE AR-N 4105 & BDEW)
- ✓ Enhanced diagnostics and visualization

### DESCRIPTION

Woodward's LS-5 Series relays are synchronizer controllers with integrated mains decoupling and protection features. The applications range from independent synch check relay to complex power management with multiple utility feeds, bus tie-breakers and group breakers in combination with Woodward's easYgen-3400XT/3500XT equipped genset controllers. Wiring efforts are reduced to a minimum, since only one CAN bus connection is required between all LS-5 and easYgen controllers to transmit AC measurement signals, I/O states, flags, etc.

The LS-5x1 devices manage synchronization, loading and un-loading on each bus segment and send the required voltage, frequency and phase angle references via CAN bus to the easYgen-3400XT/3500XT genset controllers. When serving an incoming mains breaker it automatically detects mains failure, performs mains decoupling and sends the start signal to the easYgen. The LS-5x1 is software selectable to be applied as an independent synch check relay, mains circuit breaker control or bus tie-breaker control thereby providing exceptional versatility and value for OEM switchgear builders, generator packagers, and system integrators.

The LS-5x1 Series is available in two different mounting styles. An LS-521 with a plastic housing and graphic LCD display is designed to be mounted on the cabinet's front door. An LS-511 with an aluminum powder coated housing without display is designed to be back panel mounted.

### FEATURES

- Up to 16 LS-5 units can be operated in one network with up to 32 easYgen-3400XT/3500XT
- 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)
- 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-3400XT/3500XT controls
- LS-5 "Stand alone" mode without the easYgen-3400XT/3500XT is possible
- Preconfigured application modes that simplify the configuration process for complex multi-breaker applications
- AUTOMATIC and MANUAL mode
- Full remote control via CAN or RS-485 interface
- Vector group adjustment in case transformers are used in the application
- Breaker open/close failure detection
- Mains decoupling "Test" mode
- Lock keypad feature
- 4 freely configurable alarms
- 8 Freely configurable LED's on the LS-511 back panel mountable device
- Multi-lingual capability: English, German, Spanish, French, Italian, Portuguese, Japanese, Chinese, Russian, Turkish, Polish
- Designed as a compact solution for complex power management applications
- Up to 16 LS-5 units can be utilized in one application
- Up to 32 bus segments are possible
- Synch check and mains decoupling in one compact controller
- Adjustable vector groups for synchronization
- Utility import/export control
- Automatic and Manual mode
- LS-5 "Stand alone" mode for use without easYgen-3400XT/3500XT System
- LogicsManager functionality for application customization
- CAN and RS-485 interfaces for remote control and visualization purposes
- True RMS sensing
- Available as cabinet front door mounted device or DIN-Rail back panel mounted metal housing
- Freely configurable relay outputs
- Freely configurable discrete inputs
- QV monitoring
- Time-dependent voltage monitoring
- RoHS2, BDEW and VDE AR-N 4105 compliant

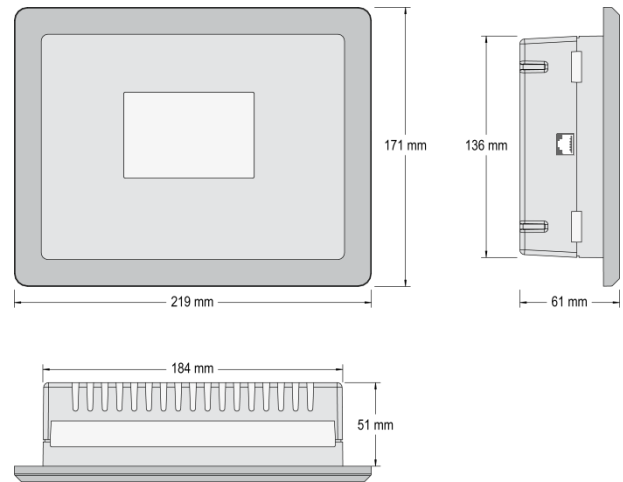
# SPECIFICATIONS

|                                           |                                                       |
|-------------------------------------------|-------------------------------------------------------|
| Power supply                              | 12/24 Vdc (8 to 40 Vdc)                               |
| Intrinsic consumption                     | max.~ 5 W (LS-511)                                    |
|                                           | max.~ 6 W (LS-521)                                    |
| Ambient temperature (operation)           | -20 to 70 °C / -4 to 158 °F                           |
| Ambient temperature (storage)             | -30 to 80 °C / -22 to 176 °F                          |
| Ambient humidity                          | 95 %, non-condensing                                  |
| <b>Voltage</b>                            | ( $\Delta$ )                                          |
| 120 Vac [1]                               | Rated ( $V_{rated}$ ).....69/120 Vac                  |
|                                           | Max. value ( $V_{max}$ ).....86/150 Vac               |
|                                           | Rated voltage phase – ground .....150 Vac             |
|                                           | Surge volt. ( $V_{surge}$ ).....2.5 kV                |
| and 480 Vac [4]                           | Rated ( $V_{rated}$ ).....277/480 Vac                 |
|                                           | Max. value ( $V_{max}$ ).....346/600 Vac              |
|                                           | Rated voltage phase – ground .....300 Vac             |
|                                           | Surge volt. ( $V_{surge}$ ).....4.0 kV                |
| Accuracy                                  | Class 1                                               |
| Linear measuring range                    | $1.25 \times V_{rated}$                               |
| Measuring frequency                       | 50/60 Hz (30 to 85 Hz)                                |
| High Impedance Input; Resistance per path | [1] 0.498 M $\Omega$ , [4] 2.0 M $\Omega$             |
| <b>Current (Isolated)</b>                 | Rated ( $I_{rated}$ ).....[1] ..1 A or [5] ..1/5 A    |
| Linear measuring range                    | $I_{gen} = 1.5 \times I_{rated}$                      |
| Burden                                    | < 0.15 VA                                             |
| Rated short-time current (1 s)            | [1] $50 \times I_{rated}$ , [5] $10 \times I_{rated}$ |
| <b>Discrete inputs</b>                    | isolated                                              |
| Input range                               | 12/24 Vdc (8 to 40 Vdc)                               |
| Input resistance                          | approx. 20 kOhms                                      |

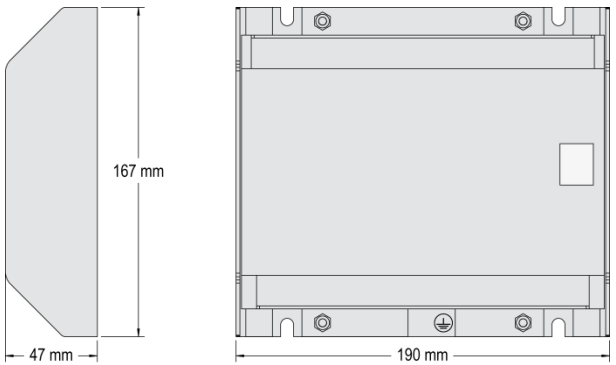
|                              |                                                           |
|------------------------------|-----------------------------------------------------------|
| <b>Relay outputs</b>         | potential free                                            |
| Contact material             | AgCdO                                                     |
| Load (GP)                    | AC: 2.00 Aac@250 Vac                                      |
|                              | DC: 2.00 Adc@24 Vdc / 0.36 Adc@125 Vdc / 0.18 Adc@250 Vdc |
| Pilot duty (PD)              | AC: B300                                                  |
|                              | DC: 1.00 Adc@24 Vdc / 0.22 Adc@125 Vdc / 0.10 Adc@250 Vdc |
| <b>Housing (LS-521)</b>      | Front door mounting..... Plastic housing                  |
| Dimensions                   | WxHxD..... 219 x 171 x 61 mm                              |
| Front cutout                 | WxH..... 186 [+1.1] x 138 [+1.0] mm                       |
| Connection                   | screw/plug terminals 2.5 mm <sup>2</sup>                  |
| Front                        | insulating surface                                        |
| Sealing                      | Front..... IP66 (with screw fastening)                    |
|                              | Front..... IP54 (with clamp fastening)                    |
|                              | Back ..... IP20                                           |
| Weight                       | approx. 850 g                                             |
| <b>Housing (LS-511)</b>      | Back panel mounting..... Sheet metal housing              |
| Dimensions                   | WxHxD..... 190 x 167 x 47 mm                              |
| Connection                   | screw/plug terminals 2.5 mm <sup>2</sup>                  |
| Protection system            | IP 20                                                     |
| Weight (plastic/sheet metal) | approx. 850/840 g                                         |
| <b>Disturbance test (CE)</b> | tested according to applicable EN guidelines              |
| <b>Listings</b>              | CE, UL/cUL, BDEW, VDE AR-N 4105, EAC                      |
| <b>Marine</b>                | Pending: LR, ABS                                          |

# DIMENSIONS

Plastic housing for front panel mounting



Metal housing for cabinet mounting



# TERMINAL DIAGRAM

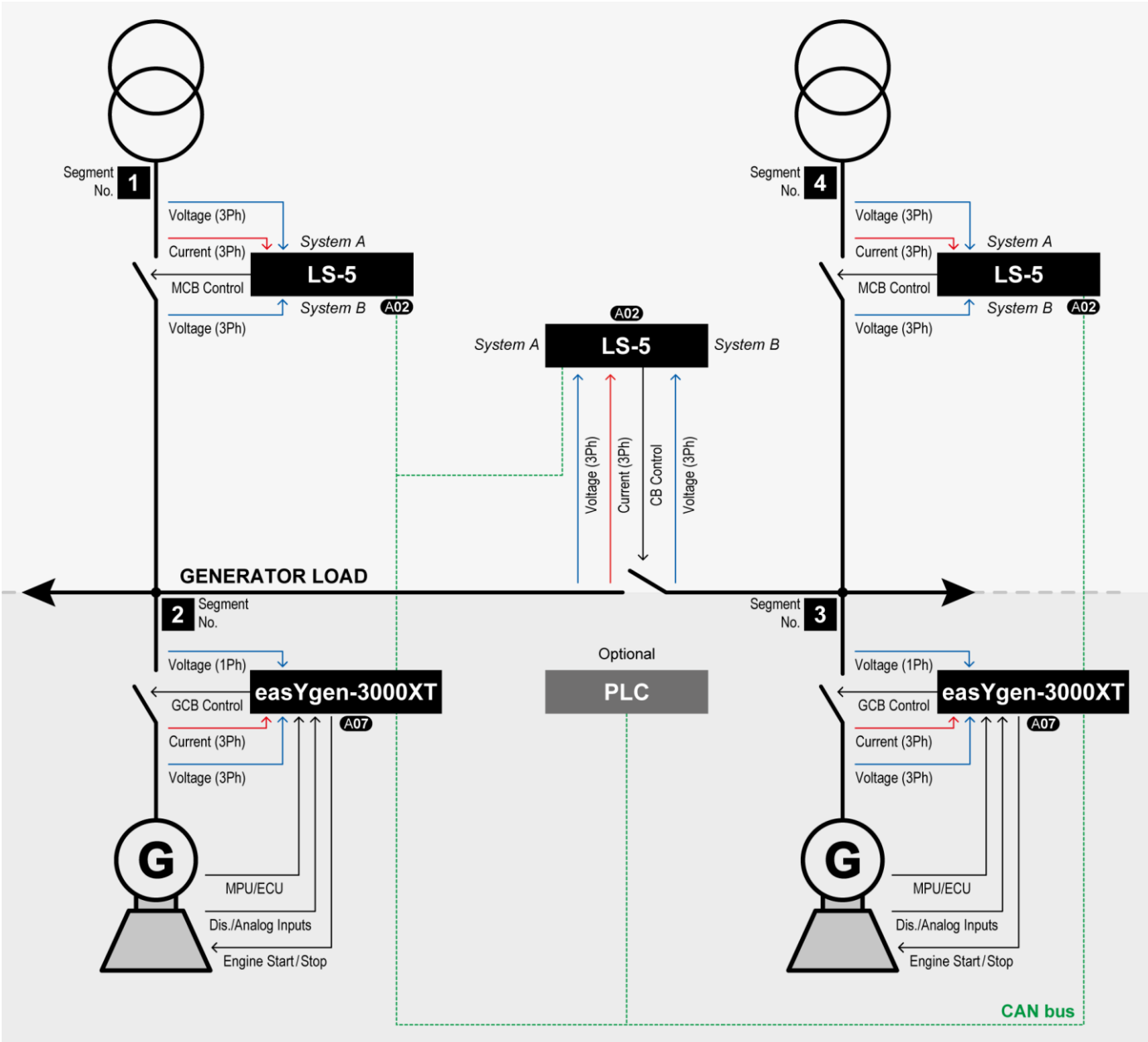
|          |          |       |       |               |              |           |               |                 |      |      |      |      |      |      |      |        |
|----------|----------|-------|-------|---------------|--------------|-----------|---------------|-----------------|------|------|------|------|------|------|------|--------|
| 59       | 58       | 57    | 56    | 55            | 54           | 53        | 52            | 51              | 50   | 49   | 48   | 47   | 46   | 45   | 44   | 43     |
| RS-485-A | RS-485-B | CAN-H | CAN-L | No Connection | 0 Vdc        | 12/24 Vdc | No Connection | DI08            | DI07 | DI06 | DI05 | DI04 | DI03 | DI02 | DI01 | COMMON |
| RS-485   |          | CAN   |       |               | POWER SUPPLY |           |               | DISCRETE INPUTS |      |      |      |      |      |      |      |        |

|               |    |     |    |    |    |     |    |     |    |     |    |     |
|---------------|----|-----|----|----|----|-----|----|-----|----|-----|----|-----|
| 42            | 41 | 40  | 39 | 38 | 37 | 36  | 35 | 34  | 33 | 32  | 31 | 30  |
|               |    |     |    |    |    |     |    |     |    |     |    |     |
| R06           |    | R05 |    |    |    | R04 |    | R03 |    | R02 |    | R01 |
| RELAY OUTPUTS |    |     |    |    |    |     |    |     |    |     |    |     |

|                       |                   |                   |                   |                   |                   |               |    |
|-----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------------|----|
| SYSTEM A CURRENT      |                   |                   |                   |                   |                   | No Connection |    |
| <div>SEE MANUAL</div> |                   |                   |                   |                   |                   |               |    |
| S <sub>2</sub> L1     | S <sub>1</sub> L1 | S <sub>2</sub> L2 | S <sub>1</sub> L2 | S <sub>2</sub> L3 | S <sub>1</sub> L3 |               |    |
| 01                    | 02                | 03                | 04                | 05                | 06                | 07            | 08 |

|               |    |    |    |                  |         |         |         |         |         |         |         |                  |         |         |         |         |         |         |         |
|---------------|----|----|----|------------------|---------|---------|---------|---------|---------|---------|---------|------------------|---------|---------|---------|---------|---------|---------|---------|
| NO CONNECTION |    |    |    | SYSTEM A VOLTAGE |         |         |         |         |         |         |         | SYSTEM B VOLTAGE |         |         |         |         |         |         |         |
|               |    |    |    | L1               | L2      | L3      | N       | L1      | L2      | L3      | N       | L1               | L2      | L3      | N       | L1      | L2      | L3      | N       |
|               |    |    |    | 120 Vac          | 480 Vac | 120 Vac | 480 Vac | 120 Vac | 480 Vac | 120 Vac | 480 Vac | 120 Vac          | 480 Vac | 120 Vac | 480 Vac | 120 Vac | 480 Vac | 120 Vac | 480 Vac |
| 10            | 11 | 12 | 13 | 14               | 15      | 16      | 17      | 18      | 19      | 20      | 21      | 22               | 23      | 24      | 25      | 26      | 27      | 28      | 29      |

# EXAMPLE APPLICATION



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## FEATURES OVERVIEW

|                                                                            | LS-511                | LS-521                       |
|----------------------------------------------------------------------------|-----------------------|------------------------------|
| <b>I/Os</b>                                                                |                       |                              |
| Display                                                                    | No                    | Yes                          |
| Configurable LEDs on Faceplate                                             | Yes                   | No                           |
| System A/B voltage measurement                                             | 3-Phases + Neutral    | 3-Phases + Neutral           |
| System A current measurement                                               | 3-Phase               | 3-Phase                      |
| Discrete inputs                                                            | 8                     | 8                            |
| Relay outputs                                                              | 6                     | 6                            |
| CAN Interface                                                              | 1                     | 1                            |
| RS-485 Interface                                                           | 1                     | 1                            |
| <b>Control</b>                                                             |                       |                              |
| Automatic and Manual operating modes                                       | ✓                     | ✓                            |
| Breaker synchronization<br>(± slip frequency/phase matching)               | ✓                     | ✓                            |
| Vector group adjustment for synchronization                                | ✓                     | ✓                            |
| Configurable dead bus closure direction                                    | ✓                     | ✓                            |
| <b>HMI</b>                                                                 |                       |                              |
| Configuration via HMI and PC                                               | ✓                     | ✓                            |
| Event recorder with real time clock (battery backup)                       | ✓                     | ✓                            |
| Date and Time Synchronization between LS-5 units and easYgen-3400XT/3500XT | ✓                     | ✓                            |
| <b>Protection</b>                                                          |                       |                              |
| Over-/undervoltage (59/27)                                                 | ✓                     | ✓                            |
| Over-/underfrequency (81O/U)                                               | ✓                     | ✓                            |
| Voltage asymmetry (47)                                                     | ✓                     | ✓                            |
| Phase shift (78)                                                           | ✓                     | ✓                            |
| df/dt (ROCOF) (81)                                                         | ✓                     | ✓                            |
| QV monitoring                                                              | ✓                     | ✓                            |
| Time-dependent voltage                                                     | ✓                     | ✓                            |
| Mains voltage increase (accord. to VDE-AR-N-4105)                          | ✓                     | ✓                            |
| <b>Monitoring</b>                                                          |                       |                              |
| Breaker open/close monitoring                                              | ✓                     | ✓                            |
| Synchronization time out monitoring                                        | ✓                     | ✓                            |
| Voltage plausibility                                                       | ✓                     | ✓                            |
| Freely configurable alarms                                                 | 4                     | 4                            |
| <b>Counter</b>                                                             |                       |                              |
| Circuit breaker closure counter                                            | ✓                     | ✓                            |
| Energy counters                                                            | ✓                     | ✓                            |
| <b>Listings/Approvals</b>                                                  |                       |                              |
| UL / cUL / EAC / CE Marked                                                 | ✓                     | ✓                            |
| Pending: LR & ABS Marine                                                   | ✓                     | ✓                            |
| <b>Part Numbers</b>                                                        | Metal housing         | Plastic housing with display |
| LS-511 (1A / 5A)                                                           | 8440-2180 / 8440-2152 | ---                          |
| LS-521 (1A / 5A)                                                           | ---                   | 8440-2178 / 8440-2150        |
| DIN-Rail mounting Kit for LS-511                                           | 8923-1746             | ---                          |
| DPC-RS-232 direct configuration cable                                      | 5417-557              |                              |
| DPC-USB direct configuration cable                                         | 5417-1251             |                              |
| Spare parts: Plug set containing all terminal plugs                        | 8928-7544             | 8928-7545                    |

## RELATED PRODUCTS

- Two breakers control **LS-512/522** (Product Specification # 37665)
- **easYgen-3400XT/3500XT** (Product Specification # 37583)
- **ToolKit** (Product Specification # 03366)
- **Power Generation Learning Module** (Product Specification # 03412): P/N 8447-1012
- Profibus Gateway **ESEPRO** (Application Note # 37577): P/N 8445-1046
- Ethernet (Modbus/TCP) Gateway **ESENET** (Application Note # 37576): P/N 8445-1044
- CANbus to Fiber Optic Converters (Application Note # 37598):  
**DL-CAN** P/N 8445-1049 and **DL-CAN-R** P/N 8445-1048
- Remote Access Gateway (with HMS **Netbiter** EasyConnect **EC250** and **EC350**)