LPS-O™

Generator Backup Protection

System backup for generators and transmission lines.

Features and Benefits

- Waveform sampling of current and voltage inputs
- High-resolution oscillography and playback
- Four zones of phase and ground mho distance functions
- Out-of-step blocking and tripping available
- Phase and ground overcurrent instantaneous backup
- Ground time overcurrent backup
- User-configurable I/Os
- Integrated RMS metering
- Horizontal and vertical models

Applications

- Backup protection for generators or transmission lines
- Three-phase tripping applications
- **NEW** enerVista.com compatible (see page 275)

Protection and Control

- Out-of-step tripping
- Over and undervoltage functions

Monitoring and Metering

- Fault location, event and fault recording
- Currents, voltages, watts, vars and frequency

User Interfaces

- LCD and keypad
- RS232 and RS485 serial ports

GE Multilin **1**

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Protection and Control

The LPS-O provides backup protection for generators and transmission lines. Advanced protection functions include:

Distance

Four zones of phase step distance protection are provided. Functions are positive sequence voltage polarized mho characteristics. The reach of the three forward looking zones can be compensated for a delta-wye transformer.

Zone 4 is reversed and disregards any transformer between the relay and the fault in the forward direction. Zones 1, 2, 3, and 4 each include independent timers for phase step distance protection.

Out-of-step blocking monitors swing condition and blocks tripping. Out-of-step tripping logic is provided with a choice of two or three mho type characteristics with adjustable shapes.

Forward and reverse share a common maximum reach angle. Loss of synchronism or a power swing between two areas of the power system is detected by measuring the positive sequence impedance seen by the relay over a period of time as the power swing develops.

Directional Ground Overcurrent

The ground directional functions are forward and reverse negative sequence current and voltage operated. The ground instantaneous and TOC functions can be independently set with directional control.

Overcurrent Backup

The LPS-O provides instantaneous phase and ground overcurrent functions. The phase backup consists of an instantaneous function. Ground overcurrent backup consists of IOC and TOC functions. The TOC function includes four selectable and one programmable curve.

The ground overcurrent functions can be controlled by the directional functions. Both IOC and TOC functions can be set as non-directional or directional.

The LPS-O provides an adaptive sensitive current disturbance detector (fault detector) and an unbalanced current alarm to detect open or shorted CT leads.

Voltage

Three single-phase under and overvoltage detectors and a positive sequence overvoltage detector are provided.

Fuse failure logic detects a full or partial loss of AC potential and blocks tripping of distance and directional functions. The LPS-O has a three-wire voltage input suitable for either delta or wye connected VTs.

Scheme Logic

The LPS-O provides user-programmable logic with up to 40 gates and eight timers.

Manual Breaker Control

Manual circuit breaker tripping or closing can be done locally or remotely.

Multiple Settings Groups

Two separate groups of protection settings may be stored in the LPS-O non-volatile memory. The active settings group can be selected by the user.

Configurable I/Os

All 12 contact converter inputs and 20 contact outputs (except for alarms) are user-configurable. SCR tripping outputs are available for high speed operation.

Monitoring and Metering

The LPS-O provides sophisticated monitoring and metering functions that include:

Trip Circuit Monitor

DC battery voltage is monitored across each open trip contact. An alarm triggers when the voltage becomes virtually zero. A current sensor in series with each trip contact is provided, to log an event message on the DC trip current status following the trip.

Metering

The LPS-O provides the following RMS metering values:

- Current (I_a, I_b, I_c, I_n)
- Voltage (V_{ab}, V_{bc}, V_{ca})
- Watts (three-phase)
- Vars (three-phase)
- Frequency

The currents are calculated for each phase, and voltages are calculated between phases. The accuracy is 1% of rated current and voltage. The phasor value (magnitude and angle) of the phase currents and voltages are also displayed.

Functional Block Diagram
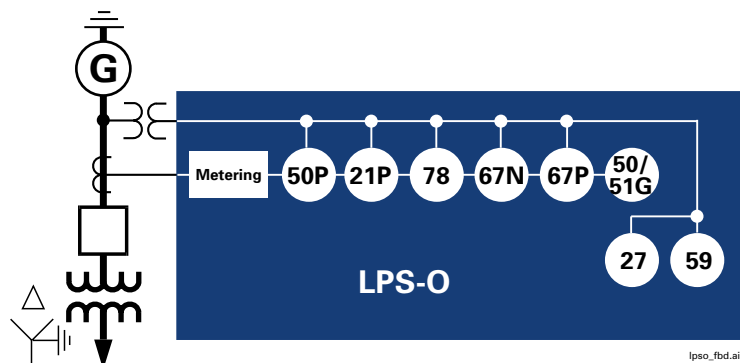
lpso_fbd.ai

Event Recording

The LPS-O stores up to 150 events with the date and time stamped to the nearest millisecond. This aids the user with determining the sequence of events, facilitating diagnosis and recovery.

Oscillography

The LPS-O captures current and voltage waveforms and selected internal logic signals at 64 samples per cycle. The unit can store from six events of 72 cycles each to 36 events of 12 cycles each. The time, date, active settings, and fault report are stored with the data capture. Prefault data can be set from one to eight cycles.

Oscillography can be triggered by internal or external signals. Internal signals include trip outputs or a programmable logic signal. The supplied out-of-step trip logic features a three second oscillography data file consisting of phasor values of the currents and voltages captured at a rate of one per cycle. The LPS-O has the capability to store the oscillography files in Comtrade format.

The LPS-O relay can playback stored waveform files through the relays processor, allowing the user to playback faults with different settings.

Breaker Health

The breaker health threshold is set by the user to achieve "just in time" maintenance. When the cumulative value of the three-phase currents exceeds the threshold, an alarm occurs. The user can adjust the threshold for breakers with previous duty.

Self-Test Diagnostics

Self-test routines are performed during power up and continue in the background during service. Failures are categorized as either critical or non-critical alarm and recorded in the event log.

Typical Wiring

OPTIONAL SINGLE POLE MODEL   730750A3.CDR

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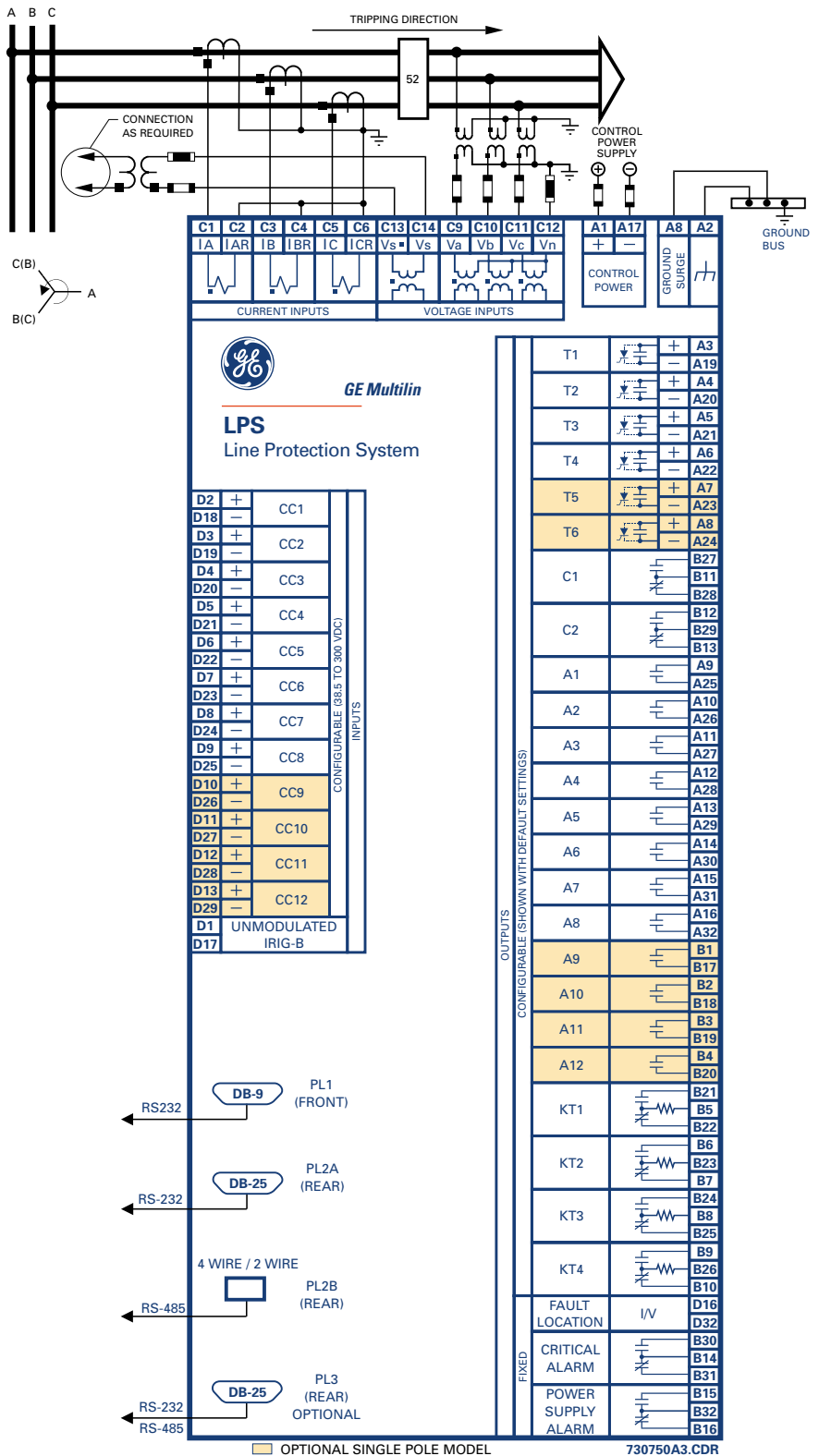
Time Synchronization

An IRIG-B input is provided for time synchronization via satellite signal.

Security

There are separate remote passwords which permit view only, view and settings changes, or view, settings, and control capability.

Software

Windows®-based software packages are included in the LPS-O instruction book.

- LPS-O LINK – allows communication with the relay using GE protocol
- XPRESSION BUILDER™ – allows the user to graphically design programmable logic settings and I/O assignments

The user may also obtain GE-DATA or GE-OSC to analyze oscillography data.

LPS-O Guideform Specifications

For an electronic version of the LPS-O guideform specifications, please visit: www.GEindustrial.com/Multilin/specs, fax your request to 905-201-2098 or email to literature.multilin@indsys.ge.com.

Guideform Specifications
Available on the Product CD, Online or from your Sales Representative.
www.GEindustrial.com/Multilin

NOTE: For dimensions see ALPS brochure.

enerVista enabled See page 275.
www.enerVista.com

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LPS-O Technical Specifications

PROTECTION

	$I_n = 1$	$I_n = 5$
Positive sequence angle:	45 – 90°	45 – 90°
Zero sequence angle:	45 – 90°	45 – 90°
Zero sequence current :		
Compensation (K0):	1.00 – 7.00	1.00 – 7.00
Zone 1, 2, 3 and 4 reach:	0.05 – 250 Ω	0.01 – 50 Ω
Zone 4 offset reach:	0.00 – 0.40	0.00 – 0.40
	(Zone 4 is reversible)	
Zone 2 timer:	0.10 – 3.00 sec	0.10 – 3.00 sec
Zone 3 and 4 timers:	0.10 – 10.0 sec	0.10 – 10.0 sec
Phase instantaneous OC:	0.4 – 32 A	2.0 – 160.0 A
Ground instantaneous OC:	0.1 – 16.0 A	0.5 – 80.0 A
Ground TOC:	0.04 – 3.00 A	0.20 – 15.00 A
TOC curves:	Inverse, very inverse, extremely inverse, definite and custom	

RECLOSURE (OPTIONAL)
Reclose attempts:	4
Synchronism check:	Optional

METERING
Frequency:	50 or 60 Hz
Voltage (ph-ph):	100 – 120 VAC
Current (I_n):	1 or 5 A
Maximum permissible current:	
Continuous:	3 A for I_n = 1 A
	15 A for I_n = 5 A
Three sec:	50 x I_n
One sec:	100 x I_n
Maximum permissible AC voltage:	
Continuous:	138 VAC (ph-n)
One minute:	3.5 x rated

MONITORING
Records:	6 – 36
Record length:	72 – 12 cycles
Pre-fault cycles:	1 – 8
Samples per cycle:	64

INPUTS
Contact converter inputs:	5 – 300 VDC (jumper selectable)

BURDENS
Current circuits:	I_n = 1	0.02 Ω at 5°
	I_n = 5	0.12 Ω at 30°
Voltage circuits:	50 Hz	0.20 VA
	60 Hz	0.15 VA
DC battery:		
Power supply:	<20 W	
Contact converters:	2.5 mA each	

POWER SUPPLY
Control voltage:	Range:
48 VDC	38.5 – 60.0 VDC
110/125 VDC	88 – 150 VDC
220/250 VDC	176 – 300 VDC

OUTPUTS
CONTACT RATINGS
Trip contact (T1 – T6):	Continuous = 5 A
	Make & carry = 30 A per ANSI C37.90
	Interrupting: 25 VA
	Pickup <4 ms
Trip SCR (T1 – T6):	Continuous = 5 A
	Make & Carry = 30 A per ANSI C37.90
Auxiliary	
(A1 – A12):	Continuous = 5 A
(C1, C2):	Make & carry = 30 A
	Interrupting: 25 VA
	Pickup <8 ms
High speed (KT1 – KT4):	Continuous = 0.5 A
	Max voltage = 280 VDC =
	Pickup <0.5 ms

COMMUNICATIONS
Protocol:	ASCII, GE-MODEM	
Ports:	Front:	1 DB9, RS232
	Rear:	1 DB25, RS232 and 4 pin Phoenix, RS485 (standard): 1 DB25, RS232 or RS485 optional
Display:	4 line liquid crystal display standard	
Keypad:	Full numeric keypad standard	

INSTRUCTION BOOK
Single-pole	GEK 106202
Three-pole	GEK 106159

ENVIRONMENTAL
Ambient temperature range:	
Storage:	-30° C to +75° C
Operation:	-20° C to +60° C
Humidity:	95% without condensation

TYPE TESTS
Insulation test voltage:	2 kV, 50/60 Hz, 1 min (high-pot) ANSI C37.90 IEC 255-5
Impulse voltage withstand fast transient:	5 kV peak, 1.2/50 µs, 0.5 J IEC 255-4 ANSI C37.90.1
Surge withstand capability (SWC):	ANSI C37.90.1 IEC 255-22-1
Radio frequency interference withstand (RFI):	ANSI C37.90.2 IEC 255-22-3
Electrostatic discharge (ESD):	IEC 255-22-2

*Specifications subject to change without notice.

Ordering

LPS	*	*	*	*	*	*	*	*	*	*	*	*	
LPS													Line protection system
	0												Phase distance relay with out-of-step tripping (system phase backup)
		B											Revision level B
			3										Three-phase tripping logic
				5									5 A rated current
					U								For applications without series capacitors
						0							48 VDC battery voltage
						1							110/125 VDC battery voltage
						2							220/250 VDC battery voltage
							1						SCR trip outputs and contact channel interface
							2						Contact trip outputs and contact channel interface
								3					Front RS232 com port and 2 selectable RS232/RS485 rear port (GE-MODEM/ASCII)
									H				Horizontal mounting
									V				Vertical mounting
										E			Extended oscillography memory
											1		With out-of-step tripping
											N		No reclosure

Accessories:

158D7358P1	L2 Flange for vertical mounting
158D7359P1	KD Flange for vertical mounting