



For high-speed transmission line protection.

Features and Benefits

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

NEW

Applications

- Distance protection for transmission lines or system backup
- Single or three-phase tripping applications
- 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



Protection and Control

The LPS-D provides high speed transmission line protection for single or three-phase tripping. Advanced protection functions include:

Distance

The LPS-D provides four zones of phase and ground distance functions. Functions are positive sequence voltage polarized mho characteristics. Ground Zone 1 functions may be set as adaptive reactance characteristics, including an independent supervising mho characteristic with a load compensating adaptive reach.

Zone 4 is reversible for use as a blocking zone. Zones 2, 3, and 4 each include independent timers for phase and ground step protection.

Out-of-step blocking detects a swing condition and blocks either tripping or reclose initiation. A choice of two or three characteristics are provided, with adjustable characteristic shapes.

The LPS-DB modification offers four zones of quadrilateral ground characteristics.

Directional Ground Overcurrent

This function can replace or be used with overreaching ground distance functions in a pilot scheme. Forward and reverse negative sequence current and voltage operate the functions.

Overcurrent Backup

The LPS-D provides instantaneous phase and ground overcurrent functions.

The instantaneous phase function can be controlled by Zone 2 distance functions. The ground function consists of IOC and TOC functions with four selectable and one programmable curve. The ground overcurrent functions can be controlled by the directional functions. IOC and TOC functions can be set as non-directional or directional.

The LPS-D also provides an adaptive sensitive current disturbance detector (fault detector). Overcurrent supervision of distance functions is included. Both trip and block units can be used in ground directional overcurrent pilot schemes.

An unbalanced current alarm is provided 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.

A line pickup function will trip if the breaker is closed into a zero-voltage bolted fault when line-side potential is used.

The LPS-D has a four-wire voltage input suitable for wye connected

VTs, plus an optional synchronization check voltage for use with the recloser.

Scheme Logics

The scheme logics include:

- Blocking
- Permissive Underreach Transfer Trip (PUTT)
- Permissive Overreach Transfer Trip (POTT1 and POTT2)
- Hybrid (POTT plus echo and weak in-feed tripping)
- Step distance backup (non-pilot)

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

Pilot Channels

Typical pilot channels include AM and FSK via Power Line Carrier (PLC), FSK via microwave, and FSK via multiplexed fiber optic. Optional 5 V / 20 mA hardware allows connection to older GE carrier sets.

Four-Shot Recloser

This option is available with reclosure programs for single and three-phase tripping applications. Reclosing may be initiated from LPS-D protection functions, or via external contact inputs. The unit features recloser inputs for initiation, inhibit cancel and reset. Output contacts allow breaker close, reclosure in progress, and recloser in lockout.

Manual Breaker Control

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

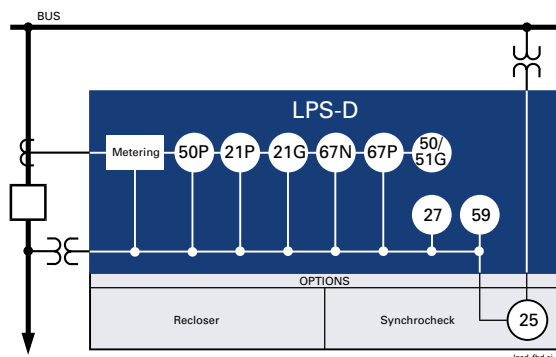
Multiple Settings Groups

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

Configurable I/O

All 12 contact converter inputs and 24 contact outputs (except for two fixed alarms) are user-configurable. SCR tripping outputs are available for high speed operation.

Functional Block Diagram



Monitoring and Metering

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

Fault Location

Proven algorithms provide reliable fault location, reports in miles, kilometers, or percent of line impedance. The location and trip target are available locally, and are included in the fault reports and oscillography files.

Trip Circuit Monitor

DC battery voltage is monitored across each open trip contact, triggering an alarm when the voltage nears 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-D provides the following RMS metering values:

- Current (I_a , I_b , I_c , I_n)
- Voltage (V_a , V_b , V_c)
- Watts (three-phase)
- Vars (three-phase)
- Frequency

The currents and voltages are calculated for each phase to an accuracy of 1% of their rating. The phasor value (magnitude and angle) of the phase currents and voltages are also displayed.

Event Recording

The LPS-D stores up to 150 time stamped events. This aids the user with troubleshooting and recovery.

Oscillography

The LPS-D 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 re-

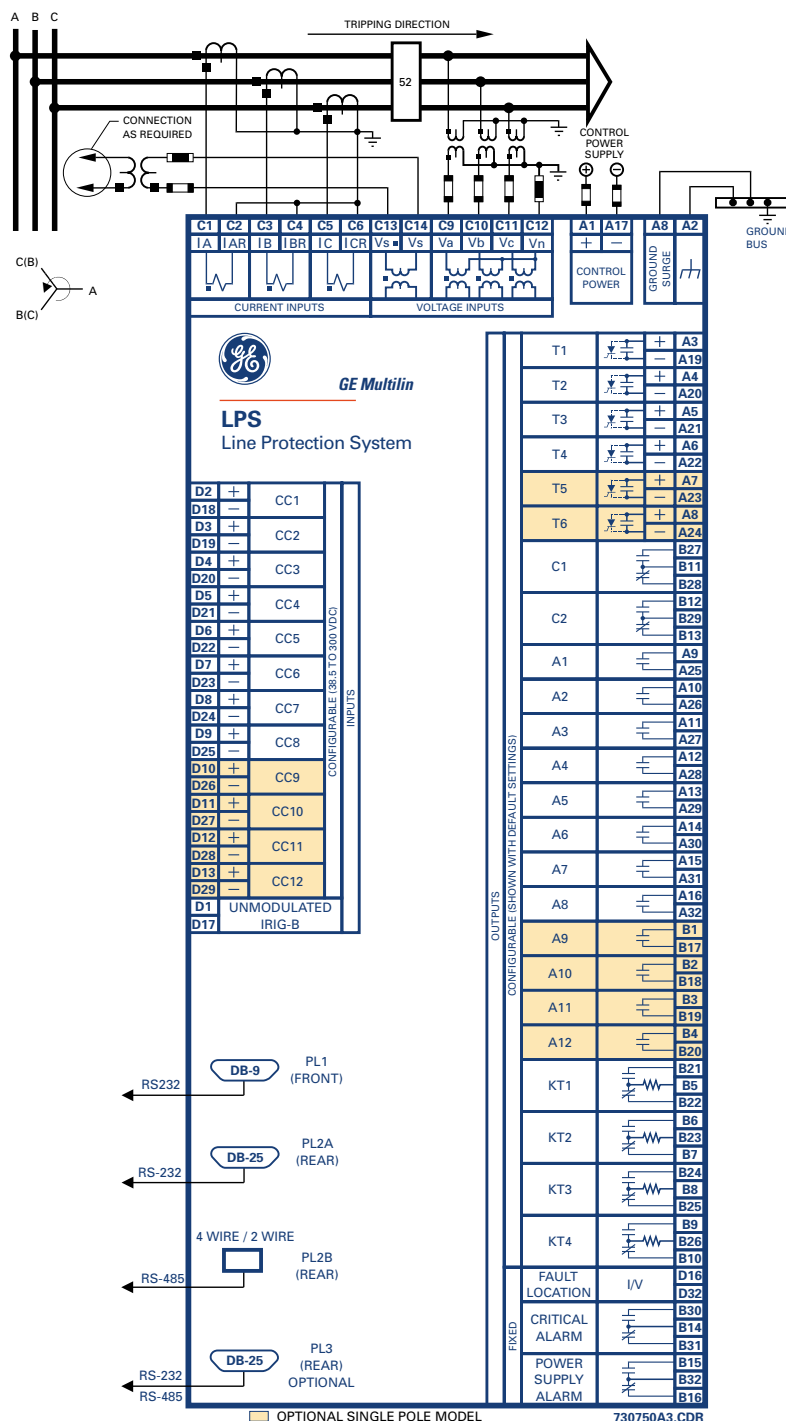
port are stored with the data capture. Prefault data can be set from one to eight cycles.

Oscillography can be triggered by internal signals such as trip outputs and programmable logic, or external signals. The LPS-D has

the capability to store the oscillography files in Comtrade format.

The LPS-D relay can playback stored waveform files allowing the user to playback faults with different settings.

Typical Wiring



Breaker Health

When the cumulative value of the three-phase currents exceeds the user's breaker health threshold, an alarm occurs. The user can adjust the threshold for breakers with previous duty.

Self-Test Diagnostics

Self-test routines are performed at power up and continue throughout service. Failure alarms or alerts are recorded automatically in the event log.

Time Synchronization

An IRIG-B input allows time synchronization via satellite signal.

Security

Passwords allow viewing, control and settings access.

Software

Four Windows®-based software packages are included:

- ALPS-LINK – allows relay communication using GE protocol
- ALPS-SET – aids user in creating and downloading settings files
- ALPS-TEST – calculates expected operating voltages for mho distance functions for settings and test conditions
- XPRESSION BUILDER™ – allows the user to graphically design programmable logic settings and I/O assignments

User can obtain GE-DATA or GE-OSC to analyze oscillography data.

LPS-D Guideform Specifications

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

Accessories:

- 158D7358P1 L2 flange for vertical mounting
- 158D7359P1 KD flange for vertical mounting

enerVista enabled See page 275.
www.enerVista.com

LPS-D 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 IOC:	0.4 – 32 A	2.0 – 160.0 A
Ground IOC:	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	
RECLOSER (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 min:	3.5 x rated

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

COMMUNICATIONS	
Protocol:	ASCII, GE-MODEM, ModBus® RTU (opt. card)
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

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

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

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 Continuous = 5 A Make & carry = 30 A Interrupting: 25 VA Pickup <8 ms
Auxiliary (A1 – A12): (C1, C2):	Continuous = 0.5 A Max voltage = 280 VDC = Pickup <0.5 ms
High speed (KT1 – KT4):	Continuous = 0.5 A Max voltage = 280 VDC = Pickup <0.5 ms

INSTRUCTION BOOK			
Single-pole	GEK 106202	LPS-D	GEK 106159
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	D	A	B
	1	3	1
	5	U	0
	1	2	1
	2	3	2
	3	4	3
	2		
	3		
	H	V	E
			0
			N
			R
			S
			AC
			ModBus® communications option (LPS-DA only)

*These options are applicable to Revision A models only.

NOTE: For dimensions see ALPS brochure.