8ZLV

Distance Protection IED

Selective, fast and reliable protection in overhead lines and cables

0.1% accuracy on measured magnitudes.

IEC 61850 / UCA 2.0 compatible.

Programmability allows free definition of operational logic.

Configurable communications and programming tools.

Contributing to improve Safety, Quality of Service and Profitability of Electrical Systems

Protection Functions

21/21N Distance protection for ground and phase faults.
50SUP Overcurrent supervision for distance protection .
68/78 Lockout and/or trip due to power oscillation.
85-21 Protection schemes for distance elements.
50 Instantaneous phase overcurrent (3 units).
50Q Instantaneous negative sequence overcurrent (I2) (3 units).
50N Instantaneous ground overcurrent (3 units).
51 Time phase overcurrent (inverse / definite) (3 units).
51Q Time negative sequence overcurrent (inverse / definite) (I2) (3units).
51N Time phase / ground overcurrent (inverse / definite) (3 units).
67 Directional phase overcurrent.
67Q Directional negative sequence overcurrent.
67N Directional neutral overcurrent.
27 Phase undervoltage (3 units).
59 Phase overvoltage (3 units).
59N Ground overvoltage (2 units).
81M Overfrequency (3 units).
81m Underfrequency (3 units).
81D Frequency rate of change (3 units).
49 Thermal image.
46 Open phase: I2/I1 (current unbalance) .
85-67N/67Q Protection algorithms for ground overcurrent elements.
50BF Breaker failure.
27WI Weak infeed logic.
50SOF Switch-on-to-fault detector.
50STUB Stub bus protection .
79 Recloser.
FL Fault locator.
3 Switching circuit monitoring (up to 6 circuits).
25 Synchrocheck.
2 Pole discordance detection.

8ZLV

Description

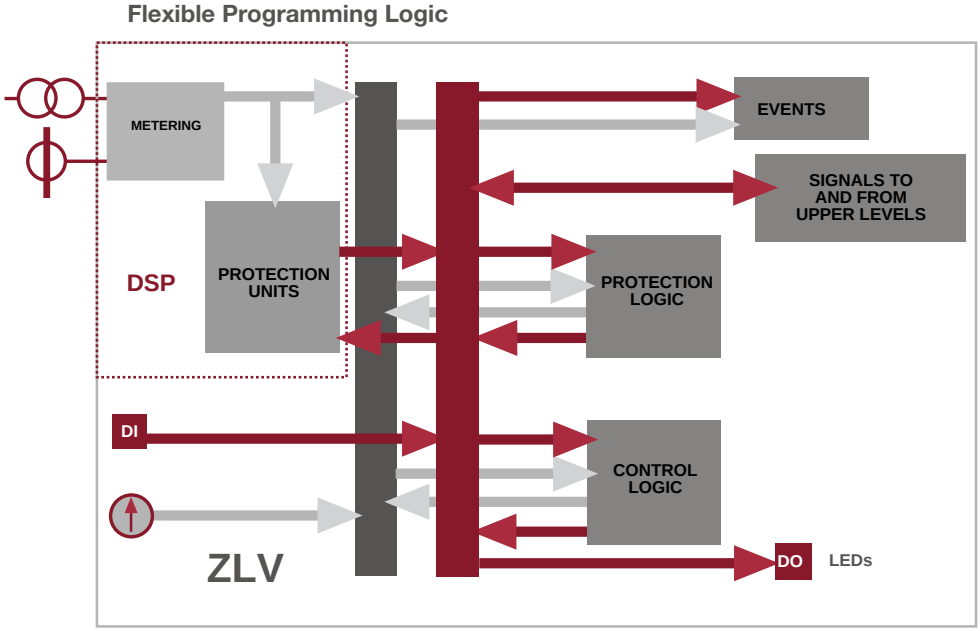
The **ZLV** model protection and control IEDs are based on the most advanced digital technology and are designed to provide maximum flexibility and versatility.

They have all the necessary functions to protect, control and meter a HV/MV bay. They are designed to provide selective, fast and reliable protection in overhead lines with or without series compensation, whether single-phase or three-phase trips are required.

Their programmable logic unit allows the user to freely define the operational logic of the protection and control functions to adapt them to the specific bay or system requirements.

ZLV models are complemented with a series of easy-to-use communications and programming tools that provide a user-friendly environment in which to configure applications.

ZLV models are based on the most advanced digital technology and are designed for maximum flexibility and versatility.



Basic relationships between the configurable modules of 8ZLV IEDs

Protection

ZLV IEDs include a set of protection functions that meet the maximum needs of the applications above. Each function can be enabled or disabled during configuration or by commands transmitted via the communications ports, operator interface (HMI) or digital inputs.

Control

ZLV IEDs can support control functions required in a line bay with all the characteristics of an intelligent RTU:

- Captured and calculated metering data via analog inputs and transducers.
- Data capture from digital inputs and internal signal states.
- Local and remote control of substation equipment via auxiliary output contacts.
- Input/output logic, interlocks, control hierarchy and programmable control functions.
- Energy meters.
- Communications ports for connections to the substation HMI or directly to the Control Center and/or SCADA.

Metering

ZLV models provide readings of:

- Captured analog values: phase currents, ground current of the parallel line, ground current and phase voltages (phase-ground), synchronism 1 and 2 voltages.
- Power values calculated with the preceding magnitudes: active, reactive and apparent power
- Ground current and voltage.
- Sequence currents and voltages (positive, negative, zero).
- Harmonic content of current and voltage on phase A and total harmonic distortion
- Frequency.
- Cosine φ.
- Thermal image.
- Energy meters: active input and output, and capacitive and inductive reactive.

The sampling frequency of the metering units is 32 samples per cycle (1920 Hz in 60 Hz systems and 1600 Hz in 50 Hz systems). All samples are used for metering and oscillography storage.

Metering values are used as inputs for the protection functions built into the IED. Additionally, any reading, whether measured or calculated, can be selected as an input to user-programmed functions (communications, display, logic, etc.).

Flexible analog metering can replace traditional panel meters.

Metering Values

Phase currents and voltages (simple and between phases).

Ground current and voltage.

Ground current of parallel line.

Grounding current (for polarization).

Voltage and current harmonics on phase A.

Sequence currents and voltages (positive, negative and zero).

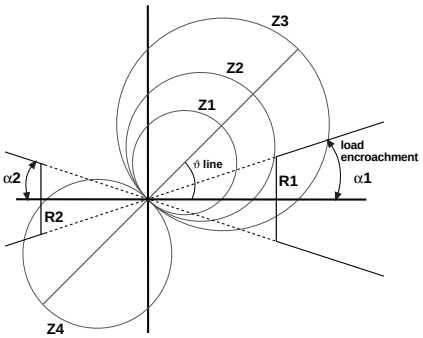
Active, reactive and apparent power .

Cosine φ.

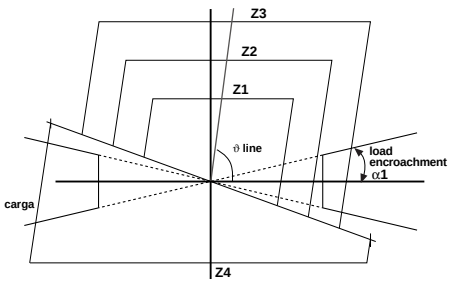
Frequency.

Thermal image.

Active input and output energy and capacitive and inductive reactive.



MHO characteristic



Quadrilateral characteristic

Protection Functions

Distance Protection

There are **four distance zones** available, all of them reversible. Each zone has six independent measuring elements.

Each zone allows for independent timers for phase and ground faults. The reach (Z1) and zero sequence compensation (K0=Z0/Z1) settings are also independent for each zone both in magnitude and angle, wich allows a better accuracy on measuring bucles for mixed line applications.

The distance units have independently selectable **mho** and **quadrilateral** characteristics for phase and ground faults.

The **mho** characteristic is polarized by positive sequence voltage with memory, creating a dynamic expansion that increases the characteristic resistive coverage. This approach provides directional security against three-phase faults with zero voltage, against voltage reversals on lines with series compensation and against disturbances in presence of capacitive voltage transformers.

The **quadrilateral** characteristic allows independent resistive reaches for phase and ground faults

The directional element associated with the quadrilateral characteristic is also polarized by positive sequence voltage with memory wich bears the directional security before mentioned.

The **reactance unit** that limits the quadrilateral characteristic compensates the load influence during phase faults as well as ground faults. It is polarized by a phasor parallel to the fault current, thus avoiding the effects of overreach and underreach in resistive faults. It also compensates system unbalance with an internally calculated tilt angle.

Distance Protection Schemes

ZLV IEDs can complement the distance elements with protection schemes to speed up trips outside of zone 1 and inside the protected line. There are selectable schemes that work in parallel with the distance step scheme:

- Zone 1 extension.
- Permissive underreach transfer trip (PUTT).
- Direct transfer trip (DTT).
- Permissive overreach transfer trip (POTT)
- Directional comparison unblocking (DCUB).
- Directional comparison blocking (DCB):
  - Backward zone carrier.
  - Non directional units carrier.

These schemes can be complemented by **transient blocking logic** to avoid false trips when current reversal occur in double circuits.

In addition to the available protection schemes, any protection scheme can be configured with the **programmable logic** built into the IED. The user can generate teleprotection schemes that require the exchange of several signals between both two ends of the line (indication of the faulted phase, single-phase and three-phase permissions, etc.). The communication medium can be a digital network.

Load Encroachment

The purpose of these elements is to avoid trips in high-load conditions. They block the operation of the distance elements if the calculated positive sequence impedance stays within the range set for the limiters.

Weak Infeed Logic

ZLV IEDs include **echo logic** to avoid time delay trips in permissive schemes when one of the ends of the line has weak infeed conditions. This scheme allows the weak end to re-send the trip command signal received with previous directionality confirmation to produce the instantaneous trip of the strong end.

Trip logic for weak infeed can be enabled. It will work together with the echo logic to trip the weak end. In this case, besides the directionality a voltage threshold is proven.

Power Swing Blocking / Out-of-Step Tripping

ZLV IEDs have a power swing detector to avoid inappropriate operations of distance elements when there are stable power swings (block due to power swing) and to allow controlled trips in the event of unstable power swings (trip due to loss of stability) as required.

ZLV IEDs also have an algorithm to detect faults originated during power swings, in order to unblock the distance elements.

Switch-on-to-fault

The switch-on-to-fault detector permits instantaneous tripping in the event of faults detected at breaker closing. Manual close and reclose commands activate this algorithm whether the commands are internal or external. It has non-directional phase overcurrent units with second harmonic restraint (to avoid operations on transformers energization). These units work in parallel with the zone 1 extension function.

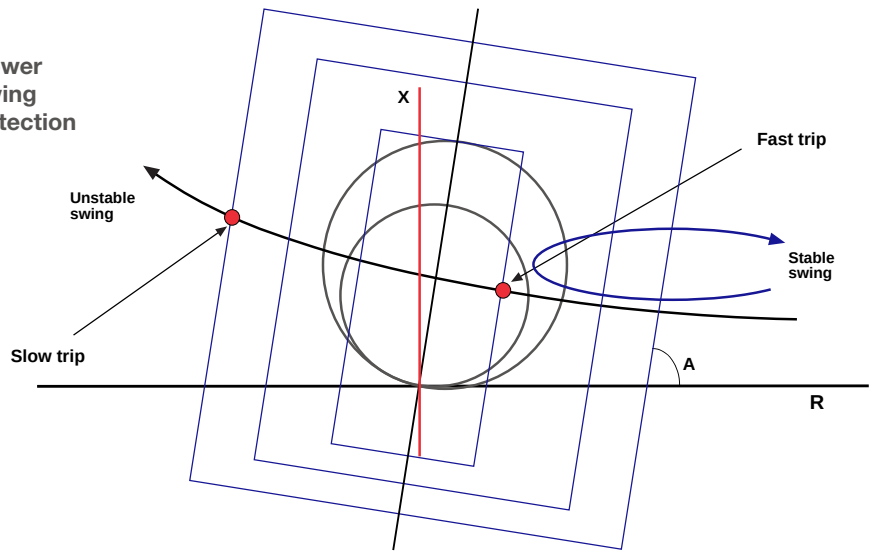
Breaker Failure

ZLV IEDs have breaker failure protection with **two time steps** to retrip (single or three-phase) the faulted breaker, if required, before generating the trip command for the adjacent breakers.

The breaker failure protection has **independent overcurrent timers and levels for single- and three-phase trips**. The pickups generated by single phase trips have overcurrent detectors and timers segregated by phase in order to act correctly in the event of evolving faults. Overcurrent detectors feature very fast reset.

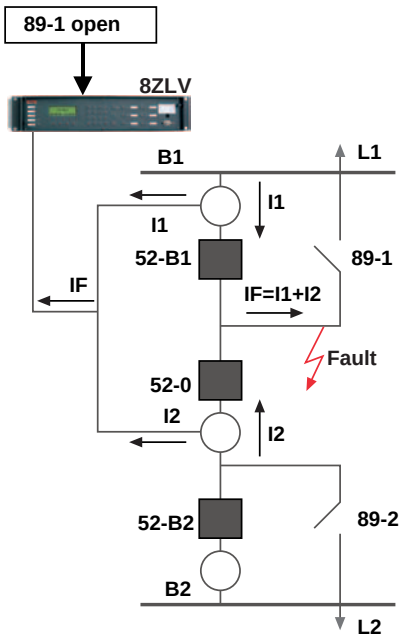
They also protect against breaker failures without overcurrent and detect the existence of internal arcing.

Power swing detection



ZLV IEDs can complement the distance units with teleprotection schemes.

The slow trip for loss of stability avoids excessive overload in the breaker.



Stub Bus protection

Protection Functions

Overcurrent Elements

ZLV IEDs incorporate a great number of overcurrent elements:

- Delayed and instantaneous.
- Phase, ground and negative sequence.
- Support to other functions (50SUP, 50STUB, 50SOF).

All the overcurrent elements can be made directional through the configuration settings (including distance zone 2 as a directional element).

The directional characteristic security is achieved via polarization. This makes them suitable for lines with series compensation and for systems with strong zero sequence or reversed sources, where very small polarization voltages would be obtained.

Stub Bus Protection

This unit is applied in breaker-and-a-half and ring substations. Its purpose is to protect the section between the two current transformers and the disconnect switch when the latter is open. This definite time phase overcurrent element is activated when the line disconnect switch opens.

Protection Schemes for Ground Overcurrent Elements

The following protection schemes can complement the directional elements of ground or negative sequence overcurrent:

- Permissive underreach transfer trip (PUTT).
- Direct transfer trip (DTT).
- Permissive overreach transfer trip (POTT).
- Directional comparison unblocking (DCUB).
- Directional comparison blocking (DCB).

All these schemes are independent of those associated with the distance elements. Therefore, they can use different communication channels. Also, the user can create customized protection schemes with the programmable logic.

The complementary schemes of weak infeed and transient blocking due to current reversal are also available to work in parallel with these protection schemes.

Levels 1 and 2 of instantaneous ground overcurrent can be set to produce **single phase trips** using the IED's phase selector.

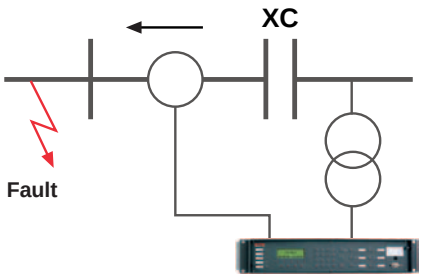
Transient Compensation on Capacitive Voltage Transformers

ZLV IEDs include an algorithm that compensates transients due to capacitive voltage transformers to avoid distance elements overreach.

Lines with Series Compensation

On lines with series compensation, a reverse directional fault can cause erroneous directional decisions once the voltage memory time has lapsed.

To avoid false trips with reverse faults cleared with time delays, the **ZLV** has an algorithm that temporarily blocks the forward directional elements. This blocking signal is generated by the activation of the distance and directional overcurrent elements that monitor the reverse directional current.



Reverse faults on lines with series compensation (VT line side of capacitor bank)

Monitoring Functions

Fuse Failure

This function can block the operation of the distance elements, the synchrocheck unit and the weak infeed if it detects a failed VT secondary fuse.

Synchrocheck

The synchronism check is made up of various elements: line and bus voltage (type of energizing can be set), voltage difference, phase difference and frequency difference.

This unit can inhibit the recloser function and prevent the execution of closing commands under lack of synchronism conditions.

Breaker monitoring

To assist in breaker maintenance, the **ZLV** IED has an element that sums and accumulates the kA^2 value each time it trips. It also prevents the breaker from making an excessive number of trips in a given period of time to prevent damage.

Open Pole and Pole Discordance Detector

The open pole detection algorithm operation is based on the status of the breaker auxiliary contacts and on phase segregated current detectors. Due to the various conditions that generate pole opening, the protection elements take the result of this algorithm into account.

The IED can also detect pole discordance. This can trigger a trip if it persists during the set time.

Trip Circuit Monitoring

The IED can monitor **up to 6** trip or close coil circuits of the breaker.

Control Functions

Recloser

The **ZLV** recloser may be coordinated with an external protection device in addition to the IED's built-in protection.

Reclosing is selectable up to a maximum of **three attempts** with independent settings for recloser timers and reset times. Settings can select the unit or units that enable the start of the reclosure.

Reclosing sequences can be set independently for single- and three-phase trips. The following operational modes are selectable:

- 1p mode: reclosing only in the event of a single-phase trip
- 3p mode: reclosing only in the event of a three-phase trip
- 1p/3p mode: reclosing for both types of trip
- Dependent mode: only one reclosing shot if the first trip is three-phase and a set number of reclosing shots if it is single-phase.

The recloser function can monitor two breakers with resulting advantages in breaker-and-a-half and ring substations.

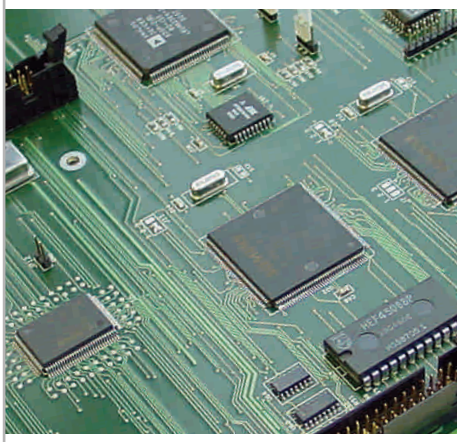
Programmable Logic

The inputs to the logic functions can be any of the signals or readings generated by the following functions: protection units, digital inputs; communications; command functions; analog inputs.

The user can define a logical operation using primitive logic functions (AND, OR, XOR, NOT, etc.), flip-flops, timers, comparators, etc.

The programming function allows the user to define trip logic, control logic, interlocks, functional modules and control hierarchy required for complete protection and operation of a bay.

The logical outputs produced when processing input signals can be assigned to auxiliary outputs, HMI display, communications, external HMI, etc.



The synchronism unit can supervise two breakers simultaneously. Therefore, it is very useful in breaker-and-a-half or ring substations.

Recording and Information Functions

Fault Locator

The included fault locator obtains the distance to the fault in miles, km or in percentage of the total length of the line.

For double circuits, zero sequence **mutual coupling compensation** can be enabled. This function is based on the residual current measurement of the line offset.

Event Recording and Programmable Event Logs

A 400-record-capacity sequence of event log is stored in non-volatile memory. A user can generate event-triggering signals. The events are recorded with a 1-ms resolution. The log can include up to 12 selectable analog quantities.

Fault Reporting

Capacity to store up to 15 fault reports with relevant data, such as picked-up units, tripped units, pre-fault metering, fault metering, current interrupted, etc.

Oscillographic Recording

The oscillography record allows up to 64 oscillographs to be saved in a cyclical memory. Sampling frequency is 32 samples per cycle. The records are saved for at least 27 days in the event of a sustained loss of auxiliary power.

Recordable values include analog signal metering, digital inputs and internal signals generated by the protection functions and the logic control units.

IEDs are supplied with a complete display and analysis software package that allows the waveform records to be converted to COMTRADE format.

Metering Logs

Up to twelve minimum and maximum values will be stored for each selected quantity in the metering logs (captured or calculated) for each time slot. Time slot resolution can be adjusted to the needs of the application by configuring day and recording intervals. Up to 168 records can be stored.

Additional Functions

Integrated Simulator

ZLV models include a special test and simulation mode that allows operations to be simulated using waveforms loaded in via the front-panel communications port without unwiring the analog magnitudes of the associate position.

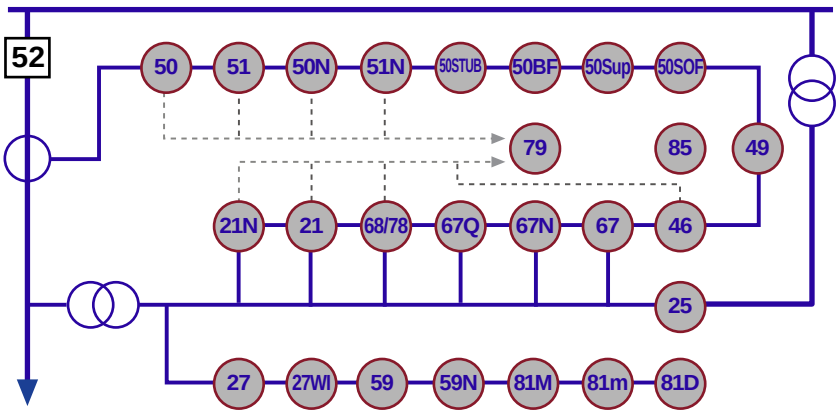
Time Synchronization

The IEDs include an internal clock with a resolution of 1 ms. This can be synchronized via GPS (IRIG-B protocol) or by communications through the remote communications port (DNP3 or other protocols).

- **Operator Interface consisting of Alphanumeric Display and Keypad.**
- **4 Selectable Setting Groups.**
- **Programmable Push-buttons (6) for Control Operations.**
- **4 LED Targets.**
- **Configurable Digital Inputs (quantity depends on the concrete model).**
- **Configurable Auxiliary Outputs (valid all for maneuver) (quantity depends on the concrete model).**
- **4 Solid State Fast Outputs (Teleprotection).**

Application

ZLV IEDs can be used as primary or secondary protection in transmission or subtransmission networks, in underground lines, overhead lines or mixed lines of different characteristics: unbalance loads, one or multiple source, parallel circuits, with or without series compensation, etc. They are designed for applications with single- or three-phase trips and can be used with or without teleprotection schemes.



Virtual Digital Net

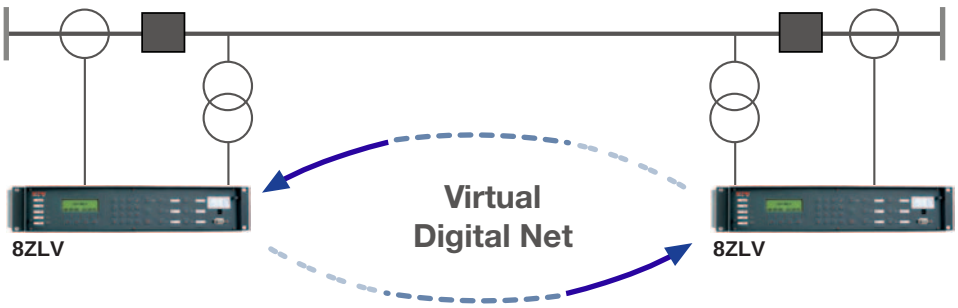
Virtual Inputs and Outputs communications allow the bidirectional transmission up to 16 digital signals and 16 analogs between two **ZLV** IED connected through a digital communication system.

One of the main application of the digital inputs and outputs communication is teh optimization of protection schemes:

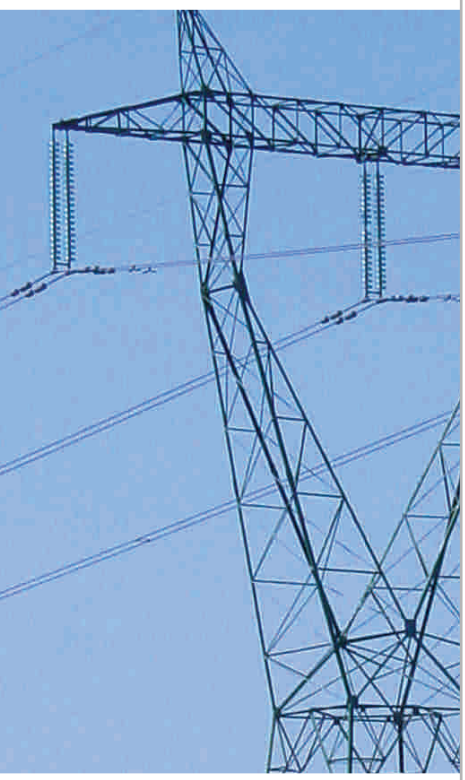
· Reduce transfer times between ends.

· Allows phases segregate transmission, necessary to clear simultaneous single-phase faults correctly in parallel lines (cross-country faults)

· Provide a better flexibility to programm new schemes.



Optimization of teleprotection schemes is one of the main application of the Virtual Digital Net.

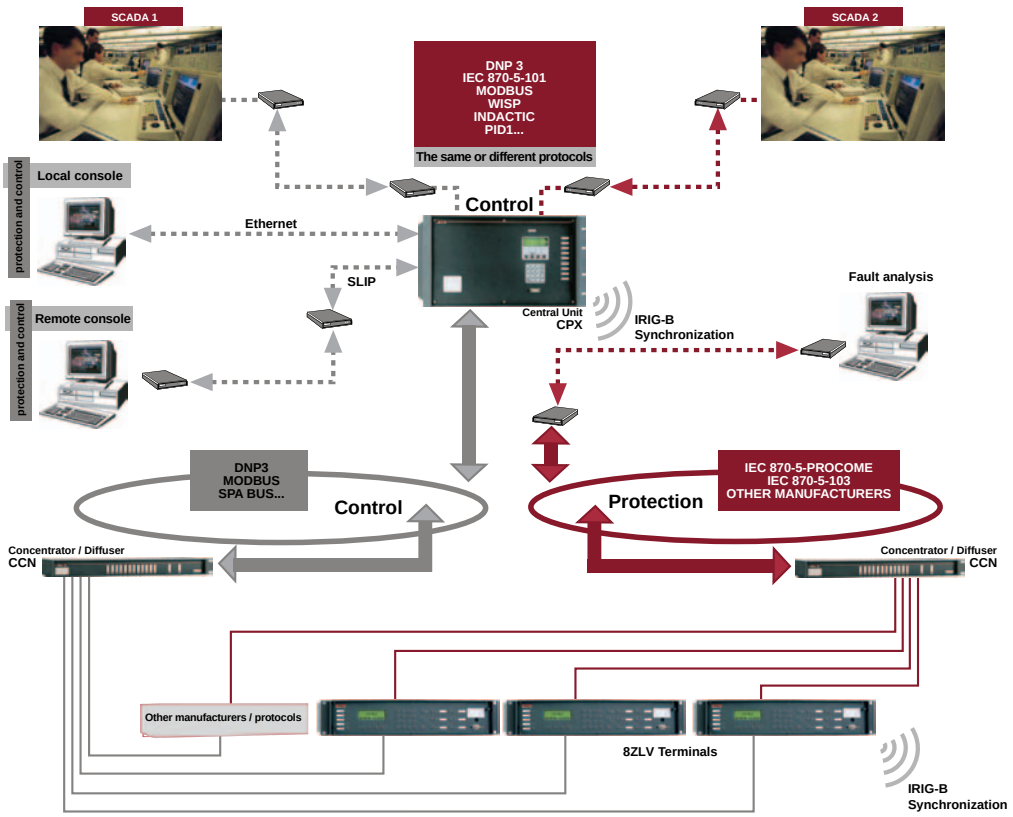


ZLV units are designed to work best as part of an integrated protection and control system.

Application

ZLV units are designed to work best as part of an integrated protection and control system, although their performance and use offers significant advantages when they are used as stand-alone components of conventional protection systems.

Due to their flexible communications structure, **ZLV** units provide great versatility when applied to distributed integrated protection and control systems.



One or two networks, depending on the protocol and the application:

- **Fiber Optic (glass / plastic) / RS232 / RS485**
- **Asynchronous serial links, 38,400 Bps (database refresh period: 0.5s)**
- **Star Topology / Switches**
- **Double ring**

Each unit has two remote communications ports. Dual ports are intended for applications with separated protection and control networks.

Each port is connected to the associated network, providing independent control for each subsystem from the higher levels of the system.

This architecture enables to integrate the **ZLV** in different communication networks running different protocols. The IED simultaneously supports multiple protocols.

Human-Machine Interface

The operator interface (HMI) allows flexible configuration. The HMI includes an alphanumeric display (4 rows of 20 characters each) with a keypad that can be used to interact with the IED.

Alphanumeric Display

This interface provides the following operations:

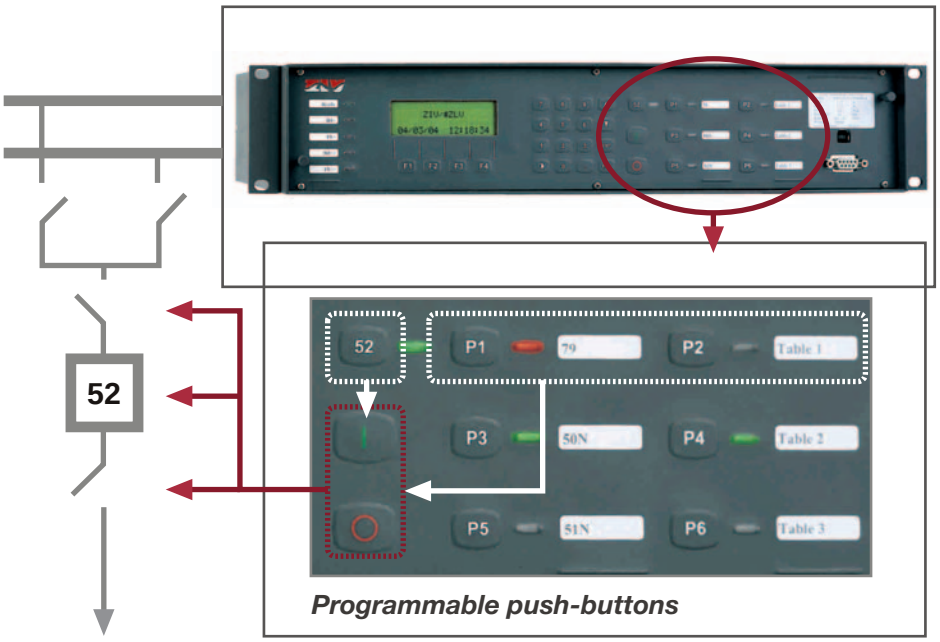
- Viewing and modifying settings.
- Viewing all captured and calculated metering values.
- Control operations.
- Changing setting groups.
- Data queries.
- Consulting events of any protocol configured for this purpose.

Programmable Buttons

The front panel has three columns of buttons for control operations on the system's elements (breaker control, fan control, motor operated sectionalizing switches, programmable control functions, local/remote, etc.).

These push-buttons allow local control of substation apparatuses or IED functions, and six of them are fully programmable. Each of these push-buttons has an associated LED indicator to display the state of the element associated with the button.

One of the buttons can be configured to reset the IED's operation LED targets. The push-button group has a general blocking function that can be configured from the HMI or via the communications ports providing the security required for proper operation.



Local control of the breaker (52) and the disconnecting switches (89) from the 8ZLV

The push-button control system provides the operator with simple, fast controls for the bay.

Communications

All **ZLV** IEDs include two communications ports on the rear panel for remote access, plus a front panel port for local access.

All **ZLV** models have three simultaneous communication protocols: PROCOME, MODBUS and DNP3.

PROCOME protocol complies with the IEC 870-5 series of standards and is used for both protection and control data. DNP3 and MODBUS protocols are used exclusively to communicate control data.

All of these three communications ports can be used simultaneously, with independently selectable baud rates up to 38.400 Bps.

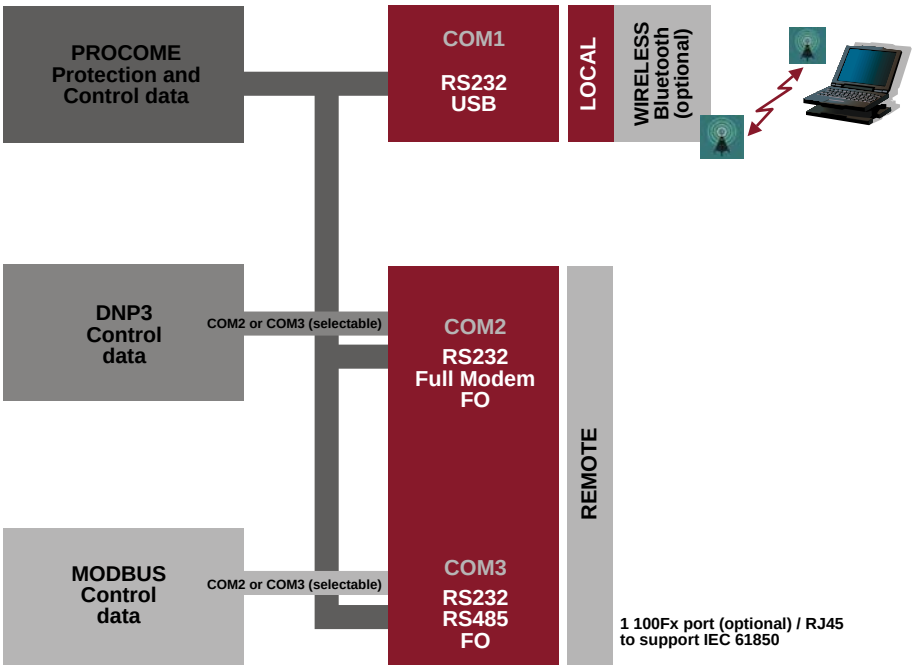
Some models can optionally include a 100 FX port (Ethernet over optic fiber) and RJ45 port, as physical support for the IEC 61850 / UCA 2.0. This protocol allows interchange of data of all types, both with the higher hierarchical levels and with other IEDs. Moreover, it is based on accepted open standards (Ethernet) and supports self-description.

Ports
- Front panel (COM1) local communications.
- Rear panel P1 (COM2) remote communications.
- Rear panel P2 (COM3) remote communications.

Protocol
- PROCOME
- DNP3
- MODBUS

Physical interface
- RS232
- USB
- RS232 Full Modem
- RS232-RS485
- Glass Optic Fiber
- Plastic Optic Fiber

Local and remote communications ports can be used simultaneously.



Construction

ZLV units are designed for mounting in 19" racks, and are two, three or four units high (depending on the number of analog inputs and digital inputs/outputs).

The electronic cards, or modules, are mounted horizontally and can be extracted by removing the front panel. External connections use plug-in terminal blocks on the rear panel of the enclosure, with ring lug connectors.

The enclosure is provided with a ground terminal. It is essential that this terminal be properly connected to the substation ground to enable correct operation of the filters that protect the IED from external electromagnetic disturbances.

Placement and design of the terminal blocks and ports allow easy, reliable connection of the IED.

Voltage and current analog inputs

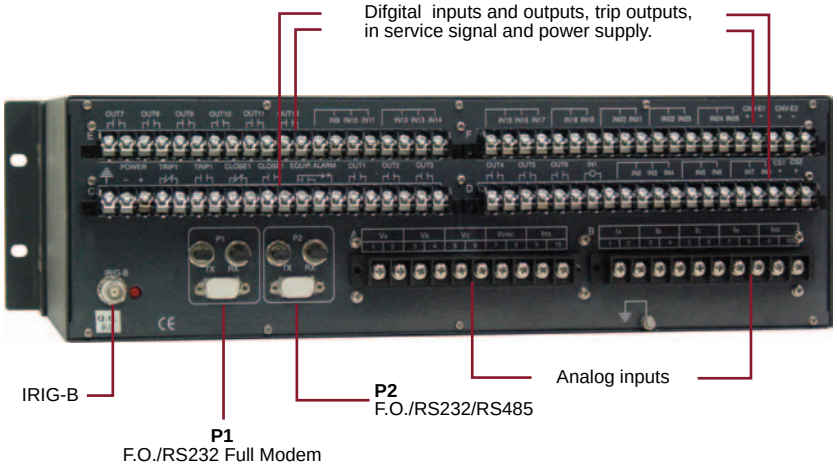
The units include up to 10 analog inputs divided into two non self-shorting ring lug terminal blocks. Connectors accept lugs for wires up to AWG 12 (6 mm^2).

Contact inputs and outputs

Two-unit high models have 10 status contact inputs, 10 digital outputs and one in-service output. The connectors accept ring lug terminals. Connectors accept lugs for AWG wires 17 to 13 (1 to 2.5 mm^2).

Additional digital inputs and outputs are available in the three-unit high models with 22 inputs and 23 outputs (4 of which are fast) or in the four-unit high models with 34 inputs and 36 outputs (4 of which are fast).

All the outputs from the IED are robust. Therefore, any of them can be used as switching output (open or close).



The image shows the rear panel of a 3 unit high ZLV

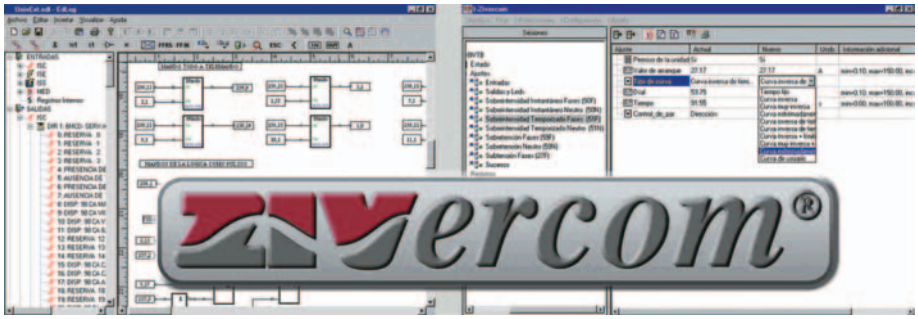
Available digital inputs and outputs:

2 U high models:
- 10 digital inputs
- 10 digital outputs

3 U high models:
- 22 digital inputs
- 23 digital outputs

4 U high models:
- 34 digital inputs
- 36 digital outputs

3ZLV



Programming Tools

The Zivercom® communication software package provides an user-friendly interface for all of the necessary parameter setting operations and for accessing the data recorded by the equipment. The program can be installed and used on a PC with any of the following operating systems: Windows® 95, Windows 98, Windows 2000 or Windows XP.

The program allows to perform the following functions via serial communications (RS232 or USB) between the IED and a PC:

- Upload or download settings.
- Edit settings.
- Store settings for future editing.
- Information retrieval.
- Synchronize with PC date and time.
- Retrieval, display and storage of the logs generated by the equipment.
- Load configuration files that define the configurable parameters of the equipment.
- Retrieve configuration files from the **ZLV**.
- Update the IED firmware.

Off-line programming is available for the following tasks:

- Edit settings files.
- Program digital inputs, auxiliary outputs and targets.
- Edit logic functions via graphical user interface.
- Define signals to be recorded in the event log and the metering quantities to be stored with these records.
- Define the signals to be stored in the oscillographs.
- Define the display names of the configurations.
- Define the signals to be transmitted over the communications protocols.
- Convert retrieved oscillographs to COMTRADE format.

The software includes an oscillography display and analysis tool that can use waveforms captured by the IED. It can also import and display data files in COMTRADE format created by other manufacturers' IEDs.

Information retrieval:

Captured and calculated metering.
Contact input status.
State of the auxiliary and control outputs: trip and close.
State of the protection modules.
State of the signals used by the internally programmed logic functions.
State of the self-test functions.

Retrieval, display and storage of the logs generated by the equipment:

Sequence of events.
Fault reports.
Oscillography.
Metering logs.

Zivercom® software package allows easy definition of logical control functions.

Settings

Protection Settings

Distance Protection

Line properties

Positive sequence magnitude (zone 1)	0.01 - 100 Ω
Positive sequence angle	5 - 90º
Zero seq. angle (zones 1 to 4)	5 - 90º
K0 Factor (zones 1 to 4)	0.5 - 8.00

Fault locator

Line length	0.00 - 400.00
Line length units	Km / Miles
Fault locator units	Length units or % of length
Permanent indication	YES / NO
Fixed time indication	1 - 120 min
Mutual coupled compensation permission	YES / NO

Local/ remote source impedance

Positive/zero seq. magnitude	0.01 - 50.00 Ω
Positive/zero sequence angle	5 - 90º

Equivalent parallel impedance

Positive/zero seq. magnitude	0.01 - 10.000 Ω
Positive/zero sequence angle	5 - 90º

Ground distance characteristic / between phases

Unit type:
Quadrilateral / Mho / Quadrilateral and Mho

Directional unit characteristic unit quadrilateral characteristic 0 - 90º

Distance Zone 1

Direction	Forward / Reverse
Reach[1]	0.01 - 100.00 Ω
Resistive limit (ground fault / phase fault)	0.01 - 100.00 Ω
Compensation Time	0.00 - 0.50 s

Distance Zones 2 / 3 / 4

Direction	Forward / Reverse
Reach[1]	0.01 - 100.00 Ω
Resistive limit (ground fault / phase fault)	0.01 - 100.00 Ω
Time (ground fault)	0.00 - 300.00 s
Time (phase fault)	0.00 - 300.00 s

Supervision elements

Forward supervision	
Single-phase element pickup	0.20 - 7.50 A
Two-phase element pickup	0.20 - 7.50 A
Reverse supervision	
Single-phase element pickup	0.20 - 7.50 A
Two-phase element pickup	0.20 - 7.50 A

Load limiters

Resistive limit zone right/left	0.1 - 100 Ω
Zone angle right/left	0 - 90º

Distance Protection

Protection scheme (distance units)

See schemes on page 4

Overreach zone	Zone 2 / Zone 3
Open 52 send carrier permission[2]	YES / NO
Carrier time	0 - 200 ms
Coord. time (dist. scheme)	0 - 50 ms
ZUND on blocking scheme	0 - 200 ms
Zone 1 extension inh. time	0.05 - 300.00 s
Carrier reception security time[2]	0 - 50 ms

Weak infeed

Logical output
None / Echo / Echo+Trip

Voltage level[2]	15.00 - 70.00 V
Trip blocking by AD due to fuse fail[2]	YES / NO

Current Protection

Directional units

Characteristic angle (phase / ground / negative sequence)	0º - 90º
Blocking due to lack of polarization	YES / NO
Min. voltage (phase / ground / negative sequence)	0.05 - 10 V
Ground / negative sequence voltage compensation factor	0.00 - 50

Phase time overcurrent

Pickup	0.02 - 25 In
Time curve	IEC/IEEE/US
Time curve index (IEC)	0.05 - 1
Time curve index (IEEE/US)	0.1 - 10
Fixed time characteristic	0.05 - 300 s
Torque control (enable pickup blocking)	0: Non-directional 1: Directional 2: Reverse directional
Torque control type	0: Phase directional unit 1: Zone 2

Ground time overcurrent

Pickup	0.02 - 25 In
Time curve	IEC/IEEE/US
Time curve index (IEC)	0.05 - 1
Time curve index (IEEE/US)	0.1 - 10
Fixed time characteristic	0.05 - 300 s
Torque control (enable pickup blocking)	0: Non-directional 1: Directional 2: Reverse directional
Torque control type	0: Ground dir. unit 1: Negative seq. dir. unit 2: Ground Zone 2

1) Different zones setting will be considered depending on the next inequality:
3.9×10^{-3} (reach_Z1) < reach_Z2 < 127 (reach_Z1)
3.9×10^{-3} (reach_Z1) < reach_Z3 < 127 (reach_Z1)
3.9×10^{-3} (reach_Z1) < reach_Z4 < 127 (reach_Z1)

2) Common for distance and overcurrent schemes.

Available Curves

IEC Curves
Inverse curve
Very inverse curve
Extremely inverse curve
Long-term inverse curve
Short-term inverse curve
Inverse curve + time limit
Very inverse curve + time limit
Extremely inverse curve + time limit
Long-term inverse curve + time limit
Short-term inverse curve + time limit

IEEE / ANSI Curves
Moderately inverse curve
Very inverse curve
Extremely inverse curve
Moderately inverse curve + time limit
Very inverse curve + time limit
Extremely inverse curve + time limit

US Curves
Moderately inverse curve
Inverse curve
Very inverse curve
Extremely inverse curve
Short-term inverse curve
Moderately inverse curve + time limit
Inverse curve + time limit
Very inverse curve + time limit
Extremely inverse curve + time limit
Short-term inverse curve + time limit

RI inverse Curve

Protection Schemes (Distance Units)

Step distance.
Zone 1 extension.
Permissive underreach transfer trip.
Direct transfer trip.
Permissive overreach transfer trip.
Directional comparison unblocking.
Directional comparison blocking.

Protection Schemes (Ground Overcurrent)

None.
Permissive underreach.
Direct transfer trip.
Permissive overreach.
Directional comparison unblocking.
Directional comparison blocking.

Settings

Protection Settings

Current Protection

Negative Sequence Time Overcurrent

Pickup	0.1 - 5.0 In
Time curve[3]	IEC/IEEE/US
Time curve index (IEC)	0.05 - 1
Time curve index (IEEE/US)	0.1 - 10
Fixed time characteristic	0.05 - 300 s
Torque control (enable pickup blocking)	0: Non-directional 1: Directional 2: Reverse directional
Torque control type	0: Negative seq. dir. unit 1: Zone 2

Phase Instantaneous Overcurrent

Pickup	0.01 - 30 In
Time	0 - 300 s
Torque control (enable pickup blocking)	0: Non-directional 1: Directional 2: Reverse directional
Torque control type	0: Phase directional unit 1: Zone 2

Ground Instantaneous Overcurrent

Pickup	0.01 - 30 In
Time	0 - 300 s
Torque control (enable pickup blocking)	0: Non-directional 1: Directional 2: Reverse directional
Torque control type	0: Ground dir. unit 1: Negative seq. dir. unit 2: Ground zone 2

Negative Sequence Inst. Overcurrent

Pickup	0.01 - 30 In
Time	0 - 300 s
Torque control (enable pickup blocking)	0: Non-directional 1: Directional 2: Reverse directional
Torque control type	0: Negative seq. dir. unit 1: Zone 2

Protection Schemes (Ground Overcurrent)

See side schemes

Carrier time	0 - 200 ms
Coordination time (overcurrent scheme)	0 - 50 ms
Level 2 delay time on blocking schemes	0 - 200 ms

Weak Infeed

Logical output
None / Echo / Echo + Trip

Voltage Protection

Phase overvoltage / undervoltage

Pickup	20 - 300 V
Time	0 - 300 s
Output Logic	OR / AND

Ground overvoltage

Pickup	2 - 150 V
Time	0 - 300 s

Frequency Protection

Common settings

Inhibition for min. voltage	20 - 150 V
Activation time	3-30 half-waves
Reset time	0 - 10 cycles

Overfrequency / underfrequency

Pickup	40 - 70 Hz
Time	0.00 - 300 s
Reset time	0.00 - 300 s

Rate of change

Pickup frequency	40 - 70 Hz
Rate of change pickup	0.5 - 10.00 Hz/s
Time	0.00 - 300 s
Reset time	0.00 - 300 s

Recloser Start Enable

Units enable (YES / NO):
Zone 1; zone 2; zone 3; zone 4 units.
Open phase detector.
Remote breaker open detector.
Phase instantaneous / time overcurrent.
Ground instantaneous / time overcurrent.
Negative sequence inst. / time overcurrent.

Recloser Sequence Control

Reclosing mode
1p; 3p; 1p/3p; Dependent Mode

Number of reclose attempts	1 - 3
Recloser timers:	
1st single-phase reclosing	0.05 - 300 s
1st three-phase reclosing	0.05 - 300 s
2nd/ 3rd reclosing	0.05 - 300 s
Sequence check (start) time	0,07 - 0,60 s
Reset time	0,05 - 300 s
Manual close reset time	0,05 - 300 s
Synchronism check time	0,05 - 300 s

Synchronism Check Supervision

Synchronism check supervision enable[4]	YES / NO
Synchronism check supervision wait enable[4]	YES / NO

3) See available curves on page 15.

4) First / Second / Third reclose attempt supervision.

Settings

Protection Logic

Three-phase trip	YES / NO
Ground overcurrent single phase trip	YES / NO
Enable (YES / NO) zones 1 / 2 / 3 / 4 elements trip[5]	Phase fault elements Ground fault elements
Block tripping (YES / NO) by Out-of-step detector	
Zone 1 / Zone 2 / Zone 3 / Protection Scheme	

Breaker Monitor Settings

Excessive number of trips	1 - 40
I square sum alarm	0-99,999.99kA^2
Cumulative preset value I2	0-99,999.99kA^2
Trip coil monitoring 1 / 2 / 3 / 4 / 5 / 6	
0: Do not monitor	
1: Monitor both states (open and closed)	
2: Monitor one state	
Time to give coil failure trip 1 / 2 / 3 / 4 / 5 / 6	1 - 60 s
Pole discordance time	1 - 50 s

Oscillography Settings

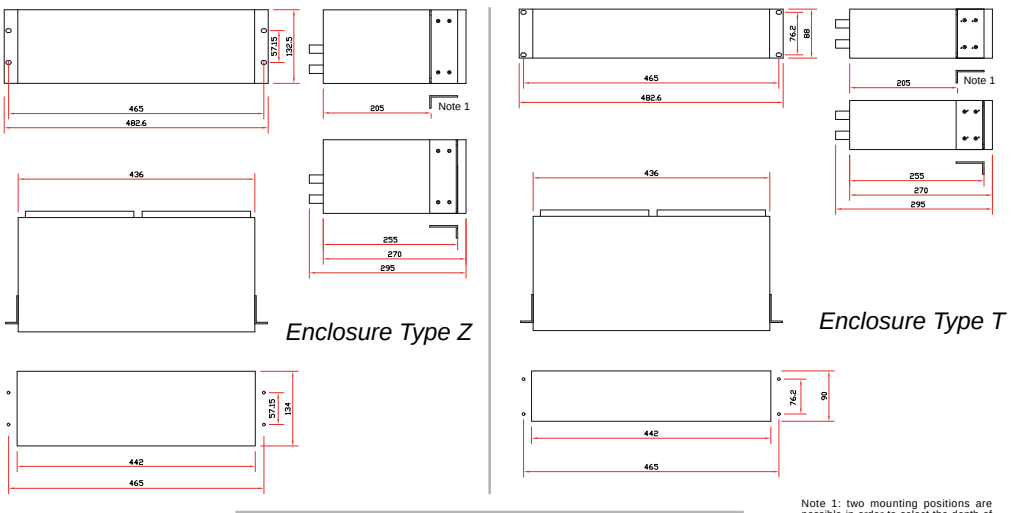
Trip required	YES / NO
Concatenation	YES / NO
Pre-trigger length	0 - 25 cycles
Oscillography record length	5 - 725 cycles
Digital channel select	
Selectable from among all the user-definable digital inputs and status contact input signals	
Start function (YES / NO)[6]:	
Distance elements	
Fase fault elements (zones 1, 2, 3 and 4)	
Ground fault elements (zones 1, 2, 3 and 4)	
Auxiliary units	

Log

Averaging calculation time interval	1-15 min
Logging interval	1min - 24.00 h
Day calendar mask	Monday throungh Sunday
Hour range	0 - 24.00 h

Dimensions

Type T, Z and Q enclosures
Measurements in mm.
Mounting holes 8 mm.

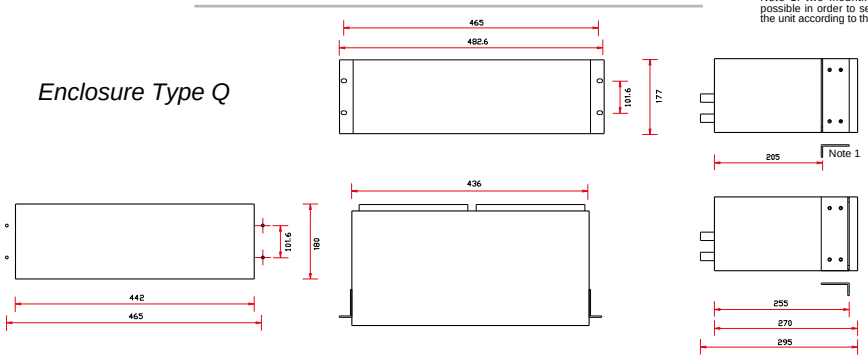


Enclosure Type Z

Enclosure Type T

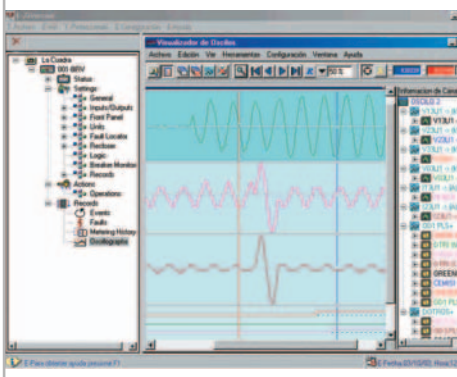
Note 1: two mounting positions are possible in order to select the depth of the unit according to the cabinet.

Enclosure Type Q



5) Independent for each zone.

6) Independent for each protection unit.



Technical Assistance

High-quality local technical service is available to customers worldwide, either from our own personnel (in Spain, Brazil and the USA) or from our extensive network of local collaborators in other countries.

Several round-the-clock help services are available (24 hours/day, 365 days/year) for immediate attention.

Servicio de Asistencia Permanente
(91) 352 80 30
24h durante 365 días al año

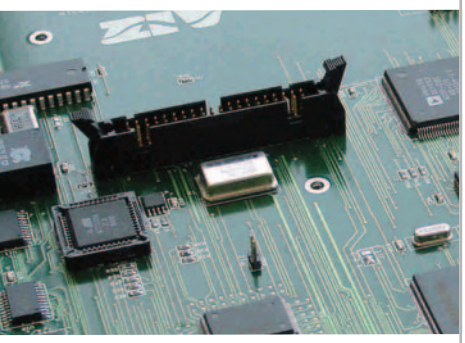
24 h. service in Spain and Europe

Assistência Técnica Permanente
(021) 2719 3388
24h durante 365 dias ao ano

24 h. service in Brazil and South America

Technical Assistance Around the Clock
(877) ZIV-USA 1
24 hours 365 days

24 h. service in the USA and Canada



Warranty

All new products sold to customers are warranted against defects in design, materials, and workmanship for a period of ten (10) years from the time of delivery. Contact p+c for complete details.

Quality

p+c is an **ISO 9001** Certified Company.

p+c is firmly committed to a Plan for Continuous Improvement within the framework of a policy of Total Quality that covers all stages from feasibility studies through commissioning of the complete system.

Technical Characteristics

Auxiliary Voltage

Ranges	24 Vdc/Vac (± 20%) 48–250 Vdc/Vac (± 10%)
Current drain	< 20 W

Voltage Inputs

Rated value (Vn)	50 - 150 Vac (selectable)
Thermal withstand capability	300Vac (continuously) 600Vac (for 10 s)
Voltage circuit burden	0.55 VA (110/120 Vac)

Current Inputs (phases, ground current of offset line and for polarization)

Rated value	1 A / 5 A (selectable) (phases / ground)
Thermal withstand capability	20 A (continuously) 250 A (for 3 s) 500 A (for 1 s)
Dynamic limit	1250 A
Current circuit burden	< 0.2 VA (In = 5 A or 1 A)

Frequency

Operating range	15 - 80 Hz

Repeatability

Operating Time	2% or 25 ms (the greater)

Transient Overreach

Expresado como: $ST = \frac{I_A - I_T}{I_A} \times 100$

<10% for totally inductive lines
<5% for lines with an impedance angle of 70º

I_A = Pickup value for a current with no dc component.
I_T = Pickup value for a current with maximum dc offset.

Outputs

I (DC) maximum limit (*)	60A (1 s)
I (DC) continuous service (*)	16A
Close	5000 W
Breaking capability (*)	200W (48Vdc) 110W (110Vdc) 2500 VA
Break (L/R = 0.04 s)	120W to 125Vdc
Switching voltage	250 Vdc
Momentary close time trip contacts remain closed	100 ms

Measurement Accuracy

Measured currents (phases, ground current of offset line and for polarization)	
In = 1A and 5A	±0.1% or ±2mA (the greater)
Calculated currents (IN, I_1, I_2 and I_0)	
In = 1A and 5A	±0.3% or ±8mA (the greater)
Measured voltages (phase-ground, ground and synchronism)	±0.1% or ±50mV (the greater)
Calculated voltages	
Phase-phase and ground	±0.2% or ±75mV (the greater)
V_1, V_2 and V_0	±0.3% or ±100mV (the greater)
Active and reactive powers (In = 5A and phase currents >1A)	
±0.3%	0º or ±90º or 180º
±1%	±45º or ±135º
±5% / 0.5%	±75º / ±115º
Angles	±0.4º
Power factor	±0.01
Frequency	±0.005Hz

Accuracy of the Pickup and Reset (Overcurrent Elements)

Pickup and reset (of the setting)	
In = 5A	±3% or ±50mA (the greater)
In = 1A	±3% or ±10mA (the greater)
Measuring times (of the setting)	
Fixed time characteristic	±1% or ±20ms (the greater)
Inverse time	Class 2 (E = 2) (UNE21-136; IEC 255; ANSI C37.60)

Digital inputs

Programmable digital inputs, with polarity (IN1: AC / IN2 to IN8 or to IN25: DC)

Rated voltage	Maximum V.	Burden	V on	V off
110/125 Vac	250 Vac	350 mW	85 Vac	51 Vac
24 Vdc	48 Vdc	200 mW	15 Vdc	12 Vdc
48 V	90 Vdc	500 mW	30 Vdc	25 Vdc
125 Vdc	300 Vdc	800 mW	70 Vdc	65 Vdc
250 Vdc	500 Vdc	1 W	120 Vdc	115 Vdc

(*) With resistive load.

Model Selection

Use this table to select the most suitable model for your application:

8ZLV

Functions	Code
21(3Φ) + 79 + 25 + 3x(3x27) + 3x(3x59) + 2x59N + 3x(3x67-3x50/51) + 3x(67N-50N/51N) + 3x(67Q-50Q/51Q) + 27WI + 3x81M + 3x81m + 3x81D + 49 + 68/78 + 46 + 50Sup + 50STUB + 85 + 50FI + 6x3 + 2 + FL + OSC	A
21(1Φ/3Φ) + 79 + 25 + 3x(3x27) + 3x(3x59) + 2x59N + 3x(3x67-3x50/51) + 3x(67N-50N/51N) + 3x(67Q-50Q/51Q) + 27WI + 3x81M + 3x81m + 3x81D + 49 + 68/78 + 46 + 50Sup + 50STUB + 85 + 50FI(1Φ/3Φ) + 6x3 + 2 + FL+ OSC	B
A + (25 + 79 + 50BF) and HW for breaker and a half (1)	C
B + (25 + 79 + 50BF) and HW for breaker and a half (1)	D

Options	Code
Standar model	1
Ports 100FX - Ethernet F.O. (MT-RJ) and RJ45 (2)	2
Ports 100FX - 2x RJ45 (IEC 61850 / UCA 2.0) (2)	3

Rated values	Code
1A / 5A and 50Hz / 60Hz	N

Power supply voltage	Code
24 Vdc / Vca (±20%)	1
48 - 250 Vdc / Vca (±10%)	2

Voltage of the digital status contact inputs	Code
24 Vdc	0
48 Vdc	1
125 Vdc	2
250 Vdc	3

Ports			Code
COM1 (LOC)	+ COM2 (REM - P1)	+ COM3 (REM - P2)	
RS-232+USB	RS-232/FOP	RS232/RS485/FOC	1
RS-232+USB	RS-232/FOP	RS232/RS485/FOP	2
RS-232+USB	RS-232/FOC	RS232/RS485/FOP	3
RS-232+USB	RS-232/FOC	RS232/RS485/FOC	4
RS232+USB	RS232	RS232/RS485	5

Number of inputs and outputs (3)	Code
Basic model (10 DI / 10 DO) (only model A)	0
Standar model (22 DI / 23 DO)	1
Ampliated model (34 DI / 36 DO)	2
Special model (25 DI / 31 DO) (only C and D models)	3

Spare	Code
As default	00

Enclosure	Code
2U	T
3U	Z
4U	Q

Protocols			Code
COM1 (LOCAL)	+ COM2 (REM)	+ COM3 (REM)	
PROCOME	PROCOME/DNP3.0	PROCOME/MODBUS	A

Finishing	Code
Stainless steel + printed circuit board not tropicalized	--
Stainless steel + tropicalized printed circuit board	L

Vertical construction to be ordered as: 3ZLV-□□N-□□□□□□□□□

(1) Only for 4U mounted.
(2) Incompatible with options 1, 2, 3, 4 of communications.
(3) Close and trip outputs included.

Standards and Type Tests

Insulation Test
Between circuits and ground: 2 kV at 50/60 Hz for 1 min
Between independent circuits: 2 kV at 50/60 Hz for 1 min

Voltage Impulse Test IEC-60255-5 (UNE 21-136-83/5)
5 kV; 1.2/50 µs; 0.5 J

Surge Immunity Test IEC-61000-4-5 (UNE 61000-4-5)
Between conductors: 4 kV
Between conductors and ground: 4 kV

1 MHz Burst Test
IEC-60255-22-1 Class III (UNE 21-136-92/22-1)
Common mode: 2.5 kV
Differential mode: 2.5 kV

Fast Transient Disturbance Test
IEC-60255-22-4 Class IV (UNE 21-136-92/22-4)
(IEC 61000-4-4)
4 kV ±10%

Radiated Electromagnetic Field Disturbance

Amplitude-modulated (EN 50140): 10 V/m
Pulse modulated (EN 50204): 10 V/m

Conducted Electromagnetic Field Disturbance
EN50141 Clas III
Amplitude-modulated: 10 V

Electrostatic Discharge Test
IEC-60255-22-2 Class IV (UNE 21-136-92/22-2)
(IEC 61000-4-2)
On contacts: ±8 Kv ±10 %
In air: ±15Kv ±10 %

Temperature
Operating temperature range: -40º C to +85º C
Storage temperature range: -40º C to +85º C
Humidity: 95% (non-condensing)

Power Supply Interference and Ripple
IEC 60255-11 / UNE 21-136-83
< 20%

Resistance of Ground Connection IEC 1131-2
< 0.1Ω

Inverse Polarity of Power Supply IEC 61131-2

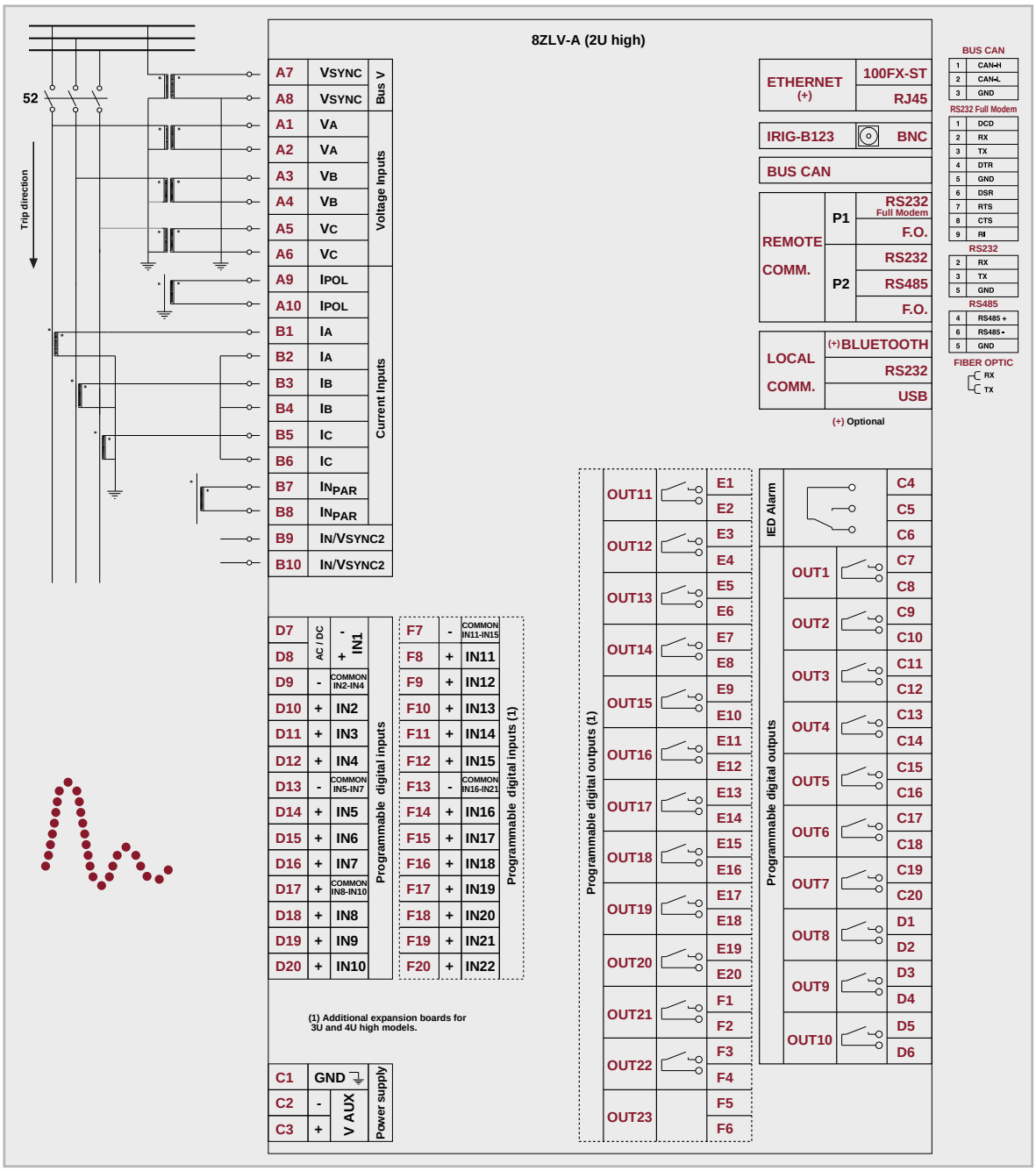
External Protection Level

Vibrations (sinusoidal) IEC 60255-21-1 Class I
Mechanical Shock IEC 60255-21-2 Class I

8ZLV models conform with the Directive 89/336/EEC Electromagnetic Compatibility.

CE

External Connections



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