



*Protection for two breakers and complex substation busbar schemes.*

#### Features and Benefits

- IRIG-B time synchronization
- User configurable internal logic

#### Applications

- Complex substation busbar schemes
- Protection for two breakers

#### Protection and Control

- Undervoltage
- Voltage absence
- Voltage presence
- Weak infeed
- Closing/reclosing permission
- Synchronism checking
- 3 settings tables
- Configurable inputs and outputs

#### Monitoring and Metering

- Three-phase line voltage, busbars  
1 & 2 voltage measurement
- Associated line selector switch status
- Optical signalling with 17 LED indicators
- Event recording
- Oscillographic record
- Self-check

#### User Interfaces

- RS232 port, faceplate accessible
- RS232/fiber optic/RS485 ports, rear accessible (see model list)
- HMI with keypad and alphanumeric display
- Windows® based GE-INTRO configuration, GE-LOCAL communications, and GE-OSC oscillography analysis software (part of GE-NESIS)



## Description

The MOV is a digital multifunction protective relay that provides undervoltage, voltage absence, voltage presence, and closing and reclosing permission functions for two breakers. It offers a great flexibility of configuration for the definition of inputs, outputs and internal logics. The MOV includes analysis functions, such as event recording, oscillography recording, and an alarms panel.

In complex substation busbar schemes such as double busbar and breaker and a half, there is a need for special breaker closing logics. These logics involve several previous requirements, such as interlockings between disconnector switches and breakers, voltage checking, etc. All this associated logic, as well as the closing and opening commands, are traditionally performed by means of relays and auxiliary measuring elements, which can involve a great complexity, requiring an intensive use of these auxiliary units.

The MOV provides the ideal replacement for all this associated logic, at a sensibly smaller

cost. Besides, it offers the advantage of being adaptable to all further modifications of the Substation, without the need to change the hardware elements and the associated wiring, as the internal programmable logic provides great versatility with an important reduction in Engineering, Installation and Equipment Supervision costs.

## Protection

The available protection functions are:

### Undervoltage

Undervoltage on both sides of the side breaker (function A). The MOV detects undervoltage on both sides of the side breaker during a selectable time period. It monitors the Busbar voltage (V1) and the line voltage values (V3, V4, V5) or V2, depending on the status of the line disconnector switch. The operation of this function allows the side breaker to trip and signal undervoltage to the control system.

Undervoltage on both sides of the central breaker (function A'). The MOV detects undervoltage on the line side associated to the

central breaker. In order to monitor undervoltage on both sides of the central breaker, this function has to be ANDed with function A' of the MOV relay protecting the other two breakers (contacts in series).

### Voltage Absence

Voltage absence on the line (function B). This function detects voltage absence on the line in order to allow a line grounding operation.

Voltage absence on any side of the side breaker (function C). This function detects the voltage absence on any side of the side breaker, in order to allow the side breaker closing, when the remote connection cannot operate, due to the lack of voltage. This function can be used for emergency closing.

Voltage absence on the line side of the central breaker (function D). This function detects the voltage absence on the line side of the central breaker. Voltage absence on any side of the central breaker can be detected by parallel connecting the operation of both MOVs protecting the breaker. The use of this function is the same as function C, but for the central breaker.

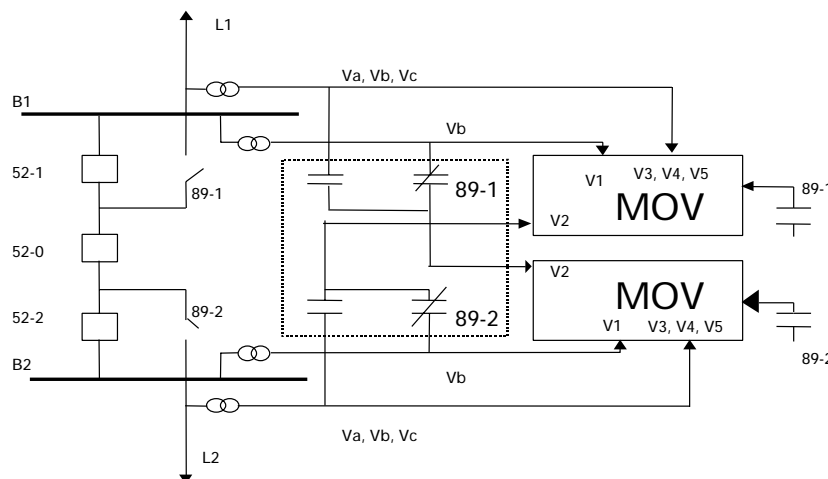
### Voltage Presence

Voltage presence on both sides of the side breaker (function E). This function detects the voltage presence on both sides of the side breaker. It is used for signaling this situation to the control system and the remote connection.

Voltage presence on the line side of the central breaker (function F). This function detects the voltage presence on both sides of the central breaker, by series connecting the operations of both MOVs protecting the breaker and a half scheme. It is used for sending a signal to the control system and the remote connection.

Voltage presence on any side of

## Functional Block Diagram



the side breaker (function J). This function detects voltage presence on any side of the side breaker. It can be used for conditioning the undervoltage trip to voltage presence. This allows the breaker to close when there is no voltage (voltage absence) avoiding an undervoltage trip afterwards.

**Weak Infeed**

Weak Infeed on the line (functions G, H and I). These functions detect weak infeed condition on each phase of the line. These functions are required by some protection units for applying weak infeed logics.

**Closing/Reclosing Permission**

Closing permission for the side breaker (only MOV2). This function allows supervision of the manual closing of the side breaker for DL-DB, LL-DB, DL-LB and/or Synchronism check conditions. In order to verify synchronism differences of voltage Module, Phase and Frequency are checked. The BUS side is V1, independently of the position of the line disconnecter switch. The LINE side refers to (V3, V4, V5) or (V2) voltages, depending on the status of the switch (89).

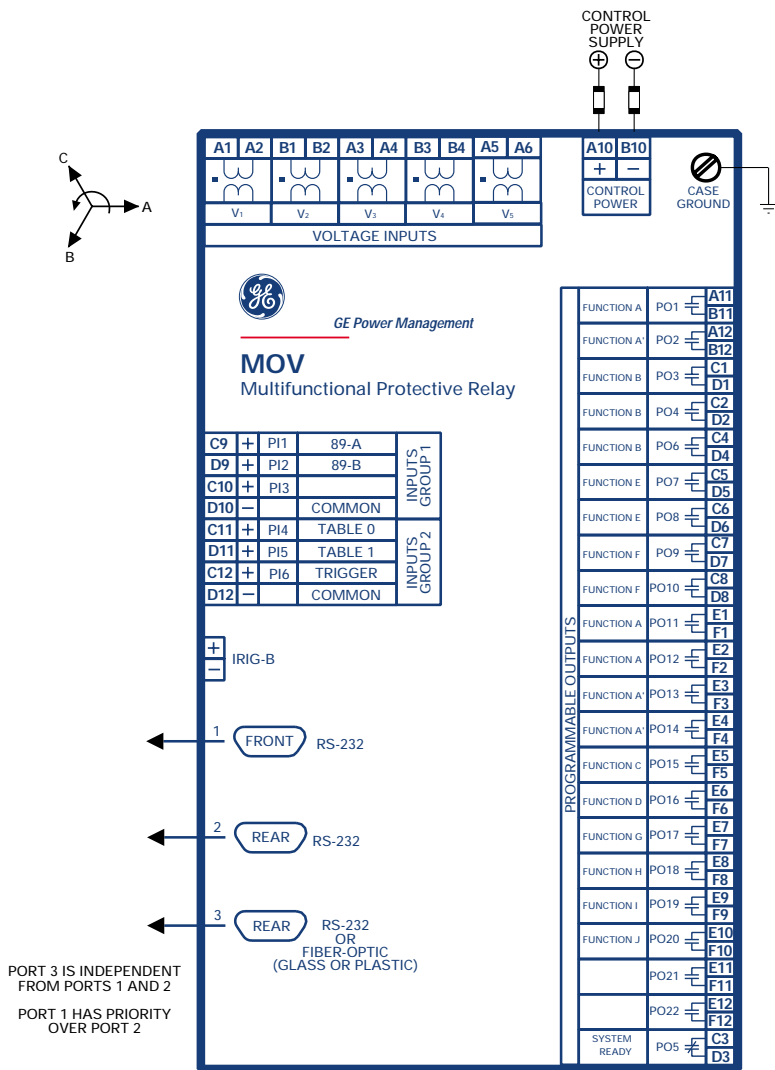
Reclosing permission for the Side breaker (only MOV2). This function allows supervision of the

Side breaker reclosing for the following conditions DL-DB, LL-DB, DL-LB, and/or Synchronism check.

Closing Permission for the Central Breaker (only MOV2). This function allows supervision of the Central Breaker manual closing for the following conditions DL-DB, LL-DB, DL-LB, and/or Synchronism check. In order to verify synchronism differences of voltage Module, Phase and Frequency are checked. The BUS side is V2, independently of the position of the line disconnecter switch. The LINE side refers to (V3, V4, V5) or (V1) voltages, depending on the status of switch (89).

Reclosing permission for the Central breaker (only MOV2). This function allows supervision of the Central Breaker reclosing for the following conditions DL-DB, LL-DB, DL-LB, and/or Synchronism check.

**Typical Wiring**



**Monitoring And Metering**

**Line (Three Phase), Bus1, and Bus2 Voltage Level Metering**

This function displays the primary modules for the three line voltages, and for both buses, as well as the difference in Module, Angle and Frequency between the voltages on both sides of the side breaker (52-1) and central breaker (52-0).

**Status of the Associated Line Disconnector Switch**

This function displays the status of a line disconnector switch associated to the unit using the digital inputs 89/a and 89/b.

**Optical Signaling with 17 LED Indicators**

The MOV includes 17 LED indicators, one bicolor for the SYSTEM READY, and 16 red, configurable using the GE-INTRO configuration program.

### Event Recording

The unit keeps a record of the last 165 events, with the following information: date and time (with 1 ms resolution), event description, voltage levels in the moment of the event, and unit status (set of all internal digital signals). This information is stored in a non-volatile memory.

### Oscillography Recording

The unit maintains a record of 4 oscillography registers, of 62 cycles each, with a resolution of 16 samples per cycle. The number of pre-fault cycles can be selected between 1 and 8.

Each record includes the following information: instantaneous values of voltages, internal digital flags, date and time, causes of the oscillo, and active Settings Table in the moment of the record. The oscillography trigger causes can be configured. The oscillography can also be triggered by an input or by communications. The record is stored in COMTRADE format (Standard IEEE C37.111-1991) and can be displayed using the GE-OSC software, or any other software package accepting COMTRADE format or ASCII files (for example EXCEL™)

## Control

### 3 settings tables

There are 3 independent settings tables, stored in a non-volatile memory. It is possible to change the active settings table using digital inputs.

Time synchronization using communications or the GPS satellite system by IRIG-B.

A demodulated IRIG-B input for time synchronization allows relating data from different units, even if these are hundreds of kilometers away from each other, thanks to the GPS satellite system. The units can also be synchronized by communica-

tions, with the GE-LOCAL communications software, or manually using the HMI.

### Configurable inputs & outputs

There are 6 digital inputs (two groups of 3 inputs + a common per group), and 22 configurable outputs available. The configuration can be performed using the GE-INTRO configuration software.

### User configurable internal logic

The programming logic of outputs and LEDs is performed at several levels. At a first level, AND gates with up to 16 signals can be programmed. Their output is incorporated to the available signals in order to be used in a next AND gate with up to 16 signals. Once the configuration of AND gates is finished, a second level can be performed using OR gates with 16 inputs; the logic outputs of these OR gates are assigned to the physical outputs of the unit, or to LED indicators.

## Communications Interfaces

### HMI with keypad and alphanumeric display

The MOV includes as standard a 20 key keypad and a 2-line liquid crystal display (LCD) with 16 characters per line. This display has highly reliable LED diode back lighting (the screen brightness can be adjusted on the rear of the front board).

By means of this interface the user can change the settings, visualize measurements, carry out operations and access information stored in the unit.

### Local & Remote Communications

The relay has 2 serial gates and three connectors. Gate 1 can be reached from the front of the relay in connector 1 (PORT 1) or from the back in connector 2 (PORT 2). The second gate can be

reached from connector 3 (PORT 3) which is located on the rear.

There are different models available, each of them with a different physical connection for the PORT 3 connector (RS-232 or fiber-optic). In the "RS232" models the three connectors are RS232. In the "RS232 and fiber-optic" models the PORT1 and PORT2 connectors are RS232 while the PORT3 connector is replaced by a fiber-optic connector.

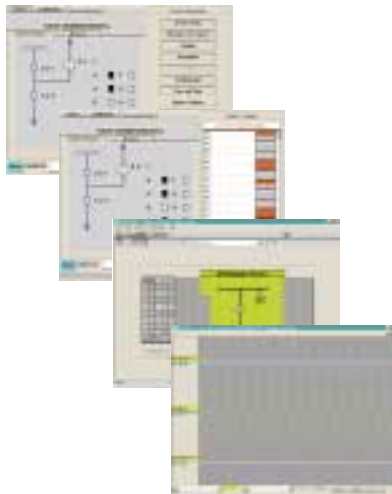
The PORT 1 connector has priority over the PORT 2 connector and is selected when the DCD (Data Carrier Detect) signal is activated. Communication driver 1 (PORT 1 and PORT 2 connectors) and Comm. driver 2 (PORT 3 connector) are independent and the unit can serve them simultaneously.

Local and remote communications can exist at the same time, although settings change and operations can be performed only from one of them as defined by communication priority levels.

### GE-NESIS Software

The GE-NESIS software package includes the following programs, to be used for different purposes:

- GE-LOCAL: Communications Software
- GE-INTRO: Configuration Software
- GE-OSC: Oscillography Treatment Software



## MOV Technical Specifications

### COMMUNICATIONS

**RS232 DB9 female connector (2/3 connectors depending on model)**  
 Mode: Half duplex.  
**1 mm plastic fiber optic (depending on the model):**  
 Typical emitted power: -8 dBm  
 Receptor's sensitivity: -39 dBm  
 Numerical opening N.O.: 0.5  
 Wave length: 660 nm (visible red)  
**HFBR-4516 type connector**  
**62.5 /125 glass fiber optic (depending on the model):**  
 Typical emitted power: -17.5 dBm  
 Receptor's sensitivity: -25.4 dBm  
 Numerical Opening N.O.: 0.2  
 Wave length: 820 nm (close infrared)  
**SMA type connector**

### POWER SUPPLY

Frequency: 50 or 60 Hz (selectable)  
 Rated Voltage: 100/√3 - 220/√3 VAC  
 Auxiliary Voltage: 48-125 VDC or 110-250 VDC  
 Operative Range: 80-120% of rated values  
 Digital Inputs Voltage: 48-125 or 110-250 VDC  
 Thermal Capacity:  
 Voltage Circuits:  
 Permanent:  $2 \times V_n$   
 During 1 min:  $3.5 \times V_n$

### OUTPUTS

**TRIPPING CONTACTS:**  
 Rated Voltage/Maximum Opening Voltage: 250/440 VAC  
 Rated Current/Make Current: 16/25 A  
 Operating Power: 4000 VA  
 Mechanical Life:  $30 \times 10^6$

**AUXILIARY AND ALARM CONTACTS**  
 Operating Power (non-inductive loads): 1760 VA  
 Operating Voltage: 380/250 VAC/VDC  
 Rated Current DC: 8 A  
 Mechanical Life:  $10^7$   
 Electrical Life at Full Load:  $10^5$

**CIRCUITS LOAD:**  
 Voltage Circuits: 0.2 VA at  $U_n = 63.5$  V  
 Consumption:  
 Auxiliary voltage: 12 W (stand-by condition)  
 16 W (all output relays active)  
 Digital inputs: 8 mA (1 W for Vaux = 125 VDC)  
 Accuracy:  
 Voltage and current: 5%  
 Time: 5% or 30 ms (whichever is greater)  
 Error margin: Class E-5 according to IEC 255-4  
 Repetitively:  
 Operation value: 1%  
 Operating time: 2% or 30 ms (whichever is greater)

### TYPE TESTS

The MOV system complies with the following standards, which include the GE insulation and electromagnetic standard and the standards required by European Community Directive 89/336 for the CE marking, in line with European standards. It also complies with the European directive requirements for low voltage, and the environmental and operating requirements established in ANSI standards C37.90, IEC 255-5, IEC 255-6 and IEC 68.  
**Insulation Test Voltage:** IEC 255-5, 600V, 2kV, 50/60 Hz 1 min  
**Impulse Voltage Withstand:** IEC 255-5, 5 kV, 0.5 J  
**1 MHz Interference:** IEC 255-22-1, Class III  
**Electrostatic Discharge:** IEC 255-22-2  
 EN 61000-4-2, Class IV, 8 kV  
**Immunity to Radio Interference:** IEC 255-22-3, Class III  
**Electromagnetic Fields Radiated with Amplitude Modulation:** ENV 50140, 10 V/m  
**Electromagnetic Fields Radiated with Amplitude Modulation:** ENV 50141, 10 V/m  
**Common Mode:** ENV 50141, 10 V/m  
**Electromagnetic Fields Radiated with Frequency Modulation:** ENV 50204, 10 V/m  
 IEC 255-22-4  
 EN 61000-4-4, Class IV  
**Fast Transients:** IEC 255-22-4  
 EN 61000-4-4, Class IV  
**Magnetic Fields at Industrial Frequency:** EN 61000-4-8, 30 Av/m  
**RF Emission:** EN 55011, Class B

### ENVIRONMENTAL

**Temperature Ranges:**  
 Operating: -20°C to +55°C  
 Storage: -40°C to +65°C  
 Humidity: Up to 95% without condensing

### MECHANICAL CHARACTERISTICS

- 19" rack case, 2 units high
- Protection level IP51 (according to IEC 529).
- LCD Display with two rows of 16 characters, and 20 key keypad.
- Rear connection with 6 terminal boards of 12 terminals each.

### PACKAGING

**Dimensions:** 14.12" x 7.95" x 3.46"  
 437 x 164 x 88 mm  
**Weight:**  
 Net: 6 kg  
 Shipping: 7 kg

\*Specifications subject to change without notice.

## Ordering

To order select the basic model and the desired features from the Selection Guide below.

MOV \* \* 0 \* \* 1 0 1 \* \* \* \*

MOV								Digital multifunctional protective relay
1								Undervoltage
2								Undervoltage + synchronism
0								RS232 communications interface
1								Plastic F.O. + RS232 communications interface
2								Glass F.O. + RS232 communications interface
		0						P1, P2, P3: M-Link protocol
		2						P1, P2: M-Link protocol; P3: ModBus® RTU protocol
		M						Spanish HMI language
		D						English HMI language
				G				48 - 125 VDC auxiliary voltage
				H				110 - 250 VDC auxiliary voltage
					0	0		Options (special models)
							A	Revision level

