



U-MLEs-PLv

DC SUBSTATION PROTECTIVE RELAY
(double voltage Line Test)

32, 45, 49, 64, 76, 79, 80

D.C. Feeder protection relay with setting parameters programmable locally or via serial communication. Suitable for protection of D.C. feeders with High-Speed DC Breakers, for railway application.

The relay measures the Line current and voltage through one current transducer and one voltage transducer.

The transducers (type MHCO and MHIT) are galvanically insulated.

Via fiber optic and have the following measuring ranges:

- Line voltage: $(0 \div 2)V_n$
- Line current: $(0 \div 10)I_n$
- Insulation voltage 20kVac 1min.

Real time measurements of primary input values can be read continuously both from the display and via ports communication.

Relay settings can be done via the front Panel and via rear serial communication.

The associated Circuit Breaker can be controlled via the frontal keyboard and via serial communication.

Settings, events and oscillographic recordings are stored in a non-volatile memory (E²PROM).

Besides the normal Watchdog and Powerfail functions, a comprehensive program of self-test and self diagnostic provides:

- Diagnostic and functional test with checking of program routines and memory contents, running every time the auxiliary power supply is switched on.
- Dynamic functional test running during normal operation.
- Complete Test activated by the keyboard or via the communication bus.

Any internal fault detected is indicated by a fault message on the display and by de-energization of associated I.R.F. output relay.

The relay is available in three different executions:

- Flush mounting.
- Surface mounting.
- 19" Rack mounting.

Protection Relays

U-MLEs-PLv

Protective Functions

- Thermal image protection of the Cable/Line
- 4 Overcurrent levels Forward/Reverse programmable
- 2 Current Step level with di/dt dependance
- 2 Rate of rise level
- 1 Impedance monitoring level with di/dt dependance
- 1 Current monitoring level with di/dt dependance
- 2 Frame Fault Current and Voltage monitoring levels
- 4 Shot Automatic Reclosure
- 2 Overvoltage levels
- 2 Undervoltage levels
- Automatic programmable Line Test
- Energy counter pulse
- C/B Lock
- Remote Trip

Control

- Trip circuit supervision
- Associated Circuit Breaker control (OPEN / CLOSE)
- Breaker failure protection
- Breaker interruption energy $\sum i^2t$

Recording

- Two complete setting programs switchable locally or remotely
- Blocking input and Blocking output for pilot wire selectivity coordination and intertripping schemes
- Event Recording (last 100 events)
- Trip Recording (last 10 trips) complete with cause of tripping and values of the input quantities at the moment of trip
- Oscillographic recording of input quantities

Accessories

- High-Voltage Current/Voltage measuring Transducer with Fiber Optic output : Type MHCO-T/V-I
- High-Voltage Current measuring Transducer with Fiber Optic output : Type MHCO-T-I.
- High-Voltage Voltage measuring Transducer with Fiber Optic output : Type MHCO-T-V
- Voltage measuring reciver with fiber optic input and 3 Analogic outputs : Type MHCO-R-V
- Current measuring reciver with fiber optic input and 3 Analogic outputs : Type MHCO-R-I
- Input/Output Expansion Module:
 - UX10-4 - 10 Digital Inputs + 4 Outputs Relay
 - UX14DI - 14 Digital Inputs
 - UX14DO - 14 Outputs Relay
- Line Test Contactor
- Line Test Resistor
- Rail Earthing Contactor
- Other protection Relay
- SCADA and Communication systems

Communications

- Modbus RTU, Modbus RTU on TCP-IP and IEC870-5-103 communication protocols
- RS232 communication port on Front Face
- RS485 or RJ45 (optional) communication port on Back Panel
- Synchronisation with other relays (resolution 1ms)
- CanBus line for control of slave I/O Expansion modules

Technical Characteristics

- Graphic Display (128x64 dots)
- 4 LEDs for: Power on/internal relay fault, Trip / alarm, Trip circuit fault
- 6 Output relays totally user programmable
- 4 Digital inputs user programmable

Mounting

- 2 Module box, totally draw-out execution
- IP44 protection case (on request IP54)
- Totally draw-out execution

Power Supply Ratings

- Type 1 : 24V(-20%) / 110V(+15%) a.c. - 24V(-20%) / 125V(+20%) d.c.
- Type 2 : 80V(-20%) / 220V(+15%) a.c. - 90V(-20%) / 250V(+20%) d.c.

Software

- MCom2 Program interface for device management



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U-MLEs-PLv

Real Time Measurements

I = Current V = Voltage P = Power +Wh, = Exported Energy -Wh, = Imported Energy

F49 (T>): Thermal Image element with prealarm

| | | |
|-------------------------------|----------------------------------|---------------|
| Function enabling | : Disable / Enable | |
| Temperature prealarm | : $T_{al} = (10 \div 100)\%T_n$ | step 1% T_n |
| Continuous admissible current | : $I_s = (0.5 \div 1.5)$ | step 0.01 |
| Time constant | : $K_t = (1 \div 600)\text{min}$ | step 0.01min |

1F - 67/50/51 (1I>): 1st Overcurrent Element

| | | |
|------------------------|--|-----------------|
| Function enabling | : Disable / Enable | |
| Time current curves | : f(t) = Indep.Definite Time (D), IEC (A/B/C) | |
| Operation Mode | : f(a) = Non Directional - Directional Forward - Directional Reverse | |
| Setting range | : $I_s = (0.1 \div 4)I_n$ | step 0.01 I_n |
| Instantaneous output | : $\leq 0.03\text{s}$ | |
| Independent time delay | : $t_s = (0.02 \div 100)\text{s}$ | step 0.01s |

2F - 67/50/51 (2I>): 2nd Overcurrent Element

| | | |
|------------------------|--|-----------------|
| Function enabling | : Disable / Enable | |
| Time current curves | : f(t) = Indep.Definite Time (D), IEC (A/B/C) | |
| Operation Mode | : f(a) = Non Directional - Directional Forward - Directional Reverse | |
| Setting range | : $I_s = (0.1 \div 4)I_n$ | step 0.01 I_n |
| Instantaneous output | : $\leq 0.03\text{s}$ | |
| Independent time delay | : $t_s = (0.02 \div 100)\text{s}$ | step 0.01s |

3F - 67/50/51 (3I>): 3rd Overcurrent Element

| | | |
|------------------------|--|-----------------|
| Function enabling | : Disable / Enable | |
| Operation Mode | : f(a) = Non Directional - Directional Forward - Directional Reverse | |
| Setting range | : $I_s = (0.1 \div 10)I_n$ | step 0.01 I_n |
| Instantaneous output | : $\leq 0.03\text{s}$ | |
| Independent time delay | : $t_s = (0.02 \div 100)\text{s}$ | step 0.01s |

4F - 67/50/51 (4I>): 4th Overcurrent Element

| | | |
|------------------------|--|-----------------|
| Function enabling | : Disable / Enable | |
| Operation Mode | : f(a) = Non Directional - Directional Forward - Directional Reverse | |
| Setting range | : $I_s = (0.1 \div 10)I_n$ | step 0.01 I_n |
| Instantaneous output | : $\leq 0.03\text{s}$ | |
| Independent time delay | : $t_s = (0.02 \div 100)\text{s}$ | step 0.01s |

1F - (1ΔI): 1st DI Element

| | | |
|---------------------------------|------------------------------------|------------|
| Function enabling | : Disable / Enable | |
| Setting range | : $DI = (100 \div 9990)\text{A}$ | step 10A |
| Minimum di/dt level to start ΔI | : $di = (4 \div 400)\text{A/ms}$ | step 1A/ms |
| Instantaneous output | : $\leq 0.03\text{s}$ | |
| Independent time delay | : $t_{DI} = (0 \div 500)\text{ms}$ | step 1ms |
| Detection reset time delay | : $t_{di} = (0 \div 100)\text{ms}$ | step 1ms |

2F - (2ΔI): 2st DI Element

| | | |
|---------------------------------|------------------------------------|------------|
| Function enabling | : Disable / Enable | |
| Setting range | : $DI = (100 \div 9990)\text{A}$ | step 10A |
| Minimum di/dt level to start ΔI | : $di = (4 \div 400)\text{A/ms}$ | step 1A/ms |
| Instantaneous output | : $\leq 0.03\text{s}$ | |
| Independent time delay | : $t_{DI} = (0 \div 500)\text{ms}$ | step 1ms |
| Detection reset time delay | : $t_{di} = (0 \div 100)\text{ms}$ | step 1ms |



Protection Relays

U-MLEs-PLv

| 1F - (1di/dt): 1st Current Rate of Rise Element | | |
|---|---|--------------------------|
| Function enabling | : Disable / Enable | |
| Setting range | : $G = (4 \div 400)A/ms$ | step 1A/ms |
| Instantaneous output | : $\leq 0.03s$ | |
| Independent time delay | : $tG = (2 \div 500)ms$ | step 1ms |
| 2F - (2di/dt): 2nd Current Rate of Rise Element | | |
| Function enabling | : Disable / Enable | |
| Setting range | : $G = (4 \div 400)A/ms$ | step 1A/ms |
| Instantaneous output | : $\leq 0.03s$ | |
| Independent time delay | : $tG = (2 \div 500)ms$ | step 1ms |
| Rapp: Impedance monitoring with di/dt dependence | | |
| Function enabling | : Disable / Enable | |
| Arc Voltage | : $V_a = (0 \div 800)V$ | step 1V |
| Internal Resistance | : $R_i = (0 \div 0.250)\Omega$ | step 0.001 Ω |
| Total Resistance of the circuit | : $R_t = (0.001 \div 2.5)\Omega$ | step 0.001 Ω |
| Internal Inductance | : $L_i = (0.001 \div 0.01)H$ | step 0.001H |
| Total Inductance of the circuit | : $L_t = (0.002 \div 0.05)H$ | step 0.001H |
| Resistance trip level | : $R^* = (0 \div 100)\Omega$ | step 0.01 Ω |
| Limit value of di/dt | : $g = (10 \div 500)A/ms$ | step 1A/ms |
| Instantaneous output | : $\leq 0.03s$ | |
| Independent time delay | : $g = (0 \div 100)ms$ | step 1ms |
| Iapp: Current monitoring with di/dt dependence | | |
| Function enabling | : Disable / Enable | |
| Current trip level when di/dt = 0 | : $I_a = (500 \div 5000)A$ | step 10A |
| Current trip level when di/dt $\geq [g]$ | : $I^* = (400 \div 1500)A$ | step 10A |
| Limit value of di/dt | : $g = (30 \div 500)A/ms$ | step 1A/ms |
| Drop-out percentage | : $Res = (80 \div 100)\%I_{app}$ | step 1%I _{app} |
| Instantaneous output | : $\leq 0.03s$ | |
| Independent time delay | : $t_r = (0 \div 5)s$ | step 0.01s |
| 1F - 64 (1Ig): 1st Frame Fault Element | | |
| Function enabling | : Disable / Enable | |
| Time current curves | : $f(t) = \text{Indep. Definite Time (D), IEC (A/B/C)}$ | |
| Current setting range | : $I_s = (0.1 \div 4)I_{gn}$ | step 0.01I _{gn} |
| Voltage setting range | : $U_s = (0.01 \div 1)U_{gn}$ | step 0.01U _{gn} |
| Instantaneous output | : $\leq 0.03s$ | |
| Independent time delay | : $t_s = (0.02 \div 100)s$ | step 0.01s |
| 2F - 64 (2Ig): 2nd Frame Fault Element | | |
| Function enabling | : Disable / Enable | |
| Time current curves | : $f(t) = \text{Indep. Definite Time (D), IEC (A/B/C)}$ | |
| Current setting range | : $I_s = (0.1 \div 4)I_{gn}$ | step 0.01I _{gn} |
| Voltage setting range | : $U_s = (0.01 \div 1)U_{gn}$ | step 0.01U _{gn} |
| Instantaneous output | : $\leq 0.03s$ | |
| Independent time delay | : $t_s = (0.02 \div 100)s$ | step 0.01s |



Protection Relays

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| | | |
|---|--------------------------|--------------|
| RCL: Automatic Reclosure | | |
| Function enabling | : Disable / Enable | |
| Number of Reclosure | : ShN° = 1 / 2 / 3 / 4 | |
| Reclaim time | : tr = (1 ÷ 200)s | step 1s |
| Time first reclosure | : t1 = (0.1 ÷ 1000)s | step 0.1s |
| Time second reclosure | : t2 = (0.1 ÷ 1000)s | step 0.1s |
| Time third reclosure | : t3 = (0.1 ÷ 1000)s | step 0.1s |
| Time fourth reclosure | : t4 = (0.1 ÷ 1000)s | step 0.1s |
| LT: Automatic Line Test (Double Voltage Line test) | | |
| Function enabling | : Disable / Enable | |
| Number of Test | : TestN° = 0 / 2 / 3 / 4 | |
| Minimum residual voltage downstream | : Vv< = (0 ÷ 1)Vn | step 0.001Vn |
| Minimum residual voltage upstream | : Vm< = (0 ÷ 1)Vn | step 0.001Vn |
| Minimum residual resistance | : RR< = (0 ÷ 500)Ω | step 1Ω |
| Minimum line voltage | : VFast = (0.5 ÷ 1)Vn | step 0.1Vn |
| Waiting time after C/B closing | : tp = (0 ÷ 30)s | step 1s |
| Duaction of the Line Test | : tt = (1 ÷ 10)s | step 1s |
| Wait time between 2 consecutive tests | : tcy = (1 ÷ 60)s | step 1s |
| Wait time to start recl.after succes fine test | : tw = (0 ÷ 10)s | step 1s |
| 1F - 59 (1U>): 1st Overvoltage Element | | |
| Function enabling | : Disable / Enable | |
| Setting range | : Us = (0.5 ÷ 1.5)Un | step 0.01Un |
| Instantaneous output | : ≤0.03s | |
| Independent time delay | : ts = (0 ÷ 650)s | step 1s |
| 2F - 59 (2U>): 2nd Overvoltage Element | | |
| Function enabling | : Disable / Enable | |
| Setting range | : Us = (0.5 ÷ 1.5)Un | step 0.01Un |
| Instantaneous output | : ≤0.03s | |
| Independent time delay | : ts = (0 ÷ 650)s | step 1s |
| 1F - 27 (1U<): 1st Undervoltage Element | | |
| Function enabling | : Disable / Enable | |
| Setting range | : Us = (0.2 ÷ 1)Un | step 0.01Un |
| Instantaneous output | : ≤0.03s | |
| Independent time delay | : ts = (0 ÷ 650)s | step 1s |
| 1F - 27 (2U<): 2nd Undervoltage Element | | |
| Function enabling | : Disable / Enable | |
| Setting range | : Us = (0.2 ÷ 1)Un | step 0.01Un |
| Instantaneous output | : ≤0.03s | |
| Independent time delay | : ts = (0 ÷ 650)s | step 1s |
| Wi: Circuit Breaker Energy Maintenance | | |
| Function enabling | : Disable / Enable | |
| Setting range | : li = (0.1 ÷ 99)In | step 0.1In |
| Conventional interruption current | : Wi = (1 ÷ 9999) | step 1 |
| RT: Remote Trip | | |
| Function enabling | : Disable / Enable | |
| Independent time delay | : ts = (0 ÷ 10)s | step 0.01s |
| Wh: Energy Counter Pulse | | |
| Function enabling | : Disable / Enable | |
| Energy level | : WpP = (10 ÷ 1000)kW | step 10kW |
| Pulse duration | : Pulse = (0.1 ÷ 2)s | step 0.01s |
| CB-L: C/B Lock | | |
| Function enabling | : Disable / Enable | |
| Breaker Failure Element | | |
| Alarm time delay | : tBF = (0.05 ÷ 0.75)s | step 0.01s |

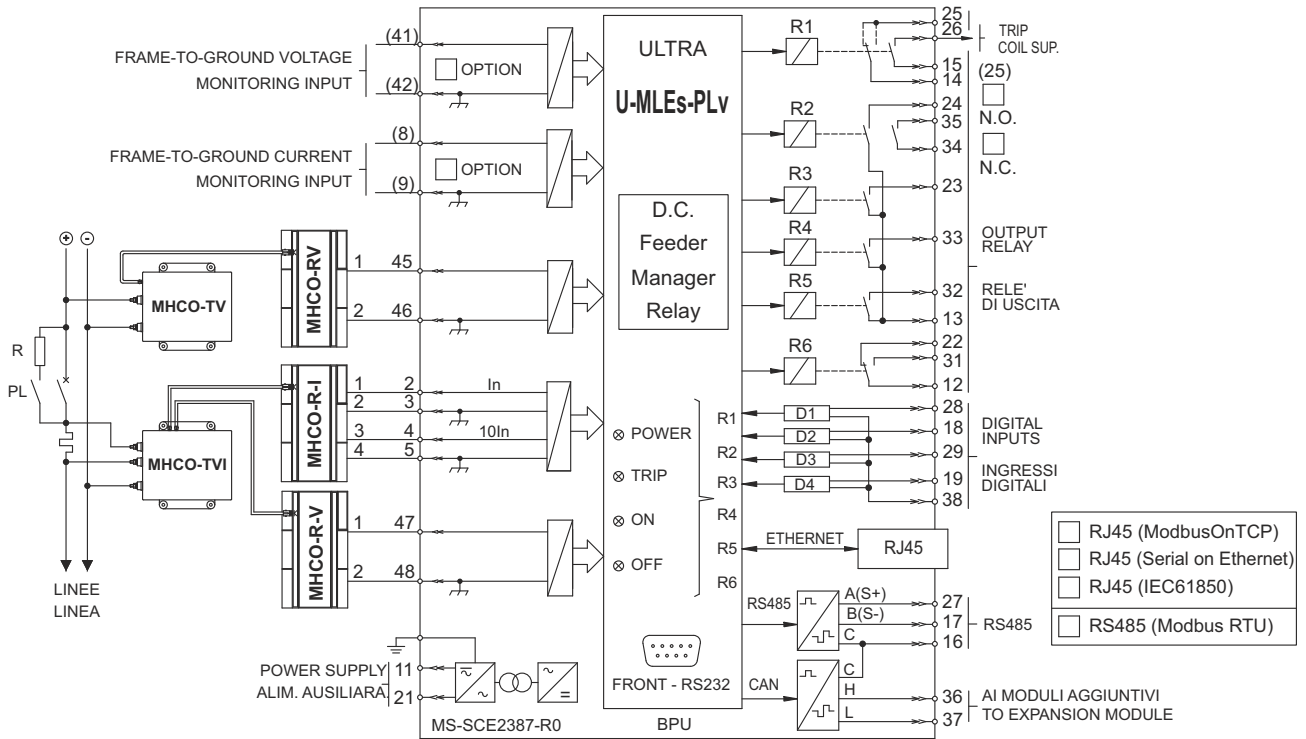


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Protection Relays

U-MLEs-PLv

U-MLEs-PLv
(Example with MHCO Transducer)



| Typical Characteristics | | |
|--|---|------------------|
| Accuracy at reference value of influencing factors | 1% FS | for measurements |
| Input | 2% +/- 10ms | for times |
| Average power supply consumption | 0 ÷ 20 mA | |
| Output relays | < 10 VA | |
| | rating 5A; Vn = 380V | |
| | A.C. resistive switching = 1100W (380V max) | |
| | make = 30A (peak) 0.5 sec. | |
| | break = 0.3A, 110Vcc | |
| | L/R = 40ms (100.000 op.) | |

| Order code - Example : | | | | | |
|------------------------|--------------|--------------------------|----------------------------------|----------------------------------|--------------------------|
| U-MLEs-PLv | 1 | 2 | 1 | 1 | 1 |
| | Power Supply | Configuration R1 (14-25) | 1 st Expansion module | 2 nd Expansion module | Communication Protocol |
| | 1 = Type 1 | 1 = N.O. | 1 = None | 1 = None | 1 = ModbusRTU (standard) |
| | 2 = Type 2 | 2 = N.C. | 2 = UX10-4 | 2 = UX10-4 | 2 = Modbus TCP-IP |
| | | | 3 = 14DI | 3 = 14DI | 3 = IEC61850 |
| | | | 4 = 14DO | 4 = 14DO | |

The performance and the charecteristics reported in this document are not binding and can modified ant any moment without notice.



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