U-MLEs-PLs-Ts
DC SUBSTATION PROTECTIVE RELAY
(single 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 : $(0 \div 2)Vn$

• Line current : $(0 \div 10)In$

• 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 Touch Pannel (or USB 2.0 port) and via rear serial communication.

The associated Circuit Breaker can be controlled via the frontal keyboard (or USB 2.0 port) and via serial communication.

Settings, events and oscillographic recordings are stored in a non-volatile memory (E^2PROM).

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

• Diagnostic and functional test with checking of programroutines 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.

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Protection Relays

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 dependence
- 2 Frame Fault Current and Voltage monitoring levels
- Cable insulation monitoring
- 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 $\sum i^2 t$

Recording

- Two complete setting programs switchable locally or remotely
- Blocking input and Blocking output for pilot wire selectivity coordination and intertripping scheems
- 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

Communications

- Modbus RTU (TCP-IP) and IEC870-5-103 communication protocols
- USB 2.0 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 4.3" (480x262 dots)
- 10 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

- MSCom2 Program interface for device management

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

- Cable monitoring system MSG/N-DIN independent tripping and measurement
- Cable Screen-to-Ground and Conductor-to-Screen monitoring
- Two-channels Digital/Fiber Optic converter for remote intertripping signal Type CFV-BL
- Line Test Contactor
- Line Test Resistor
- Rail Earthing Contactor
- Other protection Relay
- SCADA and Communication systems

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Protection Relays

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	: Tal = (10 ÷ 100)%Tn	step 1%Tn
Continuous admissible current	: Is = (0.5 ÷ 1.5)	step 0.01
Time constant	: Kt = (1 ÷ 600)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	: Is = (0.1 ÷ 4)In	step 0.01In
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)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	: Is = (0.1 ÷ 4)In	step 0.01In
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)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	: Is = (0.1 ÷ 10)In	step 0.01In
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)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	: Is = (0.1 ÷ 10)In	step 0.01In
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s
1F - (1ΔI): 1st 1DI Element		
Function enabling	: Disable / Enable	
Setting range	: DI = (100 ÷ 9990)A	step 10A
Minimum di/dt level to start ΔI	: di = (4 ÷ 400)A/ms	step 1A/ms
Instantaneous output	: ≤0.03s	
Independent time delay	: tDI = (0 ÷ 500)ms	step 1ms
Detection reset time delay	: tdi = (0 ÷ 100)ms	step 1ms
2F - (2ΔI): 2st 2DI Element		
Function enabling	: Disable / Enable	
Setting range	: DI = (100 ÷ 9990)A	step 10A
Minimum di/dt level to start ΔI	: di = (4 ÷ 400)A/ms	step 1A/ms
Instantaneous output	: ≤0.03s	
Independent time delay	: tDI = (0 ÷ 500)ms	step 1ms
Detection reset time delay	: tdi = (0 ÷ 100)ms	step 1ms

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Protection Relays

1F - (1di/dt): 1st Current Rate of Rise Element

Function enabling	: Disable / Enable	
Setting range	: G = (4 ÷ 400)A/ms	step 1A/ms
Instantaneous output	: ≤0.03s	
Independent time delay	: tG = (2 ÷ 500)ms	step 1ms

2F - (2di/dt): 2nd Current Rate of Rise Element

Function enabling	: Disable / Enable	
Setting range	: G = (4 ÷ 400)A/ms	step 1A/ms
Instantaneous output	: ≤0.03s	
Independent time delay	: tG = (2 ÷ 500)ms	step 1ms

Rapp: Impedance monitoring with di/dt dependence

Function enabling	: Disable / Enable	
Arc Voltage	: Va = (0 ÷ 800)V	step 1V
Internal Resistance	: Ri = (0 ÷ 0.250)Ω	step 0.001Ω
Total Resistance of the circuit	: Rt = (0.001 ÷ 2.5)Ω	step 0.001Ω
Internal Inductance	: Li = (0.001 ÷ 0.01)H	step 0.001H
Total Inductance of the circuit	: Lt = (0.002 ÷ 0.05)H	step 0.001H
Resistance trip level	: R* = (0 ÷ 100)Ω	step 0.01Ω
Limit value of di/dt	: g = (10 ÷ 500)A/ms	step 1A/ms
Instantaneous output	: ≤0.03s	
Independent time delay	: g = (0 ÷ 100)ms	step 1ms

Iapp: Current monitoring with di/dt dependence

Function enabling	: Disable / Enable	
Current trip level when di/dt = 0	: Ia = (500 ÷ 5000)A	step 10A
Current trip level when di/dt ≥ [g]	: I* = (400 ÷ 1500)A	step 10A
Limit value of di/dt	: g = (30 ÷ 500)A/ms	step 1A/ms
Drop-out percentage	: Res = (80 ÷ 100)%Iapp	step 1%Iapp
Instantaneous output	: ≤0.03s	
Independent time delay	: tr = (0 ÷ 5)s	step 0.01s

1F - 64 (1Ig): 1st Frame Fault Element

Function enabling	: Disable / Enable	
Time current curves	: f(t) = Indep.Definite Time (D), IEC (A/B/C)	
Current setting range	: Is = (0.1 ÷ 4)Ign	step 0.01Ign
Voltage setting range	: Us = (0.01 ÷ 1)Ugn	step 0.01Ugn
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s

2F - 64 (2Ig): 2nd Frame Fault Element

Function enabling	: Disable / Enable	
Time current curves	: f(t) = Indep.Definite Time (D), IEC (A/B/C)	
Current setting range	: Is = (0.1 ÷ 4)Ign	step 0.01Ign
Voltage setting range	: Us = (0.01 ÷ 1)Ugn	step 0.01Ugn
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s

RS-G: Cable insulation (Screen-Ground)

Function enabling	: Disable / Enable	
Setting range	: RL-S = (100 ÷ 5000)Ω	step 100Ω
Instantaneous output	: ≤0.03s	
Independent time delay	: tRL-S = (0.05 ÷ 100)s	step 0.01s

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Protection Relays

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 (Single Voltage Line test)

Function enabling	: Disable / Enable	
Number of Test	: TestN° = 0 / 2 / 3 / 4	
Minimum residual voltage	: VR< = (0 ÷ 1)Vn	step 0.1Vn
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
Duation 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 Maintenence

Function enabling	: Disable / Enable	
Setting range	: Ii = (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

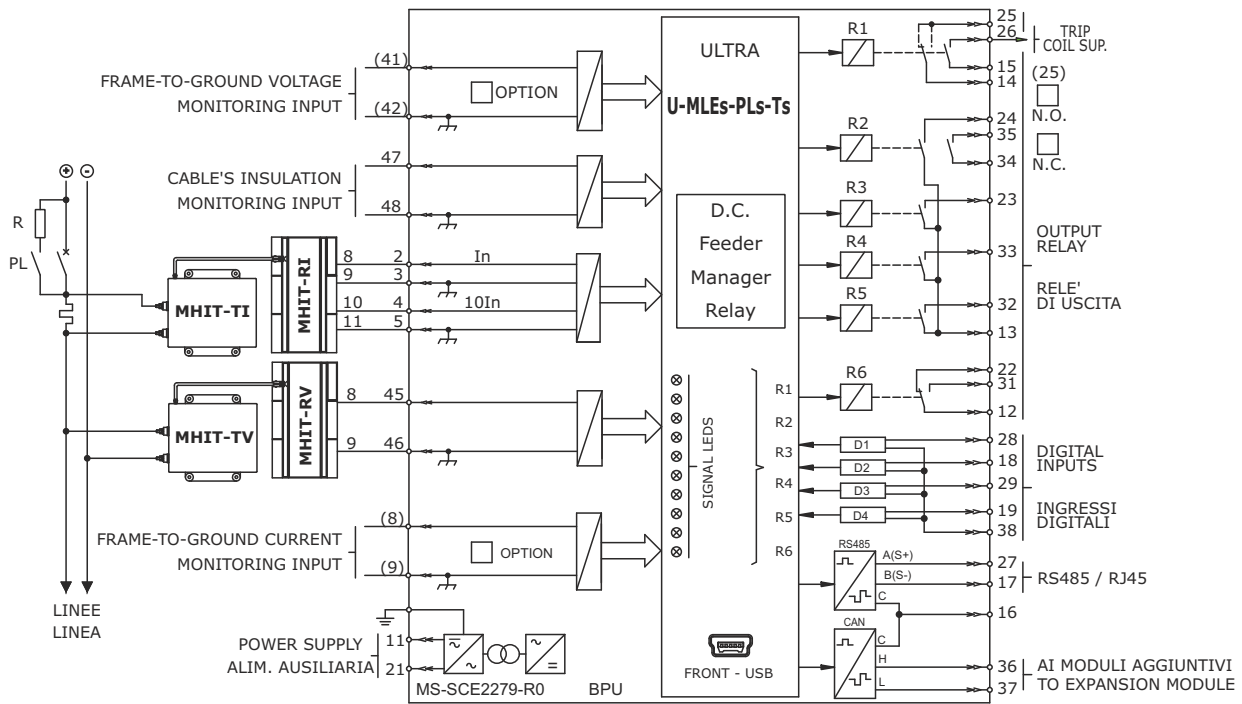|		
Alarm time delay	: tBF = (0.05 ÷ 0.75)s	step 0.01s

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Protection Relays

U-MLEs-PLs-Ts

U-MLEs-PLs-Ts
(Example with MHIT Transducer)

Typical Characteristics

Accuracy at reference value of influencing factors	1% FS	for measurements
	2% +/- 10ms	for times
Input	0 ÷ 20 mA	
Average power supply consumption	< 10 VA	
Output relays	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-PLs-Ts	1	2	1	1	1
	Power Supply	Configuration R1 (14-25)	1st Expansion module	2nd 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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