PROTECTION RELAYS

FMR

Feeder manager relay

Three-phase Current, Voltage and Earth Fault multifunction relay for protection and management of MV/HV distribution lines. Real time measurement of the primary value of the input quantities are continuously available from relay's display and from the serial communication port. Relay's programming and setting can be made directly by the front face keyboard or via the serial communication ports. Setting, event recording and oscillography are stored into non volatile memory (E2prom).

The relay is fitted with a multivoltage, autoranging power supply unit self protected and trasformer isolated. 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 continuously normal operation.
- Complete Test (including or not including output relays) activated by the keyboard or via the communication bus.

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

MICROELETTRICA

Protective Functions

- F49 : One Thermal Image element
- F50/51/51V/67 : Three levels for phase overcurrent Independently programmable as directional or non directional
- F50N/51N/67N : Three levels for Earth Fault independentely programmable as directional or non directional
- F27/59 : Two over/under voltage levels
- F81 : Two over/under frequency levels
- F46 : Two Negative Sequence current levels
- F59Uo : Zero sequence overvoltage level
- F51BF : Breaker Failure protection
- F27U1 : One Positive Sequence overvoltage level
- F59U2/47 : One Negative Sequence undervoltage level
- F79 : Four shot autoreclosing (optional- FMR-R)
- Two Reactive Power (VAR) control levels (optional)
- Two complete setting programs switchable locally or remotely

Recording

- Event Recording (last 100 events)
- Trip Recording (last 20 trips) complete with cause of tripping and values of the input quantities at the moment of trip
- Oscillographic recording of input quantities (8 channels, 32 sample/cycle, 3 sec each)

Control

- 6 Output Relays user programmable
- 4 Digital Inputs user programmable
- Blocking input and output for pilot wire selectivity coordination
- Time tagging resolution 1ms.
- Trip circuit supervision
- Associated Circuit Breaker control (OPEN / CLOSE)
- Breaker interruption energy ∑i2t
- Complete autodiagnostic program with dedicated relay

Technical Characteristics

- Graphical Display (128x64 dot)
- 4 Leds for signalization
- Multilanguage Display (English/Italian standard, available - other on request)

Power Supply Ratings

- Autoranging multivoltage power supply
- 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.

Communications

- 1 RS485 Serial communication port on rear side
- 1 RS232 Serial communication port on front panel
- Modbus RTU / IEC870-5-103 Communication Protocols
- Canbus port for external additional modules

Expansion Modules (optional)

- "UX10-4" 10 Digital Inputs and 4 Output Relays
- "14DI" 14 Digital Inputs
- "14DO" 14 Output Relays

Execution

- 2 Module box. (3 modules with 1 expansion, 4 modules with 2 expansion)
- IP44 protection case (on request IP54)
- Totally draw-out execution

Software

- MSCom2 Program interface for device management

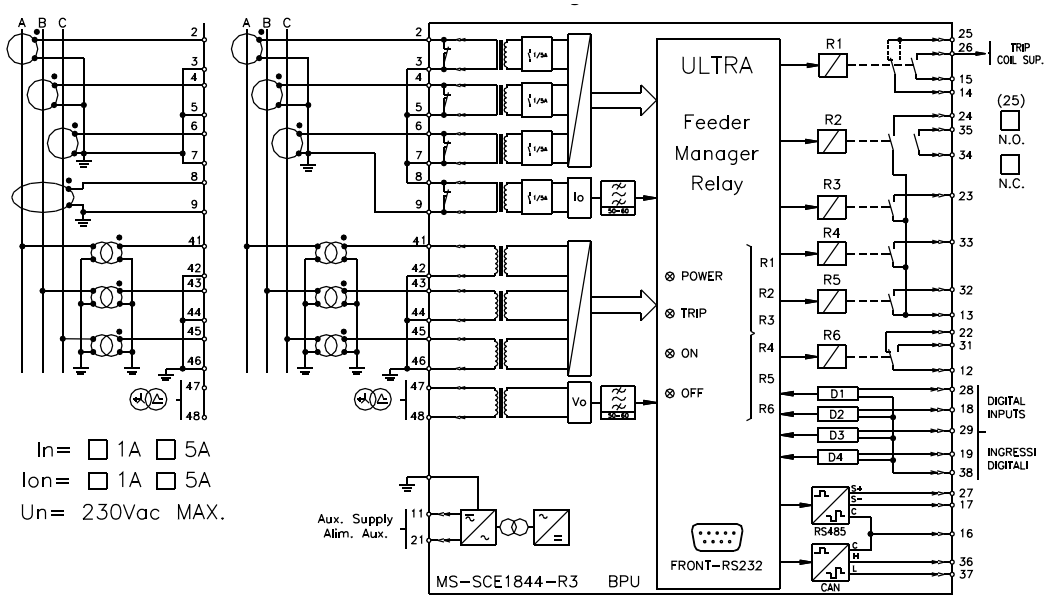
Real Time Measurements			
Ia = current of phase A	Va = Voltage of phase A	Pa, Qa = Active, Reactive Power of phase A	+Wh,+Rh =Active, Reactive Exp. Energy
Ib = current of phase B	Vb= Voltage of phase B	Pb, Qb = Active, Reactive Power of phase B	Wh,-Rh =Active, Reactive Imp. Energy
Ic = current of phase C	Vc = Voltage of phase C	Pc, Qc = Active, Reactive Power of phase C	
Io = neutral current	cosφ =Power Factor A,B,C	P, Q = Average of Active, Reactive Power	

F49 (T>): Thermal Image element with prealarm		
Function enabling	ON - OFF	
Operation Mode	Opmod = (I1 I2 / Imax)	
Temperature prealarm	Tal =(10 ÷ 100)%Tn	step 1 %Tn
Setting range	Is = (0.5 ÷ 1.5)	step 0.01
Time constant	Kt = (1 ÷ 600)min	step 0.01min
1F - 67/50/51/51V (1I>): 1st Overcurrent Element		
Function enabling	ON - OFF	
Time current curves	f(t) = Indep.Definite Time (D), IEC (A/B/C), IEEE (MI/VI/I/EI/SI)	
Operation Mode	f(a) = Non Directional - Directional Supervision - Total Directional	
Voltage restraint	f(U) = ON - OFF	
Current setting range	Is = (0.1 ÷ 4)In	step 0.01In
Characteristic sensitivity direction	a = (0 ÷ 359)°	step 1°
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
2F & 3F - 67/50/51/51V (2I> & 3I>): 2nd & 3rd Overcurrent Elements - Individually Programmable		
Function enabling	ON - OFF	
Operation Mode	f(a) = Non Directional - Directional Supervision - Total Directional	
Voltage restraint	f(U) = ON - OFF	
Current setting range	Is = (0.1 ÷ 40) In	step 0.01 In
Characteristic sensitivity direction	a = (0 ÷ 359)°	step 1°
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
Stabilization on Inrush current		
Automatic doubling of the operation levels I>> and/or IH		2xI> = ON/OFF
Activation level		di/dt = ≥25 In/s
Revert level		I< 1.25In
1F - 67N/50N/51N (1Io>): 1st Earth Fault Element		
Function enabling	ON - OFF	
Operation Mode	f(ao) = Non Directional - Total Directional	
Time current curves	f(t) = Indep.Definite Time (D), IEC (A/B/C), IEEE (MI/VI/I/EI/SI)	
Current setting range	Is = (0.01 ÷ 4)On	step 0.01On
Minumum level of residual voltage for directional element	Vo = (0 ÷ 20)%Un	step 0.1%Un
Characteristic sensitivity direction	ao = (0 ÷ 359)°	step 1°
Trip sector amplitude	az = (0 ÷ 359)°	step 1°
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
2F & 3F - 67N/50N/51N (2Io> & 3Io>): 2nd & 3rd Earth Fault Elements - Individually programmable		
Function enabling	ON - OFF	
Operation Mode	f(ao) = Non Directional - Total Directional	
Characteristic sensitivity direction	ao = (0 ÷ 359)°	step 1°
Trip sector amplitude	az = (0 ÷ 359)°	step 1°
Current setting range	Is = (0.01 ÷ 9.99)On	step 0.01On
Instantaneous output	= ≤0.03s	step 1°
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s

1F - 46 (1Is>): 1st Negative Zero Sequence Element		
Function enabling	ON - OFF	
Time current curves	f(t) = Indep.Definite Time (D), IEC (A/B/C), IEEE (MI/VI/I/EI/SI)	
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 - 46 (2Is>): 2nd Negative Zero Sequence Element		
Function enabling	ON - OFF	
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
1F & 2F - 59 (1U> & 2U>): 1st & 2nd Maximum Voltage Elements - Individually programmable		
Function enabling	ON - OFF	
Setting range	Us = (10 ÷ 190)%Un	step 1%Un
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
1F & 2F - 27 (1U< & 2U<): 1st & 2nd Minimum Voltage Elements - Individually programmable		
Function enabling	ON - OFF	
Setting range	Us = (10 ÷ 190)%Un	step 1%Un
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
1F & 2F - 81> (1f> & 2f>): 1st & 2nd Maximum Frequency Elements - Individually programmable		
Function enabling	ON - OFF	
Setting range	fs = (40 ÷ 70)Hz	step 0.01Hz
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 1000)s	step 0.01s
1F & 2F - 81< (1f< & 2f<): 1st & 2nd Minimum Frequency Elements - Individually programmable		
Function enabling	ON - OFF	
Setting range	fs = (40 ÷ 70)Hz	step 0.01Hz
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 1000)s	step 0.01s
1F & 2F - 59Uo (1Uo> & 2Uo>): 1st & 2nd Maximum Zero Sequence Overvoltage Elements - Individually programmable		
Function enabling	ON - OFF	
Setting range	Us = (1 ÷ 100)%Un	step 1%Un
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
1F - 27U1 (U1<): Positive Sequence Undervoltage Element		
Function enabling	ON - OFF	
Setting range	Us = (10 ÷ 190)%Un	step 1%Un
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s
1F - 59U2/47 (U2>): Negative Sequence Overvoltage Element		
Function enabling	ON - OFF	
Setting range	Us = (10 ÷ 190)%Un	step 1%Un
Instantaneous output	= ≤0.03s	
Independent time delay	ts = (0.02 ÷ 100)s	step 0.01s

1F - (Wi): Circuit Breaker Energy Maintenance		
Function enabling	ON - OFF	
Conventional interruption current	Ii = (0.1 ÷ 99)In	step 0.1In
Max Energy before maintenance	Wi = (1 ÷ 9990)	step 1
Breaker Failure Element		
Alarm time delay	tBF = (0.05 ÷ 0.75)s	step 0.01s
Trip Circuit Supervision Element		
Function enabling	ON - OFF	
Independent time delay	ts = (0.1 ÷ 100)s	step 0.01s
Trip circuit voltage	= (24 ÷ 250)Vdc	
F79 : Autoreclose (option FMR-R) **Selection of function "initiating" the autoreclose shot (t1I> - t2I> - t3I> - t4I> - t1Io> - t2Io> - t3Io> - t4Io>):**		
First shot Sh1	(t1I> - t2I> - t3I> - t4I> - t1Io> - t2Io> - t3Io> - t4Io>); any combination	
Second shot Sh2	(t1I> - t2I> - t3I> - t4I> - t1Io> - t2Io> - t3Io> - t4Io>); any combination	
Third shot Sh3	(t1I> - t2I> - t3I> - t4I> - t1Io> - t2Io> - t3Io> - t4Io>); any combination	
Fourth shot Sh4	(t1I> - t2I> - t3I> - t4I> - t1Io> - t2Io> - t3Io> - t4Io>); any combination	
Reclosing time delay for each shot:		
First shot Sht1	(0.1 ÷ 300)s	step 0.1s
Second shot Sht2	(0.1 ÷ 300)s	step 0.1s
Third shot Sht3	(0.1 ÷ 300)s	step 0.1s
Fourth shot Sht4	(0.1 ÷ 300)s	step 0.1s
Reset (Reclaim) time : tr = (0.1 - 300)s, step 1s		

Connection Diagram



Typical Characteristics		
Accuracy at reference value of influencing factors	1% In - 0.1% On	for measure
	2% + to (to=20 ÷ 30ms @ 2xIs)	for times
Rated Current	In = 1 or 5A - On = 1 or 5A	
Current overload	80 In for 1 sec; 4 In continuous	
Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A	
	Neutral : 0.01VA at In = 1A ; 0.2VA at In = 5A	
Rated Voltage	Un = 100 ÷ 125V	
Voltage Overload	2Un continuous	
Burden on voltage input	0.1 VA at Un	
Averange power supply consumption	<10 VA	
Output Relays	rating 5 A; Vn = 380 V	
	A.C. resistive swictching = 1100W (380V max)	
	make= 30 A (peak) 0.5 sec.	
	break = 0.3 A, 110 Vcc,	
	L/R = 40 ms (100.000 op.)	

Order Code - Example						
FMR	2	1	1	1	2	
	Power Supply	Phase Rated Input Current	Neutral Rated Input Current	Configuration R1 (14-25)	1st Expansion module	2nd Expansion module
	1 = Type 1	1 = 1A	1 = 1A	1 = N.O.	1 = None	1 = None
	2 = Type 2	2 = 5A	2 = 5A	2 = N.C.	2 = UX10-4	2 = UX10-4
					3 = 14DI	3 = 14DI
					4 = 14DO	4 = 14DO

The technical specifications reported are not binding and they should be agreed in the contract.

For further technical information on our products visit www.microelettrica.com

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