



## FMR-Ts

### 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 transformer 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.

#### Protective Functions

- F49 : One Thermal Image element
- F50/51/67 : Three levels for phase overcurrent independently programmable as directional or non directional
- F50N/51N/67N : Three levels for Earth Fault independently 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-Ts)
- 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  $\Sigma i^2 t$
- Complete autodiagnostic program with dedicated relay

#### Technical Characteristics

- Graphic Display 4.3" (480x262 dots)
- 10 Leds programmable
- 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 (*optional*)
- 1 Ethernet 10/100 (RJ45) Serial communication port on rear side
- IEC61850 Communication Protocol (Modbus over TCP-IP optional)

#### 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

- MCom2 Program interface for device management



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## 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	: Disable / Enable	
Operation mode	: Opmod = (I1 I2 / Imax)	
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), IEEE (MI/VI/I/EI/SI)	
Operation Mode	: f(a) = Non Directional - Directional Supervision - Total Directional	
Voltage restraint	: f(U) = Disable / Enable	
Setting range	: Is = (0.1 ÷ 4)In	step 0.01In
Characteristic sensivity 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 (2I> & 3I>): 2nd & 3rd Overcurrent Element - Individually Programmable

Function enabling	: Disable / Enable	
Operation Mode	: f(a) = Non Directional - Directional Supervision - Total Directional	
Voltage restraint	: f(U) = Disable / Enable	
Setting range	: Is = (0.1 ÷ 40)In	step 0.01In
Characteristic sensivity 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 level 2I> and/or 3I>	: 2x1I> = Disable / Enable
Activation level	: di/dt = ≥25In/s
Revert level	: I < 1.25In

## 1F - 67N/50N/51N (1Io>): 1st Earth Fault Element

Function enabling	: Disable / Enable	
Time current curves	: f(t) = Indep.Definite Time (D), IEC (A/B/C), IEEE (MI/VI/I/EI/SI)	
Operation Mode	: f(ao) = Non Directional - Total Directional	
Setting range	: Is = (0.01 ÷ 4)On	step 0.01On
Minimum level of residual voltage for directional element	: Vo = (0 ÷ 20)%Un	step 0.1%Un
Characteristic sensivity 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



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<b>2F &amp; 3F - 67N/50N/51N (2I<sub>o</sub>&gt; &amp; 3I<sub>o</sub>&gt;): 2nd &amp; 3rd Earth Fault Elements - Individually programmable</b>		
Function enabling	: Disable / Enable	
Operation Mode	: f(ao) = Non Directional - Total Directional	
Characteristic sensivity direction	: ao = (0 ÷ 359)°	step 1°
Trip sector amplitude	: az = (0 ÷ 359)°	step 1°
Setting range	: Is = (0.01 ÷ 9.99)In	step 0.01In
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s
<b>1F - 46 (1Is&gt;): 1st Negative Zero Sequence Element</b>		
Function enabling	: Disable / Enable	
Time current curves	: f(t) = Indep.Definite Time (D), IEC (A/B/C), IEEE (MI/VI/I/El/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
<b>2F - 46 (2Is&gt;): 2nd Negative Zero Sequence Element</b>		
Function enabling	: Disable / Enable	
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
<b>1F &amp; 2F - 59 (1U<sub>o</sub> &amp; 2U<sub>o</sub>&gt;): 1st &amp; 2nd Maximum Voltage Element - Individually programmable</b>		
Function enabling	: Disable / Enable	
Setting range	: Us = (10 ÷ 190)%Un	step 1%Un
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s
<b>1F &amp; 2F - 27 (1U<sub>o</sub> &amp; 2U<sub>o</sub>&lt;): 1st &amp; 2nd Minimum Voltage Element - Individually programmable</b>		
Function enabling	: Disable / Enable	
Setting range	: Us = (10 ÷ 190)%Un	step 1%Un
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s
<b>1F &amp; 2F - 81&gt; (1f&gt; &amp; 2f&gt;): 1st &amp; 2nd Maximum Frequency Element - Individually programmable</b>		
Function enabling	: Disable / Enable	
Setting range	: fs = (40 ÷ 70)Hz	step 0.01Hz
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 1000)s	step 0.01s
<b>1F &amp; 2F - 81&lt; (1f&lt; &amp; 2f&lt;): 1st &amp; 2nd Minimum Frequency Element - Individually programmable</b>		
Function enabling	: Disable / Enable	
Setting range	: fs = (40 ÷ 70)Hz	step 0.01Hz
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 1000)s	step 0.01s
<b>1F &amp; 2F - 59U<sub>o</sub> (1U<sub>o</sub>&gt; &amp; 2U<sub>o</sub>&gt;): 1st &amp; 2nd Maximum Zero Sequence Overvoltage Element - Individually programmable</b>		
Function enabling	: Disable / Enable	
Setting range	: Us = (1 ÷ 100)%Un	step 1%Un
Instantaneous output	: ≤0.03s	
Independent time delay	: ts = (0.02 ÷ 100)s	step 0.01s



# Protection Relays

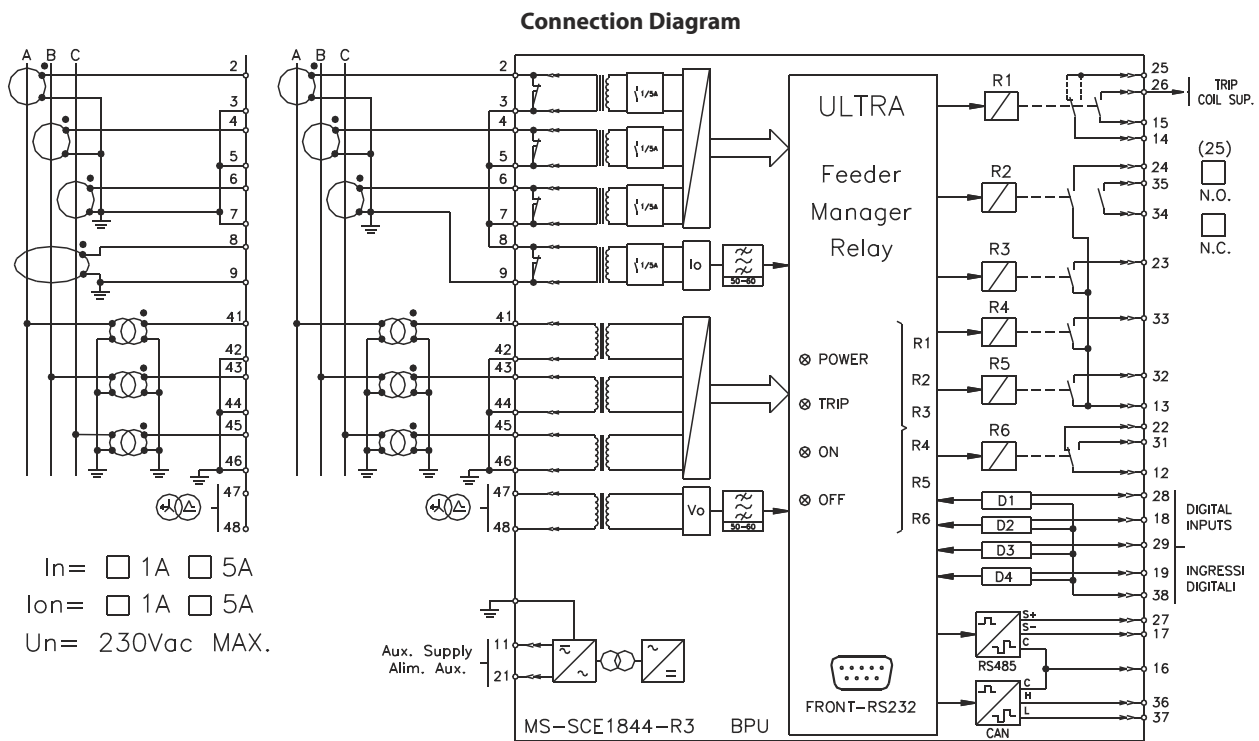
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<b>1F - 27U1 (U1&lt;): Positive Sequence Undervoltage Element</b>		
Function enabling	: Disable / Enable	
Setting range	: $U_s = (10 \div 190)\%U_n$	step 1% $U_n$
Instantaneous output	: $\leq 0.03s$	
Independent time delay	: $t_s = (0.02 \div 100)s$	step 0.01s
<b>1F - 59U2/47 (U2&gt;): Negative Sequence Overvoltage Element</b>		
Function enabling	: Disable / Enable	
Setting range	: $U_s = (10 \div 190)\%U_n$	step 1% $U_n$
Instantaneous output	: $\leq 0.03s$	
Independent time delay	: $t_s = (0.02 \div 100)s$	step 0.01s
<b>1F - (Wi): Circuit Breaker Energy Maintenance</b>		
Function enabling	: Disable / Enable	
Conventional interruption current	: $I_i = (0.1 \div 99)I_n$	step 0.1 $I_n$
Max energy before maintenance	: $W_i = (1 \div 9990)s$	step 1
<b>Breaker Failure Element</b>		
Alarm time delay	: $t_{BF} = (0.05 \div 0.75)s$	step 0.01s
<b>Trip Circuit Supervision Element</b>		
Function enabling	: Disable / Enable	
Independent time delay	: $t_s = (0.1 \div 100)s$	step 0.01s
Trip circuit voltage	: $(24 \div 250)s$	
<b>F79 : Autoreclose(option FMR-R)</b>		
<b>Selection of function "initiating" the autoreclose shot (t1I&gt; - t2I&gt; - t3I&gt; - t4I&gt; - t1Io&gt; - t2Io&gt; - t3Io&gt; - t4Io&gt;):</b>		
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	
<b>Reclosing time delay for each shot:</b>		
First shot Sht1	: $(0.1 \div 300)s$	step 0.1s
First shot Sht2	: $(0.1 \div 300)s$	step 0.1s
First shot Sht3	: $(0.1 \div 300)s$	step 0.1s
First shot Sht4	: $(0.1 \div 300)s$	step 0.1s
<b>Reset (Reclaim) time : <math>t_r = (0.1 - 300)s</math>, step 1s</b>		



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### Typical Characteristics

Accuracy at reference value of influencing factors	1% $I_n$ - 0.1% $I_{on}$	for measurements
	2% + to ( $t_o = 20 \div 30ms @ 2xI_s$ )	for times
Rated current	$I_n = 1A$ or $5A$ - $I_{on} = 1A$ or $5A$	
Current overload	80 $I_n$ for 1 sec; 4 $I_n$ continuous	
Burden on current inputs	Phase : 0.01VA at $I_n = 1A$ ; 0.2VA at $I_n = 5A$ Neutral : 0.01VA at $I_{on} = 1A$ ; 0.2VA at $I_{on} = 5A$	
Rated voltage	$U_n = (100 \div 125)V$	
Voltage overload	2 $U_n$ continuous	
Burden on Voltage inputs	0.1VA at $U_n$	
Average power supply consumption	< 10 VA	
Output relays	rating 5A; $V_n = 380V$ 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 :

FMR-Ts or FMR-R-Ts	1	2	1	1	1
	Power Supply	Configuration R1 (14-25)	1 <sup>st</sup> Expansion module	2 <sup>nd</sup> 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 characteristics reported in this document are not binding and can be modified at any moment without notice.