

We touch your **electricity** everyday!

Under & Over Frequency Relay

**Hi-Tech Range  
MRF2-UF**



**UNDER  
FREQUENCY  
PROTECTION**

**OVER  
FREQUENCY  
PROTECTION**

**SUITABLE  
FOR LOAD  
SHEDDING**

**INDEPENDENT  
SEPARATE  
ADJUSTABLE  
TIMER**

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## 1) Introduction & Application

The *MRF2* is a universal frequency relay and contains the protective functions required by most electrical utilities for mains parallel operation of power stations:

- Four elements for over/under frequency protection
- Fast decoupling of the generator from the grid at mains failure
- Suitable for load shedding systems

## 2) Features & Characteristics

- Microprocessor technology with watchdog
- Effective active low pass filter for suppressing of harmonics
- Four elements for frequency supervision, alternatively for under/over frequency detection
- Independent separate adjustable timers
- Adjustable voltage threshold for blocking of the frequency measurement
- Display of setting parameters
- Display of actual measuring values, storage and display of tripping values
- Minimum- and maximum value recording of measurements
- The protective functions can be assigned individually to the output relays (relay matrix)
- In compliance with VDE 0435, part 303, IEC 255

## 3) Design

### 3.1 Connections

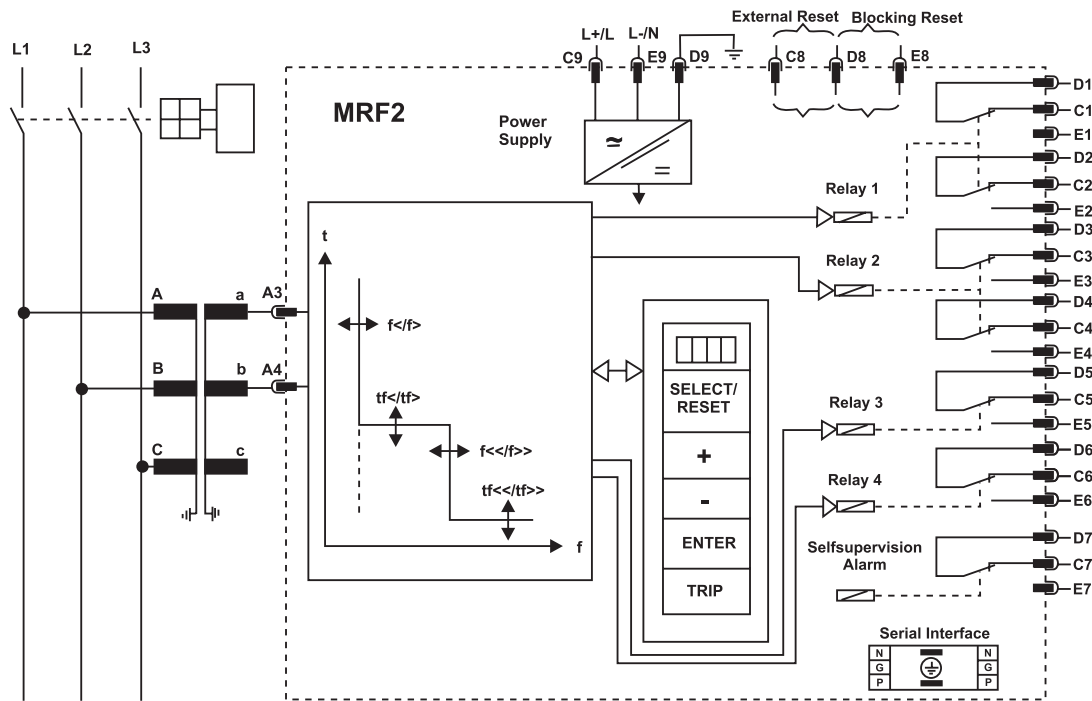


Fig. : Connection diagram MRF2

Note:

Phase voltages can also be connected to A3/A4

#### 3.1.1 Analog Inputs

The analog input voltage is galvanically isolated via the input transformer of the relay and the signal is passed through an active low pass filter. The frequency is detected from the square wave voltages which are formed via comparators. The external wiring of the measuring circuits as well as the auxiliary voltage are shown in the connection diagram.

#### 3.1.3 Blocking Input

When required to inhibit the underfrequency elements of the relay, the auxiliary voltage has to be connected to D8/E8

#### 3.1.2 Output Relays

The MRF2 has 5 output relays with change-over contacts:

- Output relay 1: C1, D1, E1 and C2, D2, E2
- Output relay 2: C3, D3, E3 and C4, D4, E4
- Output relay 3: C5, D5, E5
- Output relay 4: C6, D6, E6
- Output relay 5: Self-supervision (internal fault of the relay) C7, D7, E7

All relays are normally off, only the self-supervision relay is normally on.

## 3.2 Display

| Function   | Display shows   | Pressed push button operation                     | Corresponding LED          | Color of the LED |
|--|---|---|----------------------------|------------------|
| Normal operation   | CSE   |   |                            |                  |
| Measured values:   | meas. value of voltage                                | <SELECT/RESET>                                    | U                          | green            |
|  | meas. value of frequency                              | <SELECT/RESET>                                    | f                          | green            |
|  | min./max. frequency<br>meas. values before last reset | <SELECT/RESET><br>one time for each value         | f + (min. or max.)         | green            |
| Setting values:<br>Nominal frequency $f_N$               | setting value in Hz                                   | <SELECT/RESET> <+> <->                            | $f_N$                      | green            |
| Measuring repetition                                     | setting value in periods of<br>nominal frequency      | <SELECT/RESET> <+> <->                            | T                          | red              |
| Frequency pickup value $f_1$<br>Tripping delay for $f_1$ | setting value in Hz<br>setting value in seconds       | <SELECT/RESET> <+> <-><br>one time for each value | $f_1$<br>$t_1$             | green<br>red     |
| Frequency pickup value $f_2$<br>Tripping delay for $f_2$ | setting value in Hz<br>setting value in seconds       | <SELECT/RESET> <+> <-><br>one time for each value | $f_2$<br>$t_2$             | green<br>red     |
| Frequency pickup value $f_3$<br>Tripping delay for $f_3$ | setting value in Hz<br>setting value in seconds       | <SELECT/RESET> <+> <-><br>one time for each value | $f_3$<br>$t_3$             | green<br>red     |
| Frequency pickup value $f_4$<br>Tripping delay for $f_4$ | setting value in Hz<br>setting value in seconds       | <SELECT/RESET> <+> <-><br>one time for each value | $f_4$<br>$t_4$             | green<br>red     |
| Blocking   | EXIT  | <SELECT/RESET> <+> <->                            | LED of blocked<br>function | green            |
| Voltage threshold for frequency<br>measurement $U_b$     | setting value in Volt                                 | <SELECT/RESET> <+> <->                            | $U_b$                      | green            |
| Assignment of output relays                              | 1 - 4   | <ENTER> + <TRIP><br><SELECT/RESET> <+> <->        | R<br>$f_1 - f_4$           | green<br>red     |
| Slave address of serial interface                        | 1 - 32  | <SELECT/RESET> <+> <->                            | RS                         | yellow           |
| Stored fault values:<br>Frequency                        | tripping values in Hz                                 | <SELECT/RESET> <+> <->                            | $f_1, f_2, f_3, f_4$       |                  |
| Save parameter?  | SAV?  | <ENTER>   |                            |                  |
| Save parameter!  | SAV!  | <ENTER> for abt. 3 s                              |                            |                  |
| Software version   |   | <TRIP><br>one time for each part                  |                            |                  |
| Manual tripping  | TRI?  | <TRIP><br>3 times                                 |                            |                  |
| Inquire password   | PSW?  | <SELECT/RESET> /<br><+> / <-> / <ENTER>           |                            |                  |
| Relay tripped  | TRIP  | <TRIP><br>or fault tripping                       |                            |                  |
| Secret password  | XXXX  | <SELECT/RESET> /<br><+> / <-> / <ENTER>           |                            |                  |
| System reset   | CSE   | <SELECT/RESET><br>für abt. 3 s                    |                            |                  |

Table : Possibilities for indications by the display

## 3.3 LEDs

All LEDs (except LEDs RS and min., max.) are two-coloured. The LEDs left next to the alphanumerical display light up green during measurement and red at fault signals.

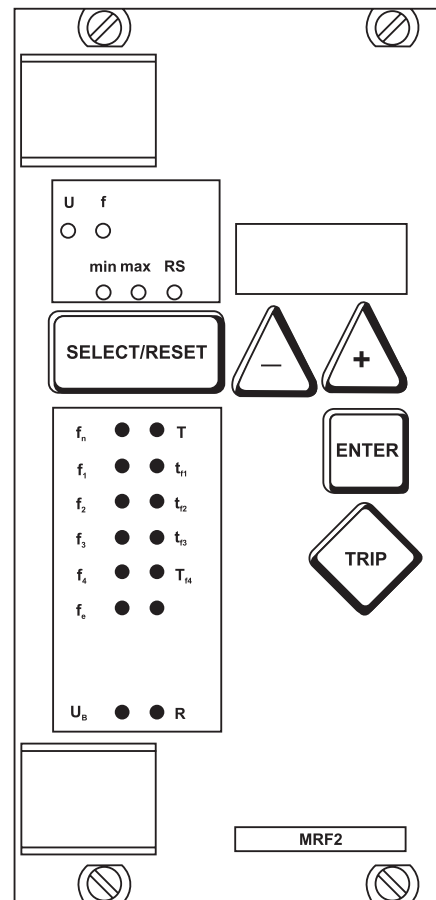
The LEDs below the <SELECT/RESET> push button light up green during setting and reading out the setting values printed on the left side next to the LEDs. The LEDs light up red when the setting values printed on the right side next to them are activated.

The LED marked with the letters RS lights up green during setting of the slave address for the serial interface (RS485) of the unit.

## 4) Working Principle

### 4.1 Analog Circuits

The input voltage is galvanically isolated via the input voltage transformer. The noise signals caused by the influence of inductive and capacitive couplings are then suppressed by RC-analog filter circuits. The analog voltage signals are fed to the A/D-converter of the microprocessor and then transformed into digital signals via sample- and hold-circuits. These digital values are then used for further processing. The analog signals are sampled with a sampling frequency of  $16 \times f_N$ , namely, a sampling rate of 1.25 ms for every measuring quantity (at 50 Hz). The input voltage is also passed through an analog filter for frequency measurement and is then converted into square wave signals via comparators. The frequency is determined by measuring complete cycles.



Front plate MRF2

## 4.2 Digital Part

The essential element of the protection relay is a powerful microcontroller. All functions - from the analog digital conversion to the relay tripping decision are carried out by the microcontroller digitally.

The relay program is located in an EPROM (Electrically-Programmable-Read-Only-Memory). With this program the microcontroller's CPU calculates the value of the measured voltage of the fundamental frequency. Harmonics are suppressed by an efficient digital filter based on the Fourier transformation (DFFT = Discrete Fast Fourier Transformation) When the measured voltage falls below the voltage threshold  $U_B$ , all frequency functions are blocked.

The frequency is established from the time difference of two similar voltage zero passages. The microprocessor compares continuously the frequency measured values with the preset pickup values (setting value) stored in the parameter memory (EPROM).

If a fault occurs an alarm is given and after the set tripping delay has elapsed, the corresponding tripping relay is activated.

The relay setting values for all parameters are stored in a parameter memory (EPROM - Electrically Erasable Programmable Read Only Memory), so that the actual relay settings cannot be lost, even if the power supply is interrupted. The microprocessor is supervised by a built-in "watchdog" timer. In case of failure the watchdog timer resets the microprocessor and gives an alarm signal via output relay "self supervision".

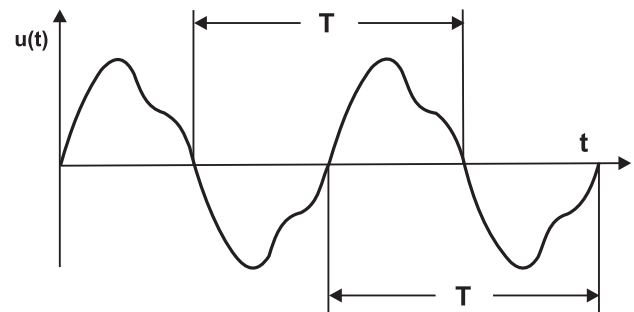
## 4.3 Principle of Frequency Supervision

Frequency relay *MRF2* protects electrical generators, consumers or electrical operating equipment in general against over- or underfrequency.

The relay has, independent from each other, four frequency elements  $f_1 - f_4$  with a free choice of parameters, with separate adjustable pickup values and delay times

With the aid of the frequency gradient sign both frequency increase and frequency decrease can be supervised.

The measuring principle of the frequency supervision is based in general on the time measurement of complete cycles, whereby a new measurement is started at each voltage zero passage. The influence of harmonics on the measuring result is thus minimized.



*Fig. : Determination of cycle duration by means of zero passages.*

In order to avoid false tripping during occurrence of interference voltages and phase shifts the relay works with an adjustable measuring repetition

Frequency tripping is sometimes not desired by low measured voltages which for instance occur during alternator start-up.

All frequency supervision functions can be blocked with the aid of an adjustable voltage threshold  $U_B$  in case the measured voltage value is below this value.

## 5) Operation & Settings

### 5.1 Settings & Measuring Values

#### Settings Values

|          |   |  |
|----------|---|--|
| $f_N$    | : | nominal frequency                              |
| T        | : | measuring repetition for frequency measurement |
| $f_1$    | : | pickup value of the first frequency element    |
| $t_{f1}$ | : | tripping delay of the first frequency element  |
| $f_2$    | : | pickup value of the second frequency element   |
| $t_{f2}$ | : | tripping delay of the second frequency element |
| $f_3$    | : | pickup value of the third frequency element    |
| $t_{f3}$ | : | tripping delay of the third frequency element  |
| $f_4$    | : | pickup value of the fourth frequency element   |
| $t_{f4}$ | : | tripping delay of the fourth frequency element |
| $U_B$    | : | voltage threshold for frequency measurement    |
| RS       | : | slave address of the serial interface          |
| R        | : | assignment of the output relays                |



## Displayed Measuring Values

- U : system voltage in Volt  
f : system frequency in Hz  
 $f_{\min/\max}$  : minimum and maximum value of the system frequency in Hz

## 5.2 Setting Procedure

Before changing a parameter a password has to be entered first.

The parameter setting procedure is guided by two-colored illuminated LEDs. During setting of the frequency setting values  $f_N$ ,  $f_1$  -  $f_4$ ,  $f_e$  the LEDs light up green.

During setting of the tripping delays, differential periods or counters these LEDs light up red. The desired pickup values, nominal values and tripping delays can be adjusted by pressing push buttons <+> and <-> and stored with <ENTER>.

### 5.2.1 Setting of Nominal Frequency

First the nominal frequency (50 or 60 Hz) has to be set before unit *MRF2* is put into operation.

All frequency functions are determined by setting the nominal frequency, i.e. whether the set frequency thresholds are evaluated as over- or underfrequency

Also the cycle duration (20 ms at 50 Hz and 16.67 ms at 60 Hz) derives from this setting which determines the minimum tripping delay for frequency elements  $f_1$  -  $f_4$  with an adjustable multiplier

During setting of the nominal frequency a value in Hz is shown on the display.

### 5.2.2 Number of measuring repetitions (T)

In order to avoid false tripping of the unit at short voltage drops of the system voltage or interference voltages, *MRF2* works with an adjustable measuring repetition. When the instantaneous frequency measuring value exceeds (at overfrequency) or falls below (at underfrequency) the set threshold value, the counter is incremented, otherwise the counter is decremented down to the minimum value of 0. Only when the counter exceeds the value adjusted at T, alarm is given and after the tripping delay of the frequency element has elapsed the tripping command is given. The setting range for T is between 2 - 99.

#### Recommendation for setting:

For short tripping times, e.g. for machine protection or for mains decoupling T should be set in the range from 2 - 5.

At precision measurements, e.g. exact measurement of the mains frequency a setting of T in the range from 5 - 10 is recommended.

### 5.2.3 Pickup Values of Frequency Supervision

The frequency supervision of *MRF2* has four independent frequency elements. Acc. to the setting of the pickup value above or below the nominal frequency, these elements can be used for over- or under frequency supervision. Dependent on the preset nominal frequency  $f_N$  the pickup values from 30 Hz up to 70 Hz at  $f_N = 50$  Hz and from 40 Hz to 80 Hz at  $f_N = 60$  Hz can be set.

During setting of the pickup values  $f_1$  -  $f_4$  the display shows the values in Hz. A value of for instance 49.8 Hz is indicated with "4980".

The function of the individual frequency elements can be deactivated by setting the pickup values to "EXIT". To achieve this setting the frequency setting value must be set to the adjusted nominal frequency  $f_N$ .

### 5.2.4 Tripping Delays for the Frequency Elements

Tripping delays  $t_{f1}$  -  $t_{f4}$  of the four frequency elements can be set independently. The minimum tripping delay  $t_{f1min}$  of the relay depends upon the number of set measuring repetitions  $T$  (periods) and amounts to:

$$t_{f,min} = (T+1) \cdot 20 \text{ ms}$$

When setting the tripping delay to "EXIT" by pressing push button  $<+>$  up to the maximum setting value, the corresponding tripping relay is blocked. Pickup of the frequency element is however displayed on the front plate by the corresponding LED, an assigned alarm relay is also activated.

### 5.2.5 Voltage Threshold for Frequency measurement

At very low system voltage, e.g. during alternator start-up or voltage failure the frequency measurement cannot be done correctly. An adjustable voltage threshold  $U_b$  prevents a false tripping of the *MRF2* in such cases. When the system voltage drops below this threshold, all frequency functions of unit *MRF2* are blocked.

### 5.2.6 Setting of Slave Address

When pressing push buttons  $<+>$  and  $<->$  the slave address can be set in the range from 1 - 32, hereby LED RS lights up.

### 5.2.7 Assignment of Output Relays

Unit *MRF2* has five output relays. The fifth output relay is provided as permanent alarm relay for self supervision is normally on. Output relays 1-4 are normally off and can be assigned as alarm or tripping relays to the frequency functions. By pressing push buttons  $<ENTER>$  and  $<TRIP>$  simultaneously, the assignment mode is selected.

The assignment of output relays 1 - 4 to the frequency elements can be changed by pressing  $<+>$  and  $<->$  push buttons.

The relays are assigned as follows:

LEDs  $f_1$  -  $f_4$  are two-coloured and light up green when the output relays are assigned as alarm relays and red as tripping relays.

#### Definition:

Alarm relays are activated at pickup of the relay. Tripping relays are only activated after elapse of the tripping delay.

It is possible to assign one or more relays to one frequency element.

The selected relays for frequency element are indicated on the display. Indication "1\_\_" means that output relay 1 is assigned to this frequency element. When the display shows "\_ \_ \_", no relay is assigned to this frequency element.

The selected assignment can be stored by pressing push button  $<ENTER>$  and subsequent input of the password.

#### Note:

- The jumper J2 has no function. For relays without assignment mode this jumper is used for parameter setting of alarm relays (activation at pickup or tripping).

| Relay function |          | Output relays |   |   |   | Display-<br>indication | LED : Color   |
|----------------|----------|---------------|---|---|---|------------------------|---------------|
|                |          | 1             | 2 | 3 | 4 |                        |               |
| $f_1$          | alarm    | X             |   |   |   | 1 _ _ _                | $f_1$ : green |
|                | tripping |               |   |   |   | _ _ _ _                | $f_1$ : red   |
| $f_2$          | alarm    |               |   |   |   | _ _ _ _                | $f_2$ : green |
|                | tripping |               | X |   |   | _ 2 _ _                | $f_2$ : red   |
| $f_3$          | alarm    | X             |   |   |   | 1 _ _ _                | $f_3$ : green |
|                | tripping |               | X |   |   | _ 2 _ _                | $f_3$ : red   |
| $f_4$          | alarm    |               |   |   |   | _ _ _ _                | $f_4$ : green |
|                | tripping |               |   |   |   | _ _ _ _                | $f_4$ : red   |

Example of assignment matrix of the output relay. (Default settings)

## 5.4 Reset

MRF2 has the following 3 possibilities to reset the display as well as the output relays

### Manual reset

- by pressing push button <SELECT/RESET> for some time (abt. 3 secs.).

### Electrical reset

- by applying aux. voltage to C8/D8.

### Software reset

- software reset has the same effect as the <SELECT/RESET> push button. Please also refer here to the communication protocol of RS 485 interface.

Resetting the display is only possible when there is no pickup anymore (otherwise signal "TRIP" will still remain in the display and the relays remain activated). Resetting the relay does not change the preset parameters.

## 5.5 Dynamic behaviour of the Relay functions

The following table shows the dynamic behaviour of the relay functions under various system conditions.

| System condition/<br>event   | Function           |                    |
|--|--------------------|--------------------|
|  | $f >$              | $f <$              |
| Applying auxiliary voltage   | active after 1 s   | active after 1 s   |
| Applying auxiliary voltage to the external blocking input                    | not blocked        | blocked            |
| Disconnecting the auxiliary voltage from the external blocking input         | no influence       | active after 1 s   |
| Applying auxiliary voltage to the external reset input                       | reset of the relay | reset of the relay |
| Applying the system voltage to the frequency measuring input                 | active after 1 s   | active after 1 s   |
| Applying a voltage $< U_B$ to the frequency measuring input                  | blocked            | blocked            |
| Applying a voltage with a frequency $< f_e$ to the frequency measuring input | active after 1 s   | active after 1 s   |
| Disconnecting system voltage from the frequency measuring input              | blocked            | blocked            |
| Voltage drops below $U_B$  | blocked            | blocked            |
| Recovering of system voltage   | active after 1 s   | active after 1 s   |
| Voltage vector surge   | no tripping        | no tripping        |
| Short time voltage drop  | no tripping        | no tripping        |

## 6) Relay Testing & Commissioning

The following test instructions should help to verify the protection relay performance before or during commissioning of the protection system. To avoid a relay damage and to ensure a correct relay operation, be sure that:

- the auxiliary power supply rating corresponds to the auxiliary voltage on site.
- the rated frequency and voltage of the relay corresponds to the plant data on site.
- the voltage transformer circuits are connected to the relay correctly.
- all signal circuits and output relay circuits are connected correctly.

### 6.1 Power-On

#### NOTE!

Prior to switch on the auxiliary power supply, be sure that the auxiliary supply voltage corresponds to the rated data on the type plate.

Switch on the auxiliary power supply to the relay and check that the message "CSE" appears on the display and the self supervision alarm relay (watchdog) is energized (Contact terminals D7 and E7 closed).

### 6.2 Testing the Output Relays

#### NOTE!

Prior to commencing this test, interrupt the tripping circuit to the circuit breaker if tripping is not desired.

By pressing the push button <TRIP> once, the display shows the first part of the software version of the relay (e.g. „D01-“). By pressing the push button <TRIP> twice, the display shows the second part of the software version of the relay (e.g. „7.00“). The software version should be quoted in all correspondence. Pressing the <TRIP> button once more, the display shows "PSW?". Please enter the correct password to proceed with the test. The message "TRI?" will follow. Confirm this message by pressing the push button <TRIP> again. All output relays should then be activated and the self supervision alarm relay (watchdog) be deenergized one after another with a time interval of 1 second. Thereafter, reset all output relays back to their normal positions by pressing the push button <SELECT/RESET>.

### 6.3 Checking the set values

By pressing the push button <SELECT>, all relay set values may be checked. Set value modification can be done with the push button <+><-> and <ENTER>.

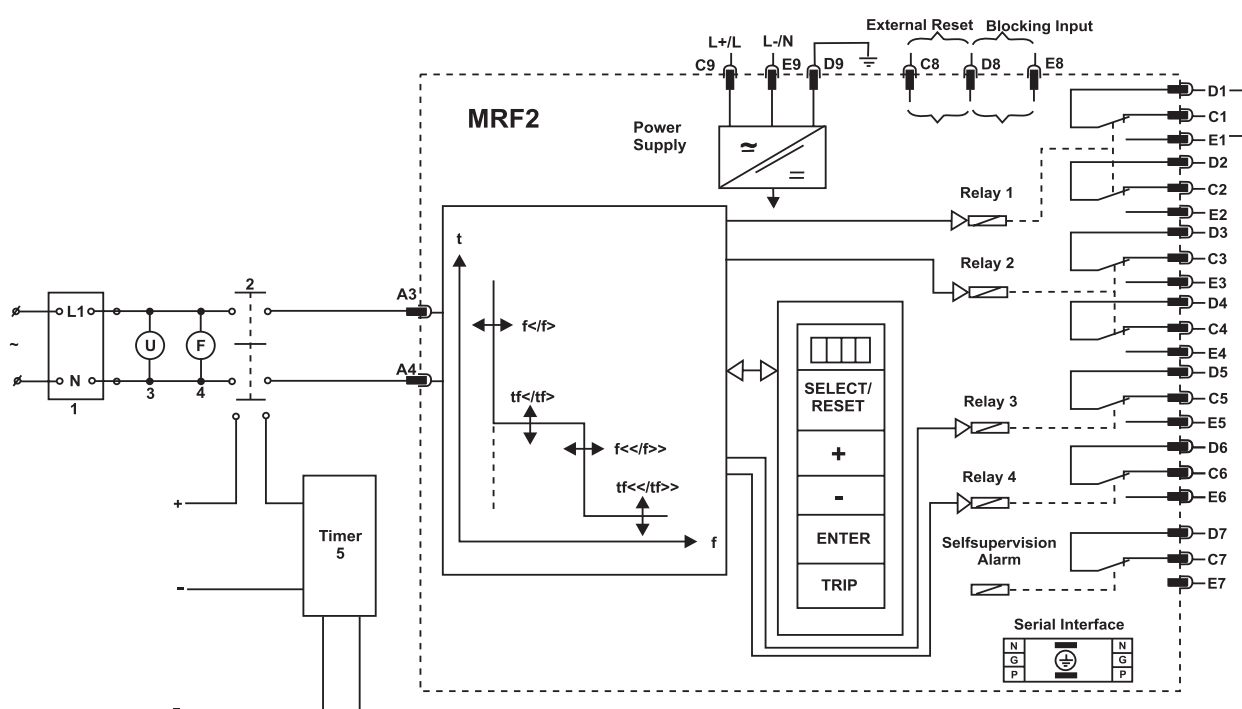
## 6.4 Secondary Injection Test

### 6.4.1 Test Equipment

- Voltmeter and frequency meter
- Auxiliary power supply with the voltage corresponding to the rated data on the type plate
- AC voltage supply with frequency regulation (Voltage: adjustable from 0 to  $\geq 2 \times U_N$ ; Frequency: adjustable from 40 - 70 Hz)
- Timer to measure the operating time
- Switching device
- Test leads and tools

### 6.4.2 Test Circuit

For testing MRF2 the connection of a voltage source with adjustable frequency is required. Fig. shows a simple example of a test circuit.



1. Voltage source with variable voltage and frequency
2. Switching device
3. Frequency meter
4. Voltmeter
5. Timer
6. Relay under test

Fig. : Test circuit

### 6.4.3 Checking the input circuits & measuring values

First the measuring voltage as high as the nominal voltage is to be connected to terminals A3 and A4. Then the actual measuring values of the frequency can be read by pressing push button <SELECT/RESET>. The measured frequency is indicated on the display by the simultaneous illumination of LED f as follows: 5001; corresponds to 50.01 Hz.

### 6.4.4 Checking of operating & resetting values of the over-under frequency functions

#### Note!

During frequency test each of the four frequency elements should be checked. To guarantee a trouble-free test run the other frequency elements of the unit have therefore to be blocked at the beginning by adjusting the corresponding frequency operating values  $f_1$  -  $f_4$  to "EXIT".

To check the operating- and reset values the test frequency must be increased or decreased until the relay picks up. This is signalized when LEDs  $f_1$  -  $f_4$  light up. When comparing the values indicated on the display with those of the frequency meter, the deviation must not exceed more than 0.05 Hz.

The reset values are detected by increasing or decreasing the test frequency slowly till the output relay releases.

The reset value for overfrequency must be larger than  $0.99 \times f_N$ , for underfrequency it must be smaller than  $1.01 \times f_N$ .

### 6.4.5 Checking the Tripping Delays

For checking the tripping delays if a voltage source is needed which changes the frequency in a defined quantity at a certain time and at the same time generates an output signal.

While checking the tripping delay a timer can be connected with the contact of the tripping relay. The timer is simultaneously started with the change of the frequency and stopped when the relay trips. Hereby the test frequencies have to be selected so that the relay detects a safe under- or overfrequency. The tripping time measured with the aid of the timer should not deviate more than 3%, or more than 20 ms (at short tripping delay), from the set tripping delay. It is to be observed that the measured time till tripping is longer by the number of the measuring periods (T) to be evaluated than the set tripping delay.

### 6.4.6 Checking the External blocking & Reset Functions

The external blocking input blocks the underfrequency functions of the **MRF2**.

At the beginning of the test the auxiliary voltage is connected to terminals D8/E8 of the unit. Then a test frequency has to be set which normally leads to tripping of one of the frequency functions. Neither an alarm nor tripping must take place.

After this the auxiliary voltage has to be removed from the blocking input. Changing the frequency again by the same amount, the relay trips and the signal "TRIP" appears on the display. After this the test frequency must be set again to a value which does not lead to tripping. By applying auxiliary voltage to the reset input (C8/D8), the LED indication extinguishes and the display resets.

### 6.5 Primary Injection Test

Generally, a primary injection test could be carried out in the similar manner as the secondary injection test described above. With the difference that the protected power system should be, in this case, connected to the installed relays under test "on line", and the test voltages should be injected to the relay through the voltage transformers with the primary side energized. Since the cost and potential hazards are very high for such a test, primary injection tests are usually limited to very important protective relays in the power system.

Because of its powerful combined indicating and measuring functions, the **MRF2** relay may be tested in the manner of a primary injection test without extra expenditure and time consumption.

In actual service, for example, the measured voltage and frequency values on the **MRF2** relay display may be compared phase by phase with the concerned indications of the instruments of the switchboard to verify that the relay works and measures correctly.

### 6.6 Maintenance

Maintenance testing is generally done on site at regular intervals. These intervals vary among users depending on many factors: e.g. the type of protective relays employed; the importance of the primary equipment being protected; the user's past experience with the relay, etc.

For electromechanical or static relays, maintenance testing will be performed at least once a year according to the experiences. For digital relays like **MRF2**, this interval can be substantially longer. This is because:

- The **MR-** relays are equipped with very wide self-supervision functions, so that many faults in the relay can be detected and signalised during service. Important: The self-supervision output relay must be connected to a central alarm panel!
- The combined measuring functions of **MR-** relays enable supervision the relay functions during service.
- The combined TRIP test function of the **MR-** relay allows to test the relay output circuits.

A testing interval of two years for maintenance will, therefore, be recommended.

During a maintenance test, the relay functions including the operating values and relay tripping times should be tested.

## 7) Technical Data

### 7.1 Measuring Input Circuits

|                   |   |   |
|-------------------|---|---|
| Rated data        | : | Nominal voltage $U_N$ : 100 V, 230 V, 400 V<br>Nominal frequency $f_N$ : 50/60 Hz<br>Operating range: $0.05...2.0 \times U_N$ |
| Power consumption | : | $<1$ VA at $U_N$  |
| Thermal rating    | : | continuously $2 \times U_N$   |

### 7.2 Common Data

|   |   |   |
|---|---|---|
| Dropout to pickup ratio   | : | $f > : > 99.99 \% \quad f < : < 100.02 \%$                                      |
| Dropout time  | : | 30 ms   |
| Time lag error class index E  | : | $\pm 10$ ms   |
| Minimum operating time  | : | 60 ms   |
| Max. allowed interruption of the auxiliary supply without influence to the function of the device | : | 50 ms   |
| Influences on frequency measuring   | : |   |
| Aux. voltage  | : | in the range $0.8 < U_H / U_{HN} < 1.2$ no additional influences to be measured |
| Frequency   | : | no influences   |
| Influences on delay time  | : | no additional influences to be measured   |

For additional common data of all **MR** -relays please refer to manual “**MR** - Digital Multifunctional relays”.



## 7.3 Setting Ranges & Steps

| Function                                    | Parameter         | Setting range  | Steps   | Tolerance                                    |
|---|-------------------|--|---|--|
| Rated frequency                             | $f_N$             | 50 Hz/60 Hz  | 50 Hz/60 Hz   | none   |
| Frequency measuring repetitions             | T                 | 2...99 (periods)   | 1   | none   |
| Frequency element 1                         | $f_1$<br>$t_{f1}$ | 30...49.99; EXIT; 50.01...70 Hz <sup>1</sup><br>40...59.99; EXIT; 60.01...80 Hz <sup>2</sup><br>$t_{f,min}$ ...120 s; EXIT | 0.1; 0.01 Hz<br>0.02; 0.05; 0.1; 0.2;<br>0.5; 1.0; 2.0, 5.0 s | 0.05 Hz<br>$\pm 1\%$ or $\pm 20$ ms          |
| Frequency element 2                         | $f_2$<br>$t_{f2}$ | 30...49.99; EXIT; 50.01...70 Hz <sup>1</sup><br>40...59.99; EXIT; 60.01...80 Hz <sup>2</sup><br>$t_{f,min}$ ...120 s; EXIT | 0.1; 0.01 Hz<br>0.02; 0.05; 0.1; 0.2;<br>0.5; 1.0; 2.0, 5.0 s | 0.05 Hz<br>$\pm 1\%$ or $\pm 20$ ms          |
| Frequency element 3                         | $f_3$<br>$t_{f3}$ | 30...49.99; EXIT; 50.01...70 Hz <sup>1</sup><br>40...59.99; EXIT; 60.01...80 Hz <sup>2</sup><br>$t_{f,min}$ ...120 s; EXIT | 0.1; 0.01 Hz<br>0.02; 0.05; 0.1; 0.2;<br>0.5; 1.0; 2.0, 5.0 s | 0.05 Hz<br>$\pm 1\%$ or $\pm 20$ ms          |
| Frequency element 4                         | $f_4$<br>$t_{f4}$ | 30...49.99; EXIT; 50.01...70 Hz <sup>1</sup><br>40...59.99; EXIT; 60.01...80 Hz <sup>2</sup><br>$t_{f,min}$ ...120 s; EXIT | 0.1; 0.01 Hz<br>0.02; 0.05; 0.1; 0.2;<br>0.5; 1.0; 2.0, 5.0 s | 0.05 Hz<br>$\pm 1\%$ or $\pm 20$ ms          |
| Voltage threshold for frequency measurement | $U_B$             | 5...100 V ( $U_N = 100$ V)<br>12...230 V ( $U_N = 230$ V)<br>20...400 V ( $U_N = 400$ V)                                   | 1 V<br>1 V<br>2 V   | $\pm 1\%$ from setting value or $<0.3\% U_N$ |

Table : Setting ranges and steps

<sup>1</sup> for setting  $f_N = 50$  Hz

<sup>2</sup> for setting  $f_N = 60$  Hz

## 7.4 Order Form

|                        |   |                                  |          |                      |  |
|------------------------|---|----------------------------------|----------|----------------------|--|
| Frequency relay        | <b>MRF2-UF</b>  |                                  |          |                      |  |
| Rated voltage:         | 100 V<br>230 V<br>400 V   | <b>1</b><br><b>2</b><br><b>4</b> |          |                      |  |
| Auxiliary voltage:     | 24 V (16 to 60 V AC / 16 to 80 V DC)<br>110 V (50 to 270 V AC/70 to 360 V DC) | <b>L</b><br><b>H</b>             |          |                      |  |
| Serial interface RS485 |   |                                  | <b>R</b> |                      |  |
| Housing (12TE)         | 19"-rack<br>Flush mounting  |                                  |          | <b>A</b><br><b>D</b> |  |

Technical data subject to change without notice!



## 8) Setting List - MRF2-UF

Project: \_\_\_\_\_

Function group: = \_\_\_\_\_ Location: + \_\_\_\_\_ Relay code: \_\_\_\_\_

Relay functions: \_\_\_\_\_ Password: \_\_\_\_\_

| Function |  | Unit | Default settings | Actual settings |
|----------|--|------|------------------|-----------------|
| $f_N$    | nominal frequency                              | Hz   | 50               |                 |
| T        | measuring repetition for frequency measurement |      | 4                |                 |
| $f_1$    | pickup value of the first frequency element    | Hz   | 48,00            |                 |
| $t_{f1}$ | Tripping delay of the first frequency element  | s    | 0,1              |                 |
| $f_2$    | pickup value of the second frequency element   | Hz   | 49,00            |                 |
| $t_{f2}$ | tripping delay of the second frequency element | s    | 0,1              |                 |
| $f_3$    | pickup value of the third frequency element    | Hz   | 51,00            |                 |
| $t_{f3}$ | tripping delay of the third frequency element  | s    | 0,1              |                 |
| $f_4$    | pickup value of the fourth frequency element   | Hz   | 52,00            |                 |
| $t_{f4}$ | tripping delay of the fourth frequency element | s    | 0,1              |                 |
| $U_B$    | voltage threshold for frequency measurement    | V    | 10/23/40*        |                 |
| RS       | slave address of the serial interface          |      | 1                |                 |

\* threshold dependent on rated voltage 100 V / 230 V / 400 V

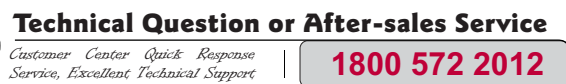
## Revision History

[illegible]

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