

Rate of change of frequency protection

User's manual version information

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1 Rate of change of frequency protection function

1.1 Application

The deviation of the frequency from the rated system frequency indicates unbalance between the generated power and the load demand. If the available generation is large compared to the consumption by the load connected to the power system, then the system frequency is above the rated value. If the unbalance is large, then the frequency changes rapidly. The rate of change of frequency protection function is usually applied to reset the balance between generation and consumption to control the system frequency.

Another possible application is the detection of unintended island operation of distributed generation and some consumers. In the island, there is low probability that the power generated is the same as consumption; accordingly, the detection of a high rate of change of frequency can be an indication of island operation.

Accurate frequency measurement is also the criterion for the synchro-switch function.

1.2 Mode of operation

The source for the rate of change of frequency calculation is an accurate frequency measurement. Depending on the hardware-software configuration, the frequency measurement is usually based on channel No. 1 (line voltage) and channel No. 4 (busbar voltage) of any voltage input modules. In some applications, the frequency is measured based on the weighted sum of the phase voltages.

The accurate frequency measurement is performed by measuring the time period between two rising edges at zero crossing of a voltage signal. For the acceptance of the measured frequency, at least four subsequent identical measurements are needed. Similarly, four invalid measurements are needed to reset the measured frequency to zero. The basic criterion is that the evaluated voltage should be above 30% of the rated voltage value.

The rate of change of frequency protection function generates a start signal if the df/dt value is above the setting value. The rate of change of frequency is calculated as the difference of the frequency at the present sampling and at three periods earlier.

1.3 Summary of the parameters

Enumerated parameter

Parameter name	Title	Selection range	Default
Selection of the operating mode			
FRC81_Oper_EPar_	Operation	Off,On	On

Table 1-1 The enumerated parameter of the rate of change of frequency protection function

Boolean parameter

Parameter name	Title	Default	Explanation
FRC81_StOnly_BPar_	Start signal only	True	If the setting is "true" then the function generates the start signal only, while the trip command is blocked.

Table 1-2 The Boolean parameter of the rate of change of frequency protection function

Float parameter

Parameter name	Title	Unit	Min	Max	Step	Default
Setting value of the comparison						
FRC81_St_FPar_	Start df/dt	Hz/sec	-5	5	-2	0.5

Table 1-3 Float parameter of the rate of change of frequency protection function

Timer parameter

Parameter name	Title	Unit	Min	Max	Step	Default
Time delay						
FRC81_Del_TPar_	Time Delay	msec	100	60000	1	200

Table 1-4 The timer parameter of the rate of change of frequency protection function

1.4 Technical summary

1.4.1 Technical data

Function	Effective range*	Accuracy*

*To be defined by types tests

Table 1-5 Technical data of the rate of change of frequency protection function

1.4.2 Summary of the parameters

The parameters are summarized in Chapter 1.3, Table 1-1 to Table 1-4.

1.4.3 Summary of the generated output signals

The **binary output status signals** of the Rate of change of frequency protection function are listed in Table 1-6.

Binary status signal	Title	Explanation
FRC81_GenSt_Grl_	General Start	General start signal of the function
FRC81_GenTr_Grl_	General Trip	General trip command of the function

Table 1-6 The binary output status signals of the rate of change of frequency protection function

1.4.4 Summary of the input signals

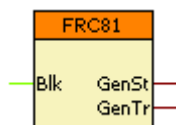
The Rate of change of frequency protection function has a binary input signal. **The conditions of the input signal are defined by the user, applying the graphic equation editor.**

The **binary input status signal** of the Rate of change of frequency protection function is shown in Table 1-7.

Binary status signal	Title	Explanation
FRC81_Blkn_GrO_	Block	Blocking of the rate of change of frequency protection function

Table 1-7 The binary input signal of the rate of change of frequency protection function

1.4.5 The symbol of the function block



The names of the input and output signals are parts of the “Binary status signal” names listed in Table 1-6 and Table 1-7 above.