Paris Session 2022

Application of improved ROCOF in Japan

SC B5 PS1 Q1.04
Are there any key considerations for securing the ROCOF protection against maloperation?

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Inspire the Next

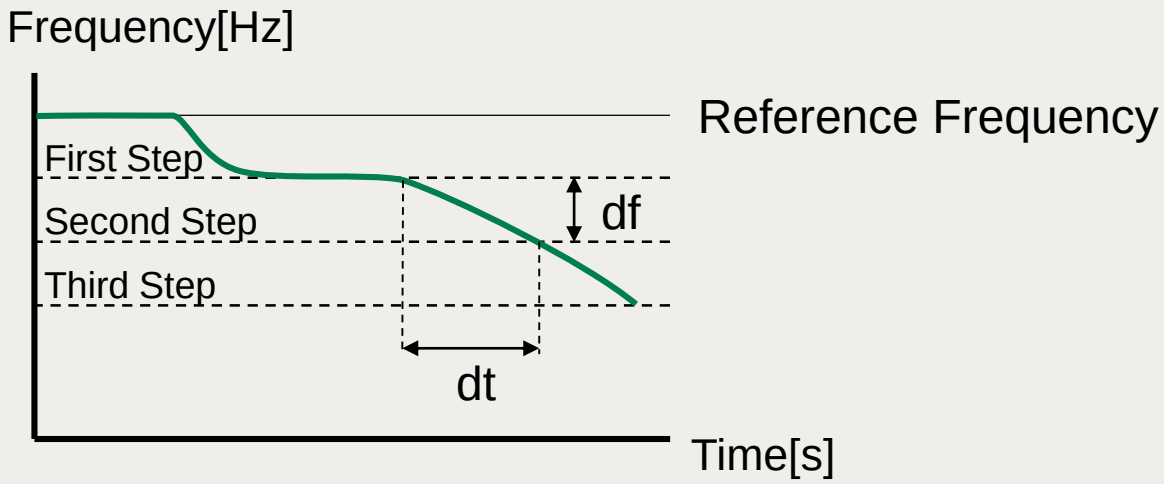
Conventional ROCOF Relay

When a large-scale power outage occurs
- the frequency will reduce significantly
- wide area instability may occur
- lead to a collapse of the whole power system

in order to ensure frequency stability

✓ Under Frequency Relay
✓ ROCOF Relay

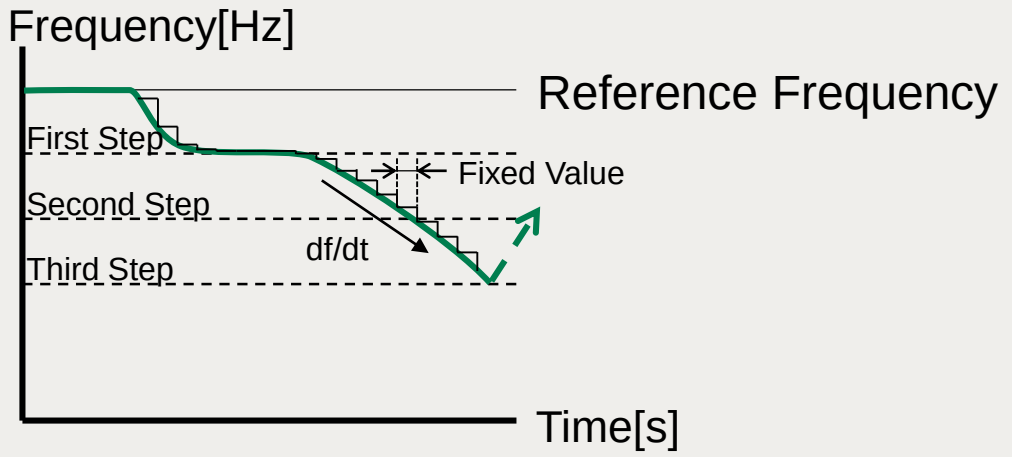
Conventional ROCOF Relay
- calculates the frequency change rate (df/dt) for a certain period
- may not operate in the case where the power outage occurs in multiple times



Improved ROCOF Relay

Improved ROCOF Relay

- Integrates the number of operations with “dt” as a small fixed value of several samples
- can deal with multiple frequency drops

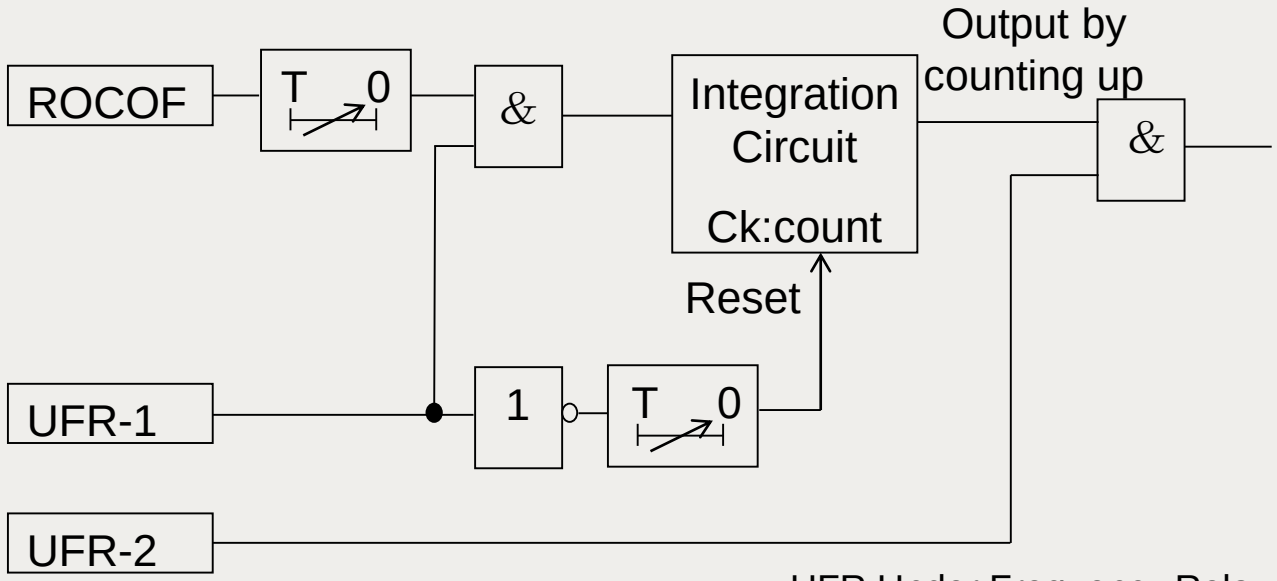


Logic of Improved ROCOF

- mainly composed of ROCOF, UFR-1, UFR-2 and Integration Circuit
- Integration Circuit:

Outputs a signal when number of ROCOF operations reaches Ck

- UFR-1: Reset integration if below operating level
- UFR-2: Block output if below operating level

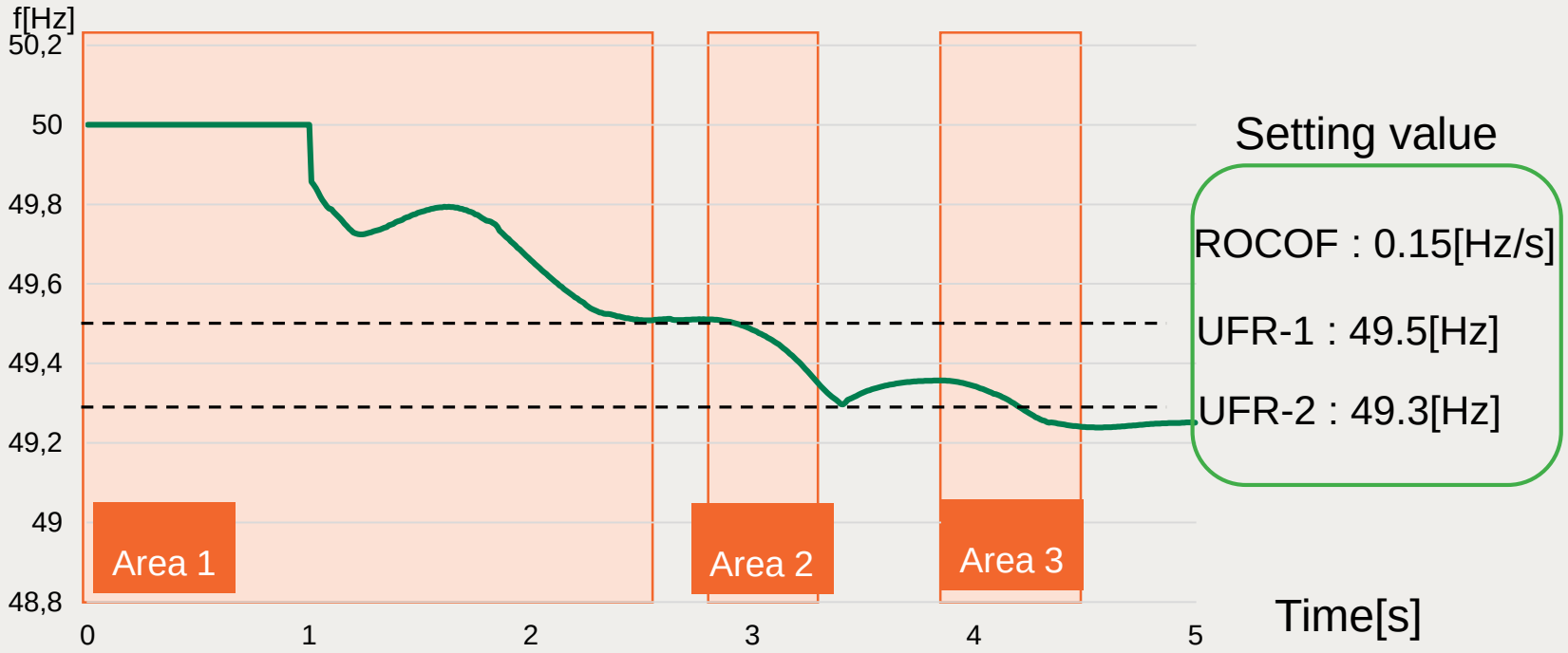


UFR:Under Frequency Relay

Test Result and Conclusion

Test result

It operated correctly in “Area 3” where the frequency was below a setting value and the integration of operations reaches Ck.



Conclusion

By defining the operating requirements of the Improved ROCOF relay and setting value of the UFR and frequency reduction rate, it is possible to prevent the ROCOF relay from malfunctioning.

	Area 1	Area 2	Area 3
ROCOF relay	Non-operation (UFR-1,2 don’t operate)	Non-operation (UFR-2 doesn’t operate)	Operation