



POWERFACTORY

PowerFactory 2021

Technical Reference

ABB RET 630

PF2021

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

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Disclaimer

DigSILENT protection device models are developed using publicly accessible information, such as user manuals, and are not validated or tested by the respective manufacturers.

1 Model information

Manufacturer ABB

Model RET 630

Variants The ABB RET 630 models consist of two models, one for each of the two pre-configurations A and B and support the connection of both 1A and 5A current transformers. Model parameters and pre-configurations were taken from [1] and [2].

Modelled Functionality

Functionality	RET 630 A	RET 630 B
Three-phase non-directional overcurrent protection, low stage	2	2
Three-phase non-directional overcurrent protection, high stage	2	2
Non-directional earth-fault protection, low stage	1 HV	2
Non-directional earth-fault protection, high stage	1 HV	2
Stabilised restricted earth-fault protection, high stage	-	2
Negative-sequence overcurrent protection	2	2
Transformer differential protection for two-winding transformers	1	1
Three-phase overvoltage protection	2 LV	2 LV
Three-phase undervoltage protection	2 LV	2 LV

Per-Unit System

The per-unit system used in the models is the device per-unit system. If the reference system(s) specified in the device differ, recalculation of settings is necessary.

2 General description

The model consists of a main relay with several sub-functions:

- Main relay : Measurement transformer slots, measurement processing, breaker logics
- Differential : Transformer differential protection for two-winding transformers
- Overcurrent HV : Three-phase non-directional overcurrent protection for HV side
- Overcurrent LV : Three-phase non-directional overcurrent protection for LV side
- Earth-fault HV : Non-directional earth-fault protection for HV side
- Earth-fault LV : Non-directional earth-fault protection for LV side
- REF-Differential HV : Stabilised restricted earth-fault protection for HV side
- REF-Differential LV : Stabilised restricted earth-fault protection for LV side
- Unbalance HV : Negative-sequence overcurrent protection for HV side
- Unbalance LV : Negative-sequence overcurrent protection for LV side
- Under-Overvoltage LV : Under- and overvoltage protection

3 Main relay

Measurement transformers

The "CT" and "VT" slots hold the assigned 3-phase measurement transformers. The "Ct-N" slot contains a designated 1-phase current transformer connected to the neutral current.

Measurement units

The "Measurement" slots process the transformer input and hold the nominal current and voltage values. Please note that phase current and neutral current may have different rated values. The rated current "Ct HV-N" of the relay must be entered in unit "Measurement Zero Seq HV". The rated current "Ct LV-N" of the relay must be entered in unit "Measurement Zero Seq LV" (only for model RET630B). The rated voltage "Vt LV" and rated current "Ct LV" of the relay must be entered in unit "Measurement LV" and in unit "Measurement Delta LV". The rated current "Ct HV" of the relay entered in unit "Measurement HV".

Address	Relay Setting	Model Unit	Model Parameter	Note
CTsec1	Rated CT secondary current	Measurement HV Measurement HV 2h Measurement HV 5h	Nominal Current	
CTsec4	Rated CT secondary current	Measurement Zero Seq HV Measurement Zero Seq HV 2h	Nominal Current	see 1)
CTsec5	Rated CT secondary current	Measurement LV Measurement LV 2h Measurement LV 5h Measurement Delta LV	Nominal Current	
CTsec8	Rated CT secondary current	Measurement Zero Seq LV Measurement Zero Seq LV 2h	Nominal Current	see 1)
VTsec9	Rated VT secondary voltage	Measurement LV Measurement Delta LV	Nominal Voltage	

Notes:

- 1) "Measurement Zero Seq HV 2h" and "Measurement Zero Seq LV 2h" are only available in pre-configuration B

Breaker logics

The "Out Logic" hold the breaker and signal assignments for relay trips.

4 Differential

The *"Differential"* sub-function models transformer differential protection is designed to protect two-winding transformers and generator-transformer blocks, includes low biased and high instantaneous stages.

Note

- Harmonic blocking is always enabled for 2nd and 5th harmonic
- *"CT connection type"* is assumed to be *"Type 1"*

Address	Relay Setting	Model Unit	Model Parameter	Note
T2WPDIF: 1	Operation	T2WPDIF	Out of Service	
T2WPDIF: 1	High operate value	T2WPDIF	Unrestrained Differential Threshold	
T2WPDIF: 1	Low operate value	T2WPDIF	Release Threshold	
T2WPDIF: 1	Slope section 2	T2WPDIF	Restraint 1st Slope	
T2WPDIF: 1	End section 2	T2WPDIF	Restraint 2nd Slope Threshold	
T2WPDIF: 1	Start value 2.H	T2WPDIF	2nd Harmonic Blocking: Threshold	
T2WPDIF: 1	Start value 5.H	T2WPDIF	5th Harmonic Blocking: Threshold	
T2WPDIF: 1	Winding 1 type	T2WPDIF Ct1 Adapter T2WPDIF Ct1 Adapter 2h T2WPDIF Ct1 Adapter 5h		see 1)
T2WPDIF: 1	Winding 2 type	T2WPDIF Ct2 Adapter T2WPDIF Ct2 Adapter 2h T2WPDIF Ct2 Adapter 5h		see 1)

Notes:

- 1) Setup vector group and zero sequence elimination according to manual; Additionally the nominal voltage of the respective transformer side needs to be provided

5 Overcurrent HV

The *"Overcurrent HV"* sub-function models three-phase non-directional overcurrent protection for HV side against single-phase, two-phase or three-phase short circuits. The response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT).

Address	Relay Setting	Model Unit	Model Parameter	Note
PHLPTOC: 1	Operation	PHLPTOC	Out of Service	
PHLPTOC: 1	Start value	PHLPTOC	Current Setting	
PHLPTOC: 1	Time multiplier	PHLPTOC	Time Dial	see 1)
PHLPTOC: 1	Operating curve type	PHLPTOC	Characteristic	see 2)
PHLPTOC: 1	Operate delay time	PHLPTOC	Time Dial	see 3)
PHLPTOC: 1	Reset delay time	PHLPTOC	Reset Delay	see 3)
PHLPTOC: 1	Minimum operate time	PHLPTOC	Min. Time	see 1), 4)
PHHPTOC: 1	Operation	PHHPTOC	Out of Service	
PHHPTOC: 1	Start value	PHHPTOC	Current Setting	
PHHPTOC: 1	Time multiplier	PHHPTOC	Time Dial	see 1)
PHHPTOC: 1	Operating curve type	PHHPTOC	Characteristic	see 2)
PHHPTOC: 1	Operate delay time	PHHPTOC	Time Dial	see 3)
PHHPTOC: 1	Reset delay time	PHHPTOC	Reset Delay	see 3)
PHHPTOC: 1	Minimum operate time	PHHPTOC	Min. Time	see 1), 4)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic *"Programmable"*
- 3) Used only in DT mode
- 4) Lower bound of the range might be smaller than permitted in the device

6 Overcurrent LV

The "Overcurrent LV" sub-function models three-phase non-directional overcurrent protection for LV side against single-phase, two-phase or three-phase short circuits. The response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT).

Address	Relay Setting	Model Unit	Model Parameter	Note
PHLPTOC: 1	Operation	PHLPTOC	Out of Service	
PHLPTOC: 1	Start value	PHLPTOC	Current Setting	
PHLPTOC: 1	Time multiplier	PHLPTOC	Time Dial	see 1)
PHLPTOC: 1	Operating curve type	PHLPTOC	Characteristic	see 2)
PHLPTOC: 1	Operate delay time	PHLPTOC	Time Dial	see 3)
PHLPTOC: 1	Reset delay time	PHLPTOC	Reset Delay	see 3)
PHLPTOC: 1	Minimum operate time	PHLPTOC	Min. Time	see 1), 4)
PHHPTOC: 1	Operation	PHHPTOC	Out of Service	
PHHPTOC: 1	Start value	PHHPTOC	Current Setting	
PHHPTOC: 1	Time multiplier	PHHPTOC	Time Dial	see 1)
PHHPTOC: 1	Operating curve type	PHHPTOC	Characteristic	see 2)
PHHPTOC: 1	Operate delay time	PHHPTOC	Time Dial	see 3)
PHHPTOC: 1	Reset delay time	PHHPTOC	Reset Delay	see 3)
PHHPTOC: 1	Minimum operate time	PHHPTOC	Min. Time	see 1), 4)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic "Programmable"
- 3) Used only in DT mode
- 4) Lower bound of the range might be smaller than permitted in the device

7 Earth-fault HV

The "Earth-fault HV" sub-function models non-directional earth-fault protection for HV side. The response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT).

Address	Relay Setting	Model Unit	Model Parameter	Note
EFLPTOC: 1	Operation	EFLPTOC	Out of Service	
EFLPTOC: 1	Start value	EFLPTOC	Current Setting	
EFLPTOC: 1	Time multiplier	EFLPTOC	Time Dial	see 1)
EFLPTOC: 1	Operating curve type	EFLPTOC	Characteristic	see 2)
EFLPTOC: 1	Operate delay time	EFLPTOC	Time Dial	see 3)
EFLPTOC: 1	Reset delay time	EFLPTOC	Reset Delay	see 3)
EFLPTOC: 1	Minimum operate time	EFLPTOC	Min. Time	see 1), 4)
EFHPTOC: 1	Operation	EFHPTOC	Out of Service	
EFHPTOC: 1	Start value	EFHPTOC	Current Setting	
EFHPTOC: 1	Time multiplier	EFHPTOC	Time Dial	see 1)
EFHPTOC: 1	Operating curve type	EFHPTOC	Characteristic	see 2)
EFHPTOC: 1	Operate delay time	EFHPTOC	Time Dial	see 3)
EFHPTOC: 1	Reset delay time	EFHPTOC	Reset Delay	see 3)
EFHPTOC: 1	Minimum operate time	EFHPTOC	Min. Time	see 1), 4)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic "Programmable"
- 3) Used only in DT mode
- 4) Lower bound of the range might be smaller than permitted in the device

8 Earth-fault LV

The *"Earth-fault LV"* sub-function models non-directional earth-fault protection for LV side. The response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT).

Address	Relay Setting	Model Unit	Model Parameter	Note
EFLPTOC: 1	Operation	EFLPTOC	Out of Service	
EFLPTOC: 1	Start value	EFLPTOC	Current Setting	
EFLPTOC: 1	Time multiplier	EFLPTOC	Time Dial	see 1)
EFLPTOC: 1	Operating curve type	EFLPTOC	Characteristic	see 2)
EFLPTOC: 1	Operate delay time	EFLPTOC	Time Dial	see 3)
EFLPTOC: 1	Reset delay time	EFLPTOC	Reset Delay	see 3)
EFLPTOC: 1	Minimum operate time	EFLPTOC	Min. Time	see 1), 4)
EFHPTOC: 1	Operation	EFHPTOC	Out of Service	
EFHPTOC: 1	Start value	EFHPTOC	Current Setting	
EFHPTOC: 1	Time multiplier	EFHPTOC	Time Dial	see 1)
EFHPTOC: 1	Operating curve type	EFHPTOC	Characteristic	see 2)
EFHPTOC: 1	Operate delay time	EFHPTOC	Time Dial	see 3)
EFHPTOC: 1	Reset delay time	EFHPTOC	Reset Delay	see 3)
EFHPTOC: 1	Minimum operate time	EFHPTOC	Min. Time	see 1), 4)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic *"Programmable"*
- 3) Used only in DT mode
- 4) Lower bound of the range might be smaller than permitted in the device

9 Unbalance HV

The *"Unbalance HV"* sub-function models negative-sequence overcurrent protection used to increase sensitivity for detecting single-phase and interphase faults or unbalanced loads for HV side. The response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT).

Address	Relay Setting	Model Unit	Model Parameter	Note
NSPTOC: 1	Operation	NSPTOC	Out of Service	
NSPTOC: 1	Start value	NSPTOC	Current Setting	
NSPTOC: 1	Time multiplier	NSPTOC	Time Dial	see 1)
NSPTOC: 1	Operating curve type	NSPTOC	Characteristic	see 2)
NSPTOC: 1	Operate delay time	NSPTOC	Time Dial	see 3)
NSPTOC: 1	Minimum operate time	NSPTOC	Min. Time	see 1), 4)
NSPTOC: 1	Reset delay time	NSPTOC	Reset Delay	see 3)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic *"Programmable"*
- 3) Used only in DT mode
- 4) Lower bound of the range might be smaller than permitted in the device

10 Unbalance LV

The *"Unbalance LV"* sub-function models negative-sequence overcurrent protection used to increase sensitivity for detecting single-phase and interphase faults or unbalanced loads for LV side. The response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT).

Address	Relay Setting	Model Unit	Model Parameter	Note
NSPTOC: 1	Operation	NSPTOC	Out of Service	
NSPTOC: 1	Start value	NSPTOC	Current Setting	
NSPTOC: 1	Time multiplier	NSPTOC	Time Dial	see 1)
NSPTOC: 1	Operating curve type	NSPTOC	Characteristic	see 2)
NSPTOC: 1	Operate delay time	NSPTOC	Time Dial	see 3)
NSPTOC: 1	Minimum operate time	NSPTOC	Min. Time	see 1), 4)
NSPTOC: 1	Reset delay time	NSPTOC	Reset Delay	see 3)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic *"Programmable"*
- 3) Used only in DT mode
- 4) Lower bound of the range might be smaller than permitted in the device

11 REF-Differential HV

The *"REF-Differential HV"* sub-function models stabilized restricted low-impedance earth-fault protection for HV side for a two winding transformer is based on the numerically stabilized differential current principle.

Address	Relay Setting	Model Unit	Model Parameter	Note
REFPDIF: 1	Operation	REFPDIF	Out of Service	
REFPDIF: 1	Operate value	REFPDIF	Release Threshold	
REFPDIF: 1	Start value 2.H	REFPDIF	2nd Harmonic Blocking: Threshold	

12 REF-Differential LV

The *"REF-Differential LV"* sub-function models stabilized restricted low-impedance earth-fault protection for LV side for a two winding transformer is based on the numerically stabilized differential current principle.

Address	Relay Setting	Model Unit	Model Parameter	Note
REFPDIF: 1	Operation	REFPDIF	Out of Service	
REFPDIF: 1	Operate value	REFPDIF	Release Threshold	
REFPDIF: 1	Start value 2.H	REFPDIF	2nd Harmonic Blocking: Threshold	

13 Under-Overvoltage LV

The *"Under-Overvoltage LV"* sub-function models the functions associated with under / overvoltage: three-phase overvoltage protection, three-phase undervoltage protection. For protections, the response time characteristics of the protection can be selected equal to a definite time (DT) or inverse definite minimum time (IDMT). Three-phase protections can control both phase-to-earth voltage and phase-to-phase voltage.

Address	Relay Setting	Model Unit	Model Parameter	Note
PHPTOV: 1	Operation	PHPTOV1 PhPh	Out of Service	
PHPTOV: 1	Start value	PHPTOV1 PhPh	Input Setting	
PHPTOV: 1	Time multiplier	PHPTOV1 PhPh	Time Dial	see 1)
PHPTOV: 1	Operating curve type	PHPTOV1 PhPh	Characteristic	see 2)
PHPTOV: 1	Operate delay time	PHPTOV1 PhPh	Time Dial	see 3)
PHPTOV: 1	Reset delay time	PHPTOV1 PhPh	Reset Delay	see 3)
PHPTOV: 1	Minimum operate time	PHPTOV1 PhPh	Min. Time	see 1)
PHPTOV: 2	Operation	PHPTOV2 PhPh	Out of Service	
PHPTOV: 2	Start value	PHPTOV2 PhPh	Input Setting	
PHPTOV: 2	Time multiplier	PHPTOV2 PhPh	Time Dial	see 1)
PHPTOV: 2	Operating curve type	PHPTOV2 PhPh	Characteristic	see 2)
PHPTOV: 2	Operate delay time	PHPTOV2 PhPh	Time Dial	see 3)
PHPTOV: 2	Reset delay time	PHPTOV2 PhPh	Reset Delay	see 3)
PHPTOV: 2	Minimum operate time	PHPTOV2 PhPh	Min. Time	see 1)
PHPTUV: 1	Operation	PHPTUV1 PhPh	Out of Service	
PHPTUV: 1	Start value	PHPTUV1 PhPh	Input Setting	
PHPTUV: 1	Time multiplier	PHPTUV1 PhPh	Time Dial	see 1)
PHPTUV: 1	Operating curve type	PHPTUV1 PhPh	Characteristic	see 2)
PHPTUV: 1	Operate delay time	PHPTUV1 PhPh	Time Dial	see 3)
PHPTUV: 1	Reset delay time	PHPTUV1 PhPh	Reset Delay	see 3)
PHPTUV: 1	Minimum operate time	PHPTUV1 PhPh	Min. Time	see 1)
PHPTUV: 2	Operation	PHPTUV2 PhPh	Out of Service	
PHPTUV: 2	Start value	PHPTUV2 PhPh	Input Setting	
PHPTUV: 2	Time multiplier	PHPTUV2 PhPh	Time Dial	see 1)
PHPTUV: 2	Operating curve type	PHPTUV2 PhPh	Characteristic	see 2)
PHPTUV: 2	Operate delay time	PHPTUV2 PhPh	Time Dial	see 3)
PHPTUV: 2	Reset delay time	PHPTUV2 PhPh	Reset Delay	see 3)
PHPTUV: 2	Minimum operate time	PHPTUV2 PhPh	Min. Time	see 1)

Notes:

- 1) Used only in IDMT mode
- 2) The model does not support the type of characteristic *"Programmable"*
- 3) Used only in DT mode

14 References

- [1] ABB Distribution Solutions Distribution Automation, P.O. Box 699 FI-65101 VAASA. *630 series Technical Manual*. 1MRS756508 F.
- [2] ABB Distribution Solutions Distribution Automation, P.O. Box 699 FI-65101 VAASA. *Transformer Protection and Control RET630 Product Guide*. 1MRS756978 H.