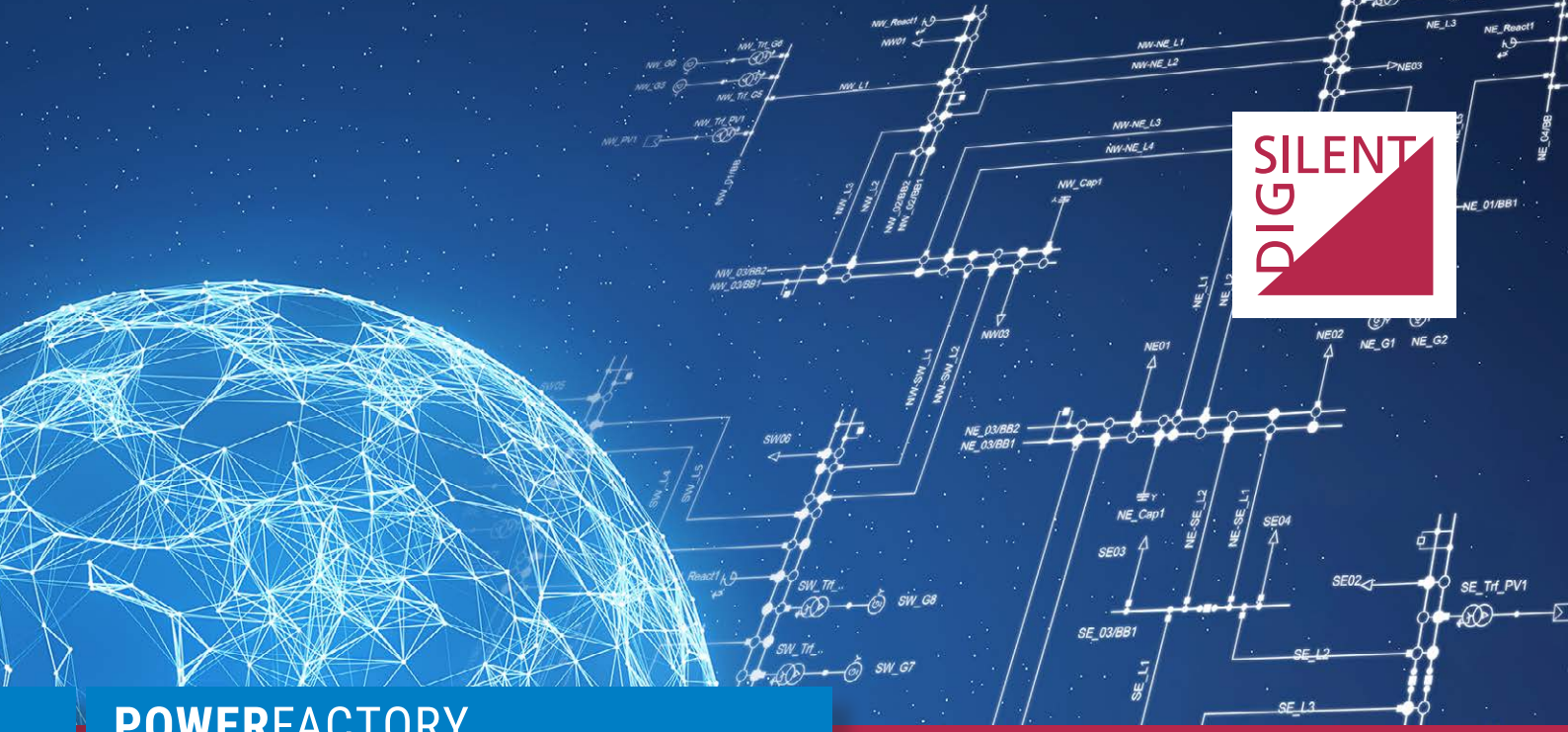

PowerFactory 2021

Technical Reference

ABB REF 615

PF2021

POWER SYSTEM SOLUTIONS

MADE IN GERMANY

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Contents

1 Model information

Manufacturer ABB

Model REF 615

Variants This model covers the features present in all standard configurations of the ABB REF 615 Rev 2 relay.

2 General description

REF615 is a native IEC 61850 feeder protection IED for selective short-circuit, overcurrent and earth-fault protection. It is applicable to all types of radial isolated neutral networks, resistant earthed networks and compensated networks. REF615 is part of a product family that will cover many protection applications for utility and industry customers.It is available with six alternative standard configurations.

The PowerFactory ABB REF 615 relay model simulates most of the protective elements available in all standard configurations. For each configuration the user must disable manually the protective functions non available for that configuration.

The model implementation has been based on the information available in the relay manuals [3] [1] [2].

3 Supported features

3.1 Measurement and acquisition

It represents the interface between the power system and the relay protective elements. The currents flowing in the power system are converted by a block simulating the 3 phase CT and by a block simulating a single phase CT measuring the earth current; the phase voltages are converted by a block simulating a 3 phases VT.

The secondary currents and voltages are then measured by an element modeling the digital sampling of the relay.

3.1.1 Available Units

- one 3ph current transformer (”Ct-3p” block)
- one single phase current transformer (”Ct-E/N*” block)*
- *one 3ph voltage transformer (”*Vt-3p*” block)*
- *two measurement elements (”*Measure Ph*” and ”*Measure Seq” block)

3.1.2 Functionality

The ”Ct-3p*” and the ”*Ct-E/N” block represent ideal CTs. Using the CT default configuration the current at the primary side are converted to the secondary side using the CT ratio. The CT saturation and/or its magnetizing characteristic are not considered. Please set the *”Detailed Model”* check box in the *”Detailed Data””* tab page of the CT dialog and insert the data regarding the CT burden, the CT secondary resistance and the CT excitation parameter if more accurate simulation results are required.

The *”Measure Ph”* and the *”Measure Seq”* block simulate a DFT (*”Discrete Fourier Transform”*) using 20 samples per cycle.

3.1.3 Data input

The CT secondary rated current (1 or 5 A) value and the VT secondary voltage must be set in the *”Measure Ph”* and in the *”Measure Seq”* block.

If no core CT is available please select the 3 phases CT also in the ”Ct-E/N” slot: the earth current will be calculated assuming that an Holmgreen’s connection of the phases is used.

3.2 Protective elements

A set of inverse time and definite time directional and non directional overcurrent elements is modeling the relay protective functions. All the inverse characteristics available in the relay are available in the inverse time model blocks.

The set of overvoltage and undervoltage elements is simulating exactly the protective functions available in the relay.

A simplified reclosing feature implementation is available.

3.2.1 Available Units

- Four Three-phase non-directional overcurrent protection with definite-time or IDMT characteristic, low-stage and high-stage elements (”51P-1(1)”, ”51P-1(2)”, ”51P-2(1)*” and ”*51P-2(2)” block)
- Two 3-phases non-directional overcurrent protection, definite time instantaneous-stage elements (”50P/51P (1)*” and ”*50P/51P (2)” block)
- Two 3-phases directional overcurrent protection with definite-time or IDMT characteristic, low-stage elements (”67-1 (1)*” and ”*67-1 (2)” block)
- One 3-phases directional overcurrent protection with definite-time or IDMT characteristic, high-stage element (”67-2” block)
- Four earth fault non-directional overcurrent protection with definite-time or IDMT characteristic, low-stage and high-stage elements (”51N-1(1)”, ”51N-1(2)”, ”51N-2(1)*” and ”*51N-2(2)” block)
- One earth fault non-directional overcurrent protection, definite time instantaneous-stage elements (”50N/51N ” block)
- Two negative sequence overcurrent protection elements (*”46(1)”*, *”46(2)”* block)

- One phase discontinuity protection element (*"46PD"* block)
- One 3-phases thermal overload protection for cables element (*"49F"* block, simplified logic)
- Three residual overvoltage elements (*"59G(1)"*, *"59G(2)"*, *"59G(3)"* block)
- Three 3phases overvoltage elements (*"59(1)"*, *"59(2)"*, *"59(3)"* block)
- Three 3phases undervoltage elements (*"27(1)"*, *"27(2)"*, *"27(3)"* block)
- One positive sequence undervoltage element (47U+)
- One negative sequence overvoltage element(47O-)
- One automatic reclosing element(*"79"* block). Please configure the *"Tab page"* of the *"79"* block to set the reclosing/lockup logic.

3.2.2 Functionality

The inverse time overcurrent elements support the following trip characteristics:

- ANSI Def time
- ANSI Ext. Inv.
- ANSI Mod. Inv.
- ANSI Norm. Inv.
- ANSI Very Inv.
- IEC Def time
- IEC Ext. inv.
- IEC Inv.
- IEC L.T. inv.
- IEC Norm. Inv.
- IEC S.T. inv.
- IEC Very Inv.
- L.T. V.Inv.
- L.T.E.Inv.
- L.T.Inv.
- Programmable
- RD-Type characteristic
- RI-Type characteristic

The relationship between current and time for "IEC Normal Inverse,*"IEC Very Inverse"*,*"IEC Extremely Inverse and "*IEC Long Time Inverse" complies with the BS 142.1966 and IEC 60255-3 standards. The *"IEEE extremely inverse"*, *"IEEE inverse"* and *"IEEE very inverse"* characteristic complies with the IEEE C37.112 standards. The "RI-type*" and "*RD-Type" characteristic is a special characteristic used mainly in combination with existing mechanical relays.
The inverse time overcurrent elements include an user configurable reset delay. The *"Type of reset curve"* is always *"Def time reset"*.

Both the phase directional and the earth directional element use a *"Phase angle"* operation mode. The voltage memory has a fixed length equal to 30 cycles. The phase directional element uses as polarizing quantity the cross polarizing voltages.

Please configure the *"Tab page"* of the *"79"* block to set the reclosing/lockup logic.

The phase discontinuity protection will be disabled when all phase currents fall below 0.1 x CT. It is possible to block the tripping of the phase discontinuity element by applying a digital input signal to the relay.

The following relay input signals are available to block the protective elements:

- *Block I>* controlling *51P-1(1)*, *51P-1(2)* , *67-1(1)*
- *Block I>>* controlling *67-1(2)*, *67-2*, *51P-2(1)* and *51P-2(2)*
- *Block I>>>* controlling *50P/51P(1)* and *50P/51P(2)*
- *Block Ie>* controlling *51N-1(1)* and *67N-1(1)*
- *Block Ie>>* controlling *50N-51N*, *51N-1(2)*, *51N-2(1)*, *51N-2(2)* , *67N-1(2)* and *67N-2*
- *Block 46* controlling *46(1)* and *46(1)*

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table:

Address (IEC 61850)	Relay Setting	Model block	Model setting	Note
PHLPTOC1	Operation	51P-1(1)	Out of Service (*"out-serv"*)	
PHLPTOC1	Start Value	51P-1(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
PHLPTOC1	Time multiplier	51P-1(1)	Time Dial (*"Tpset"*)	
PHLPTOC1	Operate delay time	51P-1(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
PHLPTOC1	Minimum operate time	51P-1(1)	Minimum Response time (*"minresptime"*)	
PHLPTOC1	Reset Delay time	51P-1(1)	Reset Delay (*"ResetT"*)	
PHLPTOC1	Operating Curve Type	51P-1(1)	Characteristic (*"pcharac"*)	
PHLPTOC2	Operation	51P-1(2)	Out of Service (*"out-serv"*)	
PHLPTOC2	Start Value	51P-1(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
PHLPTOC2	Time multiplier	51P-1(2)	Time Dial (*"Tpset"*)	
PHLPTOC2	Operate delay time	51P-1(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
PHLPTOC2	Minimum operate time	51P-1(2)	Minimum Response time (*"minresptime"*)	
PHLPTOC2	Reset delay time	51P-1(2)	Reset Delay (*"ResetT"*)	

Address (IEC 61850)	Relay Setting	Model block	Model setting	Note
PHLPTOC2	Operating Curve Type	51P-1(2)	Characteristic (*"pcharac"*)	
PHHPTOC1	Operation	51P-2(1)	Out of Service (*"outserv"*)	
PHHPTOC1	Start Value	51P-2(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
PHHPTOC1	Time multiplier	51P-2(1)	Time Dial (*"Tpset"*)	
PHHPTOC1	Operate delay time	51P-2(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
PHHPTOC1	Minimum operate time	51P-2(1)	Minimum Response time (*"minresptime"*)	
PHHPTOC1	Reset delay time	51P-2(1)	Reset Delay (*"ResetT"*)	
PHHPTOC1	Operating Curve Type	51P-2(1)	Characteristic (*"pcharac"*)	
PHHPTOC2	Operation	51P-2(2)	Out of Service (*"outserv"*)	
PHHPTOC2	Start Value	51P-2(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
PHHPTOC2	Time multiplier	51P-2(2)	Time Dial (*"Tpset"*)	
PHHPTOC2	Operate delay time	51P-2(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
PHHPTOC2	Minimum operate time	51P-2(2)	Minimum Response time (*"minresptime"*)	
PHHPTOC2	Reset delay time	51P-2(2)	Reset Delay (*"ResetT"*)	
PHHPTOC2	Operating Curve Type	51P-2(2)	Characteristic (*"pcharac"*)	
PHIPTOC1	Operation	50P/51P(1)	Out of Service (*"outserv"*)	
PHIPTOC1	Start Value	50P/51P(1)	Pickup Current (*"Ipset"*)	
PHIPTOC1	Time Setting	50P/51P(1)	Time Setting (*"Tset"*)	
PHIPTOC2	Operation	50P/51P(2)	Out of Service (*"outserv"*)	
PHIPTOC2	Start Value	50P/51P(2)	Pickup Current (*"Ipset"*)	
PHIPTOC2	Time Setting	50P/51P(2)	Time Setting (*"Tset"*)	
DPHLPDOC1	Operation	67P-1(1)	Out of Service (*"outserv"*)	
DPHLPDOC1	Directional mode	67P-1(1)	Tripping Direction (*"idir"*)	
DPHLPDOC1	Start Value	67P-1(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DPHLPDOC1	Time multiplier	67P-1(1)	Time Dial (*"Tpset"*)	
DPHLPDOC1	Operate delay time	67P-1(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
DPHLPDOC1	Minimum operate time	67P-1(1)	Minimum Response time (*"minresptime"*)	
DPHLPDOC1	Reset delay time	67P-1(1)	Reset Delay (*"ResetT"*)	
DPHLPDOC1	Operating Curve Type	67P-1(1)	Characteristic (*"pcharac"*)	
DPHLPDOC2	Operation	67P-1(2)	Out of Service (*"outserv"*)	
DPHLPDOC2	Directional mode	67P-1(2)	Tripping Direction (*"idir"*)	
DPHLPDOC2	Start Value	67P-1(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DPHLPDOC2	Time multiplier	67P-1(2)	Time Dial (*"Tpset"*)	
DPHLPDOC2	Operate delay time	67P-1(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
DPHLPDOC2	Minimum operate time	67P-1(2)	Minimum Response time (*"minresptime"*)	
DPHLPDOC2	Reset delay time	67P-1(2)	Reset Delay (*"ResetT"*)	
DPHLPDOC2	Operating Curve Type	67P-1(2)	Characteristic (*"pcharac"*)	
DPHHPDOC1	Operation	67P-2(1)	Out of Service (*"outserv"*)	
DPHHPDOC1	Directional mode	67P-2(1)	Tripping Direction (*"idir"*)	

Address (IEC 61850)	Relay Setting	Model block	Model setting	Note
DPHHPDOC1	Start Value	67P-2(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DPHHPDOC1	Time multiplier	67P-2(1)	Time Dial (*"Tpset"*)	
DPHHPDOC1	Operate delay time	67P-2(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
DPHHPDOC1	Minimum operate time	67P-2(1)	Minimum Response time (*"minresptime"*)	
DPHHPDOC1	Reset delay time	67P-2(1)	Reset Delay (*"ResetT"*)	
DPHHPDOC1	Operating Curve Type	67P-2(1)	Characteristic (*"pcharac"*)	
DPHHPDOC2	Operation	67P-2(2)	Out of Service (*"outserv"*)	
DPHHPDOC2	Directional mode	67P-2(2)	Tripping Direction (*"idir"*)	
DPHHPDOC2	Start Value	67P-2(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DPHHPDOC2	Time multiplier	67P-2(2)	Time Dial (*"Tpset"*)	
DPHHPDOC2	Operate delay time	67P-2(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
DPHHPDOC2	Minimum operate time	67P-2(2)	Minimum Response time (*"minresptime"*)	
DPHHPDOC2	Reset delay time	67P-2(2)	Reset Delay (*"ResetT"*)	
DPHHPDOC2	Operating Curve Type	67P-2(2)	Characteristic (*"pcharac"*)	
DPHLPDOC1	Characteristic angle	Dir phase	Max Torque Angle (*"mtau"*)	In the "Voltage polarizing"
DPHLPDOC2				tab page
DPHHPDOC1				
DPHHPDOC2				
DPHLPDOC1	Max Forward Angle	Dir phase	Operating Sector Angle (*"phisec"*)	Operating Sector Angle=Max
DPHLPDOC2	Max Reverse Angle			Forward Angle+Min Forward
DPHHPDOC1	Min Forward Angle			Angle = Max Reverse Angle+
DPHHPDOC2	Min Reverse Angle			Min Reverse Angle
EFLPTOC1	Operation	51N-1(1)	Out of Service (*"outserv"*)	
EFLPTOC1	Start Value	51N-1(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
EFLPTOC1	Time multiplier	51N-1(1)	Time Dial (*"Tpset"*)	
EFLPTOC1	Operate delay time	51N-1(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
EFLPTOC1	Minimum operate time	51N-1(1)	Minimum Response time (*"minresptime"*)	
EFLPTOC1	Reset delay time	51N-1(1)	Reset Delay (*"ResetT"*)	
EFLPTOC1	Operating Curve Type	51N-1(1)	Characteristic (*"pcharac"*)	
EFLPTOC2	Operation	51N-1(2)	Out of Service (*"outserv"*)	
EFLPTOC2	Start Value	51N-1(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
EFLPTOC2	Time multiplier	51N-1(2)	Time Dial (*"Tpset"*)	
EFLPTOC2	Operate delay time	51N-1(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
EFLPTOC2	Minimum operate time	51N-1(2)	Minimum Response time (*"minresptime"*)	
EFLPTOC2	Reset delay time	51N-1(2)	Reset Delay (*"ResetT"*)	
EFLPTOC2	Operating Curve Type	51N-1(2)	Characteristic (*"pcharac"*)	
EFHPTOC1	Operation	51N-2(1)	Out of Service (*"outserv"*)	
EFHPTOC1	Start Value	51N-2(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
EFHPTOC1	Time multiplier	51N-2(1)	Time Dial (*"Tpset"*)	

Address (IEC 61850)	Relay Setting	Model block	Model setting	Note
EFHPTOC1	Operate delay time	51N-2(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
EFHPTOC1	Minimum operate time	51N-2(1)	Minimum Response time (*"minresptime"*)	
EFHPTOC1	Reset delay time	51N-2(1)	Reset Delay (*"ResetT"*)	
EFHPTOC1	Operating Curve Type	51N-2(1)	Characteristic (*"pcharac"*)	
EFHPTOC2	Operation	51N-2(2)	Out of Service (*"outserv"*)	
EFHPTOC2	Start Value	51N-2(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
EFHPTOC2	Time multiplier	51N-2(2)	Time Dial (*"Tpset"*)	
EFHPTOC2	Operate delay time	51N-2(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
EFHPTOC2	Minimum operate time	51N-2(2)	Minimum Response time (*"minresptime"*)	
EFHPTOC2	Reset delay time	51N-2(2)	Reset Delay (*"ResetT"*)	
EFHPTOC2	Operating Curve Type	51N-2(2)	Characteristic (*"pcharac"*)	
EFIPTOC1	Operation	50N/51N(1)	Out of Service (*"outserv"*)	
EFIPTOC1	Start Value	50N/51N(1)	Pickup Current (*"Ipset"*)	
EFIPTOC1	Time Setting	50N/51N(1)	Time Setting (*"Tset"*)	
EFIPTOC2	Operation	50N/51N(2)	Out of Service (*"outserv"*)	
EFIPTOC2	Start Value	50N/51N(2)	Pickup Current (*"Ipset"*)	
EFIPTOC2	Time Setting	50N/51N(2)	Time Setting (*"Tset"*)	
DEFLPDEF1	Operation	67N-1(1)	Out of Service (*"outserv"*)	
DEFLPDEF1	Directional mode	67N-1(1)	Tripping Direction (*"idir"*)	
DEFLPDEF1	Start Value	67N-1(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DEFLPDEF1	Time multiplier	67N-1(1)	Time Dial (*"Tpset"*)	
DEFLPDEF1	Operate delay time	67N-1(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
DEFLPDEF1	Minimum operate time	67N-1(1)	Minimum Response time (*"minresptime"*)	
DEFLPDEF1	Reset delay time	67N-1(1)	Reset Delay (*"ResetT"*)	
DEFLPDEF1	Operating Curve Type	67N-1(1)	Characteristic (*"pcharac"*)	
DEFLPDEF2	Operation	67N-1(2)	Out of Service (*"outserv"*)	
DEFLPDEF2	Directional mode	67N-1(2)	Tripping Direction (*"idir"*)	
DEFLPDEF2	Start Value	67N-1(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DEFLPDEF2	Time multiplier	67N-1(2)	Time Dial (*"Tpset"*)	
DEFLPDEF2	Operate delay time	67N-1(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
DEFLPDEF2	Minimum operate time	67N-1(2)	Minimum Response time (*"minresptime"*)	
DEFLPDEF2	Reset delay time	67N-1(2)	Reset Delay (*"ResetT"*)	
DEFLPDEF2	Operating Curve Type	67N-1(2)	Characteristic (*"pcharac"*)	
DEFHPDEF1	Operation	67N-2	Out of Service (*"outserv"*)	
DEFHPDEF1	Directional mode	67N-2	Tripping Direction (*"idir"*)	
DEFHPDEF1	Start Value	67N-2	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
DEFHPDEF1	Time multiplier	67N-2	Time Dial (*"Tpset"*)	
DEFHPDEF1	Operate delay time	67N-2	Time Dial (*"Tpset"*)	*"DT"* curve only
DEFHPDEF1	Minimum operate time	67N-2	Minimum Response time (*"minresptime"*)	

Address (IEC 61850)	Relay Setting	Model block	Model setting	Note
DEFHPDEF1	Reset delay time	67N-2	Reset Delay (*"ResetT"*)	
DEFHPDEF1	Operating Curve Type	67N-2	Characteristic (*"pcharac"*)	
DEFLPDOC1	Characteristic angle	Dir Earth	Max Torque Angle (*"mtau"*)	In the *"Voltage polarizing"*
DEFLPDOC2				tab page
DEFHPDOC1				
DEFHPDOC2				
DEFLPDOC1	Max Forward Angle	Dir phase	Operating Sector Angle (*"phisec"*)	Operating Sector Angle=Max
DEFLPDOC2	Max Reverse Angle			Forward Angle+Min Forward
DEFHPDOC1	Min Forward Angle			Angle = Max Reverse Angle+
DEFHPDOC2	Min Reverse Angle			Min Reverse Angle
NSPTOC1	Operation	46(1)	Out of Service (*"outserv"*)	
NSPTOC1	Start Value	46(1)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
NSPTOC1	Time multiplier	46(1)	Time Dial (*"Tpset"*)	
NSPTOC1	Operate delay time	46(1)	Time Dial (*"Tpset"*)	*"DT"* curve only
NSPTOC1	Minimum operate time	46(1)	Minimum Response time (*"minresptime"*)	
NSPTOC1	Reset delay time	46(1)	Reset Delay(*"ResetT"*)	
NSPTOC1	Operating Curve Type	46(1)	Characteristic (*"pcharac"*)	
NSPTOC2	Operation	46(2)	Out of Service (*"outserv"*)	
NSPTOC2	Start Value	46(2)	Current Setting (*"Ipset"*)	Current Setting = Start Value * Start Value Multiplier
NSPTOC2	Time multiplier	46(2)	Time Dial (*"Tpset"*)	
NSPTOC2	Operate delay time	46(2)	Time Dial (*"Tpset"*)	*"DT"* curve only
NSPTOC2	Minimum operate time	46(2)	Minimum Response time (*"minresptime"*)	
NSPTOC2	Reset delay time	46(2)	Reset Delay(*"ResetT"*)	
NSPTOC2	Operating Curve Type	46(2)	Characteristic (*"pcharac"*)	
PDNSPTOC1	Operation	46PD	Out of Service (*"outserv"*)	
PDNSPTOC1	Start Value	46PD	Pickup Current (*"Ipset"*)	
PDNSPTOC1	Time Setting	46PD	Time Setting (*"Tset"*)	
PHPTUV1	Operation	27 (1)	Out of Service (*"outserv"*)	
PHPTUV1	Start Value	27 (1)	Input Setting(*"Ipset"*)	
PHPTUV1	Time Setting	27 (1)	Time Dial (*"Tpset"*)	
PHPTUV2	Operation	27 (2)	Out of Service (*"outserv"*)	
PHPTUV2	Start Value	27 (2)	Input Setting(*"Ipset"*)	
PHPTUV2	Time Setting	27 (2)	Time Dial (*"Tpset"*)	
PHPTUV3	Operation	27 (3)	Out of Service (*"outserv"*)	
PHPTUV3	Start Value	27 (3)	Input Setting(*"Ipset"*)	
PHPTUV3	Time Setting	27 (3)	Time Dial (*"Tpset"*)	
PHPTOV1	Operation	59 (1)	Out of Service (*"outserv"*)	
PHPTOV1	Start Value	59 (1)	Input Setting(*"Ipset"*)	
PHPTOV1	Time Setting	59 (1)	Time Dial (*"Tpset"*)	
PHPTOV2	Operation	59 (2)	Out of Service (*"outserv"*)	
PHPTOV2	Start Value	59 (2)	Input Setting(*"Ipset"*)	

Address (IEC 61850)	Relay Setting	Model block	Model setting	Note
PHPTOV2	Time Setting	59 (2)	Time Dial (*"Tpset"*)	
PHPTOV3	Operation	59 (3)	Out of Service (*"outserv"*)	
PHPTOV3	Start Value	59 (3)	Input Setting(*"Ipset"*)	
PHPTOV3	Time Setting	59 (3)	Time Dial (*"Tpset"*)	
ROVPTOV1	Operation	59 G (1)	Out of Service (*"outserv"*)	
ROVPTOV1	Start Value	59 G (1)	Pickup Voltage(*"Uset"*)	
ROVPTOV1	Time Setting	59 G (1)	Time Delay (*"Tpset"*)	
ROVPTOV2	Operation	59 G (2)	Out of Service (*"outserv"*)	
ROVPTOV2	Start Value	59 G (2)	Pickup Voltage(*"Uset"*)	
ROVPTOV2	Time Setting	59 G (2)	Time Delay (*"Tpset"*)	
ROVPTOV3	Operation	59 G (3)	Out of Service (*"outserv"*)	
ROVPTOV3	Start Value	59 G (3)	Pickup Voltage(*"Uset"*)	
ROVPTOV3	Time Setting	59 G (3)	Time Delay (*"Tpset"*)	
PSPTUV1	Operation	47U+	Out of Service (*"outserv"*)	
PSPTUV1	Start Value	47U+	Pickup Voltage(*"Uset"*)	
PSPTUV1	Time Setting	47U+	Time Delay (*"Tdel"*)	
NSPTOV1	Operation	47O-	Out of Service (*"outserv"*)	
NSPTOV1	Start Value	47O-	Pickup Voltage(*"Uset"*)	
NSPTOV1	Time Setting	47O-	Time Delay (*"Tdel"*)	
T1PTTR1	Operation	49	Out of Service (*"outserv"*)	
T1PTTR1	Full load current	49	Current Setting (*"Ipset"*)	
T1PTTR1	Time constant of stage	49	Time Dial (*"Tpset"*)	
DARREC1	Number of AR shots	79	Operations to Lockout (*"oplockout"*)	Set *"Operations to lockout"="Number of AR shots"*+1
DARREC1	CB Closing time	79	Closing Command Duration (*"closingcomtime"*)	
DARREC1	Reclaim Time	79	Reset Time (*"resettime"*)	
DARREC1	Dead time of shot 1	79	Reclosing Interval 1 (*"recltime1"*)	
DARREC1	Dead time of shot 2	79	Reclosing Interval 2 (*"recltime2"*)	
DARREC1	Dead time of shot 3	79	Reclosing Interval 3 (*"recltime3"*)	
DARREC1	Dead time of shot 4	79	Reclosing Interval 4 (*"recltime4"*)	

3.3 Output logic

It represents the output stage of the relay; it is the interface between the relay and the power breaker.

3.3.1 Available Units

- one output trip element (*"Trip Logic"* block)
- one breaker control element (*"Closing Logic"* block)

3.3.2 Functionality

The *"Trip Logic"* block is collecting the trip signals coming from the protective elements and operating the relay output contacts. The output contact is *"yout"*.

The *"Closing Logic"* block has the responsibility to generate the command to close the breaker during the reclosing sequence. It is driven by the reclosing logic hosted inside the *"79"* block.

3.3.3 Data input

To disable the relay model ability to open the power circuit breaker simply disable the *"Trip Logic"* block.

4 Features not supported

The following features are not supported:

- In rush detection
- Transient/intermittent earth fault protection
- Non-directional (cross-country) earth fault protection
- Any kind of differential protection
- Motor startup supervision
- Phase reversal protection
- Master trip
- Arc protection
- Circuit breaker failure detection
- Trip circuit supervision
- Current circuit supervision
- Fuse failure supervision
- Motor runtime counter
- Alarm level of element 49

5 References

[1] ABB Oy Distribution Automation, P.O.box 699, FI-65101 Vaasa , FINLAND. *Feeder Protection and Control REF615 Application Manual 1MRS756378 E Issued: 04.03.2009 Revision: D*, 2009.

[2] ABB Oy Distribution Automation, P.O.box 699, FI-65101 Vaasa , FINLAND. *Feeder Protection and Control REF615 Operation Manual 1MRS756708 E Issued: 03.07.2009 Revision: B Product Version 2.0*, 2009.

[3] ABB Oy Distribution Automation, P.O.box 699, FI-65101 Vaasa , FINLAND. *Feeder Protection and Control Relay REF615 Product Guide 1MRS756379 E Issued: 03.07.2009 Revision: E*, 2009.