

RefleX² Protection and Control

RefleX² - 222

Impedance protection for distribution
and sub-transmission networks



Medium voltage
impedance protection
Model 222

RefleX impedance protection

Application

The RefleX distribution impedance relay is designed to protect isolated, impedance compensated and directly-grounded medium-voltage networks. It is extremely easy to use, and the setting tools and menus are carefully designed to enable easy setting and quick and cost-effective operation. The relay offers uncomplicated and efficient protection of lines in interconnected distribution networks, or distribution networks with unreasonable long tripping times due to a high number of serial lines.

Measurement

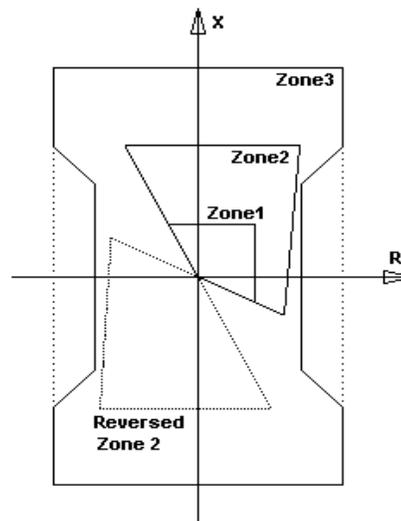
The relay includes three measuring zones, all with quadrilateral characteristics. The two first zones Z1 and Z2 can be independently set forward, backward, non-directional or off. If a zone is directional then two additional blinders are added to restrict the operation to forward (or reverse) faults. Independent settings for the R-reach and R-angle enable excellent control towards the load resistances

If necessary then the zone reach in R-direction can be further limited, thus permitting extremely high load currents independent of the initial zone settings.

Each of the three zones has six "measuring elements", each measuring one of the six loop impedances. The operation of each zone and each element is totally independent and is continuously calculated by the software.

The relay therefore forms a true "full scheme" unit.

Increased $3I_0$ (EF current) or increased $3U_0$ (EF voltage) are applied as additional starting criteria for the phase-ground impedance measuring loops.



Zone blocking

Zone 2 can be blocked by an external signal. This enables the user to create inexpensive and uncomplicated blocking schemes to form simple busbar protection logic, line trip acceleration systems etc.

Voltage memory and cross-polarisation

To ensure correct directional measurement during 3-phase close-up faults a 4-cycle post-fault memory is used. During asymmetrical faults cross-polarisation is applied to provide undisturbed directional measurement.

Switch On To Fault logic (SOTF)

When the SOTF logic is primed, it will remove the directional check from the Zone2 measurement and make the zone non-directional. The SOTF signal will also bypass the Zone2 time delay. This ensures that the relay can trip instantaneously when switched on (from dead) to a zero voltage fault at the relay location.

The function can be activated either by internal measurement or by an external signal.

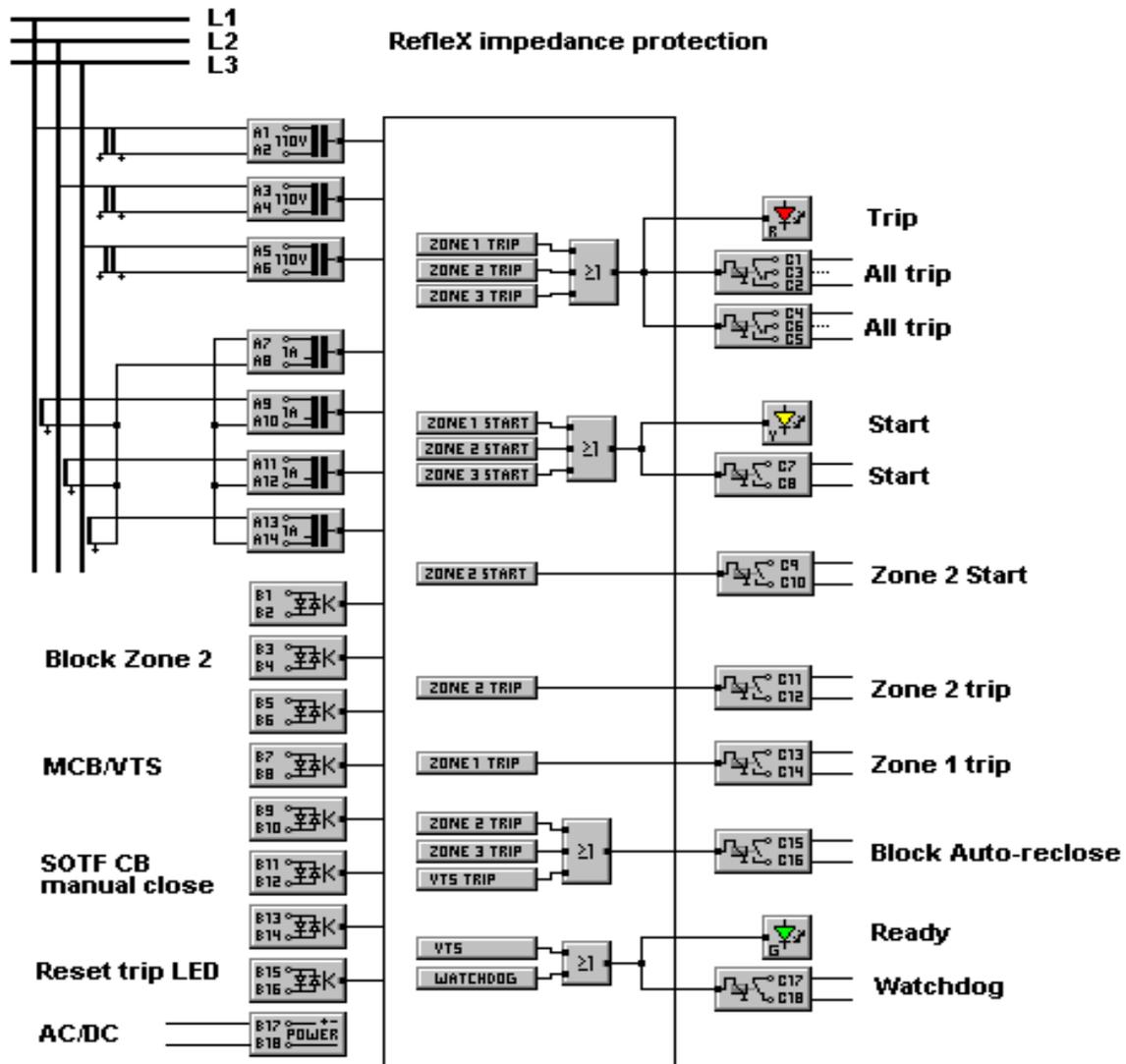
Voltage Transformer Supervision (VTS)

When the VTS unit detects a faulty VT supply and operates, and the user has selected VTS blocking, all six elements in each zone will be prevented from operation.

The function can be activated either by internal measurement or by external activation (MCB contact).

Reflex impedance protection

Logic diagram



File:222_PRD_301.bmp

RefleX impedance protection

Impedance relay I1 124A I2 120A I3 123A	(See separate description of sub-menu "in-service displays")	In-service display. Different displays are available. Press "enter" to toggle between displays
Trip records	(See separate description of sub-menu "Trip records")	Press "enter" here to view recorded data. After selecting a record use "arrow up" or "arrow down" to display additional information. Leave sub-menu by pressing "Esc".
Measuring Set: Ω/ph sec VT 132000/110V CT 1000/1A In1A	<hr/> <hr/> <hr/>	Define measuring system and display Choose to set impedances in sec or primary values Primary / secondary VT Primary / secondary CT, Relay rated current
Z1 t 0.0s R 7.65Ω X 3.55Ω R∠ 85° Forward kR 1.2 kX 1.2	<hr/> <hr/> <hr/>	Zone 1 settings Zone 1 delay R1 reach in ohm/ph X1 reach in ohm/ph R1 angle ref +R-axis Fwd, Rev, Non-dir, Off R1 EF compensation X1 EF compensation
Z2 t 0.3s R 9.3Ω X 5.6Ω R∠ 78° Forward kR 1.45 kX 1.35	<hr/> <hr/> <hr/>	Zone 2 settings Zone 2 delay R2 reach in ohm/ph X2 reach in ohm/ph R2 angle ref +R-axis Fwd, Rev, Non-dir, Off R2 EF compensation X2 EF compensation
Z3 t 2.5s R± 35Ω X+ 56Ω X- 35Ω Zone-cut kR 1.5 kX 1.5	<hr/> <hr/> <hr/>	Zone 3 settings Zone 3 delay Resistive reach Reactive forward reach Reactive reverse reach On, Off, Zone-cut R3 EF compensation X3 EF compensation
Z3 zone-cut R min 2.0Ω R ang 30° Limit Z1 Z2 Z3	<hr/> <hr/> <hr/>	Zone-cut function settings Resistive reach for ±Rmin (min load impedance) Load sector angle Limiter active in: Z3 alone / Z1, Z2 and Z3
EF detection 3Uo 22V sec 3Io 150/0.15A Solid earthing	<hr/> <hr/> <hr/>	Earth Fault detection levels Secondary voltage setting Primary / secondary current setting Powe System Earth: Solid, isolated or compensated
SOTF by CB close (high)	<hr/> <hr/>	Switch On To Fault activated by Alt1: I/U level (internal logic) Alt2: CB close (high) (high=high opto-input) Alt3: CB close (low) (low=low opto input)
VTS response Alarm and block	<hr/> <hr/>	Voltage Transformer Supervision response Alt1: Off Alt2: Alarm Alt3: Alarm and block
YMD 2002-05-29 HMS 13:52:36 Password **** Frequency 50Hz	<hr/> <hr/> <hr/> <hr/>	Year, month, and day 24 hour clock Four-digit password (default 1111) Rated power system frequency

RefleX impedance protection

Trip-records sub-menu

All displays show recordings subsequent to relay tripping. The last five recordings are always stored. After each relay trip the display showing date and time of the trip automatically appears. By using arrow up/arrow down the user may access all relevant information in the displays below. Each trip is automatically assigned a unique serial number. Only trip records (displays) with active information are stored and/or displayed after a trip.

Trip records

Trip 333
1999-12-333
12:13:14.123
Delay 0.3s

This display is part of the main menu
After selecting a record use "arrow up" or "arrow down" to display additional information.
Leave trip records by pressing "Esc".

Header (in this case looking at trip no. 333)
Date of "trip 333"
Time of "trip 333"
Delay of "trip 333"

Trip 333
L1-N L1-L2
L2-N* L2-L3*
L3-N* L3-L1

Activated measuring loops (trip 333)
* indicates activated measuring loops

Trip 333
Z1 Z2*
Z3

Tripped zone (trip 333)
* indicates the shortest zone activated
In this case zone Z2 tripped

Trip 333
SOTF trip

Switch OnTo Fault
This display appears only after a "Switch On To Fault" trip.

Trip 333
VTS trip

Voltage Transformer Supervision trip
This display appears if the "Voltage transformer supervision" has been activated. It indicates a problem in the voltage measuring circuit.

RefleX impedance protection

In-service displays

During commissioning of the relay the in-service display will show the primary phase currents.

Press "enter" to switch between the different in-service displays

Chosen in-service display will automatically be default in-service display

In-service display

Impedance relay	
IL1	124A
IL2	120A
IL3	123A

Phase 1 primary current measurement
Phase 2 primary current measurement
Phase 3 primary current measurement

Impedance relay	
IL1	0.12A∠ 0°
IL2	0.12A∠ -120°
IL3	0.12A∠ 120°

Phase 1 secondary current and angle measurement
Phase 2 secondary current and angle measurement
Phase 3 secondary current and angle measurement

Impedance relay	
UL1	63.5V∠ Ref°
UL2	63.5V∠ -120°
UL3	63.5V∠ 120°

Phase 1 secondary voltage and angle measurement
Phase 2 secondary voltage and angle measurement
Phase 3 secondary voltage and angle measurement

R Ω/ph X Ω/ph		
L12	529Ω	0Ω
L23	529Ω	0Ω
L31	529Ω	0Ω

Secondary ph-ph impedance
Secondary ph-ph impedance
Secondary ph-ph impedance

	R	X
L1N	529Ω	0Ω
L2N	529Ω	0Ω
L3N	529Ω	0Ω

Secondary ph-ground impedance
Secondary ph-ground impedance
Secondary ph-ground impedance

* All angles are measured and displayed with reference to the UL1 voltage

RefleX impedance protection

Technical data

All zones

Measuring scheme	Full-scheme impedance protection
Measuring elements	Six independent elements per zone
Minimum operating current	0.1 * In
Resetting ratio	1.03
Typical trip time	30-40 ms (50 Hz system frequency)
Typical reset-time for measuring system	20-30 ms (50 Hz system frequency)
Measuring limit - voltage	2 V
Measuring limit - current	0.1A (In 1A)
Measuring limit - current	0.5A (In 5A)

Measuring zones, Z1, Z2

Resistive reach	In 1A	R	0.20-300 ohm/phase secondary
Resistive reach	In 5A	R	0.04-60.0 ohm/phase secondary
Resistive directional blinder angle		R∠	45° - 85°
Reactive reach	In 1A	X	0.10-300 ohm/phase secondary
Reactive reach	In 5A	X	0.02-60.0 ohm/phase secondary
Resistive EF compensation factor		kR	0.10-2.50 (remember to cover arc resistance)
Reactive EF compensation factor		kX	0.10-2.50
Zone trip delay		t	0.00-9.99 s and ∞
Measuring direction - operational status			Forwards, backwards, non-directional, off
Fixed directional blinders			-30° and +120°

Measuring zone 3, Z3

Resistive reach (+R and -R)	In 1A	R±	0.20-300 ohm/phase secondary
Resistive reach (+R and -R)	In 5A	R±	0.04-60.0 ohm/phase secondary
Reactive reach (fwd direction)	In 1A	X+	0.10-300 ohm/phase secondary
Reactive reach (fwd direction)	In 5A	X+	0.02-60.0 ohm/phase secondary
Reactive reach (reverse direction)	In 1A	X-	0.10-300 ohm/phase secondary
Reactive reach (reverse direction)	In 5A	X-	0.02-60.0 ohm/phase secondary
Resistive EF compensation factor		kR	0.10-2.50
Reactive EF compensation factor		kX	0.10-2.50
Zone trip delay		t	0.00-9.99 s and ∞
Zone operational status			On (non-directional) or off
Resistive reach (R min)	In 1A	R±	0.20-+R and -R ohm/phase secondary
Resistive reach (+R and -R)	In 5A	R±	0.04-+R and -R ohm/phase secondary

Characteristics

