AZT 3/0

AUTONOMOUS IDMT O/C BACK-UP PROTECTION

Application field

The electronic autonomous IDMT back up protection type **AZT 3/0** can operate the circuit breaker without power supply from the substations battery. In case of breakdown of the auxiliary (battery) power supply in a substation, the protection cannot operate the circuit breaker. If a fault occurs during this time, it can cause serious damage to the primary devices as well. The AZT 3/0 type autonomous protection is supplied by the measuring transformers, and can store sufficient energy to open the circuit breaker. So it can serve disaster prtection.

Main features

- External energy source is not needed to operate the AZT 3/0 device, since the electronic circuits are supplied from the CT circuits.
- The device stores energy in capacitors. The stored energy is sufficient to trip the CB.
- The device has an inverse definite minimum time characteristic.
- The characteristic can be shifted parallel to the direction of the time axis.
- The three phase O/C relay with integrated energy store is able to trip a CB with three phase drive as well.
- The device of the same design can be applied as a zero sequence back up protection. In this case the external connections of the device is to be changed only.

Operation of the device

Operation of the AZT 3/0 device is explained in *Figure 1.* It contains 6 auxiliary CT's: 3 of them (CT4, CT5, CT6) supply the IDMT O/C protection, the other 3 (CT1, CT2, CT3) charge the energy storage capacitor bank. Two CT-s are connected to each input terminals of the device.

On O/C pick-up, the first three auxiliary CT-s start to charge the energy storage capacitor bank until it reaches the voltage limit. The second three auxiliary CT's feed the AC/DC power supply unit which serves the internal energy supply of the electronic circuits and the [t_1] and [t_2] timers. If the O/C relay with maximum selection picks up, it starts the [t_1] inverse electronic timer and then the [t_2] independent timer. Here [t_2] has a setting range of 0 to 8 s. which shifts the inverse characteristic parallel to the time axis. *Figure 2* shows the inverse characteristics.

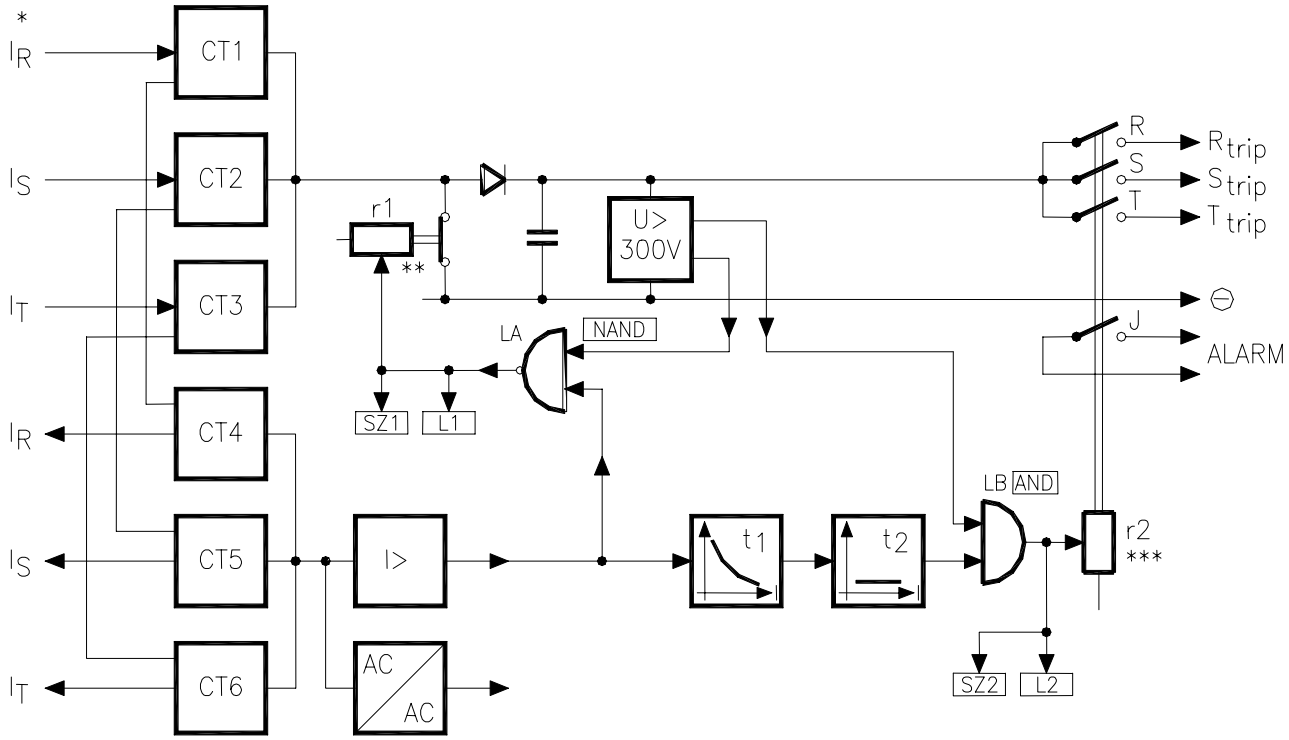

Figure 1

If the voltage relay of the energy storage capacitor bank is discharged, and the [I>] O/C relay picks up, then through [LA] logical gate, [L1] LED gets a signal, [SZ1] counter steps and [r1] relay operates. This triggers the capacitor bank charging. While [I>] O/C relay does not pick up, [r1] relay provides a short circuit on CT1, CT2, CT3. This way the power consumption of the protection is low. During charging, the power consumption increases until the capacitor bank is charged to 300 V.

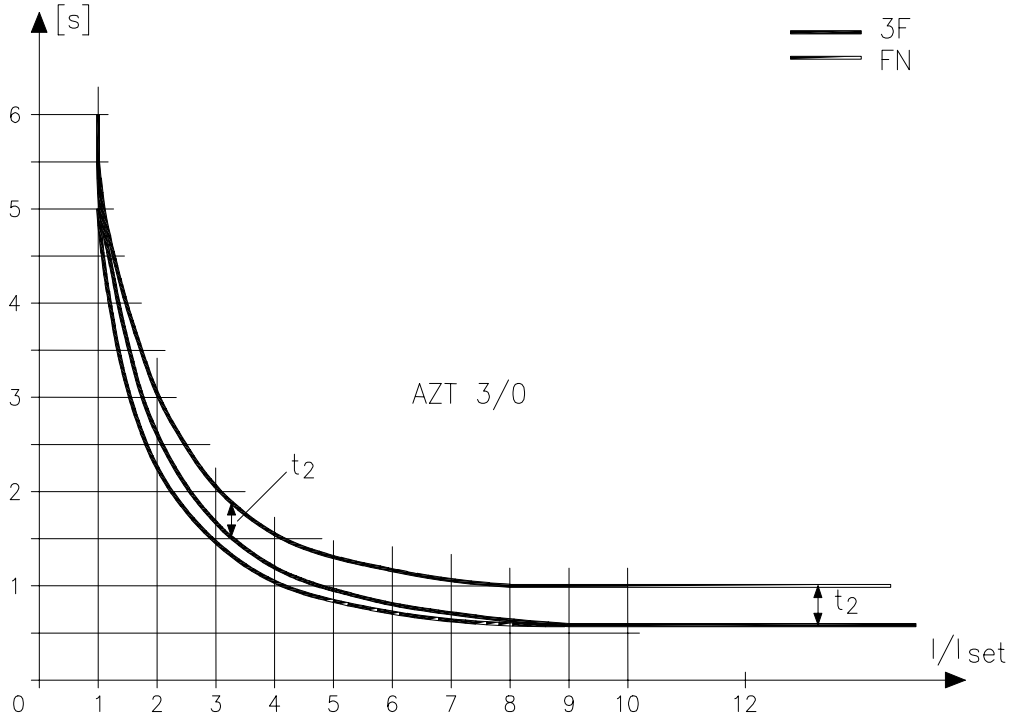

Figure 2

When the voltage limit is reached, the voltage relay picks up, [r1] relay resets, and stops the bank charging. Then the power consumption will be low again, due to the short-circuit of CT1, CT2, CT3. Picking up of [U>] voltage relay gives a permission signal to the [LB] trip logic gate. If [t_1] and [t_2] timers also expire, they also give permission to the [LB] gate. Due to the two permission signals, [L2] LED lights, [SZ2] counter steps, and [r2] relay operates. Then [J] contact gives an external alarm, and [R], [S] and [T] contacts discharge the capacitor bank to the appropriate CB. The stored energy of the capacitor bank is 20,25 Joule. This energy is sufficient to trip the three phases of the CB.

After an operation, the LED signals will disappear, so neither signal latching nor acknowledgement is needed. The two integrated counters give information to check the proper operation of the device. The alarm given by the [J] relay contact is suitable to use as a local and remote signal for the SCADA system.

If the AZT 3/0 device is used as a zero sequence back up protection of a transmission line in a solidly earthed network, its external connections have to be changed only. Of course, the setting needs reconsiderations as well. In this case the phase voltages are supervised as well. In asymmetrical operation (if one of the phases is continuously disconnected) the trip command is blocked.

The CT circuit consumption of AZT 3/0 device depends on the connection (normal or zero sequence), and the ratio of the six integrated auxiliary CT-s. The ratio can be changed in M = 1:2 rate by internal connections.

For safety point of view and in order to avoid the energy loss, it is advisable to select the secondary wiring of the external circuits as short as possible and to avoid serial CB auxiliary contacts. It is also advisable to locate the AZT 3/0 device in the supplying CT cabinet and to apply direct wiring.

Technical data

Rated current, I_n	1 A or 5 A (other value on request)
Rated voltage, U_n (for "two phase operation block")	100-110 V, 200-220 V (other value on request)
Rated frequency, f	50...60 Hz
Overload capacity, thermal, 1 s continuous	$50xI_n$ $1,2xI_n$
Dynamic current limit	$100xI_n$
Overload capacity in VT circuit	$1,2xU_n$
Auxiliary CT's, ratio factor, M	1 or 2
O/C relay [I>], setting range	$\frac{1}{M}(1,5 \text{ to } 3,48)I_n$
O/C relay [I>], setting range at zero sequence connection	$\frac{1}{M}(1 \text{ to } 3,48)I_n$
O/C relay, resetting ratio	≤ 0,85
O/C relay, accuracy	± 5 %
Consumption in CT circuits, in normal and tripping condition, if $I_n = 1$ A M = 1 $I_n = 1$ A M = 2 $I_n = 5$ A M = 1 $I_n = 5$ A M = 2	 0,6 VA 1,2 VA 2,0 VA 4,0 VA
Consumption in CT circuits, just before whole charging condition, if $I_n = 1$ A M = 1 $I_n = 1$ A M = 2 $I_n = 5$ A M = 1 $I_n = 5$ A M = 2	 1,5 VA 3,0 VA 5,0 VA 10,0 VA
Consumption in CT circuits, in normal and tripping condition, at zero sequence connection, if $I_n = 1$ A M = 1 $I_n = 1$ A M = 2 $I_n = 5$ A M = 1 $I_n = 5$ A M = 2	 1,8 VA 3,6 VA 6,0 VA 12,0 VA
Consumption in CT circuits, before whole charging condition, at zero sequence connection, if $I_n = 1$ A M = 1 $I_n = 1$ A M = 2 $I_n = 5$ A M = 1 $I_n = 5$ A M = 2	 4,5 VA 9,0 VA 15,0 VA 30,0 VA

Controlled CB tripping coil, rated voltage	220 V (other value on request)
Protection time delaying	$t_1 + t_2$
t_1 inverse timer characteristic	according to *Figure 1*
t_1 inverse timer, accuracy	± 5 %
t_2 independent timer setting range at zero sequence connection steps accuracy	 3 to 8 s 0 to 8 s 0,5 s ± 50 ms
Under voltage relay of "two-phase-operation block", setting values, if U_n = 100-110 V U_n = 200-220 V	 30 V and 40 V 60 V and 80 V
Consumption in VT circuits	≤ 1 W/phase
External blocking or external zero sequence O/C relay, dc auxiliary supply voltage	220 V ± 20 %, or 110 V ± 20 %
Consumption DC circuit	≤ 1 W
Output relay contacts (J, R, S, T), electrical data rated switching voltage continuous load current making current DC breaking current at 220 V DC at pure resistive load at inductive load of L/R = 40 ms	 250 V 8 A 16 A 0,25 A 0,14 A
Permissible ambient temperature	- 20 ^{0}C to + 60 ^{0}C
Insulation test (IEC 255)	2 kV, 50 Hz 5 kV, 1,2/50 μs
Disturbance test (IEC 255)	2,5 kV, 1 MHz

Design

The device is seen in the photograph. It is switchboard mounted type design. It is placed into a closed steel case painted to flatted black. Its dimensions are as follows: width: 323 mm, height: 432 mm, depth: 124 mm. External connection of the device are 21 pcs terminals with front connection. Its weight is 9 kg. The enclosure protection of the device is IP 40.

Ordering information

- Rated current (1A, 5A or other).
- O/C relays, reset ratio (if it deviates from 0,85).
- CB trip coil, rated voltage (if it deviates from 220 V DC).
- "Two-phase-operation block" option (if it is necessary).
- Rated voltage of "two-phase-operation block".
- Auxiliary DC voltage (220 V, 110 V).