

Application (cont'd)

The UKT 913 is particularly suitable for:

- two-stage overvoltage protection of generators
- low-voltage and phase-sequence protection of motors, whereby the second voltage unit can be used to monitor voltage symmetry
- monitoring system voltage with respect to an upper and a lower permissible limit
- detecting residual voltage on feeders.

The UKT913 has been designed to perform the following protection functions:

- Detection of inadmissible deviations of power system voltage from its rated value: Operating mode 7 (see Technical Data) should be chosen in this instance for which the 1st voltage unit detects overvoltage and the 2nd voltage unit undervoltage. The relay's high measuring accuracy and low hysteresis are of particular advantage, for example, when monitoring step switches on regulating transformers where relay response is required as close as possible to the permissible limits.
- Overvoltage protection of generators: Since the relay has two voltage units, one can be set to give alarm after a time delay, when the rated voltage is only marginally exceeded, and the other to trip at a higher voltage. The

recommended operating modes are 1 and 6. The auxiliary supply is frequently obtained from the a.c. input signal in this application.

- Undervoltage and NPS protection of motor drives: The significance of these two factors for induction motors differs, because the thermal stress on the machine increases in the one case due to reduced motor torque and the consequentially increased slip, and in the other due to the flow of NPS currents. Operating mode 5 is best for a motor, which produces a signal to inhibit motor starting when the phase-sequence is reversed.

The connection of the relay to the primary system is the same for the three applications given above and is the one given in Fig. 2. The only differences between the three applications are adjustments made to the relay. Overvoltage or undervoltage operation is selected by means of the plug-in links inside the UKT relays as required by the intended application. At the end of its time delay, the relay's timer can be accordingly arranged to either energise or de-energise the auxiliary tripping relay. The user thus has a choice between using a normally-open or a normally-closed contact for tripping, for example, where a station battery is not available.

Design

The basic circuit design is shown in the block diagram Fig. 1. All types have galvanic isolating input circuits and filter against harmonics and transients. In type UKT913 the filter additionally provides the positive and negative voltage components for detection of field rotation and unbalance.

Removable plug-in jumpers permit a selection of various operating modes as maximum/minimum value detection ($U > / <$) or voltage component evaluation (U_1, U_2).

Operation**Operating Mode: Positive-Sequence Signal (U_1)**

This signal is proportional to the symmetrical component of the input signal and also contains the information regarding phase-sequence. It can thus be used to monitor both voltage amplitude and phase-sequence. Its value is dependent on the phase relationship between the three phase voltages and their respective amplitudes.

Operating Mode: Negative-Sequence Signal (U_2)

This signal is approximately zero as long as the three phase voltages are bounded by an equilateral triangle and increases as the triangle departs from the equilateral. It permits highly sensitive detection of any asymmetry of amplitude and/or phase-angle between the three phase voltages of three-phase systems.

Operating Mode for $U >$ and $U <$

This operating mode is basically the detection of the maximum phase voltage in the case of an overvoltage unit ($U >$), respectively of the mini-

mum phase voltage in the case of an undervoltage unit ($U <$).

Any phase signal, which exceeds the set reference value for overvoltage, or falls below the set reference value for undervoltage, will cause the measuring unit to pick up. The phase relationship between the voltage signals is of no consequence.

The best operating mode to suit the application is selected with the help of the plug-in links W0, W1 and W2.

The possible combinations are to be found in the subsection "Operation Modes" in "Technical Data".

Whichever operating mode has been chosen, the corresponding signal is compared by the measuring units (U_{E1}, U_{E2}) with the pickup values, which have been finely set on the thumbwheel switches. The associated timer (t_1 or t_2) is excited when one of the measuring units picks up. Each of the voltage units has an output amplifier by means of which the corresponding auxiliary relay is energised at the end of the time delay, causing its contact to change its state.