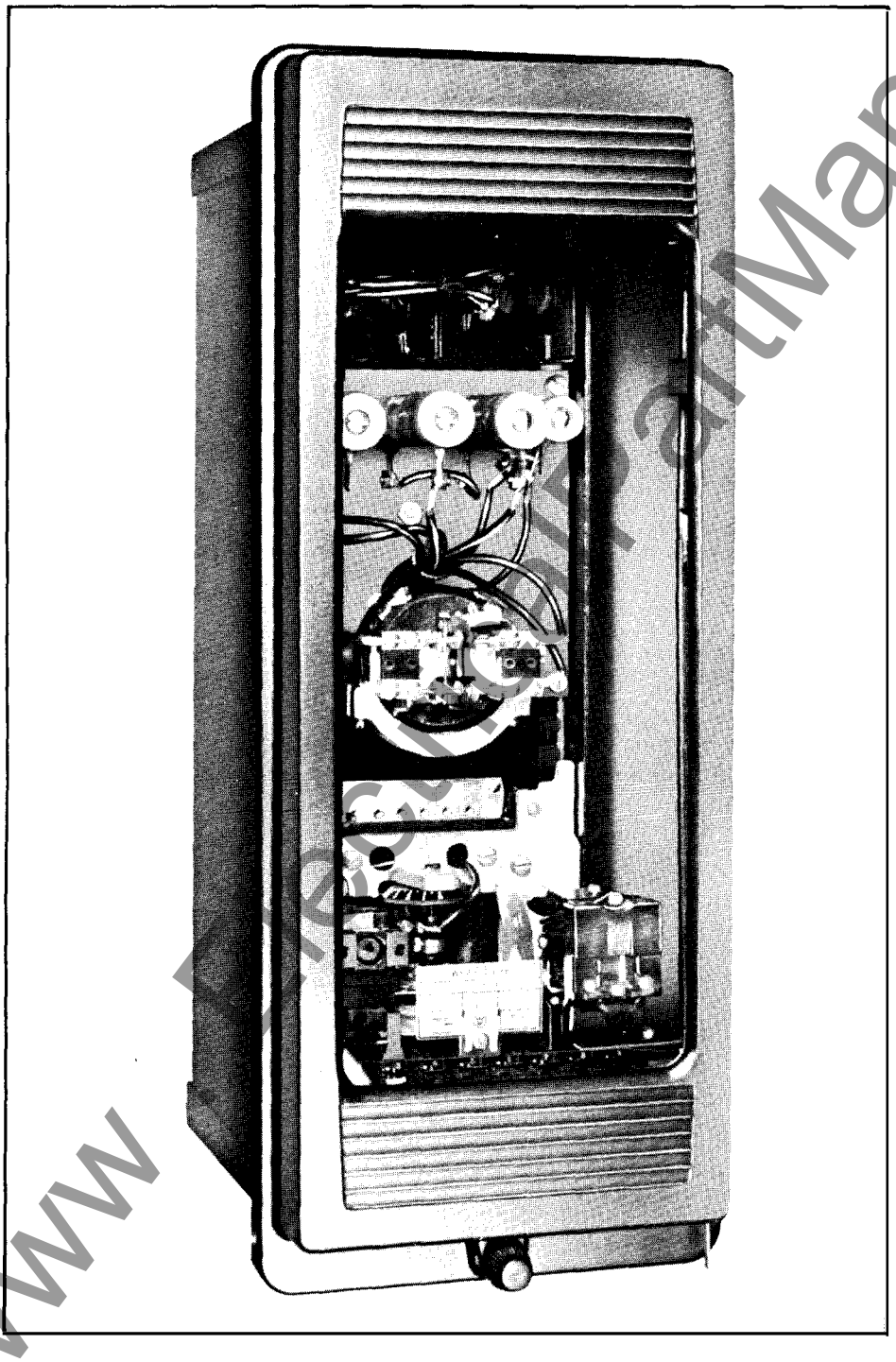
Type CVQ Relay



Application

The type CVQ relay provides instantaneous and time delay detection of negative sequence overvoltage as well as responding with time delay to phase-to-phase undervoltage.

Used in motor protection, the relay protects against system undervoltage, single phasing of the supply and reversal of phase rotation of the supply.

The volt-time characteristic of the relay is that of the CV-7 relay, and the negative sequence overvoltage pickup is adjustable from 5 to 10 per cent of rated line to neutral voltage.

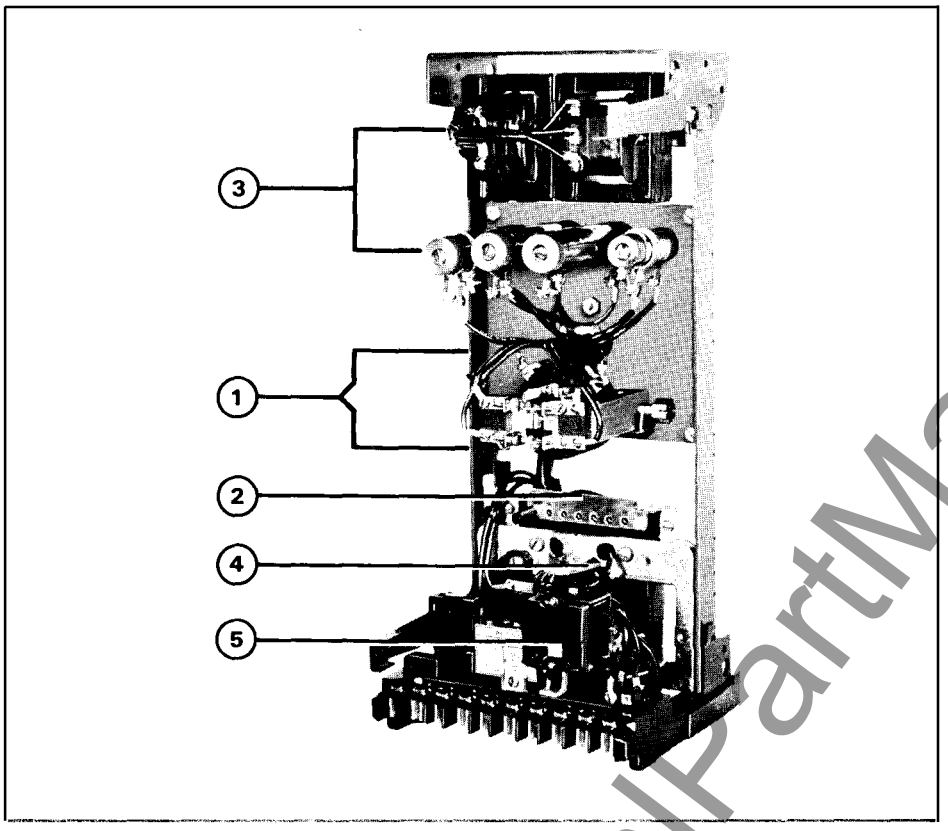
When one of the three supply circuits to a motor is opened, a negative sequence voltage will appear on the motor side of the open which is approximately equal to I_L/I_S in per unit where I_L is positive sequence current flowing prior to opening the phase and I_S is the motor starting current. For most induction motors this will produce approximately 6% negative sequence voltage even if single phasing occurs at no load because of the effect of the magnetizing requirement of the motor.

If static (i.e. non-motor) load is single phased with a motor or group of motors, the negative sequence voltage will be greater than the value calculated above. Single phasing of a predominately static load produces 50% negative sequence voltage on the load side of the open circuit.

When the relay is used for overvoltage protection the back contacts are made at normal voltage and the negative sequence element is committed to an instantaneous function. The normally open E2 contact, see internal schematics Figures 1 and 2, may be used for alarm purposes.

Further Information

Prices: Price List 41-020
Ordering Information and Specifications: Technical Data 41-020.
Dimensions: Descriptive Bulletin 41-075 (FT-31 Case)
Instructions, Testing, Calibration: IL 41-223
Other Westinghouse Protective Relays: Selector Guide 41-000A, B and C



Construction

The CVQ relay mounted in an FT-31 case consists of:

1. Polar Unit – operates on negative sequence quantities.
2. Full Wave Bridge – consisting of four diodes connected to the output of the negative sequence filter. The output is rectified, filtered and fed to the polar unit through an adjustable resistor, which is used to set the sensitivity of the relay. (Not visible on photo).
3. Negative Sequence Filter – consists of an autotransformer, reactor, and resistors connected as shown in the internal schematic. See Figures 1 and 2.
4. Voltage Unit – The undervoltage unit operates on the induction-disc principle. The unit is the same as used in CV relays.
5. Indicating Contactor Switch – dc operated clapper type device, includes an indicator target which drops on relay operation. The target is reset from the outside of the case by a push rod located at the bottom of the case.

Reduced Frequency Operation

Operation of the E2 unit will occur at 54 Hz with rated positive sequence voltage applied when set for 5% negative sequence pickup at 60 Hz. With a 10% setting, operation will occur at 48 Hz.

Characteristics

The volt-time characteristic of the relay is that of the CV-7 relay. See Figure 3.

Polar Unit – The sensitivity of the negative sequence portion of the relay is adjustable between 5 and 10 per cent of the rated line to neutral voltage.

CV Unit – Tap value is the value of voltage at which the front contact (left hand, front view) closes. The back contact (right hand, front view) will close within 5% of this value.

When the relay is used as an overvoltage relay, the moving contact is made with the back contact for values of applied voltage less than tap value voltage. With application of voltages greater than tap value voltage, the moving contact moves to close the front contact in a time as shown by the right-hand curves of Figure 3.

When the relay is used as an undervoltage relay, the moving contact is made with the front contact for values of applied voltage greater than tap value voltage. With the application of voltages less than tap value voltage, the moving contact moves to close the back contact in a time as shown by the left-hand curves of Figure 3.

Trip Circuit

The main circuit will safely close 30 amperes at 250 Vdc and the seal in contacts of the ICS will carry this current long enough to trip a circuit breaker.

Energy Requirements

The burden of the undervoltage unit at rated voltage is as follows:

Rated① Voltage	Taps 120 Volt Relay	Volt-Amps	Power Factor	Watts
120	55	10.0	.38	3.8
	64	7.0	.35	2.5
	70	5.8	.34	2.0
	82	4.0	.33	1.3
	93	3.1	.31	1.0
	105	2.4	.29	.7
	120	1.8	.28	.5
	140	1.3	.26	.3

① These relays will continuously stand either 110% of rated voltage or tap value voltage, whichever is higher.

The burden of the negative sequence filter is as follows:

	Volt-amperes
Phase 1	58.4
Phase 2	10.5
Phase 3	52.2

Settings

Polar Unit – The relay will be shipped adjusted for 5% sensitivity. Other settings may be made by the user. See Instruction Leaflet 41-223 for details.

CV Unit – The setting of the CV unit can be defined by:

1) tap setting and time dial position

OR

2) tap setting and a specific time of operation at some percentage of tap value voltage.

For example, setting the unit at the 120 volt tap and #2 on the time dial or the 120 volt tap, 1.8 seconds at 140% of tap value voltage.

To provide selective circuit breaker operation, a minimum coordinating time of 0.3 seconds plus circuit breaker time is recommended between the relay being set and the relays with which coordination is to be effected.

For motor protection, a tap setting of 75 to 85% of normal line to line voltage and a time dial setting of 6 or more should be satisfactory for protecting the motor and overriding voltage variations for which tripping is not desired.

Internal Schematic Diagrams

Figure 1. Type CVQ-Negative Sequence and Undervoltage Relay—in Type FT-31 Case

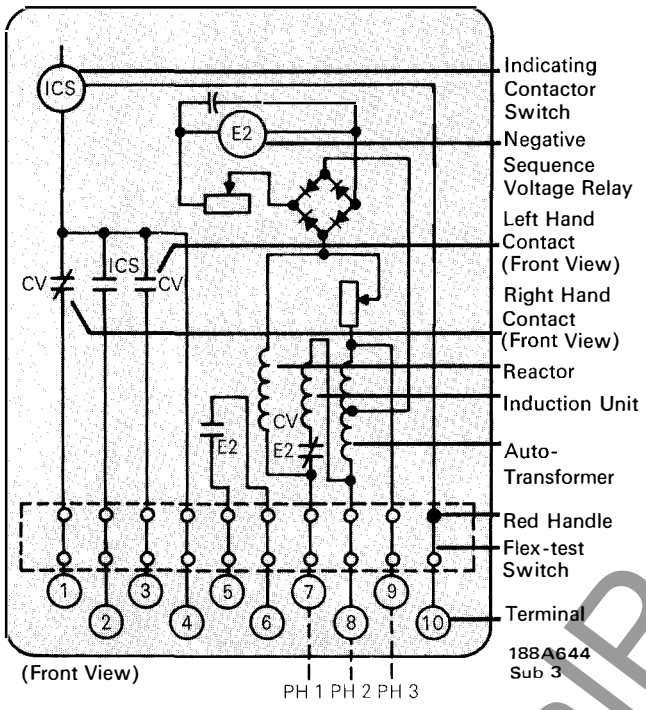


Figure 2. Type CVQ-Negative Sequence and Undervoltage Relay—With Telephone Relay in Type FT-31 Case

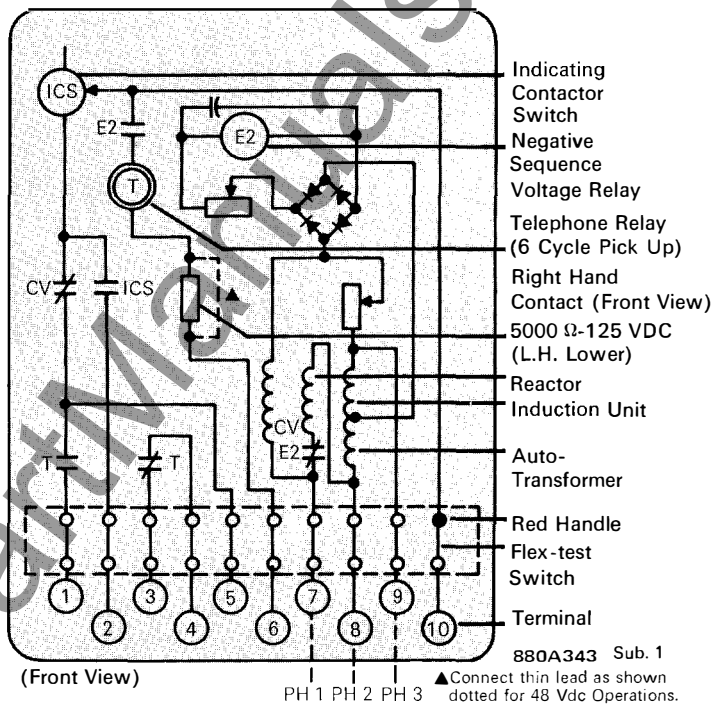
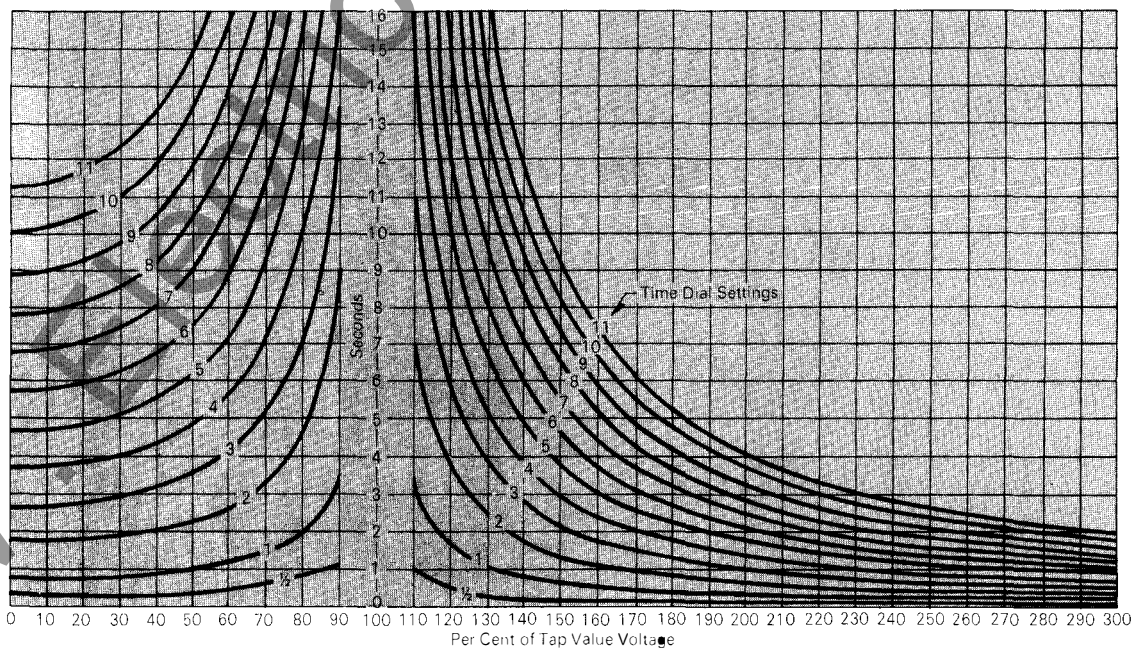


Figure 3. Typical Time Curves



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External Schematic Diagrams

Figure 4. External Schematic for the CVQ Relay used in Motor Protection

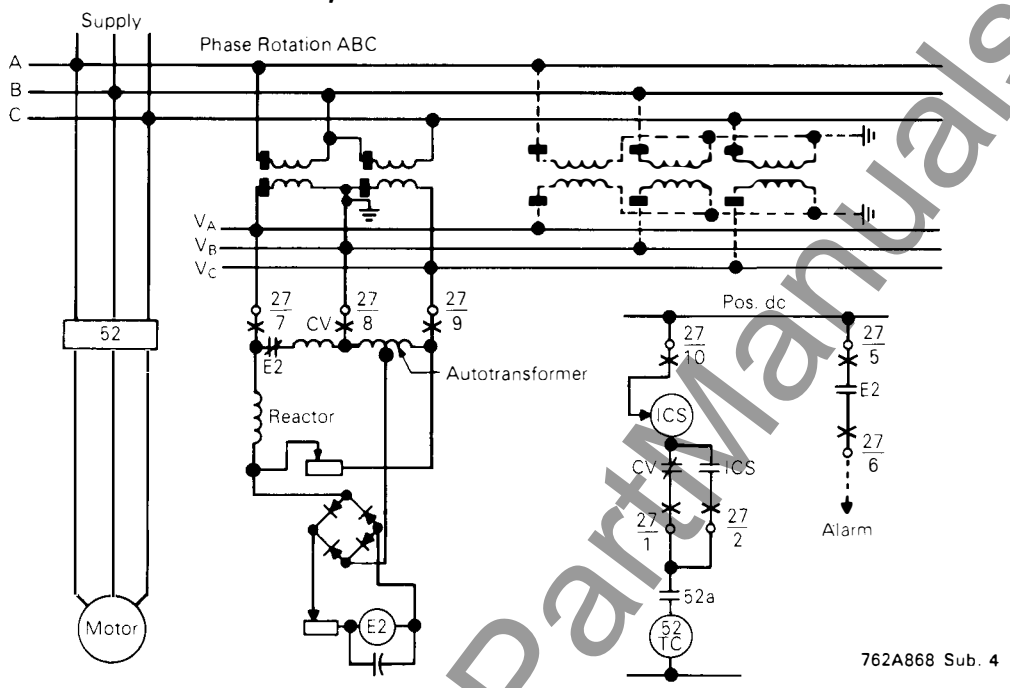

Figure 5. External Schematic of the CVQ Relay used for Tripping on Negative Sequence Voltage Only