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HRU Instantaneous Overcurrent Relay with Harmonic Restraint

Application

The HRU harmonic restraint relay is a high speed relay used for the supervision of differential, overcurrent, or pilot relays. It is applied in various transformer protection schemes to provide security against false tripping on transformer magnetization inrush.

Operation

Magnetizing inrush currents have various wave shapes. A typical current appears as a rectified half wave with decaying peaks. The various wave shapes are rich in harmonics with the second harmonic predominant. Since the second harmonic is always present in inrush waves and not in internal fault waves, this harmonic is used to restrain the harmonic-restraint unit during inrush. The differential, overcurrent or pilot relay may or may not close its contact, depending on the magnitude of the inrush. If the HRU contact is supervising these contacts, the scheme will not trip on magnetizing inrush.

When a magnetizing inrush current is applied to the relay, the dc component of the wave is by-passed by the air-gap operating transformer. The other components are fed into the filter circuits. The impedance characteristics of these filters are such that the second harmonic component flows into the restraint coil of the polar unit, while the fundamental and other harmonics flow into the operating coil. The polar unit will not close its contacts unless the second harmonic content is less than 15 percent of the fundamental component.

Fault currents will normally appear as an offset sine wave with a decaying dc component and contain very few harmonics. As a result then the harmonic restraint unit and instantaneous trip will operate during faults to permit tripping of the relay.

The varistor connected across the dc side of the restraint rectifier of the harmonic restraint unit prevents excessive voltage peaks from appearing across the rectifiers. These peaks arise through transformer action of the harmonic-restraint polar-unit coils during heavy faults. The varistor has a large value of resistance for low voltages while presenting a low value of resistance for high voltages. This characteristic effectively reduces the voltage spikes on heavy faults while not hampering performance during inrush, where the voltage is considerably lower.



Further Information

Prices and Ordering Information: Price List 41-020
 Flexitest Case (FT-21): Descriptive Bulletin 41-075
 Contactor Switches: Descriptive Bulletin 41-080
 Instruction Leaflet: Instruction Leaflet 41-347.3
 Other Protective Relays: Selector Guide 41-000 A, B and C

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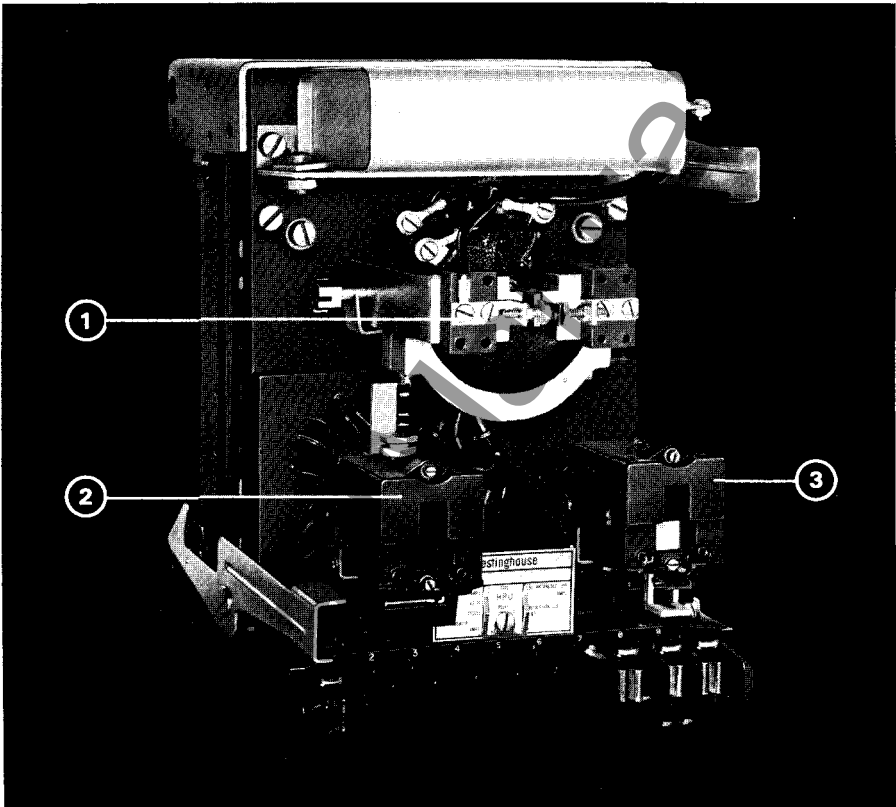


Construction

The single phase HRU relay consists of an instantaneous trip unit, a harmonic restraint unit, and an indicating contactor switch.

The three-phase HRU relay consists of the same parts as the single-phase, except with a mixing transformer included. (See internal schematics).

- ① Harmonic Restraint Unit – consists of an air-gap transformer, a second harmonic block filter, a fundamental block-second harmonic pass filter, two full wave rectifiers, a varistor, and a polar unit.
- ② Instantaneous Trip Unit – is a small ac operated clapper type device. Adjustment of the pickup is accomplished by changing the setting of an adjustable core screw. A range of adjustment of 4:1 may be made.
- ③ Indicating Contactor Switch – is a small dc operated clapper type device. No settings are required except the selection of the 0.2 or 2.0 ampere tap. When the relay is to energize a 125 or 250 Vdc type WL relay switch or equivalent, use the 0.2 amp tap; for 48 Vdc applications set relay in the 2.0 amp tap and use WL relay coil style number 304C209G01 or equivalent.



Characteristics

Rated Current	Continuous Rating	1 Second	Burden@	
			Tap Value	8 Times
.87	10 amp	300 amp	2.26	76
2.00	18 amp	300 amp	2.50	92
4.00	22 amp	300 amp	3.18	132

Continuous rating of 3-phase HRU – 5.75 amp.

Frequency Response: Curve 471052

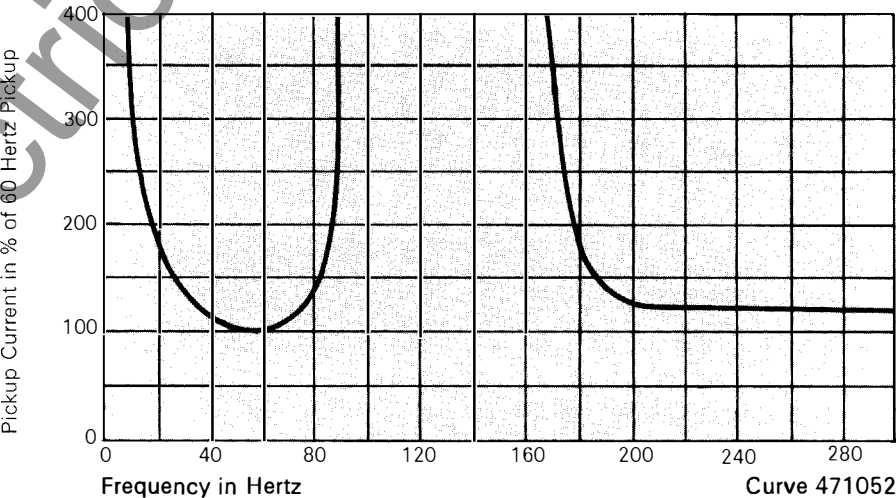
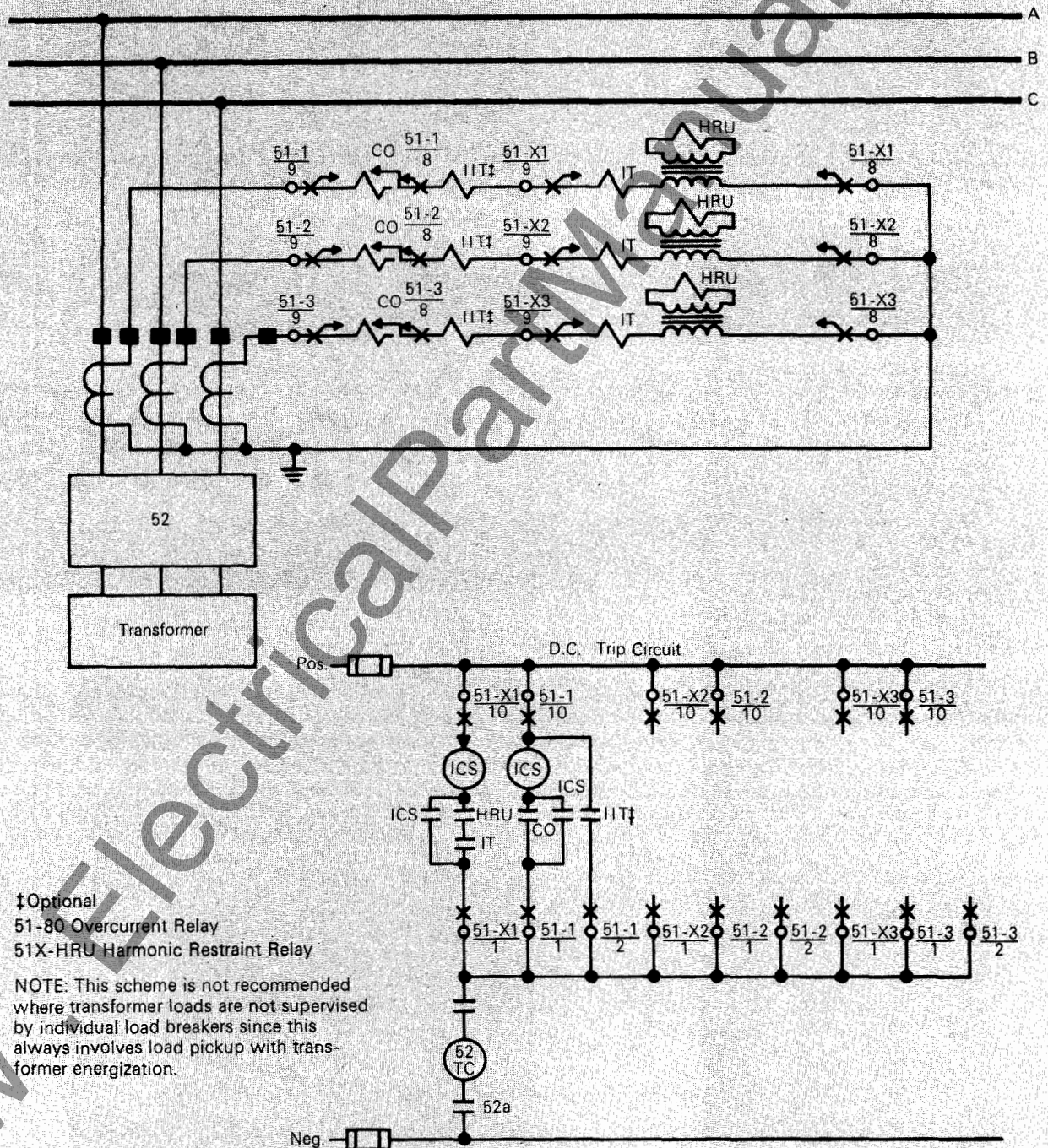


Figure 1

HRU Instantaneous Overcurrent Relay with Harmonic Restraint

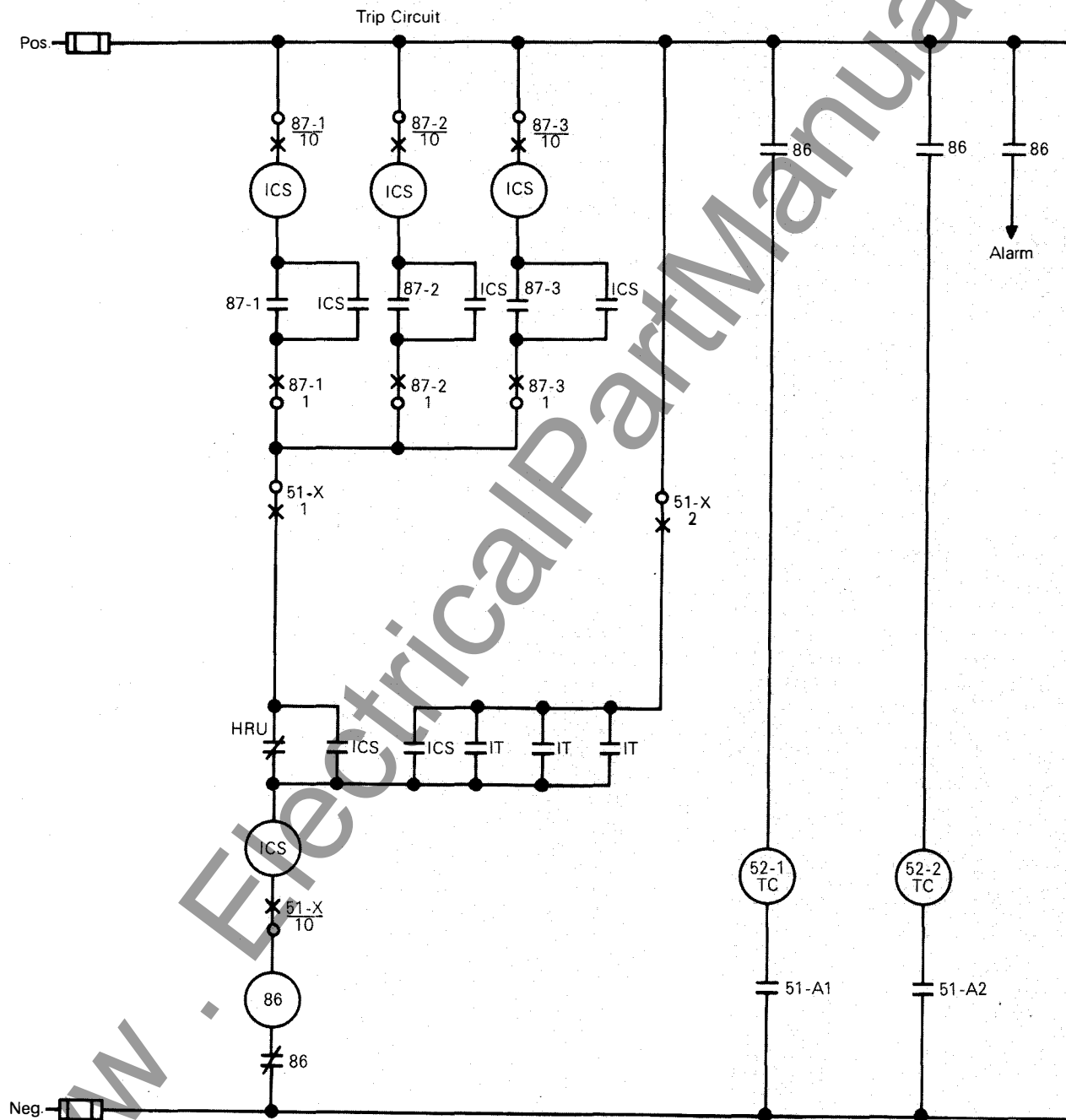
External schematics—Single phase HRU relays may be used to provide sensitive instantaneous overcurrent protection for rectifier transformers where there are no selectivity requirements with low-side protective devices.



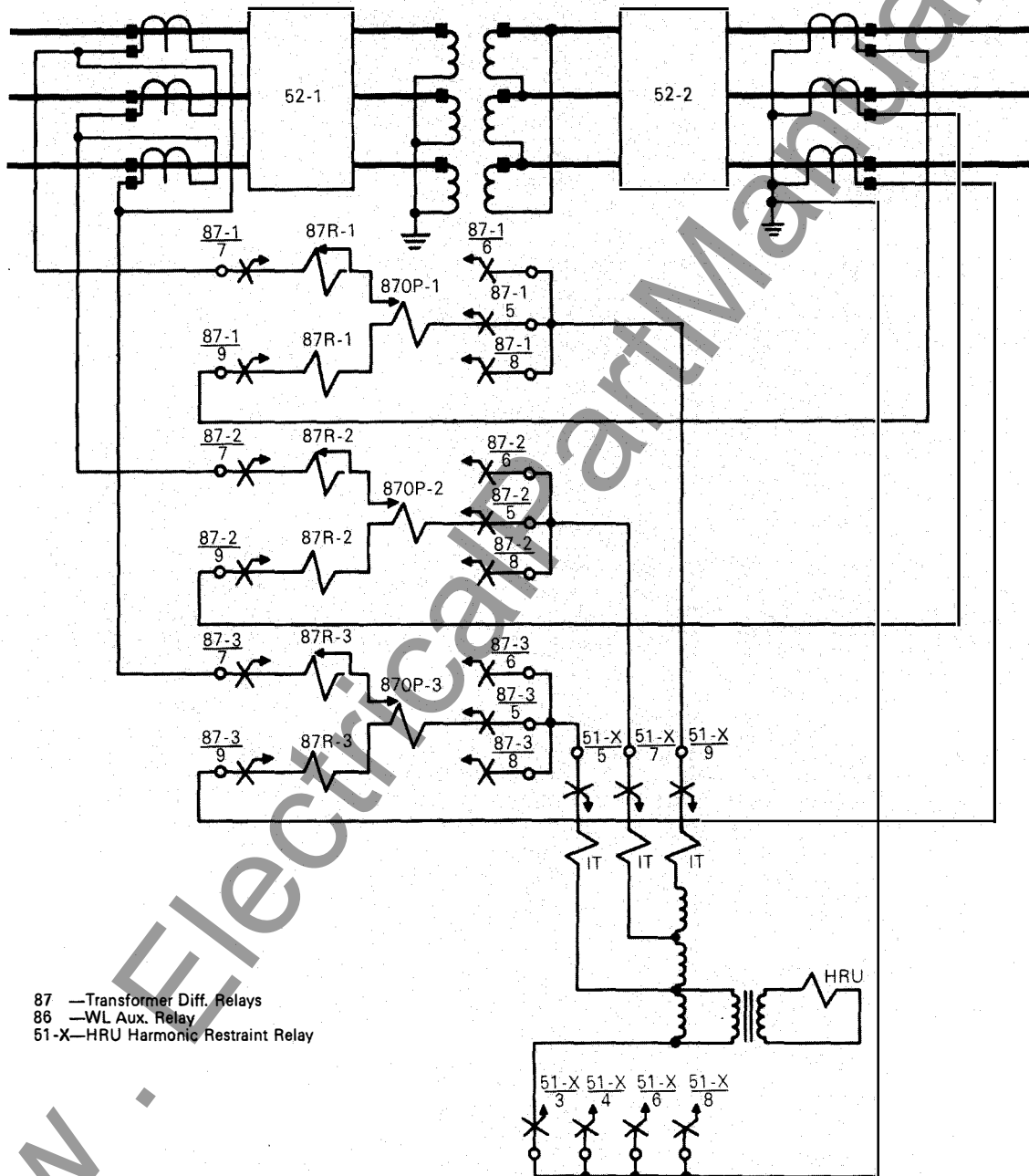
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External schematics—The 3-Phase HRU relay may be added to an existing induction-disc differential relay installation should inrush tripping become a problem.



HRU Instantaneous Overcurrent Relay with Harmonic Restraint





87 —HCB Or HCB—1 Pilot Relay
 51-X—HRU Harmonic Restraint Relay
 (Use Normally Open Contact 3—Phase HRU)
 ACT —5/5 Aux. C.T.

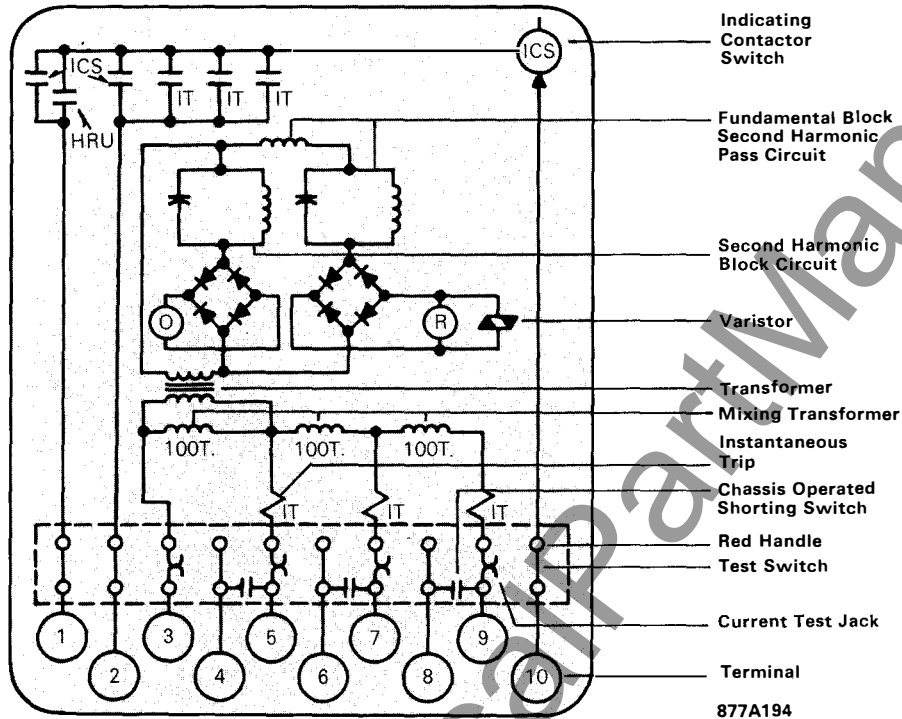
NOTE: CT'S Must be WYE Connected

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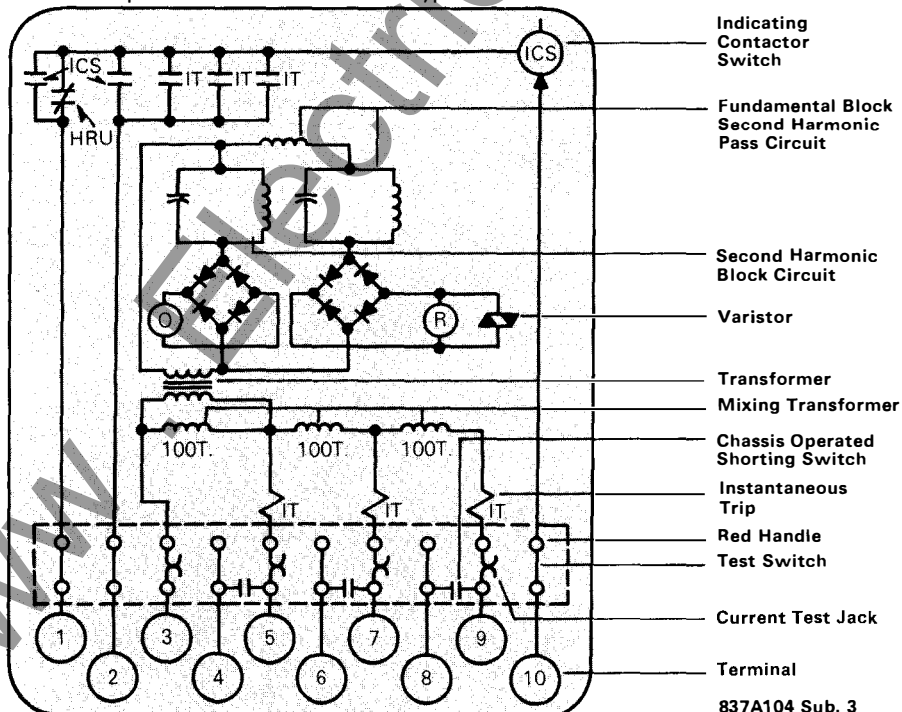
HRU Instantaneous Overcurrent Relay with Harmonic Restraint

Internal Wiring

Type HRU Relay—Instantaneous with Harmonic Restraint Supervision for Three Phase in Type FT-31 Case-SPST-CO



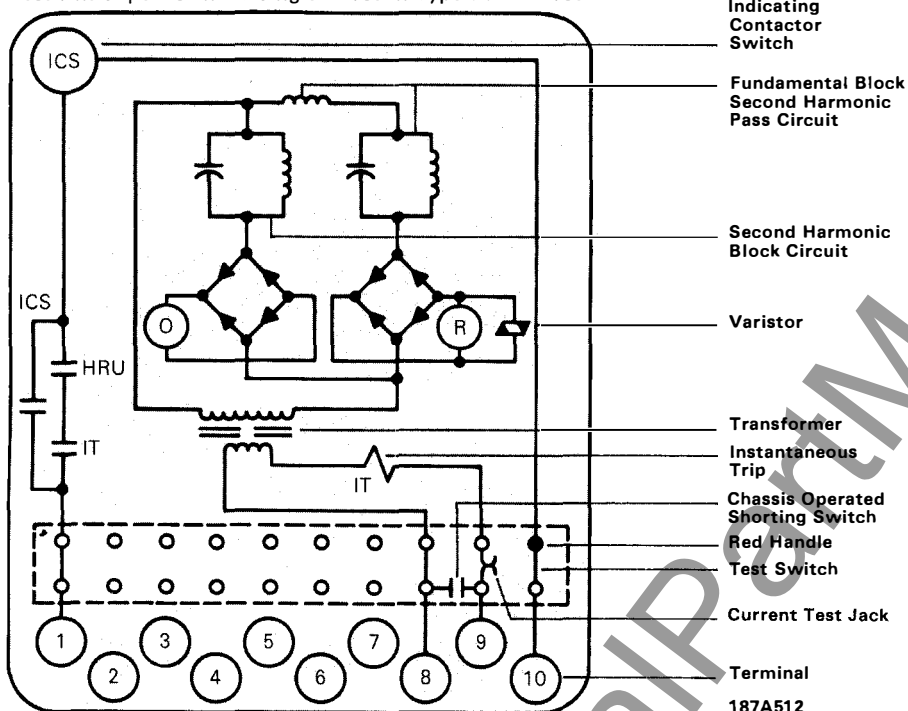
Type HRU Relay—Instantaneous with Preclosed Contact and Harmonic Restraint Supervision for Three Phase in Type FT-31 Case—SPST-CC



HRU Instantaneous Overcurrent Relay with Harmonic Restraint

Internal Wiring

Type HRU Relay—Instantaneous Overcurrent with Harmonic
Restraint Supervision for Single Phase in Type FT-21 Case



Type HRU Relay—Instantaneous and Harmonic Restraint
for Single Phase in Type FT-21 Case

