ICW

Power Directional Relays

Protection against excess power flow in a predetermined direction. For anti-motoring protection of AC generators.

Application

- Power directional protection
- Generator protection against motoring

Protection and Control

- Timed directional power
- Overpower and underpower
- Reverse power – anti-motoring

Features

- Mechanical target
- Drawout case

DESCRIPTION

The ICW relays are single phase, time delay, power directional relays in size S1 drawout cases. Several different types are available, providing underpower as well as overpower detection and giving a choice be tween line-to-neutral or quadrature (line-to line) polarizing. For applications on 3-phase systems, only one relay is required in most cases because the power flow is usually the same in all three phases.

APPLICATION

The ICW relays are designed for power-directional applications. The operation of these relays depends upon both phase angle and magnitude of the applied current and voltage. They will operate when power flow is of suffficient magnitude and in a specific direction.

The ICW51A functions from line current and quadrature line-to-line voltage, and is calibrated in three-phase watts. It exhibits maximum contact-closing torque when the applied current leads the applied voltage by 90 degrees (unity power factor.)

The ICW51B functions from line current and line-to-neutral voltage, and is calibrated in single-phase watts. It exhibits maximum contact-closing torque when the applied current is in phase with the applied voltage. Because of its operating characteristic, the ICW51B is also recommended for single phase applications.

The ICW52A provides both overpower and underpower detection in the same relay. With the normal factory setting, the right contact closes when the power flowing is less than 80 percent of the value required to close the left contact.

The ICW53A responds to reactive power (vars) and has both an overpower and an underpower setting (90 percent of overpower). This relay can be used to control the switching of power factor correcting capaci tor banks.

Small Generating Stations: The ICW51A and ICW51B relays are commonly used to protect against excess power flow from the station into a larger system. The relay will trip the tie breaker if power in excess of a predetermined amount is fed into the large system over a given period of time. The relay will not trip the tie breaker if the local station fails and power is fed to its load from the large system.

Generator Protection Against Motoring

Internal combustion engine-driven

Gas turbine-driven

Water wheel-driven

APPLICATION

The ICW51 is recommended for anti-motoring protection for generators rated 200 kw and above and driven by internal combustion engines or gas turbines. This relay may also be used for hydro units if sensitive enough for the particular installation. For internal combustion engine and gas turbine-driven generators, the reverse power losses generally exceed 5 percent of the full-load machine rating.

In general, the most sensitive relay model that has a current coil rating higher than full-load generator current should be used.

Steam Turbine, driven Generators: Low-capacity Units: For units rated from 150 to 1000 kw, the motoring losses generally exceed 2 1/2 percent and may be as high as 5 percent. The standard application for larger units requires a more sensitive relay. How ever, for these lower rated units the ICW is sufficiently sensitive to provide anti-motoring protection.

Reverse Power-Overpower: The ICW can be connected to close its contacts on reverse power or on overpower, but not both.

Balanced Load vs Unbalanced load: When loads are balanced, one single-phase relay can be used as indicated in the Selection Guide. When an unbalanced load is expected, three ICW relays may be used or the GGP, three-phase power-directional relay should be considered for complete protection.

Operating Time—ICW51A, 51B or 52B

The number 10 time dial gives approximately 23 sec at 1.5 times tap setting and 1.0 sec at 20 times tap setting.

CONTACTS

The main contacts of the relays will carry 2.0 A continuously and will close and carry 30 A DC momentarily for tripping duty at control voltages of 250 VDC or less. The breaker trip coil circuit should, however, always be opened by a circuit breaker auxiliary switch or other suitable means. If the tripping current exceeds 30 A an auxiliary tripping relay should be used.

On relays which include a combination target and seal-in unit (see Selection Guide) the current-carrying rating of the associated main contact circuit is determined by the tap setting of the seal-in coil as shown in Section 14.

When the main contacts are not bypassed by seal-in unit contacts, as in the ICW52A, they may be required to interrupt the circuit. The interrupting ratings of the main contacts for inductive and noninductive loads are shown in Table A.

Table A — Main Contacts

Volts	Inductive		Noninductive	
	AC	DC	AC	DC
	Interrupting Rating in Amperes			
125	0.6	0.14	1.5	0.30
250	0.3	0.07	0.75	0.15

SELECTION GUIDE

Frequency Hertz	Volts	Amps	Operating Watts① Calibration Range		Model Number	Contacts	Target Seal-in Unit (Amps)	Case Size	Approx Weight Lb (Kg)	
			Single Phase	Three Phase					Net	Ship
FOR SINGLE PHASE AND BALANCED LOAD 3 PHASE WATT APPLICATIONS (Using Line-to-Neutral Voltage)										
60	120	5.0	10-40		ICW51B1A	One Normally Open	0.2/2	S1	20 (9.1)	25 (11.3)
			25-100		B2A					
			50-200		B3A					
			100-400		B4A					
			200-800		B7A					
		2.5	5-20		B8A					
50	120	5.0	15-60		B5A					
	120		25-100		B6A					
	240		25-100		B9A					
FOR BALANCED LOAD 3 PHASE WATT APPLICATIONS (Using Line-to-Line Voltage)										
60	120	3.5		15-60	ICW51A1A	One Normally Open	0.2/2	S1	20 (9.1)	25 (11.3)
		4.0		20-80	A10A					
		5.0		25-100	A2A					
		5.0		50-200	A3A					
		5.0		100-400	A4A					
		5.0		200-800	A5A					
	208	3.5		26-104	A12A					
		5.0		44-175	A13A					
		5.0		50-200	A11A					
		5.0		87-350	A14A					
		5.0		175-700	A15A					
		5.0		350-1400	A16A					
	480	5.0		100-400	A21A					
50	120	2.0		10-40	A19A					
		3.5		15-60	A6A					
		5.0		25-100	A7A					
		5.0		50-200	A9A					
		5.0		200-800	A8A					
	208	5.0		44-175	A24A					
		5.0		50-200	A17A					
		5.0		200-800	A23A					
COMBINATION OVER AND UNDER POWER (Using Line-to-Line Voltage)										
60	120	3.5		15-60	ICW52A10A	One Normally Open and One Normally Closed	No Target Seal-in	S1	20 (9.1)	25 (11.3)
		5.0		25-100	A2A					
		5.0		50-200	A3A					
		5.0		100-400	A6A					
		5.0		100-1000	A1A					
	208	5.0		200-800	A5A					
	240	5.0		100-400	A4A					
50	120	5.0		25-100	A8A					
				50-200	A7A					
				100-1000	A9A					
FOR SINGLE PHASE VARS AND BALANCED 3-PHASE (Using Line-to-Line Voltage)										
60	120	5.0	15-150		ICW53A1A	1 N.O. and 1 N.C.	No Target Seal-in	S1	20 (9.1)	25 (11.3)
	120		80-400		A2A					
	208		15-150		A5A					
50	120	5.0	15-150		A4A					

① Tap ratings for the various ranges are as follows:
5—20: 5, 6, 8, 10, 12, 16, 20
10—40: 10, 12, 16, 20, 25, 32 and 40 watts.
15—60: 15, 20, 25, 32, 40, 50 and 60 watts.
20—80: 20, 25, 32, 40, 50, 63, 80
25—100: 25, 32, 40, 50, 63, 80 and 100 watts.
26—104: 26, 35, 44, 55, 70, 87 and 104 watts.
44—175: 44, 55, 70, 87, 110, 140 and 175 watts.
50—200: 50, 63, 80, 100, 125, 160 and 200 watts.
87—350: 87, 110, 140, 175, 215, 275 and 350 watts.
100—400: 100, 125, 160, 200, 240, 300 and 400 watts.
100—1000: 100, 133, 200, 330, 470, 670 and 1000 watts.
175—700: 175, 215, 275, 350, 415, 520 and 700 watts.
200—800: 200, 240, 300, 400, 480, 600 and 800 watts.
350—1400: 350, 415, 520, 700, 830, 1000 and 1400 watts.

15—150: 15, 20, 30, 50, 70, 100 and 150 vars
80—400: 80, 100, 120, 150, 200, 300 and 400 vars

DEVICE FUNCTION NUMBERS

32—Power Directional Relay Type ICW
UC—Upper Coil
LC—Lower Coil
SI—Seal-in

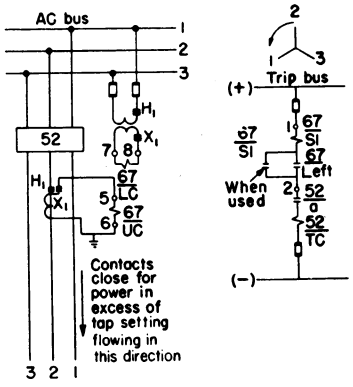

Fig. 1. Typical diagram, ICW51a and ICW52A relays for balanced-load, 3-phase applications using line-to-line voltage