

Features

- High speed operation
- High sensitivity
- High stability for through faults
- Operating current set using 7 position plug bridge
- Optional 1A or 5A CT input
- Tuned to 50Hz or 60Hz
- 25ms operation at 5x setting
- Hand reset mechanical flag
- 2 heavy duty N/O trip contacts
- Rugged attracted armature sensing elements
- Use 3 independent units for 3 phase applications
- Size 2M draw out case

Application

The 2C73 relay provides high speed differential protection for various items of power system plant including generators, busbars, motors & the individual windings of power transformers. It is also suitable for restricted earth fault protection applications.

When circulating current protection schemes are subjected to sudden & often asymmetrical growth in system currents due to through faults, the line current transformers can quickly reach saturation. In this condition, variation in transformer magnetizing characteristics can cause large ratio errors with a consequent circuit imbalance & false tripping of the protective relay scheme.

In order to ensure protection stability, a high impedance differential relay set to operate at a slightly higher voltage than that developed in the worst case of the above condition for a through fault current may be used. On a balanced earth fault system for example, this is when one CT of a group is saturated while the others remain unaffected. The saturated CT presents a low impedance path in parallel with the relay, which effectively limits the voltage applied to avoid operation. On internal faults however, this limitation does not exist & voltages of twice the relays pick up settings are easily reached.

The 2C73 relay is a single phase device built in a compact size 2M draw out case suitable for rack and flush mounting. Where 3 phase monitoring is required, 3 single phase units should be employed.



2C73 depicted in a 2M28 case

Operation

The relay measuring element is basically an attracted armature unit of simple & rugged construction. The operating coil of this unit is connected in series with an inductor & capacitor forming a resonant circuit. These components are energised from a transformer which is tapped to provide current setting using the front panel mounted plug bridge. Removal of the setting plug bridge will result in the maximum current tap setting. The relay circuit is tuned to the supply frequency & rejects harmonics produced by current transformer saturation. A slight time delay on operation is provided to ensure stability on heavy external faults.

RELATED EQUIPMENT

- ◆ Refer to the 2V75 Technical Bulletin for details on the RMS Metrosil modules;
- ◆ Refer to the 1M123 & 1M124 Technical Bulletin for details on complete BUS protection rack solutions;
- ◆ Refer to the 2V68 Technical Bulletin for details on CT supervision applications;
- ◆ The 2C73 is a current operated relay. For a voltage operated version refer to the 2V73 Technical Bulletin.

2C73

RATED FREQUENCY
50Hz

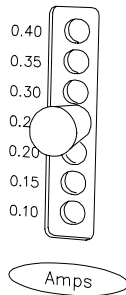
BURDEN
<1.2VA at pick up

STANDARD CURRENT SETTING RANGES
The 2C73 current setting range is determined by the setting range times the CT rating.

Current Setting		CT Rating	Front Label (Amps)	Setting Steps	
Order Code	Setting Range			%	Amps
AA#	10-40%	1	0.1-0.4*	7x 5%	0.05
AB#	10-40%	5	0.5-2.0	7x 5%	0.25
BA#	20-80%	1	0.2-0.8	7x 10%	0.1
CB#	20-80%	5	1.0-4.0	4x 20%	1.0
DA#	5-20%	1	0.05-0.2	7x 2.5%	0.025
DB#	5-20%	5	0.25-1.0	7x 2.5%	0.125
EA#	50-200%	1	0.5-2.0	7x 25%	0.25

Table 1

Adjustable via front panel plug bridge*

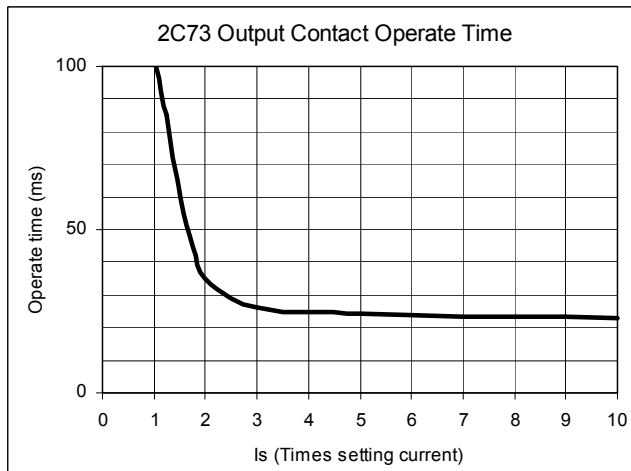


CT RATING
1A or 5A input rating

PICK UP ACCURACY
+/-10% of setting at rated frequency

HARMONIC REJECTION
100Hz >10x setting required to pick up
150Hz >30x setting required to pick up

OPERATE TIMES
Pick up: 25ms at 5x I_s
The timing characteristic depicted below is intended to improve system security during transient conditions.



Technical Data

THERMAL WITHSTAND – RELAY ALONE

5x tap setting to a maximum of 10A continuous
20x tap setting for 3s

AUTOMATIC CT SHORTING FACILITIES

While current setting changes would not normally be made with the relay energised, a CT shorting feature is incorporated. This automatically operates by shorting CT input terminal 5 to the maximum current tap setting when the front panel plug bridge is removed.

It should be noted that the CT input is also automatically shorted when the 2C73 module is withdrawn from the case. This feature may be used to take the 2C73 relay out of service.

OUTPUT RELAY CONTACTS

2 N/O tripping duty contacts

CONTACT RATINGS

Make & Carry Continuously

1,250 VA AC resistive with maximums of 300V & 5A
1,250 W DC resistive with maximums of 300V & 5A

Make & Carry for 3 Seconds

7,500 VA AC resistive with maximums of 300V & 30A
7,500 W DC resistive with maximums of 300V & 30A

AC Break Capacity

1,250VA AC resistive with maximums of 300V & 5A

DC Break Capacity

100W DC resistive with maximums of 300V & 5A
50W DC inductive with maximums of 300V & 5A

OUTPUT RELAY OPERATION INDICATOR

Hand reset mechanical indicator

TRANSIENT OVERVOLTAGE

Between all terminals & earth
Between independent circuits without damage or flashover

IEC60255-5 CLASS III

5kV 1.2/50us 0.5J

5kV 1.2/50us 0.5J

INSULATION COORDINATION

Between all terminals & earth
Between independent circuits
Across normally open contacts

IEC60255-5 CLASS III

2.0kV RMS for 1 minute

2.0kV RMS for 1 minute

1.0kV RMS for 1 minute

HIGH FREQUENCY DISTURBANCE

2.5kV 1MHz common mode
1.0kV 1MHz differential mode

IEC60255-22-1 CLASS III

≤ 5% variation

TEMPERATURE RANGE

Operating:
Storage:

IEC68-2-1/2

-5 to +55°C
-25 to +75°C

HUMIDITY

40°C & 95% RH non condensing

IEC68-2-78

CASE

Size 2M28-S draw out case
28 M4 screw terminals
Flush panel mount or 4U high 1/8 width 19 inch rack mount

2C73

CURRENT TRANSFORMERS (CT's)

The knee point voltage is defined as the point on the magnetization curve at which a 10% increase in excitation voltage produces a 50% increase in excitation current. The required stability voltage produces a 50% increase in excitation current. The required stability voltage setting (V_s') minimum knee point voltage (V_k) & maximum excitation current (I_e) are calculated as follows:

$$V_s' \geq I_f (R_s + R_p)$$

$$V_{sA} = \frac{VA}{I_r} + I_r R_{sr}$$

$$V_k \geq 2V_{sA}$$

$$I_e = \frac{I_s - I_r}{n}$$

- I_f = Max. secondary through fault current for which stability is required (RMS Amps)
- I_s = effective fault setting expressed in secondary amps
- I_r = relay setting current
- R_s = CT secondary winding resistance
- R_p = maximum loop lead resistance between CT's & relay
- n = number of CT groups forming the protected zone for bus-zone differential protection
- n = 2 for machine differential protection
- n = 3 for restricted earth fault protection on delta windings
- n = 4 for restricted earth fault protection on star windings
- V_{sA} = Actual voltage setting

Technical Data

RECOMMENDED METROSIL's (Refer 2V75 Technical Bulletin)

An external Metrosil is required to limit the CT output voltage under an internal fault condition if $V_p > 3kV$. The voltage spike (V_p) due to CT saturation is calculated from:

$$V_p = 2 \sqrt{2Vk_a (Vf - Vk_A)}$$

$$Vf = I_{f_{int}} (R_s + R_p + R_{sr} + \frac{VA}{I_r^2})$$

Where:

$I_{f_{int}}$ = maximum secondary internal fault current

Vk_A = actual CT knee – point voltage

Standard single disc Metrosils suitable for $I_{f_{int}} < 50A$ RMS

STABILISING RESISTORS (Refer 2V75 Technical Bulletin)

The appropriate value of series resistance (R_{sr}) required to ensure stability is calculated as follows:

$$R_{sr} = \frac{V_s' - \frac{VA}{I_r}}{I_r}$$

Where:

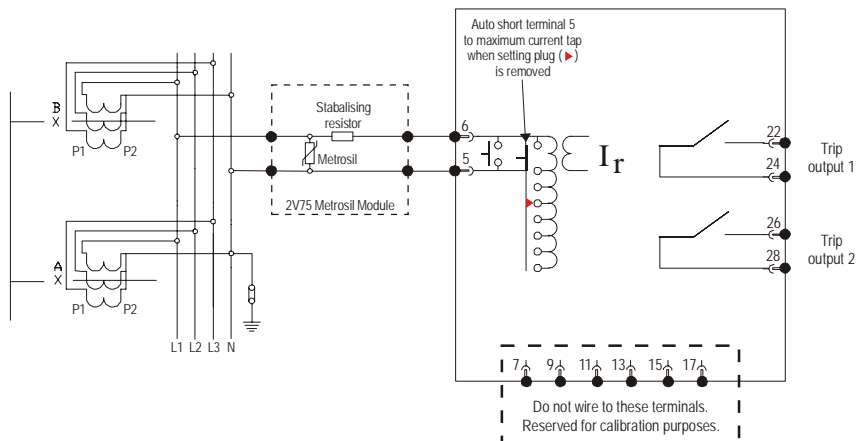
V_s' = minimum required stability voltage

VA = relay burden

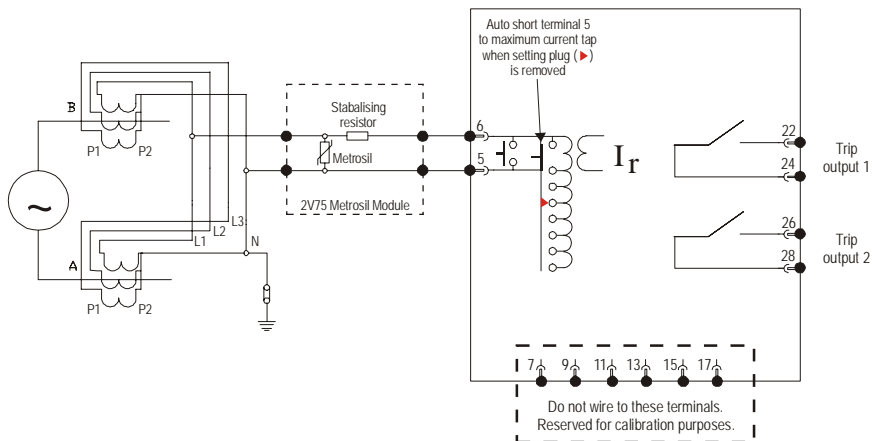
I_r = relay setting current

In certain applications there is no need to utilise stabilizing resistors in series with the 2C73 (Indicated by negative calculated stabilizing resistance value), the impedance of the relay element alone will offer adequate operational stability.

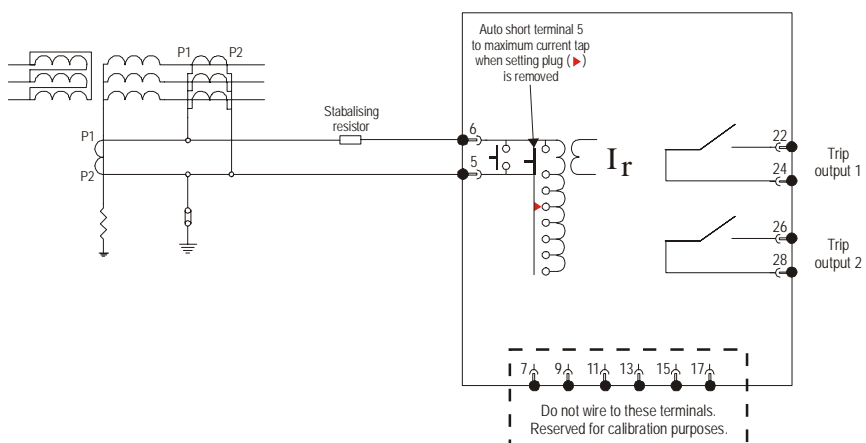
High impedance differential BUS bar protection application (Use 3 units for 3 phase configuration)



High impedance differential generator protection application (Use 3 units for 3 phase configuration)



Restricted earth fault application



2C73 wiring diagrams - Relay shown in de-energised condition

2C73

Ordering Information

Generate the required ordering code as follows: e.g. 2C73-ABA

General Type	Order Code		
	1	2	3
2C73	-		

1 SETTING RANGE (% of nominal CT rating – refer Table 1)

A	10 - 40%	in 7x 5%	steps	
B	20 - 80%	in 7x 10%	steps	(1A CT only)
C	20 - 80%	in 4x 20%	steps	(5A CT only)
D	5 - 20%	in 7x 2.5%	steps	
E	50 - 200%	in 7x 25%	steps	(1A CT only)

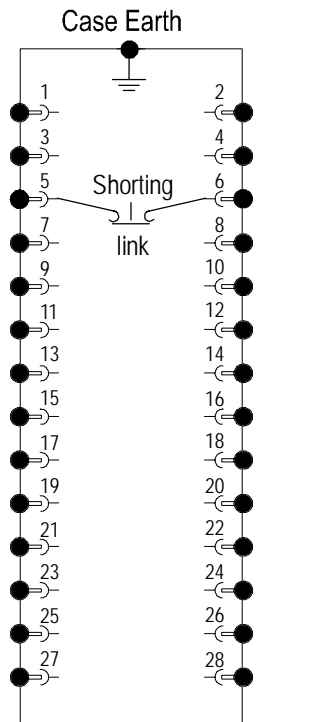
2 CT RATING

A	1A
B	5A

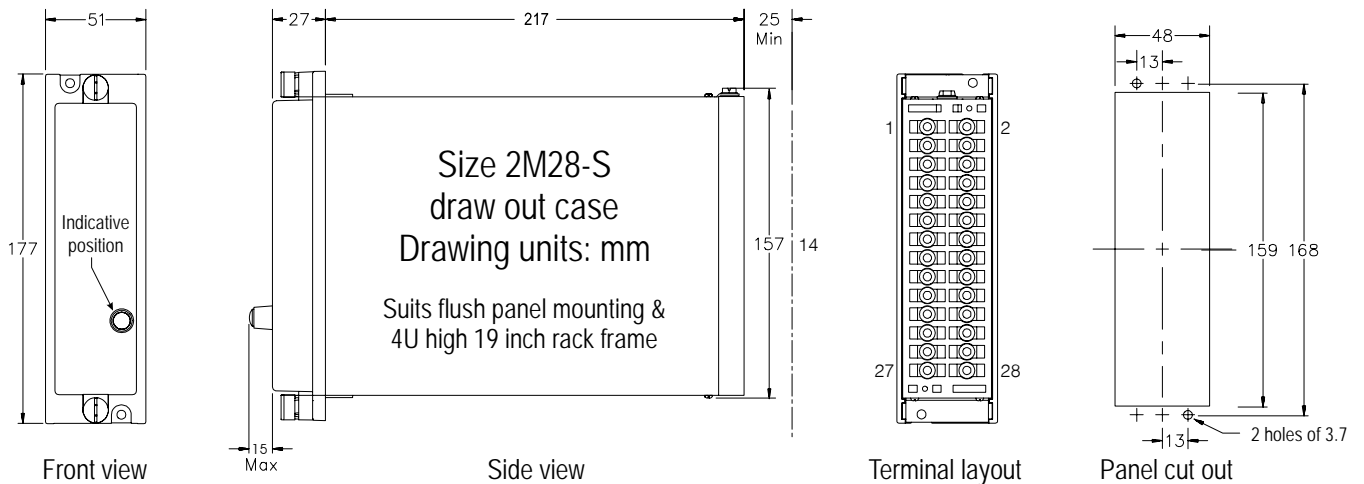
3 RATED FREQUENCY

A	50Hz
B	60Hz

Refer to the 2V75 Technical Bulletin for details on combined Metrosil - resistor modules & loose components.



2M28-S Case terminations (REAR VIEW)



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