

Order Number

Serial Number

PRODUCT / TEST MANUAL

2C59K9

CIRCUIT BREAKER FAIL RELAY

Issue Level	Date	Summary of changes
D	20/11/1995	Initial issue.

Due to RMS continuous product improvement policy this information is subject to change without notice.

Document updated	Checked	Registered	.pdf file created	.pdf uploaded to web site

1. DESCRIPTION OF RELAY

The 2C59K9 is a 10" rack mounted 3 Rack Unit High Definite Time Overcurrent Relay employing electronic measuring and timing elements and having electromechanical output contacts. Modular construction is used, enabling the instantaneous current sensing, timer, signalling relay or trip output relay modules to be withdrawn.

2. SPECIFICATION

DC Auxiliary Supply Voltage	D125	+15%	-20%
DC Auxiliary Supply Burdens (at 125V)			
Current Sensing Circuitry (excluding signalling relay burden)	<3.5W		
Timer (excluding signalling relay burden)	<2.5W		
Signalling Relays operated	<40W		
AC Current Sensing Range	.2 - .8A		
AC Current Sensing Burden	<0.5VA/phase		
AC Current DO/PU Ratio	70% nominal		
AC Current Sensing Element Operate Time (including signalling relay response time)			
Pickup $1.5 \times <1 <40 \times$ setting	<20ms		
Dropout $1.5 \times <1 <40 \times$ setting	<20ms		
Timer Range - 100 - 500 ms	± 10 ms		
Timer Reset Time (overshoot time)	<7ms		
Timer Repeatability Error	< $\pm 2\%$ of setting		
Operating Temperature Range	0°C to 55°C		

3. TEST EQUIPMENT REQUIRED

DC Auxiliary Supply
AC Variable Current Supply
Digital Voltmeter
Frequency Counter
Oscilloscope
HV Test Equipment
Electronic Counter (for measuring operate & release times).

4. ASSOCIATED DRAWINGS

159-059-009	2C59K9 Descriptive Manual
159-059-209	2C59K9 Master Circuit Diagram
660-108-206	Circuit Diagram PCB Current Sensing
660-108-306	Loading Diagram PCB Current Sensing
660-198-201	Circuit Diagram PCB Timer
660-198-301	Loading Diagram PCB Timer
660-197-301	Loading Diagram PCB Instantaneous Relays
660-162-301	Loading Diagram PCB Output Relays
660-161-301	Loading Diagram PCB Motherboard

5. HIGH VOLTAGE TESTING

- a) Apply 2KV RMS 50Hz between terminal groups 1 and 2 in table 1 below for one minute.
- b) Apply 3 5KV 1/50us pulses of each polarity between terminal groups 1 and 2 in table 1 below.

TABLE 1

<u>GROUP 1</u>	<u>GROUP 2</u>
1 - 43 incl, 48 - 54 include joined	44 - 47 incl, 56 - 59 include joined
1 - 41 incl, 44, 45, 56,57 joined	42, 43, 46 - 54 incl, 58,59 joined
1 - 8 incl, 11 - 41 include,	9, 10, 42, 43, 56 - 59
44 - 54 incl joined	include joined
All terminals (except 55)	55 (FRAME)

6. CALIBRATION & TEST PROCEDURE

6.1 Overcurrent Sensing PCB (660/108-6)

This PCB contains 3 identical circuits fed from separate current transformers mounted in the main chassis. Each sensing circuit has an open collector output relay drive transistor. The operate times are measured from the time of application of input current to closure of contact on the output relay mounted on 660/197-1 Relay Board. The transformers are precalibrated at test with trimpots R1, R2 and R3 (159-059-209 reference) to permit interchange of boards between units.



6.1 Overcurrent Sensing PCB (660/108-6) (Cont)

- a) Plug 660/108 board into unit. (Each phase on this PCB picks up when 140mV is applied to the input, with dial at mid-scale).
- b) Check that dial pot knobs have equal overtravel at either end.
- c) Connect RMS measuring DVM across phase A PCB input (pins 26 and 28, or terminal block TB2-3 and TB2-4) and apply 125V Auxiliary Supply.
- d) Apply 0.5A input and adjust trimpot R1 until the voltage across its terminals is 140mV.
- e) Connect DVM across phase B PCB input (pins 16 and 18, or terminal block TB3-3 and TB3-4) and apply 125V Auxiliary Supply.
- f) Apply 0.5A input and adjust trimpot R2 until the voltage across its terminals is 140mV.
- g) Connect DVM across phase C PCB input (pins 8 and 10, or terminal block TB4-1 and TB4-2) and apply 125V Auxiliary Supply.
- h) Apply 0.5A input and adjust trimpot R3 until the voltage across its terminals is 140mV.
- i) Check that Test Point "5" waveform is clean, and varies by a factor of four to one in amplitude as the dial pot is moved from min. to max. setting. R3 may be decreased if the scale span is too small.
- j) Check that Test Point "6" waveform is as smooth as possible ie. symmetrical 3 phase ripple). If percentage ripple is too great, C6 may be altered to achieve best symmetry.
- k) Check that pickup currents are within accuracy at the following settings:

<u>SETTING</u>	<u>MIN</u>	<u>MAX</u>	<u>NOM</u>	<u>UNITS</u>
0.2	0.18	0.22	0.20	A
0.4	0.36	0.44	0.40	A
0.6	0.54	0.65	0.60	A
0.8	0.72	0.88	0.80	A

6.1 Overcurrent Sensing PCB (660/108-6) (Cont)

- l) Check that DO/PU ratio is between 70% and 75%, repeating step above if necessary.

ACTUAL %

- m) Repeat steps 9 to 10 for input B, monitoring test points 3 and 4 in lieu of 5 and 6, adjusting R24 in lieu of R3, and check that pickup currents are within accuracy at the following settings:

<u>SETTING</u>	<u>MIN</u>	<u>MAX</u>	<u>NOM</u>	<u>UNITS</u>
0.2	0.18	0.22	0.20	A
0.4	0.36	0.44	0.40	A
0.6	0.54	0.65	0.60	A
0.8	0.72	0.88	0.80	A

- n) Check that DO/PU ratio is between 70% and 75%.

ACTUAL %

- o) Repeat steps 9 to 10 for input C, monitoring test points 1 and 2 in lieu of 5 and 6, adjusting R45 in lieu of R3, and check that pickup currents are within accuracy at the following settings:

<u>SETTING</u>	<u>MIN</u>	<u>MAX</u>	<u>NOM</u>	<u>UNITS</u>
0.2	0.18	0.22	0.20	A
0.4	0.36	0.44	0.40	A
0.6	0.54	0.65	0.60	A
0.8	0.72	0.88	0.80	A

- p) Check that DO/PU ratio is between 70% and 75%.

ACTUAL %

6.2 Operate Time Check

Connect timing apparatus to measure time delay between application of AC input current and operation of instantaneous relay K1 (Rail Mounted Terminals 38 and 37).

6.2 Operate Time Check (Cont)

a) Set input A to 2 A on 0.2 Setting

	<u>MAX</u>	<u>ACTUAL</u>
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

b) Set input A to 8 A on 0.8 Setting

	<u>MAX</u>	<u>ACTUAL</u>
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

c) Set input B to 2 A on 0.2 Setting

	<u>MAX</u>	<u>ACTUAL</u>
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

d) Set input B to 8 A on 0.8 Setting

	<u>MAX</u>	<u>ACTUAL</u>
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

e) Set input C to 2 A on 0.2 Setting

	<u>MAX</u>	<u>ACTUAL</u>
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

f) Set input C to 8 A on 0.8 Setting

	<u>MAX</u>	<u>ACTUAL</u>
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

6.3 Timers

The timer may be initiated by bridging PCB pin 30 to the timer initiate put in 29), checking that none of the phases of the overcurrent are not picked up.

Refer to PCB Circuit Diagram 660-198-201

6.3 Timers (Cont)

- a) Cut links A, C and E to set the divide ratio to 256.
- b) Connect period counter between Timer IC1 pin 1 and 0V (Avlugs J & L **A** Ø , N & Q **B** Ø , R & T **C** Ø respectively), and time interval measuring time between application of 125V (K1 Overcurrent element picked up) and closure of K2 contact (Rail Terminals 46 & 47 **A** Ø, 56 & 57 **B** Ø, 58 & 59 **C** Ø).
- c) Adjust trimpot R4 to give a maximum to minimum period ratio of 5:1 for the dial scale end settings.
- d) Pad C2 with C2b as necessary to achieve .5s scale maximum time. Readjust R4 as necessary to achieve full calibration as follows:

<u>SETTING</u>	<u>MIN</u>	<u>MAX</u>	<u>NOM</u>	<u>A</u> Ø	<u>B</u> Ø	<u>C</u> Ø
0.1	0.09	0.11	0.1	sec	sec	sec
0.2	0.19	0.21	0.2	sec	sec	sec
0.3	0.29	0.31	0.3	sec	sec	sec
0.4	0.39	0.41	0.4	sec	sec	sec
0.5	0.49	0.51	0.5	sec	sec	sec

7. GENERAL & FUNCTIONAL TEST

- a) Check that relays K3, K4, K5, K6, K7, K8 operate correctly when Auxiliary Supply is applied to their respective coils, and that all contacts are functional and correctly wired.

ACTUAL **OK**

- b) Check that the reset push button resets relay K8 and its indicator LED. Check that K8 output contact is correctly wired and functional (Terminals 42 & 43).

ACTUAL **OK**

- c) Check that relay K9 picks up when Auxiliary Supply is applied to the unit. Check that its output contacts are correctly wired and functional (Terminals 9 & 10, 44 & 45).

ACTUAL **OK**

7. GENERAL & FUNCTIONAL TEST (Cont)

d) Check that each of the plug-in boards have been correctly polarised.

ACTUAL

 OK

e) Check that the relay is electrically sound and mechanically robust as per Standard Inspection & Test Schedule 903-000-026

PASS

TESTED BY : _____ DATE : _____

8. CONNECTION DIAGRAM

Refer to drawing 159-059-209