Order Number | | Serial Number | |

PRODUCT/TEST MANUAL

2C59K5

CIRCUIT BREAKER FAIL RELAY

1. BROAD DESCRIPTION

The 2C59K5 is a 19" 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is used enabling the instantaneous current sensing, timer, signalling relay or trip output relay modules to be withdrawn.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. SPECIFICATIONS

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
Signal Relays (operated)	<40W
AC Current Sensing Range	1-4A
AC Current Sensing Burden	<0.5VA/phase
AC Current DO/PU Ratio	>80% nominal
AC Current Sensing Element Operate Time (including signalling relay response time)	
Pickup 1.5 x <I < 40 x setting	<20ms
Dropout 1.5 x <I <40 x setting	<20ms
Timer Range	
100 - 500ms	$\pm$10ms
Timer Reset Time (overshot time)	<7ms
Timer Repeatability Error	<$\pm$2% of setting
Operating Temperature Range	0^{o}C to 55 ^{o}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

159-059-005	2C59K5 Descriptive Manual
159-059-205	2C59K5 Master Circuit Diagram
660-108-204	Circuit Diagram PCB Current Sensing
660-108-304	Loading Diagram PCB Current Sensing
660-083-203	Circuit Diagram PCB Timer
660-083-303	Loading Diagram PCB Timer
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

GROUP 1	GROUP 2
1 to 43 joined	44 to 55 joined
1 to 37 joined & 44 to 47 joined	38 to 43 joined & 50 to 55 joined
1 to 35 joined, including 38, 39, 42, 43, 46, 47, 50 & 51	52 to 55 joined, including 36, 37, 40, 41, 44, 45, 48 & 49
50 to 53 joined, including 38, 39, 44 & 45	42, 43, 48, 49, 54 & 55 joined

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 660/162-1 Relay Board. The transformers are precalibrated at test with trimpots R1, R2 and R3 (159-059-205 reference) to permit interchange of boards between units.

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 2.5A 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 2.5A 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 2.5A 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.

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

k) Check that pickup currents are within accuracy at the following settings:

SETTING	MIN	MAX	NOM	UNITS
1.0	0.9	1.1	1.0	**A**
2.0	1.8	2.2	2.0	**A**
3.0	2.7	3.3	3.0	**A**
4.0	3.6	4.4	4.0	**A**

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:

SETTING	MIN	MAX	NOM	UNITS
1.0	0.9	1.1	1.0	**A**
2.0	1.8	2.2	2.0	**A**
3.0	2.7	3.3	3.0	**A**
4.0	3.6	4.4	4.0	**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:

SETTING	MIN	MAX	NOM	UNITS
1.0	0.9	1.1	1.0	**A**
2.0	1.8	2.2	2.0	**A**
3.0	2.7	3.3	3.0	**A**
4.0	3.6	4.4	4.0	**A**

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

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 36 and 37).

a) Set input A to 2 A on 1 A Setting

	MAX	**ACTUAL**
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 4 A Setting

	MAX	**ACTUAL**
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 1 A Setting

	MAX	**ACTUAL**
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 4 A Setting

	MAX	**ACTUAL**
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 1 A Setting

	MAX	**ACTUAL**
Check PU time at 100 V	19 ms	ms
Check DO time at 150 V	19 ms	ms

6.2 Operate Time Check (Cont)

f) Set input C to 8 A on 4 A Setting

	MAX	ACTUAL
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 pin 29, checking that none of the phases of the overcurrent are not picked up.

Refer to PCB Circuit Diagram 660-083-205

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 respectively), and time interval measuring unit to measure time between application of 125V (K1 Overcurrent element picked up) and closure of K2 contact (Rail Terminals 38 & 39)

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:

SETTING	MIN	MAX	NOM	ACTUAL
0.1	0.09	0.11	0.1	sec
0.2	0.19	0.21	0.2	sec
0.3	0.29	0.31	0.3	sec
0.4	0.39	0.41	0.4	sec
0.5	0.49	0.51	0.5	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**

7. GENERAL & FUNCTIONAL TEST (Cont)

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 44 & 45, 46 & 47).

ACTUAL | **OK**

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 159-059-205 Sheets 1 and 2