



Order Number

Serial Number

## 2C59K12 TEST PROCEDURE

### CIRCUIT BREAKER FAIL RELAY

#### 1. 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).

#### 2. ASSOCIATED DRAWINGS

159-059-012	2C59K12 Descriptive Manual
159-059-212	2C59K12 Master Circuit Diagram
660-108-208	Circuit Diagram PCB Current Sensing
660-108-308	Loading Diagram PCB Current Sensing
660-198-203	Circuit Diagram PCB Timer
660-198-302	Loading Diagram PCB Timer
660-264-301	Loading Diagram PCB Motherboard

#### 3. 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**

<b><u>GROUP 1</u></b>	<b><u>GROUP 2</u></b>
1,2,3,4,5,6,7,8,9,10,11,12,13,14 (Inputs)	15-60 + (Frame 61) (Outputs)
All Terminals	(Frame 61)

## 4. CALIBRATION & TEST PROCEDURE

### 4.1 Overcurrent Sensing PCB (660/108-8)

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. The transformers are precalibrated at test with trimpots R1, R2 and R3 (159-059-212 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 1.25A 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 1.25A 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 1.25A 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.



**4.1 Overcurrent Sensing PCB (660/108-8) (Cont)**

- 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>
0.5	0.45	0.55	0.50	A
1.0	0.90	1.10	1.00	A
1.5	1.35	1.65	1.50	A
2.0	1.80	2.20	2.00	A

- l) Check that DO/PU ratio is between 70% and 80%, repeating step above if necessary. Nominal 75 %.

**ACTUAL**  %

- m) Repeat steps i to j 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>
0.5	0.45	0.55	0.50	A
1.0	0.90	1.10	1.00	A
1.5	1.35	1.65	1.50	A
2.0	1.80	2.20	2.00	A

- n) Check that DO/PU ratio is between 70% and 80%. Nominal 75%.

**ACTUAL**  %

- o) Repeat steps i to j 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>
0.5	0.45	0.55	0.50	A
1.0	0.90	1.10	1.00	A
1.5	1.35	1.65	1.50	A
2.0	1.80	2.20	2.00	A

- p) Check that DO/PU ratio is between 70% and 80%. Nominal 75 %.

**ACTUAL**

	%
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#### 4.2 Operate Time Check

Connect timing apparatus to measure time delay between application of AC input current and operation of instantaneous relays 4, 5 and 6 (Rail Mounted Terminals 38 and 37).

- a) Set input A to 5 A on 0.5 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 20 A on 2.0 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 5 A on 0.5 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 20 A on 2.0 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 5 A on 0.5 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 20 A on 2.0 Setting

MAX

ACTUAL

Check PU time at 100 V            19 ms  
 Check DO time at 150 V            19 ms

	ms
	ms



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### 4.3 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 660-198-203.

- 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 (Overcurrent element picked up) and closure of timing contact (Rail Terminals 43 & 44 **A Ø** , 43 & 45 **B Ø** , 43 & 46 **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 Ø</u>	<u>B Ø</u>	<u>C Ø</u>
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

### 5. GENERAL & FUNCTIONAL TEST

- a) Check that relays 1, 2, 3, 4, 5 & 6 operate correctly when Auxiliary Supply is applied to their respective coils, and that all contacts are functional and correctly wired.

**ACTUAL**

	<b>OK</b>
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b) Check that the relay is electrically sound and mechanically robust as per Standard Inspection & Test Schedule 903-000-026.

PASS

TESTED BY : \_\_\_\_\_ DATE : \_\_\_\_\_