

Order Number

Serial Number

## PRODUCT / TEST MANUAL

**2C59K8**

### DEFINITE TIME OVERCURRENT RELAY

| Issue Level | Date       | Summary of changes |
|-------------|------------|--------------------|
| D           | 16/11/1995 | 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 2C59K8 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is used enabling the instantaneous current sensing, timer, signalling relay or trip output relay modules to be withdrawn.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. 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% - 75% nominal      |      |      |
| AC Current Sensing Element Operate Time<br>(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  | $\pm 10$ 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

|             |                                     |
|-------------|-------------------------------------|
| 159-059-008 | 2C59K8 Descriptive Manual           |
| 159-059-208 | 2C59K8 Master Circuit Diagram       |
| 660-108-206 | Circuit Diagram PCB Current Sensing |
| 660-108-306 | Loading Diagram PCB Current Sensing |
| 660-083-205 | Circuit Diagram PCB Timer           |
| 660-083-305 | 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**

| <u>GROUP 1</u>   | <u>GROUP 2</u>  |
|--|---|
| 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,<br>46, 47, 50 & 51 | 52 to 55 joined, including 36, 37, 40,<br>41, 44, 45, 48 & 49 |
| 50 to 53 joined, including 38, 39, 44 &<br>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 (159-059-208 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).

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

- 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:

| SETTING | MINIMUM | MAXIMUM | NOMINAL | UNITS |
|---------|---------|---------|---------|-------|
| 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     |

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

**ACTUAL**

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

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 | MINIMUM | MAXIMUM | NOMINAL | UNITS |
|---------|---------|---------|---------|-------|
| 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:

| SETTING | MINIMUM | MAXIMUM | NOMINAL | UNITS |
|---------|---------|---------|---------|-------|
| 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 36 and 37).

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      | <input type="text"/> ms |
| Check DO time at 150 V | 19 ms      | <input type="text"/> ms |

### 6.2 Operate Time Check (Cont)

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 660-083-205

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)

### 6.3 Timers (Cont)

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 | MINIMUM | MAXIMUM | NOMINAL | 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

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

**7. GENERAL & FUNCTIONAL TEST (Cont)**

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

PASS

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



159-059-908  
Sheet 9 of 9

**8. CONNECTION DIAGRAM**

Refer to drawing 159-059-208 Sheets 1 and 2