

Order Number

Serial Number

## PRODUCT/TEST MANUAL

**2C135K7**

### DEFINITE TIME SENSITIVE EARTH FAULT RELAY WITH HARMONIC SUPPRESSION

<b>Issue Level</b>	<b>Date</b>	<b>Summary of changes</b>
E	23/05/1997	Initial issue.

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ERL	MW	MW	

## 1. BROAD DESCRIPTION OF RELAY

The 2C135K7 is a high speed definite time sensitive earth fault relay with harmonic suppression. Current and time settings are made on DIL switches on the dial of the unit and bistable magnetic disc flag also mounted on the dial indicate when delayed output relay operation has occurred.

## 2. SPECIFICATIONS

DC Auxiliary Supply (multi-range)	DC 30 VDC nom. (125V/250V with ext resistors)
DC Auxiliary Supply Tolerance	85% to 110% of nom
Supply Burden (independent of range)	55mA
AC Current Sensing Range	.5-15.5% of 5A (25-775mA, 25mA steps)
Setting Accuracy (Vx & Temp at nominal)	±5% of setting
Temp Dependence of Ipickup (over Temp range 20-50 deg C)	<±1.5mA per deg C
Vx Dependence of Ipickup (over Vsupply range 85%-110% of nom)	<±2% of setting
Max operate time @ 1.1 x setting	<80ms
Max resetting time from 1.1 x setting	<80ms
Harmonic Rejection	Greater than 20 x setting for frequencies >100Hz
AC Continuous Rating	10A
AC Short Time Rating	200A for 3sec
AC Burden	Less than 1VA at 5A
Resetting ratio (at 20 deg C)	Greater than 90%
Timer Range	0-31.875s, .125s steps
Timer Accuracy (Vx & Temp at nominal)	±5% of setting
Temp Dependence of Timer (over Temp range 0-50 deg C)	<30ms
Vx Dependence of Timer (over Vsupply range 85%-110% of nom)	<±2% of setting
Max resetting time	<50ms
Overall Ambient Temperature Range	-5 to 55 deg C
Operation Indicator (Timed output)	Magnetic Disc

### Output Relay Contact Ratings

#### Make and Carry Continuously

3000 VA AC resistive with maximums of 660 Volt and 12 Amp  
 3000 VA DC resistive with maximums of 660 Volt and 12 Amp

#### Make and Carry of 0.5 Second

7500 VA AC resistive with maximums of 660 Volt and 30 Amp  
 7500 VA DC resistive with maximums of 660 Volt and 30 amp

#### AC Break Capacity

3000 VA AC resistive with maximums of 660 Volt and 12 Amp

## 2. SPECIFICATIONS (Cont)

### DC Break Capacity (Amps)

Voltage			24V	48V	125V	250V
Resistive rating		a	12	1.5	0.5	0.25
		b	12	12	10	5
L/R=40m S	Maximum break	a	12	1	0.4	0.2
		b	30	15	5.5	3.5
1K operations (N3 Rating)		b	12	12	5	2.5

a = Without magnetic blowouts    b = With magnetic blowouts

\* As tested by Powernet Yarraville laboratories in Victoria.

Operation Indicators

Hand resettable magnetic disc  
(permanent memory).

Insulation Withstand

In accordance with AS2481-1981  
(Clause 5-4), 2KV 50Hz between  
output and input. In Accordance  
with AS2481-1981 (Clause 5-4),  
1.2/50 5KV.

Noise Immunity

The 2C135 relay has been  
designed to withstand the high  
frequency interference test detailed  
in AS2481-1981 (Clause 5-5).

Case Type

GEC 1D compatible frame

## 3. TEST EQUIPMENT REQUIRED

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

## 4. ASSOCIATED DRAWINGS

159-135-107	Wiring Diagram
660-277-201	Circuit Diagram PCB 2C135K7
660-277-301	Loading Diagram PCB

## 5. HIGH VOLTAGE TESTING

- a) Apply 2KV RMS 50Hz between terminal Groups 1 and 2 in Table 1  
for 1 minute.

**5. HIGH VOLTAGE TESTING (Cont)**

- b) Apply three 5KV 1/50us pulses of each polarity between terminal Groups 1 and 2 in Table 1.

**TABLE 1**

GROUP 1	GROUP 2
3 - 8	1,2,9,10
3,4,9,10	5,8,1,2
All	Earth

**6. CALIBRATION & TEST PROCEDURE**

- a) Connect 30V DC Auxiliary power supply to terminals 3 & 5 (+) and 4 & 8 (-). (Terminals 3 & 4 operate the "enable" relay - energise to enable.) Connect a 150 ohm 20 W resistor between terminal 4 and the power supply negative.
- b) Connect variable frequency adjustable current supply via Pickup/Dropout time measuring equipment and Ammeter to the current input terminals (9 and 10). Use RL2-1 contact (terminals 1 and 2) to detect pickup of the 2C135.
- c) Check that 12V supply rail is within tolerance. (Measure between auxiliary supply negative and transformer shield can.)

MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
11.5	12.6	12.0	<input type="text"/>	V DC

- d) Check that 24V supply rail is within tolerance. (Measure between auxiliary supply negative and IC1 pin 4.)

MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
23.0	25.2	24.0	<input type="text"/>	V DC

- e) Connect oscilloscope 0V connection to +12V rail (shield can of input transformer is a convenient point) and monitor U1C-8 pin 8.
- f) With zero input current, set trimpot R6 to mid setting, SW2 to .5% Inom (25mA) and adjust R12 to give zero DC offset as observed on the oscilloscope.

ACTUAL	UNITS
<input type="text"/>	OK

- g) Set current setting switch to 2% setting (100mA) and apply 50Hz input current such that a 5V peak to peak signal is observed on the oscilloscope at U2C-8.
- h) Change input current frequency to 150Hz and adjust trimpot R20 for minimum signal amplitude on the CRO. Note that C11 may be padded if necessary.
- i) Temporarily short out diode D9, set input frequency to 50Hz and adjust input amplitude until square waves just appear at U1D-14.

**6. CALIBRATION AND TEST PROCEDURE (Cont)**

- j) Connect CRO second channel to U4B-4 pin 4 (D13 anode) and adjust trimpot R42 so that U4B-4 pin 4 goes high 8ms after U1D-14 pin 8 goes low.

MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
8.0	9.0	8.0	<input type="text"/>	ms

- k) Remove temporary short circuit from across D9.
- l) Set timer switches to zero.
- m) Set current setting DIL to 2%. Adjust trimpot R6 until output relay just picks up at 100mA.
- n) Set current setting DIL switch to .5% and input current to zero. Check that U1C-8 pin 8 output offset voltage is zero and adjust R12 if necessary.

ACTUAL	OK
<input type="text"/>	

- o) Set current setting DIL to .5%. Connect pickup/dropout time measuring equipment to measure the time between application of 250 mA and subsequent closure of RL2-1 contact. Note that the pickup time of the instantaneous current sensing element plus output relay will be approximately 35 ms. Record operate times at the following settings:

SETTING	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
0.125	0.15	0.17	0.16	<input type="text"/>	s
0.25	0.27	0.29	0.28	<input type="text"/>	s
0.5	0.50	0.56	0.53	<input type="text"/>	s
1.0	0.98	1.08	1.03	<input type="text"/>	s
2.0	1.93	2.13	2.03	<input type="text"/>	s
4.0	3.83	4.23	4.03	<input type="text"/>	s
8.0	7.63	8.43	8.03	<input type="text"/>	s
16.0	15.23	16.83	16.03	<input type="text"/>	s
31.875	30.30	33.40	31.91	<input type="text"/>	s

- p) Set timer to zero and record the following pickup and hysteresis currents at the indicated settings:

SETTING	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
0.5% PU	22.0	28.0	25	<input type="text"/>	mA
Hysteresis	1.50	3.5	2.5	<input type="text"/>	mA
1.0% PU	46.5	53.5	50	<input type="text"/>	mA
Hysteresis	3.0	7.0	5.0	<input type="text"/>	mA
2.0% PU	95.0	105.0	100.0	<input type="text"/>	mA
Hysteresis	6.0	14.0	10.0	<input type="text"/>	mA
4.0% PU	192.0	208	200.0	<input type="text"/>	mA
Hysteresis	12.0	28.0	20.0	<input type="text"/>	mA
8.0% PU	386.0	414.0	400.0	<input type="text"/>	mA
Hysteresis	24.0	56.0	40.0	<input type="text"/>	mA
15.5% PU	750.0	800.0	775.0	<input type="text"/>	mA
Hysteresis	46.0	110.0	77.8	<input type="text"/>	mA

**6. CALIBRATION AND TEST PROCEDURE (Cont)**

q) Reconnect auxiliary supply set to 25.5V to enclosure. Record pickup and hysteresis currents:

	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
2.0% PU	95.0	105.0	100.0	<input type="text"/>	mA
Hysteresis	6.0	14.0	10.0	<input type="text"/>	mA

r) Repeat step q) above for an auxiliary supply of 33V:

	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
2.0% PU	95.0	105.0	100.0	<input type="text"/>	mA
Hysteresis	6.0	14.0	10.0	<input type="text"/>	mA

s) Set input current to 120mA and record PU & DO times for an auxiliary supply of 30 volts.

	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
PU		80		<input type="text"/>	mS
DO		80		<input type="text"/>	mS

**7. GENERAL & FUNCTIONAL**

a) Check that magnetic disc flag operates correctly when the output relay picks up.

OK

b) Check that reset button resets the flag.

OK

c) 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

