

Order Number

Serial Number

## PRODUCT / TEST MANUAL

**2C135K20**

**DEFINITE TIME SENSITIVE EARTH FAULT**

<b>Issue Level</b>	<b>Date</b>	<b>Summary of changes</b>
C	02/04/1996	Initial issue.

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ERL	MW	MW	

## 1. DESCRIPTION OF RELAY

The 2C135 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 for the unit and a bistable magnetic disc flag also mounted on the dial indicates when an output relay operation has occurred.

## 2. SPECIFICATION

DC Auxiliary Supply (multi-range)	DC 30V 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. SPECIFICATION (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.

Enclosure

GEC 1D compatible frame only

Insulation Withstand

In accordance with AS2481-1981 (Clause 5-4), 2KV 50Hz between input and frame, output and frame and between output and input. In accordance with AS2481-1981 (Clause 5-4), 1.2/50 5KV impulse between each terminal and earth, between circuits not normally connected together and between terminals of the same circuit.

Noise Immunity

The 2C135 has been designed to withstand high frequency interference test detailed in AS2481-1981 (Clause 505).

## 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

159-135-020	Descriptive Manual 2C135K20
159-135-120	Wiring Diagram PCB 2C135K20
660-252-215	Circuit Diagram PCB 2C135K15
660-252-315	Loading Diagram PCB

## 5. HIGH VOLTAGE TESTING

a) Apply 2KV RMS 50 Hz between terminal groups 1 and 2 in table 1 for 1 minute.

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

- b) Apply 3 5KV 1/50us pulses of each polarity between terminal groups 1 and 2 in table 1.

**TABLE 1**

<b><u>GROUP 1</u></b>	<b><u>GROUP 2</u></b>
1,2,3,4,5,8	6,7,9,10,FRAME
1,2,5,8,9,10	3,4,6,7,FRAME
1,2,6,7	5,8,FRAME

**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 RL1-1 contact (term's 1 and 2) to detect pickup of the 2C135.
- c) Set timer switches to 0.5sec.
- d) Check that 12V supply rail is within tolerance. (Measure between auxiliary supply negative and transformer shield can).

<b>MIN</b>	<b>MAX</b>	<b>NOM</b>	<b>ACTUAL</b>	<b>UNITS</b>
11.5	12.6	12.0	<input style="width: 100px; height: 15px;" type="text"/>	V DC

- e) Check that 24V supply rail is within tolerance. (Measure between auxiliary supply negative and R63).

<b>MIN</b>	<b>MAX</b>	<b>NOM</b>	<b>ACTUAL</b>	<b>UNITS</b>
23.0	25.2	24.0	<input style="width: 100px; height: 15px;" type="text"/>	V DC

- f) Connect oscilloscope 0V connection to +12V rail (shield can of input transformer is a convenient point) and monitor IC1-3 pin 8.
- g) 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.

<b>ACTUAL</b>	<b>OK</b>
<input style="width: 100px; height: 15px;" type="text"/>	

- h) 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 IC1-4 pin 14
- i) 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.
- j) Temporarily short out diode D9, set input frequency to 50Hz and adjust input amplitude until square waves just appear at IC2-3 pin 8.

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

- k) Connect CRO second channel to IC4-2 pin 4 (D13 anode) and adjust trimpot R42 so that IC4-2 pin 4 goes high 8ms after IC2-3 pin 8 goes low.

MIN	MAX	NOM	ACTUAL	UNITS
8.0	9.0	8.0	<input type="text"/>	ms

- l) Remove temporary short circuit from across D9
- m) Set timer switches to zero .
- n) Adjust trimpot R6 until output relay just picks up at 100mA.
- o) Set current setting DIL switch to .5% and input current to zero. Check that IC1-3 pin 8 output offset voltage is zero and adjust R12 if necessary.

ACTUAL	OK
<input type="text"/>	

- p) Connect frequency counter to IC4-1 pin 3 and apply 250mA to 2C135 sensing input (DIL switch should still be set at .5% (25mA).
- q) Check IC4-1 pin 3 has a frequency of 65,536Hz, adjust C19 if necessary.
- r) Connect pickup/dropout time measuring equipment to measure the time between application of 250mA and subsequent closure of RL1-1 contact. Note that the pickup time of the instantaneous current sensing element plus output relay will be approximately 35ms. Record operate times at the following settings:

SETTING	MIN	MAX	NOM	ACTUAL	UNITS
0.125	0.15	0.17	0.16	<input type="text"/>	Sec
0.25	0.27	0.29	0.28	<input type="text"/>	Sec
0.50	0.50	0.56	0.53	<input type="text"/>	Sec
1.00	0.98	1.08	1.03	<input type="text"/>	Sec
2.00	1.93	2.13	2.03	<input type="text"/>	Sec
4.00	3.83	4.23	4.03	<input type="text"/>	Sec
8.00	7.63	8.43	8.03	<input type="text"/>	Sec
16.00	15.23	16.83	16.03	<input type="text"/>	Sec
31.875	30.30	33.40	31.91	<input type="text"/>	Sec

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

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

SETTING	MIN	MAX	NOM	ACTUAL	UNITS
0.5 % PU	22.0	28.0	25.0		mA
Hysteresis	1.5	3.5	2.5		mA
1.0 % PU	46.5	53.5	50.0		mA
Hysteresis	3.0	7.0	5.0		mA
2.0 % PU	95.0	105.0	100.0		mA
Hysteresis	6.0	14.0	10.0		mA
4.0 % PU	192.0	208.0	200.0		mA
Hysteresis	12.0	28.0	20.0		mA
8.0 % PU	386.0	414.0	400.0		mA
Hysteresis	24.0	56.0	40.0		mA
15.5 % PU	750.0	800.0	775.0		mA
Hysteresis	46.0	110.0	77.8		mA

t) Set input current to 110mA and record pickup and dropout times for auxiliary supply voltage of 30V:

	NOM	ACTUAL	UNITS
PICK UP	80		ms
DROP OUT	80		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

b) 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

