MAINTENANCE/SERVICE
MODEL CG-100A CURRENT GUN

SYPRIS TEST & MEASUREMENT
F.W. BELL PRODUCTS
6120 HANGING MOSS ROAD
ORLANDO, FL 32807
PH.(407)678-6900

UN-01-135

F.W. BELL, INC.
MAINTENANCE AND CALIBRATION
MODEL CG-100A CURRENT GUN PROBE

Complete calibration of the F.W. BELL Model CG-100A Current Gun Probe may be accomplished by adjustment of 4 trimming potentiometers. These potentiometers are accessible, without disassembly, through holes in the plastic case located under two decals, as shown in the diagram, Figure #1. It is advisable to read and understand the CG-100A Instruction manual before attempting calibration.

A. Description of Adjustments:

1. The ac Response adjustment is made to improve the frequency response out to 1.0 kHz. The effect of the adjustment increases with increasing frequency.

2. The Coarse Zero adjustment is made to null-out initial dc voltage offsets and to set the null at the center of travel of the Zero Adjustment Thumbwheel.

3. The 1V/10A Range Calibration adjustment is made with the Range Switch in the 1V/10A position and sets the sensitivity of the output amplifier so that the output voltage falls within the specified accuracy of ±2% of Rated Output (1V for 10A) over the current range from 0 to 10A.

4. The 1V/100A Range Calibration adjustment is made with the Range Switch in the 1V/100A position and sets the sensitivity of the output amplifier so that the output voltage falls within the specified accuracy of ±2% of Rated Output (1V for 100A) over the current range from 0 to 10A.

B. Equipment required:

1. ac Current Source, sine-wave, variable frequency and output.

2. dc Current Source, variable output.

3. Current shunt, 0.1 ohm ±0.1%, 50W. (non-inductive construction preferred)

4. Ten turn coil, #14 insulated wire, 18” minimum diameter.

5. Digital Voltmeter, 0.1% accuracy.

C. Equipment Setup:

See Figure #2

D. Step by Step Adjustment Procedures:

1. ac Response Adjustments.

A typical 0 to 1 kHz frequency response curve is shown in Figure #3.

D. Step by Step Adjustment Procedures Cont'd:

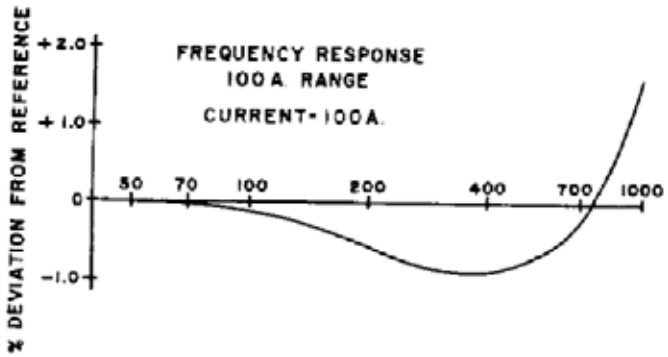


FIGURE 3.

a. Turn the CG-100A on and lock with Slide-Lock.

b. Set the CG-100A Range Switch to the 1V/100A position.

c. Clamp the CG-100A around the ten-turn coil. (Ref. Equipment Setup, Figure #2, Position #1).

d. Set the ac Current Source for 2A at 50 Hz (0.20Vac across the 0.1 ohm shunt).

e. Measure and record the ac output voltage.

f. Set the ac Current Source for 2A at 1 kHz.

g. Adjust the ac Response trimming potentiometer for the same voltage output recorded for 2A at 50 Hz in Step "e".

Note: The CG-100A is relatively insensitive to adjustments at 50 Hz, however, if a large change from the original factory setting of the 270° trim-pot has been necessary at 1 kHz, the adjustment sequence should be repeated.

2. Coarse dc Zero Adjustment:

a. Turn the CG-100A on and lock with Slide-Lock.

b. Set the CG-100A Range Switch to the 1V/100A position.

c. Connect the CG-100A output to the DVM, set to a low dc voltage range.

d. Adjust the Coarse Zero trimming potentiometer until a numerically equal positive and negative dc voltage reading is obtained at each end stop of the Zero Adjustment Thumbwheel.

Note: Typical current adjustment span of the Zero Adjustment Thumbwheel is +5A to –5A (10A total), which will be +0.050V to –0.050V (0.100V total) on the DVM for the 1V/100A range setting.

3. 1V/10A Range Calibration Adjustment:

a. Turn the CG-100A on and lock with Slide-Lock.

b. Set the CG-100A Range Switch to the 1V/10A position.

3. 1V/10A Range Calibration Adjustment Cont'd:

   c. Set the ac current source to 13A at 60 Hz.

   d. Clamp the CG-100A around the one-turn coil. (Ref. Equipment Setup, Figure #2, Position #2).

   e. Connect the voltage output of the CG-100A to the DVM, set to a low ac range.

   f. Adjust the 1V/10A Calibration trimming potentiometer for a 1.30 Vac reading on the DVM.

   Note: Typical 0 to 20A ac and dc linearity curves are shown in Figure 4. The shape and separation of these curves is fixed by the magnetic circuit design and is highly repeatable and consistent from unit to unit in our production, in both the short and the long term.

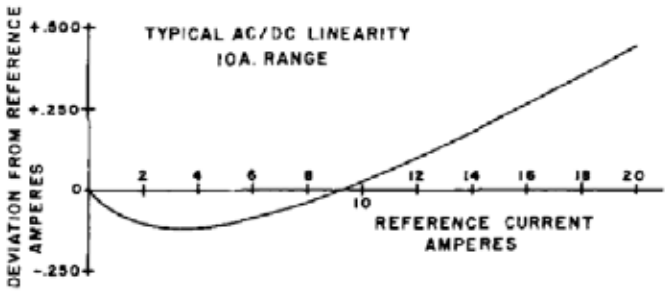


FIGURE 4.

4. Demagnetizing Circuit Check:

   a. Set the dc current source to 0.0A (Turn-off).

   b. Turn the CG-100A on and lock with Slide-Lock.

   c. Clamp the CG-100A around the ten-turn coil, Position #1.

   d. Connect the voltage output of the CG-100A to the DVM, set to a low dc range.

   e. Zero the voltage output of the CG-100A on the DVM.

   f. Turn the dc current source on and adjust for approximately 10A.

   g. Turn the current source "off".

   h. Notice a positive voltage offset in the CG-100A output to the DVM due to a small residual flux in the magnetic core.

   i. Turn the CG-100A off and on. The offset should be a zero reading.

5. 1V/100A Range Calibration Adjustment:

   a. Turn the CG-100A on and lock with Slide-Lock.

   b. Set the CG-100A Range Switch to the 1V/100A position.

   c. Set the dc current source to 0.0A (Turn-off).

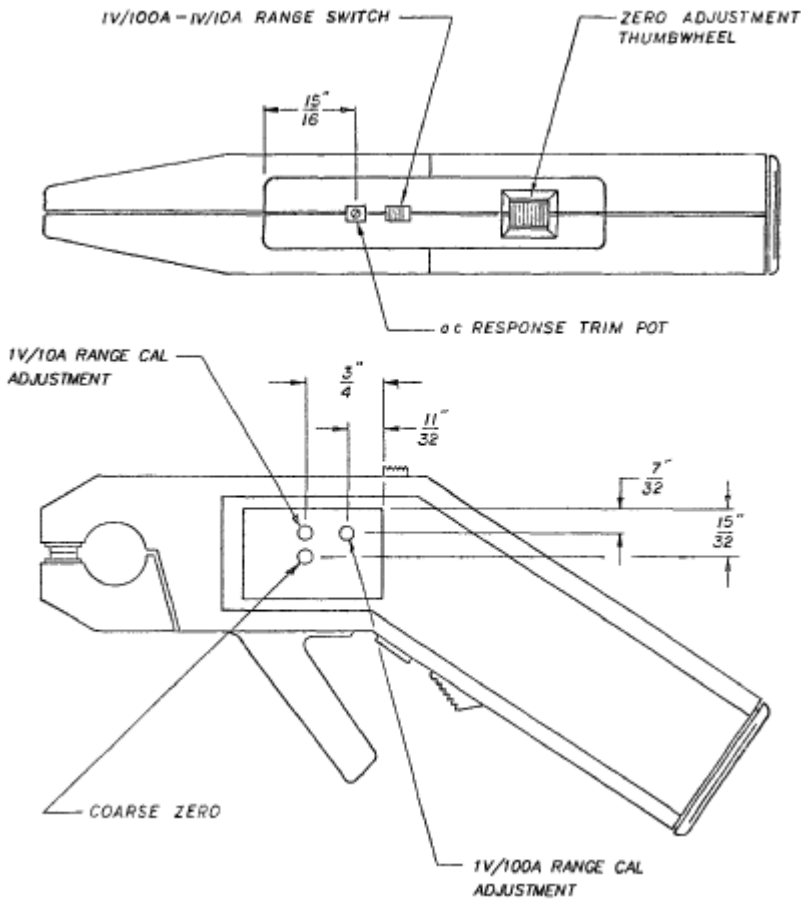


FIGURE 1 – LOCATIONS OF TRIM ADJUSTMENTS

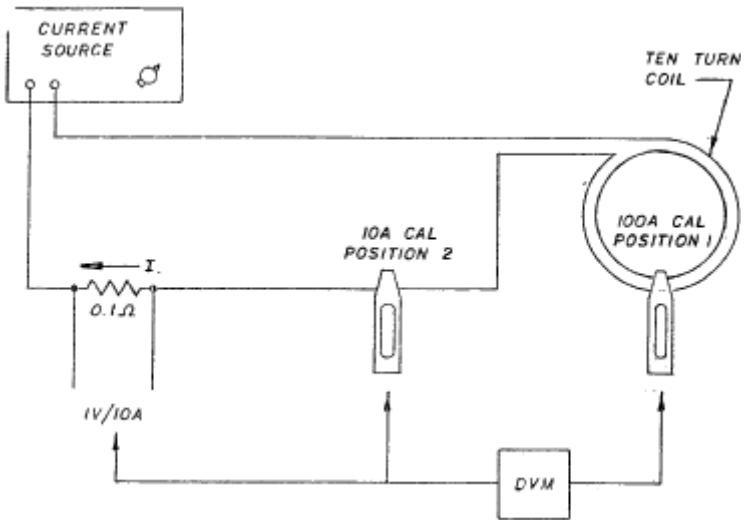


FIGURE 2 – EQUIPMENT SETUP

5. 1V/100A Range Calibration Adjustment Cont'd:

d. Clamp the CG-100A around the ten-turn coil, (Ref. Equipment Setup, Figure #2, Position #1).

e. Connect the voltage output of the CG-100A to the DVM, set to a low dc range.

f. Zero the voltage output of the CG-100A on the DVM, using the Zero Adjustment Thumbwheel.

g. Slowly increase the dc source current to 10Adc (1.0V across the 0.1 ohm shunt). This is the equivalent of 100Adc when clamped on the ten-turn coil.

h. Adjust the 1V/100A Calibration trimming potentiometer for a +1.005 Vdc reading on the DVM.

i. Verify calibration by removing the CG-100A from the coil, turning it on and off once or twice to demagnetize the core and repeating steps "a" through "h".

Note: The CG-100A should be zeroed and calibrated while being held as closely as possible to the same angle and orientation to avoid introducing a small incremental error due to earth's magnetic field.

Note: Typical 0 to 200A ac and dc linearity curves are shown in Figure 5.

The adjustment openings should now be covered with a new set of labels included with your calibration kit obtainable from F.W. BELL, INC.

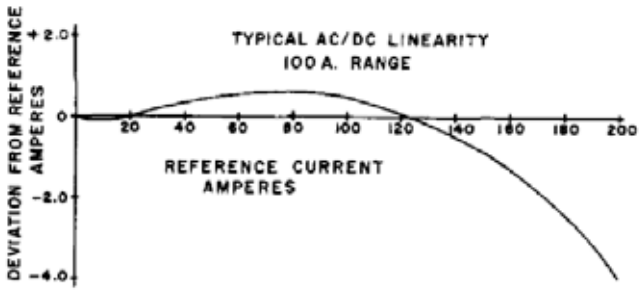


FIGURE 5.

TROUBLESHOOTING

I. Before referencing the following troubleshooting guide for the CG-100A, check the obvious potential source of problems such as the ON/OFF switches, power source (batteries), and loose or incorrect connections on the CG-100A and peripheral equipment.

II. The following troubleshooting guide is keyed to the CG-100A schematic and presented by test and symptom with the related possible cause shown in the right-hand columns of the chart.

CAUTION

If it is determined that the core, coil, or sensor is defective, return the probe to the manufacturer. These parts are not field replaceable parts.

	TEST AND SYMPTOM	POSSIBLE CAUSE
1.	Initial Procedure Low battery indicator is on when unit is turned on.	Low batteries, Q2, Q3
	No output at output jacks and low battery indicator off.	CR1
2.	Output Tests (No input current) vary output with thumb zero knob.	1. No – V supply (-3.0 to –4.5V dc) IC2, CR2, CR3, C2, C3 2. No Hall Generator control current. Check voltage across R17 = 0.35V dc ±15%, if not check IC1, CR-1, Q1, *Open HG-1 (should be 40Ω to 120Ω measured from red to black lead of HG-1)
	DC output voltage continues to drift after unit is turned on	Defective HG-1
	Cannot zero output with thumb zero knob.	Coarse zero out of Cal, IC1, HG-1
	Output >±3.0V dc and cannot adjust with thumb zero knob or coarse zero.	IC1, HG-1**
	Excessive noise at output (should be <3.0 mV ac on the 20A range).	IC1, HG-1**

TROUBLESHOOTING CONT'D:

	TEST AND SYMPTOM	POSSIBLE CAUSE
3.	Core Demagnetizing Test Turning unit on and off does not remove dc residual in the core (typical <0.2A)	S2, S3, C1, L1
4.	AC or DC Current Test Output reading out of tolerance on 10A range	R8 out of calibration (See Amplifier Gain Test).
	Output reading out of tolerance on 100A range	R9 out of calibration (See Amplifier Gain Test).
5.	Amplifier Gain Test With unit in proper calibration, positive to negative swing of thumb zero control is greater than 15mV dc on the 10A or 100A range	Excessive amplifier gain caused by: a) poor core alignment at core closure area. b) foreign material on surface of closure area. c) Hall generator not properly installed in core gap. d) Improper Hall Generator Control Current (see control current check under Output tests).
6.	Frequency Test Output reading output correct at 60 Hz, but out of tolerance at 1 kHz on the 100A range.	R23 out of calibration, L2 open

* - If the Hall Generator is open, shorting the red and black leads, (Point 3 and 4 at the printed circuit board) will cause the correct voltage reading across R17 (0.35V ±15%).

** - If the Hall Generator is defective, shorting the yellow and blue leads (Points 5 and 6 at the printed circuit board) will cause a zero output voltage to be obtainable by adjustment of the thumb or coarse zero controls, the noise level on the output will decrease < 3.0 mV ac on the 10A range.

LIST OF REPLACEMENT PARTS

I. INTRODUCTION

This section contains information on how to obtain parts and a parts list, which describes the part, gives the part number, and recommended quantity.

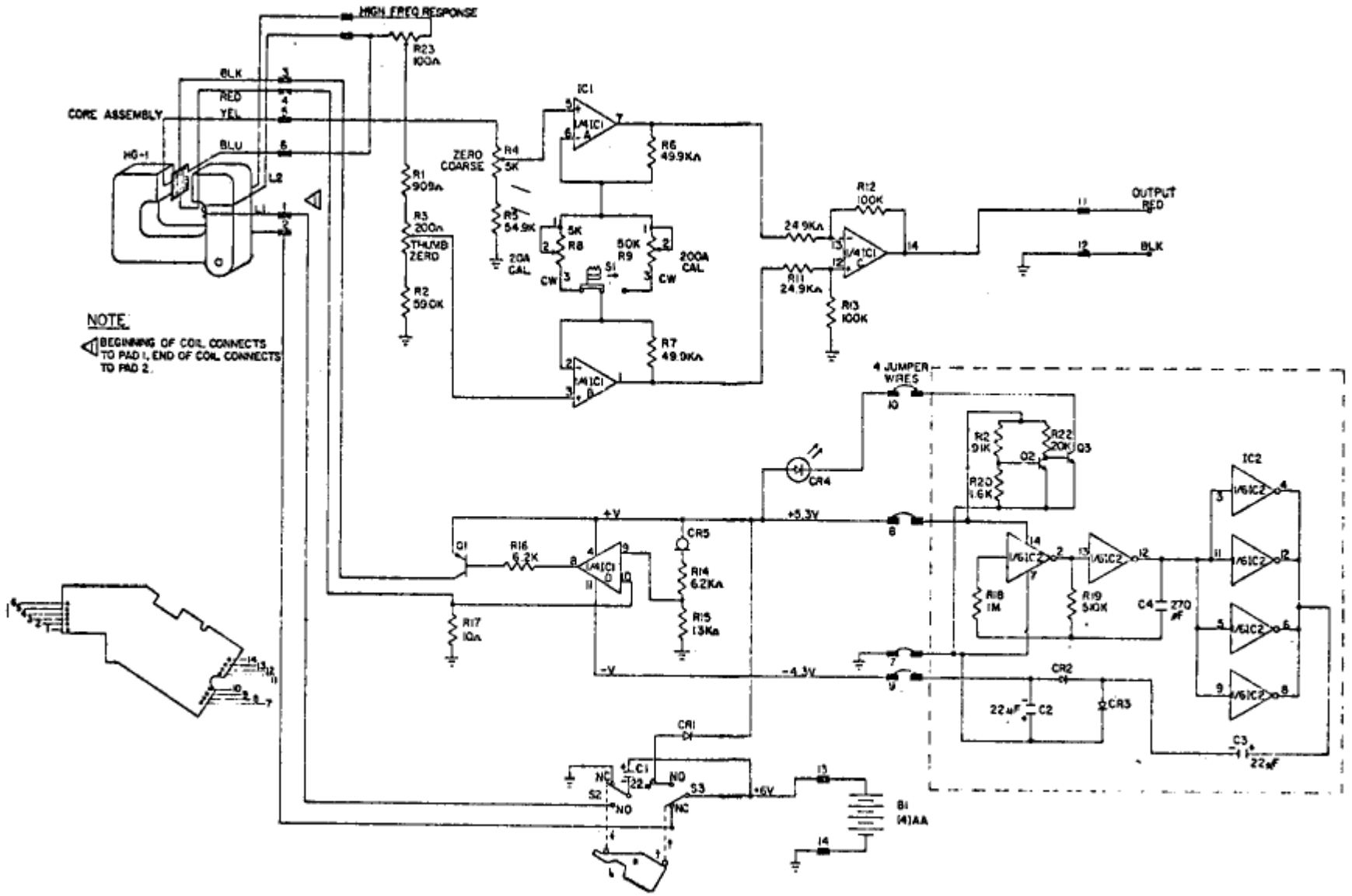
II. HOW TO OBTAIN PARTS

Parts may be ordered from the factory or authorized representative. To ensure prompt and efficient handling of your order, include the following information:

1. Quantity

2. Reference Designation

3. Description



CG-100A Schematic

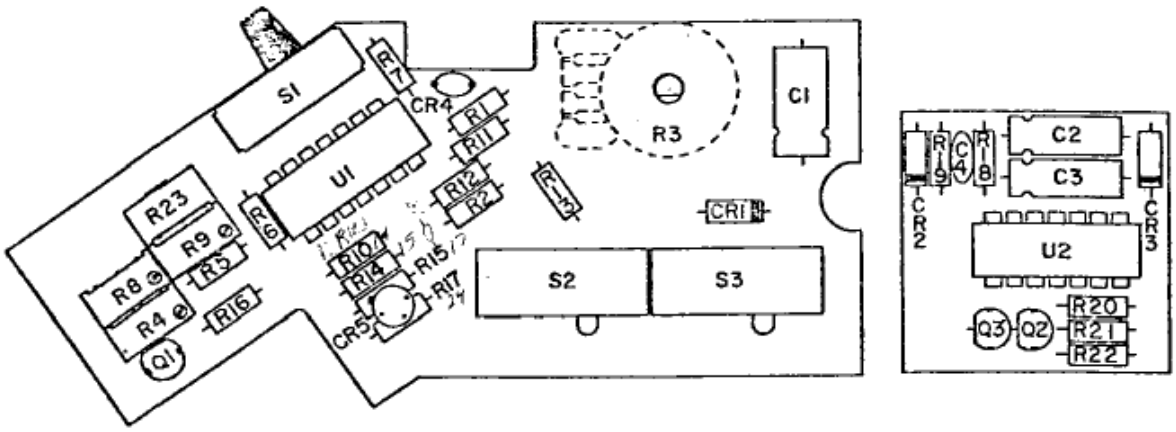
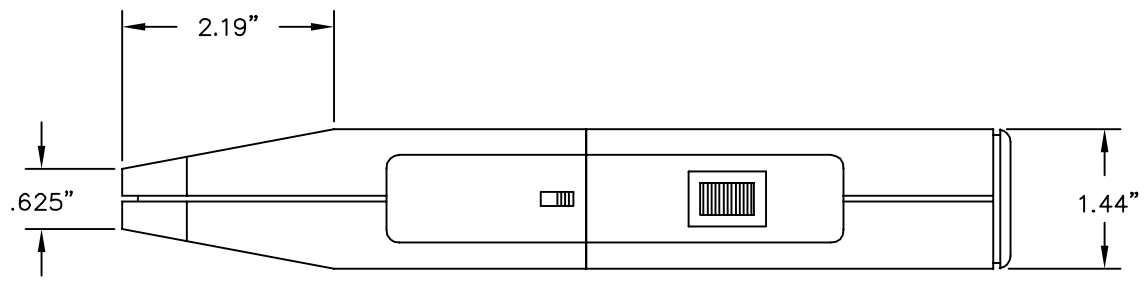
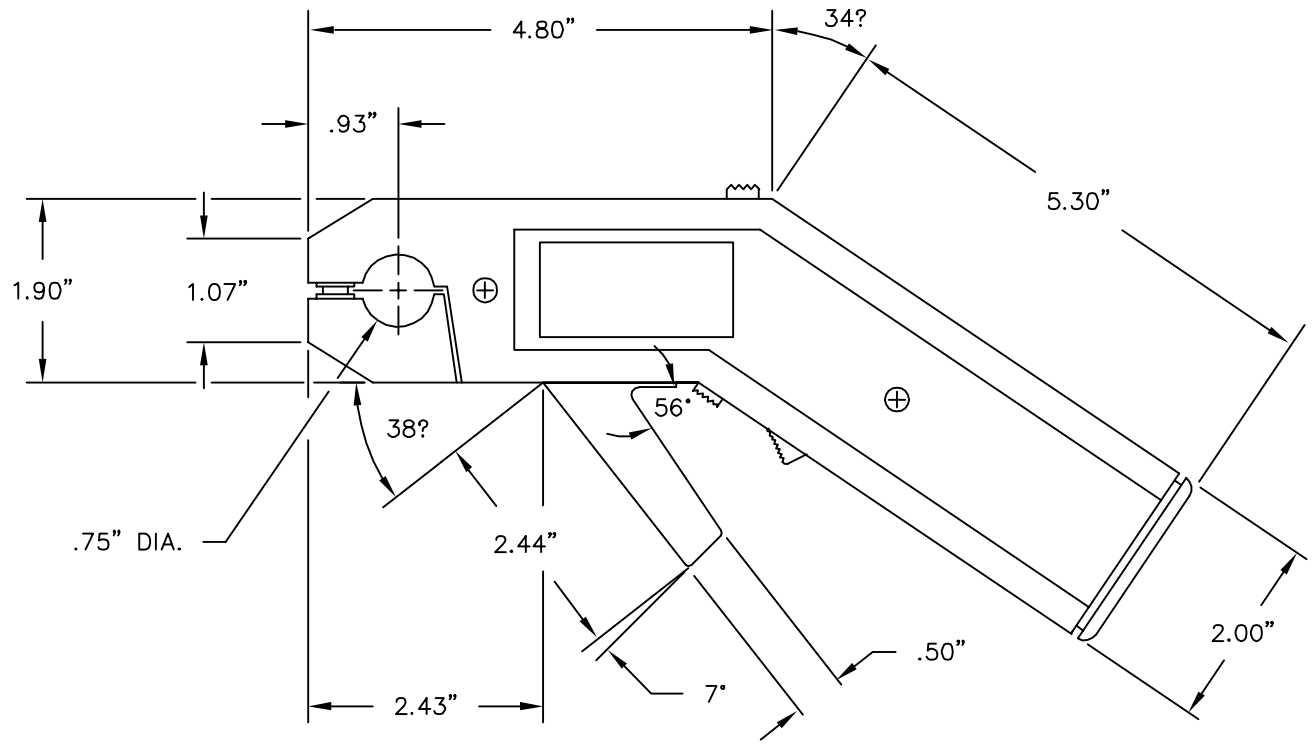


FIGURE 6 – A1, PCB ASSEMBLY

LTR	ECO	DATE / BY	APR
A	4775	5NOV.84 JW	GEM
B	8086	14MAY.91 YD	JTM
C	8143	7JUNE.91 YD	JTM





ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

DESCRIPTION:

THE MODEL CG–100A IS A CLAMP–ON PROBE DESIGNED TO MEASURE dc AND ac CURRENTS USING AN EXTERNAL VOLMETER, MULTIMETER OR OSCILLOSCOPE.

ELECTRICAL SPECIFICATIONS:

RANGES:	±10A dc OR 10A ac ±100A dc OR 100A ac
RATED OUTPUT:	±1.0V AT 10A ±1.0V AT 100A
ACUUACY:	±2.0% FS
OVERRANGE CAPABILITY:	100%. ERROR WILL NOT EXCEED ±3.0% OF READING AT 200A dc OR PEAK ac.
FREQUENCY RESPONSE:	dc TO 1.0 KHz
RECOMMENDED LOAD:	≥ 3.0 KΩ
TEMPERATURE RANGE:	+15°C TO +35°C – FOR SPECIFIED ACCURACY –10°C TO +50°C – STORAGE AND OPERATION AT REDUCED ACCURACY.
HEATING LIMITATION:	PROLONGED OPERATION ABOVE 200A ac OR 1 KHz CAN CAUSE DAMAGE TO THE CG–100A.
WITHSTAND CAPABILITY:	CORE TO OUTPUT – 600V dc OR 480V ac. CASE TO OUTPUT – RATED AT 2KV.
WEIGHT:	14 OUNCES (0.4 Kg) WITH BATTERIES.
POWER:	FOUR (4) – "AA" CELLS.
BATTERY LIFE:	ALKALINE: 30 HOURS CONTINUOUS. MERCURY: 60 HOURS CONTINUOUS.
CASE MATERIAL:	FLAME RETARDAND ABS PLASTIC.
COLOR:	BLACK.

REF	QTY	DRAWING / ITEM NO.	DESCRIPTION
8	REF	UB–3368	MANUFACTURING PROCESS, CG–100A
7	REF	UN–01–135	MAINTENANCE/SERVICE, CG–100A
6	REF	YD–2641	ASSEMBLY, LABEL AND PACKAGE, MODEL CG–100A
5	REF	364000	MANUAL, INSTRUCTION, CG–100A, UN–01–096
4	REF	UA–3369	TEST PROCEDURE, PRELIMINARY P.C.B.
3	REF	UA–3370	TEST AND CALIBRATION
2	REF	UD–3422	SCHEMATIC, CG–100A
1	REF	YA–3029	ASSEMBLY, GUN, CG–100A

MATERIAL & FINISH

F.W. BELL ORLANDO, FLORIDA C8

TITLE SPECIFICATION DRAWING MODEL CG–100A

SCALE 3/4X	DRN 17DEC.82 SR	SHT 1 OF 1	DWG NO. UC–3982 REV C
DEC± ———	CKD 21DEC.82 GM		
FRAC± ———	APR 21DEC.82 BD		
ANG± ———	REL 21DEC.82 GM	ISSUE DATE	

TABLE 1 A1, PCB ASSEMBLY

REF	DESCRIPTION	PART OR STOCK NO.	TOT. QTY	REC QTY	NOTE
A1	MAIN & POWER PCB ASSEMBLIES	ONLY REPLACEABLE PARTS	REF		
C1	CAP, ELECT, 22µF, 10V	23065	3	1	
C2	CAP, ELECT, 22µF, 10V	23065	REF		
C3	CAP, ELECT, 22µF, 10V	23065	REF		
C4	CAP, CER, 270 pF @ 50V	25182	1	1	
CR1	DIODE, GERMANIUM 1N270	27990	3	1	
CR2	DIODE, GERMANIUM 1N270	27990	REF		
CR3	DIODE, GERMANIUM 1N270	27990	REF		
CR4	DIODE, LIGHT EMITTING (LED)	29475	1	1	
CR5	DIODE, CONSTANT CURRENT	28468	1	1	
HG1	CORE ASSEMBLY (NOT SHOWN)	FOOT NOTE "A"			A
L1					
Q1	TRANSISTOR, SI PNP 2N4126	29080	1	1	
Q2	TRANSISTOR, SI NPN 2N4124	29070	2	1	
Q3	TRANSISTOR, SI NPN 2N4124	29070	REF		
R1	RES, METAL FILM, 909 ± 1%, 1/8W	15072	1		
R2	RES, METAL FILM, 59K ± 1%, 1/8W	15138	1		
R3	RES, PANEL MTG, (POT) 200W	21300	1	1	
R4	RES, CER. (POT) 5K, COARSE ZERO				
R5	RES, METAL FILM, 54.9K ± 1%, 1/8W	15134	1		
R6	RES, METAL FILM, 49.9K ± 1%, 1/8W	15127	1		
R7	RES, METAL FILM, 49.9K ± 1%, 1/8W	15127	REF		
R8	RES, CER. (POT) 5K, 10A RANGE CAL.				
R9	RES, CER. (POT) 50K, 100A RANGE CAL.				
R10	RES, METAL FILM, 24.9K ± 1%, 1/8W				

A IF THE CORE, COIL, OR HALL GENERATOR IS DAMAGED OR FAILS, RETURN TO THE FACTORY OR AUTHORIZED SERVICE CENTER. THESE ARE NOT FIELD REPLACEABLE PARTS.