Re: G-77

DEPARTMENT OF CONSUMER AND CORPORATE AFFAIRS

STANDARDS BRANCH

FILES: SL-100-751C
SE-85-79
S-17-1

OTTAWA, April 6, 1971.

TECHNICAL GAS CIRCULAR G-71/2

TO: DISTRICT INSPECTORS OF ELECTRICITY AND GAS

FROM: CHIEF, ELECTRICITY AND GAS DIVISION

RE: Field Test Procedure for Camco Computers, Models 464A and 464C

These computers are approved under Circular G-77 where a general description and some basic data are contained. Manufacturer's instruction manuals for these two models contain more detailed information and it may be necessary to refer to them when called upon to verify these computers in the field.

Before any testing begins the computer must be properly interconnected with pressure standards and satisfactorily programmed.

The manufacturer provides several mode switch positions for calibration purposes, however, during verification testing the mode switch position must be set at "Operate Temp. Probe". This position ensures that computer receives the outputs from three transducers. Internal calibration reference values for temperature and pressure are not to be used during verification testing.

SUGGESTED TEST PROCEDURE

1. Set the count rate switch to an arbitrarily selected value in the upper range, - say 160 K.

2. Set the count rate dial to 1,000.

3. Apply to the operating computer constant values of differential and static pressure, and measure these values by appropriate standards and record.

4. Place the computer's temperature probe in a suitable, constant temperature bath (or flask), and note the true temperature of the fluid.

5. During a period of 't' hours establish the net increase in counts on the computer's digital counter.

Example

A. Collected data (assumed)

Applicable atmospheric pressure, P_a	= 14.73 psia
Full range static pressure, $P_{s(max)}$	= 500 psig
Full range differential pressure, $h_{w\,max}$	= 100" w.c.
Bath temperature (probe temp.) t_f	= 75°F
Static pressure during test, p_s	= 300 psig
Differential pressure during test, h_w	= 50" w.c.
Test period 't'	= 30 minutes
Observed net counts during time 't', C_c	= 1,807 counts

Base pressure = 14.73, Base temp. = 60°F

B. Calculations

(a) From (1) and (2) above computer is programmed to have a maximum theoretical hourly count rate, C_{max}

$$C_{max} = \frac{160{,}000}{24} = \underline{6{,}666'7} \text{ counts per hour}$$

(b) This maximum count rate corresponds to the max. pressure extension of

$$Ext_{max} = \sqrt{h_{f\,max} \times P_{f\,max}} = \sqrt{100 \times 514'73} = \underline{226.88}$$

(c) True, test pressure extension is

$$Ext_t = \sqrt{h_w \times P_f} = \sqrt{50 \times (300 + 14'73)} = \underline{125'44}$$

(d) Flowing gas temperature factor is

$$F_{tf} = \sqrt{\frac{T_b}{T_f}} = \sqrt{\frac{520}{460 + 75}} = \underline{0'9859}$$

(e) Corrected, true test pressure extension

$$Ext_{tc} = Ext_t \times F_{tf} = 125'44 \times 0'9859 = \underline{123'67}$$

(f) Since rate of counting is proportional to pressure extension, we have required true count rate

$$C_t = C_{max} \times \frac{Ext_{tc}}{Ext_{max}} = 6{,}666'7 \times \frac{123'67}{266'88} = 3{,}633'9 \text{ counts per hour}$$

and during 30 minutes test period the true count rate is

$$C_{tt} = \frac{3{,}633'9}{2} = \underline{1{,}816'9} \text{ counts}$$

(g) Computer error, percent is

(I) F.S. Error % $= 100 \left(\frac{C_o - C_{tt}}{C_{max}} \right) = \left(\frac{1,807 - 1,816'9}{0'5 \times 6,666'7} \right) \times 100 =$

$= -0'297$ or approx. $-0'3\%$ F.S.

(II) Error of reading % $= 100 \times \frac{(C_o - C_{tt})}{C_{tt}} = \frac{-990}{1,816'9} \cong -0'55\%$

Acceptable tolerance is +2% and -3% of reading for any combination of test parameters.

C. Test Points

Computers should be tested at three combinations of flow parameters, as follows:

(I)	T_f = room temp.,	h_w = 80% F.S.,	p_s = 30% F.S.
(II)	T_f = room temp.,	h_w = 60% F.S.,	p_s = 60% F.S.
(III)	T_f = ice bath,	h_w = 30% F.S.,	p_s = 80% F.S.

NOTE: One test must be performed with the count rate dial setting other than 1,000. For this test the computer should be programmed according to the manufacturer's instructions, as below.

COMPUTER PROGRAMMING

Programming adjusts the flow computer integrator so that it accummulates a desired number of counts per day when the flow rate input represents 100% flow rate indication.

The CAMCO Computer is designed so that each count registered on its panel counter may be defined as an even increment of a standard unit, i.e., each count may represent 0.1, 10, 100, 1,000, etc. standard cubic feet. This allows the counter to be direct reading and eliminates confusing "meter factors".

In order to select the proper count rate switch position and dial setting it is first necessary to calculate the flow rate needed to create 100% flow indication on the computer.

Step #1
The daily flow rate at 100% on the computer flow rate meter is calculated using the following equation:

$$Q = 24\, C' \sqrt{h_w \times P_f}$$

WHERE:

Q = Daily volume in standard cubic feet

C' = Hourly coefficient from AGA Report No. 3. NOTE: If the computer is equipped with a temperature probe, the F_{tf} used in calculating C' should be 1.000.

h_w = Maximum differential pressure used for calibration.

P_f = Maximum static pressure value used for calibration.

Step #2
Determine the desired daily count rate and volume increment per count by comparing available count rates from the computer to the daily volume calculated in Step #1.

Step #3
Select the appropriate Count Rate Switch position. This position must be closest to but higher in count rate than the desired count rate. The Count Rate Switch position may be read directly as counts per day, (K = 1000 i.e., 20K = 20,000).

Step #4
Calculate the Count Rate Dial Setting using the following equation:

$$\text{Dial No.} = 1818.2 - \left[\frac{818.2 \times \text{Switch Position}}{\text{Desired Count}}\right]$$

To program the computer to the desired count rate, set the Count Rate Switch to the position selected in Step #3 and turn the Count Rate Dial to the number found in Step #4.

EXAMPLE:

Known: C' = 140.98
h_w = 100" w.c.
P_f = 1068.11 psia

Step #1,

$Q = 24C' \sqrt{100 \times 1068.11}$
$= 3383.52 \times 326.82$
$= 1{,}105{,}800$ scfd

Step #2
The two count rates available with the standard integrator are 11,058 and 110,580.

If the 110,580 rate is selected, each count would represent:

$$\frac{1{,}105{,}800}{110.580} = 10 \text{ scf.}$$

Step #3
The first switch position higher than the desired count is 160K (160,000 counts per day).

Step #4

$$\text{Dial No.} = 1818.2 - \left[\frac{818.2 \times 160{,}000}{110{,}580}\right]$$

$$= 1818.2 - 1184$$

$$= 634$$

Summary

1.	100% Flow Rate	=	1,105,800 SCF per day
2.	Each Count	=	10 SCF
3.	Count Rate Switch Position	=	160K
4.	Count Rate Dial Reading	=	634

W. J. S. Fraser

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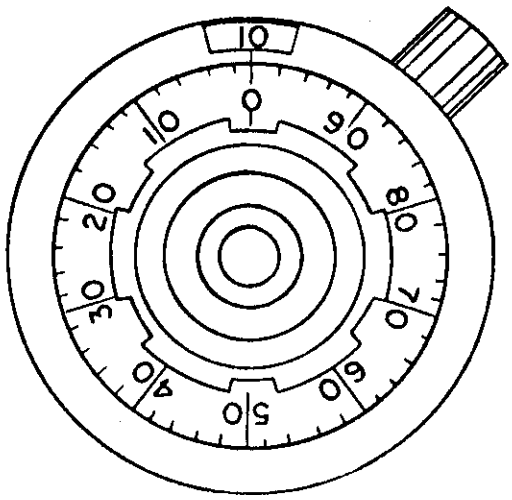
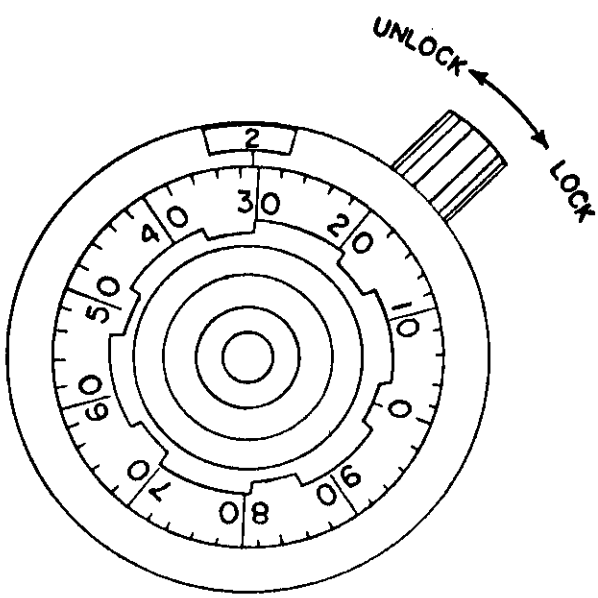
COUNT RATE DIAL READING



1000 COUNT RATE SETTING



231 COUNT RATE SETTING