Department of consumer and corporate affairs / Ministère de la consommation et des corporations

STANDARDS BRANCH - DIRECTION DES NORMES

NOTICE OF APPROVAL

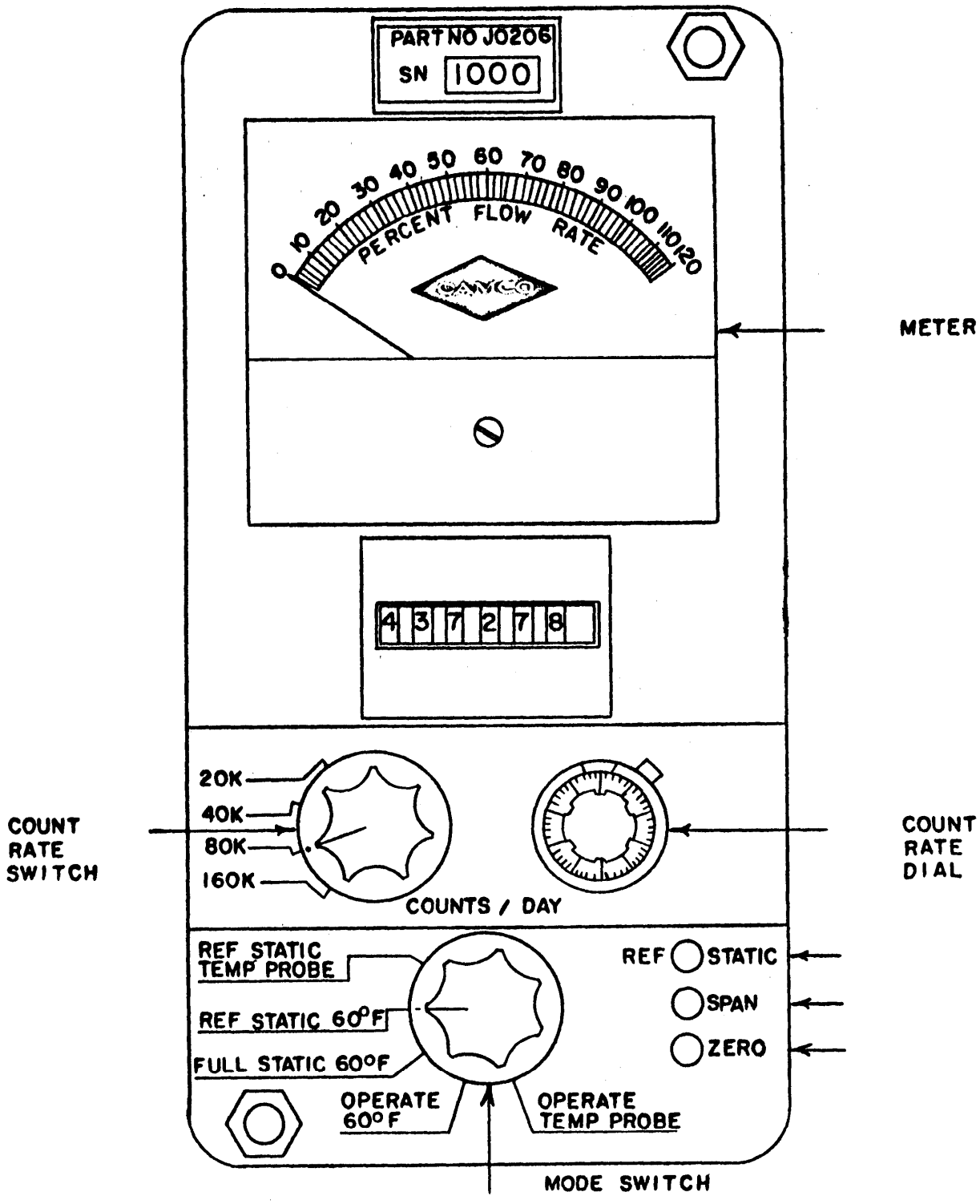
G - 77

OTTAWA April 7, 1971

CAMCO MODELS 464-A and 464-C GAS COMPUTER
FLOW MEASURING SYSTEMS

Apparatus

Camco Differential Pressure Transducers			
Model designation	DP-1A	DP-2A	DP-4A
Differential ranges, inches, w.c.	0-100	0-200	0-400
Working pressure	up to 5,000 psig		
Pressure connections	$\frac{1}{4}$ inch N.P.T.		
Bellows material	berillium copper, nickel plated		
Camco, Model 3,000, Static Pressure Transducer			
Pressure ranges, psig	0-200 to 0-5000		
Pressure connections	$\frac{1}{4}$ inch and $\frac{1}{2}$ inch N.P.T.		
Camco Temperature Transducer			
Temperature range	any 100°F span within the range from -40°F to +160°F		
Temperature sensor	resistance element		
Model designation	T-2	T-4	T-6
Length of sensor probe, inches	2	4	6
Electronic Computer, Model 464A			
Operating voltage	10 to 15 volts D.C.		
Current drain	25 to 50 mA at 12 volts D.C.		
Ambient temperature range	0°F to +130°F		
Power Supply Unit, Model PA-1 (For use only with computer, Model 464A)			
Supply voltage	115 volts A.C., 60 Hz		
Output voltage	12 volts D.C.		
Maximum output current	0.25 amp. D.C.		



MODEL 464C COMPUTER

Electronic Computer, Model 464C	
Operating voltages:	
(a) Direct current	10.5 to 15 or 16 to 32 volts
(b) Alternating current	95 to 135 or 190 to 270 volts
A.C. frequency range	45 to 400 Hz
Power consumption:	
A.C. and 24 volts D.C.	approx. 5 watts
12 volts D.C.	approx. 2.5 watts
Ambient temperature range	0°F to +130°F
Three-Way Valve, Part No. J1123	
Working pressure	up to 5,000 psig
Pressure connections	¼ inch N.P.T.
Interconnecting Cable	Six individually shielded pairs, max. length 1,500 ft.

Description

The gas flow measuring systems described herein are approved for use on orifice meters. Except for the need of a separate power supply unit with computer, model 464A, both models perform the same function and require three transducers and one "three-way valve" to become operational. The use of either model without the temperature transducer is not approved for billing applications.

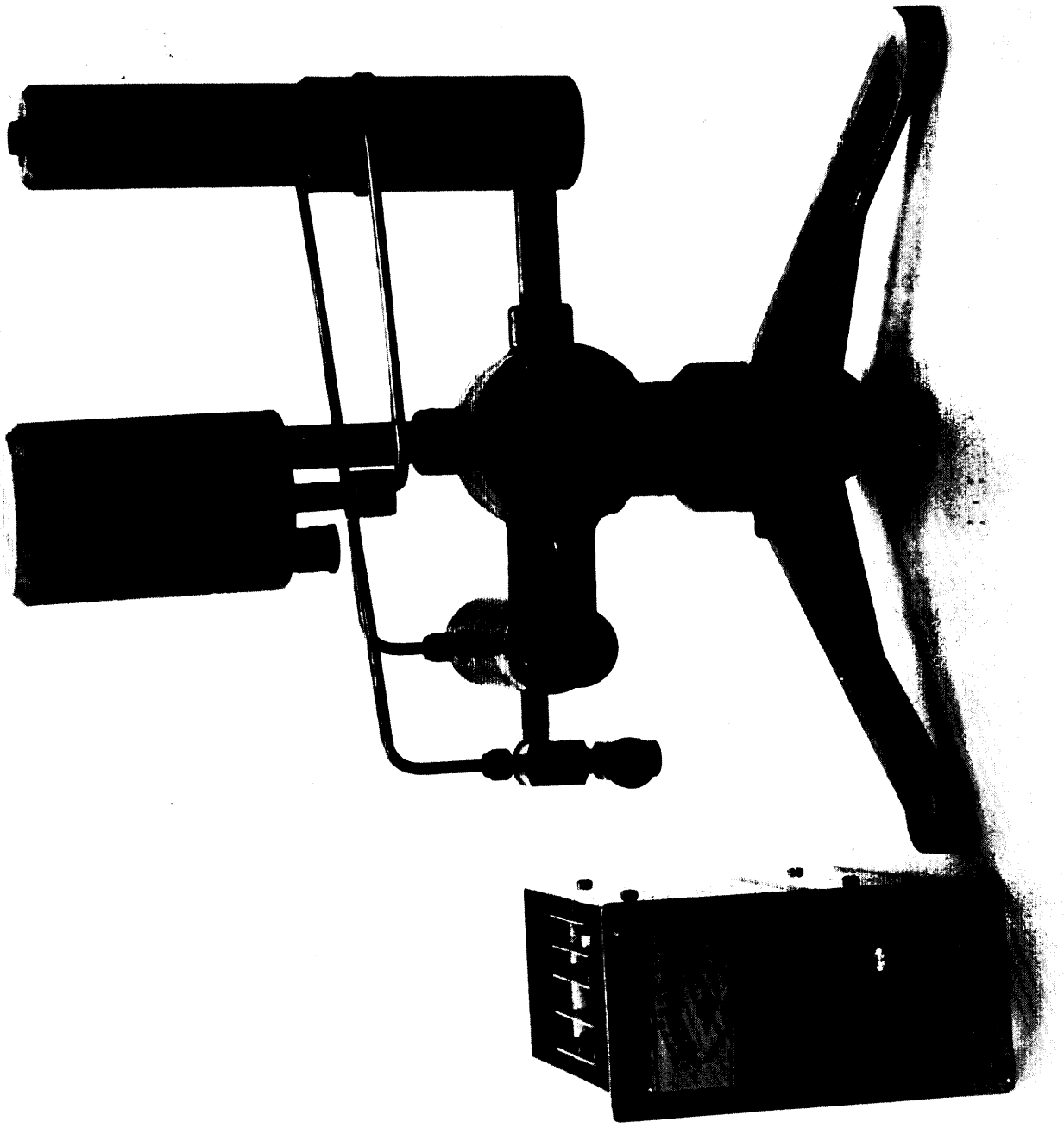
The differential pressure transducer utilizes a bellows pressure sensing element coupled mechanically to an electrical differential transformer, the output of which is connected to the computer unit.

The static pressure transducer has a Bourdon tube as a pressure sensing element. The movable end of the tube is connected to a film type resistance potentiometer from which electrical signals are fed into the computer. Transducers are calibrated in absolute pressure units and the usable range is stamped on the metal face of transducer.

The temperature transducer utilizes a resistance element whose probe is sensitive at its tip where the temperature-variable resistor is located. Although the temperature probe has a wide usable range, it is classified as 100°F range only due to some nonlinear behaviour. Each 100°F range is individually calibrated.

The CAMCO three-way valve is a special manifold valve that replaces three conventional valves and allows transducers to be placed in service, or taken from service, with one valve handle. The design is such as to automatically perform equalizing or sealing operations in the correct order and to eliminate the problems of human error in sequencing

MODEL 464-C COMPUTER



valve operation. It is a spool-type valve that is pressure-unbalanced when the equalizing portion of the three-way valve is closed.

The electronic analog computer is designed to receive the outputs from the three transducers and automatically solve the gas flow equation:-

$$Q_h = C'' \sqrt{h_w P_f} \times \left(\frac{520}{T_f}\right)$$

in which

Q_h = Quantity rate of flow at base conditions, cu. ft. per hour.

C'' = Orifice flow constant C', as designated by the AGA Report No. 3, divided by the gas flowing temperature factor, F_{tf}.

h_w = Differential pressure in inches of water.

P_t = Absolute static pressure in psia

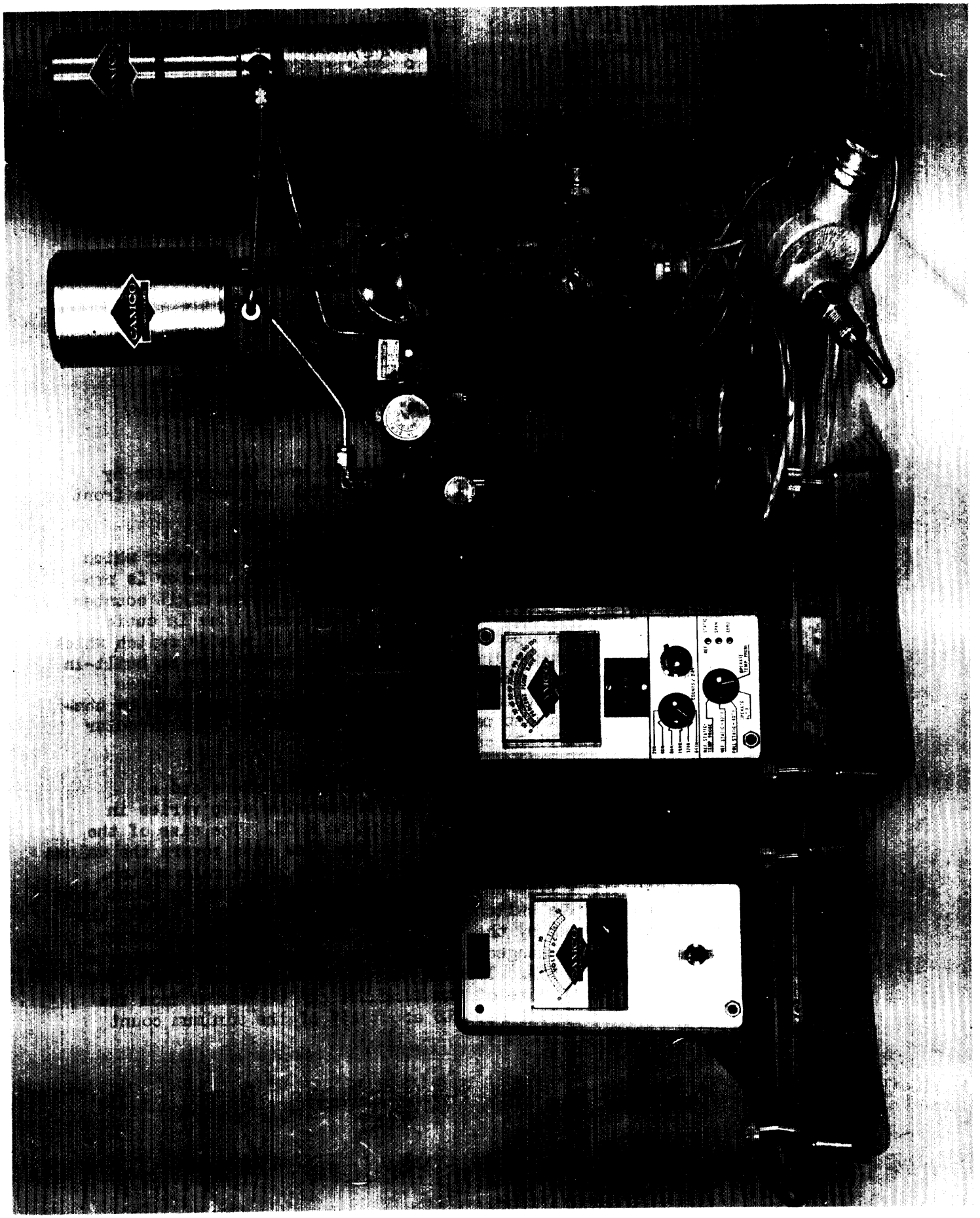
T_f = Actual flowing temperature of gas in degrees Rankine.

The value of the C" constant is programmed into the computer by means of a count rate switch and a count rate dial located on the front panel of the computer.

The computer panel also incorporates: (1) a flow rate meter which indicates the percentage of maximum flow for which the computer is programmed, (2) an electro-mechanical, non-resettable, seven digit counter which shows the integrated flow at declared base conditions in cubic feet, when appropriate multiplier is applied, and (3) a mode switch which permits selection of computer inputs from either transducers on built-in constants for calibration. The front panel also incorporates three screwdriver adjustment controls which are used when calibrating the computer. A drawing of the front panel, which is a part of this circular shows the locations of various components.

The count rate switch may have a maximum of six steps and a minimum of four. The value of 'K' in each successive step varies in the ratio of 2:1 within the range from 1.25K to 640K. The size of the orifice line and anticipated variations in the flow rate govern the values of 'K' and the number of steps incorporated in the count rate switch. The count rate dial is a fine control which modifies the daily count rate selected by the count rate switch. When the dial setting is 1,000, the daily count rate is shown by the count rate switch position, however, when the dial setting is changed to zero, the switch position indicated rate will be lowered by 55%. Through the use of the count rate switch and dial, the daily count rate of the computer can be varied from the maximum switch position count rate to about 45% of the minimum count rate switch position.

MODEL 464-A COMPUTER



The mode switch has five positions, however, only one position, namely "Operate-Temp. Probe" is approved for gas measurement in trade. In this position the computer receives and processes the information from all three transducers. Other positions may be used only during calibration of the computer.

When programming the computer the value of the C" constant must include appropriate, weighted, average supercompressibility factor Fpv, which should be based on a record of the flowing gas volumes, pressures and temperatures. If no continuous record is available, the variations in pressure and temperature normally occurring in the orifice line must not introduce an error greater than ±0.5% in the selected Fpv factor.

Installation

To facilitate the installation of transducers and to ensure proper field wiring to the computer, CAMCO supplies transducers pre-wired to barrier strips, pretubed with a three-way manifold valve, and bleed valve in a unit that has become known in the field as "condulet mounting".

The transducer condulet assembly is mounted on a two-inch vertical line pipe. The transducers should be mounted in the vertical position. This does not require precision leveling, but they are not designed to operate at any appreciable angle from the vertical. The mounting pipe should be positioned near the orifice fitting, but in an area or manner to eliminate use of a pipe saddle because of possible meter run vibration.

The cable assembly is held to the transducer condulet by a suitable seal. The cable conductors are connected to the proper barrier terminals. Care must be taken to ensure that conductors are not shorted and metal shielding does not short to condulet housing.

The temperature transducer is designed to be used at atmospheric pressure and it should be installed in a thermowell containing suitable amount of oil to ensure proper heat transfer. Temperature transducer should not be installed in a line which utilizes cathodic protection devices unless an insulating bushing is used.

Each transducer shall have a metallic decal permanently attached to the housing, showing manufacturer's name, type or model designation, serial number and the range in appropriate units.

The computer unit shall be equipped with a changeable card, located on a tray inside the weatherproof housing, and containing the information

shown on the card copy below.

CHANGEABLE CARD FOR CAMCO FLOW COMPUTER

Company_____ Location_____
Orifice Bore_____ Coefficient_____
Static_____PSIA D/P_____IN. W.C.
Avg. Press._____
Temp. Range -40° to + 160° Calib. @_____°F
Press Base_____Temp Base_____Sp. Gr._____
Supercompressability Factor_____
Dial pos____Switch pos____Multiplier____CFT/CNT
Inspection No._____ Date_____

For field test procedure refer to Technical Gas Circular G-71/2.

Approval granted to:

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Edmonton, Alberta.

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Ref: SL-100-751C