

MODEL 46

Digital Flow Totalizer / Rate Indicator

USER'S MANUAL



HP-254
August 1995

H **HOFFER FLOW CONTROLS, INC.**
The Turbine Flowmeter Company

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Notice

HOFFER FLOW CONTROLS, INC. MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

This manual has been provided as an aid in installing, connecting, calibrating, operating, and servicing this unit. Every precaution for accuracy has been taken in the preparation of this manual; however, HOFFER FLOW CONTROLS, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that may result from the use of products in accordance with information contained in the manual.

HOFFER FLOW CONTROLS' policy is to provide a user manual for each item supplied. Therefore, all applicable user manuals should be examined before attempting to install or otherwise connect a number of related subsystems.

During installation, care must be taken to select the correct interconnecting wiring drawing. The choice of an incorrect connection drawing may result in damage to the system and/or one of the components.

Please review the complete model of each item to be connected and locate the appropriate manual(s) and/or drawing(s). Identify all model numbers exactly before making any connections. A number of options and accessories may be added to the main instrument, which are not shown on the basic user wiring. Consult the appropriate option or accessory user manual before connecting it to the system. In many cases, a system wiring drawing is available and may be requested from HOFFER FLOW CONTROLS.

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HOFFER FLOW CONTROLS' policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering. The information contained in this document is subject to change without notice.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the Hoffer Flow Controls Customer Service Department, telephone number (252) 331-1997 or 1-800-628-4584. BEFORE RETURNING ANY PRODUCT(S) TO HOFFER FLOW CONTROLS, PURCHASER MUST OBTAIN A RETURNED MATERIAL AUTHORIZATION (RMA) NUMBER FROM HOFFER FLOW CONTROLS' CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned RMA number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATIONS**, consult HOFFER FLOW CONTROLS for current repair/calibration charges. Have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

LIMITED WARRANTY

HOFFER FLOW CONTROLS, INC. ("HFC") warrants HFC's products ("goods") described in the specifications incorporated in this manual to be free from defects in material and workmanship under normal use and service, but only if such goods have been properly selected for the service intended, properly installed and properly operated and maintained. This warranty shall extend for a period of (1) year from the date of delivery to the original purchaser (or eighteen (18) months if the delivery to the original purchaser occurred outside the continental United States). This warranty is extended only to the original purchaser ("Purchaser"). *Purchaser's sole and exclusive remedy is the repair and/or replacement of nonconforming goods as provided in the following paragraphs.*

In the event Purchaser believes the goods are defective, the goods must be returned to HFC, transportation prepaid by Purchaser, within twelve (12) months after delivery of goods (or eighteen (18) months for goods delivered outside the continental United States) for inspection by HFC. If HFC's inspection determines that the workmanship or materials are defective, the goods will be either repaired or replaced, at HFC's sole determination, free of additional charge, and the goods will be returned, transportation paid by HFC, using the lowest cost transportation available.

Prior to returning the goods to HFC, Purchaser must obtain a Returned Material Authorization (RMA) Number from HFC's Customer Service Department within 30 days after discovery of a purported breach of warranty, but no later than the warranty period; otherwise, such claims shall be deemed waived. See the Return Requests/Inquiries Section of this manual.

If HFC's inspection reveals the goods are free of defects in material and workmanship or such inspection reveals the goods were improperly used, improperly installed, and/or improperly selected for service intended, HFC will notify the purchaser in writing and will deliver the goods back to purchaser upon (i) receipt of Purchaser's written instructions and (ii) the cost of transportation. If Purchaser does not respond within 30 days after notice from HFC, the goods will be disposed of in HFC's discretion.

HFC does not warrant these goods to meet the requirements of any safety code of any state, municipality, or any other jurisdiction, and purchaser assumes all risk and liability whatsoever resulting from the use thereof, whether used singly or in combination with other machines or apparatus.

This warranty shall not apply to any HFC goods or parts thereof, which have been repaired outside HFC's factory or altered in any way, or have been subject to misuse, negligence, or accident, or have not been operated in accordance with HFC's printed instructions or have been operated under conditions more severe than, or otherwise exceeding, those set forth in the specifications for such goods.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. HFC SHALL NOT BE LIABLE FOR ANY LOSS OR DAMAGE RESULTING, DIRECTLY OR INDIRECTLY, FROM THE USE OF LOSS OF USE OF THE GOODS. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, THIS EXCLUSION FROM LIABILITY EMBRACES THE PURCHASER'S EXPENSES FOR DOWNTIME, DAMAGES FOR WHICH THE PURCHASER MAY BE LIABLE TO OTHER PERSONS, DAMAGES TO PROPERTY, AND INJURY TO OR DEATH OF ANY PERSON. HFC NEITHER ASSUMES NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OR USE OF HFC'S GOODS, AND THERE ARE NO AGREEMENTS OR WARRANTIES COLLATERAL TO OR AFFECTING THE AGREEMENT. PURCHASER'S SOLE AND EXCLUSIVE REMEDY IS THE REPAIR AND/OR REPLACEMENT OF NONCONFORMING GOODS AS PROVIDED IN THE PRECEDING PARAGRAPHS. HFC SHALL NOT BE LIABLE FOR ANY OTHER DAMAGES WHATSOEVER INCLUDING INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

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SECTION I

MODEL 46 DIGITAL FLOW TOTALIZER/RATE INDICATOR

The Model 46 is a Remote Flow Totalizer and Rate Indicator, with a six digit liquid crystal display for total flow and flow rate which are scaled to user desired units of measure. The Model 46 may be integrally mounted on a turbine flowmeter in remote locations, for stand alone operation where no external power is available.

The Model 46 conditions the low level signal from a turbine flowmeter or other suitable pulse generating transducer, while providing rejection of unwanted noise and spurious signals. A signal threshold control is provided which allow the user to set the input sensitivity above the ambient noise level, thereby eliminating any false readout.

Flow totalization is achieved by passing the pulse train generated by the flow transducer, into a pulse scaling network. The pulse scaling network is composed of the System Factor which multiplies the pulse rate by a preprogrammed number set into the digital rotary switch array. The output of the System factor represents a decimal multiple of the desired flow measurement units.

The pulse train is then fed into the System Factor Multiplier which effectively multiplies the pulse rate by either X1, X.1, X.01, X.001 or X.0001, depending on switch position.

The scaled pulse train is inputted to a drive stage which will increment the totalizer in the desire units of readout.

Rate indication is achieved by use of an internal time base, which generates strobe pulses which will latch and reset the Display. The time base is used in conjunction with the System Factor switches and to provide the required pulse scaling for desired units of flow rate measure.

SPECIFICATIONS

INPUT POWER	Power Options: Standard Lithium battery power for 2 years continuous duty. 8 to 30 VDC at 10mA, reverse polarity protected, input filtered.
INPUT SIGNAL	Input filtered, RF and Bandpass filtered. Adjustable trigger level 10 millivolt RMS (minimum) 10Hz to 1000Hz. Over voltage capability 120V RMS (absolute). Input impedance 40 kilo ohm (nominal).
TOTAL/RATE DISPLAYS	Type 6 digit liquid crystal (LCD) character height 0.35 inches viewing area 1.65X.57 inches leading zero blanking.
PULSE SCALING CAPABILITY	System factor and System Factor Multiplier provide a cascaded chain of two scaling factors. The System Factor provides scaling factors from X.0000 to X.9999 with four rotary type DIP switches in .0001 increments. The System Factor Multiplier provides additional scaling factors of X1, X.1, X.01, X.001 or X.0001.
TIME BASE FOR RATE	Factory wired for either .6 seconds or 1,3.6 or 6 second, depending on user application.
OUTPUT CHARACTERISTICS	Pulse Duration factory wired per requirements OPEN COLLECTOR: type 2N6660 Vmax 60Vdc absolute maximum Imax 1.2 Adc absolute maximum Optional for battery power option TTL/CMOS: Logic 1 4.5 Vdc @-.2.4mA Logic 0 0.4 Vdc @ 100mA NOTE: Optional for DC powered units, without analog output.
MINIFLOWMETER LINEARIZATION	
METHOD	Frequency injection of offset frequency with divide by 5 post scaling.
OFFSET FREQUENCY	00.0 to 199.9Hz.

ANALOG OUTPUT

CURRENT OUTPUT

Accuracy +/- .05% of full scale +/- 200 PPM/'C. Available range 4-20mA and 10-50mA. Response time 0.5 seconds for 10 to 90%. Load Resistance: Dependent on excitation voltage
 $R(\text{load}) = \frac{V(\text{ext}) - 8}{\text{I.F.S.}}$

IF.S.

where $V(\text{ext})$ = Excitation voltage
IF.S. = Full Scale current

ENVIRONMENTAL

Operating temperature -30 to 50 C.
Storage temperature -30 to 60 C.
Available in NEMA 4 standard.
Dimensions: 4.80L X 4.72W X 3.54H

CONTROLS AND ADJUSTMENTS

SENSITIVITY

A multiple turn control used to set the trigger level above the noise level.

SYSTEM FACTOR

A switch array composed of four rotary DIP switches which are used to enter the desired scaling factor. Used in conjunction with the System Factor Multiplier.

SYSTEM FACTOR MULTIPLIER

A DIP switch used to enter the desired scaling factor. Used in conjunction with the system factor switches.

RANGE

A dual in line (DIP) switch located within the enclosure which is used to program module to accept an input frequency range.

SPAN

A multiple turn adjustment which is used to set the current output signal to the desired span corresponding to the equivalent flow range (i.e., 4 to 20mA corresponding to 0-100 GPM).

ZERO

A multiple turn adjustment which is used to set output signal with no flow to the desired "zero" value (i.e., 4mA).

OFFSET FREQUENCY

Pot adjustment switches on the PCA 120 circuit board used to input the equivalent offset frequency of the miniflow meter, 00.0 to 199.9 Hz.

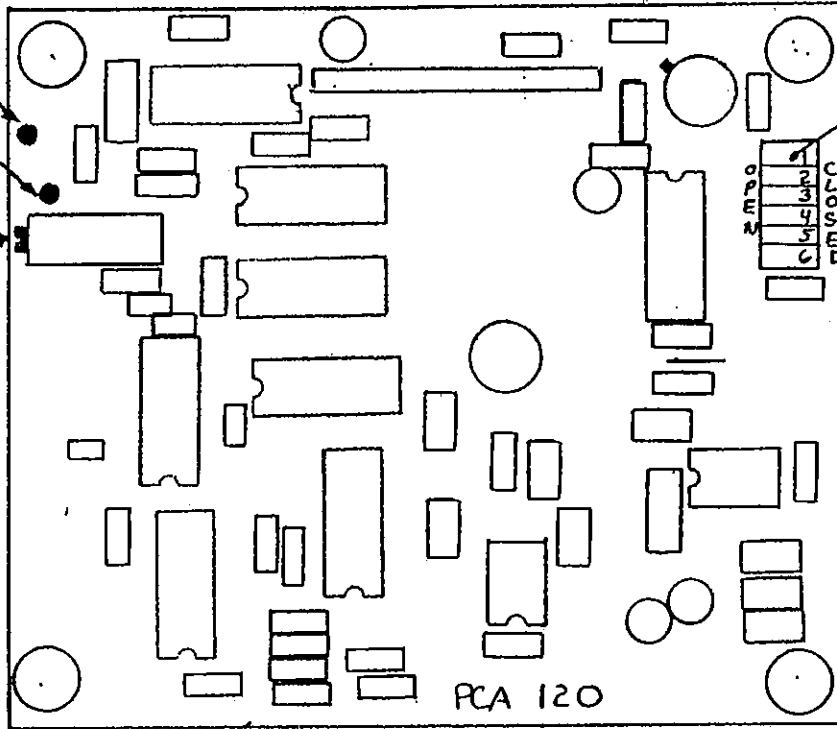
RESET

The totalizer is reset externally through the case with the aid of a magnet. A switch closure is generated when the magnet is passed in proximity of the switch.

TEST COM
 OFFSET FREQ
 TEST POINT

OFFSET
 ADJUST
 CONTROL

RANGE
 SELECT
 SWITCHES



PCA 120

LET.	DATE	CHANGE	BY	APP.
REVISIONS				
DWN.	DATE	CK.		
ENGR.	MFG. ENGR.	DATE		

TITLE
 RANGE ADJUSTMENT
 AND OFFSET ADJUSTMENT
 DETAIL

HOFFER FLOW CONTROLS, INC. CODE 33321

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DWG. SIZE 46-402 REV. SCALE SHEET OF

128374

SECTION II

Section II

INSTALLATION OF THE FLOWMETER

Upon receipt of the turbine flowmeter a visual inspection should be performed, for any indications of damage which may have occurred during shipment. Inspect all packing material carefully to prevent loss of meter parts or auxiliary components which may have been packed with the shipment. Refer to the packing list/invoice for a detailed list of items included in the shipment.

The turbine flowmeter is supplied with either a passive magnetic pickup coil or a modulated carrier/conditioner assembly. For proper signal generation the pickup coil should only be finger tightened into the well in the meter housing before the lock nut is tightened. As an option the pickup assembly can be supplied with a weatherproof or explosion proof enclosure. This enclosure is rated for Class I Group C and D Class II Groups E, F and G NEMA 7 and 9. This assembly is provided with a threaded front cover to permit access to the pickup coil or conditioner assembly. The magnetic pickup coil utilizes a MS type 2-pin male receptacle with a mating plug MS-3106A-10SL-4S while the modulated carrier/conditioner utilizes a 3-pin MS type male receptacle with a mating plug MS-3106A-10SL-3S, used for connecting the pickup coil to the signal cable. Recommended cable is a shielded twisted pair such as Beldon #8422 or Manhattan #3654 or equivalent.

Turbine flowmeters are designed for use in clean fluid service. However, most fluids carry a particulate material making it necessary to install a strainer upstream of the flowmeter. It is required that the strainer be installed as to prevent foreign material from fouling the rotor or bearings, causing premature failure. Refer to table 1 for strainer sizes recommended for general applications.

TABLE 1 STRAINER/FILTERS

METER SIZE	MESH SIZE	PARTICLE SIZE SIZE MAX.
MF SERIES	100	.0055
1/4" TO 1/2"	100	.0055
5/8" TO 1 1/4"	70	.008
1 1/2" TO 3"	40	.015
4" TO 12"	24	.028

In order to achieve accurate and reliable operation of the turbine flowmeter proper installation is required. The meter housing is marked by a flow direction arrow and the inlet is marked IN, to ensure correct orientation of the meter in the piping system. Turbine flowmeters are constructed with flow straighteners to minimize the affects of fluid swirl and non uniform velocity profiles, which in most cases is adequate for most installations. However, it is good practice to maintain a minimum straight run of pipe approximately 10 times the nominal meter size ahead of the inlet, and 5 times the diameter following the outlet. The flowmeter may be installed either horizontally or vertically for liquid service without affecting the meter calibration, in gas applications the meter must be installed horizontally for proper operation.

Upon initial start-up of the system a spool piece should be installed in place of the flowmeter so that purging of the system can be performed to remove all particle debris which could cause damage to the meter internals. In applications where meter flushing is required after meter service care should be taken as not to over speed the meter, as damage may occur.

To maintain an accurate flow measurement it is necessary to maintain a downstream pressure sufficient enough to prevent flashing/cavitation. Flashing of the liquid will result in indication of flow significantly higher than actual flow. In order to eliminate this condition adequate downstream pressure must be maintained. The minimum required downstream pressure may be calculated for the following equation:

$$\text{Min. Pressure} = 1.25 \times \text{vapor pressure} + 2 \times \text{pressure drop}$$

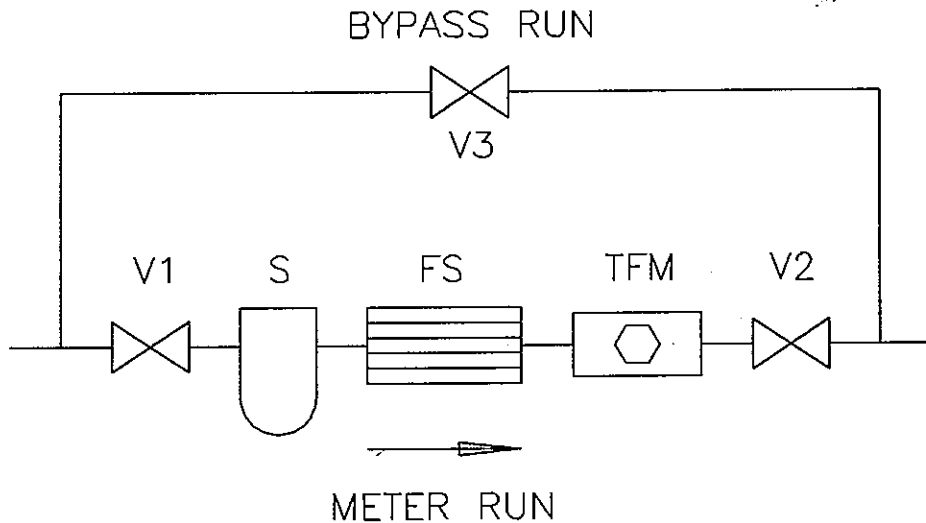
Downstream pressure may be maintained by a downstream valve that provides the necessary downstream pressure to prevent flashing/cavitation in the metering run.

NOTES:

- FACTORY RECOMMENDS 10" PIPE DIA. UPSTREAM AND 5 PIPE DIA. DOWNSTREAM OF SAME SIZE PIPE AS FLOWMETER. A FLOW STRAIGHTENER IS RECOMMENDED IF THIS IS NOT POSSIBLE OR FOR CUSTODY TRANSFER APPLICATIONS.

REVISIONS

REV	DESCRIPTION	DATE	APP
A	REDRAWN	1-31-92	
B	ADDED NOTE 2, CHG'D MESH SIZE	3-17-92	
C	DRAWING NO. WAS INSTL-104.	950907	JJ



- V1, V2 BLOCKING VALVE
- S STRAINER
- FS FLOW STRAIGHTENER
- TFM TURBINE FLOWMETER
- V3 BYPASS VALVE

METER SIZE	MESH SIZE
MF SERIES	100
1/4" - 1/2"	100
5/8" - 1 1/4"	70
1 1/2" - 3"	40
4" - 12"	24

REPLACES INSTL-104

		MATERIAL	DRAWN DW	DATE 1-31-92	H HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK JD	1-31-92	
			QA H.COVELL	1-31-92	
		FINISH	PROJ ENG KRH	1-31-92	
		CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.			TITLE TYPICAL TURBINE INSTALLATION
NEXT ASSY	USED ON	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01 3 PLACE DECIMAL ±.005 FRACTIONAL ±1/64 ANGULAR ±1/2°			
APPLICATION		SIZE A 33321		DWG NO 500-0194	REV C
		SCALE NONE		SHEET 1 OF 1	

4

3

2

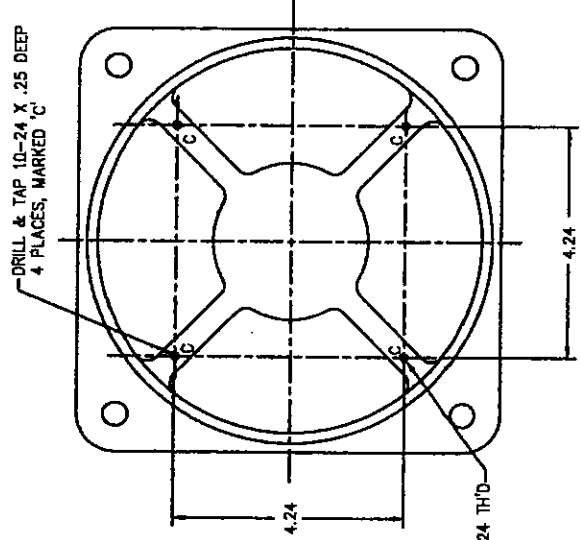
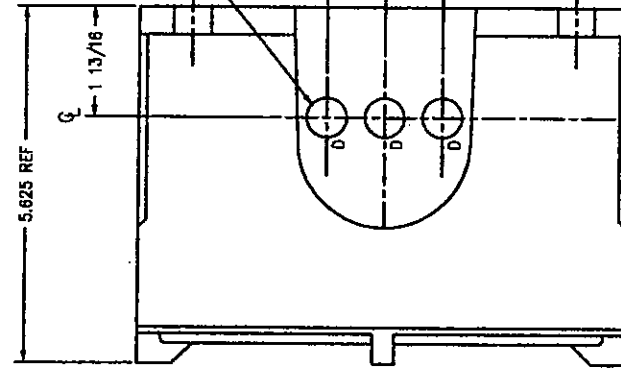
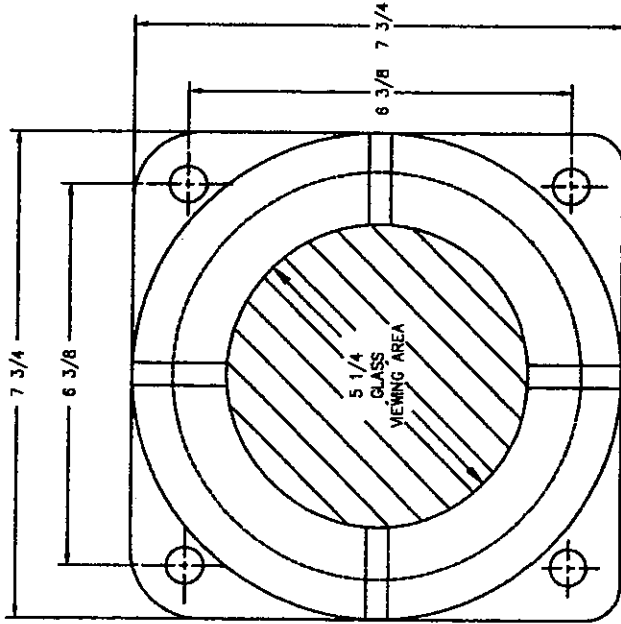
1

ADALET CASE P/N XJWHGC

SPECIFICATIONS:

CLASS I, GROUP C & D
CLASS II, GROUPS E, F & G
NEMA 7 & 9 (NEMA 3 & 4 OPTIONAL)

ZONE	REV	DESCRIPTION	DATE	APP
A		MOVED 1" CONDUIT ENTRY FROM TOP DRAWING NO. WAS EXP-102, REVISED PER ECP166.	2-4-92	JD
B				
C		ZONE C: 10-24 X .25 DEEP WAS 6-32 THD	95D916	JD
D		DWG NO. WAS 200-0504, ADDED STOCK NUMBER	96D924	RWH
			980521	GA



ENCLOSURE WITH WINDOW REMOVED
SHOWING BOTTOM OF CASE

STOCK NO. 200-0580

H HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE
ENCLOSURE, EXPLOSION
PROOF, DUST TIGHT
MODEL 46
(ADALET XJWHGC)

SIZE	C	CASE CODE	DWG NO	REV
SCALE	NONE		46-104	D
SHEET			1	OF 1

DATE	BY	CHECK	DRAWN	MATERIAL
12-31-87	JD	JD	H, COVELL	
12-31-87			K, HOFFER	
			PROG ENR	
			MACH SHOP	

USE SIZE OTHERWISE SPECIFIED OR OTHER THAN THAT SHOWN IN THIS DRAWING. ALL DIMENSIONS SHALL BE HELD AS FOLLOWS:

FINISH	± .005
PLATE DIMENSIONS	± .005
FRAMING DIMENSIONS	± .005
ANGULAR	± 1/2°

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NET ASY	USED ON
APPLICATION	

4

3

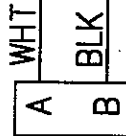
2

1

NOTES:

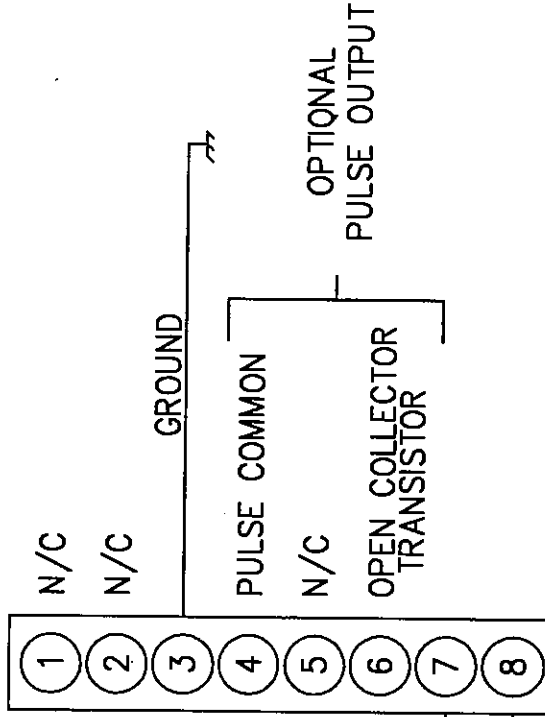
1. BATTERY OPERATED SYSTEMS ARE POWERED BY AN INTERNAL 3.6VDC LITHIUM BATTERY.
2. SEE MANUAL OR CONTACT FACTORY WHEN WIRING OPTIONAL SEALED PULSE OUTPUT.
3. ON A BATTERY POWERED SYSTEM A TTL/CMOS PULSE OUTPUT IS ACHIEVED BY THE USER PROVIDING AN EXTERNAL PULLUP RESISTOR FROM TERMINAL 6 TO A USERS 5V LOGIC SUPPLY. SUGGESTED RESISTANCE 1K OHM 1/4W.
4. CABLE IS BELDON 8422 OR EQUAL.

MS3106A-10SL-4S



TO FLOW PICKUP

NOTE 4



REVISIONS

REV	DESCRIPTION	DATE	APP
A	REDRAWN ON CAD. REPLACES REV- WITHOUT CHANGE. (CS)	930208	JD
B	DWG NO. WAS 46-708. (CS)	950916	JD
C	DWG NO. WAS 700-0032	000623	ED

REPLACES 700-0032

H HOFFER FLOW CONTROLS, INC.
ELIZABETH CITY, NC 27909

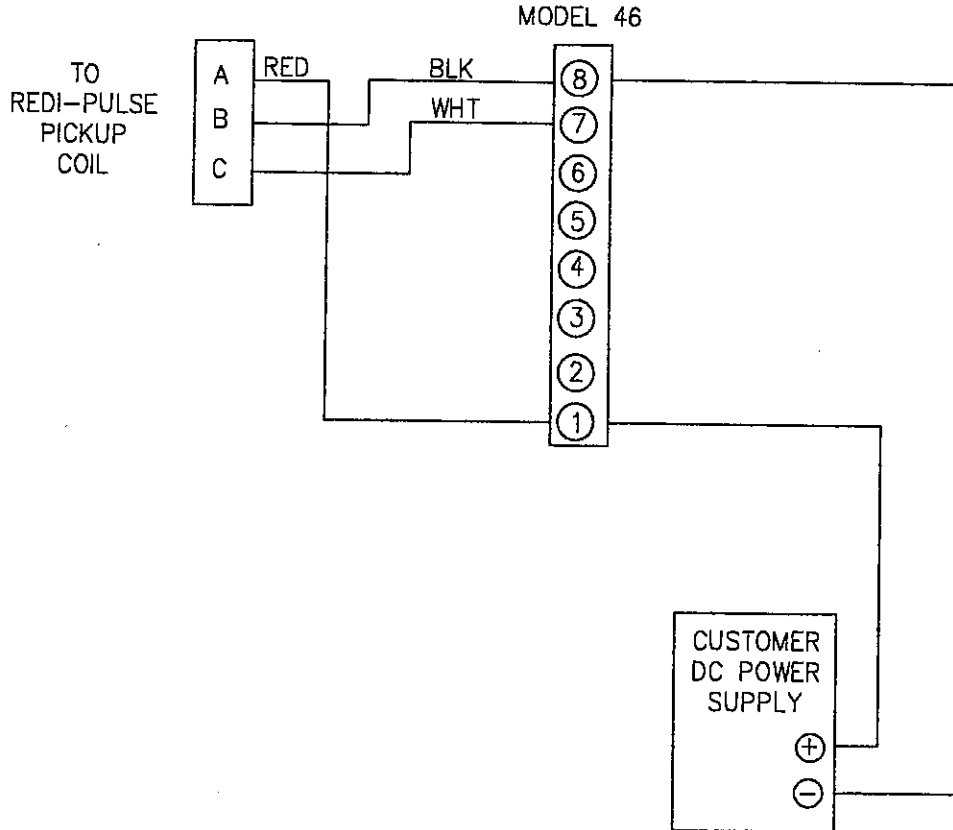
TITLE
USER WIRING-
46ER1X(0)(0)(0)

SIZE	CAGE CODE	DWG NO	REV
A	33321	46-708	C
SCALE	NONE	SHEET	1 OF 1

CONTRACT/JN		DATE
DRAWN	PB	12/89
CHECK	RG	12/89
QA		
PROJ ENG		
MATERIAL	FINISH	
<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES, TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01 3 PLACE DECIMAL ±.005 FRACTIONAL ±1/64 ANGULAR +1/2°</p>		
<p>CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.</p>		
NEXT ASSY	USED ON	
APPLICATION		

REVISIONS

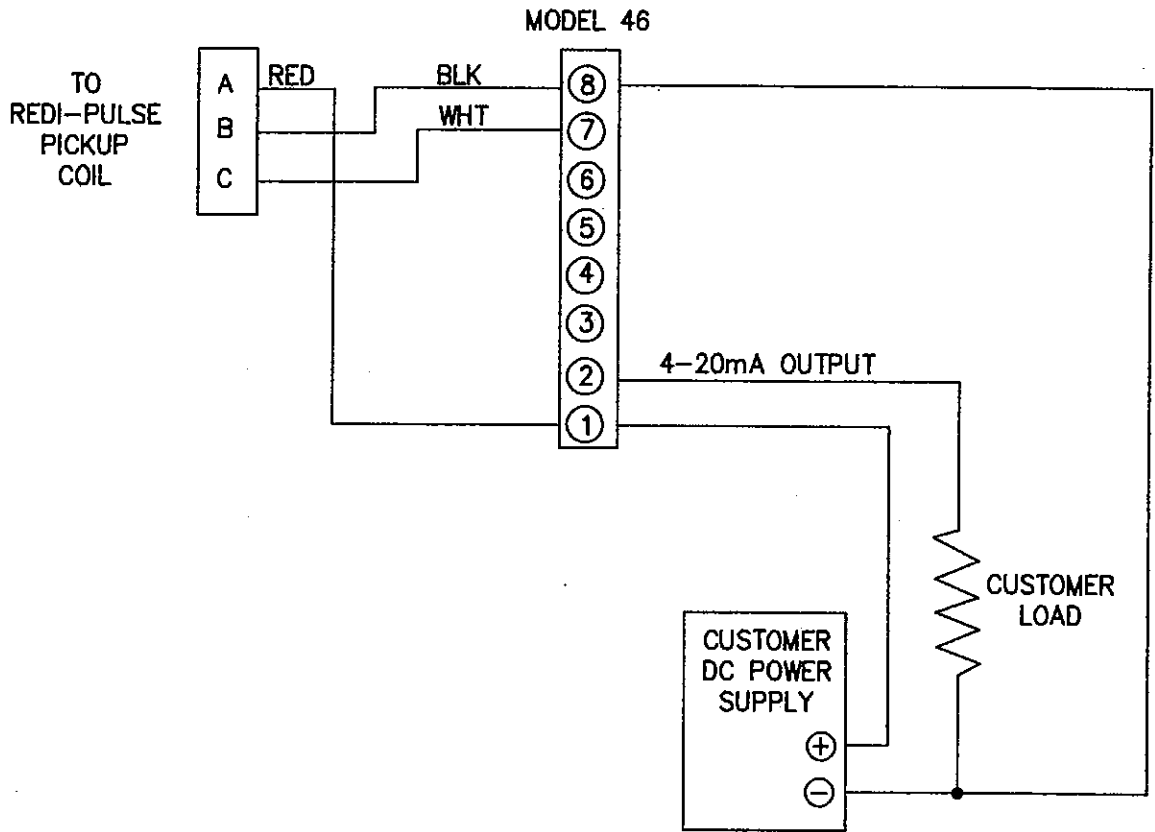
REV	DESCRIPTION	DATE	APP



		MATERIAL	DRAWN <i>Sweet</i>	DATE 990222	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK <i>E. Adams</i>	990222	
			PROJ ENG <i>E. Adams</i>	990222	
		FINISH			TITLE USER WIRING, MODEL 46 - EXTERNALLY POWERED (REDI-PULSE COIL)
		CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ±.01 3 PLACE DECIMAL ±.005 FRACTIONAL ±1/64 ANGULAR ±1/2°		SIZE CAGE CODE DWG NO A 33321 46-718
NEXT ASSY	USED ON				
APPLICATION					SCALE NONE
					SHEET 1 OF 1

REVISIONS

REV	DESCRIPTION	DATE	APP



		MATERIAL	DRAWN <i>Sweet</i>	DATE <i>9/12/18</i>	H HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK <i>E. Adams</i>	<i>9/12/18</i>	
			PROJ ENG <i>V. Kerk</i>	<i>9/12/18</i>	
		FINISH			TITLE
					USER WIRING, MODEL 46 - REDI-PULSE COIL
		CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS:		SIZE
NEXT ASSY	USED ON		2 PLACE DECIMAL ±.01 3 PLACE DECIMAL ±.005 FRACTIONAL ±1/64 ANGULAR ±1/2°	CAGE CODE	DWG NO
APPLICATION			A 33321	46-717	-
			SCALE	SHEET	
			NONE	1 OF 1	

SECTION III

CALIBRATION AND SETUP OF THE DIGITAL FLOW TOTALIZER

INTRODUCTION

In general all digital flow indicators manufactured by Hoffer are factory calibrated to user requirements at time of purchase. Rate indication is achieved by use of the SYSTEM FACTOR switch array.

By using the SYSTEM FACTOR in conjunction with the internal TIME BASE rate indication in gallons, pints, liters, barrels or other units may be achieved.

PROCEDURE

Begin by obtaining a copy of the calibration sheet for the flowmeter to be used. Obtain the desired units of measurement from the project supervisor or equipment specification.

From the calibration sheet for the flowmeter obtain the MEAN K FACTOR in cycles/gallon, designate this as the K FACTOR. If the flowmeter is one of the Mini Flow (MF) Series, also obtain from the calibration sheet the offset frequency, F (OS).

Finally, note the maximum flow rate in desired units as R(MAX) in volumes/minute.

Compute the equivalent number of pulses per desired measurement unit, designated K' from the K FACTOR for the flowmeter and the conversion factor relating the gallons per users desired measurement units. This may be done with the following equation and the aid of a conversion chart.

$$K' = K \text{ FACTOR} \times C.F.$$

WHERE C.F. IS THE CONVERSION FACTOR EQUAL TO THE RATIO OF THE NUMBER OF GALLONS PER CHOSEN VOLUME UNIT.

Example

Given: 200 pulses/gallon=K FACTOR
Desired units of measurement is Liters

Obtain: Conversion Factor C.F. = .2642 gallons/Liter

Calculate: $K' = 200 \times .2642$
 $= 52.84 \text{ pulses/liter}$

Dial into the SYSTEM FACTOR switches the four significant digits as detailed in the SYSTEM FACTOR CALCULATION section of the manual.

CALIBRATION AND SETUP OF DIGITAL FLOW TOTALIZER (CONTINUED)

SYSTEM FACTOR CALCULATION

For operation with standard, in-line, axial flowmeters.

Determine the SYSTEM FACTOR by the following equation

$$SF = 1/K'$$

Example

$$S.F. = \frac{1}{52.84} = .0189251$$

For operation with the Mini Flowmeter Linearizer.

When the Mini Flowmeter Linearizer option is equipped a third switch matrix is used to enter the offset frequency for the Mini Flowmeter. The circuitry then linearizes the conditioned output signal from the Mini Flowmeter by the method of frequency injection of offset frequency.

Dial F(OS) into the thumbwheel switches located on the PCA-120 printed circuit card.

In addition, however, the method used to implement the Mini Flowmeter linearization requires a post scaling factor which must be accounted for in calculating the SYSTEM FACTOR. When the linearizer option is equipped use the following equation to calculate the SYSTEM FACTOR.

$$SF = 5/K'$$

Concerning the SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER

From the description given in the Controls and Adjustment Section it may be observed that the SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER are used together as a scale factor to provide an indication of total flow in the user desired units.

It is important to consider how to best represent a required scale factor within the limitation of SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER.

To verify correct rate indication the following equation may be used:

$$\text{RATE} = \text{INPUT FREQUENCY} \times \text{SYSTEM FACTOR} \times \text{TIME BASE}$$

The value of the time base is factory set at either .6 seconds or 1 second or 3.6 second or 6 second.

Example

Desired units are liter/minute where maximum rate is 100.0 LPM. From the above example the SYSTEM FACTOR will have dialed into it .1893. At the flow rate of 10.0 LPM the input frequency will be:

$$\begin{aligned} \text{FREQUENCY} &= K' \times R(\text{MAX})/60 \\ 88.06 &= 52.84 \times 100/60 \end{aligned}$$

With the input frequency of 88.06 Hz it can be seen that with a system factor of .1983 and a time base of .6 seconds the readout will be 100 LPM.

CALIBRATION OF THE MODEL 46 WITH USE OF AN IN-LINE FLOWMETER

The digital rate indicator is automatically set up to the desired units of readout when the System Factor is programed as outlined in the previous discussion.

The analog is calibrated by using an external oscillator to supply the required test signal. The oscillator will be connected to the signal input terminals. The oscillator's output frequency will be set to F(MAX) for the desired full scale condition required.

In order to calibrate the Model 46, begin by calculating the following set points.

$$\text{EQUATION 1: } F(\text{MAX}) = \frac{K' \times R(\text{MAX})}{60}$$

where K' is the K-Factor of the flowmeter in Pulses/Desired units
R(MAX) is the desired full scale flowrate expressed in units per minute.

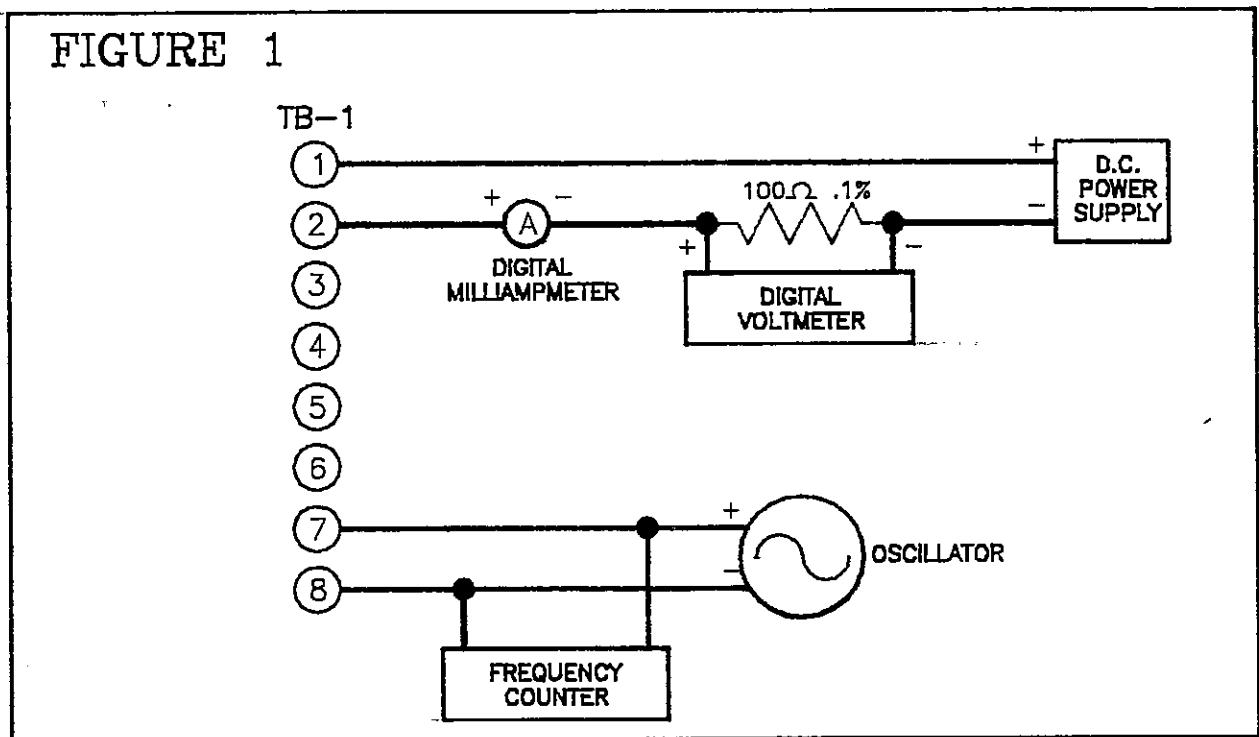
CALIBRATION PROCEDURE

1. Perform the Range Adjustment by selecting the proper switch position to accommodate F(MAX) located on the PCA-120 printed circuit card. Refer to the table below:

RANGE SELECT SWITCH POSITION	F(MAX)
1	150
2	300
3	600
4	1200
5	2400
6	4800

2. Turn the SPAN control fully counter clockwise until slippage is felt or 25 turns.
3. Connect a digital milliampmeter or digital voltmeter as shown in figure-1.

4. With a no flow condition adjust the ZERO control to obtain the desired zero current of 4.0 mA.
5. Inject the test signal corresponding to F(MAX) and adjust the SPAN control to obtain the desired current span of 20 mA.
6. Iterate steps 4 and 5 until no change is observed.



CALIBRATION OF THE MODEL 46 FOR USE WITH THE MINI FLOW (MF) SERIES

The digital rate indicator is automatically set up to the desired units of readout when the System Factor is programed as outlined in the previous discussion.

The analog is calibrated by using an external oscillator to supply the required test signal. The oscillator will be connected to the signal input terminals. The oscillator's output frequency will be set to F(MAX) for the desired full scale condition required.

In order to calibrate the Model 46, begin by calculating the following set points.

$$\text{EQUATION 1: } F(\text{MAX}) = K' \times \frac{R(\text{MAX})}{60} - F(\text{OS})$$

where K' is the K-factor of the flowmeter in Pulses/Desired units

R(MAX) is the desired full scale flowrate expressed in units per minute.

F(OS) is the offset frequency of the miniflow meter as listed on the calibration sheet.

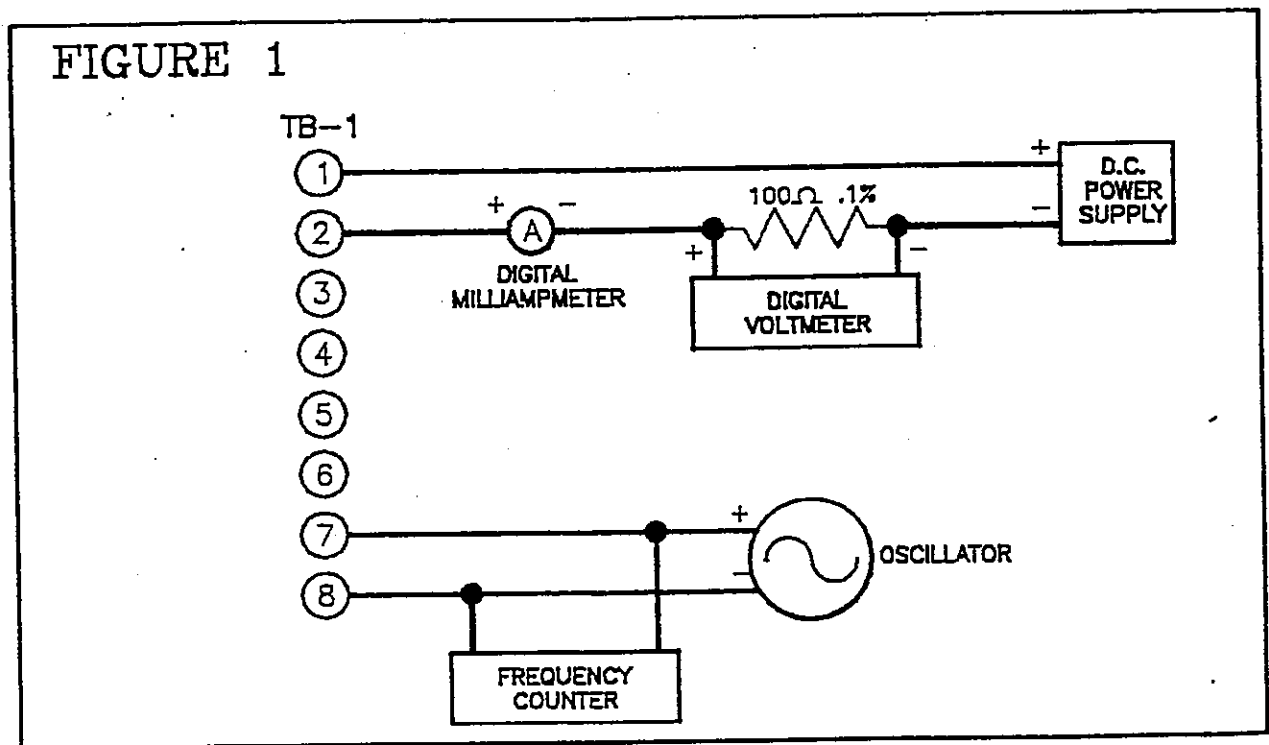
CALIBRATION PROCEDURE

1. Perform the Range Adjustment by selecting the proper switch position to accommodate F(MAX) located on the PCA-120 printed circuit card. Refer to the table below:

RANGE SELECT SWITCH POSITION	F (MAX)
1	750
2	1500
3	3000
4	N/A
5	N/A
6	N/A

2. Connect a precision frequency counter to the Offset Frequency Test Point and adjust the Offset control to obtain a frequency reading of 10 times the offset frequency.

3. Turn the SPAN control fully counter clockwise until slippage is felt or 25 turns.
4. Connect a digital milliampmeter or digital voltmeter as shown in figure-1.
5. With a no flow condition adjust the ZERO control to obtain the desired zero current of 4.0 mA.
6. Inject the test signal corresponding to F(MAX) and adjust the SPAN control to obtain the desired current span of 20 mA.
7. Iterate steps 5 and 6 until no change is observed.



SECTION III

CALIBRATION AND SETUP OF THE MODEL 46 FOR GAS MEASUREMENT

GENERAL

Members of the Series 46 family are factory wired and calibrated to the users specifications at the time of purchase. Calibration information is attached to the unit prior to shipment.

INTRODUCTION

In general, all Digital Flow Totalizers manufactured by Hoffer Flow Controls have a special feature which allows the user to scale the flow information into the desired units of measurement. This feature is termed the SYSTEM FACTOR and is composed of two arrays of switches.

By utilizing the SYSTEM FACTOR, the total flow may be indicated in gallons, pints, liters, barrels, cubic feet.

PROCEDURE

Begin by obtaining a copy of the calibration sheet for the flowmeter to be used with the Digital Flow Totalizer. Obtain the desired units of measurement from the project supervisor or equipment specification.

From the calibration sheet for the flowmeter obtain the MEAN K FACTOR in cycles/cubic foot, designate this as the K-FACTOR.

Compute the equivalent number of pulses per desired measurement unit, designated K' from the K FACTOR for the flowmeter and the conversion factor relating cubic feet per users desired measurement units. This may be done with the following equation and the aid of a conversion chart.

PROCEDURE (Continued)

$$K' = K \text{ FACTOR} \times CF$$

WHERE

CF is the conversion factor equal to the ratio of the number of cubic feet per user chosen volume unit.

Example

Given: 200 pulses/cubic foot = K FACTOR
Desire units of measurement = Liters

Obtain: Conversion Factor CF = .03521 cubic feet/liter from Table

Calculate: $K' = 200 \times .03531$
 $= 7.062 \frac{\text{Pulses}}{\text{Liter}}$

Concerning the SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER

From the description given in the Controls and Adjustment Section, it may be observed that the SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER are used together as a scale factor to provide an indication of total flow in the user desired units.

It is important to consider how to best represent a required scale factor within the limitation of SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER.

The SYSTEM FACTOR should be programmed with the largest number of significant figures which may be represented within the limitations of the switch array.

The SYSTEM FACTOR MULTIPLIER is then set to the position which results in the correct scale factor.

Example

S.F. = .0189251

Dial into SYSTEM FACTOR SWITCHES 1.8925

SYSTEM FACTOR MULTIPLIER SWITCH to X.01 position

Calculate the SYSTEM FACTOR using the following equation

$$S.F. = \frac{1}{K} \times \frac{P(FS)}{14.7} \times \frac{530}{T(FS)}$$

Where P(FS) Full scale Pressure (PSIA)
T(FS) Full Scale Temperature (°R)

Choose the optimum setting for the SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER based on above calculation.

NOTE: P(FS) and T(FS) are user operating temperature and pressure conditions which are going to be maintained. The above procedure uses the standard conditions of 70 degrees Fahrenheit and 14.7 PSIA, these reference conditions will vary from country to country. Therefore it is important that these variations of the reference conditions be reflected in calibration to the unit.

SECTION IV

Section IV

INITIAL START-UP

On initial start-up of any new piping system, a high risk of damage to the turbine flowmeter exists until the piping has been flushed of debris from the process assembly. Perform any purging of the installation with a spool piece substituted for the turbine flowmeter.

Once the lines have cleared, reinstall the flowmeter and make all necessary connections to the pickup coil and/or the signal conditioner before applying power to the indicator.

turn the power to the indicator "ON". Push the RESET, the display should read 00. With no flow, the display should not be incrementing.

If there are counts being generated, indicating flow, noise is being coupled into the unit. Slowly turn the "SENS" control on the model 46 (or the signal conditioner if one is used) counter clockwise until the false counting stops.

The unit is now ready to be put into service. Flow indication will commence upon flow through the flowmeter. The units of measurement are those that were established during the setup of the instrument.

PRINCIPLE OF OPERATION

A simplified block diagram of the Model 46 is given on drawing 46-601. Key functional blocks as well as flow information are designated. The basic operation of the system is as follows.

The frequency signal from the turbine flowmeter is connected to the Model 46 with a twisted pair shielded cable. The signal enters through the SENSITIVITY control which is used to reject unwanted noise by raising the trigger threshold above the background noise present.

The low level flowmeter signal is then passed through a signal conditioning chain where it is filtered, amplified and shaped into a train of digital pulses whose frequency is related to the volume flow rate and where each pulse represents a discrete volume of fluid.

PRINCIPLE OF OPERATION (CONTINUED)

If the Miniflowmeter linearizer option has been equipped the signal is then passed through the linearizer where the offset frequency signal is injected into it. For flow rates within the range of the meter, the linearized output will be linearly related to the volumetric flow rate. In addition, this circuitry divides the pulse train by five to reduce irregular pulse spacing.

The linear or linearized pulse train is then passed to the system factor which scales the signal for flow totalization while providing proper scaling for flow rate indication.

The pulse scaling circuitry composing of the system factor effectively multiplies the pulse rate by a number set into the rotary DIP switch array. The output of the system factor produces a pulse which represents a decimal multiple of the desired flow measurement units.

At the output of the system factor, each pulse represents a decimal multiple of the desired flow measurement units. The pulse train is divided into two stages, where one stage is for total flow indication and the second stage is for rate indication.

The pulse from the first stage is fed into the system factor multiplier which effectively multiplies the pulse rate by either 1, .1, .01, .001 or .0001 depending on the position selected on the corresponding switch.

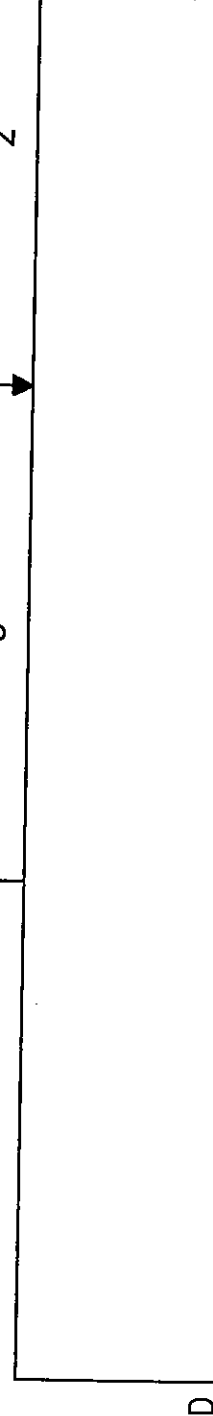
At the output of the system factor multiplier each pulse represents one unit of flow in the desired measurement units.

This pulse then provides the required drive capabilities for the total display. This pulse also is diverted into a multivibrator which is factory wired to provide user specified pulse width output for the options of TTL/CMOS or OPEN COLLECTOR.

RATE INDICATION

Rate indication is accomplished by taking the pulse train coming from the system factor and directly fed it into the display. The time base will generate a 0.6, 1.0, 3.6 or 6 second time delay, then generate the latch pulse. The latch pulse will allow the display to update to the new flow rate value while erasing the previous. After generation of the latch pulse a reset pulse is then generated. The reset pulse clears the internal registers of the display so that a new count sequence can be started.

DWG NO.	46-601	SH 1	REV D
REVISIONS			
ZONE	REV	DESCRIPTION	DATE
A		REDRAWN ON CAD.	5-11-92
B		DRAWING NO WAS 46-601.	950918
C		ZN B4 B-40VDC WAS B-35VDC.	980202
D		DRAWING NO WAS 700-0031	000823



REPLACES 700-0031

DRAWN		DW	
DATE	5-11-92	CHECK	JD
BY	H. COWELL	PROJ ENG	K. HOFFER
DATE	5-11-92	MACH SHOP	

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SECTION V

MAINTENANCE

Hoffer Flow Controls Flow Measurement Systems are constructed to give a long service life in the targeted measuring field and service environment. However, problems do occur from time to time and the following points should be considered for preventive maintenance and repairs.

The bearing type used in flowmeter was chosen to give compromise between long life, chemical resistance, ease of maintenance and performance. A preventive maintenance schedule should be established to determine the amount of wear which has occurred since last overhaul. See users' manual for flowmeter, for further instructions.

A Spare Part List has been provided which, at the discretion of the user, may be user stocked. Consult with the manufacturer if an abridged spare parts list is sought. The recommended spare parts list may be found following this section and in the users manual for the flowmeter.

In case the flow measurement system malfunctions or becomes inoperative, a trouble shooting procedure is enclosed.

Factory consultation is available to assist in diagnosing problems. In addition, factory repair parts and service are available for individuals who wish to utilize this service.

A complete set of schematic diagrams for all printed cards is available from Hoffer Flow Controls for users who wish their own personnel to service the measuring system.

NOTE:

- All printed circuit cards are under warranty for one year after date of sale.
- All printed circuit cards may be factory repaired at a nominal fee for parts and labor after warranty period.

TROUBLE SHOOTING AND MAINTENANCE

In case of an inoperable or malfunctioning system the following procedures can be used to isolate the condition. The majority of repairs can be made in the field thereby reducing the time a unit is out of service.

A recommended spare parts list is given immediately following the trouble shooting portion of this manual. The necessary documentation is contained within this manual with the exception of the calibration data sheet for the turbine flowmeter. This calibration is supplied separately.

Factory consultation is available to assist in diagnosing problems. Note that in some cases factory repairs can be performed more easily than can be accomplished in the field.

GENERAL INSPECTION TO DETERMINE IF UNIT IS OPERATING PROPERLY

Proper operation of the Model 46 can be assumed when:

- a. Applying power to the unit causes the LCD displays to light.
- b. Depressing the RESET return the counter to zero.

OBSERVED CONDITION

LCD DISPLAY FAILS
TO LIGHT

CORRECTIVE ACTION

1. For any other power option verify polarity of power source is correct.
2. Replace counter module.
3. Replace PCA-118.
4. Replace PCA-119.

NOTE: THE COUNTER MODULE SHOULD ONLY BE CHANGED BY QUALIFIED PERSONNEL, USING EXTREME CARE.

LCD SEGMENTS FAIL
TO LIGHT

1. May occur on start-up. Reset the unit using the magnet.
2. Replace counter module.

NOTE: THE COUNTER MODULE SHOULD ONLY BE CHANGED BY QUALIFIED PERSONNEL, USING EXTREME CARE.

Page-5.2-

WITH NO FLOW UNIT
COUNTS

1. Noise on input, slowly turn
SENS adjust CCW until counting
stops.

NOTE: IN THE FULLY CCW POSITION
UNIT WILL NOT OPERATE.

2. Replace pickoff coil and/or
cable.

3. Replace PCA-119.

4. Replace PCA-118.

1. Replace PCA-120.

2. Check Mini Flowmeters
calibration.

UNIT GIVES ERRONEOUS
READINGS WITH MINI
FLOWMETER LINEARIZER

RECOMMENDED SPARE PARTS

PCA-118	PRINTED CIRCUIT CARD	1
PCA-119	PRINTED CIRCUIT CARD	1
PCA-120	PRINTED CIRCUIT CARD	1
COUNTER MODULE	SUB-CUB 2	1
BATTERIES	3.6VDC LITHIUM 10.5 AMP/HR	2