Model 250

Digital Flow Totalizer/Rate Indicator

USER'S MANUAL

HP-231
August 1995

HOFFER Flow Controls

Perfecting Measurement™

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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 the 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 number 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.

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 bee 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 WARRANTLY 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 250 DIGITAL FLOW TOTALIZER/RATE INDICATOR

The Model 250 is a Digital Flow Totalizer or Rate Indicator, which provides a nonvolatile seven digit Light Emmiting Diode display for readout in user desired increments.

The Model 250 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 allows the user to set the input sensitivity above the ambient noise level, thereby eliminating any false readout.

In the event that a remote preamplifier is to be incorperated with the Model 250 to form a system, an opto-isolated input is provided. This type of input will eliminate any potential for grounding noise between the pre amplifier and the model 250.

The Model 250 may be configured to function as Flow Rate Indicator by simply selecting a DIP switch position on the front panel. In the rate mode of operation the flow total accumulated prior to converting to rate indication, will be lost. However the pulse output will continue to provide pulses in desired units.

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 inputed to a drive stage which will increment the totalizer as well as provide the pulse output in the desired 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 which provide the required pulse scaling for desired units of flow rate measure.

SPECIFICATIONS

INPUT POWER	110/220 VAC +/- 10% 50/60 hz user jumper selectable. With battery backup for 48 hour continuous use.
INPUT SIGNAL	LOW LEVEL: Input filtered, RF and Bandpass filtered. Adjustable trigger level 10 millivolt RMS (minimum) 10Hz to 2500Hz. Over voltage capability 120V RMS (absolute). Input impedance 40 kilo ohm (nominal). OPTO-ISOLATED: Input signal range 3 to 30 Vdc. Minimum input pulse duration 0.1mSec. Input impeadence 1.2 kilo ohms. Maximum isolation voltege 2500 Vdc.
TOTAL/RATE DISPLAY	Type 7 digit Light Emitting Diode(LED) Character height 0.45 inches Viewing distance 25 feet. Leading zero blanking. Accuracy +/- 1 count in total mode or +/- 2 counts in rate mode.
PULSE SCALING CAPABILITY	System factor and System Factor Multiplier provide a cascaded chain of two scaling factors. The System Factor provides scaling factors from 0.0000 to 1.9999 with five 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 second, depending on user application. Thermal stablity +/- 200ppm/ c.
OUTPUT CHARACTERISTICS	PULSE DURATION: factory set to user requirements 50 uSec to .33 Sec logic 0. OPEN COLLECTOR: type 2N6660 Vmax 60Vdc absolute maximum Imax 1.2Adc absolute maximum TTL/CMOS: Logic 1 2.4Vdc @ -.800mA Logoc 0 0.4Vdc @ 2.6mA HTL: Logic 0 0.4 Vdc @ 100mA Logic 1 10.0 Vdc @ 1mA OPTO-DRIVE: On current 3mA(nominal) Off current less than 25uA.

MINIFLOWMETER LINEARIZATION

METHOD	Frequency injection of offset frequency with divide by 5 post scaling
OFFSET FREQUENCY	00.0 to 99.9Hz.
ENVIRONMENTAL	Operating temperature 0 to 50°C Storage temperature -20 to 60°C Available in NEMA 4 standard. Explosion proof Class I, Div. I, Group C, D (optional).

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 System Factor Multiplier. Used in conjunction with system factor switches.
DECIMAL POINT	A DIP switch array used to program decimal positions of 999.9.9.9.9
RATE/TOTAL	A DIP switch position used to configure the unit as a rate indicator or totalizer.
OFFSET FREQUENCY	Three thumbwheel switches on the PCA-93 circuit board used to input the equivalent offset frequency of the miniflow meter, 00.0 to 99.9Hz. Thermal stability +/- 200ppm/ C.
RESET	A spdt sring return switch located on the front panel used to zero the display. Provisions have been made where the rest may be used locally or remote.
REMOTE START/STOP	Through rear terminal block conections a spdt switch may be added to control starting and stoping of the totalizer. If no switch is to be used a jumper must be added for proper operation.

SECTION II

Section II

INSTALLATION OF THE FLOWMETER

Upon reciept of the turbine flowmeter a visual inspection should be performed, for any indications of damage which may have occured during shipment. Inspect all packing material carefully to prevent loss of meter parts or auxilary components which may have been packed with the shipment. Refer to the packing list/invoice for a detailed list of items 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 Manhatten #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 STRAINERS/FILTERS

METER SIZE	MESH SIZE	PARTICLE SIZE SIZE MAX.
MF SERIES	100	.0055
1/4"TO1/2"	100	.0055
5/8"TO1-1/4"	70	.008
1-1/2"TO3"	40	.015
4"TO12"	24	.028

In order to achieve accurate and reliable operation of the turbine flowmeter proper installation is required. The meter hou-

sing 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 particale debris which could cause damage the 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:

Min. Pressure = 1.25 x vapor pressure + 2 x pressure drop

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

INSTALLATION OF THE SERIES 250

The Series 250 should be placed in a convenient location where both ease of viewing and wiring access are maintained. Viewing considerations should include due consideration of excessive ambient lighting or glare.

The panel cutout requirements are depicted in drawing 160/250-701. Be sure to allow adequate space behind the panel for the wiring terminations. The mounting brackets are easily removed by pushing them forward and then across the side of the enclosure. Slide then case thru the cutout and reattach the mounting brackets to the case. Tighten the bracket screw to finish the mounting to the panel.

Before making any connections verify that the Series 250 has the desired options by checking the Model number.

Two connector schemes are available for the 250. The first is a terminal block that diectly accepts wire leads, the second in a card edge, solder type connector.

The terminal block style connector directly accepts wire leads but it is a prefered practice to tin stranded wire leads before inserting them into the connector. Each wire should be stripped to a length of 5/8" +/- 1/16" before inserting into the connector. Care must be exercised to assure that each wire is inserted into the correct terminal of the connector. The connector holes are labeled both on the back plate and the connector body itself. Odd numbers are on the back row (closer to the case), even numbers are in the front row.

The solder style connector has a single row of contacts to which wires must soldered. It is recommended that the wires have a sleeve of heat shrink tubing installed around each wire to provide for a neatly dressed installation. When installed the connector must have the number/wire edge of the connector facing the top of the case.

The complete wiring terminations are shown on drawing 250-701.

Refer to the other wiring installation drawings for details of the connections for each option.

Magnetic Inputs are directly connected to terminals 21 and 22 with the shield terminated on 20. It is recommended that the high level outputs from remote Flowmeter Signal Conditioners be used to drive the Opto-Isolated Inputs. Typical connections are shown on the drawing for this option.

The pulse output option requires both rear wiring and in some cases internal solder gap/jumper connections to program it. Sample connnections are shown on the user wire drawing for this option. The form of the output is specified by the user when ordering although it may be changed in the field by a competent person family with P.C. Board repair procedures.

Connections for Remote Reset are made to terminals 7 and 8. Remove the Factory equipped jumper prior to making new connections. The wiring to the remote switch should be shielded with the shield terminated to terminal 9.

Connections for the Remote Start/Stop switch are made to terminals 11,12, and 13 with the shield terminated on 10. Remove the factory equipped jumper when using an remote Start/Stop switch prior to adding new connections.

Connections for power should assure the proper line voltage is present before making connections to the Series 250. A ground wire is required. The line should be an 'instrument grade' whose various loads do not contain solinoid valves, motors, or other similiar transient producing loads which might adversely effect the operation of the system.

After all connections have been made double check the complete wiring to verify conformance before applying power.

Most systems supplied by Hoffer come setup to user specifications if provided at the time of purchase. Review the factory calibrated systems appear to be in conformance with expectations. If not procede to Section III for setup instructions.

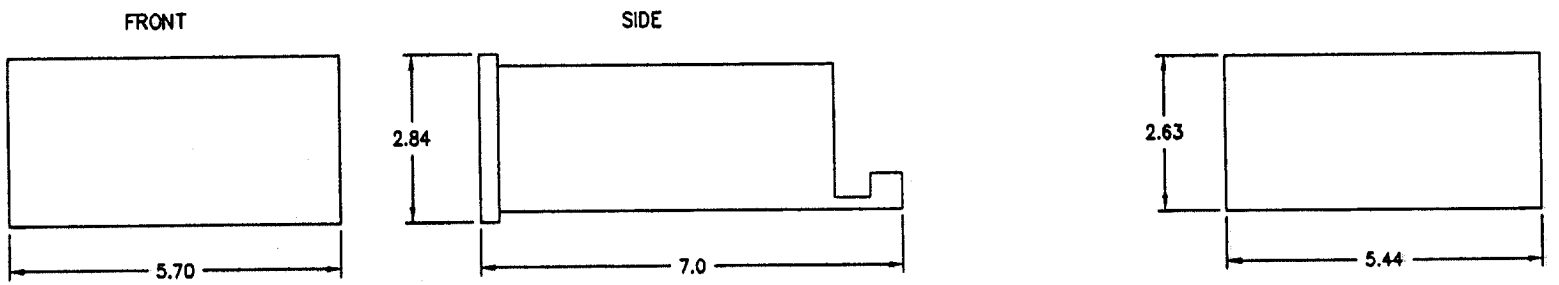
When all installations and setup procedurers have been completed, go to Section IV for a discussion of initial startup and any final adjustments which might be necessary.

DWG NO.	500-0270	SH 1	REV A

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPD
	A	DRAWING NO. WAS 160/250-701. (CS)	951108	JD

NOTES:
1. CASE CONFORMS TO DIN STANDARD 43700.
2. CASE IS CONSTRUCTED OF NORY (GLASS FILLED) PLASTIC, WHICH IS TEMPERATURE RESISTANT TO 130°C.
3. ALL DIMENSIONS ARE NOMINAL VALUES.



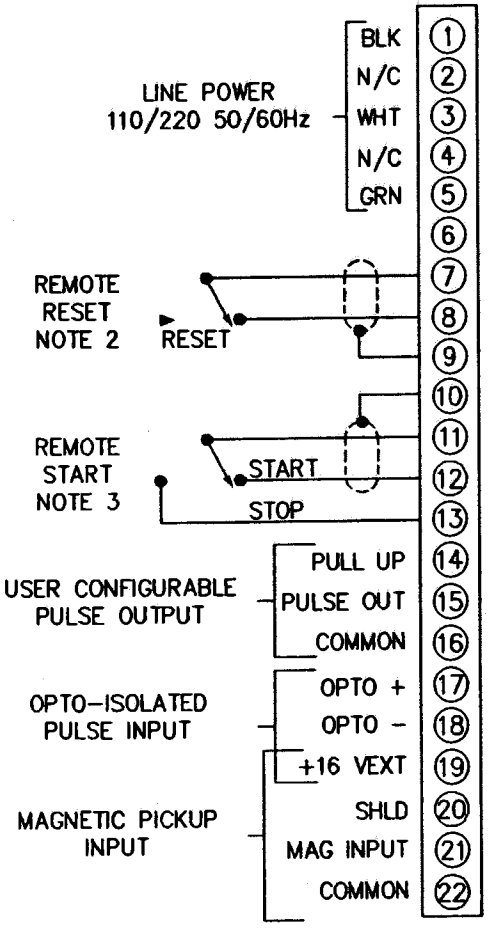
CASE DIMENSIONS

PANEL CUTOUT

		MATERIAL	DRAWN JD	DATE 11/85	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK		
			PRODUCTION		
		FINISH	PROJ ENG		TITLE: CASE DIMENSIONS, SERIES 160/250
NEXT ASSY	USED ON	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 THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ± .01, 3 PLACE DECIMAL ± .005, FRACTIONAL ± 1/64, ANGULAR ± 1/2°	SIZE B	CAGE CODE 33321	DWG NO 500-0270	REV A
APPLICATION				SCALE NONE		SHEET 1 OF 1	

NOTES:
1. INPUT POWER OPTION IS EITHER 110VAC OR 220VAC DEPENDING ON FACTORY WIRED OPTION SELECTED.
2. REMOTE RESET IS A SPDT SPRING RETURN SWITCH. JUMPER TERMINALS 7 & 8 IF NOT USED.
3. REMOTE START IS A SPDT SWITCH. IF NOT USED JUMPER TERMINALS 11 & 12.
4. PULSE OUTPUT IS USER CONFIGURABLE TO BE EITHER TTL/CMOS, HTL, OPEN COLLECTOR OR OPTO DRIVE. SEE MANUAL FOR FURTHER DETAILS.
5. PULSE OUTPUT IS SCALED TO SAME UNITS OF MEASURE AS INDICATOR.
6. FLOWMETER SIGNAL MAY BE INPUT TO EITHER THE MAGNETIC PICKUP OR THE OPTO-ISOLATED INPUT BASED ON SIGNAL TYPE AVAILABLE. SEE MANUAL FOR FURTHER DETAIL.

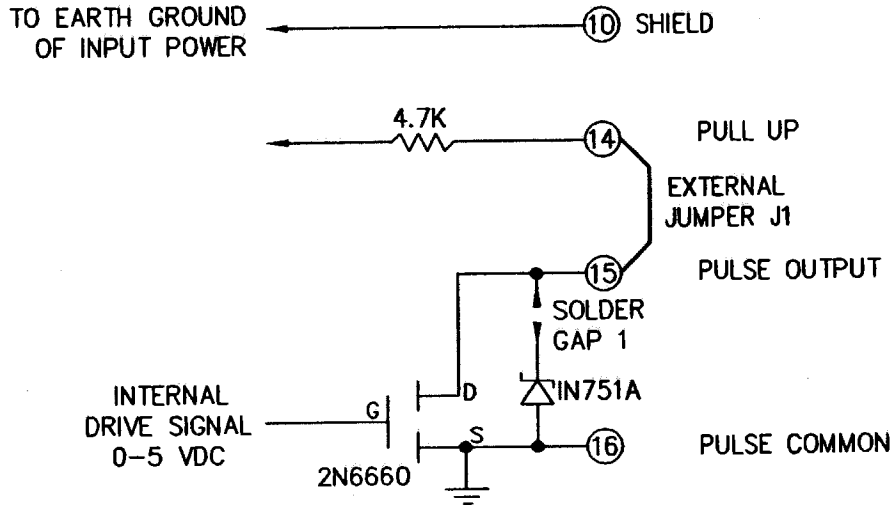
REVISIONS			
REV	DESCRIPTION	DATE	APP
A	DRAWING NO. WAS 250-701. (CS)	951107	



REPLACES 250-701

		MATERIAL	DRAWN JD	DATE	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK JD		
			PRODUCTION		TITLE: USER WIRING, SERIES 250
		FINISH	PROJ ENG		
NEXT ASSY	USED ON	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 A | CAGE CODE 33321 | DWG NO 700-0089 | REV A
APPLICATION					SCALE NONE | SHEET 1 OF 1

REVISIONS			
REV	DESCRIPTION	DATE	APP
A	DRAWING NO. WAS 250-704. (CS)	951107	



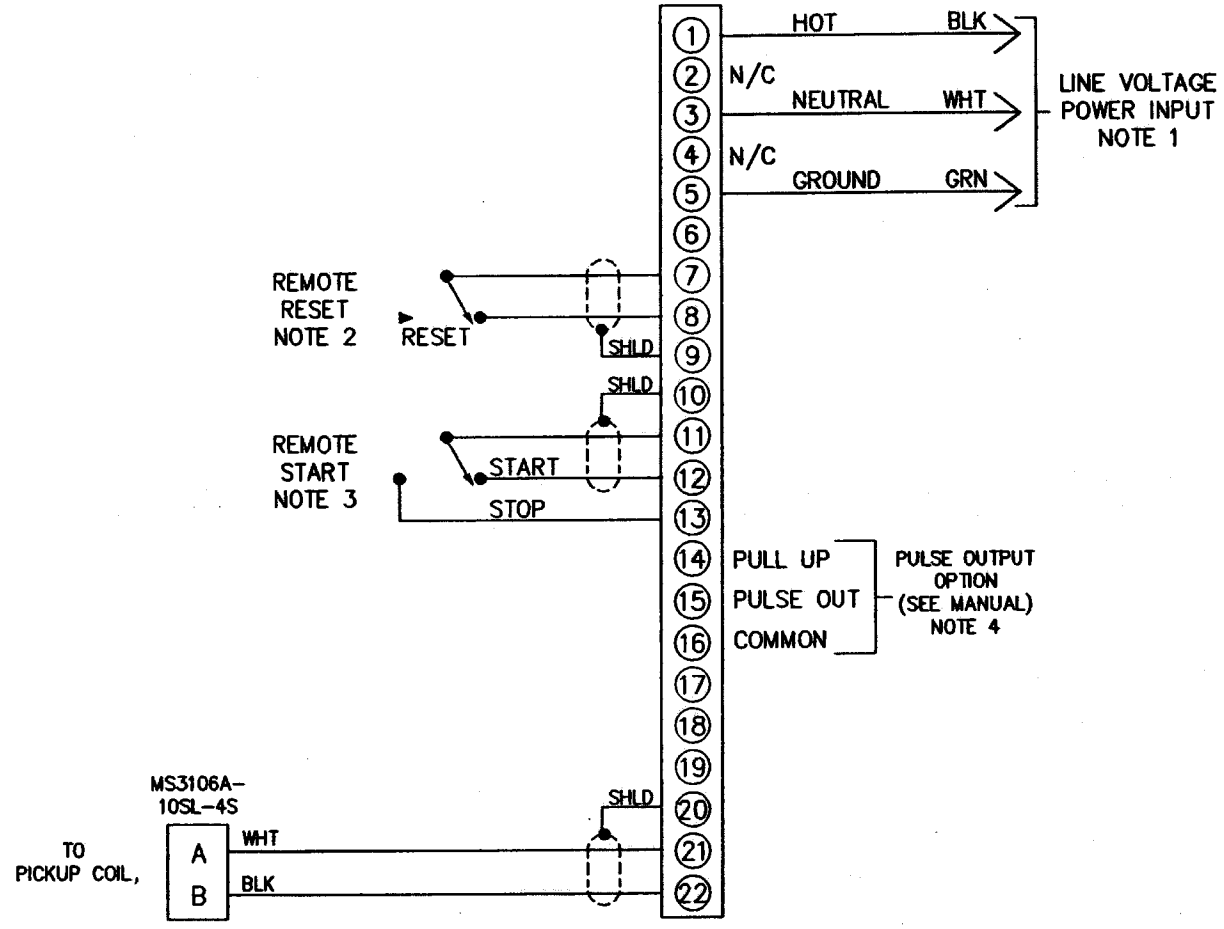
PULSE FORM	WIRING DESCRIPTION	SIGNAL +	SIGNAL -
OPEN COLLECTOR	OMIT J1, SOLDER GAP 1	15	16
TTL/CMOS	EQUIP JI, SOLDER GAP 1	15	16
HTL	EQUP J1, OMIT SOLDER GAP 1	15	16
OPTO DRIVE	OMIT J1, SOLDER GAP 1	14	15

REPLACES 250-704

		MATERIAL	DRAWN JD	DATE	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK JD		
			PRODUCTION		TITLE CONFIGURING 250 PULSE OUTPUT STAGE
		FINISH	PROJ ENG		
NEXT ASSY	USED ON	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 A	CAGE CODE 33321	DWG NO 700-0088	REV A
APPLICATION				SCALE NONE		SHEET 1 OF 1	

NOTES:
1. INPUT POWER OPTION IS EITHER 110VAC OR 220VAC DEPENDING ON FACTORY WIRED OPTION SELECTED.
2. REMOTE RESET IS A SPDT SPRING RETURN SWITCH. JUMPER TERMINALS 7 & 8 IF NOT USED.
3. REMOTE START IS A SPDT SWITCH. JUMPER TERMINALS 11 & 12 IF NOT USED.
4. PULSE OUTPUT IS SCALED TO SAME UNITS OF MEASURE AS INDICATOR.

REVISIONS			
REV	DESCRIPTION	DATE	APP
A	DRAWING NO. WAS 250-702. (CS)	951107	



REPLACES 250-702

		MATERIAL	DRAWN JD	DATE 12/85	HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK		
		FINISH	PRODUCTION		TITLE: INTERCONNECTING WIRING, MAGNETIC PICKUP - SERIES 250
			PROJ ENG		
NEXT ASSY	USED ON	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 A | CAGE CODE 33321 | DWG NO 700-0090 | REV A
APPLICATION					SCALE NONE | SHEET 1 OF 1

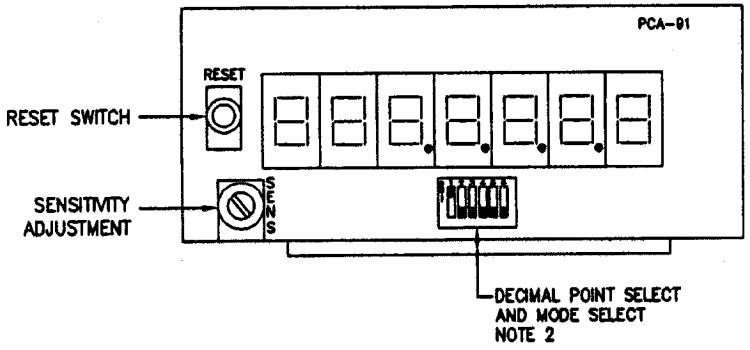
DWG NO.	500-0271	SH 1	REV A

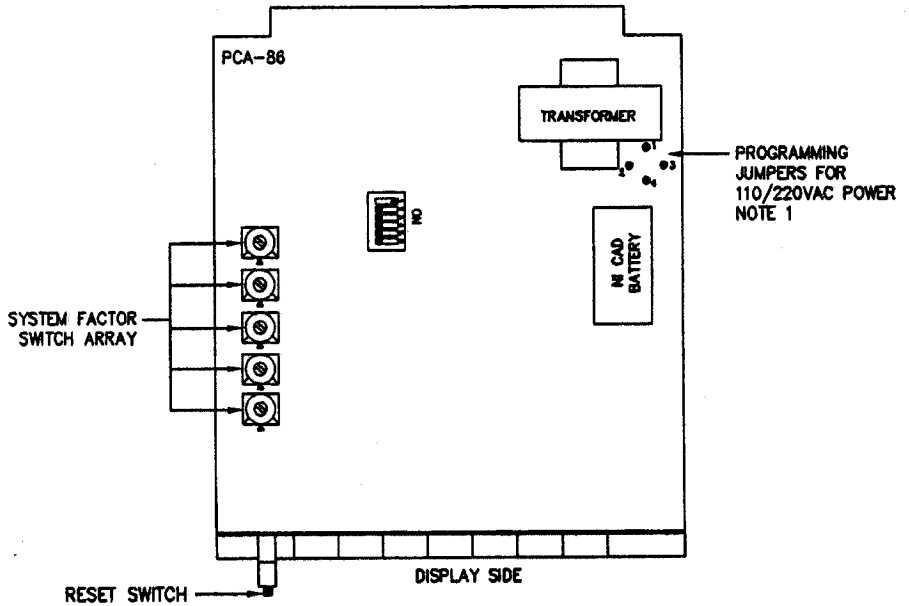
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPD
	A	DRAWING NO. WAS 250-401. (CS)	951108	JD

NOTES:

1. TO POWER UNIT FROM 110VAC, INSTALL JUMPER BETWEEN LOCATIONS 1 & 2, 3 & 4. FOR 220VAC OPERATION INSTALL A JUMPER FROM 1 TO 4.
2. DECIMAL POINT SELECT/ MODE SELECT

SWITCH (ON)	SELECTION
1	XXXXXX.X
2	XXXXX.XX
3	XXXX.XXX
4	XXX.XXXX
5	RATE (ON)/TOTAL (OFF)
6	N/A





		MATERIAL	DRAWN JD	DATE 12/85
			CHECK	
			PRODUCTION	
		FINISH	PROJ ENG	
NEXT ASSY	USED ON	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 THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMAL ± .01, 3 PLACE DECIMAL ± .005, FRACTIONAL ± 1/64, ANGULAR ± 1/2°	
APPLICATION				

HOFFER FLOW CONTROLS, INC.
ELIZABETH CITY, NC 27909

TITLE

CONTROLS AND ADJUSTMENTS MODEL 250

SIZE	CAGE CODE	DWG NO	REV
B	33321	500-0271	A

SCALE NONE		SHEET 1 OF 1

SECTION III

Section III

CALIBRATION AND SETUP OF THE DIGITAL FLOW TOTALIZER

General

All flow totalizer manufactured by Hoffer Flow Controls have a special feature which allows the user to scale the flow information into desired units of measure. This information is dialed into a rotary switch array called SYSTEM FACTOR. By using the SYSTEM FACTOR the total flow may be indicated in gallons, pints, liters, barrels etc.

In general all digital flow indicators manufactured by Hoffer Flow Controls are factory calibrated to user requirements at time of purchase.

All systems that underwent such a factory calibration are supplied with an application sheet. This sheet gives the details of calibration and should be verified upon receipt of the order. The following information will be given:

1. Flowmeter model number and serial number.
2. Mean 'K' Factor.
3. The series 250 model number and serial number.
4. The units of flow measurement.
5. SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER settings.
6. Decimal point selection.
7. Pulse output type, pulse duration and maximum count speed.
8. Special notes concerning other aspects of the system as well a list of accessories, connectors and cables provided.

Field calibration is only required when a change has occured or is sought to the measuring system. Such a change may be due to repair, replacement, or recalbration of the system.

PROCEDURE

Begin by obtaining a copy of the flowmeter calibration sheet, and obtain the MEAN K FACTOR in cycles/gallon and term this K FACTOR. Also obtain the desired units of measurement from the equipment specifications or project supervisor. If the flowmeter is one from the Mini Flow series also obtain the offset frequency, CF(OS).

Compute the equivalent number of pulses per desired unit of measure, designated as K' from the K FACTOR for the flowmeter and the conversion factor relating the gallons to user desired measurement units. The following equation along with a conversion chart should be used.

K' = K FACTOR X 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 x .2642
= 52.84 pulses/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 desird units.

It is important to consider how to best represent a required scale factor within the limitation of the SYSTEM FACTOR and SYSTEM FACTOR MULTIPLIER. Range of adjustment for the SYSTEM FACTOR is from 0.0001 thru 1.9999 in 0.0001 increments. The SYSTEM FACTOR MULTIPLIER will multiply by either X1, X.1, X.01, X.001, or X.0001. In order to program the SYSTEM FACTOR MULTIPLIER the followin chart should be used.

MULTIPLIER	SWITCH POSITION 1	2	3	4
X1	ON	OFF	OFF	OFF
X.1	OFF	ON	OFF	OFF
X.01	OFF	ON	ON	OFF
X.001	OFF	ON	OFF	ON
X.0001	OFF	ON	ON	ON

In the previous example, K' = 52.84 pulses/liter, for a total readout of liters the calculated SYSTEM FACTOR will be 0.0189251. The best representation of this setting would be to dial into the SYSTEM FACTOR SWITCHES 1.8925, while programing the SYSTEM FACTOR MULTIPLIER to multiply by X.01.

SYSTEM FACTOR CALCULATION

When the series 250 is being used with a axial in line meter or na insertion flowmeter, the SYSTEM FACTOR is calculated by the following equation:

SYSTEM FACTOR = 1/K'

WHERE K' IS PULSES/UNIT VOLUME.

For example if K' = 52.84, SYSTEM FACTOR = 1/52.84 = 0.0189251.

When the Mini Flow (MF) series flowmeter is being used an optional flowmeter linearizer is equiped in the series 250. The option is equiped with an OFFSET FREQUENCY switch matrix. This switch matrix is located on the printed circuit board PCA-93, which is used to enter the offset frequency of the Mini Flowmeter. The circuity linearizes the conditioned output signal from the flowmeter by the method of frequency injection of offset frequency. The offset frequency F(OS) is given on the flowmeter calibration sheet, and should be dialed into the rotary switch array.

In addition, the method used to implement the linearization requires a post scaling factor which must be accounted for in calculating the SYSTEM FACTOR. When this linearization option is equiped the following equation is used to calculate the SYSTEM FACTOR.

SYSTEM FACTOR = 8/K'

WHERE K' IS PULSES/UNIT VOLUME.

RATE INDICATOR CALIBRATION

Rate indication is achieved by placing the MODE select switch in the RATE position. This allows the timebase generator and control logic circuitry to latch counts to the display and reset the display.

The units of rate indication is determined by the totalizer units of measure. For example if the model 250 is reading out in whole gallons the rate indicator will readout in GPM. Calibration for rate indication is the same procedure as for the totalizer.

PROCEDURE

Begin by obtaining a copy of the flowmeter calibration sheet, and obtain the MEAN K FACTOR in cycles/gallon and term this K FACTOR. Also obtain the desired units of measurement from the equipment specifications or project supervisor. If the flowmeter is one from the Mini Flow series also obtain the offset frequency, CF(OS).

Compute the equivalent number of pulses per desired unit of measure, designated as K' from the K FACTOR for the flowmeter and the conversion factor relating the gallons to user desired measurement units. The following equation along with a conversion chart should be used.

K' = K FACTOR X 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 x .2642
= 52.84 pulses/liter

Once the K FACTOR has been obtained for desired units the system factor setting is then calculated as previously discussed. In the previous discussion the desired units of readout are liters, this yields a system factor setting of 1.8925 ignoring the system factor multiplier.

Normal operation can be assumed when the display reading is that obtained by the following equation.

READING = (FREQUENCY IN) X (SYSTEM FACTOR) X (TIME BASE)

Typically the timebase is 0.6 seconds for units per minute and 1.0 seconds for units per second, the timebase is factory set at time of order and should be specified at time of purchase.

The rate indicator will provide three significant digits of resolution, which can be extended to five digits by use of the frequency multipliers. Refer to section II drawing 250-401 inorder to located the SYSTEM FACTOR/RATE MULTIPLIER SWITCH ARRAY switches. Switch positions 5 and 6 control the number of digits that will be displayed in the rate mode of operation. The

following chart details the proper switch positions for desired rate display.

MULTIPLIER	SWITCH POSITION	5	6
X1		OFF	OFF
X10		ON	OFF
X100		ON	ON

After desired resolution of flow rate units has been achieved select the proper decimal point location.

CALIBRATION OF DIGITAL RATE INDICATOR - GENERAL CONSIDERATIONS

INTRODUCTION

In general, all flow measurement systems supplied by Hoffer Flow Controls have been factory calibrated as specified by the user, at the time of purchase, free of charge.

All systems which under went such a factory calibration have a calibration card attached prior to shipment. This card contains the flow rate units of measurement, the details of analog outputs, as well as, other useful calibration data.

Field calibration is only required when a change has occurred or is sought to the measuring system. Such a change may be due to repair, replacement or recalibration of the flowmeter, or perhaps a change in the readout units.

PROCEDURE FOR USE WITH TEMPERATURE/PRESSURE COMPENSATION OPTION

Begin by determining the equivalent maximum flow rate expected by the application, term this R (MAX) in the desired measurement units. R (MAX) may be based on the analog output span desired or upon the maximum flow capabilities of the flowmeter under existing line conditions.

Convert R (MAX) to units of standard cubic feet per minute, term this SCF/M MAX. Use of a conversion chart may be required.

Finally, note R (MAX) may be in terms of volumetric or mass units. The number of significant digits of R (MAX) should be choosen so that it fits within the capabilities of the 3½ digit display.

Calculate the flowmeter output frequency corresponding to the desired maximum flowrate SCF/M using the following equation:

$$F_{MAX} = SCF/M_{MAX} \times \frac{14.7}{P_{FS}} \times \frac{T_{FS}}{530} \times \frac{K}{60}$$

WHERE:

P_{FS} is Full Scale Pressure in PSIA

T_{FS} is Full Scale Temperature in ^{o}R

It is possible to calibrate the unit using either the internal "TEST" feature or an external oscillator.

Place the "Volumetric/Compensate" Control in the "Volumetric" position while performing the following calibration procedure. Before placing the Series 250 into active service, return the "Volumetric/Compensate" control to the "Compensate" position.

SECTION IV

Section IV

INITAL STARTUP

On inital startup 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 hace been 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. Digits three thru seven will be blanked out. With no flow, the display should not be incrementing.

If there are counts beign generated, indicating flow, noise is being coupled into the unit. Slowly turn the "SENS" control on the model 250 (or the signal conditioner if one is used) counter clock wise until the false counting stops. The sensitivity control on the 250 effects the magnetic input only.

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

THEORY OF OPERATION

General

The Series 250 is a Digital Flow Totalizer whose basic theory of operation may be summarized by the following description.

The Series 250 contains input signal conditioning circuity suitable for use with magnetic pickups or with compatable signal conditioners. If the miniflowmeter linearizer has been equipped, the offset frequency is injected in order to compensate for the nonlinear characteristics of the flowmeter. The conditioned and shaped pulse is scaled to desired units of measure for counter update and is also buffered for pulse output for driving remote data acquisition systems. A power supply circuit provides the necessary operating bias voltages.

DETAILED THEORY OF OPERATION

A turbine flowmeter equiped with a magnetic pickup coil is connected to the series 250 with a twisted pair shielded cable. The low level signal enters conditioning circuitry which is composed of a variable attenuator (sensitivity adjustment), a bandpass filter, an a comparitor with hysterisis. The bandpass filter is used to reject spurious noise which is out of the

normal frequency range generated by a turbine flowmeter (i.e. 10 to 3000HZ) while amplifingthe band signal of the flowmeter. The attenuator and comparitor with hysterisis function to provide a selectable trigger level which is usually set above background noise pickup yet below the signal level generated by the flowmeter. This combination assures that under no flow conditions zero flow will be indicated.

If the turbine flowmeter is equipped with a signal conditioner the conditioned signal will the be connected to series 250 via the opto-isolated input. The opto-isolated input is constructed around an opto-isolated transistor with suitable input current limiting and output conditioning to provide an isolated signal path. The isolated input eliminates installation problems related to equipment grounding and can accept 3 to 30 Vdc pulses of the appropriate polarity. The output conditioning circuitry produces an output swing suitable for use with the logic circuitry contained in the series 250.

The pulses generated from the magnetic pickup conditioner and the opto-isolated conditioner are combined by an "OR" gate, which will allow either pulse train to be outputed to the scaling circuitry.

For low flow measurement applications which make use of pelton wheel type flowmeters such as the Hoffer MF Series a special section of circuitry is needed to eliminate the nonlinear transfer characteristic of the MF Series.

The Miniflowmeter Linearizer implements the offset frequency injection method of linearization, by injecting into the conditioned input frequency signal, the required offset frequency necessary for linearization.

A thumbwheel programmable oscillator is used to generate the offset frequency. After injection post scaling division by eight is performed to reduce irregular pulse spacing which inherently occurs in this circuit implementation.

The linearized and conditioned signal is then inputed into a "NAND" gate along with the output of the START/STOP Flip Flop. This "NAND" gate permits the conditioned signal to pass into the pulse scaling network, as long as the START/STOP switch is in the START position.

The pulse scaling circuitry composing of the system factor affectively 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 the divide into two stages, where one stage is for total flow indication and the second stage is for rate indica-

tion.

The pulse from the first stage is fed into the system factor mulltiplier 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.

The pulse outpput of the system factor which is used for rate indication is fed into a frequency multiplier which will multiply the pulse by 1, 10, or 100 depending on the programing option selected. This pulse along with the scaled total pulse are then fed into control circuitry which determines if the series 250 will be a totalizer or rate indicator. To program the series 250 to be either a totalizer or rate indicator switch position 5 of the decimal point array will be OFF for total and ON for rate.

Rate indication is accomplished by programing switch 5 for the rate mode, in this mode of operation total flow information is not retained. Basic operation is that a factory adjusted timebase is used to generate a latch and reset pulse. The control circuitry permits the scaled pulse to be counted internally by the display driver for a period of time as determined by the timebase generator. At the termination of the time period a latch pulse is generated which allows the counts to be updated or displayed on the LED display. This then becomes the flow rate information diplayed in the same units as in thr total mode (i.e. gallons becomes gallons/minute). This reading will be held on the display until the next latch pulse is generated.

After the latch pulse has been generated and the display updated a reset pulse is generated which resets the internal count register of the display driver. Once reset the control logic permits internal counting for the timebase period. This process is performed until the mode switch is once again placed in the total mode of operation.

When the series 250 is in the rate indication mode the pusle output is still generating a pulse equal to unit volume of flow.

The power supply consists of a split primary dual secondary transformer, two rectifier bridges with power filters and one regulator with power monitoring which provide the operating voltage for the series 250. Also a 16 Vdc voltage at 20 mA is provided for excitation of signal conditioners.

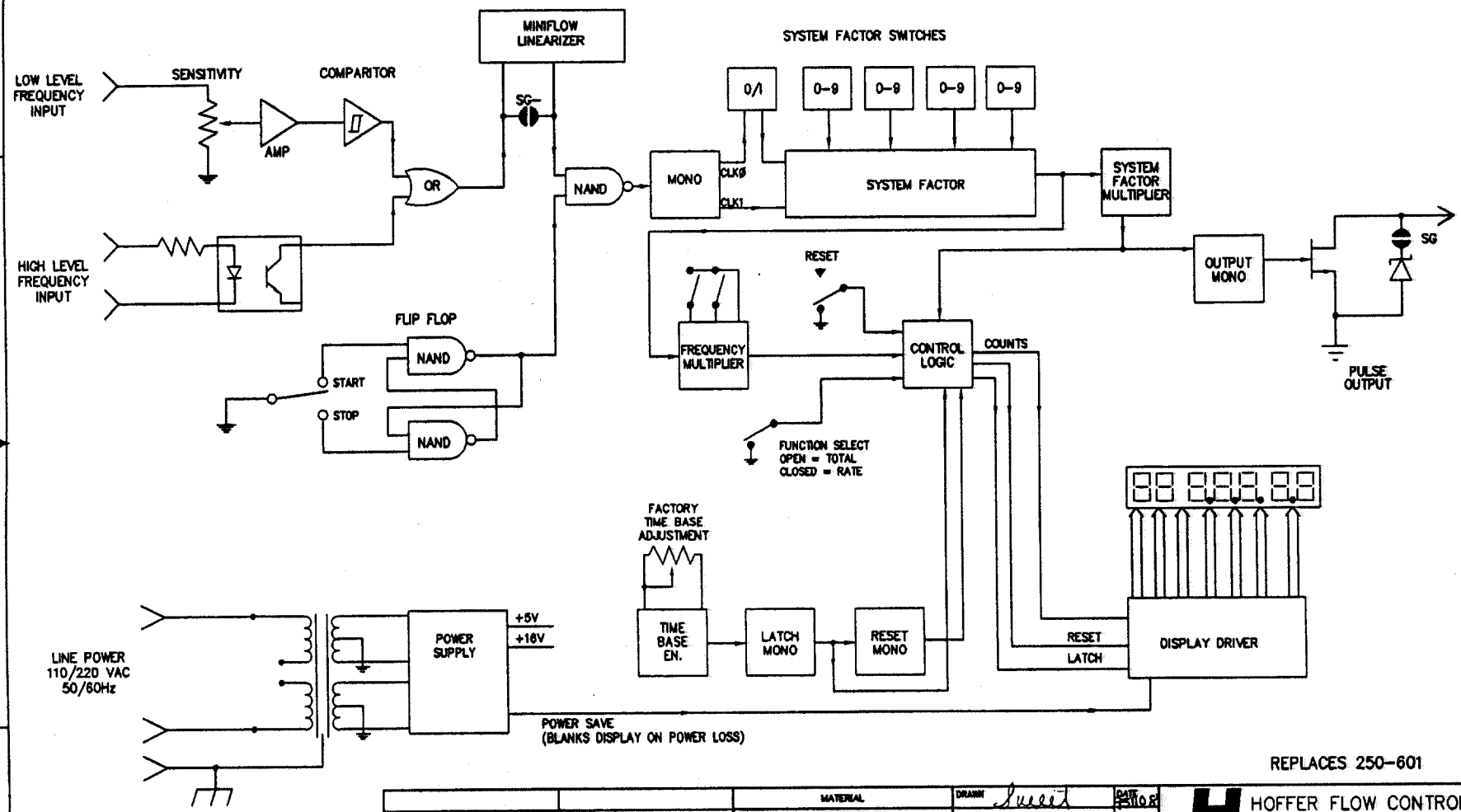
The power supply is equiped with a power monitor which detects a power fail condition. Upon a power fail condition a power save pulse is generated which will blank the display to conserve power, so that the battery backup feature will operate for 48 hours with out loss of flow information.

The transformer primary is jumper programable for operation at either 110 or 220 Vac. Transient suppression is provided by surge suppresion MOV's.

DWG NO.	700-0091	SH 1	REV A

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APP
	A	DRAWING NO. WAS 250-601. (CS)	951108	JS



REPLACES 250-601

		MATERIAL	DRAWN	DATE 951108
			CHECK	951108
			PRODUCTION	
		FINISH	PROJ ENG	951108
			MACH SHOP	
NEXT ASSY	USED ON	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 THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMALS ± .01, 3 PLACE DECIMALS ± .005, FRACTIONAL ± 1/64, ANGULAR ± 1/2°	
APPLICATION				

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE: BLOCK DIAGRAM MODEL 250

SIZE	CAGE CODE	DWG NO	REV
C	33321	700-0091	A

SCALE NONE SHEET 1 OF 1

SECTION V

Section V

TROUBLE SHOOTING AND MAINTENANCE

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

A recommended spare parts list is given immediatly 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 seperately.

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 Series 250 can be assumed when:

a. Appling power to the unit causes the LED display to light.

b. Depressing the RESET return the counter to zero.

c. The appropriate exitation voltage is available for use with the signal conditioner.

d. With no flow present the display indicates 0000 and output pulse is generated.

e. With flow present the display increments in correct units as does the pulse output.

OBSERVED CONDITION	CORRECTIVE ACTION
UNIT REPEATADLY BLOWS FUSES	1. Inspect terminal strip wiring for conformity to installation instructions and for acceptable workmanship. 2. Verify correct fuse size. 3. Replace PCA-86 assembly.
LED DISPLAY FAILS TO LIGHT	1. If AC powered verify that the fuse is okey and replace as needed. 2. Replace counter module PCA-91. 3. Replace PCA-86.

	NOTE: THE COUNTER MODULE SHOULD ONLY BE CHANGED BY QUALITIED PERSONAL, USING EXTREME CARE.
LED SEGMENTS FAIL TO LIGHT	1. May occur on startup. Push RESET. 2. Replace counter module. NOTE: THE COUNTER MODULE SHOULD ONLY BE CHANGED BY QUALIFIED PERSONAL, USING EXTREME CARE.
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 OPERATE. 2. Replace pickoff coil and/or cable. 3. Replace PCA-86 or repair.
OPTO-ISOLATED INPUT DOES NOT WORK PROPERLY	1. Verify wiring and polarity of input pulse. 2. Input waveform duty cycle not 30/70 to 70/30/ 3. Input drive levels not 3 to 30 Vdc 4. Replace or repair PCA-86. 5. Random noise coming in on the magnetic pickup input. Turn SENS fully CCW.
MAGNETIC PICKUP INPUT DOES NOT WORK PROPERLY	1. Check input wiring. 2. Turn SENS C.W. 3. Inadequate signal level 30mVp-p minimium 10 to 2500 HZ. 4. Input waveform not compatible with 30/70 to 70/30 duty cycle. 5. Replace or repair PCA-86.
PULSE OUTPUT MALFUNCTION	1. Check wiring to pulse output.

	2. Verify jumper options on PCA-86
	3. Verify recieving device.
	4. Replace or repair PCA-86.
UNIT GIVES ERRONEOUS READINGS WITH MINI FLOWMETER LINEARIZER	1. Replace PCA-93
	2. Check Mini Flowmeters calibratioin.

RECCOMMENDED SPARE PARTS

PCA-86	PRINTED CIRCUIT CARD	1
PCA-91	COUNTER MODULE	1
PCA-93	MINIFLOW LINEARIZER	1
	PICKUP COIL	1
	LENS	1
	BEZEL	1
	ENCLOSURE	1
	MOUNTING BRACKET SET	1
	CARD EDGE CONNECTOR	1
	SPARE CABLE SET	1
	PICKUP COIL CONNECTOR	1
	SIGNAL CONDITIONER	