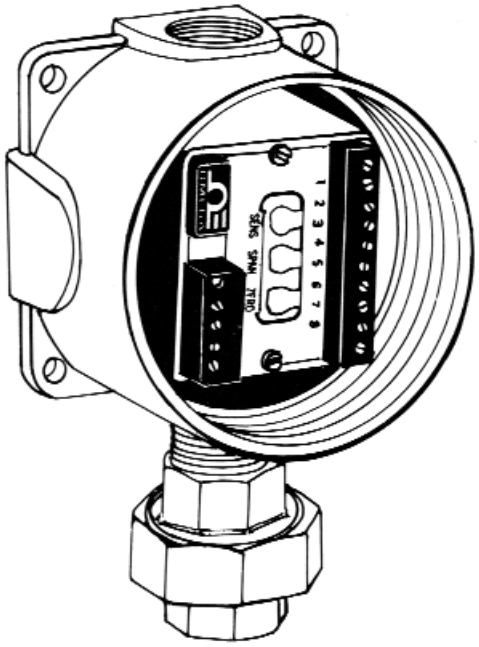
CE

User's Guide



FLSC-18B, FLSC-28, FLSC-34, FLSC-35B, FLSC-51/51B
Signal Conditioners

omega.com®
ΩOMEGA®

OMEGAnet® Online Service www.omega.com	Internet e-mail info@omega.com

Servicing North America:

USA: ISO 9001 Certified
One Omega Drive, Box 4047
Stamford CT 06907-0047
Tel: (203) 359-1660 FAX: (203) 359-7700
e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec) H7L 5A1
Tel: (514) 856-6928 FAX: (514) 856-6886
e-mail: info@omega.ca

For immediate technical or application assistance:

USA and Canada:
Sales Service: 1-800-826-6342 / 1-800-TC-OMEGA®
Customer Service: 1-800-622-2378 / 1-800-622-BEST®
Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®
TELEX: 996404 EASYLINK: 62968934 CABLE: OMEGA

Mexico:
En Español: (001) 203-359-7803 e-mail: espanol@omega.com
FAX: (001) 203-359-7807 info@omega.com.mx

Servicing Europe:

Benelux:
Postbus 8034, 1180 LA Amstelveen, The Netherlands
Tel: +31 (0)20 3472121 FAX: +31 (0)20 6434643
Toll Free in Benelux: 0800 0993344
e-mail: nl@omega.com

Czech Republic:
Rudé armády 1868, 733 01 Karviná 8
Tel: +420 (0)69 6311899 FAX: +420 (0)69 6311114
Toll Free: 0800-1-66342 e-mail: czech@omega.com

France:
9, rue Denis Papin, 78190 Trappes
Tel: +33 (0)130 621 400 FAX: +33 (0)130 699 120
Toll Free in France: 0800-4-06342
e-mail: france@omega.com

Germany/Austria:
Daimlerstrasse 26, D-75392 Deckenpfronn, Germany
Tel: +49 (0)7056 9398-0 FAX: +49 (0)7056 9398-29
Toll Free in Germany: 0800 639 7678
e-mail: germany@omega.com

United Kingdom: ISO 9002 Certified
One Omega Drive, River Bend Technology Centre
Northbank, Irlam, Manchester
M44 5EX United Kingdom
Tel: +44 (0)161 777 6611 FAX: +44 (0)161 777 6622
Toll Free in United Kingdom: 0800-488-488
e-mail: sales@omega.co.uk

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order 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, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

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

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

GENERAL TABLE OF CONTENTS

FLSC-35B With Explosion-Proof Housing Mounted on FTB 100 Turbine Meter

NOTES:

GENERAL CONSIDERATIONS

FLOWMETER INSTALLATION

Proper application of the turbine flowmeter requires a suitable piping installation in order to achieve accurate and reliable operation. (Refer to Figure 1).

The piping configuration immediately preceding and following the flowmeter is termed the meter run. Refer to the flowmeter's operators manual when installing the flowmeter and meter run.

RELATIVE - The performance of the turbine flowmeter is affected by fluid swirl and non-uniform velocity profiles. The following recommendation will reduce such flow irregularities.

It is advisable not to locate the meter run immediately downstream of pumps, partially opened valves, bends or other similar piping configurations. In addition, the area surrounding the flowmeter should be free of sources of electrical noise such as motors, solenoids, transformers and power lines which may be coupled to the pickoff device.

The metering section should not be subjected to excessive vibration or shock. Such a condition may result in a mechanically induced output signal from the pickoff device.

METER RUN - In general, the meter run should be chosen to have the same inner diameter as the meter bore. A minimum of 10 pipe diameters of straight pipe up stream and 5 pipe diameters downstream are required. Where this optimum line configuration can not be implemented, it is advisable to install a flow straightener properly positioned upstream of the f lowmeter. Orientation is not a critical factor, however, horizontal is a preferred orientation.

BYPASS RUN - A properly sized bypass run with suitable blocking valves may be equipped where an interruption in fluid flow for turbine meters servicing can not be tolerated.

STRAINER - A strainer, filter and/or air eliminator is recommended to reduce the potential of fouling or damage.

On initial startup of a line, it is advisable to install a spool piece purging the line to eliminate damaging the flowmeter, due to flux, tape, solder, welds or other contaminates carried along by the fluid stream.

CAVITATION - Cavitation causes measurement inaccuracies in turbine flowmeters and should be avoided by suitable line and operating configurations.

Figure 1. Typical Flowmeter Installation

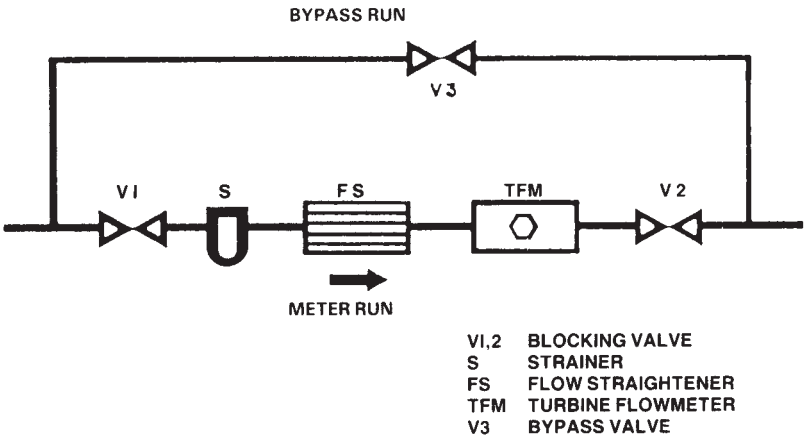


Figure 1. Typical Flowmeter Installation

Whenever the pressure within a pipeline instantaneously falls below. the equilibrium vapor pressure of the fluid, a portion of the fluid, vaporizes and forms bubbles i n the pipeline. This is termed cavitation. Cavitation is eliminated by maintaining adequate back pressure on the flowmeter. A downstream valve that provides the necessary back pressure is one means for preventing cavitation in the metering run. Control valves should be located downstream, if possible. Some installations may also make use of a vapor eliminator upstream of the flowmeter.

The minimum required back pressure may be estimated using the following equation:

Min. Back Pressure = 1.3 X Vapor Pressure + 2X Pressure Drop

INSTALLATION WIRING LAYOUT FOR INTERCONNECTIONS

In considering the interconnections between the flowmeter and the flow measurement system some attention must be given to anticipated noise sources and to the coupling of these noise sources to the interconnecting wiring.

Noise signals may be coupled inductively or capacitively into the wiring between the flowmeter and the electronic measuring systems. In general, utilizing a shielded, twisted pair for the interconnection greatly reduces this coupling. The shield should be grounded on one end of the cable only. In general, grounding only on the electronic measuring system is best.

However, even with proper interconnecting cabling, cross talk with other signal lines or power lines may still occur and should be avoided. Physical isolation in the manner in which the wiring is run reduces the chance of potential problems.

TABLE OF CONTENTS
FLSC-18B SIGNAL CONDITIONER

SECTION 1 INTRODUCTION

The OMEGA® FLSC-18B High Accuracy Integral Signal Conditioner is designed for direct mounting onto OMEGA Series FTB-100 and 200 Turbine Meters.

The input circuitry of the signal conditioners has been designed to receive and condition the low level turbine meter signals while rejecting 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 signal on the output.

The output signal is a DC current (4-20 mA) which is proportional to flow rate. The FLSC-18B is powered by a user supplied, filtered DC voltage. An on board regulator provides the required regulation and noise rejection.

A zero and span potentiometer allow for simple field adjustment of the analog output from the signal conditioner.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION OF THE FLSC-18B

The FLSC-18B should be placed in a convenient location which maintains access to the unit should repairs or readjustment be required.

If the unit is mounted on a turbine flowmeter in an explosion proof conduit enclosure, orientate the flowmeter and run conduit to prevent the accumulation of moisture in the conduit enclosure as much as is practical. In addition, assure electronics will not be overheated by hot process lines.

Refer to Figure 2-1 for outline dimensions. Drill appropriate mounting holes as required.

Refer to Figure 2-2, wiring installation drawing for appropriate terminals for interconnections. The signal leads from the turbine should be shielded whenever the FLSC-18B is not integrally mounted. Ground shield on one end only. If desired,use solder lug provided on ground stud. Connections to the terminal block should be carefully dressed to avoid having bare wires extending pass the screw clamp on the terminal block. This is particularly important or units mounted within the explosion proof enclosure. Wires should be neatly dressed near bottom of enclosure to assure wiring will not become fouled when cover is installed.

Connect two conductor shielded cable from flowmeter. Connect shield to FLSC-18B only.

Unit is powered by a DC voltage which must be within 8 to 40 volts. Connect power as outlined in Figure 2-2.

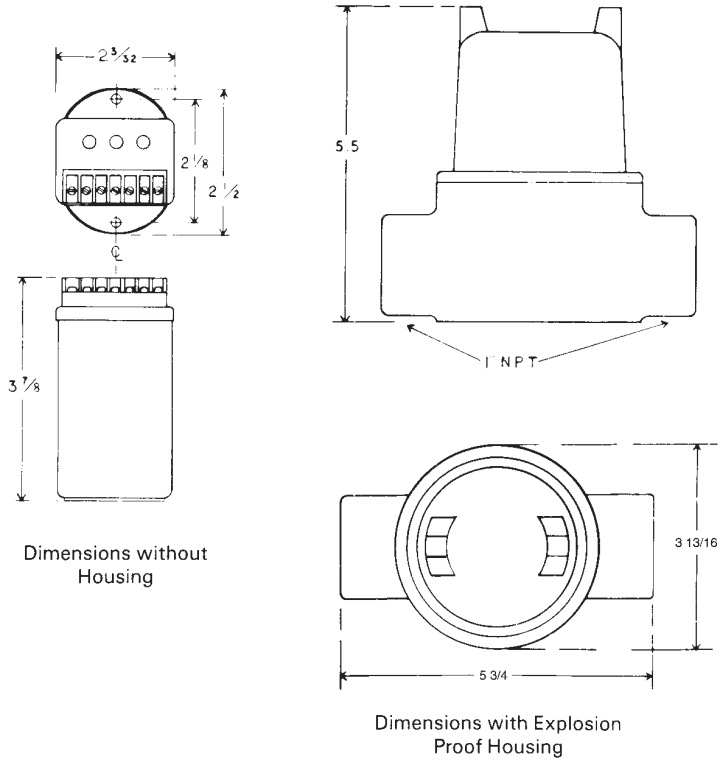


Figure 2-1. Outline Dimensions

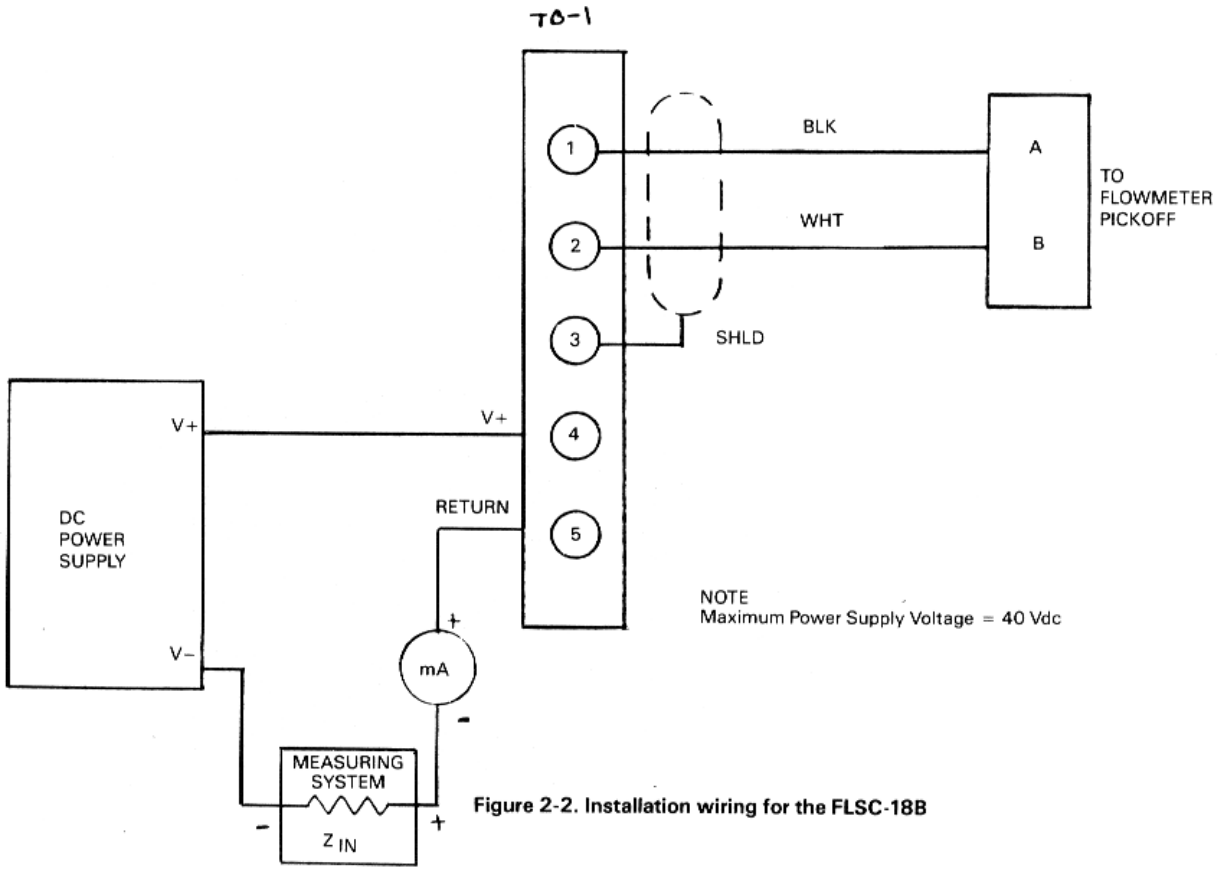


Figure 2-2. Installation wiring for the FLSC-18B

SECTION 3 OPERATION

Perform any purging of piping with spool piece in place, Once completed, install the flowmeter and connect cabling to pickup coil and power to the unit. If false indication occurs turn SENSITIVITY control counter clockwise until indication stops.

3.1 PRINCIPLE OF OPERATION

A simplified block diagram of the FLSC-18B Frequency to Current Converter is shown in Figure 3-1. Key functional blocks as well as flow information are designated. The basic operation of the system is as follows.

The frequency signal from the flowmeter is connected to the FLSC-18B with a twisted shielded pair cable. The signal enters 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.

The signal entering the frequency to voltage converter is passed through a combination of a divide by N and DIP switch matrix. The ON output is chosen whose pulse rate is between 75 and 150 Hz at the maximum flow rate measured. This scaled pulse rate is then filtered into an analog voltage. This voltage is proportional to volumetric flow rate.

The resulting output voltage related to flow is then fed into the output amplifier. The output amplifier is a voltage to current amplifier and offers ZERO and SPAN adjustments in the process range of 4-20 mA.

3.2 CONTROLS AND ADJUSTMENTS (See Figure 3-2.)

SENS A single turn control used to set the threshold sensitivity level above the ambient noise pickup.

RANGE A dual in line (DIP) switch (see Figure 3-3 and Table 3-1.) located within the enclosure which is used to program the module to accept an input frequency range.

SPAN A multiple turn adjustment which is used to set the voltage output signal to the desired span corresponding to the equivalent flow range li.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 (ie., 4 mA).

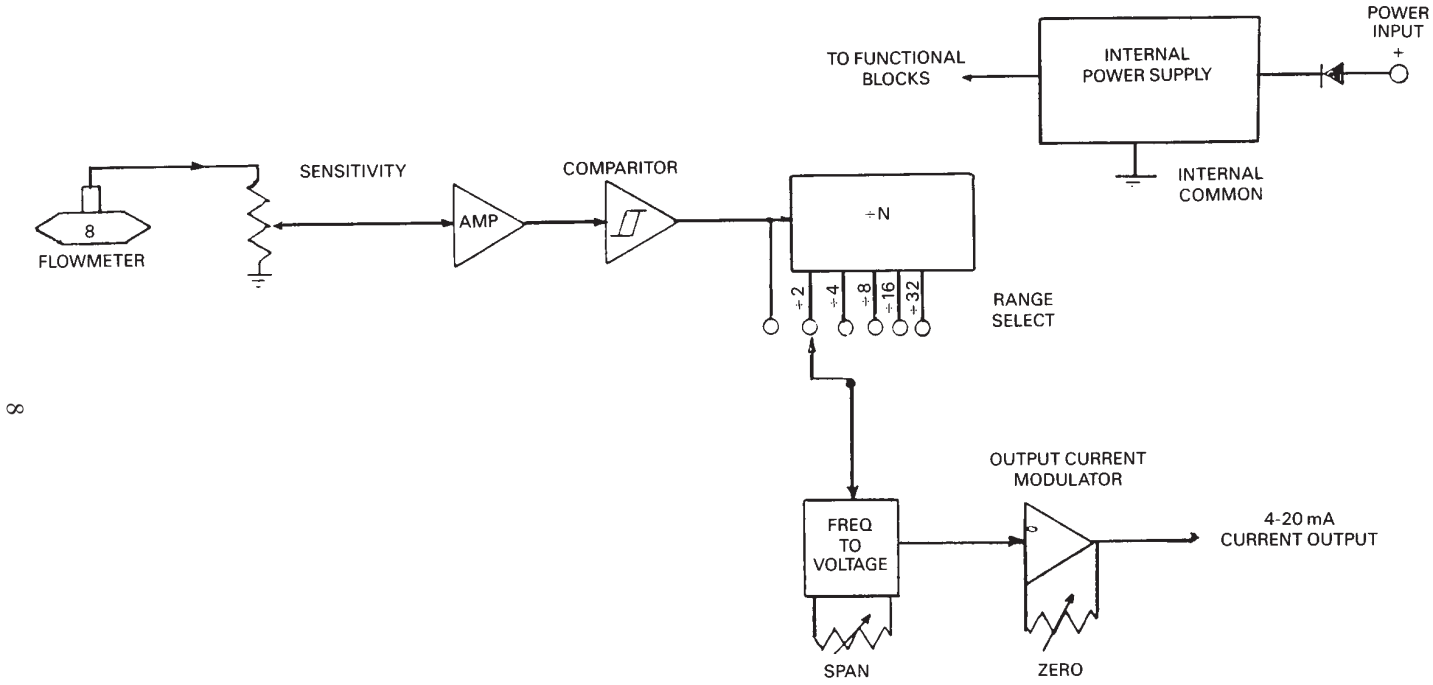


Figure 3-1. FLSC-18B Block Diagram

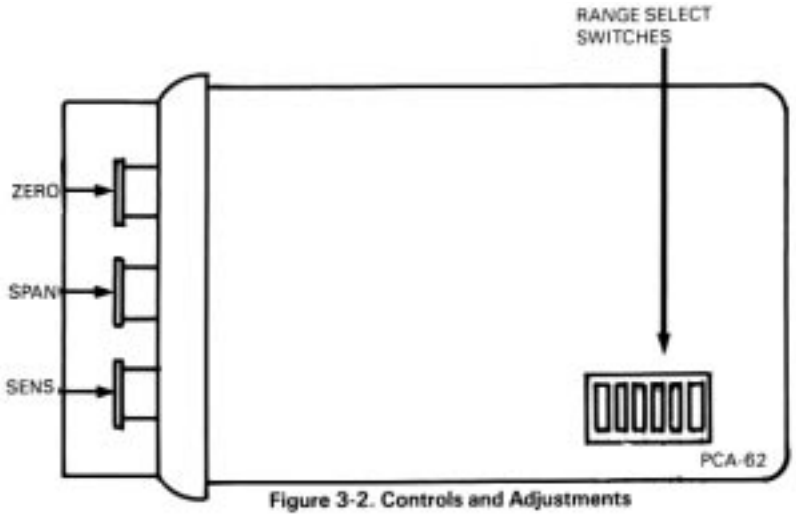
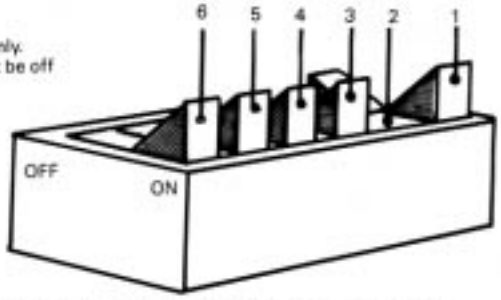


Figure 3-2. Controls and Adjustments

Switch 2 is shown depressed for illustrative purposes only.

NOTE
Select one switch only.
All other switches must be off



1. Open cover by removing the two screws on the side of box. Remove printed circuit subassembly.
2. Turn on desired range position using a ball point pen or similar object.
3. Reassemble in lower case.

Figure 3-3. Range Select for Analog Output

TABLE 3-1
RANGE SELECT

Range Select Switch Position	For F Max.
1	75 to 150
2	150 to 300
3	300 to 600
4	600 to 1200
5	1200 to 2400
6	2400 to 4800

SECTION 4 CALIBRATION OF ANALOG OUTPUT

4.1 INTRODUCTION

In general, all flow measurement systems supplied by OMEGA Engineering have been factory calibrated as specified by the user, at the time of purchase.

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 analog output span.

4.2 PROCEDURE

Begin by determining the equivalent maximum volumetric flow rate in GPM, expected by the application, term this GPM (MAX). GPM (MAX) may be calculated based on the analog output scale requirements or may,be the maximum flow rate listed on the flowmeter's calibration sheet.

From the calibration constant (or K Factor) listed on the data sheet for the flowmeter, obtain the frequency corresponding to GPM (MAX) using Equation #1 and designate this frequency F (MAX).

Equation #1 $$F_{MAX} = \frac{K_{AVE} \times GPM_{MAX}}{60}$$

The analog output of the FLSC-18B may be calibrated with the aid of an external oscillator used in conjunction with a frequency counter.

The external oscillator is used to supply a test frequency. In this method, the external oscillator is connected to the signal input terminals as shown in Figure 4-1. The oscillator's output frequency is set to equal F (MAX) as indicated on the frequency counter.

1. The course range adjustment is accomplished by selecting a switch position on a DIP switch located on the PCA62 printed circuit card. See Table 3-1 to determine required switch position and set into switch as shown in Figure 3-2. for anticipated F MAX.

NOTE

It is necessary to open the cover of the enclosure by removing two screws on side of box and lifting cover. Two printed circuit cards are attached. The "RANGE" Dip Switch may be programmed with a pen. Input power should be removed during this step.

2.. Connect a digital milliampmeter or digital voltmeter as shown in Figure 4-1.

3. Adjust SPAN control fully counter clockwise or 20 turns,
4. Adjust ZERO control for desired zero current (i.e., 4 mA).
5. Inject the Test Frequeney equal to F MAX while adjusting SPAN for current equal to desired Full Scale (20 mA). See test setup shown in Figure 4-1.)

Repeat steps 4 and 5 until no change is observed.

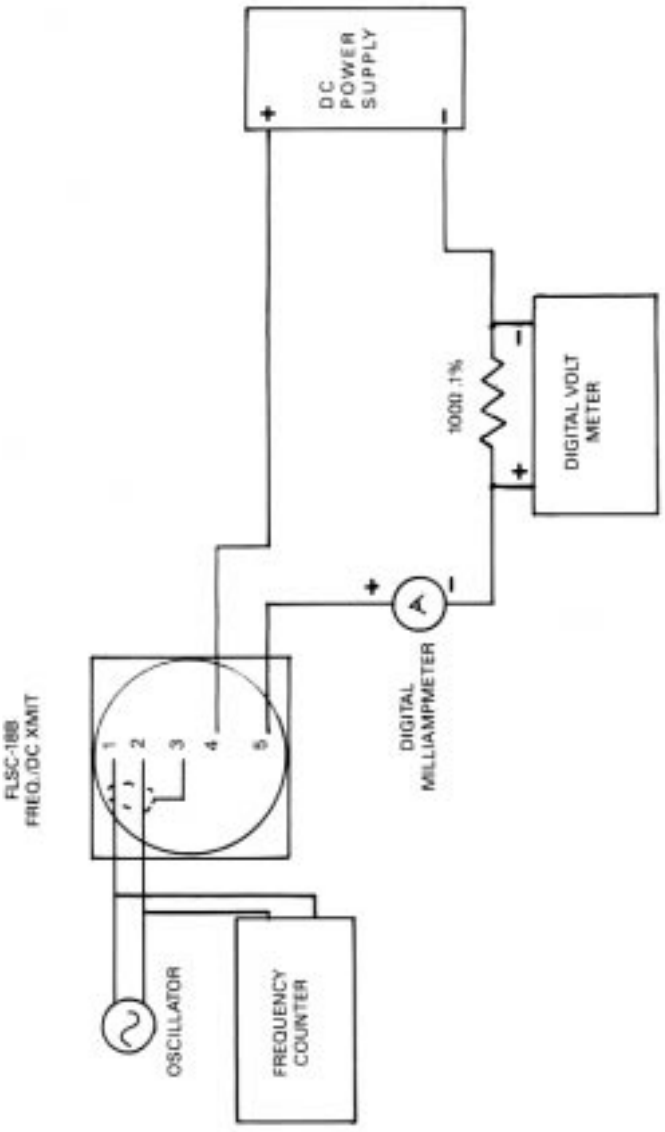


Figure 4-1. Calibration Set-up

SECTION 5 TROUBLESHOOTING

In case of an inoperable or malfunctioning system the following procedures can be used to isolate the faulty wiring, printed circuit boards and/or alternate causes. The majority of repairs can be made in the field thereby reducing the time a unit is out of service.

The necessary documentation is contained within this manual with the exception of the calibration data sheet for the turbine flowmeter. This calibration is supplied with the turbine flowmeter.

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

Failure conditions are listed and the possible corrective actions given to eliminate the observed problem.

Proper operation of the FLSC-18B can be assurned when with power applied to the unit, the analog output produces a current output signal of 4-20 mA with a span corresponding to that established by the calibration procedure.

OBSERVED CONDITION	CORRECTIVE ACTION
A. Analog Output With No Flow	1. Noise on input. Slowly turn SENS pot CCW until false indication stops. NOTE: In fully CCW position the unit will not operate. 2. Replace pickup coil 3. Defective FLSC-186, repair or replace,
B. Incorrect Zero Reading With No Flow	1. Verify that power supply voltage is sufficient for the required load resistance, 2. Unit is out of calibration - re calibrate. 3. Defective FLSC-18B, repair or replace.
C. Current Exceeds Desired Span	1 . Flowmeter being used beyond calibrated span of FLSC-18B 2. Calibration of FLSC-18B in correct. Recalibrate. 3. Defective unit, repair or re place.

D. No Current Output at All	1. Power supply polarity is re versed. Check wiring as per wiring installation. 2. Short on flowmeter coil or shield. Replace coil and check wiring. 3. Defective unit, repair or replace.

SECTION 6 SPECIFICATIONS

INPUT: Input protected, RF and band pass filtered adjustable trigger level.

Input Impedance 40 kilohm (nominal)

Trigger Sensitivity 10 millivolt RMS (minimum) 10 to 1000 Hz
Over Voltage 120 volts RMS absolute (maximum)

CURRENT OUTPUT: Accuracy ±0.05% of full scale +200 PPM/°C

Range 4-20 mA

Response time 0.5 seconds for 10 to 90%

Load Resistance: Dependent on excitation voltage (see Figure 5-1)

$$RLOAD = \frac{V_{Ext} - 8}{I.F.S.}$$

where V_{Ext} = Excitation Voltage
I.F.S. = Full Scale Current
Output ripple less than 0.2% of F.S.

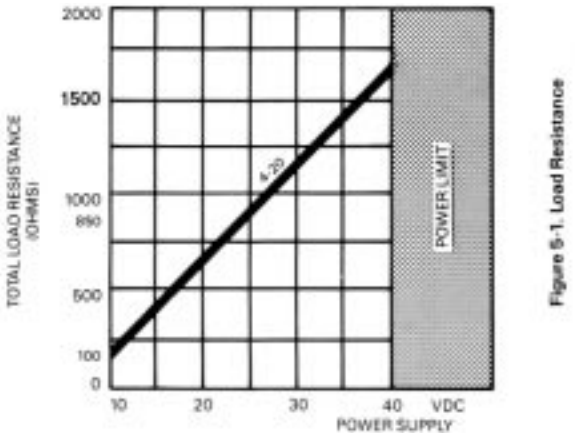
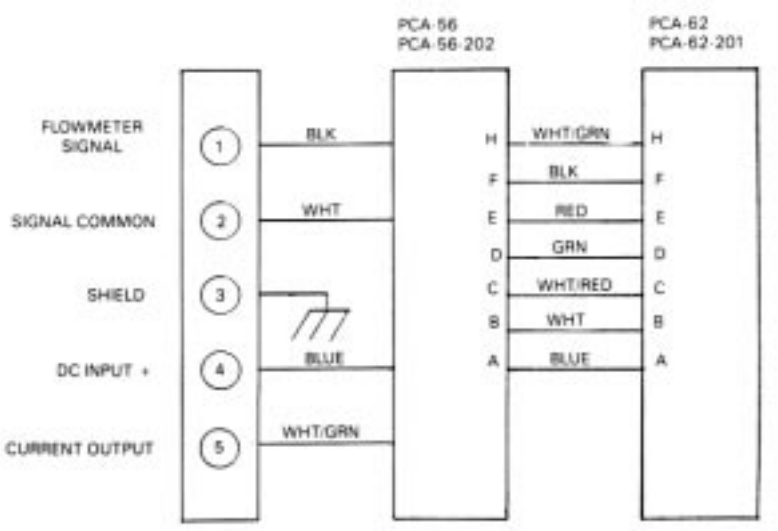


Figure 5-1. Load Resistance

INPUT POWER: 8-40 VdC @ 30 mA
TEMPERATURE RANGE: 0°- 70°C (32° to 158°F)
ELECTRICAL CONNECTIONS: Screw Terminals
MAXIMUM LEAD LENGTH: 100 ft. of 24 gage copper wire

SECTION 6 SPECIFICATIONS (CONT.)

ELECTRICAL HOUSING: Class I, Group D
Class 11 Group E, F, G
Class III



INTERNAL WIRING SCHEMATIC FLSC-18B

TABLE OF CONTENTS
FLSC-28 SIGNAL CONDITIONER

SECTION 1 INTRODUCTION

The OMEGA® FLSC-28 High Accuracy Integral Signal Conditioners are designed for direct mounting onto OMEGA Series FTB-100 and 200 Turbine Meters.

The input circuitry of the FLSC-28 Signal Conditioners has been designed to receive and condition the low level turbine meter signals while rejecting 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 signal on the output.

The FLSC-28 provides a 0-5 V output that runs off user supplied 10-40Vdc power supply. A RESPONSE TIME control provides for adjustment of the response time and output ripple to suit user requirements. Non-interacting ZERO and SPAN controls allow for convenient calibration of desired analog span. These features combine to form an interface between a flow transducer and a host system.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any signs of damage Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION OF THE FLSC-28

The FLSC-28 should be placed in a convenient location which maintains access to the unit should repairs or readjustment be required.

If the unit is mounted on a turbine flowmeter in an explosion proof conduit enclosure, orientate the f lowmeter and run conduit to prevent the accumulation of moisture in the conduit enclosure as much as is practical. In addition, assure electronics will not be overheated by hot process lines.

Refer to Figure 2-1, outline and installation drawings. Drill mounting holes where appropriate.

Refer to Figure 2-2, wiring the FLSC-28 for the appropriate terminals for interconnections.

The signal leads f rom the turbine should be shielded whenever the FLSC-28 is not integrally mounted. Ground shield on one end only If desired, use solder lug provided on ground stud.

Connections to the terminal block should be carefully dressed to avoid having bare wires extending pass the screw clamp on the terminal block. This is particularly important for units mounted within the explosion proof enclosure. Wires should be neatly dressed near bottom of enclosure to assure wiring will not become fouled when cover is installed.

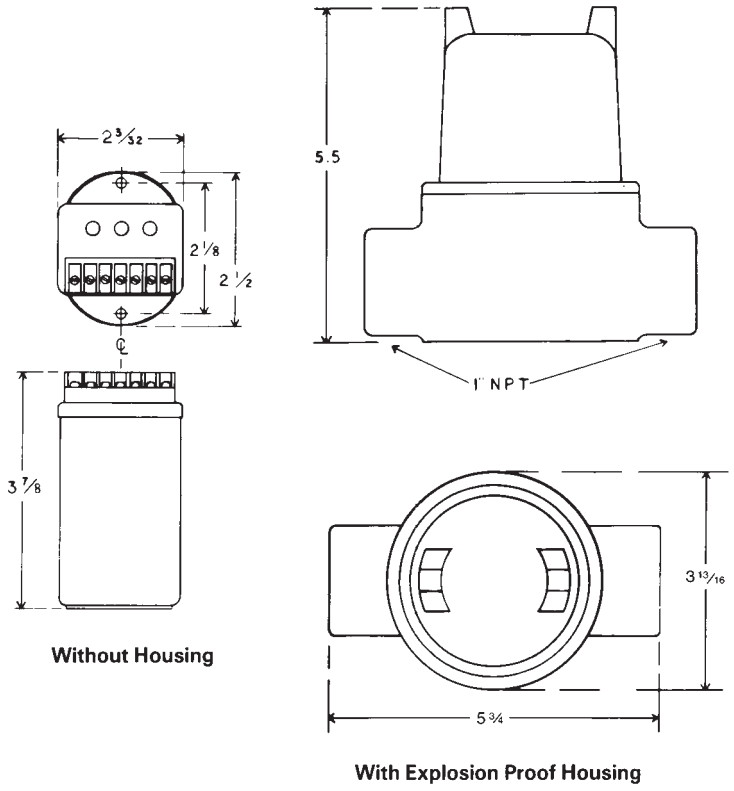


Figure 2-1. Intallation Dimensions

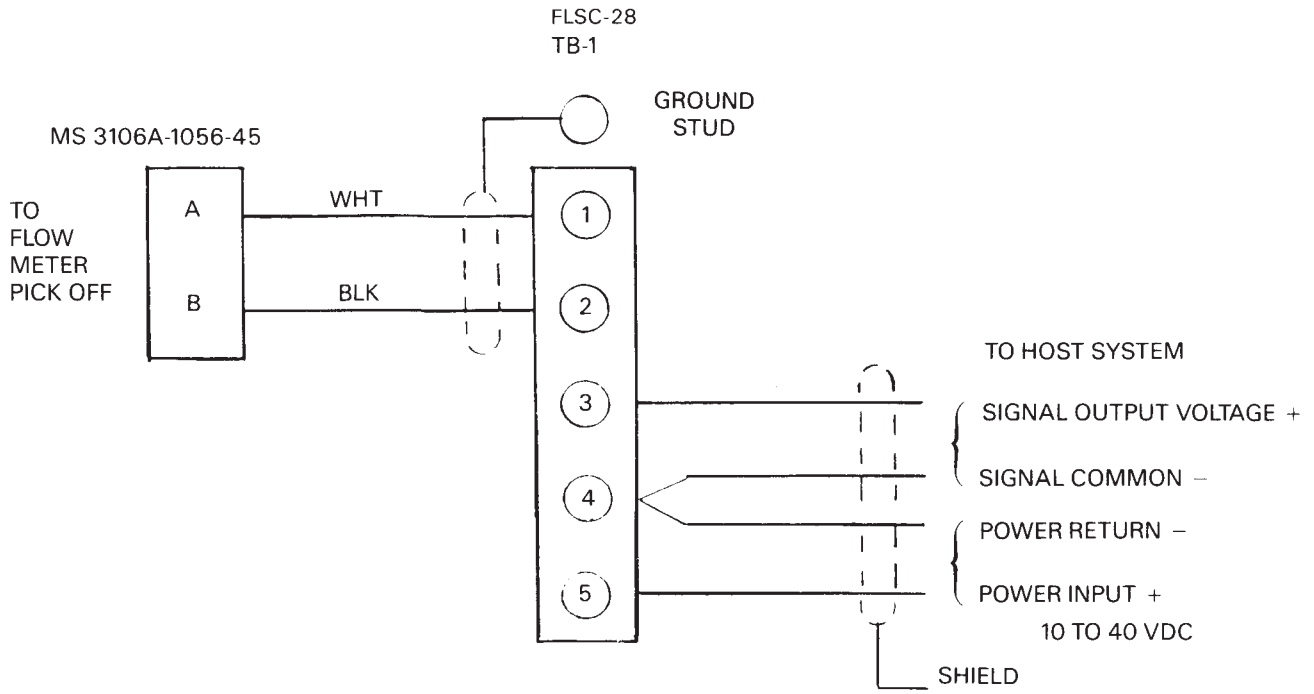


Figure 2-2. Wiring Installation for FLSC-28

The analog output signal leads may be run to the host system's signal input and power with the following options:

1. Four conductor shielded cable
2. Three conductor shielded cable (over short distances)
3. Two, two conductor shielded cables, one pair for signal output, one pair for power input.

Ground shield at one end of cable only.

The power f or the FLSC-28 is provided by the Host System. 10-40 Vdc should be provided and installed with correct polarity.

SECTION 3 OPERATION

Perform any purging of piping with spool piece in place. Once completed, install the flowmeter and connect cabling to pickup coil and power to the unit. If false indication occurs turn SENSITIVITY control counterclockwise until indication stops.

The analog output commences with flow through the flowmeter.

For the analog output, the span is established by either the factory calibration or field calibration. The range is 0-5 Vdc.

3.1 PRINCIPLE OF OPERATION

A simplified block diagram of the FLSC-28 Frequency to Current Converter is shown in Figure 3-1. Key functional blocks as well as flow information are designated. The basic operation of the system is as follows.

The frequency signal from the flowmeter is connected to the FLSC-28 with a twisted shielded pair cable. The signal enters 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.

The signal entering the frequency to voltage converter is passed through a combination of a divide by N and a DIP switch matrix. The ON output is chosen whose pulse rate is between 75 and 150 Hz at the maximum flow rate measured. This scaled pulse rate is then filtered into an analog voltage. This voltage is proportional to volumetric flow rate.

The resulting output voltage related to flow is then fed into the output amplifier. The output amplifier is a voltage to current amplifier and offers ZERO and SPAN adjustments and is available in the process range of 0-5 Vdc.

The precision power supply filters and regulates the input power and generates the internal 7.5 Vdc power for all circuits as well as providing reverse polarity protection.

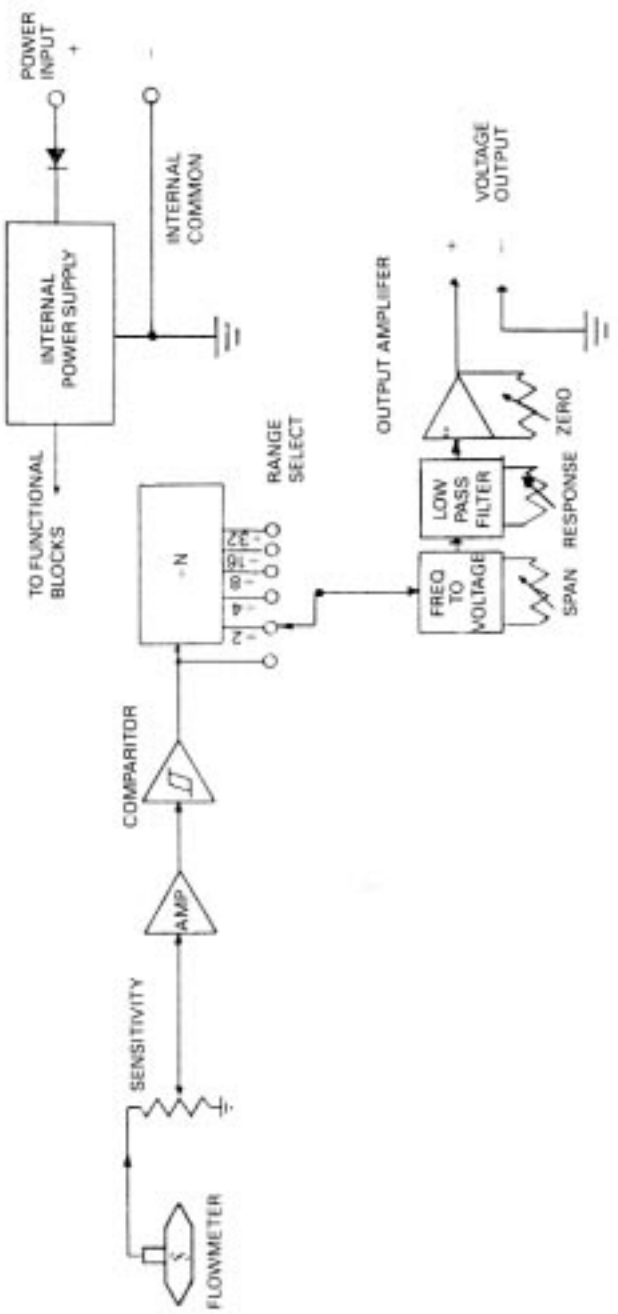


Figure 3-1. FLSC-28 Block Diagram

3.2 CONTROLS AND ADJUSTMENTS (See Figure 3-2.)

SENS — A single turn control used to set the threshold sensitivity level above the ambient noise pickup.

RANGE — A dual in line (DIP) switch located within the enclosure (see Figure 3-3 and Table 3-1) which is used to program the module to accept an input frequency range.

SPAN — A multiple turn adjustment which is used to set the voltage output signal to the desired span corresponding to the equivalent flow range (i.e., 0 to 5V corresponding to 0-100 GPM).

ZERO — A multiple turn adjustment which is used to set out put signal with no flow to the desired "zero" value (i.e., 0.00V dc).

RESPONSE — A multiple turn adjustment which is used to set the response time of the analog output.

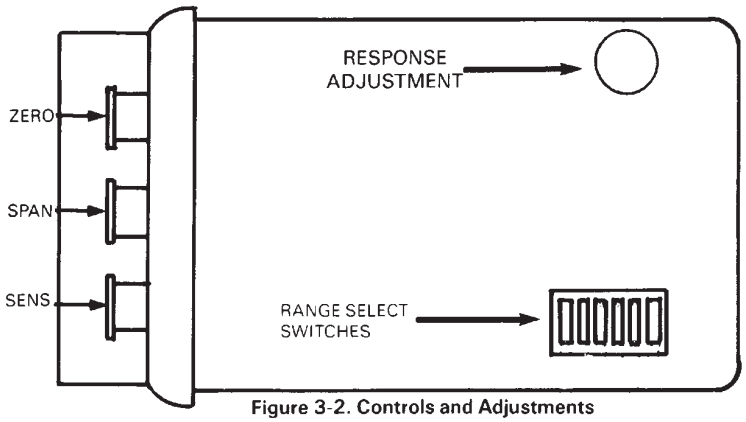
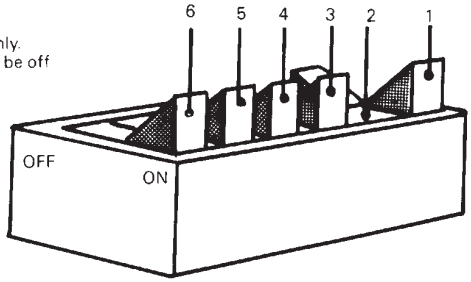


Figure 3-2. Controls and Adjustments

Switch 2 is shown depressed for illustrative purposes only.

NOTE
Select one switch only.
All other switches must be off



1. Open cover by removing the two screws on the side of box. Remove printed circuit subassembly.
2. Turn on desired range position using a ball point pen or similar object.
3. Reassemble in lower case.

Figure 3-3. Range Select for Analog Output

TABLE 3-1
RANGE SELECT

Range Select Switch Position	For F Max.
1	75 to 150
2	150 to 300
3	300 to 600
4	600 to 1200
5	1200 to 2400
6	2400 to 4800

SECTION 4 CALIBRATION OF ANALOG OUTPUT

4.1 INTRODUCTION

In general, all flow measurement systems supplied by OMEGA Engineering have been factory calibrated as specified by the user, at the time of purchase.

All systems which underwent such a factory calibration have a calibration card attached prior to shipment. This card contains 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 analog output span.

4.2 CALIBRATION PROCEDURE

Begin by determining the equivalent maximum volumetric flow rate in GPM, expected by the application, term this GPM (MAX). GPM (MAX) may be calculated based on the analog output scale requirements or may be the maximum flow rate listed on the flowmeter's calibration sheet (supplied with flowmeter

From the calibration constant (or K Factor) listed on the data sheet for the flowmeter, obtain the frequency corresponding to GPM (MAX) using Equation #1 and designate this frequency F (MAX).

Equation #1 $$F_{MAX} = \frac{K_{AVE} \times GPM_{MAX}}{60}$$

The analog output of the FLSC-28 may be calibrated with the aid of an external oscillator used in conjunction with a frequency counter.

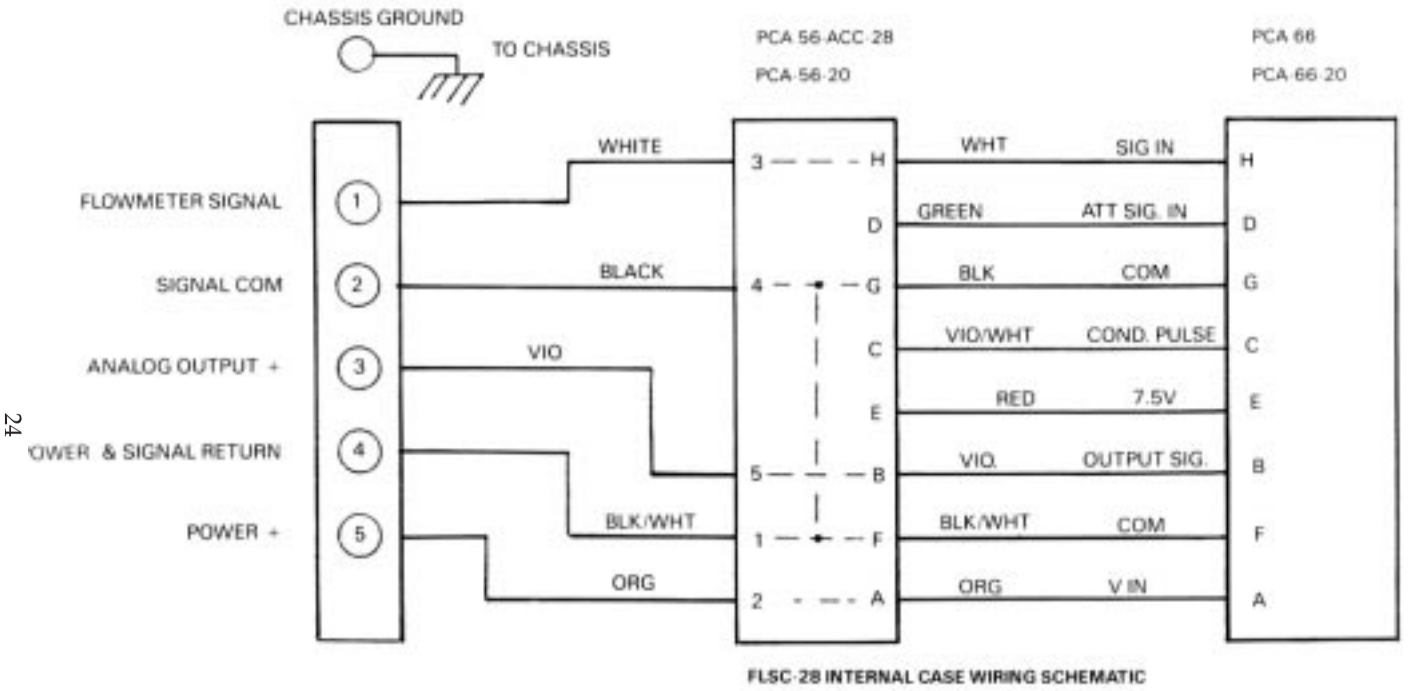
The external oscillator is used to supply a test frequency. In this method, the external oscillator is connected to the signal input terminals as shown in Figure 4-1. The oscillator's output frequency is set to equal F (MAX) as indicated on the frequency counter. Power is supplied from a DC source and the analog output voltage is measured with a digital voltmeter.

1. The course range adjustment is accomplished by selecting a switch position on a DIP switch located on the PCA-66 printed circuit card. See Table 3-1 to determine required switch position and set into switch as shown in Figure 3-3 for anticipated F MAX.

NOTE

It is necessary to open the cover of the enclosure by removing two screws on side of box and lifting cover. Two printed circuit cards are attached. The "RANGE" Dip Switch may be programmed with a pen. Input power should be removed during this step.

2. Zero Adjustment
   a. The redual DC voltage at the output of the FLSC-28 may be reduced to a low value (a few millivolts) with the aid of the zero adjustment.
   b. Apply the proper DC voltage to the power input. Turn the input frequency off.
   c. Turn the zero control CCW until no further decrease in the output level is observed. Then turn the zero control CW until the zero voltage starts to just increase.
3. Span Adjustment
   a. Turn the input frequency on and adjust frequency to obtain FMAX.
   b. Adjust the span control to obtain the span voltage on the output (5.000 Vdc)
4. Response Adjustment (Internal - located on the PCA-66 printed circuit card, see Figure 3-2)
   a. The FLSC-28 is provided with an adjustable response trim control which allows the user to control the response time to obtain either fast response or minimum ripple.
   b. To slow down response turn the response control CCW, to speed up response turn the response control CW. The maximum number of turns is 20 on this control. The control will not be damaged if the end stops are reached and a slipping action will be felt.
5. Sensitivity Adjustment
   a. The sensitivity adjustment is generally left in the full CW position and is adjusted in the final installation only when f else pickup occurs during periods of no flow. See Sect. 3 Operation.



FLSC-28 INTERNAL CASE WIRING SCHEMATIC

FLSC-28 INTERNAL CASE WIRING SCHEMATIC

TROUBLESHOOTING

In case of an inoperable or malfunctioning system the following procedures can be used to isolate the faulty wiring, printed circuit boards and/or alternate causes. The majority of repairs can be made in the field thereby reducing the time a unit is out of service.

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. Please note that in some cases factory repairs can be performed more easily than can be accomplished in the field.

Failure conditions are listed and the possible corrective actions given to eliminate the observed problem.

Proper operation of the FLSC-28 can be assumed when with power applied to the unit, the analog output produces a voltage output signal of 0-5 Vdc with a span corresponding to that already established by the calibration procedure.

OBSERVED CONDITION	CORRECTIVE ACTION
A. Analog Output With No Flow	1 .Noise on input. Slowly turn SENS pot CCW until false indication stops. NOTE: In fully CCW position the unit will not operate. 2. Replace pickup coil 3. Defective FLSC-28, repair or replace.
B. Incorrect Zero Reading With No Flow	1. Verify that power supply voltage is within limit. 2. Unit is out of calibration - re-calibrate. 3. Defective FLSC-28, repair or replace.
C. Voltage Exceeds Desired Span	1. Flowmeter being used beyond calibrated span of FLSC-28 2. Calibration of FLSC-28 incorrect. Recalibrate, 3. Defective unit, repair or replace.

OBSERVED CONDITION	CORRECTIVE ACTION
A. Analog Output With No Flow	1 .Noise on input. Slowly turn SENS pot CCW until false in dication stops. NOTE: In fully CCW position the unit will not operate.
D. Incorrect Analog Output with Flow	1 .Load resistance too small. 2. Noise pickup present. Adjust Sensitivity. 3. Calibration of FLSC-28 incorrect. Recalibrate.
E. Large Ripple on Analog Output	1 .Wrong "Range" switch selected. Recalibrate. 2. Flowmeter being operated below range. Adjust response control to minimize ripple.

SECTION 6 SPECIFICATIONS

INPUT. Input protected, RF and band pass filtered, adjustable trigger level,

Input Impedance - 40 kilohm (nominal)

Trigger Sensitivity - 10 millivolt RMS (minimum) 10 to 1000 Hz
Over Voltage - 120 volts RMS absolute (maximum)

VOLTAGE OUTPUT: Accuracy ±0.05% of full scale ±200 PPM/°C Range 0-5V

Impedance less than 10 ohms.

Response time .5 - 1.5 seconds, for 10 to 90%, adjustable. Output ripple less than 0.2% of F.S.

Load resistance output can source up to 10 mA into a grounded load only.

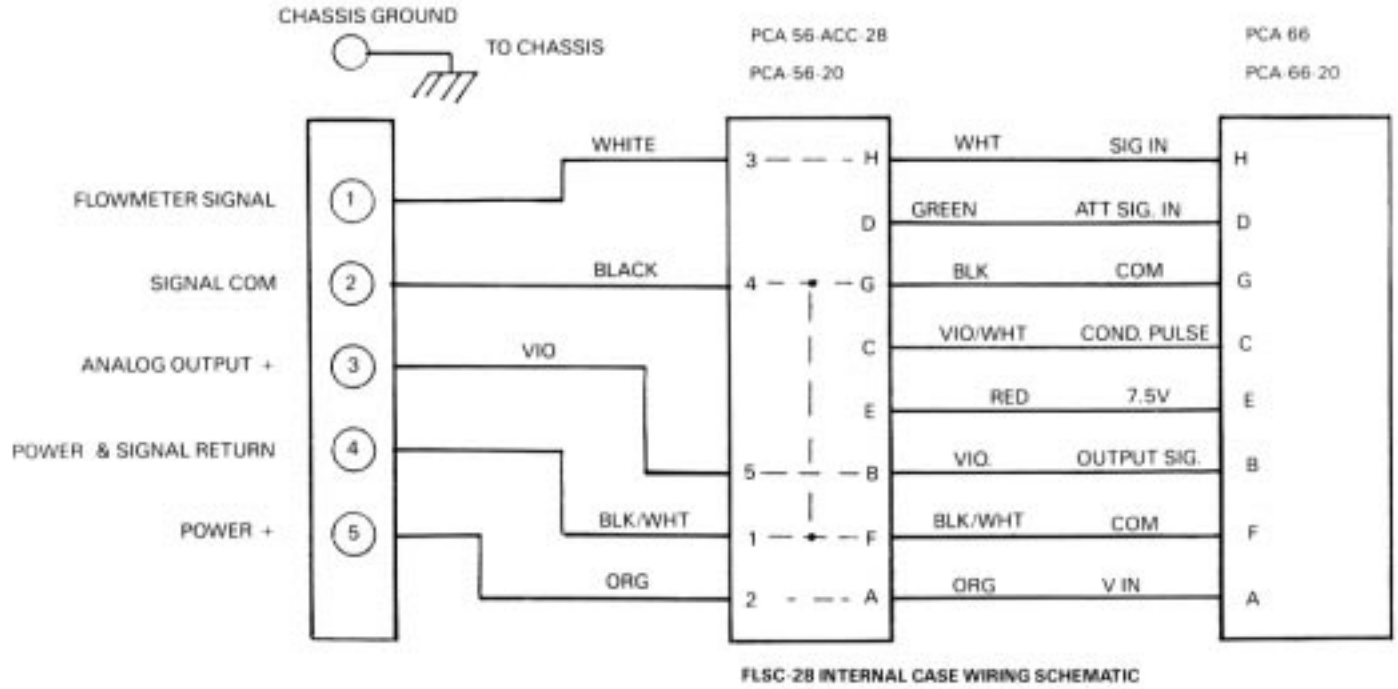
INPUT POWER: 10-40 Vdc @ 10 mA

TEMPERATURE RANGE: 0°-70°C (32° to 158°F)

ELECTRICAL CONNECTIONS: Screw Terminals

MAXIMUM LEAD LENGTH: 100 ft. of 24 gage copper wire

ELECTRICAL HOUSING: Class 1, Group D
Class 11 Group E, F, G
Class III



FLSC-28 INTERNAL CASE WIRING SCHEMATIC

FLSC-28 INTERNAL CASE WIRING SCHEMATIC

TABLE OF, CONTENTS
FLSC-34 SIGNAL CONDITIONER

SECTION 1 INTRODUCTION

The OMEGA® FLSC-34 High Accuracy Integral Signal Conditioners are designed for direct mounting onto OMEGA Series FTB-100 and 200 Turbine Meters.

The input circuitry of the FLSC-34 signal conditioner has been designed to receive and condition the low level turbine meter signals while rejecting 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 signal on the output.

The FLSC-34 runs off 115 Vac and provides both an unscaled pulse output (CMOS, TTL compatible) and a 420 mA output. A zero and span potentiometer allow for simple field adjustment of the analog outputs from the signal conditioners.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved f or their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION OF THE FLSC-34

The FLSC-34 should be placed in a convenient location which maintains access to the unit should repairs or readjustment be required.

If the unit is mounted on a turbine flowmeter in an explosion proof conduit enclosure, orientate the flowmeter and run conduit to prevent the accumulation of moisture in the conduit enclosure as much as is practical. In addition, assure electronics will not be overheated by hot process lines.

Refer to Figure 2-1 for outline dimensions. Drill appropriate mounting holes as required.

Refer to Figure 2-2, wiring installation drawing for appropriate terminals for interconnections. The signal leads from the turbine should be shielded whenever the FLSC-34 is not integrally mounted. Ground shield on one end only. If desired, use solder lug provided on ground stud. Connections to the terminal block should be carefully dressed to avoid having bare wires extend pass the screw clamp on the terminal block. This is particularly important for units mounted within the explosion proof enclosure. Wires should be neatly dressed near bottom of enclosure to assure wiring will not become fouled when cover is installed.

Connect two conductor shielded cable from flowmeter. Connect shield to FLSC-34 only.

Line power connection should be made through a circuit breaker so that power can be turned off while servicing the FLSC-34. Power is 117 Vac ±10%, an earth ground connection is also required.

Pulse output is CMOS/TTL compatible. Wire to appropriate terminal, see Figure 2-2.

For Analog Output connect wiring to appropriate terminals and load. A shielded, twisted pair wire is recommended. Ground shield on one end only. Use same precautions as described for flowmeter input signal.

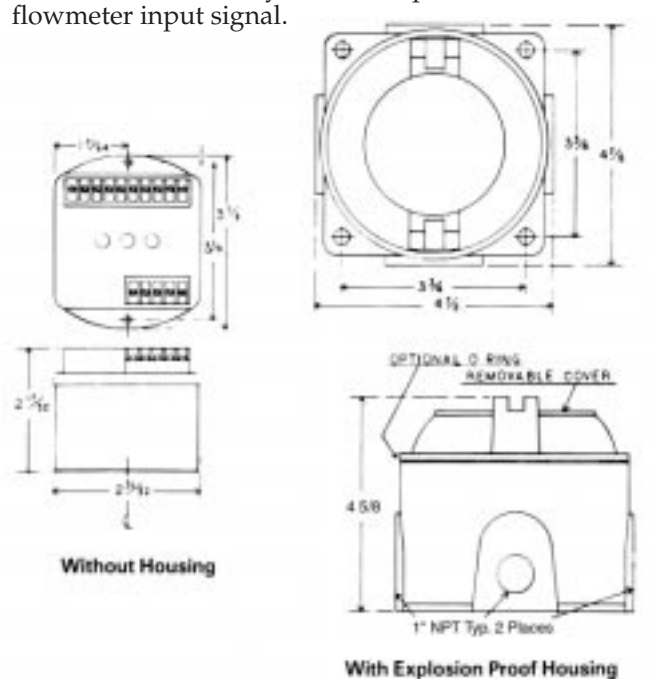


Figure 2-1. Outline and Intallation Dimensions

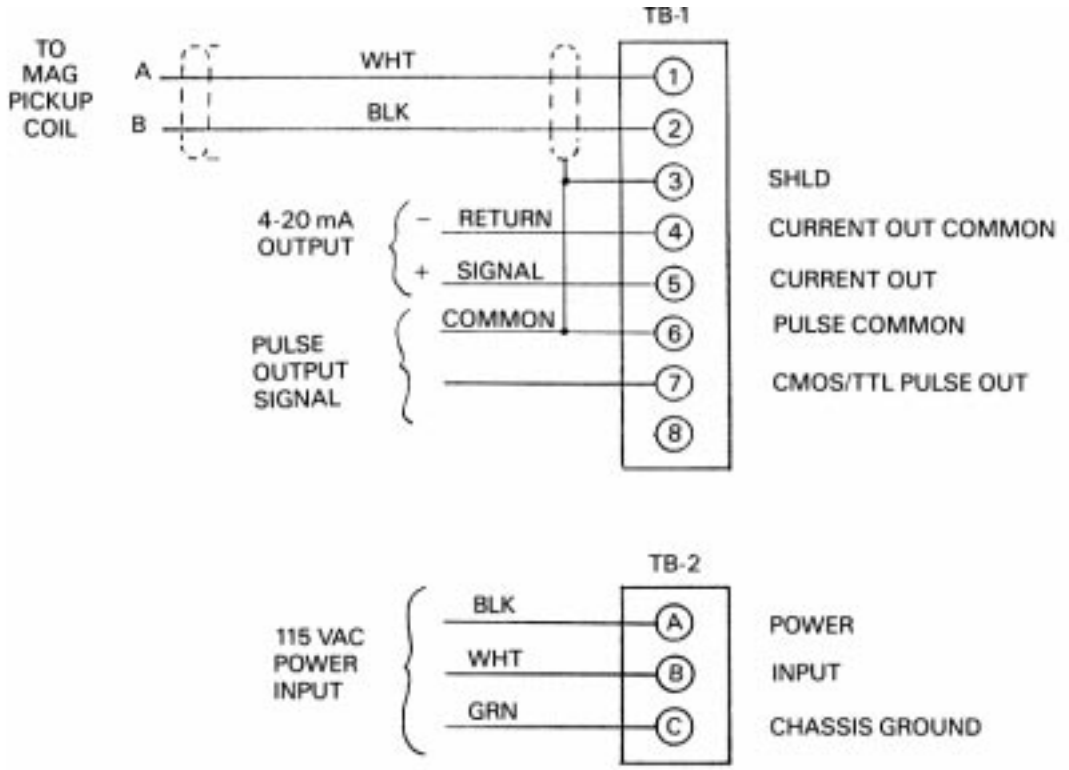


Figure 2-2. Wiring Installation for the FLSC-34

SECTION 3 OPERATION

Perform any purging of piping with spool piece in place. Once completed, install the flowmeter and connect cabling to pickup coil. If false counting action occurs turn sensitivity control clockwise.

The pulse output and analog output commence with flow through the flowmeter.

For the analog output, the span is that established by either the factory calibration or field calibration. The range is 4-20 mA DC into a maximum of 325 ohms of loop resistance.

3.1 PRINCIPLE OF OPERATION

A simplified block diagram of the FLSC-34 Frequency/Current Flow Converter Subsystem is shown in Figure 3-1. Key functional blocks as well as information flow are designated. The basic operation of the system is as follows.

The frequency signal f rom the turbine flowmeter is connected to the FLSC-34 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 amplified and shaped into a train of digital pulses whose frequency is related to the volume f low rate.

The signal entering the frequency to analog converter is passed through a combination of a divide by N and a DIP switch matrix. The ON output is chosen whose pulse rate is between 75 and 150 Hz at the maximum flow rate to be measured. This scaled pulse rate is fed to a precision monostable circuit. The output of the monostable circuit is then filtered into an analog voltage that is proportional to volumetric flow rate.

The output amplifier is a voltage to current amplifier. It offers zero and span available in a standard process range of 4-20 mA.

The Power Supply provides for operating bias voltage for all internal circuitry. The pulse output amplifier provides a TTL/CMOS compatible square pulse of 5V amplitude. The output amplifier is buffered from the signal driving the analog output.

3.2 CONTROLS AND ADJUSTMENTS (See Figure 3-2.)

FUSE A circuit protection device located inside of case (see paragraph 3.2.1)

SENS. A multiple turn control used to set the threshold sensitivity level above the ambient noise pickup.

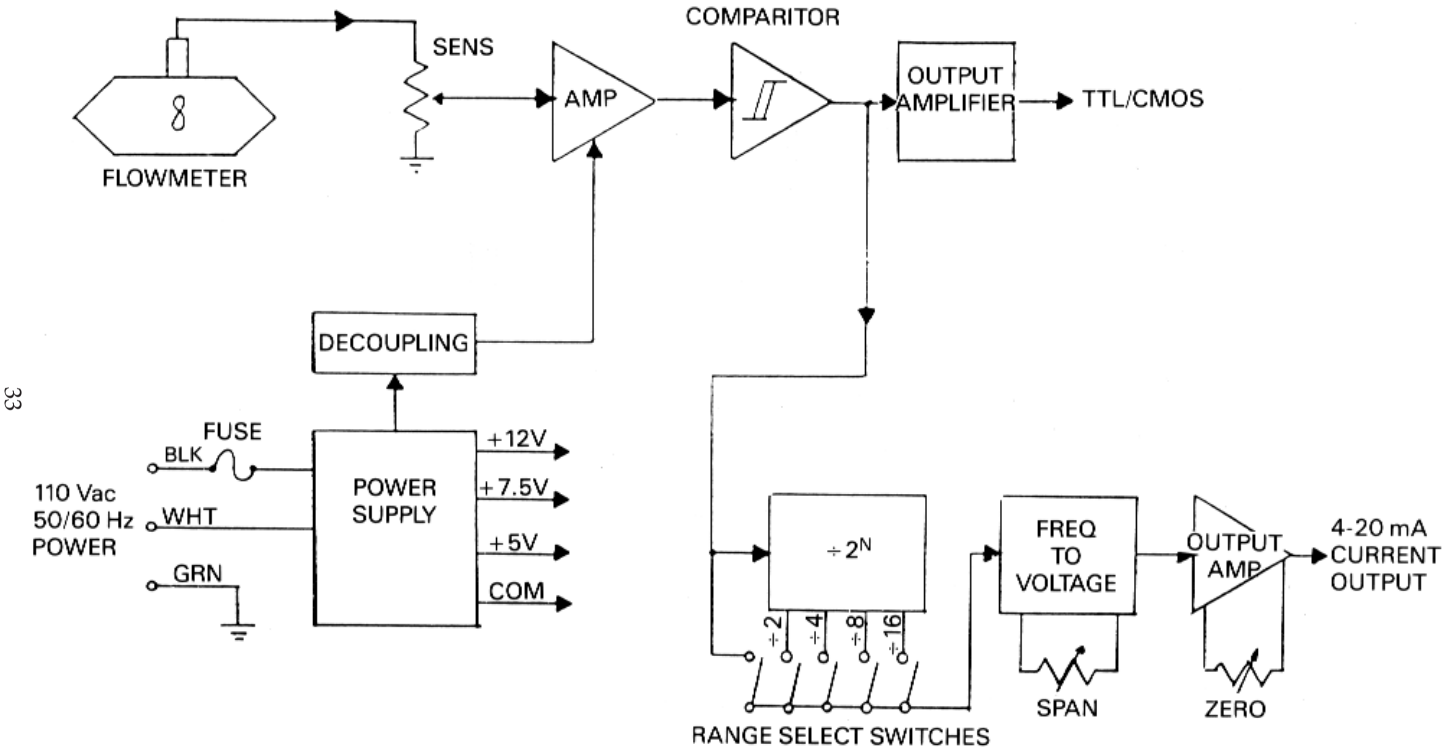


Figure 3-1. FLSC-34 Block Diagram

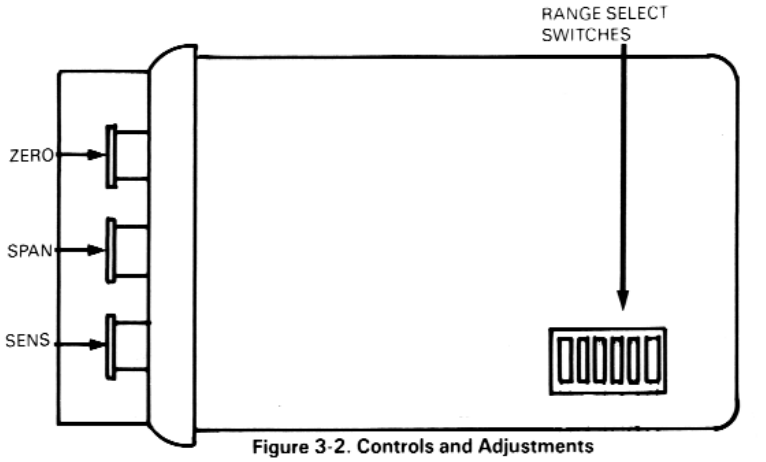


Figure 3-2. Controls and Adjustments

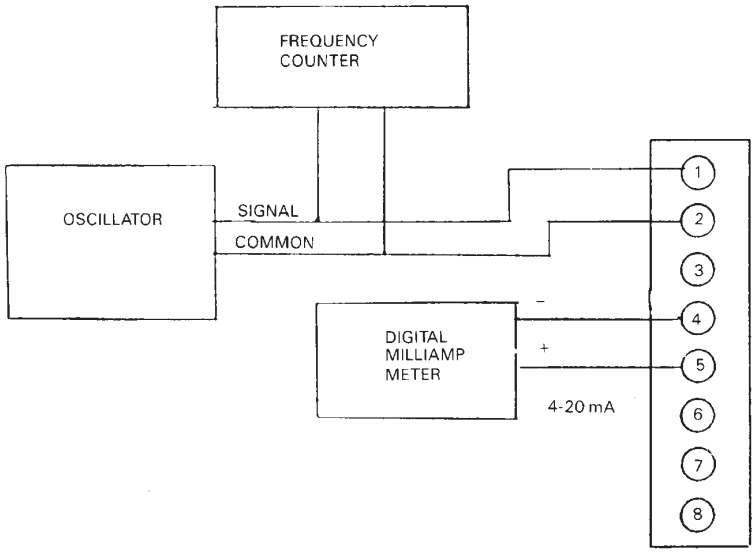


TABLE 3-1 RANGE SELECT

Range Select Switch Position	For F Max.
1	75 to 150
2	150 to 300
3	300 to 600
4	600 to 1200
5	1200 to 2400
6	2400 to 4800

RANGE A dual in line (DIP) switch located on the FICA61 board (see Figure 3-3 and paragraph 3.2.2) which is used to program the module to accept an input frequency range.

SPAN A multiple turn adjustment which is used to set the voltage 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., 4 mA).

3.2.1 Replacing the Fuse (see Figure 3-2)

1. Turn off power to the FLSC-34,
2. Remove the two screws from sides of case.
3. Lift off cover and remove printed circuit sub-assembly.
4. Pull fuse from fuse socket using fingers (Pliers are not recommended).
5. Install new fuse.
6. Reassemble into lower case.

3.2.2 Range Select for Analog Output

1. Turn power to FLSC-34 off.
2. Remove the two screws from sides of case.
3. Lift off cover and remove printed circuit sub-assembly.
4. Turn "on" desired range position using a ball point pen or similar object. (Refer to Figure 3-3 and Table 3-1.)
5. Reassemble into lower case.

SECTION 4 CALIBRATION OF ANALOG OUTPUT

4.1 INTRODUCTION

In general, all flow measurement systems supplied by OMEGA Engineering have been factory calibrated as specified by the user, at the time of purchase.

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 analog output span.

4.2 PROCEDURE

Begin by determining the equivalent maximum volumetric flow rate in GPM, expected by the application, term this GPM (MAX). GPM (MAX) may be calculated based on the analog output scale requirements or may be the maximum flow rate listed on the flowmeter's calibration sheet.

From the calibration constant (or K Factor) listed on the data sheet for the flowmeter, obtain the frequency corresponding to GPM (MAX) using Equation #1 and designate this frequency F (MAX),

Equation #1 $$F_{MAX} = \frac{K_{AVE} \times GPM_{MAX}}{60}$$

The analog output of the FLSC-34 may be calibrated with the aid of an external oscillator used in conjunction with a frequency counter.

The external oscillator is used to supply a test frequency. In this method, the external oscillator is connected to the signal input terminals as shown in Figure 4-1. The oscillator's output frequency is set to equal F (MAX) as indicated on the frequency counter.

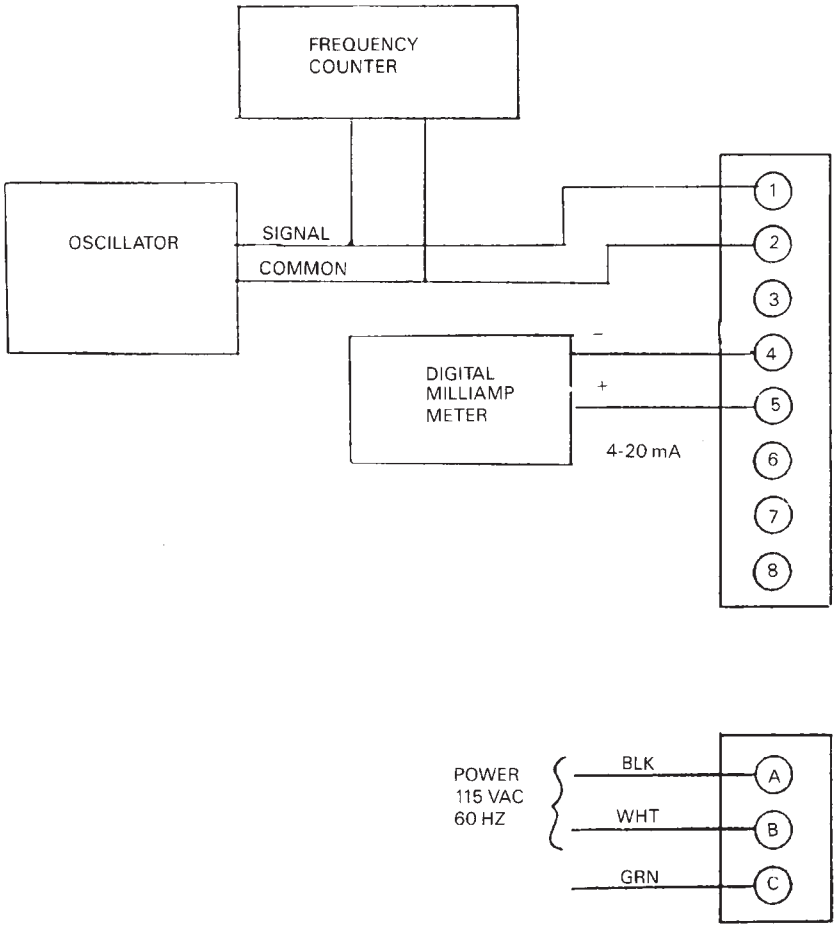
1. The course range adjustment is accomplished by selecting a switch position on a DIP switch located on the PCA61 printed circuit card. See Table 3 1 to determine required switch position and set into switch as shown in Figure 3-3 for anticipated F MAX.

NOTE

It is necessary to open the cover of the enclosure by removing two screws on side of box and lifting cover. Two printed circuit cards are attached. The "RANGE" Dip Switch may be programmed with a pen. Input power should be removed during this step.

2. Connect a digital milliampmeter or equivalent across the current output terminals.
3. Adjust ZERO control for desired zero current (i.e., 4.00 mA)
4. Turn SPAN POT fully CCW until detent is felt or 25 turns.
5. Inject the Test Frequency equal to F MAX while adjusting SPAN for current equal to 20 mA ±20 mA. See test setup shown in Figure 4-1.

Repeat steps 4 and 5 until no change is observed.



NOTES

1. USE TEST AMPLITUDE OF 100 MV RMS OR LESS, SINUSOIDAL WAVEFORM
2. REMOVE ALL OTHER INTERCONNECTIONS OTHER THAN THOSE SHOWN.
3. OBSERVE CAUTION WHEN PERFORMING CALIBRATION.

Figure 4-1. Calibration Set-Up

SECTION 5 TROUBLESHOOTING

In case of an inoperable or malfunctioning system the following procedures can be used to isolate the faulty wiring, printed circuit boards and/or alternate causes. The majority of repairs can be. made in the field thereby reducing the time a unit is out of service.

The necessary documentation is contained within this manual with the exception of the calibration data sheet for the turbine flowmeter. This calibration is supplied with the turbine flowmeter.

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

Failure conditions are listed and the possible corrective actions given to eliminate the observed problem.

Proper operation of the FLSC-34 can be assumed when with power applied to the unit:

1. The pulse output produces a pulse train of the desired amplitude when flow through the flow transducer occurs.
2. The analog output produces a current output signal of 4-20 mA with a span corresponding to that established by the calibration procedure.

OBSERVED CONDITION	PROBLEM CORRECTIVE ACTION
A. No Pulse Output	1. Inspect terminal strip wiring for conformity,to the installation instructions and for acceptable workmanship. 2. Verify fuse is good with an ohm meter. 3. Determine if flowmeter rotor is fouled. 4. Defective pickup coil. Replace 5. Defective cable. Replace. 6. Defective FLSC-34. Repair or replace. 7. Sensitivity potentiometer turned fully clockwise - unit will not function properly.
B. Pulsing Output With No Flow	1. Defective pickup coil. Replace. 2. Defective cable. Replace. 3. Defective FLSC-34. Repair or replace.

C. Analog Output	1. Improper wiring terminations. Correct wiring. 2. FLSC-34 improperly calibrated. Recalibrate. 3. Defective circuitry within the FLSC-34. Factory repair FLSC-34.

NOTE

Refer to flowmeter operator's manual for repair instructions for the turbine flowmeter.

SECTION 6 SPECIFICATIONS

INPUT: Input protected, RF and band pass filtered, adjustable trigger level,

Input Impedance 40 ohm (nominal)

Trigger Sensitivity 10 millivolt RMS (minimum) 10 Hz to 1000 Hz Over Voltage - 120 volts RMS absolute (maximum)

ANALOG OUTPUT: Range 4 to 20 mA.
Controls - Non-interacting zero and span adjustments.
Accuracy ±0.1% F. S. 200 PPM/°C

Maximum Impedance - 325 ohms.
F. S. Frequency Range 75 Hz to2500 Hz (DIP SWITCH SELECTABLE)

PULSE OUTPUT: TTL/CMOS COMPATIBLE
LOGIC 1; 2.4V AT - .800 mA
LOGIC 0; 0.4 V maximum at 100 ma

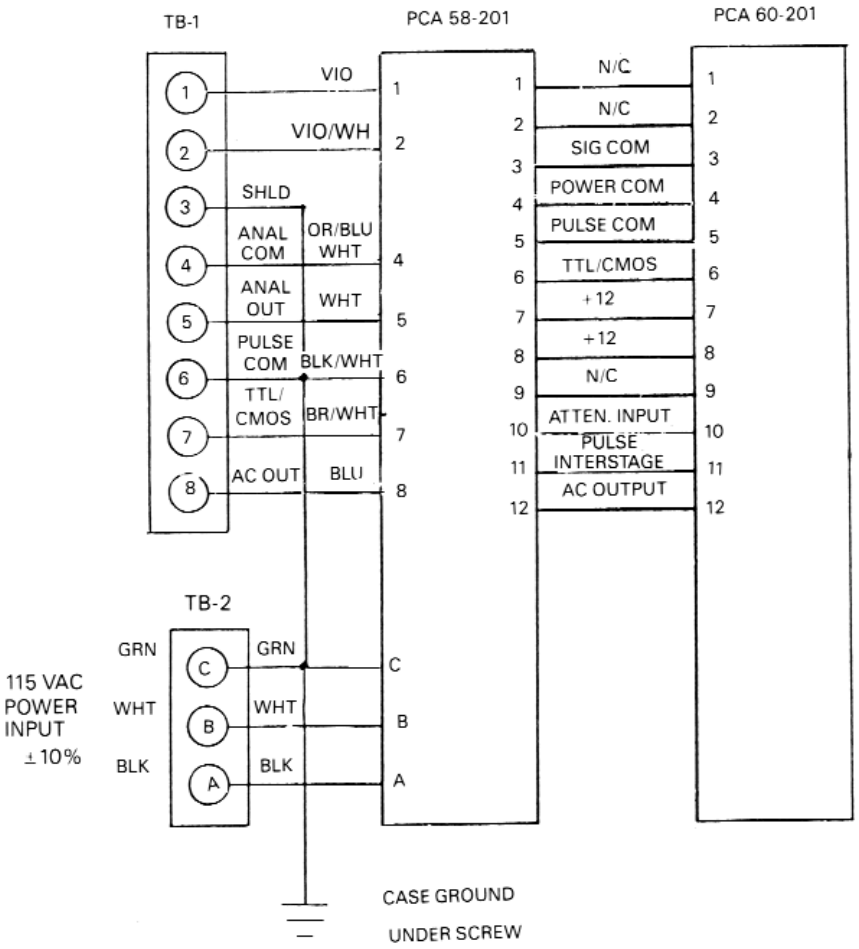
INPUT POWER: 115 Vac 50/60 Hz

TEMPERATURE RANGE: 0°-70°C (32° to 158°F)

ELECTRICAL CONNECTIONS: Screw Terminals

MAXIMUM LEAD LENGTH: 1000 ft. of 24 gage copper wire

ELECTRICAL HOUSING: Class 1, Group D
Class 11 Group E, F, G
Class III



INTERNAL CASE WIRING SCHEMATIC FOR FLSC-34

TABLE OF, CONTENTS
FLSC-35B SIGNAL CONDITIONER

SECTION 1 INTRODUCTION

The OMEGA® FLSC-35B High Accuracy Integral Signal Conditioner is designed for direct mounting onto OMEGA Series FTB-100 and 200 Turbine Meters.

The input circuitry of the signal conditioners has been designed to receive and condition the low level turbine meter signals while rejecting 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 signal on the output.

The FLSC-35B runs off 115 VAC and provides an unscaled pulse output (CMOS, TTL compatible) and a 0-5 V output. A zero and span potentiometer allow for simple field adjustment of the analog output from the signal conditioner.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION OF THE FLSC-35B

The FLSC-35B should be placed in a convenient location which maintains access to the unit should repairs or readjustment be required.

If the unit is mounted on a turbine flowmeter in an explosion proof conduit enclosure, orientate the flowmeter and run conduit to prevent the accumulation of moisture in the conduit enclosure as much as is practical. In addition, assure electronics will not be overheated by hot process lines.

Refer to Figure 2-1 for outline dimensions. Drill appropriate mounting holes as required.

Refer to Figure 2-2, wiring insulation, for appropriate terminals for interconnections. The signal leads from the turbine should be shielded whenever FLSC-35B is not integrally mounted. Ground shield on one end only. If desired, use solder lug provided on ground stud. Connections to the terminal block should be carefully dressed to avoid having bare wires extend pass the screw clamp on the terminal block. This is particularly important for units mounted within the explosion proof enclosure. Wires should be neatly dressed near bottom of enclosure to assure wiring will not become fouled when cover is installed.

Connect two conductor shielded cable from flowmeter. Connect shield to FLSC-35B only.

Line power connections should be made through a circuit breaker so that power can be turned off while servicing the FLSC-35B. Power is 117 VAC ±10%, an earth ground connection is also required.

Pulse output is CMOS/TTL compatible. Wire to appropriate terminal, see Figure 2-2.

For analog output connect wiring to appropriate terminals and load. A shielded, twisted pair wire is recommended. Ground shield on one end only. Use same precautions as described for flowmeter input signal.

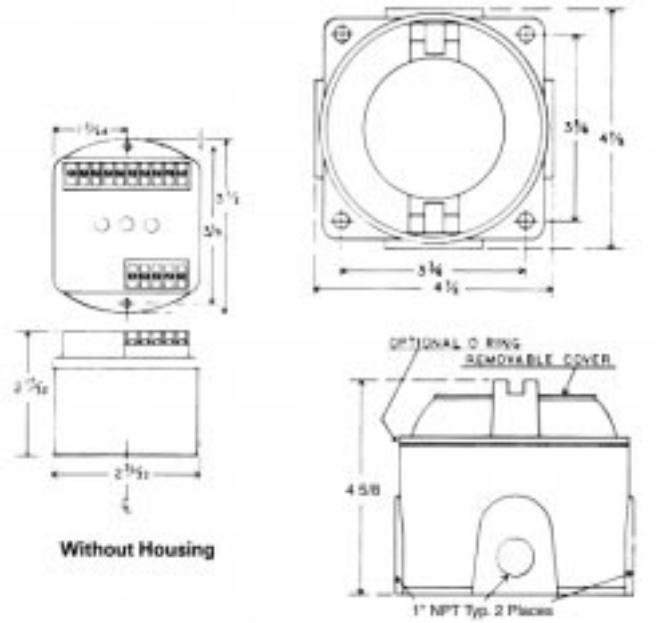


Figure 2-1. Outline Dimensions

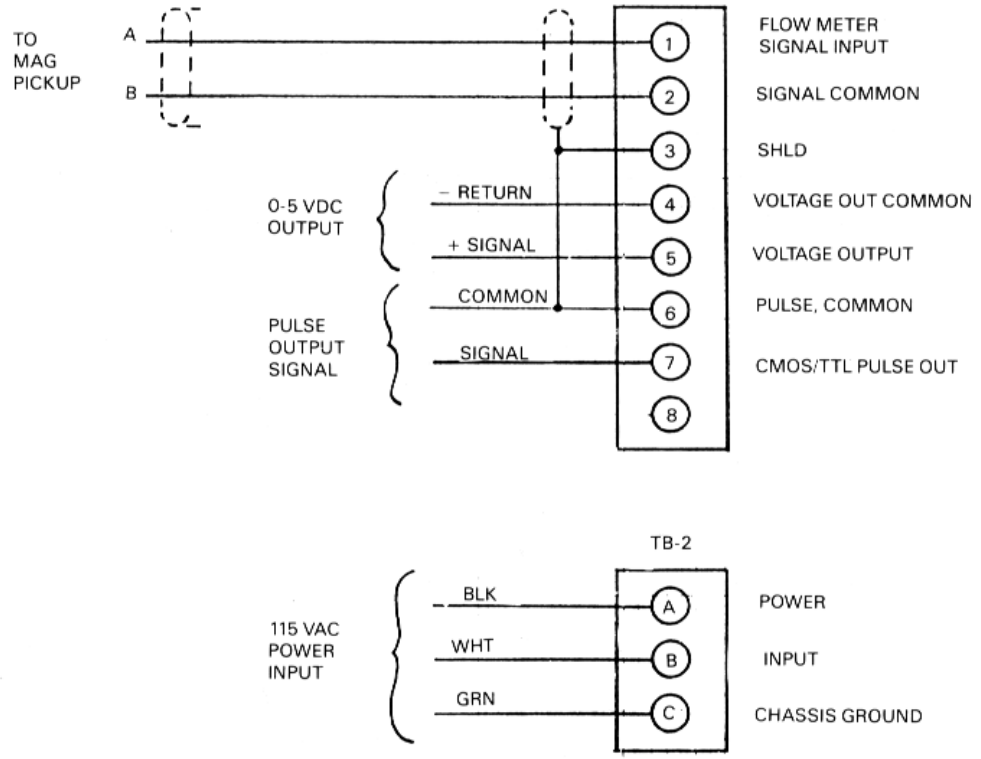


Figure 2-2. Wiring Installation for the FLSC-35B

SECTION 3 OPERATION

Perform any purging of piping with spool piece in place. Once completed, install the flowmeter and connect cabling to pickup coil. If false counting action occurs turn Sensitivity control clockwise.

The pulse output and analog output commence with flow through the flowmeter.

For the analog output, the span is that established by either the factory calibration or field calibration. The range is 05 Vdc into a maximum of 1000 ohms of loop resistance.

3.1 PRINCIPLE OF OPERATION

A simplified block diagram of the FLSC-36B Frequency/Voltage Flow Converter Subsystem is shown in Figure 3-1. 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 FLSC-35B 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 flow meter signal is then passed through a signal conditioning chain where it is amplified and shaped into a train of digital pulses whose frequency is related to the volume flow rate

The signal entering the frequency to analog converter is passed through a combination of a divide by IN and a DIP switch MATRIX. The ON output is chosen whose pulse rate is between 75 and 150 Hz at the maximum flow rate to be measured. This scaled pulse rate is then fed to a precision monostable circuit. The output of the monostable is then filtered into an analog voltage that is proportional to volumetric flow rate.

The output amplifier is a voltage to voltage amplifier. It offers zero and span available in a process range of 0 to 5 Vdc.

The Power Supply provides for operating bias voltage for all internal circuitry.

The pulse output amplifier provides a TTL/CMOS compatible square pulse of 5 volt amplitude. The output amplifier is buffered from the signal driving the analog output.

3.2 CONTROLS AND ADJUSTMENTS (See Figure 3-2.)

FUSE, A circuit protection device located inside of case (see paragraph 3.2.1)

SENS. A multiple turn control used to set the threshold sensitivity level above the ambient noise pickup.

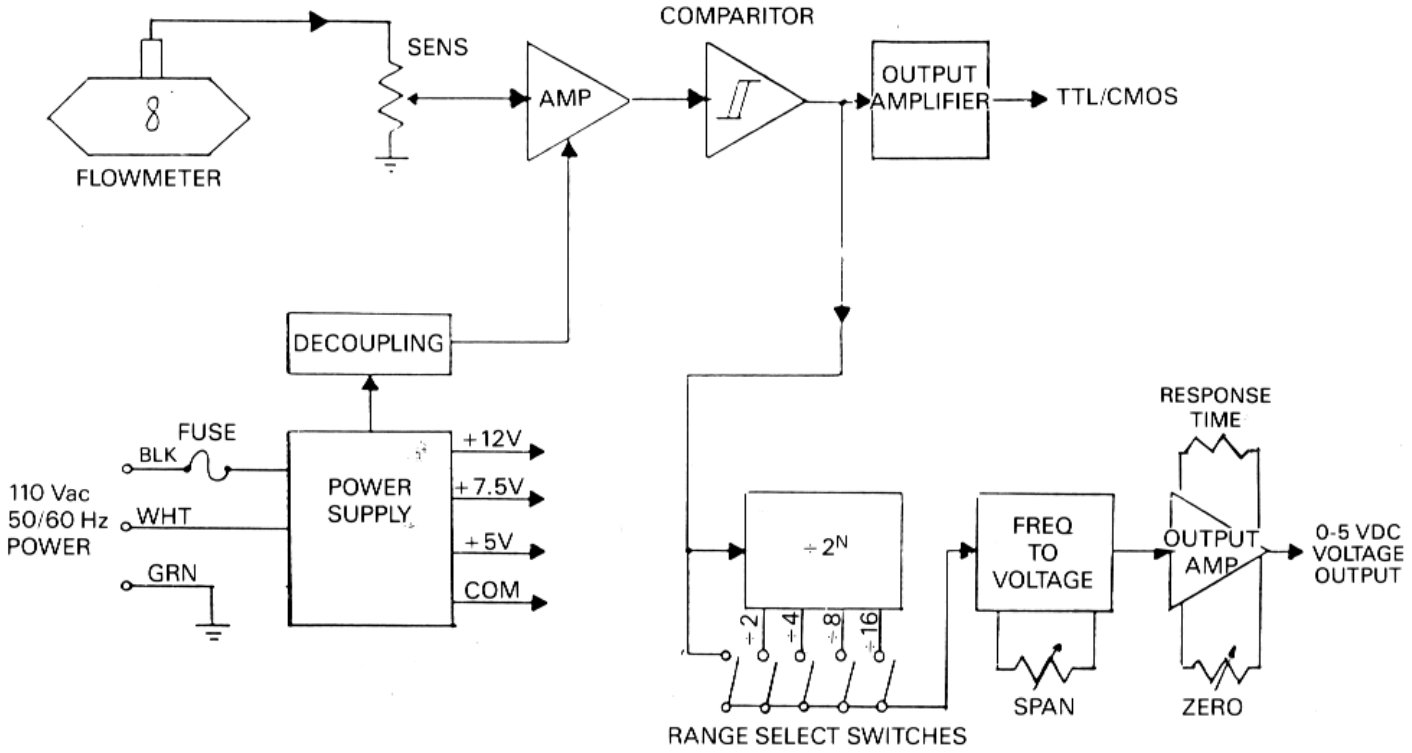


Figure 3-1. FLSC-35B Block Diagram

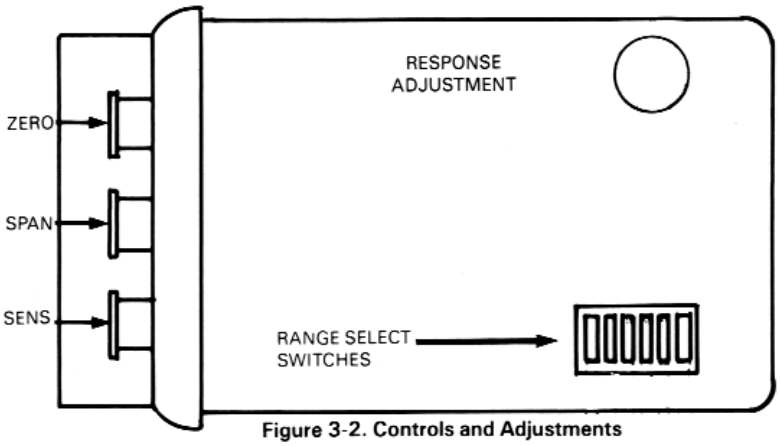
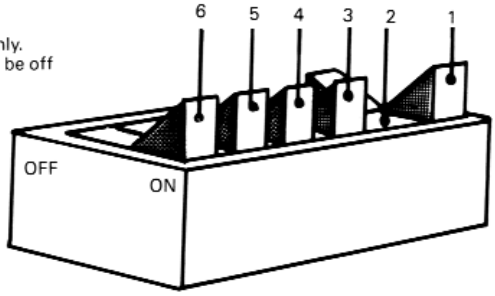


Figure 3-2. Controls and Adjustments

Switch 2 is shown depressed for illustrative purposes only.

NOTE
Select one switch only.
All other switches must be off



1. Open cover by removing the two screws on the side of box. Remove printed circuit subassembly.
2. Turn on desired range position using a ball point pen or similar object.
3. Reassemble in lower case.

Figure 3-3. Range Select Detail

TABLE 3-1
RANGE SELECT

Range Select Switch Position	For F Max.
1	75 to 150
2	150 to 300
3	300 to 600
4	600 to 1200
5	1200 to 2400
6	2400 to 4800

FUSE, A circuit protection device located inside of case (see paragraph 3.2.1)

SENS. A multiple turn control used to set the threshold sensitivity level above the ambient noise pickup.

RANGE A dual in line (DIP) switch located on the PCA61 board (see Figure 3-3 and paragraph 3.2.2.) which is used to program the module to accept an input frequency range.

SPAN A multiple turn adjustment which is used to set the voltage output signal to the desired span corresponding to the equivalent flow range (i.e., 0 to 5V 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., 0.00 Vdc).

RESPONSE An internal, multiple turn adjustment which is used to adjust the response time of the analog output.

3.2.1 Replacing the Fuse (see Figure 3-2)

1. Turn off power to the FLSC-35B.
2. Remove the two screws from sides of case.
3. Lift off cover and remove printed circuit sub-assembly.
4. Pull fuse from fuse socket using fingers pliers are not recommended).
5. Install now fuse.
6. Reassemble into lower case.

3.2.2 Range Select for Analog Output

1. Turn power to FLSC-35B off.
2. Remove the two screws from sides of case.
3. Lift off cover and remove printed circuit sub-assembly.
4. Turn "on" desired range position using a ball point pen or similar object (Refer to Figure 3-3 and Table 3-1).
5. Reassemble into lower case.

SECTION 4 CALIBRATION OF ANALOG OUTPUT

4.1 INTRODUCTION

In general, all flow measurement systems supplied by OMEGA Engineering ^^have been factory calibrated as specified by the user, at the time of purchase.

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 analog output span.

4.2 PROCEDURE

Begin by determining the equivalent maximum volumetric low rate in GPM, expected by the application, term this GPM (MAX). GPM (MAX) may be calculated based on the analog output scale requirements or may be the maximum flow rate listed on the flowmeter's calibration sheet.

From the calibration constant (or K Factor) listed on the data sheet for the flowmeter, obtain the frequency corresponding to GPM (MAX) using Equation #1 and designate this frequency F (MAX).

Equation #1 $$F_{MAX} = \frac{K_{AVE} \times GPM_{MAX}}{60}$$

The analog output of the FLSC-35B maybe calibrated with the aid of an external oscillator used in conjunction with a frequency counter.

The external oscillator is used to supply a test frequency. In this method, the external oscillator is connected to the signal input terminals as shown in Figure 4-1. The oscillator's output frequency is set to equal F (MAX) as indicated on the frequency counter.

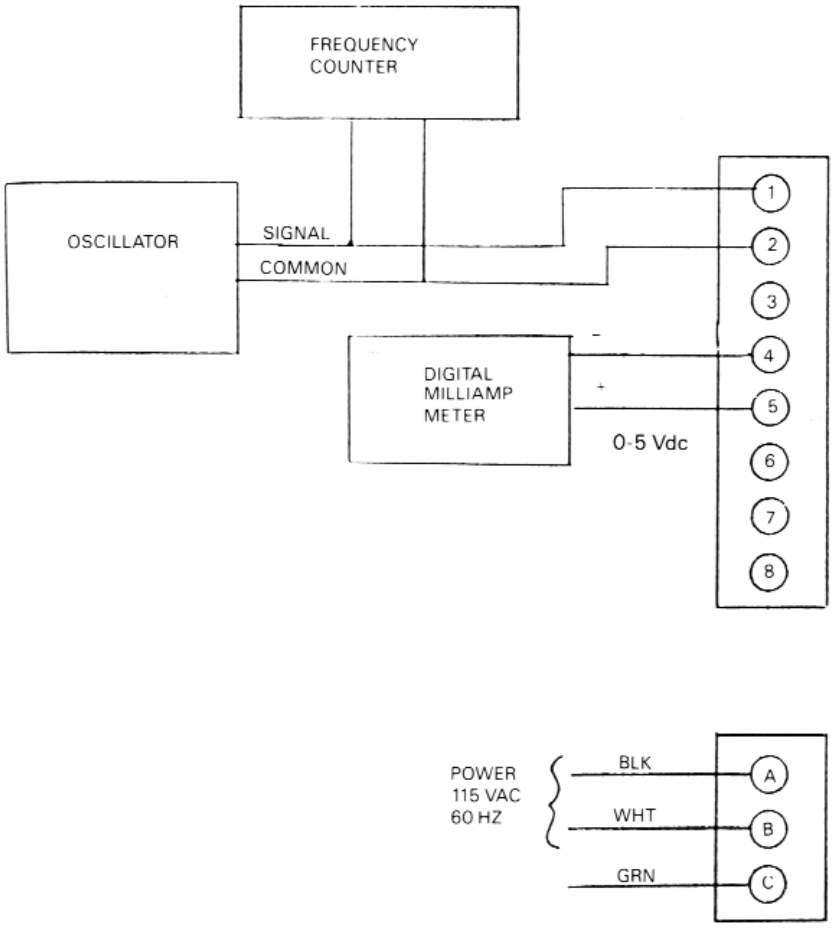
1. The course range adjustment is accomplished by selecting a switch position on a DIP switch located on the PCA61 printed circuit card. See Table 3 1 to determine required switch position and set into switch as shown in Figure 3-3 for anticipated F MAX.

NOTE

It is necessary to open the cover of the enclosure by removing two screws on side of box and lifting cover. Two printed circuit cards are attached. The "RANGE" Dip Switch may be programmed with a pen. Input power should be removed during this step.

2. Connect a digital voltmeter or equivalent, across the voltage output terminals.
3. Adjust ZERO control for desired zero voltage (.000 Vdc)
4. Turn SPAN POT fully CCW until detent is felt or 25 turns.
5. Inject the Test Frequency equal to F MAX while adjusting SPAN for voltage equal to + 5.000V +1 mV. See test setup shown in Figure 4-1.)

   Repeat steps 3 and 4 until no change is observed.



NOTES

1. USE TEST AMPLITUDE OF 100 MV RMS OR LESS, SINUSOIDAL WAVEFORM
2. REMOVE ALL OTHER INTERCONNECTIONS OTHER THAN THOSE SHOWN.
3. OBSERVE CAUTION WHEN PERFORMING CALIBRATION.

Figure 4-1. Calibration Set-up

SECTION 5 TROUBLESHOOTING

In case of an inoperable or malfunctioning system the following procedures can be used to isolate the faulty wiring, printed circuit boards and/or alternate causes. The majority of repairs can be made in the field thereby reducing the time a unit is out of service.

The necessary documentation is contained within this manual with the exception of the calibration data sheet for the turbine flowmeter. This calibration is supplied with the turbine flowmeter.

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.

Failure conditions are listed and the possible corrective actions given to eliminate the observed problem.

Proper operation of the FLSC-35B can be assumed when with power applied to the unit:

1. The pulse output produces a pulse train of the desired amplitude when flow through the flow transducer occurs.
2. The analog output produces a voltage output signal of 0-5 Vdc with a span corresponding to that established by the calibration procedure.

OBSERVED CONDITION	CORRECTIVE ACTION
A. No Pulse Output	1. Inspect terminal strip wiring for conformity,to the installation in instructions and for acceptable workmanship.
	1 . Inspect terminal strip wiring for conformity to the installation instructions and for acceptable workmanship.
	2. Verify fuse is good with an ohm meter.
	3. Determine if flowmeter rotor is fouled.
	4. Defective pickup coil. Replace
	5. Defective cable. Replace.
	6. Defective FLSC-35B. Repair or replace.
	7. Sensitivity potentiometer turned fully clockwise - unit will not function properly.
B. Pulsing Output With No Flow	1 . Defective pickup coil. Replace
	2. Defective cable. Replace.
	3. Defective FLSC-35B, Repair or replace.

C. Analog Output Malfunction	1. Improper wiring terminations. Correct wiring. 2. FLSC-35B improperly calibrated. Recalibrate. 3. Defective circuitry within the FLSC-35B. Factory repair FLSC-35B.

NOTE

Refer to flowmeter operator's manual for repair instructions for the turbine flowmeter.

SECTION 6 SPECIFICATIONS

INPUT: Input protected, RF and band pass filtered adjustable trigger level.

Input Impedance 40 kilohm (nominal)

Trigger Sensitivity 10 millivolt RMS (minimum) 10 to 1000 Hz

Over Voltage 120 volts RMS absolute (maximum)

Compatible with magnetic pickoffs.

ANALOG OUTPUT: The analog output is generated by passing the pulse output frequency signal to a frequency to voltage converter to generate a voltage proportional to flow rate.

Range 0 to 5 Vdc

Controls - Non interacting zero and span adjustments.

Accuracy ±0.1% F.S. 200 ppm/°C

F.S. Frequency Range 75 Hz to 2500 Hz (DIP SWITCH SELECTABLE)

Impedance less than 50 ohms

Response time 0.5 to 2 seconds f or 10 to 90%. Adjustable

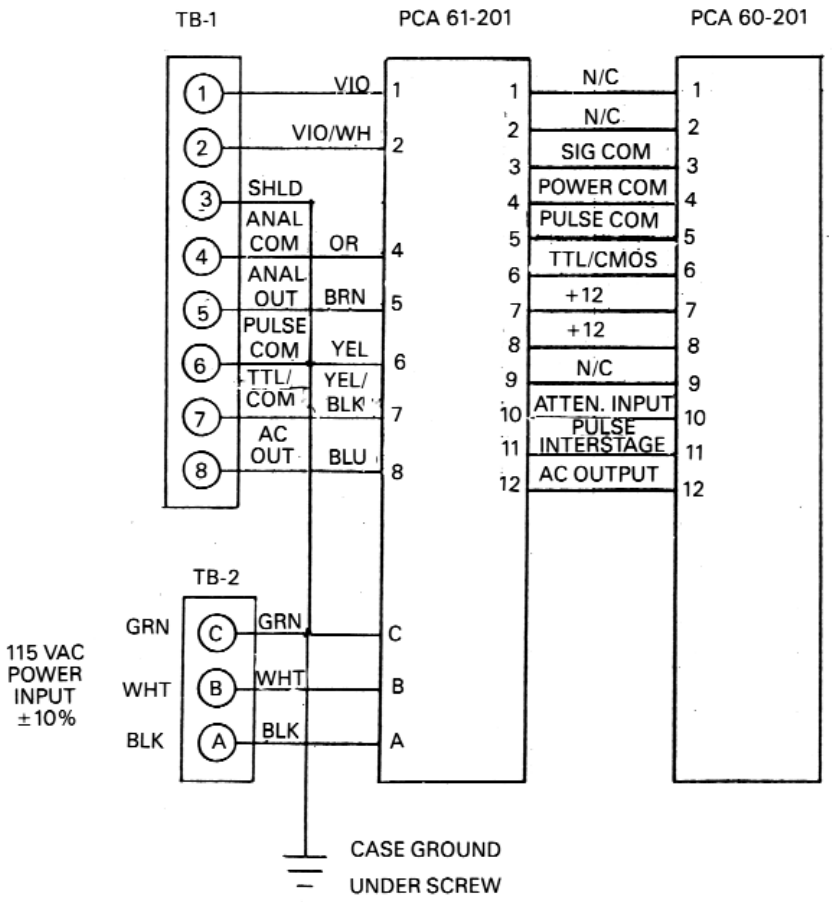
PULSE OUTPUT CHARACTERISTICS: TTL/CMOS Compatible option:

Logic 1: 2AV at -.800 mA; Logic 0:0.4V maximum at 100 mA

POWER REQUIREMENTS: 115 Vac 50/60 Hz

TEMPERATURE RANGE: 0°- 70°C Standard

ELECTRICAL HOUSING: Class 1, Group D
Class 11 Group E, F, G
Class III



Internal Case Wiring Schematic for FLSC-35B

TABLE OF, CONTENTS
FLSC-51 and 51B SIGNAL CONDITIONERS

SECTION 1 INTRODUCTION

The OMEGA" FLSC-51 and 51B High Accuracy Integral Signal Conditioners are designed for direct mounting onto OMEGA Series FTB-100 and 200 Turbine Meters.

The FLSC-51/51B provides a scaled pulse output which may be field calibrated to the desired number of pulses per unit volume. Typical outputs which may be realized are one pulse per gallon, or ten pulses per liter, etc.

This interface subsystem approach allows for direct interfacing with a host system without requiring special software considerations being given to the method of input and storage of flowmeter calibration constants. Partitioning of the system by this means will also allow for easy field adjustment when such calibration constants change due to repair or replacement. The calibration scaling factor is entered into a digital thumbwheel switch matrix.

The input signal conditioning circuitry is designed to accept the low level flowmeter signal while rejecting 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 signal on the output.

Two outputs are available, providing flexibility in the interface as required by the host system. The output is available in the form of CMOS/TTL compatible pulse If or the FLSC-51) and in the form of an open collector pulse If or the FLSC-51B). The pulse duration is.2 ms for the FLSC-51 for use with digital electronics. The pulse duration is 50 ms for the FLSC-51B for use with electromechanical totalizers.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION OF THE FLSC-51/51B

The FLSC-51/51 B should be placed in a convenient location which maintains access to the unit should repairs or readjustment be required.

If the unit is mounted on a turbine flowmeter in an explosion proof conduit enclosure, orientate the flowmeter and run conduit to prevent the accumulation of moisture in the conduit enclosure as much as is practical. In addition, assure electronics will not be overheated by hot process lines.

Refer to Figure 2-1 for outline dimensions. Drill appropriate mounting holes as required.

Refer to Figure 2-2, wiring installation, for appropriate terminals for interconnections. The signal leads from the turbine should be shielded whenever the FLSC-51/51B is not integrally mounted. Ground shield on one end only If desired,use solder lug provided on ground stud. Connections to the terminal block should be carefully dressed to avoid having bare wires extending pass the screw clamp on the terminal block. This is particularly important for units mounted within the explosion proof enclosure. Wires should be neatly dressed near bottom of enclosure to assure wiring will not become fouled when cover is installed. Connect two conductor shielded cable f rom flowmeter. Connect shield to FLSC-51/51B only.

Unit is powered by a DC voltage, 8-35 Vdc. Connect power as illustrated in Figure 2-2.

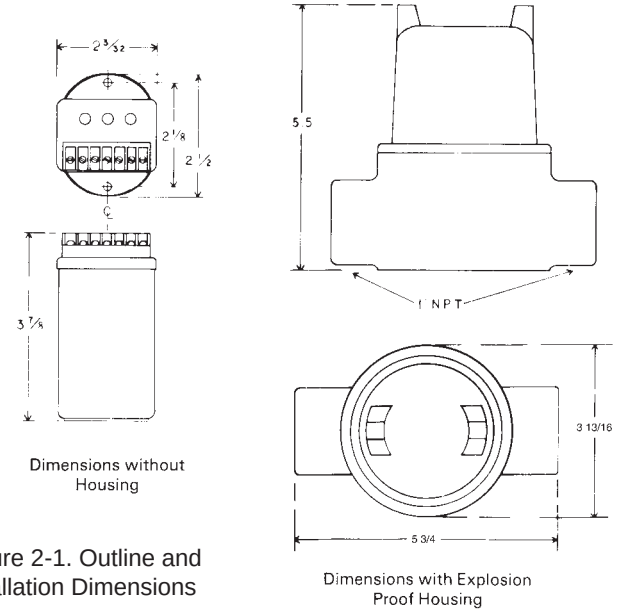


Figure 2-1. Outline and Intallation Dimensions

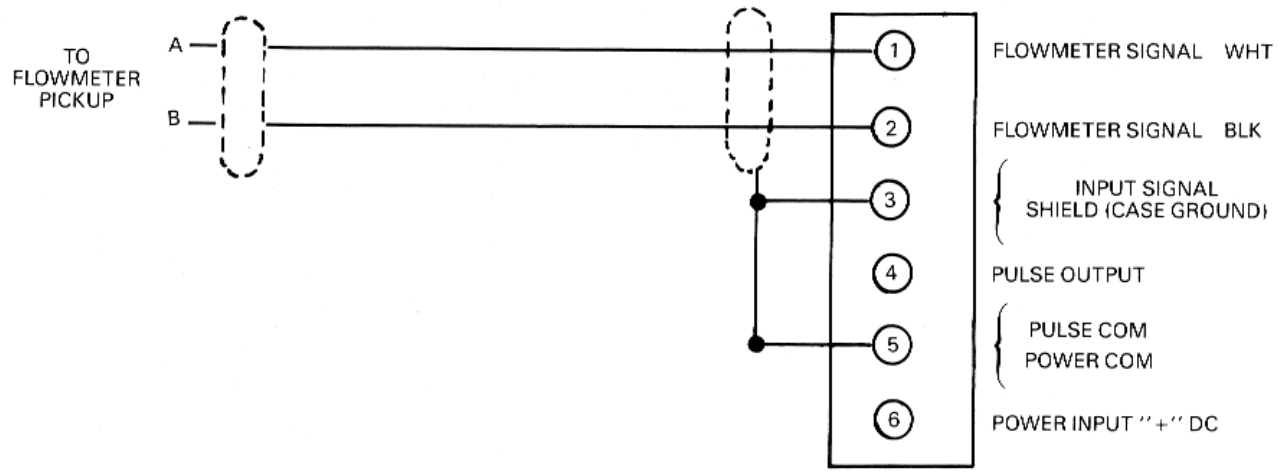


Figure 2-2. Wiring Installation for the FLSC-51/51B

SECTION 3 OPERATION

3.1 PRINCIPLE OF OPERATION

A simplified block diagram of the FLSC-51151B is shown in Figure 3-1. Key functional blocks as well as information flow are designated. The basic operation of the system is as follows.

The frequency signal from the turbine flowmeter is connected to the FLSC-51/51B 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.

The linear signal in the form of a pulse train is then passed to the System Factor which scales the signal for totalization.

The pulse scaling circuitry composing the System Factor affectively multiplies the pulse rate by a number set into the digital thumbwheel switch array on the PCA-62 printed circuit card.

At the output of the System Factor, each pulse represents a decimal multiple of the desired flow measurement units.

The pulse train is fed to 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 block, each pulse represents one unit of flow in the desired measurement units.

The pulse train is then passed through an output drive stage which is connected to a host system. A pulse is output each time a discrete volume of fluid, represented in the desired units, passes through the flowmeter.

3.2 START-UP OPERATION

Perform any purging of piping with spool piece in place. Once completed, install the flowmeter and connect cabling to pickup coil

With the Flow Measurement System properly installed and calibrated, verify the following performance checks before placing the system into active service.

The signal conditioner is normally shipped with the SENSITIVITY pot fully counterclockwise. At start-up, turn this pot gradually clockwise until input signal is sensed.

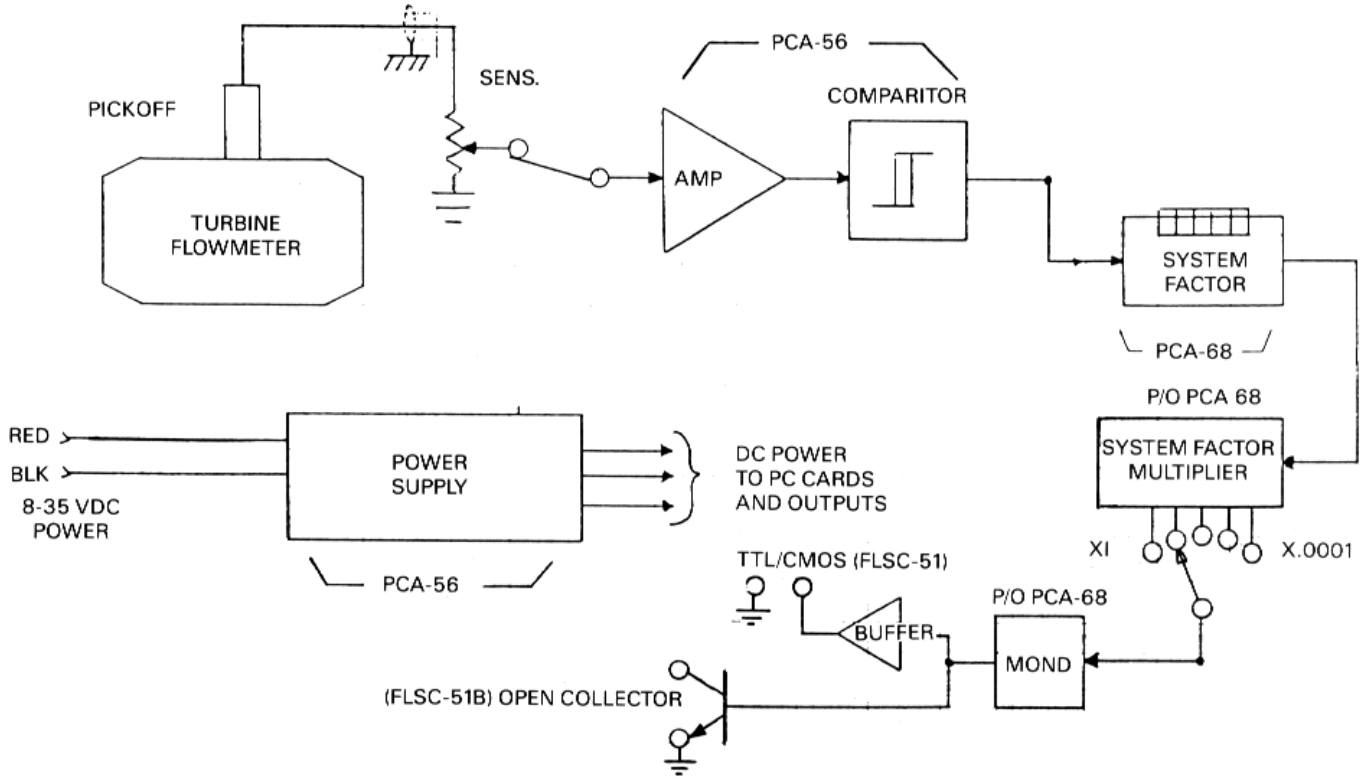


Figure 3-1. FLSC-51/51B Block Diagram

With the power to the unit, and NO flow through the flowmeter, the pulse output frequency should be 0. If the output pulse frequency is greater than 0, input noise may be present.

Slowly turn the SENSITIVITY threshold control counterclockwise until a pulse rate of 0 is indicated.

NOTE

Turning the SENSITIVITY control fully counterclockwise will render the unit inoperative,

3.3 GENERAL OPERATION

Apply power to the unit (8-35 Vdc).

The FLSC-51/51B will output the desired units of pulses per unit volume established by the calibration setup procedure (see Section 4).

Pulses output begins automatically when flow through the flowmeter commences.

3.4 CONTROLS AND ADJUSTMENTS (See Figure3-2.)

SENSITIVITY	A multiple turn control used to set the trigger level above the noise level.
SYSTEM FACTOR IS. F.)	A thumbwheel switch array composed of four switches which are used to set the desired scaling factor (.0000 to .9999). Used in conjunction with the System Factor Multiplier.
SYSTEM FACTOR MULTIPLIER (S. F. M.)	A dip switch used to enter the desired system factor multiplier (1, .1, .01, .001, .0001). Used in conjunction with the system factor.

$$(S.F.) \times (S\ F\ M) -= \frac{1}{K^1}$$

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

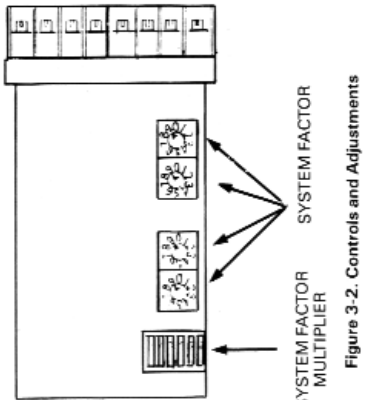


Figure 3-2. Controls and Adjustments

SECTION 4 CALIBRATION OF THE FLSC-51/61B

4.1 INTRODUCTION

The FLSC-51/51B Flowmeter Signal Conditioning/Interface/Subsystem has 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 (the SYSTEM FACTOR thumbwheel switch and the SYSTEM FACTOR MULTIPLIER dip switch).

By utilizing the SYSTEM FACTOR, the total flow may be indicated as pulse outputs in gallons, pints, liters, barrels, cc's.

4.2 PROCEDURE

Begin by obtaining a copy of the calibration sheet for the flowmeter to be used with the FLSC-51/51B, Obtain the desired units of measurement from the project supervisor or equipment specification.

From the calibration sheet for the flowmeter (supplied with flowmeter obtain the MEAN K FACTOR in cycles/gallon, designate this as the K FACTOR.

Finally, note the maximum f low rate in desired units as R (MAX) in unit volumes/minute. The value of R (MAX) should be less than the maximum count speed for the host system.

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

K' = K FACTOR x CF

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

Example:

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

Obtain: Conversion Factor CF = .2642 gallons/liter
from Table

Calculate: $K^1 = 200 \times .2642$

$= 52.84 \frac{\text{Pulses}}{\text{Liter}}$

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

SECTION 5 TROUBLESHOOTING

In case of an inoperable or malfunctioning system the following procedures can be used to isolate the faulty wiring, printed circuit boards and/or alternate causes. The majority of repairs can be made in the field thereby reducing the time a unit is out of service.

The necessary documentation is contained within this manual with the exception of the calibration data sheet for the turbine flowmeter. This calibration is supplied with the turbine flowmeter.

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.

Failure conditions are listed and the possible corrective actions given to eliminate the observed problem.

Proper operation of the FLSC-51/51B can be assumed when with power applied to the unit, the pulse output produces a pulse train of the desired amplitude when flow through the flow transducer occurs.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Unit does not produce pulse output with	Power Loss	Check inter-connecting wiring and and host system.
	Bad pickup coil or signal cable	Check coil and cable for continuity and leakage. Replace if bad.
	Fouled or damaged turbine flowmeter	Remove and clean per manufacturers recom-mended procedure.
	Bad FLSC-51/51B	Repair or replace with new unit.
	Sensitivity Pot turned too far clockwise.	Readjust Sensitivity control.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Unit produces pulse with no flow out	Input noise	Turn Sensitivity Pot clockwise until false output stops.
	Bad pickup coil or open signal cable	Check coil and cable for continuity and leakage. Replace if bad.
	Extreme shock or vibration of piping.	Dampen or relocate flowmeter.
	Power supply malfunction	Check and repair as required.
	Bad FLSC-51/51B	Repair or replace with new unit

SECTION 6 SPECIFICATIONS

INPUT Input filtered, RF and Bandpass filtered adjustable trigger level; Input impedance - 10 mV RMS, 10-1000 Hz; Over voltage capability 120 V RMS (absolute)

PULSE SCALING: System Factor and System Factor Multiplier provide a cascaded chain of two scaling factors. The system factor provides for scaling factors of .0000 to.9999 with four thumbwheel switches. The system f actor multiplier provides additional scaling factors of 1, .1, .01, .001, .0001.

OUTPUT CHARACTERISTICS: Pulse Duration - .2 ms (FLSC-51); 50 ms (FLSC-51B)

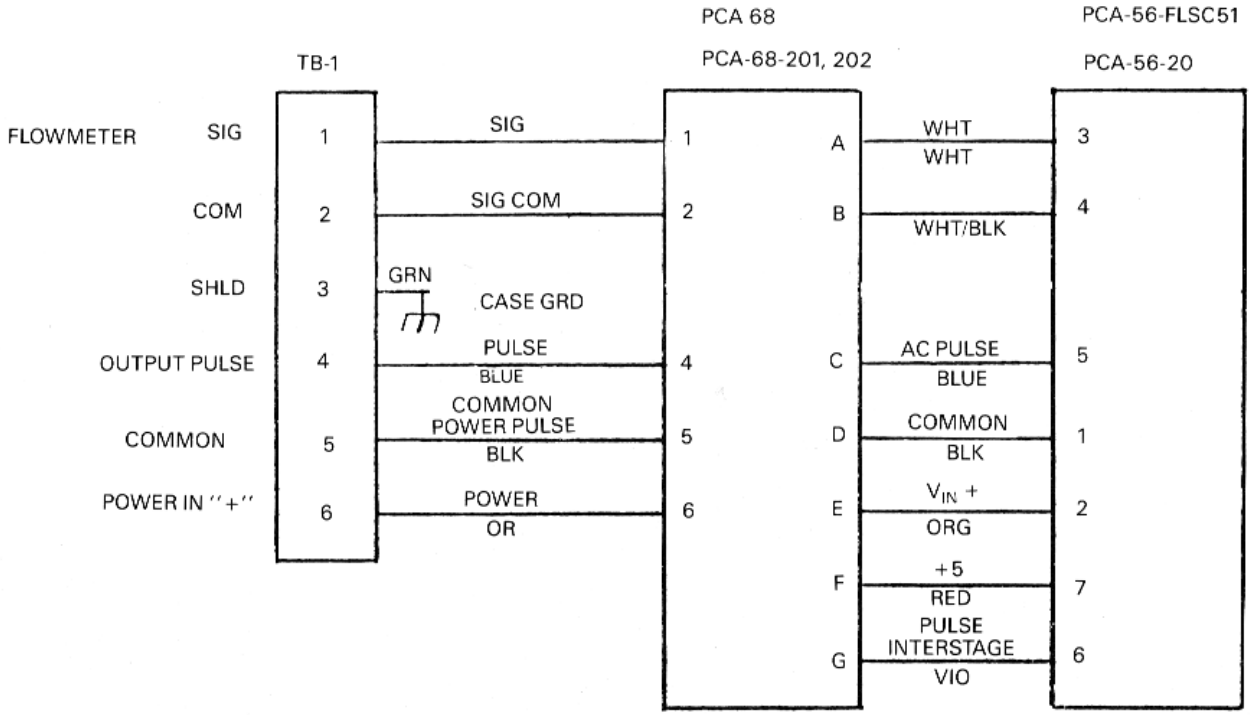
Open Collector Type FLSC-51B) - 2N6660 V max 60 Vdc Absolute Max. I max 1.2 Adc Absolute Max. CMOS/TTL (FLSC-61) Logic 1, 2.4 Vdc @ -.800 mA Logic 0, 0.4 Vdc @ 2.6 mA

High Level Pulse Output may be provided with a pullup resistor to the input power supply.

INPUT POWER: 8-35 Vdc @ 10 mA; Reverse Polarity Protected; Input Filtered

ENVIRONMENTAL: Operating Temperature 0° to 70°C (STD); Storage Temperature -65° to 150°C

ELECTRICAL HOUSING: Class 1, Group D
Class 11 Group E, F, G
Class III



INTERNAL CASE WIRING SCHEMATIC FOR FLSC-51/51B

NOTES:

NOTES:

Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

Shop online at www.omega.com

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M0390/0301