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# **Ω OMEGA®** **User's Guide**

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### **Servicing North America:**

**U.S.A.:** Omega Engineering, Inc., One Omega Drive, P.O. Box 4047  
ISO 9001 Certified Stamford, CT 06907-0047 USA  
Toll Free: 1-800-826-6342 TEL: (203) 359-1660  
FAX: (203) 359-7700 e-mail: info@omega.com

**Canada:** 976 Bergar  
Laval (Quebec), H7L 5A1 Canada  
Toll-Free: 1-800-826-6342 TEL: (514) 856-6928  
FAX: (514) 856-6886 e-mail: info@omega.ca

### **For immediate technical or application assistance:**

**U.S.A. and Canada:** Sales Service: 1-800-826-6342/1-800-TC-OMEGA®  
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info@omega.com.mx e-mail: espanol@omega.com

### **Servicing Europe:**

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Toll-Free: 0800 099 3344 TEL: +31 20 347 21 21  
FAX: +31 20 643 46 43 e-mail: sales@omegaeng.nl

**Czech Republic:** Frystaska 184  
733 01 Karviná, Czech Republic  
Toll-Free: 0800-1-66342 TEL: +420-59-6311899  
FAX: +420-59-6311114 e-mail: info@omegashop.cz

**France:** Managed by the United Kingdom Office  
Toll-Free: 0800 466 342 TEL: +33 (0) 161 37 29 00  
FAX: +33 (0) 130 57 54 27 e-mail: sales@omega.fr

**Germany/Austria:** Daimlerstrasse 26  
D-75392 Deckenpfronn, Germany  
Toll-Free: 0800 6397678 TEL: +49 (0) 7056 9398-0  
FAX: +49 (0) 7056 9398-29 e-mail: info@omega.de

**United Kingdom:** OMEGA Engineering Ltd.  
ISO 9001 Certified One Omega Drive, River Bend Technology Centre, Northbank  
Irlam, Manchester M44 5BD United Kingdom  
Toll-Free: 0800-488-488 TEL: +44 (0) 161 777-6611  
FAX: +44 (0) 161 777-6622 e-mail: sales@omega.co.uk

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The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**WARNING:** These products are not designed for use in, and should not be used for, human applications.

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# **1. Introduction**

The following information is provided for the proper installation and maintenance of your instrument.

## 2. Specifications (Turbine)

Over-range:	150% of maximum flow (intermittently)
Turn Down Range:	Dependent on gas density at user's operating conditions.
Linearity:	±1% of reading typical
Repeatability:	±0.25% of reading over repeatable range
Temperature Range:	-157 to 150 C (-250 to 300 F)
End Fittings:	Standard: NPT Optional: MS flared and flanged styles
Bearing Styles:	Self lubricating, ceramic hybrid ballbearings
Materials:	316/316L dual rated stainless steel with 17.4 pH rotor. <i>Consult OMEGA Flow Engineering for other available materials.</i>

### 3. Specifications (Transmitter)

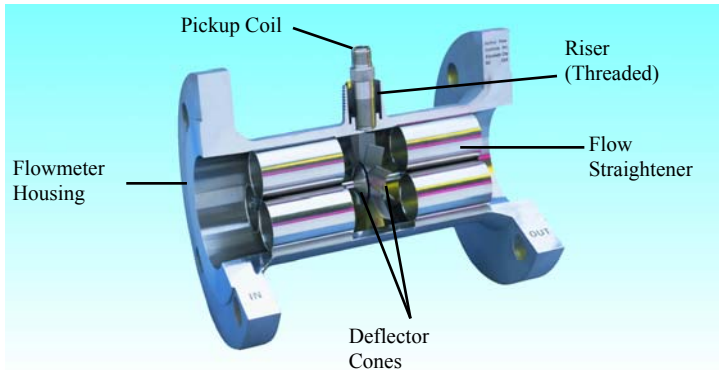
Input Signal Type:	MCP pickup
Input frequency range:	0.2 Hz to 4 KHz
Signal level:	10 mV rms to 30 Vdc
Power supply:	13-30 Vdc, 50mA max, reverse polarity protection 100-240 Vac, (optional)
Analog Output:	4 to 20mA, 1 to 5V, (dip switch selectable) 24mA overflow condition
Load resistance:	Max 650 $\Omega$ at 24 Vdc
Accuracy:	$\pm 0.02\%$ of full scale
Temperature drift:	40 ppm $^{\circ}\text{C}$
Pulse output:	0 to 5V
Recommended Minimum Load Resistance:	50k $\Omega$
Pulse Scaling:	Divide by 1, 10, 100 per flow unit of measure
Hi/Lo Alarm (Optional):	Relay (2A, 30 Vdc), 0 to 5V, Open Collector (0.5A, 30 Vdc)
Communications	RS232 port for configuration and diagnostics
Linearization:	Up to 20 points
Operating temperature:	-40 to 85 $^{\circ}\text{C}$ (-40 to 185 $^{\circ}\text{F}$ )
Humidity:	0 to 90% non-condensing
Enclosure:	Explosion-Proof FM: Class I, Div. 1, Gr. ABCD Class II/III, Div. 1, Gr. EFG CSA: Class I, Div. 1, Gr. ABCD Class II, Div 1, Gr. EFG, Class III Type 4X Ex d IIC, Class I, Zone 1, IP 66 ATEX: Ex II 2GD Ex d IIC IEC: Ex d IIC IP68
Regulatory:	CE compliant

## 4. Model Number

Omega Model Number	Meter Size	Fitting Size	Blade Angle	0.05#/FT3 Range ACFM	0.25#/FT 3 Range ACFM	Press. Drop (PSID) @ 0.05# /FT3	Press. Drop (PSID) @ 0.25# /FT3
SYS/FTBG-101/FLSC-C3	1/4	1/2	30°	0.3-1.6	.13-1.6	0.1	0.5
SYS/FTBG-102/FLSC-C3	1/4	1/2	15°	0.65-3.5	.35-3.5	0.02	0.1
SYS/FTBG-103/FLSC-C3	3/8	1/2	30°	0.6-2.3	.27-2.3	0.1	0.5
SYS/FTBG-104/FLSC-C3	3/8	1/2	15°	1.3-5	.6-5	0.02	0.1
SYS/FTBG-105/FLSC-C3	5/8	3/4	30°	1-4.4	.45-4.4	0.1	0.5
SYS/FTBG-106/FLSC-C3	5/8	3/4	15°	2.17-9.5	1-10	0.025	0.125
SYS/FTBG-107/FLSC-C3	3/4	3/4	30°	1.2-9.2	.54-9.2	0.1	0.5
SYS/FTBG-108/FLSC-C3	3/4	3/4	15°	2.6-20	1.2-20	0.02	0.1
SYS/FTBG-109/FLSC-C3	1	1	30°	1.6-20	.72-20	0.2	1
SYS/FTBG-110/FLSC-C3	1	1	15°	3.5-43	1.6-43	0.04	0.2
SYS/FTBG-111/FLSC-C3	11/2	11/2	30°	3.5-55.5	1.6-55.6	0.15	0.75
SYS/FTBG-112/FLSC-C3	11/2	11/2	15°	7.6-120	3.5-120	0.035	0.175
SYS/FTBG-113/FLSC-C3	2	2	30°	7-93	3.1-93	0.3	1.5
SYS/FTBG-114/FLSC-C3	2	2	15°	15-200	7-200	0.0625	0.3125
SYS/FTBG-115/FLSC-C3	3	3	30°	15-363	6.7-363	0.4	2
SYS/FTBG-116/FLSC-C3	3	3	15°	35-600	15-600	0.1	0.5
SYS/FTBG-101/FLSC-C3-AL	1/4	1/2	30°	0.3-1.6	.13-1.6	0.1	0.5
SYS/FTBG-102/FLSC-C3-AL	1/4	1/2	15°	0.65-3.5	.35-3.5	0.02	0.1
SYS/FTBG-103/FLSC-C3-AL	3/8	1/2	30°	0.6-2.3	.27-2.3	0.1	0.5
SYS/FTBG-104/FLSC-C3-AL	3/8	1/2	15°	1.3-5	.6-5	0.02	0.1
SYS/FTBG-105/FLSC-C3-AL	5/8	3/4	30°	1-4.4	.45-4.4	0.1	0.5
SYS/FTBG-106/FLSC-C3-AL	5/8	3/4	15°	2.17-9.5	1-10	0.025	0.125
SYS/FTBG-107/FLSC-C3-AL	3/4	3/4	30°	1.2-9.2	.54-9.2	0.1	0.5
SYS/FTBG-108/FLSC-C3-AL	3/4	3/4	15°	2.6-20	1.2-20	0.02	0.1
SYS/FTBG-109/FLSC-C3-AL	1	1	30°	1.6-20	.72-20	0.2	1
SYS/FTBG-110/FLSC-C3-AL	1	1	15°	3.5-43	1.6-43	0.04	0.2
SYS/FTBG-111/FLSC-C3-AL	11/2	11/2	30°	3.5-55.5	1.6-55.6	0.15	0.75
SYS/FTBG-112/FLSC-C3-AL	11/2	11/2	15°	7.6-120	3.5-120	0.035	0.175
SYS/FTBG-113/FLSC-C3-AL	2	2	30°	7-93	3.1-93	0.3	1.5
SYS/FTBG-114/FLSC-C3-AL	2	2	15°	15-200	7-200	0.0625	0.3125
SYS/FTBG-115/FLSC-C3-AL	3	3	30°	15-363	6.7-363	0.4	2
SYS/FTBG-116/FLSC-C3-AL	3	3	15°	35-600	15-600	0.1	0.5
FLSC-C1-LIQ	For use with FTB liquid turbines 1" riser, to be phased in as replacements for FLSC-18, FLSC-28, FLSC-34, FLSC-35 and FLSC-51 series.						
FLSC-C3-LIQ							
FLSC-C3-AL-LIQ							
FLSC-C3	Replacement signal conditioner ONLY for gas turbine system 3/4" riser.						
FLSC-C3-AL							

## 5. Principal of Operation

Omega Engineering Turbine Flowmeter includes integrally mounted microprocessor-based signal transmitter. The transmitter is mounted in an explosion proof enclosure.



The turbine flow sensor consists of a rotor assembly which is supported on a shaft held in place by triple tube clusters and secured with locking nuts within the flowmeter housing.

The rotor is free to spin on a self lubricated ceramic ball bearing. A modulated carrier pickup coil (MCP) is attached on the exterior of the flowmeter housing.

A low mass rotor design allows for rapid dynamic response. The deflector cones eliminate downstream thrust on the rotor and allows for dynamic positioning of the rotor between deflector cones.

The dynamic positioning of the low mass rotor provides wider rangeability and longer bearing life than that of conventional turbine flowmeters. Integral flow straightening tubes minimize the effects of upstream flow turbulence.

As the gas flows through the flowmeter the rotor spins at rate proportional to the volumetric gas flowrate.

Each rotor blade passing through the pickup coil generates an electrical pulse. The frequency of the pulses is proportional to flowrate. The summation of pulses represents total amount of gas volume passed through the meter.



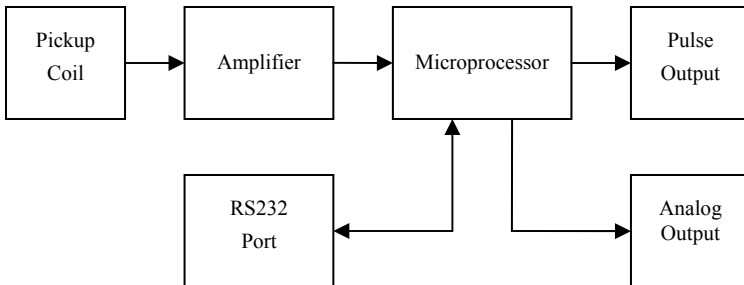
The number of pulses generated per cubic foot is called the calibration factor or K-Factor. This calibration factor is programmed into the electronic transmitter to calculate correct flowrate.

The MCP pickup is a type of coil which eliminates pickup drag and requires a Modulated Carrier Signal Conditioner circuit. The MCP works on a principle where the motion of the rotor modulates a high frequency signal. The conditioner demodulates, filters, amplifies, and shapes the resulting signal prior to sending it to the microcontroller.

### Signal Transmitter

The transmitter is a DC or AC powered microprocessor-based unit, which provides a 0 – 5 V, TTL/CMOS pulse output, a 4 to 20 mA analog output and optional High/Low flow alarm output. Optional 20-point linearization is available to correct for flowmeter non-linearities, improving overall system accuracy.

An RS232 communications port is located under the top plate of the transmitter. It allows unit to be configured using a Windows based program included with the unit. Configuration and remote monitoring may also be performed using any PC based communications program (e.g., HyperTerminal) or ASCII terminal.



**Signal Transmitter Block Diagram**

## **Material Selection and Construction**

The housing is made of 316 stainless steel. The rotor is made of 17.4 pH stainless steel. Bearings are shielded, ceramic hybrid ball bearings and are made of 440C stainless steel. Bearings are self lubricating type and do not require any external lubrication.

## **Flowmeter Calibrations**

The standard calibration provided with an Omega gas turbine flowmeter consists of a 10-point water calibration that is traceable to NIST. Based on this water calibration, we derive an average k-factor for water for the flowmeter. The average k-factor for water is then converted to ACF by using the following equation.

$$\text{K-Factor} / .134 = \text{pulses/ACF}$$

The uncertainty of this calibration methodology is +/-2%

The gas flowmeters are optionally available with actual gas calibrations at an additional charge. The uncertainty of an actual gas calibration is +/-0.5%. Actual gas calibrations are generally recommended for custody transfer (billing) applications.

The k-factor on turbine flowmeters used on gas service is NOT density dependent. The flowmeter “turndown” range is density dependent. The higher the operating density; the better the flow turndown range is on any Omega gas turbine flowmeter.

## **6. Installation**

Inspect all packages for any indications of damage which may have occurred during shipment.

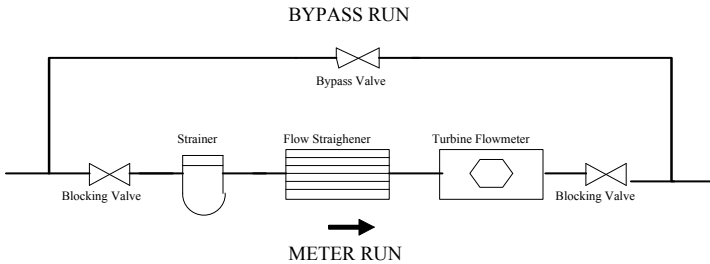
Verify that all meter parts or auxiliary components have arrived with the shipment. Refer to the packing list/invoice for a detailed list of items included in the shipment.

The flowmeter should be installed horizontally for proper operation. It is required to install meter with a minimum straight run of pipe approximately 10 pipe diameters ahead of the inlet and 5 pipe diameters following the outlet.

The meter housing is marked by a flow direction arrow and the inlet is marked 'IN' and the outlet is marked 'OUT'. The meter must be installed in the piping in the correct orientation to ensure the most accurate and reliable operation.

Install meter with adequate distance and isolation from electric motors, transformers, welding equipment and solenoids to avoid any electromagnetic interference from ambient electrical field.

A typical flowmeter installation is shown below:



**Figure 1:** Typical Flowmeter Installation

Blocking and Bypass valves should be installed if it is necessary to do preventive maintenance on the flowmeter without shutting down the flow system. The Bypass valve can be opened before the Blocking valves allowing the flow to continue while removing the turbine flowmeter for service.

---

**IMPORTANT:** *All flow lines should be purged prior to installing the meter. To prevent possible damage to the meter, install the meter **ONLY** in flow lines that are clean and free of debris.*

---

Upon initial start-up of the system a spool piece should be installed in place of the flowmeter so that purging of the system can be performed to remove all particle debris which could cause damage to the meter internals.

---

**CAUTION:** *Avoid over-spinning the meter. Over-spinning the meter may cause damage to the meter internals and lead to needless meter failure.*

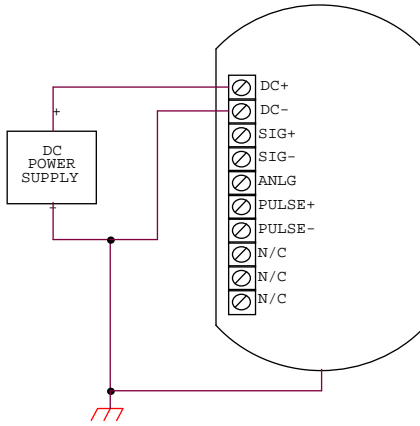
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# 7. Transmitter Wiring

Shielded cables are recommended for all input and output signals. The shield should be connected to the earth ground lug on the transmitter. The shield on the opposite end of the cable should be left unconnected.

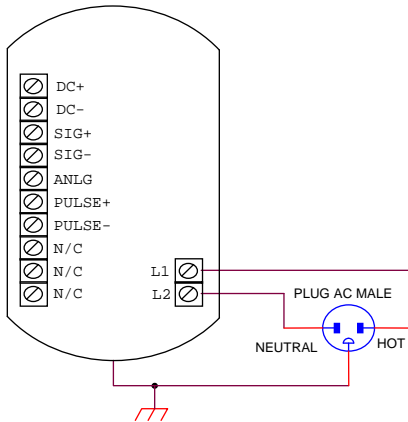
This wiring practice is required for electromagnetic compatibility, as per EMC-Directive 89/336/EEC of the Council of European Community.

## DC Power Supply (13-30 VDC)

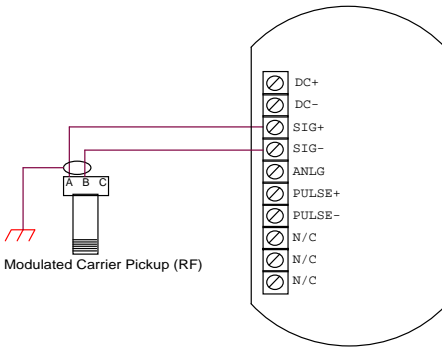


## AC Power Supply (100-240 VAC)

AC power for TRANSMITTER requires an optional circuit board, PCA182. The Alarm option (PCA184) is not available when the AC Power option is equipped.



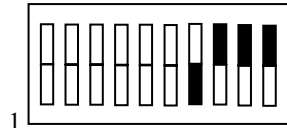
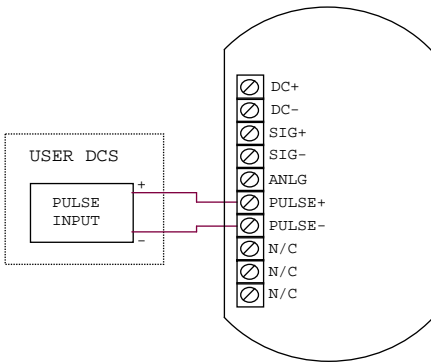
## Flowmeter Input



**PCA180  
SW1**  
DIP switch settings for  
MCP pickup coil

The flowmeter input is wired at the factory and does not require user wiring.

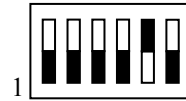
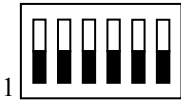
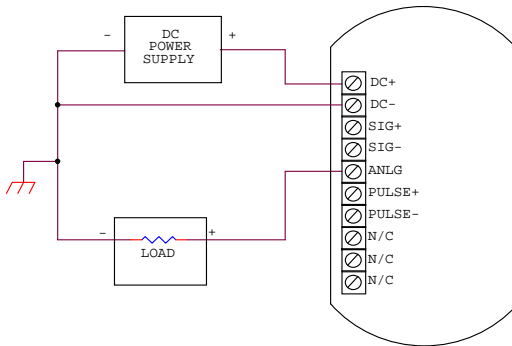
## Pulse Output (0-5V)



**PCA180  
SW2**  
DIP switch settings for  
0-5V pulse output

Pulse Output option that is scaled according to the least significant digit of the internal total amount. A scaling factor of 1, 10 or 100 is available to reduce or increase the resolution of the pulse output. For example, if the Total Decimal Point is set to 0000000.0, and the Pulse Scale is 1, then 1 pulse will be output for each tenth (0.1) of a unit of measure. Changing the Pulse Scale to 10, would result in an output pulse for each 1.0 unit of measure. The output must be scaled so that the pulse frequency does not exceed the Pulse Frequency setting (100 Hz. Max) at the maximum flow rate

## Analog Output



Analog Output is proportional to the flow rate. Default settings are 4mA (1V) at zero flow and 20mA (5V) at max flow rate of the turbine.

The following equations are used to compute the flow rate and analog output current.

Where:

$$flowrate = \frac{frequency}{Kfactor} \times 60^{FM} \times CF$$

Kfactor = Is dependent on the Flow Calculation Method setting and is either the Average K-Factor or the Linearized K-Factor from the Frequency / K-Factor table.

FM = Is the Flow rate Units setting of 0, 1, or 2. Where “0” is For Seconds, “1” is for Minutes, and “2” is for Hours.

CF = Is the Correction Factor setting.

$$current = 4mA + \left( 16mA \times \frac{flowrate}{AF} \right)$$

Where:

AF = Is the 20 mA maximum Flow rate value.

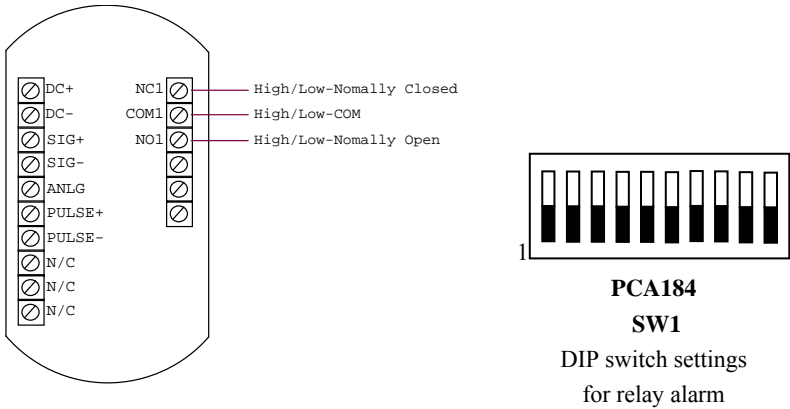
If the calculated flowrate is greater than the AF setting, the current will be set to 24mA to indicate an “Over-range” condition.

The analog output response time to reach steady state due to a change in the flow rate is approximately 0.25 seconds. When flow stops, the time for the analog output to return to 4 mA will be between 3 and 12 seconds, depending on the Maximum Sample Time (MST) setting. MST is adjusted using the NB= (DATA) command, where NB is a value between 1 and 80. The default MST setting is NB= 1. Adjusting the MST is only recommended for low flow applications where the minimum input frequency is below 1 Hz.

## Alarm Output

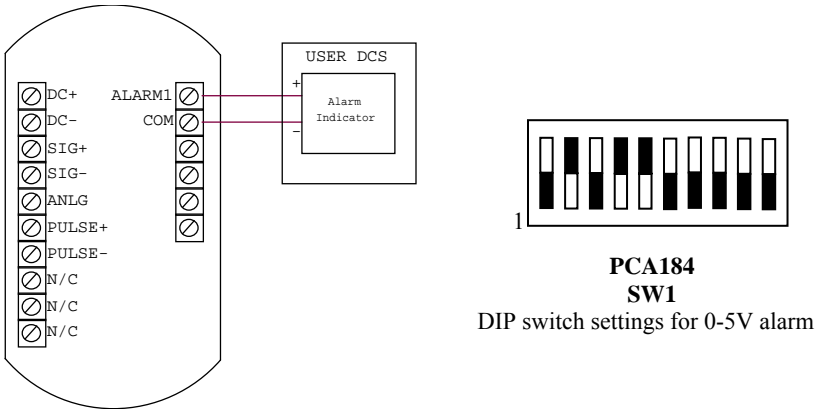
Optional High/Low Flow Alarm feature requires an optional circuit board, PCA184. The Alarm option is not available when the AC Power option is equipped.

### Hi/Lo Alarm (Relay)

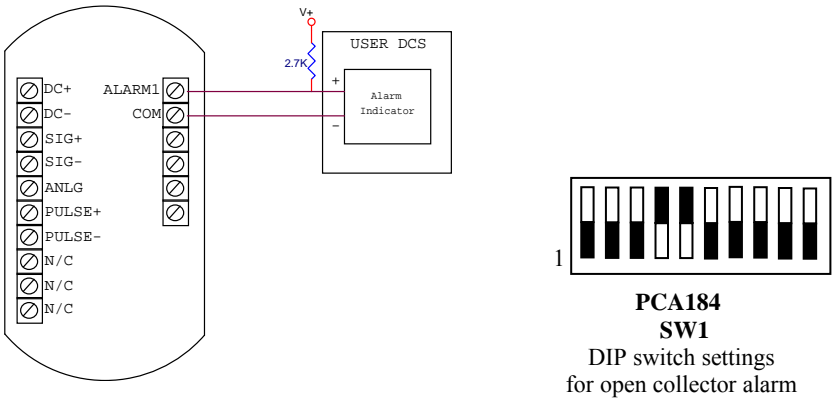




## Hi/Lo Alarm (0-5V)



## Hi/Lo Alarm (Open Collector)



## RS232 Communications Port

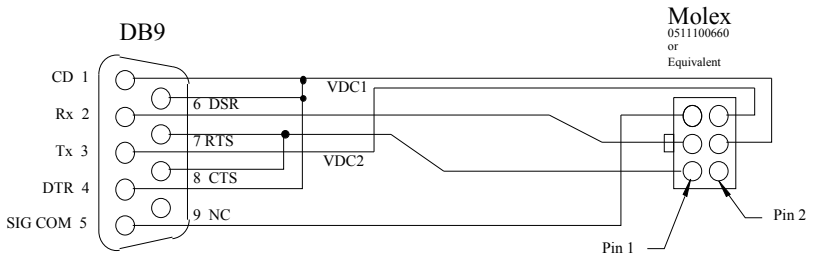
The RS232 serial port connector is located under the top plate of transmitter and may be accessed by removing the two screws from the top plate. A matching connector is provided with Communications Cable supplied with transmitter.

Transmitter unit has to be powered from external supply in order to be able to communicate. Additional power for TRANSMITTER communication circuitry is supplied by the RS232 serial port of the computer/terminal.

COM port settings must be set as follows:

Baud Rate:	2400
Data Bits:	8
Parity:	None
Stop bits:	1
Handshaking:	None

## Communications Cable



## 8. Maintenance and Troubleshooting

### Pickup Coil Testing

Testing the MCP pickup coil requires measuring the resistance with an ohmmeter.

1. Measure the resistance between pin A and pin B. The resistance should be approximately  $11.5 \pm 10\%$  Ohms.
2. The resistance from any pin to the case should be greater than 1 mega Ohm.

If either resistance measurement fails, replace the pickup coil. When installing a coil, make sure to firmly seat the coil in the flowmeter housing.

### Bearing Testing

It is recommended that the shielded, self lubricating ceramic ball bearings be checked periodically for wear. The cleanliness of the gas affects the life expectancy of the bearings.

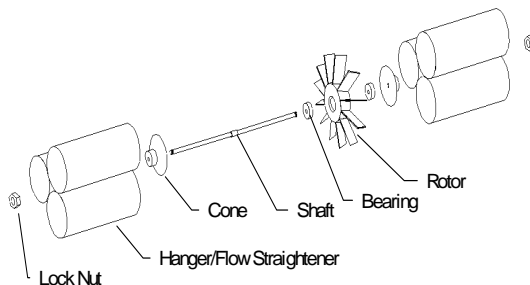
It is recommended that the bearings be replaced if any signs of wear are apparent. An unexplained shift in the output accuracy could be a sign of worn bearings.

---

**CAUTION:** *If bearings are allowed to operate without replacement at the recommended interval, the accuracy of the device may drift from the original calibration and if left long enough severe damage to the rotor and/or internals may occur.*

---

The shielded, self lubricating 440c SS ball bearings may be changed in the field.



**Figure 1** Exploded View - Flowmeter Internals

## Bearing Replacement

1. Move the flowmeter to a clean stable work surface.
2. Using two “Spin-Tite” wrenches, remove one lock nut from the shaft.
3. Place a small head stove bolt in a vise. Guide the bolt head gently through one of the hanger/flow straightener tubes and in a smooth firm stroke remove the hanger from the housing.
4. With the shaft placed vertically downward, carefully remove a cone, two bearings, and the rotor.
5. Remove the other hanger in a similar manner.
6. Examine the shaft and cones for scoring. If scoring is present, replacement is necessary.
7. Obtain new bearings of the same type from stock or the manufacturer. Discard old bearings.
8. Reassemble one hanger in the housing with the shaft, a cone, and lock nut.
9. Place the bearings into the rotor. Guide the bearings and rotor onto the shaft making sure to reassemble with the “IN” side of rotor facing the “IN” side of the housing.
10. Place the remaining cone on the shaft. Gently “rattle” the flowmeter to seat the internals on the shaft.
11. When properly seated, gently push the hanger onto the shaft. Be sure to properly align the hanger on the shaft. The hangers seat against a shoulder machined into the housing.
12. Gently tighten the self-locking lock nuts until they make contact with the spring clip hanger. “Two Finger” tight on a “Spin-Tite” is more than adequate.
13. Holding the meter horizontally, gently blow into it (DO NOT use compressed air). The rotor should turn freely. With a magnetic coil the rotor should gradually slow down and then “quiver” to a stop with one of its blades aligning with the pickup coil. With a MCP (RF) coil the rotor should “coast” smoothly to a stop.
14. Clean the flowmeter assembly with ISOPROPYL ALCOHOL or an alternately approved cleaning solution.

## 9. Communication Protocols

### Message Format and Timeout

Communication messages consist of a string of ASCII characters terminated by a carriage return character. The maximum message length coming to the unit is 20 characters, including the carriage return. The unit will transmit no more than 35 characters before transmitting a carriage return.

If a message longer than 20 characters sent, the instrument responds with

```
"Command Sequence is Too Long!<NL>"
```

If an unrecognized or invalid command is sent, the instrument responds with

```
"Invalid Command! <NL>"
```

The UNIT echoes all received messages and then transmits a response string terminated with a carriage return. If the sending unit takes longer than one minute to send a message, UNIT aborts the message by clearing the receive buffer.

If the sending unit (PC or other such device) wishes to change a setting on the UNIT, the sending unit shall follow the command with an equal sign ("=") with the data following immediately after the equal sign. The carriage return terminates the message.

Any UNIT response that sends data back to the sending unit shall have an equal sign ("=") followed by the data. Space is allowed between the equal sign and the data on the return message, but the total message length is limited to 35 characters.

READ Example:

To read the number of points that the UNIT has in the K factor table, send

```
"NP<CR>"
```

The UNIT echoes the sent message, and responds with

```
"NUM PTS=2<CR>"
```

WRITE Example:

To change the number of points to 20 in the K factor table, the sending unit shall send

```
"NP=20<CR>"
```

The UNIT echoes the sent message and responds with

"NUM PTS=20<CR>".

The UNIT checks the ranges for data and rejects writes that are not within the allowed range. If the sending unit sends data that is not within the allowed range, the UNIT echoes the sent message and responds with the value that is currently stored in the UNIT.

Example:

If the sending unit wishes to change the max sample time to 2000 from the previous setting of 10, the sending unit shall send

"NB=2000<CR>"

The UNIT echoes the sent message, and responds with

"MAX M TIME=10<CR>".

## Messages

Command	Description/Allowed Data/Response
<p><b>DN</b></p>	<p>Tag Number            "0" to "99999999"            "TAG NUM = (DATA)"            The first three digits are the units code for total.            Changing these digits will change the TU settings.</p>
<p><b>FC</b></p>	<p>Linearization            "0" = Average K factor            "1" = Linearization table              "F C METHOD = AVG" for Average K factor            or            "F C METHOD = LIN" for Linearization table</p>
<p><b>KD</b></p>	<p>K Factor Decimal Point Location            "0" for 00000000.            "1" for 0000000.0 and all K Factors are less than 9999999.9, otherwise not allowed            "2" for 000000.00 and all K Factors are less than 999999.99, otherwise not allowed            "3" for 00000.000 and all K Factors are less than 99999.999, otherwise not allowed              "K-FAC DECL=(DATA)"</p>
<p><b>AK</b></p>	<p>Average K Factor            "0.001" to            "99999.999" if KD = 3            "999999.99" if KD = 2            "9999999.9" if KD = 1            "99999999" if KD = 0              "AVG KFAC =(DATA)"</p>
<p><b>NP</b></p>	<p>Number Points in the Table            "2" to "20"              "NUM PTS =(DATA)"</p>

Command	Description/Allowed Data/Response
<b>F##</b>	<p>Frequency 1-20  F01 has a range of "0.000" to the value of F02 minus 0.001; F20 has a range of the value from F19 plus 0.001 to "5000.000"; Frequencies F02 to F19 must be 0.001 greater than the previous frequency and 0.001 less than the next frequency.</p> <p>"FREQ ## =(DATA)" for F01 through F20. Data to fixed three decimal places.</p>
<b>K##</b>	<p>K-Factor 1-20  "K-FACT # =(DATA)" for K01 through K09.  "K-FACT ## =(DATA)" for K10 through K20.  DATA to decimal places as per KD command.</p>
<b>CF</b>	<p>Correction Factor  "0.001" to "9999999.999"  "CORR FACT =(DATA)"</p>
<b>TU</b>	<p>Total Units  "100" for gallons  "140" for liters  "110" for cubic feet  "150" for cubic meters  "180" for barrels</p> <p>All other integer values from 0 and less than 999 will map to custom units</p> <p>"TOT UNITS =(DATA)"  (DATA) shall be:  "GAL" for gallons  "LIT" for liters  "FT3" for cubic feet  "M3 " for cubic meters  "BBL" for barrels  "CUS" for custom</p> <p>These three numbers will be the same as the first three digits of the tag number. Changes to this menu shall cause the changes to the tag number.</p>



Command	Description/Allowed Data/Response
<b>FM</b>	Rate Units "0" for seconds "1" for minutes "2" for hours "3" for days  "FLOW UNITS=(DATA)" (DATA) shall be: "SEC" for seconds "MIN" for minutes "HR " for hours "DAY" for days
<b>NB</b>	Max Sample Time "1" to "80"  "MAX M TIME=(DATA)"
<b>LF</b>	Out Low "0.000" to a maximum value of the Out High setting "4mA FLOW =(DATA)"
<b>AF</b>	Out High Minimum is the Out Low Setting (LF) to a maximum of the following: "99999.999" if RD = 3 "999999.99" if RD = 2 "9999999.9" if RD = 1 " 99999999" if RD = 0  "20mA FLOW =(DATA)"

Command	Description/Allowed Data/Response
<p><b>PS</b></p>	<p>Pulse Scale</p> <p>"0" for OFF</p> <p>"1" for 1</p> <p>"10" for 10</p> <p>"100" for 100</p> <p>"PULS SCALE=(DATA)"</p> <p>(DATA) shall be:</p> <p>"OFF" for OFF</p> <p>"1" for 1</p> <p>"10" for 10</p> <p>"100" for 100</p>
<p><b>FO</b></p>	<p>Pulse Frequency</p> <p>"1"</p> <p>"2"</p> <p>"4"</p> <p>"8"</p> <p>"PULS FREQ =(DATA)"</p>
<p><b>UA</b></p>	<p>Alarm Function</p> <p>"0" for OFF</p> <p>"1" for RATE</p> <p>"2" for TOTAL</p> <p>"ALARM FUNC=(DATA)"</p> <p>(DATA) shall be:</p> <p>"OFF" for OFF</p> <p>"RAT" for RATE</p> <p>"TOT" for TOTAL</p>

Command	Description/Allowed Data/Response
<b>AL</b>	<p>Alarm Out</p> <p>"0.001" to a maximum defined as follows:</p> <p>If UA is RATE:</p> <p>"99999.999" if RD = 3  "999999.99" if RD = 2  "9999999.9" if RD = 1  " 99999999" if RD = 0</p> <p>If UA is Total or Off:</p> <p>"99999.999" if TD = 3  "999999.99" if TD = 2  "9999999.9" if TD = 1  " 99999999" if TD = 0</p> <p>"ALARM OUT =(DATA)"</p>
<b>OC</b>	<p>Current Out</p> <p>"0" - Current output follows rate.  "1" - Current output set to 4mA.  "2" - Current output set to 12mA.  "3" - Current output set to 20mA.</p> <p>For "0", response = " Output equal to input."</p> <p>For "1", response = " Output is 4mA."  For "2", response = " Output is 12mA."  For "3", response = " Output is 20mA."</p>
<b>PR</b>	<p>Pulse Output Controlled By PS and FO</p> <p>" Pulse Output Released "</p> <p>The PS and FO menus shall control the pulse output.  Used to terminate the TP command.</p>

Command	Description/Allowed Data/Response
<b>TP</b>	<p>Output 1Hz Test Frequency for Pulse Output  " Test Pulse Output "</p> <p>Sets output to 1Hz, 50% duty cycle signal. This mode is for factory test.</p>
<b>RA</b>	<p>Release Alarm Output for Control According to Menu Settings  " Alarm Released "</p> <p>Releases alarm output for control by the alarm output settings.</p>
<b>AS</b>	<p>Alarm Output Test  "0" – Alarm output is set low.  "1" - Alarm output is set high.</p> <p>For "0", response = " Alarm Active "  For "1", response = " Alarm Released "</p> <p>After using the "AS" command, you must initiate a RA command to allow HIT-2A to return to normal operation.</p>
<b>OI</b>	<p>Output 4mA  " Output is 4mA."</p> <p>Current output set to 4mA.</p>
<b>MO</b>	<p>Output 12mA  " Output is 12mA."</p> <p>Current output set to 12mA.</p>
<b>OM</b>	<p>Output 20mA  " Output is 20mA."</p> <p>Current output set to 20mA.</p>
<b>OF</b>	<p>Output = Rate (Input)  " Output equal to input."</p> <p>Current output follows rate.</p>

Command	Description/Allowed Data/Response
<p><b>AA</b></p>	<p>Auto Data  " F (DATA) R (DATA) T (DATA) "</p> <p>The response, not the echo, is sent every two seconds until it receives another message from the master. The (DATA) following the F denotes the frequency of the pulses to a precision of three places past the decimal, the (DATA) following the R denotes the rate to a precision of three places past the decimal, and the (DATA) following the T denotes the total to a precision of three places past the decimal.</p>
<p><b>DA</b></p>	<p>Dump All  All of the responses in previous table.</p> <p>The UNIT gives all responses except for the CL command.</p>
<p><b>UI</b></p>	<p>Unit Identification  " UNIT MODEL= XX YY.ZZ "</p> <p>Model and software number for the unit. XX is the hardware revision number, YY.ZZ is the software revision where YY is the major software revision and ZZ is the minor software revision.</p>
<p><b>RR</b></p>	<p>Read Rate  " FLOW = (DATA) "  (DATA) = " 0 " to the following maximums:  " 99999.999 " if RD = 3  " 999999.99 " if RD = 2  " 9999999.9 " if RD = 1  " 99999999 " if RD = 0</p>

Command	Description/Allowed Data/Response
<p><b>CN</b></p>	<p>Adjust 4mA output point  "CN=# ( DATA ) "</p> <p>( DATA ) is the integer value that the unit sends to the 4-20mA converter to output 4mA</p> <p>This parameter is passed to the unit to adjust the 4mA output point of the device. This value is used in production at the test step to calibrate the 4mA output point. "CN" will cause an Invalid Command response and absence of the # symbol will cause the unit to ignore the data.</p>
<p><b>CM</b></p>	<p>Adjust 20mA output point  "CM=# ( DATA ) "</p> <p>( DATA ) is the integer value that the unit sends to the 4-20mA converter to output 20mA</p> <p>This parameter is passed to the unit to adjust the 20mA output point of the device. This value is used in production at the test step to calibrate the 20mA output point. "CM" will cause an Invalid Command response and absence of the # symbol will cause the unit to ignore the data.</p>
<p><b>SA</b></p>	<p>Set Alarm Output On  " Alarm Active "</p> <p>Sets the alarm output active regardless of the settings.</p>



## 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 in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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## 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.

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