Installation and Operating Instructions
Part Number- 3-9008-509 Revision A
January 2012

Daniel™ Fractional Parity Turbine Flow Meters

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THE MEASURE OF EXCELLENCE

INSTALLATION & OPERATING INSTRUCTIONS

BROOKS-Fractional Parity Turbine Flowmeters

June, 1980

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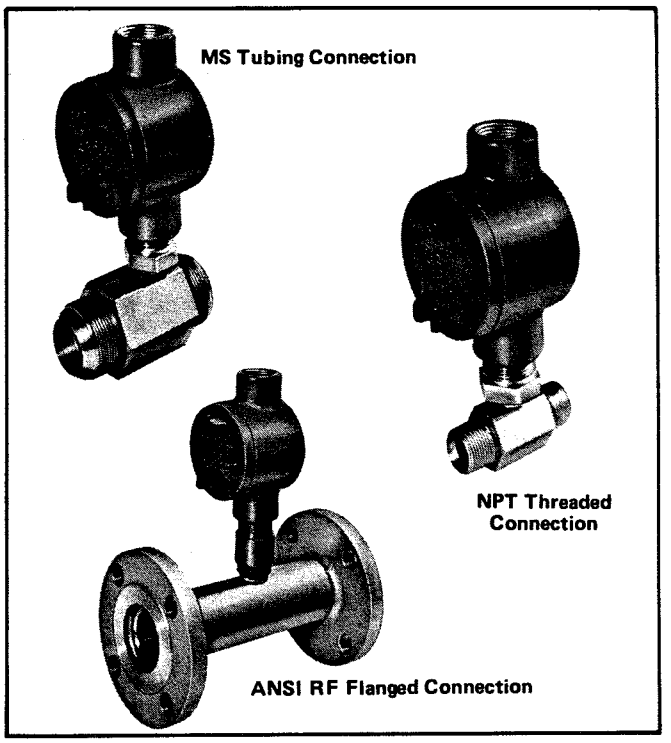

CAUTION: It is recommended that this publication be read in its entirety before performing any operation. Failure to understand and follow these instructions could result in serious personal injury and/or damage to the equipment.

Should this equipment require repair or adjustment, contact the nearest Brooks Sales Office. It is important that servicing be performed only by trained and qualified service personnel. If this equipment is not properly serviced, serious personal injury and/or damage to the equipment could result.

BROOKS - Fractional Parity Turbine Flowmeters are now manufactured by Daniel™ Measurement and Control Inc. and are sold under the Daniel™ brand of liquid measurement products.

DANIEL™

Daniel™ Measurement and Control
11100 Brittmoore Park Drive
Houston, TX 77041 USA

Daniel Part Number 3-9008-509 Rev A

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Daniel Measurement and Control, Inc. (Daniel) designs, manufactures and tests products to function within specific conditions. Because these products are sophisticated technical instruments, it is important that the owner and operation personnel strictly adhere both to the information printed on the product nameplate and to all instructions provided in this manual prior to installation, operation, and maintenance.

⚠WARNING

Installing, operating or maintaining a Daniel Product improperly could lead to serious injury or death from explosion or exposure to dangerous substances. To reduce this risk:

- Comply with all information on the product, in this manual, and in any local and national codes that apply to the product.
- Do not allow untrained personnel to work with this product.

Use Daniel parts and work procedures specified in this manual.

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BE SURE ALL PERSONNEL READ AND FOLLOW THE INSTRUCTIONS IN THIS MANUAL AND ALL NOTICES AND PRODUCT WARNINGS.

Product owners (Purchasers):

- Use the correct product for the environment and pressures present. See Technical data for limitations. If you are unsure, discuss your needs with your Daniel representative.
- Inform and train all personnel in the proper installation, operation, and maintenance of this product.
- To ensure safe and proper performance, only informed and trained personnel should install, operate, repair and maintain this product.
- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from:

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- If you resell or transfer this product, it is your responsibility to forward this instruction manual along with the product to the new owner or transferee.
- ALWAYS READ AND FOLLOW THE DANIEL™ FRACTIONAL PARITY TURBINE FLOW METERS INSTALLATION AND OPERATING INSTRUCTIONS.
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- Verify that this is the correct instruction manual for your Daniel product. If this is not the correct documentation, contact Daniel at 1-713-827-6314. You may also download the correct manual from:

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- Connect the product to the proper pressure sources when and where applicable.
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Daniel Measurement and Control, Inc.

Daniel™ Fractional Parity Turbine Flow Meters Installation and Operating Instructions

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Section 1 INTRODUCTION

1-1 Description

Fractional Parity Turbine Meters are volumetric flow measuring and transmitting devices that produce output signals directly proportional to the rate of flow of the liquid product being measured. The primary output is a high resolution signal that is amplified and shaped by an integral amplifier mounted directly on the meter. This wave pulse can be fed directly to totalizing counters, digital readout devices or control equipment. The Parity Meter can accomodate up to two primary signals.

1-2 Specifications - Fractional Parity Turbine

The following specifications apply to the meter unless otherwise noted.

CAUTION: Do not use this meter in excess of these specified values.

Materials of Construction

Housing: 303 Stn. Stl. (MS Tubing and NPT Models)
304 Stn. Stl. (Flanged Models)

Rotor Support: 316 Stn. Stl.

Rotor: Standard; 17-4 PH Stn. Stl.
(All 1/2" Meters - Nickel)

Bearings: Tungsten Carbide

Shaft: Tungsten Carbide

Thrust Washer: Tungsten Carbide

Ratings

Pressure: ANSI Pressure - Temperature rating corresponding to flanges used.

Temperature:
Standard: -100°F to 500°F (-73°C to 260°C)
Optional (Consult Factory)
Low Temperature Pick-off: -450°F to 100°F (-232°C to 38°C)
High Temperature Pick-off: -0°F to 600°F (-18°C to 316°C)

Performance (Meter)

Accuracy: ± 0.5% - 1/2" Meter Only
± 0.25% - 3/4" to 2-1/2" Meters

Repeatability: ± 0.04% - 1/2" Meter Only
± 0.02% - 3/4" to 2-1/2" Meters

Pick-off Output: 15 to 20 mv ac at Minimum Flow
2 to 3 v ac at Maximum Flow

Flow Range: 10 to 1

Linearity: ± 0.25% (3/4" to 2-1/2" Meters) ± 0.5% (1/2" Meters) of flow rate, on viscosity between 0.3 and 3.0 centistokes

Performance (Pre-Amplifier)

Power Required: 12 v dc ± 1.5 volts at 30 ma

Input Sensitivity: 5 mv Peak-to-Peak at 5 Hz

Frequency Range: 4 to 10,000 Hz

Output Signal: 0 to 5 volts pulsating d-c TTL Logic Signal. Transmitting Range up to 3,000 feet (914 meters) with Belden 8770 type cable terminated into minimum 4.7 k ohm load.

Temperature: -30°F to 185°F (-34°C to 85°C)

Connections

Mechanical

Flowmeters from 1/2" to 2" pipe sizes are available with MS Tubing or NPT threaded connections.

Flowmeters from 1/2" to 2-1/2" are available with ANSI B16.5 R.F. Flanges.
Standard: 150 lb. - 600 lb.
Optional: 900 lb. - 1500 lb.

Electrical

Standard meter to be equipped with one inductance-type pick-off (1/2" meter only) or one reluctance-type pick-off (3/4" to 2-1/2" meters) providing a minimum of 15 - 20 mv low level ac sine wave to an integrally mounted pre-amplifier.

Pre-Amp Output: 0 - 5 Pulsating dc TTL logic Signal

Optional: One additional pick-off and pre-amp mounted 90 electrical degrees out of phase from standard pick-off.

Optional: Delete pre-amp, meter supplied only with pick-off

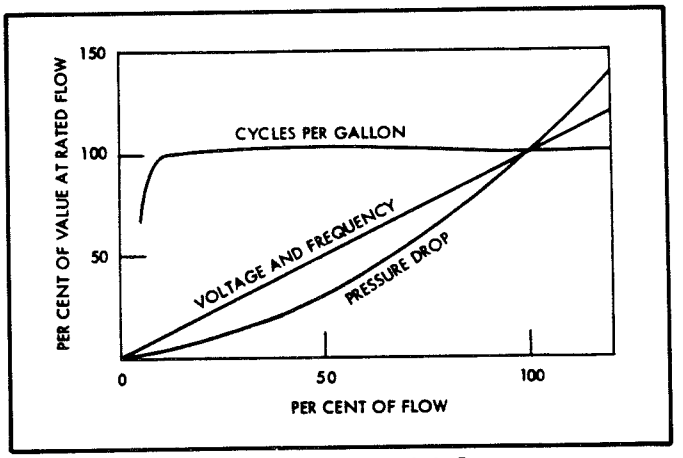


Figure 1-1 Characteristic Curves

Table 1-1 Capacities

Meter Size	Linear Flow Range				Extended Flow Range		K Factor		Pressure Drop at Max. Flow	
	Minimum		Maximum							
	GPM	LPM	GPM	LPM	GPM	LPM	Cycles/Gallon	Cycles/Litre	PSI	kPa
1/2"	.5	1.89	5.0	18.9	6.25	23.7	6700	1770	8	55
3/4"	2.0	7.57	20.0	75.7	25.0	94.6	4200	1109	9	62
1"	7.0	26.5	70.0	265	88.0	333	900	238	14	97
1-1/2"	15.0	56.8	150.0	568	188.0	712	400	106	13	90
2"	30.0	113.6	300.0	1136	375.0	1419	180	48	14	97
2-1/2"	50.0	189.3	500.0	1893	625.0	2366	100	26	10	69

NOTES: Inductance Pick-Offs — 1/2" Meter Only Reluctance Pick-Offs — 3/4" to 2-1/2" Meters

Table 1-2 Approximate Shipping Weights and Volume

Meter Size	Approximate Shipping Weight		Approximate Shipping Volume	
	Pounds	Kilograms	Cubic Feet	Cubic Meters
1/2" MS	3	1.36	.14	0.004
1/2" NPT	3	1.36	.14	0.004
1/2" 150 lb.	6	2.72	.31	0.008
1/2" 300 lb.	8	3.63	.36	0.010
1/2" 600 lb.	10	4.54	.36	0.010
3/4" MS	4	1.81	.20	0.005
3/4" NPT	4	1.81	.20	0.005
3/4" 150 lb.	7	3.18	.33	0.009
3/4" 300 lb.	9	4.08	.39	0.011
3/4" 600 lb.	11	4.99	.39	0.011
1" MS	5	2.27	.24	0.006
1" NPT	7	3.18	.41	0.012
1" 150 lb.	9	4.08	.45	0.013
1" 300 lb.	11	4.99	.53	0.015
1" 600 lb.	14	6.35	.53	0.015
1-1/2" MS	8	3.63	.31	0.008
1-1/2" NPT	11	4.99	.49	0.014
1-1/2" 150 lb.	14	6.35	.58	0.016
1-1/2" 300 lb.	19	8.62	.71	0.020
1-1/2" 600 lb.	24	10.89	.71	0.020
2" MS	11	4.99	.36	0.010
2" NPT	14	6.35	.53	0.015
2" 150 lb.	19	8.62	.71	0.020
2" 300 lb.	23	10.43	.80	0.022
2" 600 lb.	28	12.70	.80	0.022
2-1/2" 150 lb.	25	11.34	.86	0.024
2-1/2" 300 lb.	30	13.61	1.02	0.028
2-1/2" 600 lb.	38	17.24	1.02	0.028

Table 1-3 Dimensions - ANSI R.F. Flanges

Meter Size	ANSI RF Flanges					
	A		B		C	
	Inches	mm	Inches	mm	Inches	mm
1/2"	5-1/2	140	2-3/4	70	7	178
3/4"	5-1/2	140	2-3/4	70	8	203
1"	8	203	3	76	8-7/16	214
1-1/2"	9	229	3-1/2	89	8-11/16	221
2"	9	229	3-3/4	95	9-3/32	231
2-1/2"	9	229	4-1/2	114	9-9/16	243

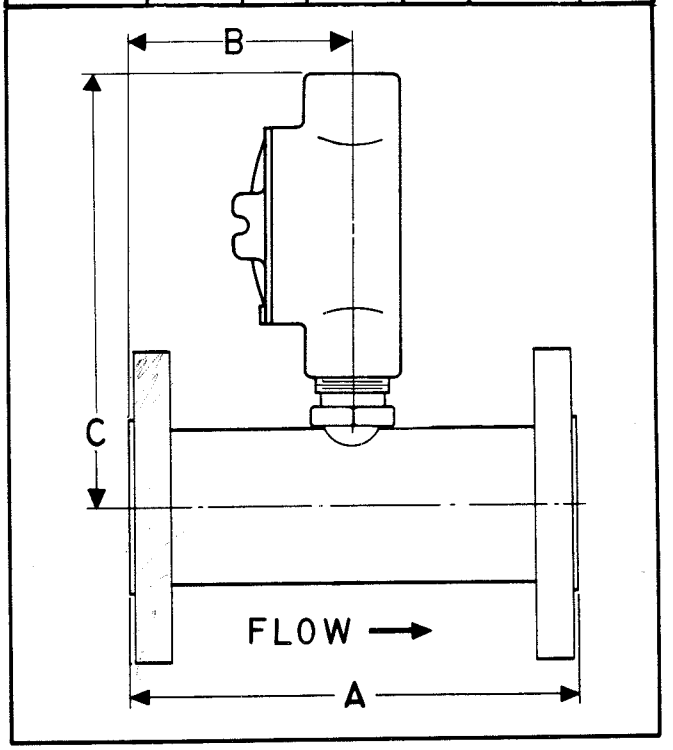
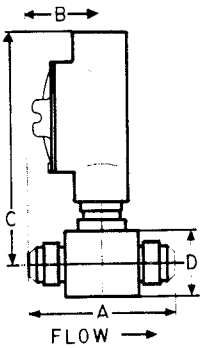


Figure 1-2 Dimensions - ANSI R.F. Flanges

Table 1-4 Dimensions - NPT Threaded and MS-33656 Tubing

Meter Size	NPT Threads							
	A		B		C		D	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm
1/2"	2-29/64	62	1-7/32	31	6-1/2	165	1	25
3/4"	3-1/4	83	1-5/8	41	6-31/32	177	1-3/8	35
1"	8	203	3	76	7-1/16	179	1-5/8	41
1-1/2"	9	229	3-1/2	89	7-5/16	186	2-1/8	54
2"	9	229	3-3/4	95	7-5/8	194	2-3/4	70



Meter Size	MS-33656 Tubing							
	A		B		C		D	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm
1/2"	2-29/64	62	1-7/32	31	6-1/2	165	1	25
3/4"	3-1/4	83	1-5/8	41	6-31/32	177	1-3/8	35
1"	3-9/16	90	2-3/32	53	7-1/16	179	1-5/8	41
1-1/2"	4-19/32	117	2-3/4	70	7-5/16	186	2-1/8	54
2"	6-1/16	154	3-3/4	95	7-5/8	194	2-3/4	70

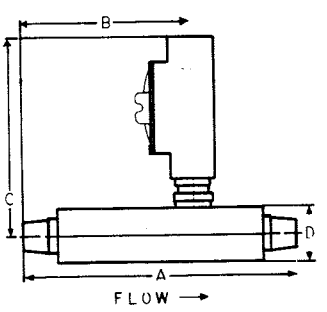


Figure 1-3 Dimensions - NPT Threaded and MS-33656 Tubing

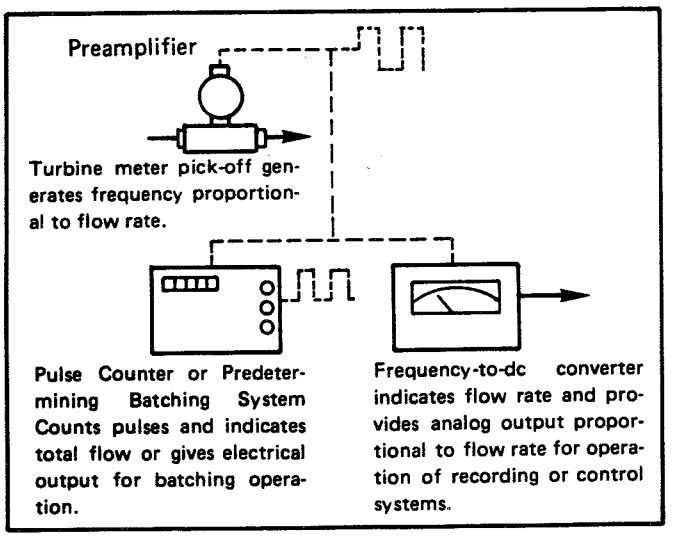


Figure 2-1 Schematic Arrangement of Turbine Meter and Readout Instruments.

Section 2 INSTALLATION

2-1 General

This section contains the procedures for receipt and installation of the meter. Specific instructions are provided for accessory equipment.

2-2 Receipt of Equipment

When the equipment is received, the outside of the packing case should be checked for any damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability.

A report should be submitted to the Product Service Department, Brooks Instrument Division, Emerson Electric Co., Statesboro, Georgia 30458.

Remove the envelope containing the packing list. Carefully remove the equipment from the packing case. Make sure spare or replacement parts are not discarded with the packing material. Inspect for damaged or missing parts.

In the event that any items are missing from your shipment, contact your local Brooks Representative or Sales Office. Provide him with the Serial Number and Sales Order Number.

2-3 Return Shipment

Do not return any assembly or part without a Return Material Report. The Return Material Report is available from all District Sales Offices and the Product Service Department, Statesboro, GA. Information describing the problem, corrective action, if any, and the work to be accomplished at the factory must be included.

2-4 General Installation Information

It is recommended that the piping installation in Figure 2-1 be followed for optimum performance of the meter. Prior to installation the consideration of the following items of general installation is highly recommended.

Installation

The Turbine Flowmeter may be mounted in any attitude or position. The recommended installation is horizontal with the pick-off on the side, rather than the top, in an outward position. This is to prevent condensation and water from setting in the pick-off well. This is the standard factory calibration position. Inlet and outlet are marked on the housing (Refer to Figure 2-2).

Table 2-1 Torque Specifications - MS and NPT Connections

Size	Steel Tubing	
	Minimum	Maximum
1/2"	37	40 Foot Pounds
3/4"	75	85 Foot Pounds
1"	100	120 Foot Pounds
1-1/2"	135	160 Foot Pounds
2"	155	200 Foot Pounds

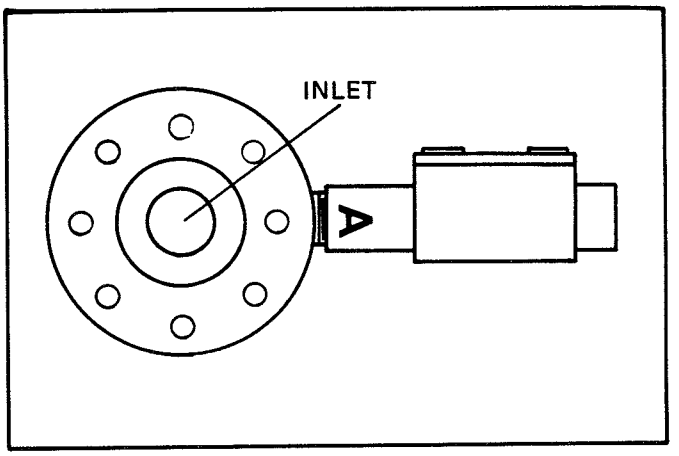


Figure 2-2 Standard Meter Installation with One Pick-up.

Twenty pipe diameters of straight pipe run upstream of the meter are recommended for maximum accuracy. At least five pipe diameters should be provided downstream. Flow straighteners also help to eliminate swirl which can influence flowmeter performance. They are recommended for high precision applications. When flow straighteners are used, they should be installed as shown in Figure 2-3.

Before installation, the flowmeter should be inspected to be certain it is absolutely clean and to see that the rotor rotates freely and easily. Strainers should be installed prior to operating the flowmeter. Recommendations are on page 5, Table 2-2. On new construction start-up or piping check-out, a dummy fitting can be installed in place of the meter to preclude any possible damage. Install the flowmeter in the direction of flow as indicated on the housing. The connection piping should not impose stress on the flowmeter itself.

The flowmeter should be located upstream of all final control elements, as well as by-pass, throttling, or on-off valves. It should never be installed in such a fashion that when flow ceases, the meter drains completely. Serious damage can be caused by striking an empty flowmeter with a high velocity fluid stream. Providing that it is full of fluid at all times, the flowmeter is not liable to damage caused by fluid velocity hydraulic shock. Over-speeding also can be detrimental to turbine flowmeters. As a safeguard, check the model number against the Calibration Data Sheet, and the flow rate shown against system flow rate or pump capacity.

Care should be taken not to locate the flowmeter or connector cable in close proximity to strong electromagnetic fields such as electric motors, transformers, sparking devices or high voltage lines. These can induce spurious signals in the flowmeter pick-off coils or cable. To avoid a-c pick-up, wiring must be in exact accordance with the wiring diagram on Page 6.

Valving

1. Valves should be capable of rapid yet smooth opening and closing with positive shut-off.
2. For intermittent flow the valves used should be fast acting and shock-free.
3. Spring-loaded or self-closing valves should be of the type which will not open to admit air when hydraulic hammering or vacuum conditions occur.
4. By-pass lines should be equipped with blind or positive shut-off devices.
5. Shut-off or control valves should be located downstream of the meter.

Flow Straightening

1. For proper operation of the meter, a flow straightener designed for the meter or a straight run of pipe, 20 pipe diameters long, is required. The pipe is the same diameter as the meter. The flow straightener or straight run of pipe must be installed upstream of the meter with no flow restricting devices in between which will cause turbulence and reverse the flow straightening effect.

Screens and Strainers

1. A strainer of proper size should be installed upstream of the meter to protect it from the entrance of foreign material, which might damage the meter.
2. A regular procedure should be set up to clean the strainer basket to prevent it from filling and rupturing the screen. Pressure gauges installed on either side of the strainer will show the differential pressure across the strainer. High differential pressure may cause the basket to rupture, permitting large quantities of foreign matter to enter the meter and require it to be disassembled and cleaned or repaired.

A screen or strainer should be installed to protect the flowmeter and to extend service life. The recommended mesh sizes are as shown:

Table 2-2 Recommended Strainer Mesh

Meter Size	Standard Sieve Mesh Size	Diameter Wire Inch	Particle Size
1/2"	120	.0037	125 Microns
3/4" & 1"	45	.0095	350 Microns
1-1/2"	18	.017	1000 Microns
2" & 2-1/2"	14	.020	.052 Square Inches

2-5 Electrical Connections

Installation of the preamplifier is covered in Installation and Operating Instructions Manual X-I.T.M.P. If electrical accessories are used, refer to their respective manuals for installation. See Instruction Cross Reference, Page 6, for service information.

Section 3 Operation

3-1 General

This section contains the operating procedures for the meter.

3-2 Pre-Start Checks

Make sure all mechanical components of meter are securely fastened together and aligned. Check electrical connections for good, firm contacts. Check bolts holding meter in line to be sure there will be no leakage. Make sure components are in right sequence in line (ie: valve, strainers, flow straightener, meter). The pick-off must have resistance of 3000 to 3500 ohms between the leads and 10 megohms between a lead and the case of the pick-off. The required minimum voltage output of the pick-off is 10 mv peak-to-peak at 10 Hz with a sine wave shape. If an electric motor or an interference inducing coil is nearby, the ideal condition is to have the turbine meter pick-off coil positioned perpendicular to and relatively centered on the interference inducing coil.

3-3 Operation

The meter should never be subjected to flow and pressure ranges above those specified. (The flow and pressure ranges are plainly stamped on a tag on the outside of the meter).

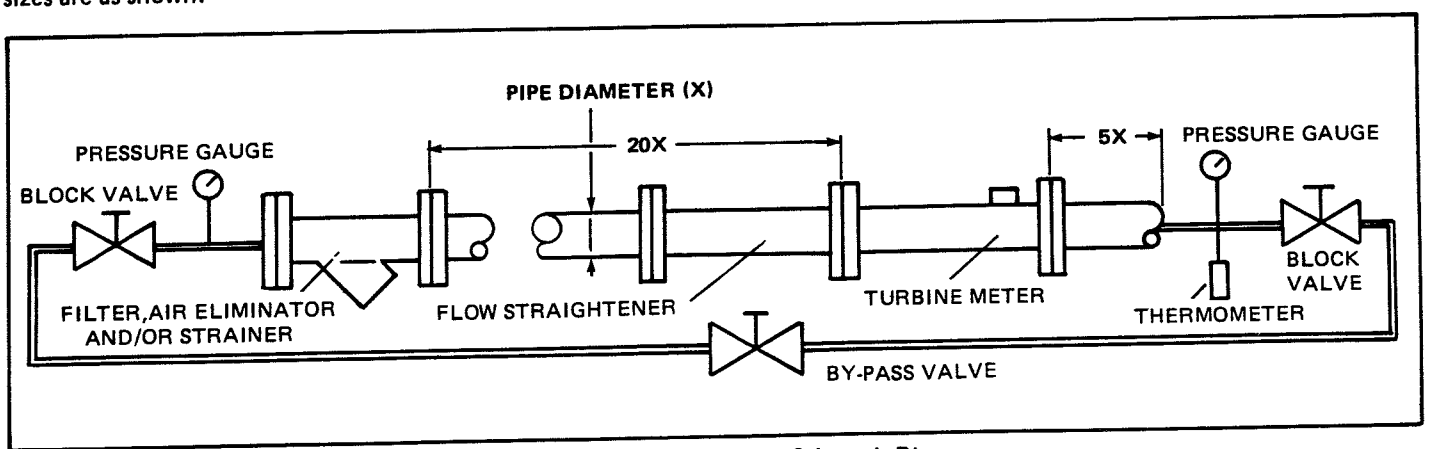


Figure 2-3 Turbine Meter System Schematic Diagram.

Do not open or close valve swiftly, in such a way as to cause shock to system.

Special care should be taken to prevent the introduction of air into the line which will result in overspeeding, damage and incorrect readings.

Avoid dropping the pick-off or getting it in excessively hot places which will cause it to lose its effectiveness.

Section 4 INSPECTION AND MAINTENANCE

4-1 General

Maintenance of the Brooks-Turbine Flowmeter consists of periodic inspection to determine that the internal parts have not been subject to fouling or corrosion. The flowmeter is designed to operate for extended periods without evidence of wear or loss of precision due to wear.

However, in the event there is a need for inspection and/or replacement of any part, it is recommended that this procedure be read and understood in its entirety before any maintenance is attempted. These procedures are recommended as follows:

1. Label all parts or place in labeled containers.
2. Use no metal clamping devices in direct contact with any meter parts.
3. If O-Rings show any signs of wear, replace them.
4. Be careful not to bend rotor blades as this is a determining factor in the accuracy of meter.
5. Do not overtighten any screws or nuts.

For close examination of internal parts, the rotor assembly may be withdrawn from the housing through the inlet end of the flowmeter after first removing the Spiralox retainer ring.

The meter calibration will not be affected by removing and replacing the rotor assembly. Should the rotor assembly itself be damaged in any fashion, it is recommended that it be returned to the factory for inspection, repair or exchange.

The rotor assembly or flowmeter itself may be cleaned with cleaning solvent or alcohol. If the flowmeter is to be stored or out of service for a considerable length of time. it should first be dipped in light machine oil and wrapped in glassine paper.

4-2 Internal Assembly

The internal assembly consists of three major parts: 1) Inlet diffuser assembly, 2) the rotor and bushing assembly and 3) the outlet diffuser assembly (sizes 1/2" thru 2" only). The standard material for the internal assembly is stainless steel with Tungsten Carbide bearings. As a general practice, the rotor assembly itself is disassembled only at the factory.

If necessary, the internal assembly may be removed from the housing by first removing the Spiralox retainer ring, and then withdrawing the assembly from the inlet end of the meter. If the rotor assembly is removed, the side with the "U" will be reassembled facing the inlet of the meter.

4-3 Pick-Off Coil and Electrical Connections

Pick-Off Coil

The Turbine Meter Pick-Off Coil produces a low level sine wave signal which varies both in amplitude (mv), and frequency (Hz), proportional to the velocity of the turbine blades. This signal information is coupled to the input terminals of the preamplifier.

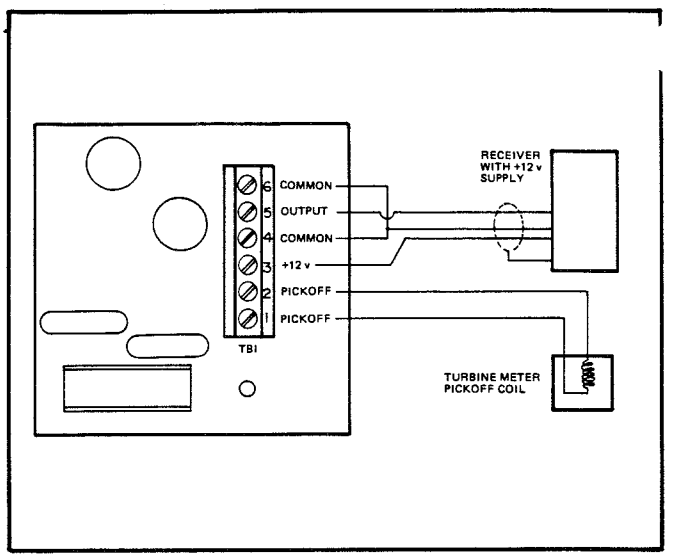


Figure 4-1 Electrical Connections

Electrical Connections

The input signal connections are made at Terminal Strip TBI. Refer to Figure 4-1 for the power supply and output signal connections.

Induced Interference

The Turbine Meter should be located as far as possible from any electrical equipment such as motors, solenoid. relays, etc., which could possibly induce an interference signal into the turbine meter pick-off coil. If high amplitude interference is introduced into the preamplifier, it could interfere with the flow signal. Upon installation of the turbine meter and preamplifier, the presence of an interference signal can be detected by performing the following check:

a. Connect a suitable readout device to the pre-amp output terminal on Terminal Strip TBI (No. 5)
b. Apply +12 volt power to pre-amp.
c. At a no-flow condition, if an output is indicated on the readout, induced interference is present.

If interference is present, it may be reduced or eliminated by changing the location or rotating the turbine meter in the pipeline in progressive steps while simultaneously checking the output for the lowest possible signal reading.

4-4 Cycles Per Gallon Or "K" Factor

Each output cycle from the Brooks-Turbine Flowmeter represents a discrete volume of fluid. The relationship between the cycle and a discrete volume of fluid is given by the meter calibration factor. This meter calibration factor is generally referred to as the "K" factor, and is typically expressed in "cycles per gallon". The degree to which these cycles represent the given volume of fluid at various flow rat determines the flowmeter's accuracy and repeatability. Ti variation experienced in this cycle-volume relationship over a specified flow-rate range, defines the flowmeter's linearity. When the variation is small, the plot of the calibration data will approach an ideal flat curve.

Table 5-1 TROUBLESHOOTING

Condition	Cause	Correction
No output pulses from amplifier module	1. Input voltage to amplifier below minimum required for operation 2. Damaged amplifier module 3. Receiver unit not operating 4. Meter rotor not turning	1. Replace pick-off 2. Replace amplifier module 3. Refer to instruction manual on defective unit 4. Troubleshoot internal assembly
Turbine Meter rotor not turning	1. Defective rotor shaft bushing or sleeve 2. Rotor damaged by foreign material passing through meter	1. Send rotor assembly to factory for replacement or repair 2. Send rotor assembly to factory for replacement of repair
Inaccurate readout	1. Foreign material on rotor blades 2. Rotor blades bent 3. Defective accessory equipment	1. Check and clean blades 2. Send to factory for replacement or repair 3. Troubleshoot equipment

4-5 Calibration

The standard calibrations of Brooks-Turbine Flowmeters are "K" factor calibrations with water or MIL-F-7024 Type 2 fluid, Stoddard Solvent. Total cycles accumulated for a given number of gallons gives cycles per "gallon". And with a constant flow rate, the time interval for total cycles accumulated gives the frequency.

4-6 Data Sheets and Calibration Curves

Calibration data is recorded on the calibration data sheet furnished with the turbine flowmeter. Frequency, flow rate, cycles per gallon, and millivolt output are given for five or more flow rates covering the complete flow range of the flowmeter.

Frequency versus flow rate curves are furnished when specified. In a case where the turbine meter frequency output is non-linear, such as the ELF low flow design, the frequency versus flow rate curve is used together with a readout which indicates frequency. Then the frequency output indicated is referred to the frequency curve to determine the flow rate.

4-7 Back Pressure

The turbine flowmeter perferably should be used with a centrifugal pump and should work against a constant head. The back pressure must equal the pressure drop through the turbine meter, plus the vapor pressure of the flowing fluid at the operating temperature and pressure, plus a minimum of 15 psi (103 kPa). This will assure that there will be no cavitation through the flowmeter which could permanently damage the bearing and/or the rotor.

4-8 Cryogenic Service and Flashing Liquids

To assure that liquids will not flash when subjected to the pressure drop through the turbine meter, it is essential that the operating pressure at the meter outlet be at least 15 psi (103 kPa) greater than the vapor pressure of the metered liquid at the operating temperature. Although the flowmeter can tolerate occassional, incidental vaporizing, the possibility of flashing conditions should be avoided. The considerable rotor overspeeding due to flashing will accelerate wear with eventual damage to the rotor. The frequency output from the flowmeter during flashing is not a valid measure of the flow rate since individual flowmeters are designed for liquid service.

Section 5 TROUBLESHOOTING

5-1 General

The troubleshooting table is presented as an aid in locating and correcting operational problems in the meter. The user must understand that every possible problem could not be listed. However, the table will provide adequate information for general field repairs.

Section 6 PARTS LIST

6-1 General

This section contains the necessary parts required to make-up any standard unit that is covered in this bulletin. Each parts list also contains the recommended spare and replacement parts denoted by an asterisk. For items that are not listed, or additional information, consult factory. When ordering, the following information must be furnished:

1. Brooks Serial Number
2. Part Number, if available.
3. Part Description
4. Quantity

Figure 6-1 Fractional Parity Meter - Internal Assembly.

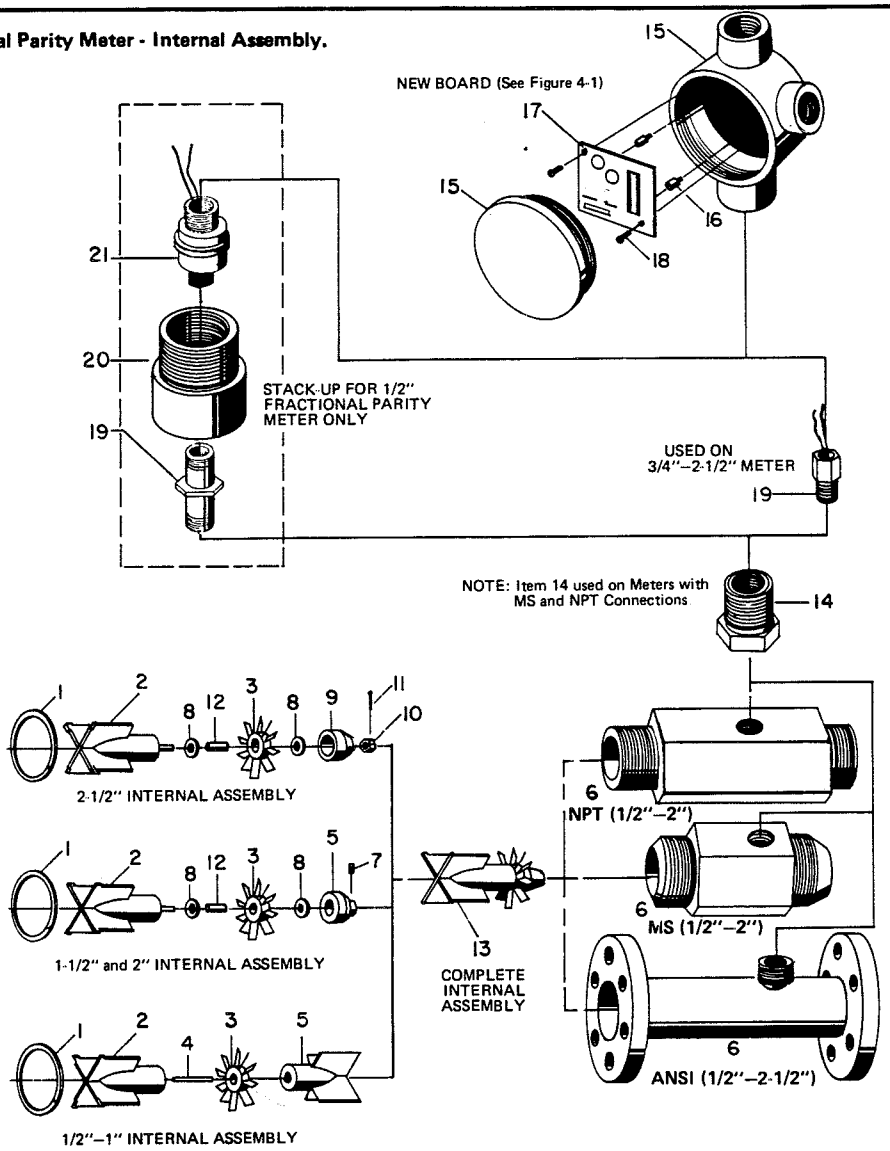


Table 6-1 Complete Meter Assembly - Parts List

Item	Description	No. Req.	1/2" Part Number	3/4" Part Number	1" Part Number	1-1/2" Part Number	2" Part Number	2-1/2" Part Number
1	Retaining Ring	1	CF-724B-105-BQA	156538	156539	156537	156535	156532
2	Inlet Diffuser Assembly	1	894-05-390-00	894-07-390-00	894-10-390-00	894-14-390-00	894-16-390-00	894-17-390-00
* 3	Rotor Assembly	1	894-05-319-00	894-07-319-00	894-10-319-00	894-14-319-00	894-16-319-00	894-17-319-00
* 4	Rotor Shaft	1	894-07-073-00	894-07-073-00	894-10-073-00			
5	Outlet Diffuser Assembly	1	894-05-390-00	894-07-391-00	894-10-391-00	894-14-013-00	894-16-013-00	
6	Body w/NPT Connections **	1	894-05-051-60	894-07-051-60	894-10-051-60	894-14-051-60	894-16-051-60	
	w/MS Connections **	1	894-05-031-60	894-07-031-60	894-10-031-60	894-14-031-60	894-16-031-60	
	150 lb. ANSI Flanges	1	894-05-311-60	894-07-311-60	894-10-311-60	894-14-311-60	894-16-311-60	894-17-311-60
	300 lb. ANSI Flanges	1	894-05-331-60	894-07-331-60	894-10-331-60	894-14-331-60	894-16-331-60	894-17-331-60
	600 lb. ANSI Flanges	1	894-05-361-60	894-07-361-60	894-10-361-60	894-14-361-60	894-16-361-60	894-17-361-60
7	Socket Head Set Screw	1				151202-419	151102-419	
* 8	Thrust Washer	2				894-16-062-00	894-16-062-00	894-22-062-00
9	Diffuser Washer	1						894-17-013-00
10	Castellated Nut	1						151650
11	Cotter Pin	1						153930
*12	Shaft Sleeve	1				894-16-073-00	894-16-073-00	894-22-073-00
13	Internal Assembly	1	894-05-300-60	894-07-300-60	894-10-300-60	894-14-300-60	894-16-300-60	894-17-300-60
14	Adaptor (MS and NPT Connections)	1	894-00-025-00	894-00-025-00	894-00-025-00	894-00-025-00	894-00-025-00	
15	Housing Assembly	1	EA-202Z-074-EAD	EA-202Z-074-EAD	EA-202Z-074-EAD	EA-202Z-074-EAD	EA-202Z-074-EAD	EA-202Z-074-EAD
16	Standoff	2	EA-830C-024-ABZ	EA-830C-024-ABZ	EA-830C-024-ABZ	EA-830C-024-ABZ	EA-830C-024-ABZ	EA-830C-024-ABZ
17	Amplifier Board Assembly	1	ES-097Y-167-AAA	ES-097Y-167-AAA	ES-097Y-167-AAA	ES-097Y-167-AAA	ES-097Y-167-AAA	ES-097Y-167-AAA
18	Screw	2	150630	150630	150630	150630	150630	150630
*19	Standard Pick-off suitable for temperature range of -100°F to +500°F (-73°C to 260°C)	1	ES-595E-006-AAA	ES-595D-017-AAA	ES-595D-017-AAA	ES-595D-017-AAA	ES-595D-017-AAA	ES-595D-017-AAA
	High temperature pick-off -0°F to 600°F (-18°C to 316°C)	1	EW-595J-004-AAA	EW-595H-004-AAA	EW-595H-004-AAA	EW-595H-004-AAA	EW-595H-004-AAA	EW-595H-004-AAA
	Low temperature pick-off -450°F to 100°F (-232°C to 38°C)	1	EW-595L-001-AAA	EW-595K-001-AAA	EW-595K-001-AAA	EW-595K-001-AAA	EW-595K-001-AAA	EW-595K-001-AAA
20	Adaptor	1	EA-014B-076-ABU					
21	Wire Assembly	1	ES-969Z-044-AAA					

* Recommended Spare Parts

** Reference Table 2-1 for Torque Specifications

DANIEL™ MEASUREMENT AND CONTROL, INC.

RETURNED MATERIAL AUTHORIZATION

REPAIR FORM FOR USED EQUIPMENT INCLUDING DECONTAMINATION/CLEANING STATEMENT

A Return Material Authorization (RMA) number must be obtained prior to returning any equipment for any reason. Download the RMA form from the Support Services web page by selecting the link below.

http://www2.emersonprocess.com/EN-US/BRANDS/DANIEL/SUPPORT-SERVICES/Pages/Support-Services.aspx

1. Return Material Authorization (RMA) Number_____
2. Equipment to be returned:
   Model Number _____Serial Number_____
3. Reason for return:
   _____
   _____
   _____
   _____
   _____

Decontamination/Cleaning Fluids Process

A. List each substance in which the equipment was exposed. Attach additional documents if necessary.

Common Name	CAS# if Available	Used for Hazardous Waste (20 CFR 261)		EPA Waste Code if used for hazardous waste
		[ ] Yes	[ ] No	
		[ ] Yes	[ ] No	
		[ ] Yes	[ ] No	
		[ ] Yes	[ ] No	
		[ ] Yes	[ ] No	
		[ ] Yes	[ ] No	

B. Circle any hazards and/or process fluid types that apply:

Infectious	Radioactive	Explosive	Pryophoric	Poison Gas	
Cyanides	Sulfides	Corrosive	Oxidizer	Flammable	Poison
Carcinogen	Peroxide	Reactive-Air	Reactive-Water	Reactive-Other (list):	

Other Hazard Category (list):

C. Describe decontamination/cleaning process. Include MSDS description for substances used in decontamination and cleaning processes. Attach additional documents if necessary.

Shipping Requirements

Failure to comply with this procedure will result in the shipment being refused.

1. Write the RMA number on the shipping package.
2. Inside the package include one copy of this document and all required Material Safety Data Sheets (MSDS)
3. Outside of the package attach one copy of this document and all required Material Safety Data Sheets (MSDS).

THIS EQUIPMENT, BEING RETURNED "FOR REPAIR," HAS BEEN COMPLETELY DECONTAMINATED AND CLEANED. ALL FOREIGN SUBSTANCES HAVE BEEN DOCUMENTED ABOVE AND MSDS SHEETS ARE ATTACHED.

By_____ _____
(Signature) (Print name)

Title:_____ Date:_____

Company:_____

Phone: _____ Fax:_____

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