

MainLine™

Electronic Propeller Meter

INSTALLATION OPERATION & MAINTENANCE

MANUAL

Issue Date: January 2006



FM104/FM184/FT194-II

SPARLING

NOTE:

*To insure all warranties expressed or implied are allowed, it is important that the unit be installed and calibrated per this manual. Follow all instructions starting in **SECTION 1.0 on page 1** concerning verifying equipment and operation, installation instructions, notes and wiring instructions.*

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1.0

Unpacking & Inspection

1.1 Receiving & Inspection

Locate the packing slip shipped with your unit, this will list all the items sent with the shipment. Compare packing slip to order acknowledgement you received previously and verify that all items correspond.

If all items correspond, examine the shipping containers for unusual denting and/or damage. If shipping containers are in good condition, begin unpacking. Do a general examination of each part as it is removed from its packaging, checking for any obvious signs of physical damage.

If there is no apparent damage to the items you may begin the installation procedure in SECTION 3, although we recommend that you familiarize yourself with SECTION 2: *Application/Installation Considerations* prior to going to SECTION 3.

If any item shows damage due to shipment call the Customer Service Department immediately, at (626) 444-0571 you will then be advised of the measures to take.

If you find items are missing from your shipment, contact the Sparling Customer Service Department immediately, at (626) 444-0571. They will verify the order and trace any missing item for you.

1.2 Storage

This equipment should be stored in a clean, dry environment. Do not store outside in an unprotected area. Observe the storage temperature requirements.

1.3

Operation

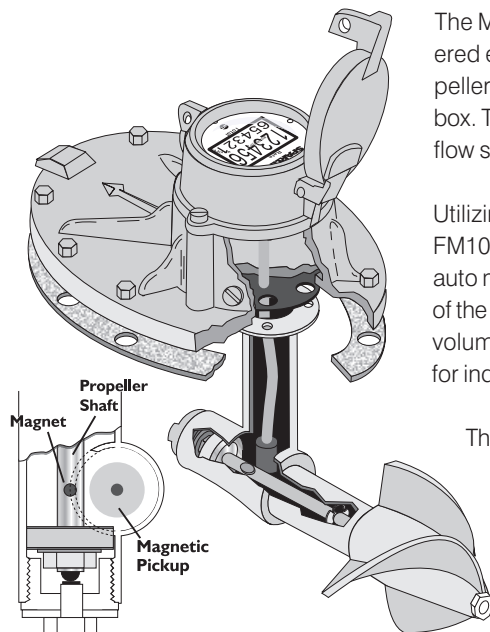


Figure 1.1
Meter Operation

The Model's FM104 and FM184 feature the FT194-II battery powered electronic rate/totalizer which senses the rotation of the propeller by means of a magnetic pickup sensor located in the gear-box. The rate/totalizer and pickup are completely isolated from the flow stream.

Utilizing the simple principle of the screw propeller, the Sparling FM104/FM184 registers total flow, much as an odometer registers auto mileage. The electronic rate/totalizer converts the revolutions of the propeller to cubic feet, gallons or other standard engineering volumetric units. The rotation of the propeller also affords a basis for indicating and recording gallons per minute or other rates.

The LCD digital display is activated by a photoelectric cell. When the cover of the bonnet is opened, the display is activated. The display will go into "sleep mode" after a preprogrammed time interval. Low light conditions may require the use of a flashlight to activate and read the display.

1.4 Specifications

FM 104/184

Operating Temperature 32°F to 100°F (higher temperature construction is available).

Storage Temperature -40°F to 175°F

Materials of Construction

Coverplate Cast Iron (2" - 14")
 Coverplate Steel (16" - 72")
 Propeller Polyethylene
 Gearbox Bronze (2" - 30")
 Gearbox Cast Iron (36" - 72")
 Mechanical Parts Stainless Steel
 Saddles Cast Steel (6" - 14")
 Saddles Fabricated Steel (16" - 72")
 Meter Tubes / Coatings Cast Iron / stainless steel metering section (2" - 3")
 Fabricated Steel (4" - 36")
 Wetted parts high build epoxy polyamide paint EPA approved for potable water

FT 194-II

Accuracy Rate: $\pm 0.25\%$ of full scale
 Totalization: $\pm 0.1\%$ of rate (in addition to propeller meter accuracy)

Power 3.6V Lithium battery (3 year average life)
 4-20mA and scaled pulse output with external 24 Vdc power source
 Battery operating temperature: -55°F to 185°F

Operating Temperature -10°F to 158°F (-23°C to 70°C)

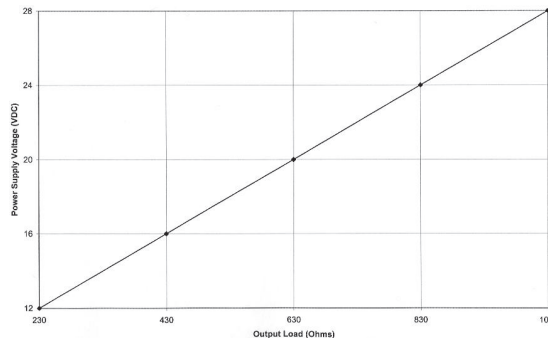
Storage Temperature -40°F to 158°F (-40°C to 70°C)

Display 5-digit rate indicator (0.35 inches high)
 8-digit totalizer indicator (0.25 inches high)
 LCD display with simultaneous rate and total, and low battery indication.

Construction Sturdy die cast aluminum bonnet
 NEMA-4X, NEMA-6, & IP67 environmental ratings.

Optional Outputs 4-20mA, scaled pulse output (open collector output, 100mA at 30 Vdc).
 User selectable units of measure for every contact closure.

Power Supply vs. Output Load
 4 to 20mA Output



Scaling Totalizer Scaler: .001 to 999999

Scaling Units Totalizer - Gallons, cubic feet, liters, cubic meters, acre feet
 Rate - GPM, CFS, MGD, LPS, M³/Hr

Electrical Rating General Purpose

2.0

Pre-Installation

2.1 Process Fluid

The FM104 and FM184 MainLine Electronic Propeller Meters are designed to operate with relatively clean process water. The percentage of solids should not exceed 0.5%. While the propeller shape is designed to shed debris and the propeller material is durable and somewhat pliable, large solid objects in the flowing stream could damage or become entangled in the propeller, causing inaccuracy or malfunction. These meterheads will function despite the presence of small abrasive particles (such as sand) but the life of the propeller shaft bearings may be reduced.

2.2 Handling Precautions

Although this device is ruggedly constructed, it is a precise measuring instrument and can be damaged by rough handling or if dropped. If the meterhead is not shipped already installed into a flow tube, care should be taken to avoid damaging the propeller during installation.

3.0

Installation

3.1 Site Selection Criteria

Choose a location that assures a full pipe of water flowing at or above the minimum velocity for the meter. There should not be any enlargements, diffusers or obstructions upstream that would produce a jet or spiraling flow into the meter. Ten diameters of straight pipe upstream and 1 diameter downstream are recommended to avoid errors caused by skewed velocity profiles. See figure 3.1.

A jet caused by a partially opened valve, a centrifugal pump, or a pipe enlargement upstream from the meter can cause inaccurate registration.

Often such disturbances can be avoided by locating the meter on the suction side of the pump. The meter will register just as efficiently on a vertical or slanting pipe as on a horizontal line. The straightening vanes eliminate cork-screw effects in the flow profile of water. Flow conditioners may be required in installations where less than optimum conditions exist. See Figure 3.1.

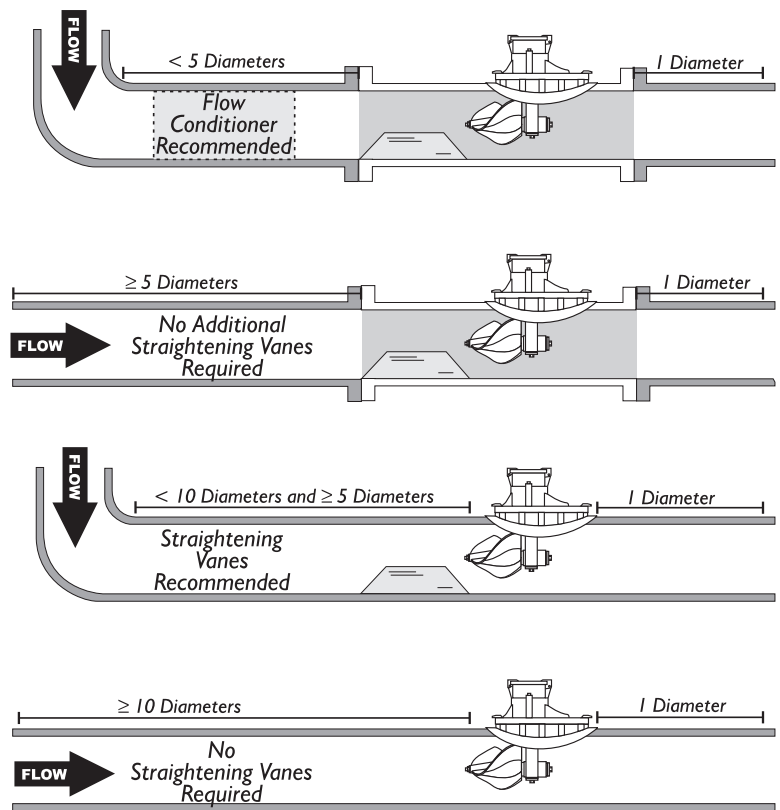


Figure 3.1
Installation Considerations

Flow conditioners may be required in installations where less than optimum conditions exist. See Figure 3.1.

3.0

Installation cont'd.

3.2 Mounting Tubes & Saddles

Meterheads can be mounted into a round process line using 1) a Sparling Model MT1 In-Line Flow Tube or 2) a Sparling Model MS1 Welding Saddle.

3.2.1 Meterhead with MT1 In-Line Flow Tube (2" - 36")

- Be sure to read Section 3.1 Site Selection Criteria prior to installing your meter.
- Install the meter tube in the line just as though it were a short length of pipe.
- The propeller must face the on-coming flow. Arrows on the meter tube and cover plate will point in the direction of the flow.

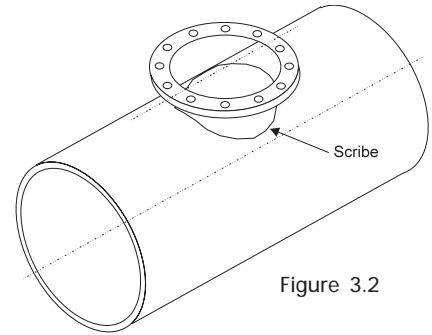


Figure 3.2

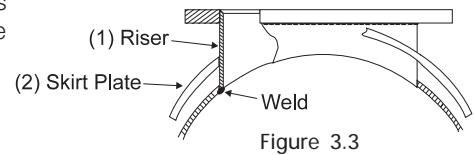


Figure 3.3

3.2.2 Meterhead with MS1 Welding Saddle (6" - 72")

- For welding 6"-14" saddles to steel or wrought-iron pipe, place the saddle on the pipe and scribe a line INSIDE the saddle.
- Cut or burn a full opening in the pipe so there will be no projections of the pipe beyond the straight inside edge of the saddle. Smooth the pipe around the opening to make a good surface for the saddle.
- Cast steel saddles (sizes 6" - 14") should be tacked first, then welded in place, taking care not to over-heat any part of the saddle.
- Fabricated steel saddles (sizes 16" - 72"):
 - Place riser on pipe (Fig. 3.2). Scribe around outside of riser as shown. Cut hole.
 - Insert riser into the hole in skirt plate (Fig. 3.3), do not weld at this point. Pull skirt plate up against the flange of riser.
 - Insert riser into cut-out in pipe. Make sure bottom edge of riser is flush with I.D. of the pipe and holes in the flange are straddling the center line of pipe. Weld riser to inside pipe as shown.
 - Lower skirt plate down onto pipe. Position to achieve conformity with O.D. of pipe. Weld in a continuous bead at point "A" and "B".
- If straightening vanes are required, go to section 3.2.3. If not, skip to section 3.3

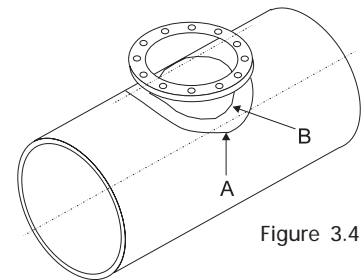


Figure 3.4

Size Meter	6-14	16-30	36 & 42	48-72
Dimension "A"	4	8	12	15

3.2.3 Install straightening vanes (if required) as shown on Figure 3.5.

Three straightening vanes are required. Vanes should be equally spaced radially and parallel with the longitudinal axis of the pipe (1)

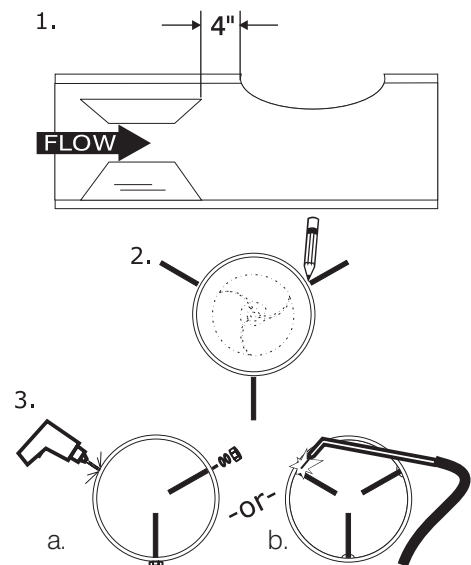


Figure 3.5
Install Straightening Vanes

3.0

Installation cont'd.

Bolting Vanes

- a. For easy vane installation, place each vane in its equivalent position on the outside of the pipe (2) and mark the location for bolt holes.
- b. Drill holes. Install vanes inside the pipe. Place lead washer and then steel washer on the bolt on outside of pipe and tighten nuts securely (3a).

Welding Vanes

- a. Space vanes equally at 120° radially and locate longitudinally as shown.
- b. (3b) Secure vanes with a continuous bead weld around both ends and with intermittent staggered bead welds along the vane.

Note: Installations with both forward and reverse flows* may require additional vanes on the downstream side of the meter. Install in the same manner, 4" from the downstream saddle opening.

*Option requiring dual remote mounted totalizers.

3.3 Mounting the Meterhead

3.3.1 Tube mounted meters (2" - 36")

2"-4" - Not required - meterheads are shipped with meterhead mounted in place.

6"-36" - Follow directions per Section 3.3.2 following.

3.3.2 Saddle meters (6" - 72")

- a. Place gasket on the face of the saddle
- b. 6" - 8" Meters
Hold meterhead with propeller facing UPSTREAM.
Lower propeller into pipe and slide it upstream to position for capscrews and secure the coverplate.
- c. 10" - 72" Meters
Hold meterhead over opening with propeller toward you and blades lengthwise with the pipe.
Tilt coverplate toward you.
Lower until one blade lies horizontally on the end of the saddle.
Ease the propeller down through the saddle with a "rolling" motion.
Turn the headplate so that the propeller faces upstream.
The arrow on the plate points in the direction of the flow. Tighten cap screws evenly (6"-14" sizes)
Insert screws and install nuts (16" - 72" only) tighten them evenly, and meter is ready to operate.

4.0

Flow Rates & Dimensions

Maximum flow ranges can be safely exceeded by 50% when used intermittently (10-15% of the time). Your Sparling meter utilizes specially designed propellers and bearings matched to your flow range to insure long life.

For proper configuration of meter construction anticipated flow ranges, including minimum and normal flow rates expected, should always be specified on application sheets accompanying your order.

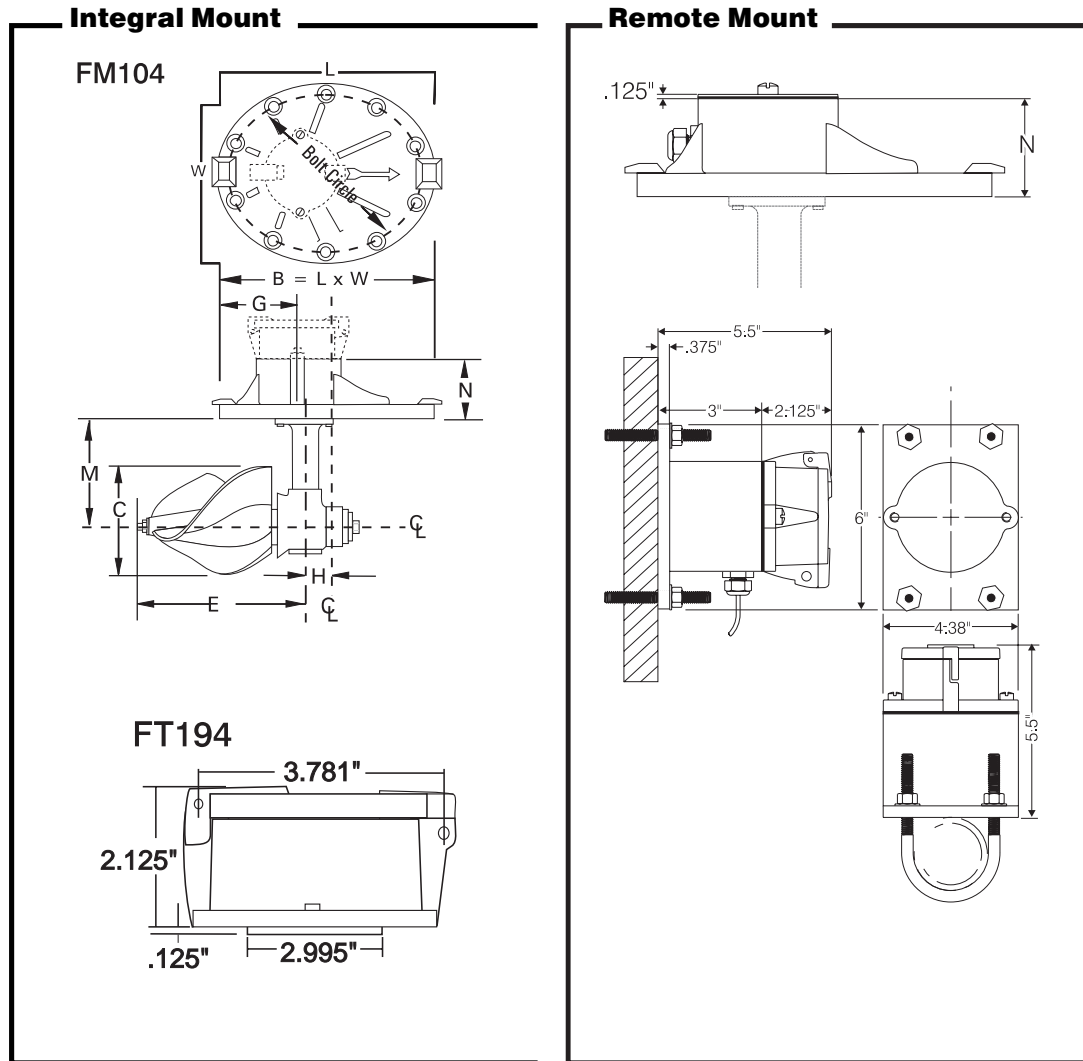


Figure 4.1
Dimensions

TABLE 1 - FLOW & DIMENSIONS

Size	Weight (lbs)		Dimensions (inches)								Flow (gpm)				
	Fabr. Steel	Cast Iron	B		C	E	G	H	M		N	Low Flow		Std. Flow	
			L	W					150 lbs	250 lbs		Min.	Max.	Min.	Max.
2	-	20	8.13	5.13	2.38	4.00	3.13	0.50	1.75	1.75	2.56	30 - 80	60 - 150		
3	-	20	8.25	6.25	2.75	4.00	3.18	0.63	2.75	2.75	2.56	35 - 200	70 - 360		
4	20	-	9.50	6.75	3.50	6.94	4.13	0.63	3.44	3.44	2.56	50 - 400	120 - 600		
6	25	-	10.38	7.31	4.75	6.31	3.69	0.94	4.25	4.25	2.93	90 - 900	200 - 1600		
8	29	-	11.00	10.63	7.00	6.31	5.81	-0.32	5.31	5.31	2.81	100 - 1200	240 - 2300		
10	34	-	11.00	10.63	8.00	6.31	5.81	-0.32	6.31	6.31	2.81	125 - 1600	320 - 3000		
12	36	-	11.00	10.63	10.00	6.31	5.81	-0.32	7.31	7.31	2.81	150 - 2200	400 - 4000		
14	37	-	11.00	10.63	11.00	6.31	5.81	-0.32	8.00	8.00	2.81	250 - 3000	520 - 5000		
16	210	-	23.50	23.50	13.00	12.00	8.20	4.25	12.25	12.25	2.88	350 - 3800	700 - 6800		
18	210	-	23.50	23.50	16.00	12.00	8.20	4.25	13.25	13.50	2.88	450 - 4500	900 - 8100		
20	215	-	23.50	23.50	16.00	12.00	8.20	4.25	14.25	14.50	2.88	550 - 5500	1100 - 9900		
24	215	-	23.50	23.50	16.00	12.00	8.20	4.25	16.25	16.50	2.88	800 - 8500	1600 - 15000		
30	220	-	23.50	23.50	16.00	12.00	8.20	4.25	19.25	19.50	2.88	1200 - 12000	3000 - 21600		
36	825	-	32.00	32.00	25.25	18.75	9.20	6.50	23.00	24.00	3.13	1500 - 16000	3000 - 28800		
42	835	-	32.00	32.00	25.25	18.75	9.20	6.50	26.00	27.00	3.13	2000 - 22000	4200 - 40000		
48	1350	-	38.75	38.75	25.25	18.75	9.50	9.50	29.50	30.50	3.25	2500 - 28000	5400 - 50000		
54	1360	-	38.75	38.75	25.25	18.75	9.50	9.50	32.50	33.50	3.25	3200 - 35000	6800 - 63000		
60	1370	-	38.75	38.75	25.25	18.75	9.50	9.50	35.50	36.50	3.25	4000 - 42000	8400 - 76000		
66	1380	-	38.75	38.75	25.25	18.75	9.50	9.50	38.50	39.50	3.25	4750 - 50000	10000 - 90000		
72	1390	-	38.75	38.75	25.25	18.75	9.50	9.50	41.00	42.50	3.25	5500 - 60000	12000 - 110000		

"B" 16" - 72" for 150 psi only

5.0

Meter Maintenance

5.1 Preventative Maintenance – Annual Inspection of Meterhead

Preventative maintenance of the FM104 and FM184 is limited to annual inspection of the propeller shaft bearings, propeller, straightening vanes and tube condition.

5.1.1 Remove Meterhead

Depressurize the line, remove the cap screws and slide the meterhead in the downstream direction. Lift the downstream end of the coverplate and withdraw the meter from the line. It may be necessary to maneuver the meter so that one blade tip can be lifted through the opening, allowing clearance for the remaining blades.

5.1.2 Inspect vanes for damage and tubes and vanes for foreign matter

Examine the pipe for any foreign matter that may have accumulated. Look at the upstream ends of the straightening vanes and remove accumulated matter. See if the vanes have been damaged - straighten any bends.

5.1.3 Inspect Propeller & Bearings

- See that the propeller blades are smooth and clean.
- Spin the propeller with your fingers (a). The propeller should spin freely without binding and crunching noises. The register should advance properly.
- Next, pull on the propeller (b). The propeller should have a little freedom of movement (about 1/64") due to the designed play in the bearings which allows grit to pass through. If movement is over 1/64" but under 1/32" adjust per 5.1.4 Adjust Bearings.
- Finally, hold the propeller with your fingers and rock it from side to side (c). There should be minimal movement when rocking the propeller, about 1/64".

If you experience:

- binding or crunching when spinning the propeller
- the propeller has **excessive** play

it could signal excess bearing wear or failure. Go to Section 5.2 Disassembly and Repair

If the register does not advance properly, go to Section 5.2 Disassembly and Repair.

Check the gasket before replacing the meterhead. Replace it if it is damaged. Finally, if everything checks out as it should, return meter to line, bolt in place and repressurize the line.

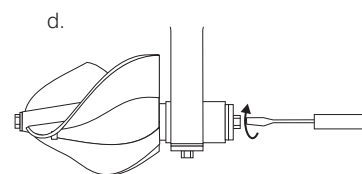
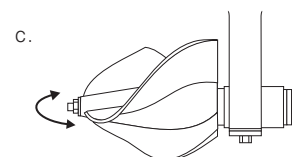
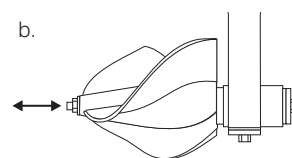
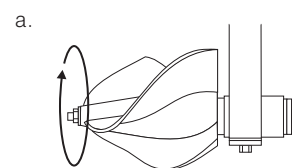


Figure 5.1
Inspection Steps

5.1.4 Adjust Bearings

The front propeller shaft bearing is the key to the life of the meter. If it is kept in good condition the other parts will last almost indefinitely.

Adjust the thrust screw (d) on the back of the propeller shaft plug to achieve 1/64" end play. Screw the thrust screw until it comes in contact with the end of the propeller shaft, then back off the thrust screw 1/4 turn and tighten the locknut and re-check the end play.

Spin the propeller to ensure that it spins freely and that the register advances properly. No further maintenance is required and the meter may be reinstalled. If you found a problem, proceed to 5.2 Disassembly & Repair.

5.0

Meter Maintenance

5.2 Disassembly & Repair

5.2.1 Grip the propeller and remove the propeller nut. Slip the propeller off by tapping it lightly and remove the propeller shaft key (a).

5.2.2 Remove the propeller shaft plug assembly and drive the propeller shaft out the rear of the gear box by tapping at the end of the propeller shaft with a rubber mallet or a piece of wood to protect the shaft (b). While removing you may have to rotate the shaft to avoid damaging the bearing retaining ring - do not force.

5.2.3 Grip the propeller shaft between the magnets and the front bearing retaining ring. Remove the rear bearing nut, rear bearing, rear bearing washer and the front bearing retaining ring (c). Inspect the propeller shaft for straightness, carefully examining magnet discs for cracks, looseness or missing discs. If faulty, a new propeller shaft must be installed.

5.2.4 Using a wooden dowel, gently tap out the front bearing from the gear box (d).

5.2.5 Check both bearings for wear and excessive play. Replace worn out bearings.

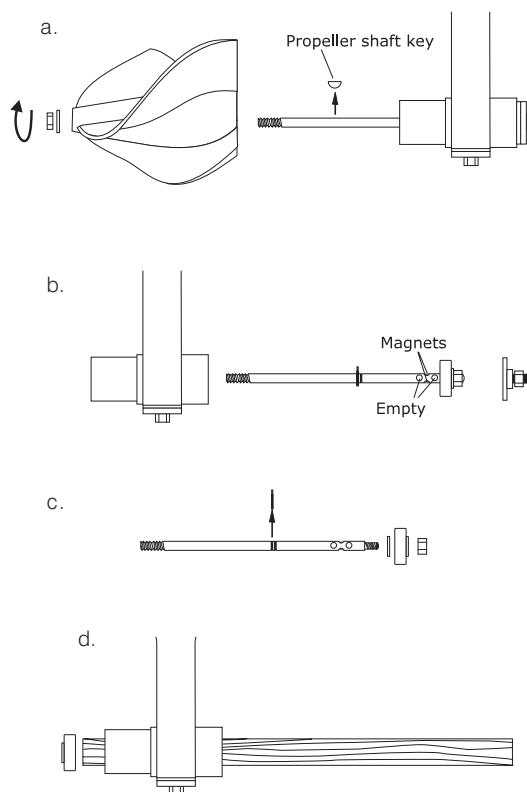


Figure 5.2
Disassembly & Repair

5.3 Reassembly

5.3.1 Install the front bearing by pushing the bearing into the gearbox. DO NOT HAMMER THE BEARING INTO PLACE. Coat bearing with Lubriplate.

5.3.2 Install the rear bearing washer, rear bearing and the bearing retainer nut on the propeller shaft. Tighten the nut snugly, but do not over-tighten. Coat bearing with Lubriplate.

5.3.3 Install the front bearing retainer on the propeller shaft. The retainer should be placed in the front slot for ball bearings or in the rear slot for rubber bearings. Note: there is a rounded side and a sharp side to the front bearing retaining ring. Be sure to put the rounded side toward the propeller.

5.3.4 Insert the propeller shaft assembly into the rear of the gearbox. Rotate the shaft if necessary to avoid damaging the front bearing retaining ring. Reinstall the propeller shaft thrust plug assembly and tighten firmly.

5.3.5 Install the propeller shaft key, the propeller, and the propeller washer and nut. Use the new propeller nut furnished with the front bearing. Tighten the nut snugly.

5.3.6 Check the propeller shaft end play. Adjust the thrust screw on the back of the propeller shaft plug to achieve 1/64" end play. Screw the thrust screw until it comes in contact with the end of the propeller shaft, back of thrust screw 1/4 turn and tighten the lock nut and recheck the end play.

5.3.7 Spin the propeller and check for free movement and that the register advances properly. Binding bearings may be freed by alternate light taps to the rear of the gearbox and the front of the propeller shaft to properly seat the bearings. Recheck propeller shaft end play.

6.0

Maintenance

6.1 Preventative Maintenance

The ideal time to inspect the unit is when you are changing the battery.

6.1.1 Inspect battery contacts

Examine the battery contacts for signs of moisture intrusion. Examine the battery for any signs of leakage.

6.1.2 Inspect Connectors

There are two connectors. One on each side of the battery bracket. Check each for moisture intrusion.

6.2 Preventative Maintenance – Extended Battery Life

To extend battery life please do the following

6.2.1 Remove battery during storage or after disconnecting power to prolong life.

6.2.2 In low light conditions shine flashlight on display to activate.

6.2.3 Always close lid.

6.3 Troubleshooting

6.3.1 Rate and Totalizer do not indicate

Bad contact? Examine & clean.

Propeller Jammed? See Section 5.2 Disassembly & Repair

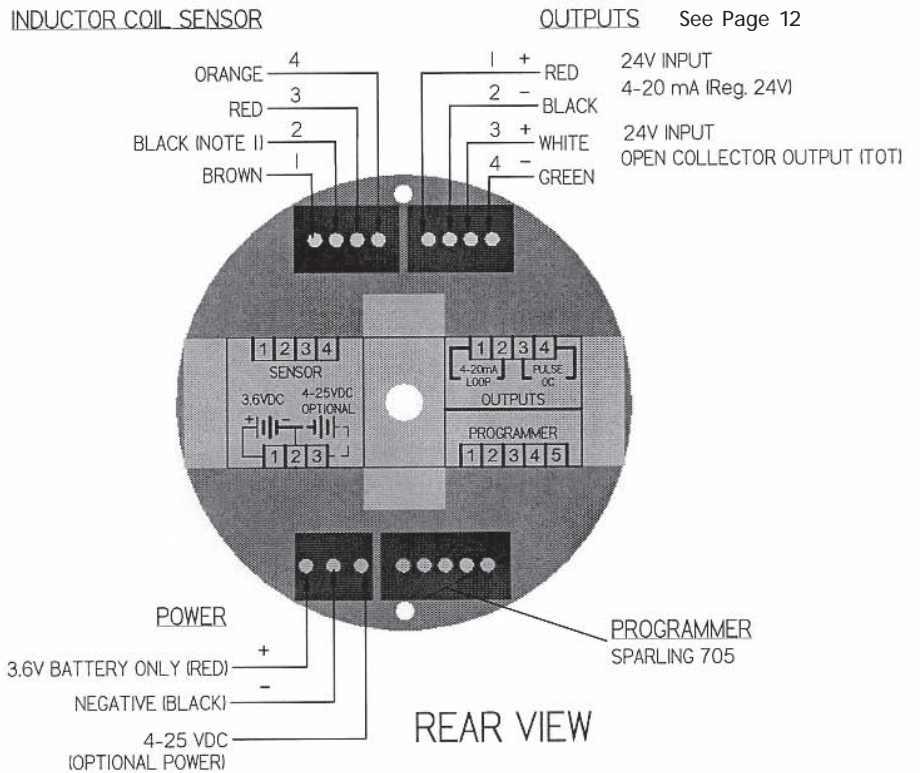
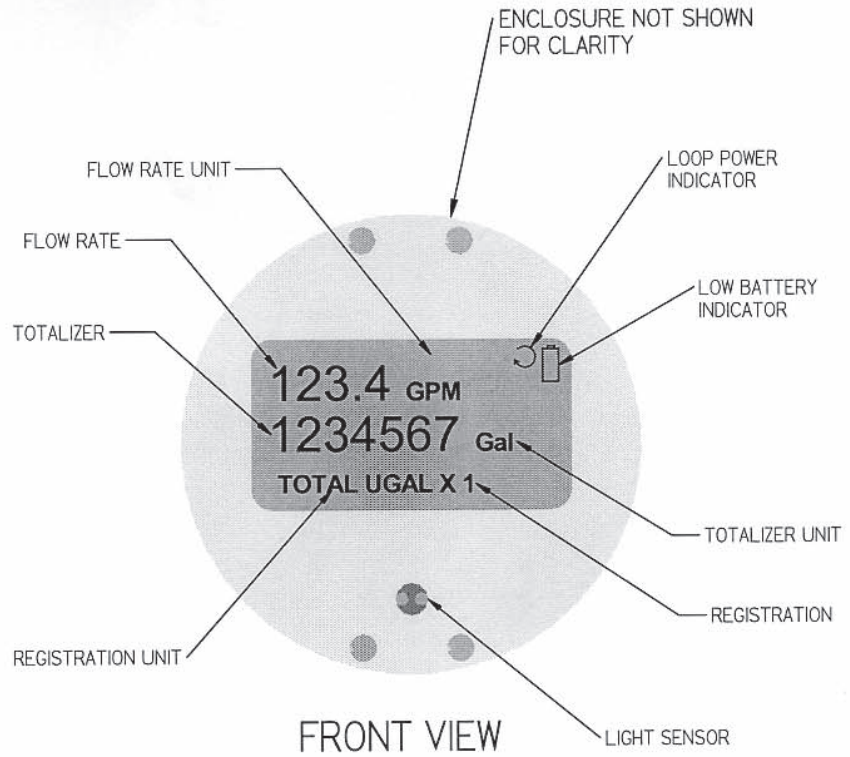
Damaged or missing magnets in propeller shaft? See Section 5.2 Disassembly & Repair

6.3.2 Contacts corroded

Moisture intrusion? Totalizer was not replaced properly. Replace totalizer.

7.0

Wiring Diagram



NOTES:
I. PREVIOUS SENSOR TYPE USED RED.

Figure 7.1

7.0

Wiring Diagram FT194-II Forward & Reverse Register

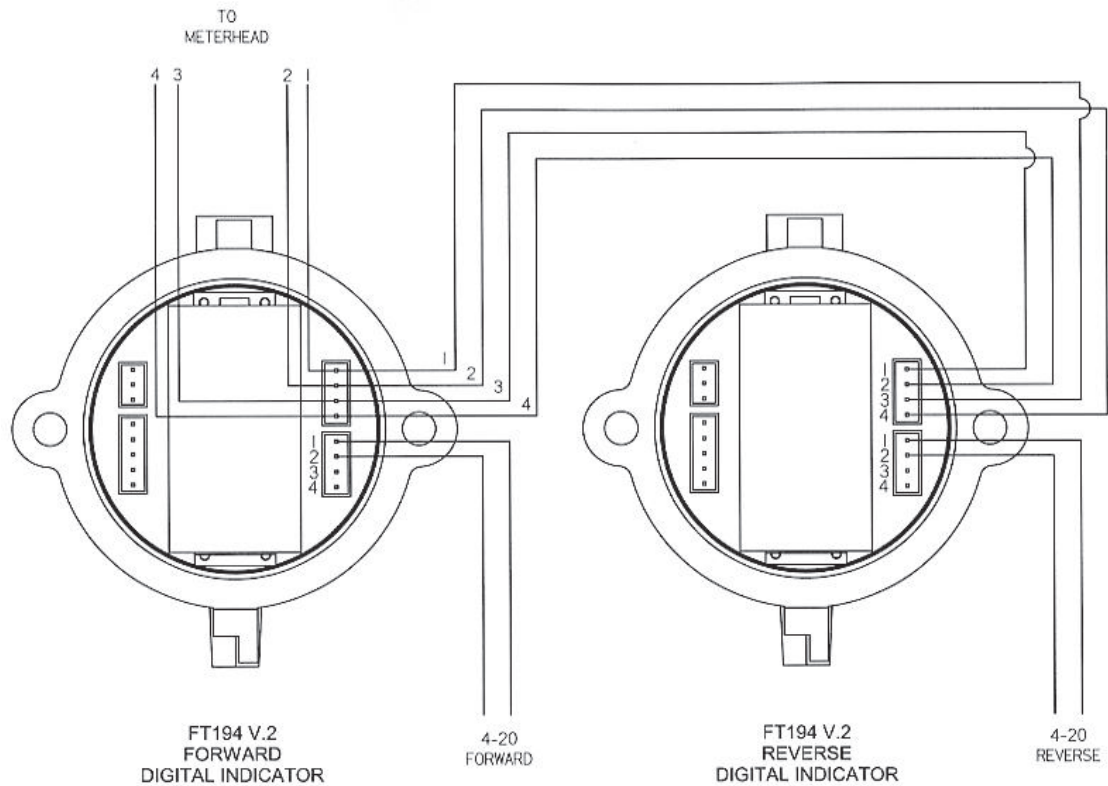
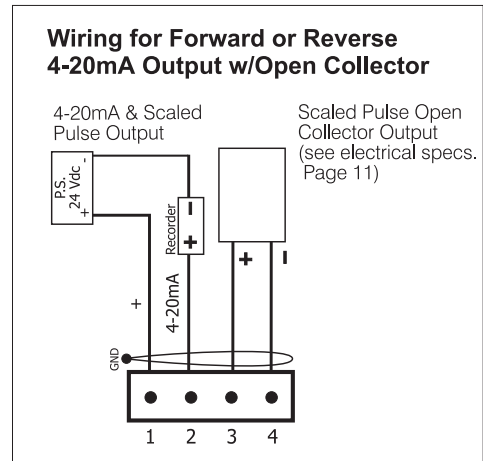
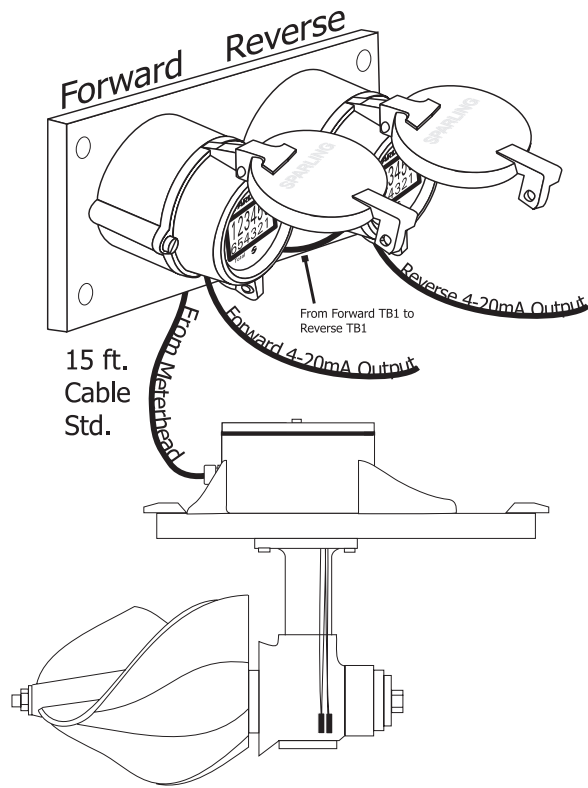


Figure 7.2

4-20mA Installation on Forward/Reverse Unit

8.0

Programming

A 705 Sparling programmer is required to access the programmable parameters for the unit.



Figure 8.1

8.1 Connecting the 705 Programmer:

Remove the mounting screws. Access the bottom of the unit and plug the programmer in the 5-pin connector as shown.



Figure 8.2

8.2 Programming Mode:

8.2.1 General Guide when using the menu:

- Moving the cursor past the farthest digit to the right will enter the value.
- Moving the decimal point: remove the current point first by making it a zero, then place the new point where desired.
- Once in a sub-menu (Rate, Total, Display, etc) you must go through to get back to the main menu.

8.2.2 Entering menu:

- Press the left or right arrow key on the 705 programmer to access the main menu. The screen will change to that of figure 8.3. Use the right/left keys to move the cursor to the next/previous digit and up/down to scroll the digit. Press the right key when the cursor is under the farthest digit to the right to enter the value.



Figure 8.3

8.0

Programming cont'd.

- b. There are two screens for the main menu. The first one (figure 8.4) allows access to Rate, Total and display parameters. The second one (figure 8.5) has Output, Diagnostics (Diag.) and Help. Press the right arrow when Display is highlighted to access the second screen. Move left one more time when Output is highlighted on the second screen to get back to the first.

8.2.3 Main Menu – Rate

- a. The Rate menu allows access to Units and Full scale. Predefined units are: GPM, LPM, CFS, M³H, MGD. If none of the predefined units match your application, set the units to User. This allows you to define the unit name and conversion factor.
- b. Full Scale affects the 4-20mA loop current only. At full scale of the rate, the loop current will be 20mA. A zero flow will make it 4mA.

8.2.4 Main Menu – Total (Totalizer)

- a. The Total menu allows access to Units, Registration and the Totalizer Reset menu. Predefined units are: US Gallons (Gal), Acre-Feet (A-ft), Imperial Gallons (IGal), Liters (Ltr), Cubic meters (M³), Cubic feet (Ft³), Acre-inches (A-in). If none of the predefined units match your application, set the units to User. This allows you to define the unit name and conversion factor.
- b. The registration value is used to divide the internal (and external) totalizer by the required number of engineering units. It is normally set to an even number like 0.1, 1, 10, etc. Example: If set to 10, the internal totalizer will increment by one count every 10 units (where units can be any totalizer specified unit). At the same time, a pulse will be driven to the external pulse output.

Reset sub-menu: This sub section of the Totalizer menu (if available) let the user Reset, lockout or change the password for the totalizer.

Reset:	Makes the value of the totalizer zero.
Change password:	Changes the password for this sub-menu
Lockout:	It disables this sub-menu. Warning: lockout is final!

8.2.5 Main Menu – Display

The Display menu allows access to Timeout, Update, Contrast and On level.

Timeout:	Sets the number of seconds the display will stay on if the lid is not closed.
Update:	The display rate and totalizer values will be updated according to this value.
Contrast:	Sets how dark or light the display looks.
On level:	Sets the brightness of the light required to turn on the display after the lid is open.

8.2.6 Main Menu – Output

- a. The Output menu allows access to Update, 4-20mA adjustment.

Update: Sets how much of the new flow value is used to update the outputs. Use a smaller value to slow the tracking of the output to the display rate indicator.

- b. 4-20mA calibration - The 4 and 20mA are calibrated at the factory. There should be no need for re-calibration under normal operating conditions but due to tolerances in equipment, the user may want to fine tune the output to its own equipment.

This section is only available if the unit is loop powered. The actual value have no direct relevance to the output. It is only a visual indication of how much the output can be changed. Each 4 and 20mA allow a range of ± 75 steps. The value is saved in non-volatile memory once entered.

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Programming

cont'd.

8.2.7 Main Menu – Diag. (Diagnostics)

The Diagnostic menu allow the user to change the meter factor and the main menu password.

8.2.8 Main Menu – Help

The Help menu shows the serial number, meter factor and technical support information.

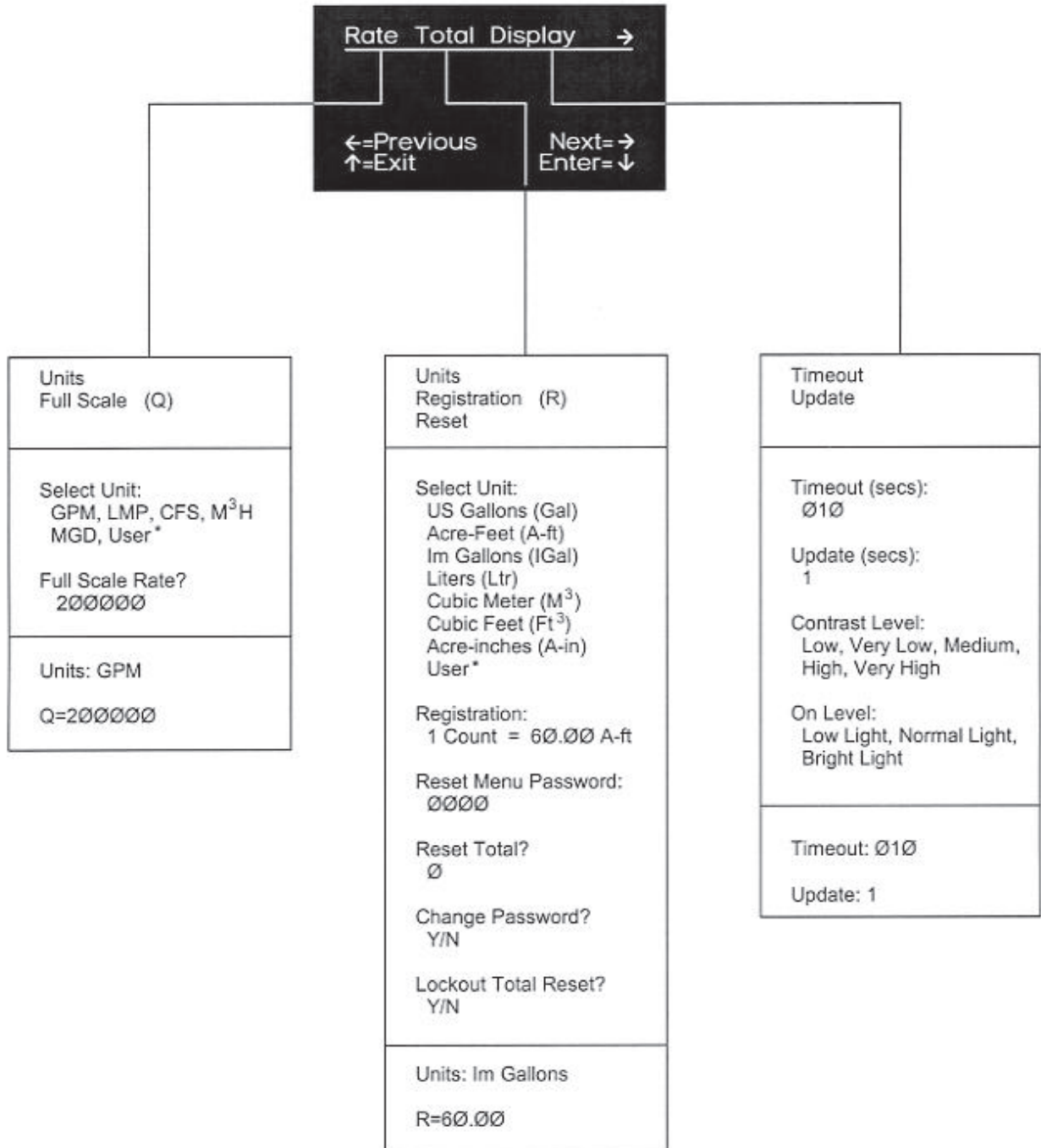


Figure 8.4

* See Section 8.2.3 & 8.2.4 a

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Programming cont'd.

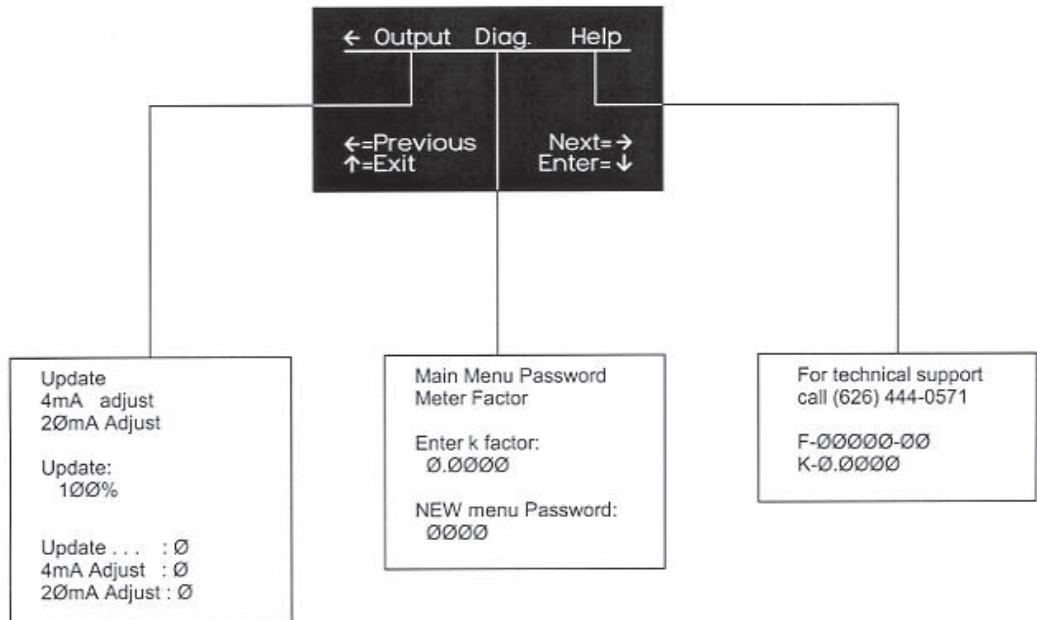


Figure 8.5

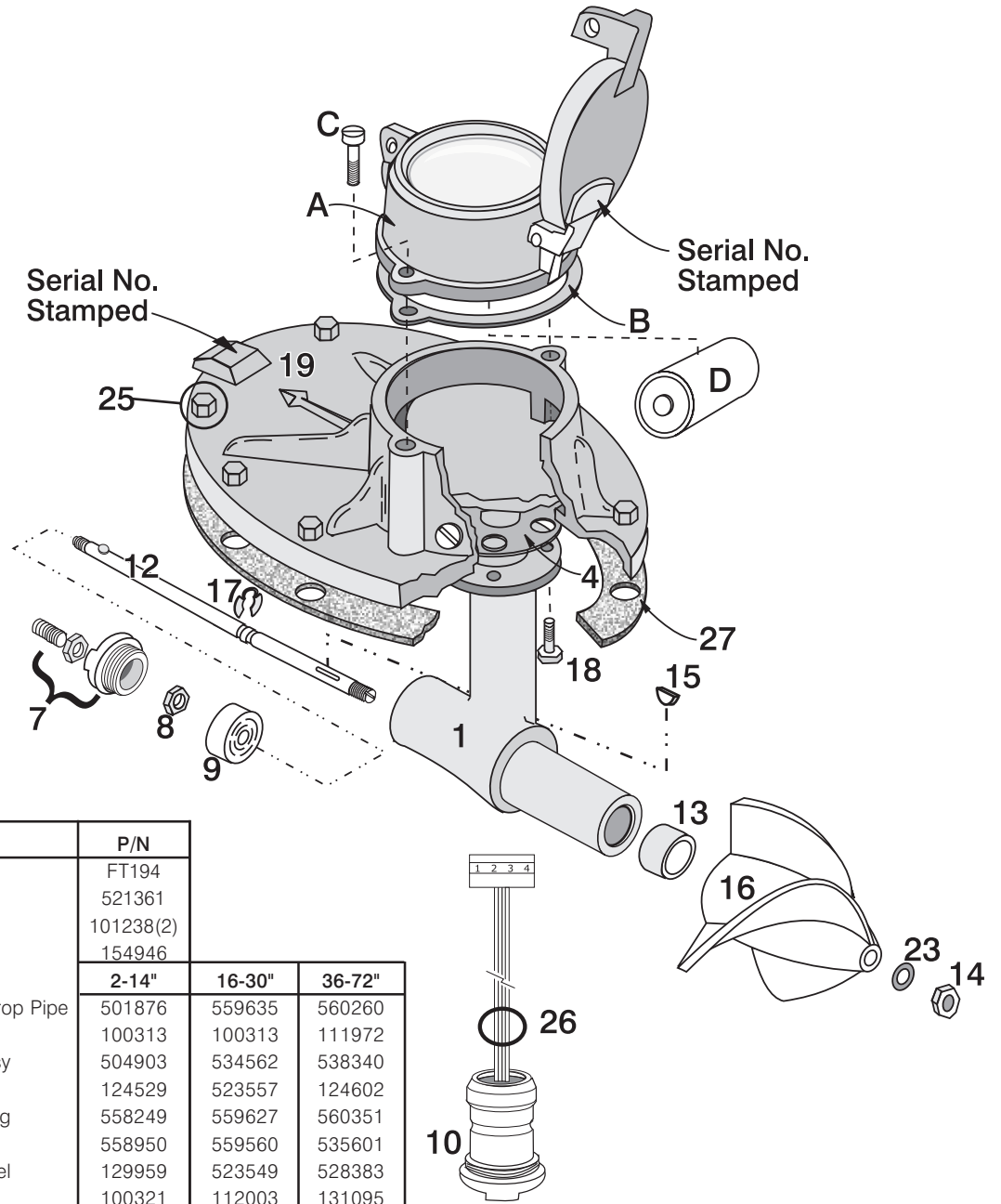
TABLE 2 – STANDARD REGISTRATION FOR FT194-II

Nom. Size	Cubic Feet	U.S. Gallons	Imperial Gallons	Acre Feet	Cubic Meters	Liters
2	1.0	10.0	10.0	0.00001	0.01	10.0
3	1.0	10.0	10.0	0.0001	0.1	100.0
4	10.0	100.0	100.0	0.0001	0.1	100.0
5	10.0	100.0	100.0	0.0001	0.1	100.0
6	10.0	100.0	100.0	0.001	1.0	100.0
8	10.0	100.0	100.0	0.001	1.0	1000.0
10	100.0	100.0	100.0	0.001	1.0	1000.0
12	100.0	1000.0	1000.0	0.001	1.0	1000.0
14	100.0	1000.0	1000.0	0.001	1.0	1000.0
16 - 30	100.0	1000.0	1000.0	0.01	10.0	10000.0
36 & 42	1000.0	10000.0	10000.0	0.01	10.0	10000.0
48 - 72	1000.0	10000.0	10000.0	0.1	100.0	100000.0

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Replacement Parts List

2" to 14"

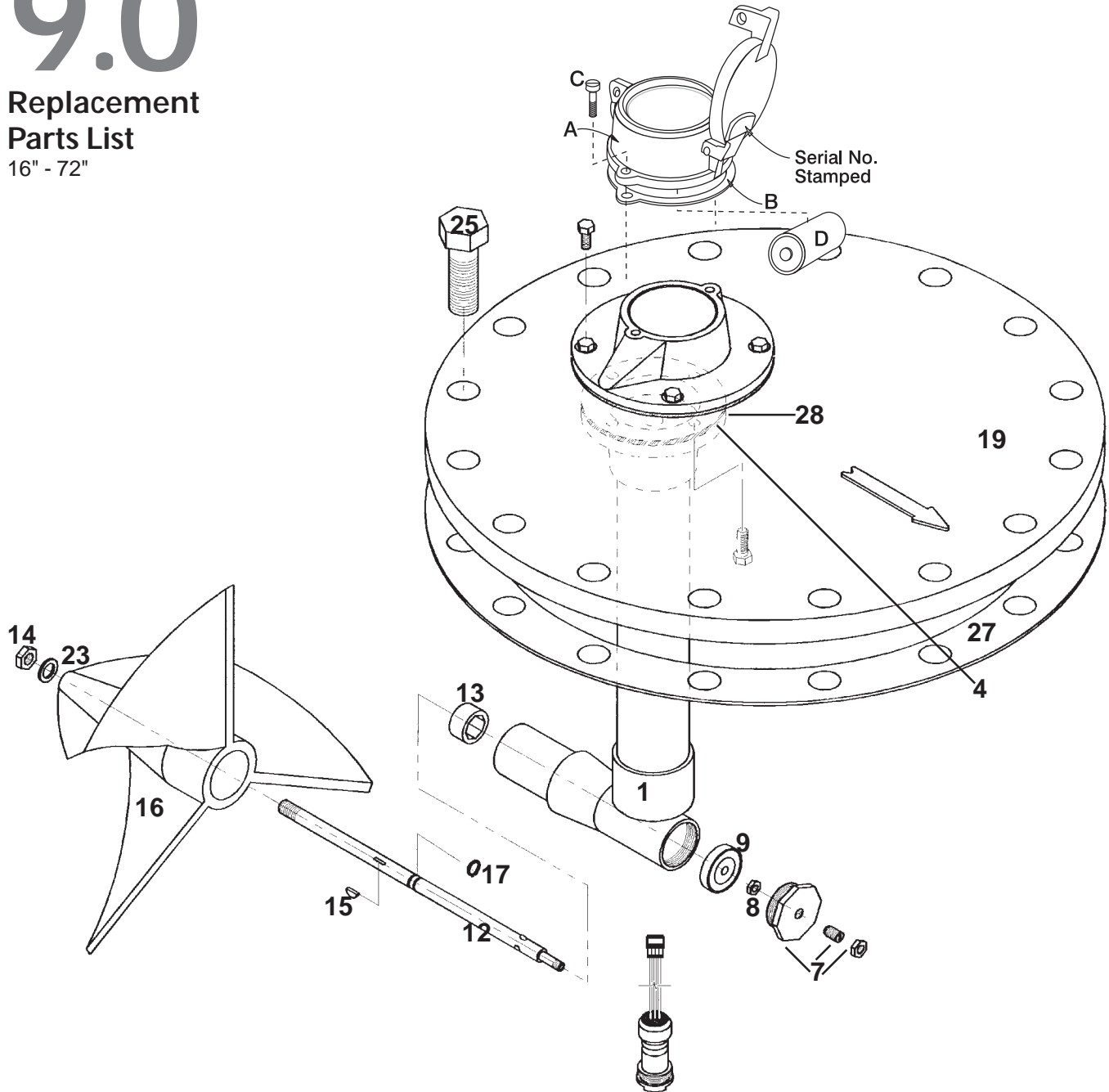


Item No.	Description	P/N									
		2-14"	16-30"	36-72"	2"	3"	4"	6"	8"	10"	12"
A	FT194 Totalizer*	FT194									
B	Totalizer Gasket	521361									
C	Register Bolt	101238(2)									
D	Battery, D Cell	154946									
4	Gasket Gear Box/Drop Pipe	501876	559635	560260							
8	Hex Nut	100313	100313	111972							
7	Prop Shaft Plug Assy	504903	534562	538340							
9	Rear Bearing	124529	523557	124602							
10	Inductor Assy w/Plug	558249	559627	560351							
12	Propeller Shaft	558950	559560	535601							
13	*Front Bearing, Steel	129959	523549	528383							
14	Nut	100321	112003	131095							
15	Shaft Key	100355	100355	121989							
17	Retainer Ring	100397	111344	121806							
18	Bolt	100298(4)	109480(4)	108987(4)							
23	Washer	100389	112805	517899							
26	O-Ring	100454	100454	100454							
1	Gear Box	503252	503278	503294	503335	503351	503377	503393	503418		
16	Propeller*	502056	502064	502080	502098	502105	502113	502121	502139		
19	Cover Plate*	501272	501298	501363	501389	501404	501404	501404	501404		
25	Hex Hd Cap Screw	100272 (10)	100272 (10)	132374 (8)	100272 (10)	130336 (10)	130336 (10)	130336 (10)	103336 (10)	103336 (10)	
27	Cover Plate Gasket	504937	504945	504953	504961	504976	504976	504976	504976		
	Dummy Cover Plate	512334	512352	516966	512360	512378	512378	512378	512378		

*Contact factory for high velocity applications. Front rubber bearings are required in lieu of steel.

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Replacement Parts List 16" - 72"



Item No.	Description	16" - 30"	36" - 72"
1	Gear Box Assy.	510976	519481
16	Propeller*	*	*
19	Cover Plate*	530520	539538
25	Hex Hd Cap Screw	134635 (16)	134651 (20)
27	Cover Plate Gasket	512956	514316
28	Gasket Register Base	559643	559643
	Dummy Cover Plate	**	***
	Nuts	110932	111493

* Provide Serial Number when Ordering

** 16" Blind Flange

*** 24" Blind Flange

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