DANIEL SERIES 500 LIQUID TURBINE FLOW METER

3" THROUGH 4" SIZES

INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS

DANIEL MEASUREMENT AND CONTROL, INC.
AN EMERSON PROCESS MANAGEMENT COMPANY
HOUSTON, TEXAS

Part Number 3-9008-610
Revision C

APRIL 2011

DANIEL®

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Process Management

IMPORTANT INSTRUCTIONS

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 must 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.

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

Daniel also urges you to integrate this manual into your training and safety program.

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

Product Owners (Purchasers):

- Select the correct product for the environment and pressures present. If you are unsure, discuss your needs with your Daniel representative.
- Inform and educate all personnel in the proper installation, operation, and maintenance of this product.
- To ensure proper performance, only informed and trained personnel should install, operate, repair and maintain this product.
- Save this instruction manual for future reference.
- 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.
- A Return Material Authorization (RMA) number must be obtained prior to returning any equipment for any reason.
- Download the RMA form on the Daniel Measurement and Control, Inc. Support Services web page by selecting the link below.

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

Product Operation Personnel (Personnel):

- Read and understand all instructions and operating procedures for this product.
- Install this product as specified in the Installation section of this manual per applicable local and national codes.
- Follow all warnings, cautions, and notices marked on, and supplied with, this product.
- Follow all instructions during the installation, operation, and maintenance of this product.
- Before opening the flameproof enclosure in a flammable atmosphere, the electrical circuits must be interrupted.
- To prevent personal injury, ensure that all components are in place prior to and during operation of the product.
- Connect all products to the proper electrical and pressure sources when and where applicable.
- If you do not understand an instruction, or do not feel comfortable following the instructions, contact your Daniel representative for clarification or assistance.
- If this instruction manual is not the correct manual for your Daniel product, telephone Daniel at 1-713-827-6314 and Daniel will provide you with the requested manual. You may also download the correct manual from http://www.daniel.com.
- Use only replacement parts specified by Daniel. Unauthorized parts and procedures can affect this product's performance, safety, and invalidate the warranty. "Look-a-like" substitutions may result in deadly fire, explosion, release of toxic substances or improper operation.
- Save this instruction manual for future reference.

CAUTION

DAMAGE TO ELECTRONIC COMPONENTS

Proper handling procedures must be observed during the removal, installation or other handling of internal circuit boards or devices.

Failure to properly handle the instrument can damage electronic components that are susceptible to static electricity.

Handling Procedure:

1. Power to the unit must be removed.

2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.

3. Printed circuit cards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in a protective container for transport, storage or return to the factory.

CAUTION

DAMAGE TO ELECTRONIC COMPONENTS

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.).

Failure to properly handle the instrument can damage or destroy electronic components that are susceptible to even small amounts of static electricity. The components will exhibit early failure even though they appear to function properly.

DANIEL MEASUREMENT AND CONTROL, INC.
SERIES 500 LIQUID TURBINE FLOW METER
INSTALLATION, OPERATING AND
MAINTENANCE INSTRUCTIONS

NOTICE

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PRODUCT NAMES USED HEREIN ARE FOR MANUFACTURER OR SUPPLIER IDENTIFICATION ONLY AND MAY BE TRADEMARKS/REGISTERED TRADEMARKS OF THESE COMPANIES.

DANIEL AND THE DANIEL LOGO ARE REGISTERED TRADEMARKS OF DANIEL INDUSTRIES, INC. THE EMERSON LOGO IS A TRADEMARK AND SERVICE MARK OF EMERSON ELECTRIC CO.

WARRANTY

1. **LIMITED WARRANTY:** Subject to the limitations contained in Section 2 herein, Daniel Measurement & Control, Inc. ("Daniel") warrants that the licensed firmware embodied in the Goods will execute the programming instructions provided by Daniel, and that the Goods manufactured by Daniel will be free from defects in materials or workmanship under normal use and care and Services will be performed by trained personnel using proper equipment and instrumentation for the particular Service provided. The foregoing warranties will apply until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Daniel, whichever period expires first. Consumables and Services are warranted for a period of 90 days from the date of shipment or completion of the Services. Products purchased by Daniel from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Daniel has no liability for Resale Products beyond making a reasonable commercial effort to arrange for procurement and shipping of the Resale Products. If Buyer discovers any warranty defects and notifies Daniel thereof in writing during the applicable warranty period, Daniel shall, at its option, correct any errors that are found by Daniel in the firmware or Services or repair or replace F.O.B. point of manufacture that portion of the Goods or firmware found by Daniel to be defective, or refund the purchase price of the defective portion of the Goods/Services. All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources or environmental conditions, accident, misuse, improper installation, modification, repair, use of unauthorized replacement parts, storage or handling, or any other cause not the fault of Daniel are not covered by this limited warranty, and shall be at Buyer's expense. Daniel shall not be obligated to pay any costs or charges incurred by Buyer or any other party except as may be agreed upon in writing in advance by Daniel. All costs of dismantling, reinstallation and freight and the time and expenses of Daniel's personnel and representatives for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Daniel. Goods repaired and parts replaced by Daniel during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Daniel and can be amended only in a writing signed by Daniel. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE. THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES. **Buyer acknowledges and agrees that corrosion or erosion of materials is not covered by this warranty.**

2. LIMITATION OF REMEDY AND LIABILITY: DANIEL SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE REMEDIES OF BUYER SET FORTH IN THIS AGREEMENT ARE EXCLUSIVE. IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, OTHER TORT OR OTHERWISE), SHALL DANIEL'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED OR SERVICES PROVIDED BY DANIEL GIVING RISE TO THE CLAIM OR CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL DANIEL'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXTEND TO INCLUDE INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES. THE TERM "CONSEQUENTIAL DAMAGES" SHALL INCLUDE, BUT NOT BE LIMITED TO, LOSS OF ANTICIPATED PROFITS, REVENUE OR USE AND COSTS INCURRED INCLUDING WITHOUT LIMITATION FOR CAPITAL, FUEL AND POWER, AND CLAIMS OF BUYER'S CUSTOMERS.

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1.0 INTRODUCTION

1.1 General

This manual is designed to assist in the installation and operation of the Daniel Series 500 Liquid Turbine Flow Meter. To assure proper installation and startup it is important to read this manual in its entirety.

1.2 Description

The Daniel Series 500 Liquid Turbine Flow Meter is a volumetric flow metering and transmitting device used extensively in the petroleum industry for the accurate measurement of liquid hydrocarbons. The meter's simple configuration assures higher flow rates, extended flow range and sustained performance capability. This meter is specifically designed for truck off-loading.

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2.0 SPECIFICATIONS

WARNING

PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Do not exceed specifications listed below.

Failure to heed this warning could result in serious injury and/or damage to the equipment.

Meter Performance
Linearity: ± 0.25%*
Repeatability: ± 0.02%*

Materials of Construction
Meter Body: Aluminum
Internal Components: Aluminum and Stainless Steel
Bearings: Stainless Steel Ball Bearings
Flow Conditioning Plate: Delrin

Ratings:

Pressure	75 PSI Maximum @ 100˚F
Ambient Temperature	-40˚F to 158˚F (-40˚C to 70˚C)
Process Temperature	32˚F to 140˚F (0˚C to 60˚C)

Connections
CAM and Groove Couplers on TTMA Flanges

Approvals
Pending

* under pressure conditions and a full line

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3.0 INSTALLATION

3.1 General

This section contains specific instructions for installation of the meter.

3.2 Flow Considerations

Linearity can be defined as the total range of deviation of accuracy, expressed as a curve, between minimum and maximum flow rates. The ideal accuracy curve of a volumetric meter, such as the turbine, is a straight line denoting a constant K-factor.

Specific Gravity

Turbine meter performance is affected by specific gravity and may influence performance. The effect of specific gravity on the turbine meter may be evidenced when specific gravity drops below 0.66. As specific gravity decreases, the lift forces on the turbine blade decreases. Likewise as velocity decreases, lift forces decrease. These reduced lift forces are overtaken by bearing friction as low rates are approached. Subsequently, linearity deteriorates at low flow rates while measuring light fluids.

Viscosity

Turbine meters are viscosity sensitive in that as the metered fluid increases in viscosity, meter linearity begins to suffer. This effect on linearity is primarily due to a change in the fluid's velocity profile and skin friction between the fluid and the rotor blades.

Seasonal Changes

For optimal performance in applications where fuel oils are metered and where there is a large temperature swing from summer to winter, it is recommended that a new K-factor be established as seasons change. This is recommended since temperature affects the viscosity of fuel oil and viscosity affects turbine meter performance.

Generally speaking, viscosities of 3 centipoise or less give no cause for concern. Above this viscosity, all influential factors should be considered.

New Installations

Lines should be flushed thoroughly to rid piping of potentially damaging foreign material such as welding bead, pipe scale, etc. before the meter is placed into service.

Figure 3-1. Typical Application

Valves

The control valve located on the outlet side of the meter should always be used to control the flow rate, as well as, starting and stopping.

Flow Straightening

The Daniel Series 500 Liquid Turbine Flow Meter is supplied with a flow conditioning plate standard.

4.0 OPERATION

1. Always check to ensure that no foreign objects are in the inlet or the outlet of the meter.

2. Connect to truck as shown in the following figure. Ensure that the cam-locks are tight. The meter valve on the outlet side of the meter should be closed (handle vertical).

Figure 4-1. Typical Installation - Valve in Closed Position

3. Connect hose to outlet side of the meter as shown in Figure 4-1. Ensure that the cam-locks are tight.

4. For initial use, program totalizer. See Appendix for more details.

5. Reset totalizer to zero.

6. When ready to off-load the fuel open the truck valve (dry break).

7. Slowly open meter valve on the outlet side of the meter. Move handle to the horizontal position.

Figure 4-2. Typical Installation - Valve in Open Position

8. Close meter valve to stop flow for split compartment. Re-open the meter valve when ready to resume flow.

9. If hose disconnect is necessary, close the truck valve (dry break) and re-open the meter valve to drain the meter.

10. When ready to restart, open the truck valve and then slowly open the meter valve.

CAUTION

POSSIBLE EQUIPMENT DAMAGE

On start up always open truck valve first, then slowly open the meter valve. On shut down always close meter valve first, then the truck valve.

Failure to follow these precautions could result in possible damage to the meter and/or the truck.

5.0 MAINTENANCE

Reference Figures 7-1 and 7-2, exploded parts drawing.

NOTICE

Item numbers reference actual engineering drawings and are not meant to be consecutively numbered.

5.1 General

The Daniel Series 500 Liquid Turbine Flow Meter is designed to operate for extended periods of time without evidence of wear or loss of precision. All meter adjustments were completed at the factory during liquid calibration. However, field calibration may be necessary to obtain accuracy on a specific truck. Information contained in this document must be read and understood before attempting any maintenance procedure.

If the Daniel Series 500 Liquid Turbine Flow Meter needs repair, contact the nearest Daniel Measurement and Control Sales or Service Office. It is important that servicing be performed by trained and qualified service personnel.

5.2 Maintenance Considerations

1. Label all parts or place parts in labeled containers during disassembly.

2. Metal clamping devices should not be in direct contact with any meter part or surface.

3. Rotor blades determine proper flow measurement and should be handled with extreme care. Bending or altering the blades in any way can effect meter accuracy.

5.3 Disassembly Procedure - Internal Components

Before removing the meter from the system the following precautions must be taken:

Relieve all line pressure.

WARNING

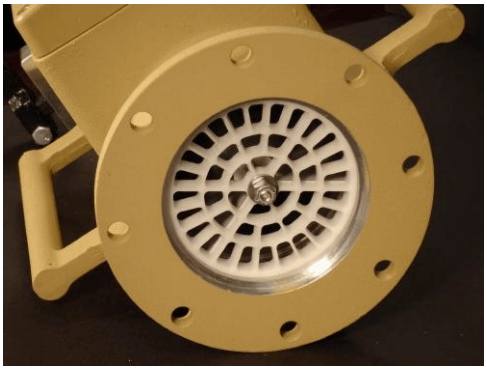
PERSONAL INJURY AND/OR EQUIPMENT DAMAGE

Relieve all pressure at this time.

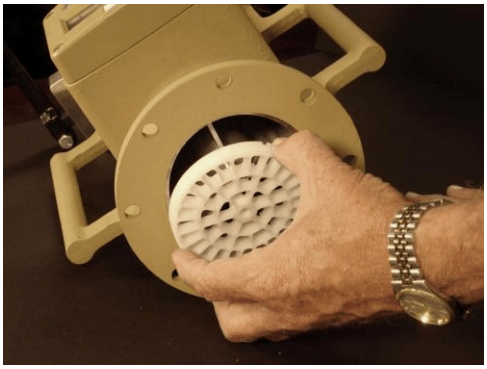
Failure to relieve line pressure at this time could result in serious personal injury and/or damage to the equipment.

Disassembly Internal Components Size 3" and 4"

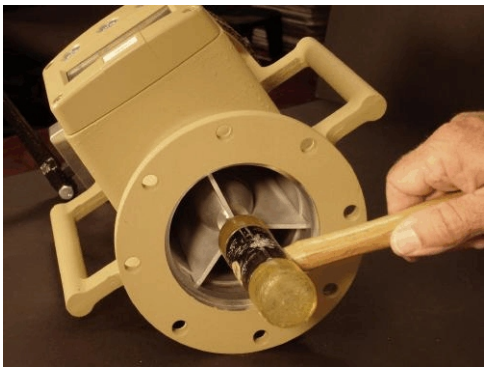
Remove cam lock connector and sight glass from inlet as shown.



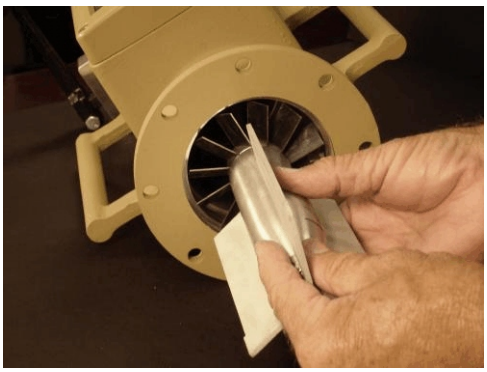
The internals of the Daniel Series 500 Liquid Turbine Flow Meter (sizes 3" and 4") are retained by means of patented self-centering support fins, which are engaged by the compression of the flow conditioning plate against the support fins.



Remove the nut, washer and flow conditioning plate from the center bolt.



Lightly tap the center bolt on the end with a soft-faced mallet to loosen the compression on the support fins. Push the shaft in approximately flush with the support fins and lift the fins slightly to remove them from their engagement into the groove inside the flow tube.



Gently remove the internals from the flow tube.

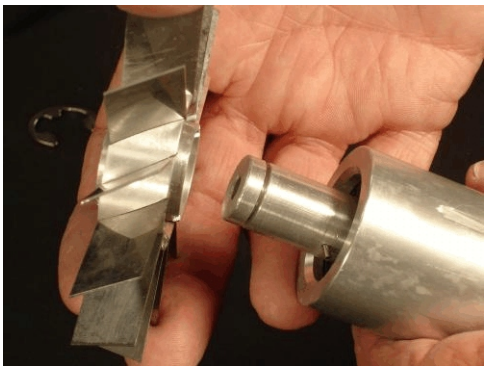
CAUTION

METER PERFORMANCE CAN BE AFFECTED

Handle the rotor with care.

Improper handling of the rotor assembly may cause distortion to the rotor blades.

After removing the internals from the flow tube, lay the support fins aside and remove the retaining ring from the end of the shaft supporting the rotor.



Gently slide the rotor from the bearing shaft.

NOTICE

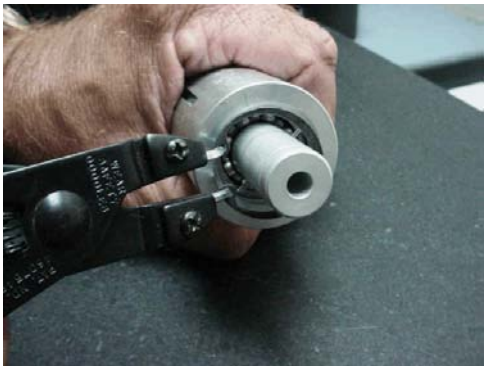
The rotor has a “U” etched on the upstream side of the rotor. Be sure to re-assemble the internal assembly with the rotor correctly oriented.

CAUTION

METER PERFORMANCE CAN BE AFFECTED

Do not lay the internal assembly in a horizontal position. Handle the rotor with care.

Improper handling of the rotor assembly may cause distortion to the rotor blades.



Remove the internal retaining ring holding the bearing in the diffuser.

CAUTION

METER PERFORMANCE CAN BE AFFECTED

Use care not to damage ring or seat during removal.

Improper handling of the ring or seat may cause damage to rotor assembly.

Remove the bearing assembly from the diffuser.

Remove bearing retaining ring to remove bearings.

5.4 Reassembly of Internal Components

To reassemble the internal components reverse the disassembly procedure.

CAUTION

METER PERFORMANCE CAN BE AFFECTED

Handle the rotor blades with caution at all times.

Blade position is critical to meter performance.

NOTICE

Torque the retaining nuts to 25 ft. lbs.

5.5 Reassembly of External Components

Reassemble cam lock connector and sight glass to meter body.

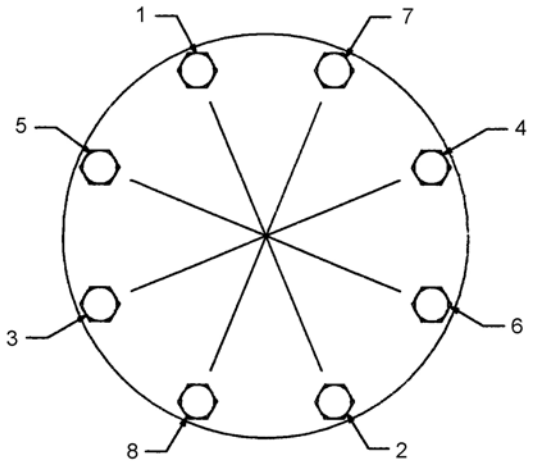
Torque bolts and nuts to 15-20 ft. lbs. in a four step star pattern. See figure below. Follow the torque settings for each pass in Table 5-1.

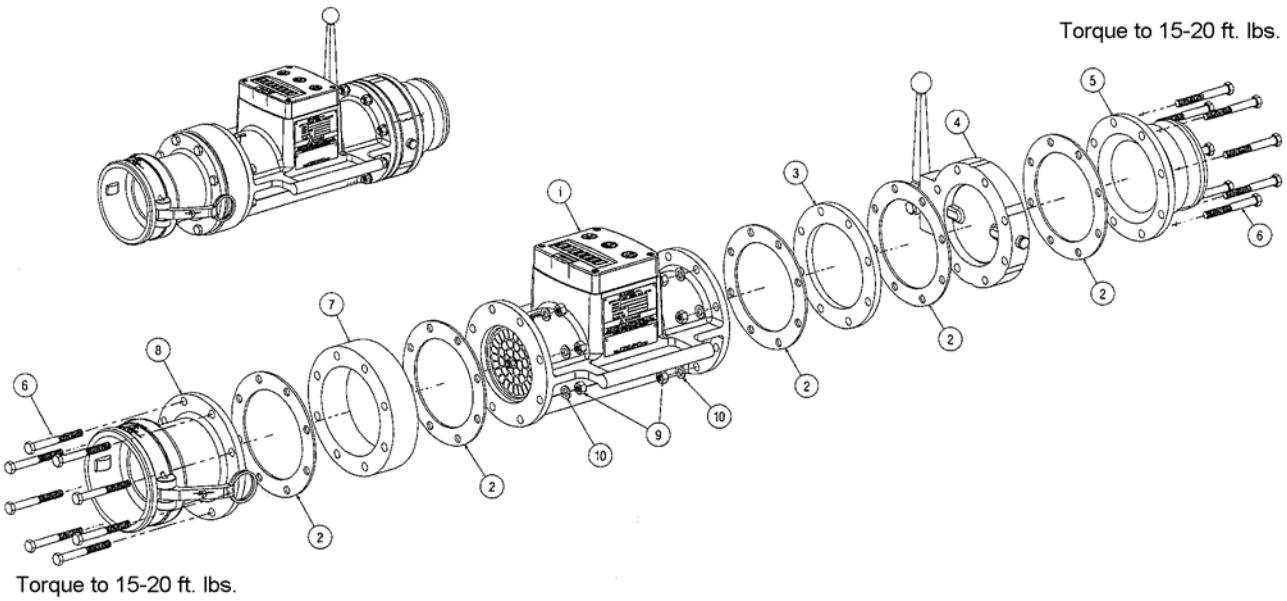
Torquing Procedure:

Torque nuts (Item 9) while holding bolt (Item 6) in a sequential pattern as indicated below.

Table 5-1. Torque Settings

	3"	4"
	Torque all nuts to:	
1st Pass	Tight	Tight
2nd Pass	10 ft. lbs.	12.5 ft. lbs.
3rd Pass	12.5 ft. lbs.	15 ft. lbs.
4th Pass	15 ft. lbs.	18 ft. lbs.
5th Pass	17 ft. lbs.	20 ft. lbs.





6.0 TROUBLESHOOTING

Table 6-1. Troubleshooting

Condition	Probable Cause	Correction
Totalizer not counting	Totalizer configured incorrectly	Check Totalizer settings
	Damaged or shorted pickoff (Resistance across leads should be 1000 Ohm ±15%	Replace pickoff
	Manual valve closed on meter outlet	Slowly open valve
	Rotor not turning	See below
Turbine meter rotor not turning	Defective rotor bearing	Return rotor assembly to factory for replacement or repair
	Rotor damaged by foreign material passing through meter	Return rotor assembly to factory for replacement or repair
Inaccurate readout	Foreign material on rotor blades	Check and clean blades
	Rotor blades are bent	Return to factory for replacement or repair
	Defective Totalizer	Refer to Appendix A
	Totalizer configured incorrectly	Check Totalizer settings

6.1 General

This information has been provided as an aid in basic troubleshooting. Disassembly procedures have been outlined in Section 5.3 of this manual. If the Daniel Series 500 Liquid Turbine Flow Meter needs repair, contact the nearest Daniel Measurement and Control Sales or Service Office. It is important that servicing be performed by trained and qualified service personnel.

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7.0 PARTS LIST

This section contains the necessary parts required to make up any standard unit covered in this manual. Recommended spare or replacement parts have been denoted by an asterisk.

NOTICE

Item numbers reference actual engineering drawings and are not meant to be consecutively numbered.

When ordering, the following information must be supplied.

- Serial number
- Part number
- Part description
- Quantity required

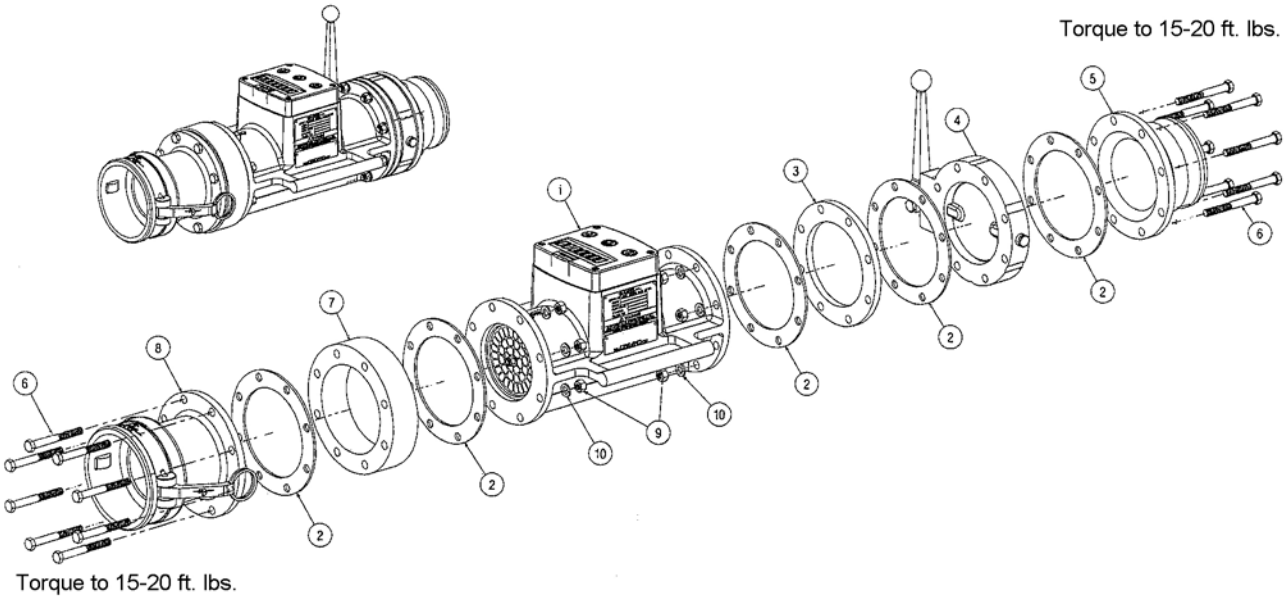


Figure 7-1. Complete Meter Assembly (3" and 4")
(Reference Table 7-1)

Table 7-1. Complete Meter Assembly Parts (3" and 4")
(Reference Figure 7-1)

Item Number	Description	3" Part Number	4" Part Number	Quantity Required
1	Meter (See page 7-2)	797-20-200-00	797-22-200-00	1
2*	Gasket	1505142	1505143	5
3	Spacer	1505144	1505145	1
4	Valve	1505146	1505147	1
5	Adapter	1505148	1505149	1
6	Bolt	1505141-419	1505141-419	16
7	Sight Glass	1505150	1505151	1
8	Coupler	1505152	1505153	1
9	Nut	151545-019	151545-019	16
10	Lock Washer	152122	152122	16

* Recommended Spare Parts

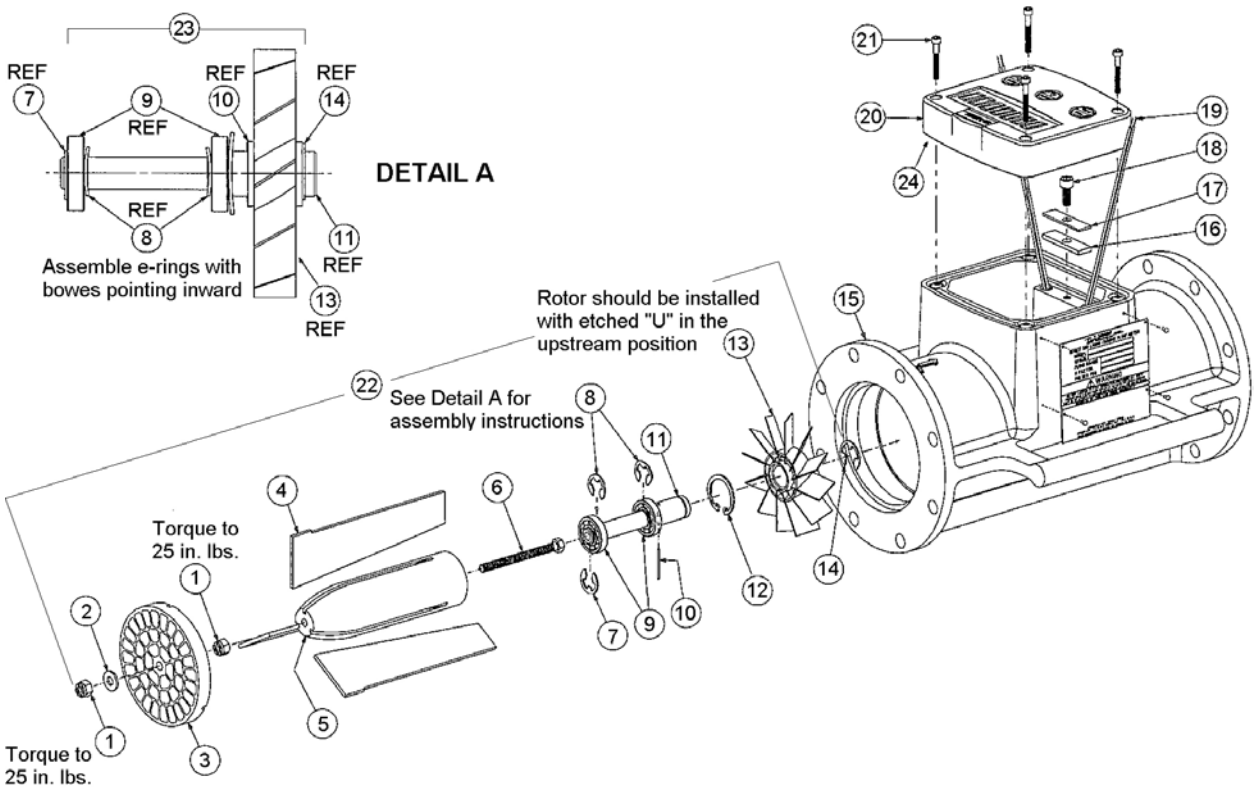


Figure 7-2. Meter Assembly Internals (3" and 4")
(Reference Table 7-2)

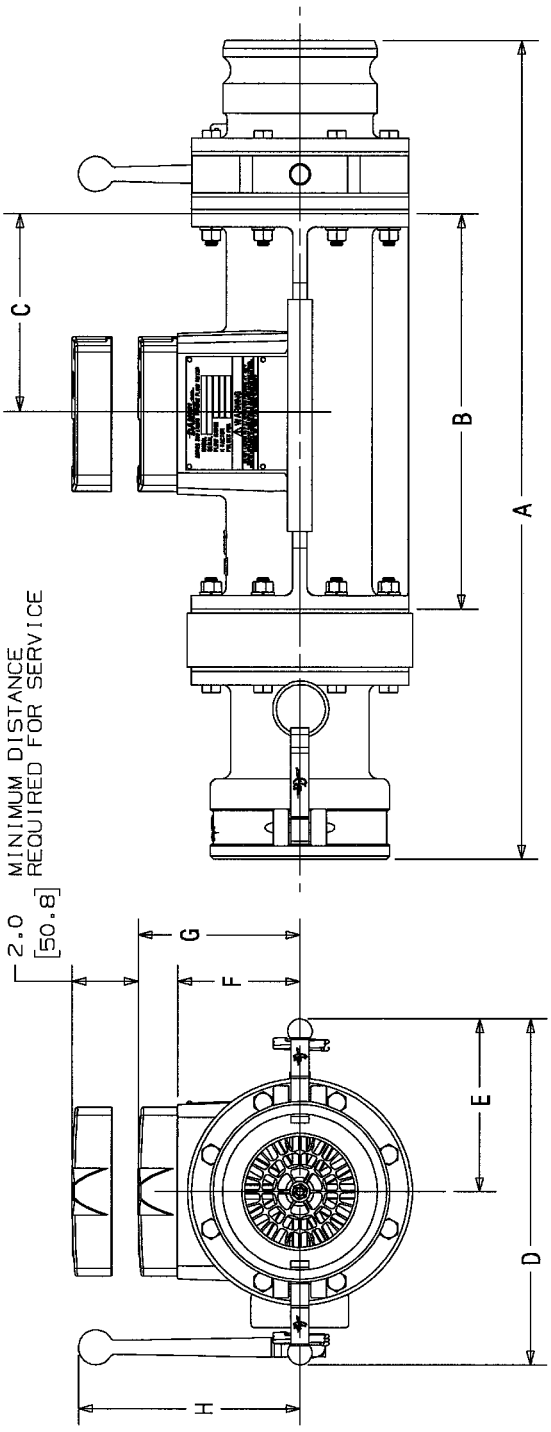
Table 7-2. Meter Assembly Internals Parts (3" and 4")
(Reference Figure 7-2)

Item Number	Description	3" Part Number	4" Part Number	Quantity Required
1	Nut	151687	151685	2
2	Washer	151891	151857-419	1
3	Flow Conditioning Plate	798-20-301-01	798-22-301-01	1
4	Support Fin	798-20-070-00	798-22-070-00	3
5	Diffuser	798-20-008-00	798-22-008-00	1
6	Screw (Hex Head)	1500615	150739-419	1
7*	E-Ring	156514	1500732	1
8*	Bowed E-Ring	1500733	1500735	2
9*	Ball Bearing	155194	159641	2
10	Roll Pin	153569	153505-419	1
11	Rotor Shaft	798-20-010-00	798-22-010-00	1
12*	Retaining Ring	1500616	1500617	1
13*	Rotor	W798-20-319-00	W798-22-319-00	1
14*	E-Ring	1500732	1500734	1
15	Housing	797-20-312-20M	797-22-312-20M	1
16	Insulator	797-20-410-01	797-22-410-01	1
17	Clamp	797-20-410-00	797-22-410-00	1
18	Screw	151496	151496	1
19*	Pickoff	797-00-201-00	797-00-201-00	1
20	Register	797-00-900-00	797-00-900-00	1
21	Screw (Hex Socket)	1505136	1505136	4
22	Complete Internal (See Note 1)	798-20-300-01	798-22-300-01	1

Item Number	Description	3" Part Number	4" Part Number	Quantity Required
23	SS Bearing Shaft C/W Rotor (See Note 2)	798-20-318-00	798-22-318-00	1
24*	Replacement Battery for Register (Item 20)	1505176	1505176	1

* Recommended Spare Parts

Note 1: Includes Items 1-14
Note 2: Includes Items 7, 8, 9, 10, 11, 13, 14



SIZE	A		B		C		D	
inches	inches	mm	inches	mm	inches	mm	inches	mm
3	22.92	582	10	254	5	127	10.5	267
4	24.812	630	12	305	6	152	10.5	267

SIZE	E		F		G		H	
inches	inches	mm	inches	mm	inches	mm	inches	mm
3	5.25	133	3.280	83	4.486	114	6.75	171
4	5.25	133	3.730	95	4.936	125	6.75	171

Figure 7-3. Dimensional Drawing

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APPENDIX A F012-P FLOWRATE INDICATOR/TOTALIZER

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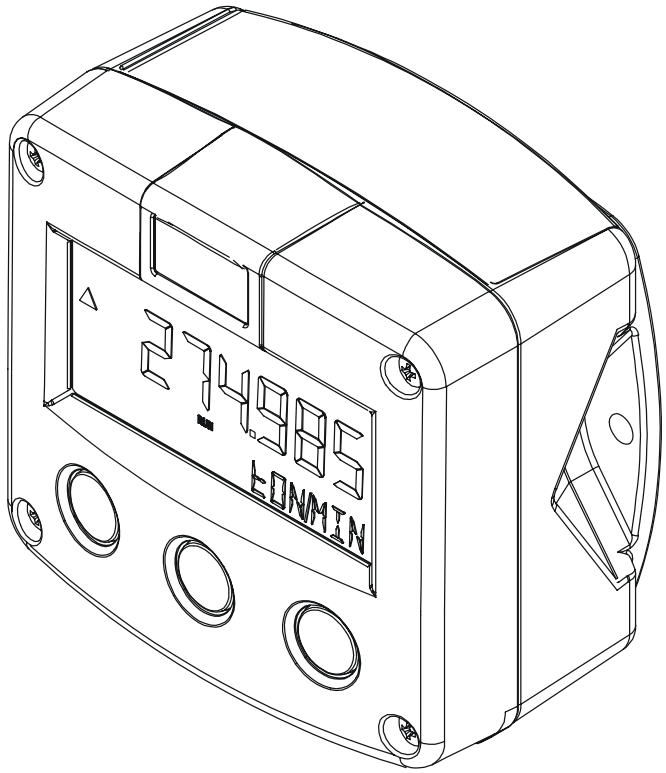
F012-P

FLOWRATE INDICATOR / TOTALIZER



Signal input flowmeter: pulse, Namur and coil.

Options: Intrinsically Safe.

ISO 9001:2000
KEMA
DUTCH COUNCIL FOR ACCREDITATION

SAFETY INSTRUCTIONS

- *Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.*

- *LIFE SUPPORT APPLICATIONS: The F012-P is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.*

- *Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.*

- *This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).*

- *Do connect a proper grounding to the aluminum casing as indicated if the F012-P has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.*

- *Intrinsically Safe applications.*

SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F012-P implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the F012-P supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification.
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

- The daily use of the unit is described in chapter 2 "Operation". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

This operation manual describes the standard unit as well as most of the options available. For additional information, please contact your supplier.

A hazardous situation may occur if the F012-P is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:

A "**warning**" indicates actions or procedures which, if not performed correctly, may lead to personal injury, a safety hazard or damage of the F012-P or connected instruments.

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F012-P or connected instruments.

A "**note**" indicates actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

CONTENTS MANUAL

1. INTRODUCTION

1.1. SYSTEM DESCRIPTION OF THE F012-P

Functions and features
The flowrate / totalizer model F012-P is a microprocessor driven instrument designed to display flowrate, total and accumulated total.
This product has been designed with a focus on:

- ultra-low power consumption to allow long-life battery powered applications (type PB / PC),
- intrinsic safety for use in hazardous applications (type XI),
- several mounting possibilities with GRP or aluminum enclosures for industrial surroundings,
- ability to process all types of flowmeter signals,

Flowmeter input
This manual describes the unit with a pulse type input from the flowmeter "-P version". Other versions are available to process (0)4-20mA or 0-10V flowmeter signals.
One flowmeter with a passive or active pulse, Namur or coil signal output can be connected to the F012-P. To power the sensor, several options are available.

Overview typical application F012

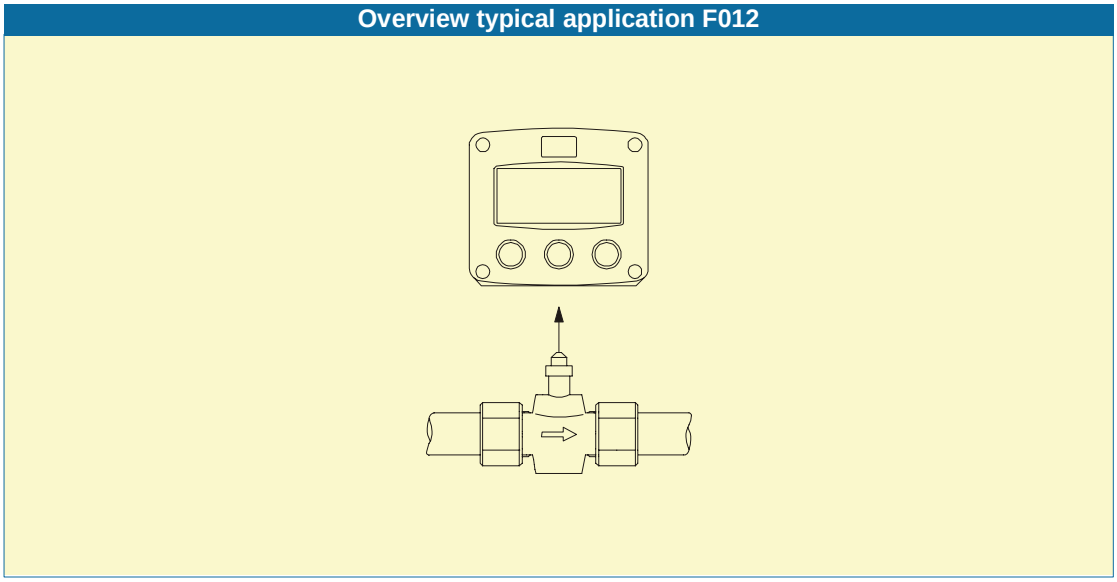


Fig. 1: Typical application for the F012-P.

Configuration of the unit
The F012-P has been designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F012-P according to your specific requirements.
It includes several important features, such as K-factors, measurement units, signal selection etc. All setting are stored in EEPROM memory and will not be lost in the event of power failure. To extend the battery-life time, please use of the power-management functions as described in chapter 3.2.3.

Display information
The unit has a large transflective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.
Flowrate and totals can be displayed either with the small 8mm digits or with the 17mm digits.
A backup of the total and accumulated total in EEPROM memory is made every minute.

Options
The following options are available: intrinsic safety, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure and LED backlight.

2. OPERATIONAL

2.1. GENERAL

Caution !

- *The F012-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

This chapter describes the daily use of the F012-P. This instruction is meant for users / operators.

2.2. CONTROL PANEL

The following keys are available:

Fig. 2: Control Panel.

Functions of the keys

This key is used to program and save new values or settings.
It is also used to gain access to SETUP-level; please read chapter 3.

This key is used to SELECT accumulated total.
The arrow-key ▲ is used to increase a value after PROG has been pressed or to configure the unit; please read chapter 3.

Press this key twice to CLEAR the value for total.
The arrow-key ▶ is used to select a digit after PROG has been pressed or to configure the unit; please read chapter 3.

2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F012-P will always function at Operator level. The information displayed is dependant upon the SETUP-settings The signal from the connected sensor is processed by the F012-P in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.

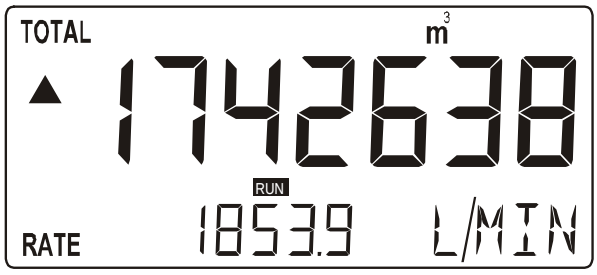


Fig. 3: Example of display information during process.

For the Operator, the following functions are available:

- **Display flowrate / total or flowrate**
  This is the main display information of the F012-P. After selecting any other information, it will always return to this main display automatically.
  Total is displayed on the upper-line of the display and flowrate on the bottom line.
  It is possible to display flowrate only with the large 17mm digits; in this instance press the SELECT-key to read the total.
  When "-------" is shown, then the flowrate value is too high to be displayed. The arrows ⬍ indicate the increase/decrease of the flowrate trend.

- **Clear total**
  The value for total can be re-initialized. To do so, press CLEAR twice. After pressing CLEAR once, the flashing text "PUSH CLEAR" is displayed. To avoid re-initialization at this stage, press another key than CLEAR or wait for 20 seconds.
  Re-initialization of total DOES NOT influence the accumulated total.

- **Display accumulated total**
  When the SELECT-key is pressed, total and accumulated total are displayed. The accumulated total cannot be re-initialized. The value will count up to 99,999,999,999. The unit and number of decimals are displayed according to the configuration settings for total.

- **Low-battery alarm**
  When the battery voltage drops, it must be replaced. At first "low-battery" will flash, but as soon as it is displayed continuously, the battery MUST be replaced shortly after!
  Only original batteries supplied by the manufacturer may be used, else the guarantee and liability will be terminated. The remaining lifetime after the first moment of indication is generally several days up to some weeks.

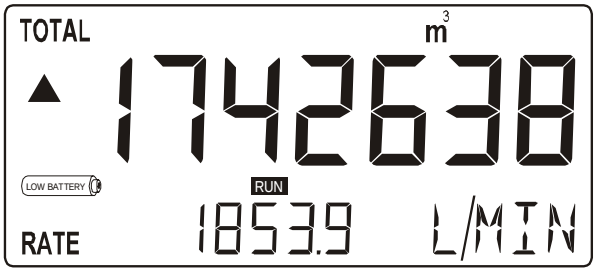


Fig. 4: Example of low-battery alarm.

Alarm 01-03 When "alarm" is displayed, please consult Appendix: problem solving.

3. CONFIGURATION

3.1. INTRODUCTION

This and the following chapters are exclusively meant for electricians and non-operators. In these, an extensive description of all software settings and hardware connections are provided.

Caution !

- *Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.*
- *The F012-P may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.*
- *Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.*
- *Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.*

3.2. PROGRAMMING SETUP-LEVEL

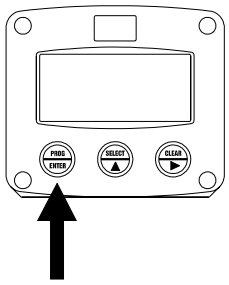
3.2.1. GENERAL

Configuration of the F012-P is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows ⬍ will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically.
SETUP can be reached at all times while the F012-P remains fully operational.

Note !

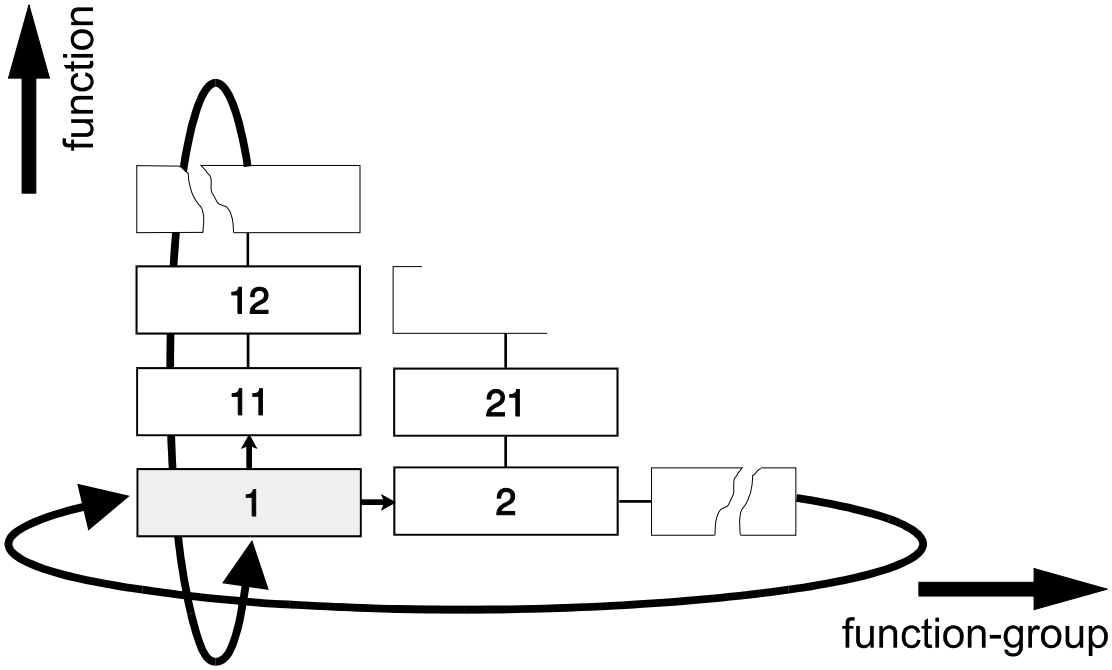
Note: *A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.*

To enter SETUP-level:



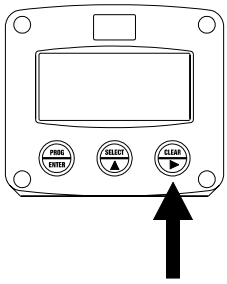
Press PROG/ENTER for 7 seconds

Matrix structure SETUP-level:

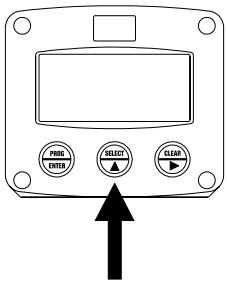


SCROLLING THROUGH SETUP-LEVEL

Selection of function-group and function:
SETUP is divided into several function groups and functions.



Select function-group with CLEAR ▶

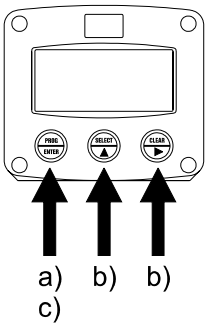


Select function with SELECT ▲

Each function has a unique number, which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function-group and the second figure the sub-function. Additionally, each function is expressed with a keyword.

After selecting a sub-function, the next main function is selected by scrolling through all "active" sub-functions (e.g. 1▲, 11▲, 12▲, 13▲, 14▲, 1▶, 2▶, 3▲, 31 etc.). The “CLEAR” button can be used to jump a step back if you missed the desired function.

To change or select a value:



a) press PROG ENTER briefly; **PROGRAM** will start flash

b) select or enter value with SELECT and / or CLEAR

c) press PROG ENTER to confirm the value / selection.

To change a value, use ▸ to select the digits and ▲ to increase that value.
If the new value is invalid, the increase sign ▲ or decrease-sign ▼ will be displayed while you are programming.

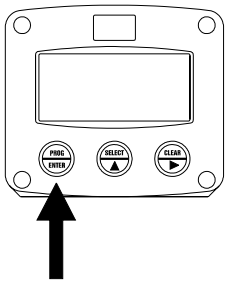
To select a setting, ▲ is used to select in one direction and ▸ can be used to select in the other direction.

When data is altered but ENTER is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for three seconds: the PROG-procedure will be left automatically and the former value reinstated.

Note !

Note: *alterations will only be set after ENTER has been pressed!*

To return to OPERATOR-level:



Press PROG ENTER for 3 seconds

In order to return to the operator level, PROG will have to be pressed for three seconds. Also, when no keys are pressed for 2 minutes, SETUP will be left automatically.

3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

SETUP FUNCTIONS AND VARIABLES			
1	**TOTAL**		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	K-FACTOR:	0.000010 - 9,999,999
	14	DECIMALS K-FACTOR	0 - 6
2	**FLOWRATE**		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	K-FACTOR	0.000010 - 9,999,999
	25	DECIMALS K-FACTOR	0 - 6
	26	CALCULATION	per 1 - 255 pulses
	27	CUT-OFF	0.1 - 999.9 seconds
3	**DISPLAY**		
	31	FUNCTION	total - flowrate
	32	BACKLIGHT (optional)	off - green - amber
	33	BL. BRIGHTNESS	1 - 5
4	**POWER MANAGEMENT**		
	41	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	42	BATTERY MODE	operational - shelf
5	**FLOWMETER**		
	51	SIGNAL	npn - npn_lp - reed - reed_lp - pnp - pnp_lp - namur - coil_hi - coil_lo - active
6	**OTHERS**		
	61	TYPE / MODEL	F012-P
	62	SOFTWARE VERSION	03.xx.xx
	63	SERIAL NO.	xxxxxxx
	64	PASS CODE	0000 - 9999
	65	TAGNUMBER	0000000 - 9999999

3.2.3. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL	
MEASUREMENT UNIT **11**	SETUP - 11 determines the measurement unit for total and accumulated total. The following units can be selected: L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit). Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.
DECIMALS **12**	The decimal point determines for total and accumulated total the number of digits following the decimal point. The following can be selected: 0000000 - 111111.1 - 22222.22 - 3333.333
K-FACTOR **13**	With the K-factor, the flowmeter pulse signals are converted to a quantity. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 11), for example per cubic meter. The more accurate the K-factor, the more accurate the functioning of the system will be. **Example 1:** **Calculating the K-factor.** *Let us assume that the flowmeter generates 2.4813 pulses per liter and the selected unit is "cubic meters / m3". A cubic meter consists of 1000 parts of one liter which implies 2,481.3 pulses per m3. So, the K-factor is 2,481.3. Enter for SETUP - 13: "2481300" and for SETUP - 14 - decimals K-factor "3".* **Example 2:** **Calculating the K-factor.** *Let us assume that the flowmeter generates 6.5231 pulses per gallon and the selected measurement unit is gallons. So, the K-Factor is 6.5231. Enter for SETUP - 13: "6523100" and for SETUP - 14 decimals K-factor "6".*
DECIMALS K-FACTOR **14**	This setting determines the number of decimals for the K-factor entered. (SETUP 13). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 Please note that this setting influences the accuracy of the K-factor indirectly. (i.e. the position of the decimal point and thus the value given) This setting has NO influence on the displayed number of digits for total (SETUP 12)!

2 - FLOWRATE	
The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate. The display update time for flowrate is one second or more.	
MEASUREMENT UNIT **21**	SETUP - 21 determines the measurement unit for flowrate. The following units can be selected: mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P. Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the K-factor has to be adapted as well; the calculation is not done automatically.
TIME UNIT **22**	The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).
DECIMALS **23**	This setting determines for flowrate the number of digits following the decimal point. The following can be selected: 00000 - 1111.1 - 2222.22 - 3333.333
K-FACTOR **24**	With the K-factor, the flowmeter pulse signals are converted to a flowrate. The K-factor is based on the number of pulses generated by the flowmeter per selected measurement unit (SETUP 21), for example per liter. The more accurate the K-factor, the more accurate the functioning of the system will be. For examples read SETUP 13.
DECIMALS K-FACTOR **25**	This setting determines the number of decimals for the K-factor (SETUP 24). The following can be selected: 0 - 1 - 2 - 3 - 4 - 5 - 6 Please note that this SETUP - influences the accuracy of the K-factor indirectly. This setting has NO influence on the displayed number of digits for "flowrate" (SETUP 23)!
CALCULATION **26**	The flowrate is calculated by measuring the time between a number of pulses, for example 10 pulses. The more pulses the more accurate the flowrate will be. The maximum value is 255 pulses. ***Note:*** *the lower the number of pulses, the higher the power consumption of the unit will be (important for battery powered applications).* ***Note:*** *for low frequency applications (below 10Hz): do not program more than 10 pulses else the update time will be very slow.* ***Note:*** *for high frequency application (above 1kHz) do program a value of 100 or more pulses.*
CUT-OFF TIME **27**	With this setting, you determine a minimum flow requirement thresh-hold, if during this time less than XXX-pulses (SETUP 26) are generated, the flowrate will be displayed as zero. The cut-off time has to be entered in seconds - maximum time is 999 seconds (about 15 minutes).

3 - DISPLAY	
FUNCTION **31**	The large 17mm digits can be set to display total or flowrate. When "total" is selected, both total and flowrate are displayed simultaneously. When "flowrate" is selected, only flowrate will be displayed with it's measuring unit while total will be displayed after pressing SELECT.
The functions below will only effect the optional LED-backlight.	
BACKLIGHT (OPTION) **32**	If a LED backlight has been supplied, the color can be selected. Following selections are available: OFF - GREEN - AMBER
BRIGHTNESS (OPTION) **33**	The density of the backlight can be set in following range: 1 - 5 One is minimum and five is maximum brightness.

4 - POWER MANAGEMENT	
When used with the internal battery option, the user can expect reliable measurement over a long period of time. The F012-P has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:	
LCD NEW **41**	The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is **strongly advised** to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signal will be generated in the normal way. The following can be selected: Fast - 1 sec - 3 sec - 15 sec - 30 sec - off. **Example battery life-time:** *life-time with a coil pick-up, 1kHz. pulses and FAST update: about 2 years.* *life-time with a coil pick-up, 1kHz. pulses and 1 sec update: about 5 years.* ***Note:** after a button has been pressed by the operator - the display refresh rate will always switch to FAST for 30 seconds. When "OFF" is selected, the display will be switched off after 30 seconds and will be switched on as soon as a button has been pressed.*
BATTERY-MODE **42**	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not process the sensor signal; the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the unit again, press the SELECT-key twice.


Note !

5 - FLOWMETER				
SIGNAL **51**	The F012-P is able to handle several types of input signal. The type of flowmeter pickup / signal is selected with SETUP 51. Read also par. 4.4.2. or 4.4.3 - flowmeter input terminals.			
TYPE OF SIGNAL	EXPLANATION	RESISTANCE	FREQ. / mV	REMARK
NPN	NPN input	100kOhm pull-up	6 kHz.	(open collector)
NPN - LP	NPN input with low pass filter	100kOhm pull-up	1.2 kHz.	(open collector) less sensitive
REED	Reed-switch input	1mOhm pull-up	600 Hz.	
REED - LP	Reed-switch input with low pass filter	1mOhm pull-up	120 Hz.	Less sensitive
PNP	PNP input	47kOhm pull-down	6 kHz.	
PNP - LP	PNP input with low pass filter	100kOhm pull-down	1.2 kHz.	Less sensitive
NAMUR	Namur input	820 Ohm pull-down	4 kHz.	External power required
COIL HI	High sensitive coil input	-	20mV p.t.p.	Sensitive for disturbance!
COIL LO	Low sensitive coil input	-	90mV p.t.p.	Normal sensitivity
ACTIVE	Active pulse input detection level 1.2V DC	47kOhm	10KHz.	External power required

6 - OTHERS	
TYPE OF MODEL **61**	For support and maintenance it is important to have information about the characteristics of the F012-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
VERSION SOFTWARE **62**	For support and maintenance it is important to have information about the characteristics of the F012-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
SERIAL NUMBER **63**	For support and maintenance it is important to have information about the characteristics of the F012-P. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
PASS CODE **64**	All SETUP-values can be pass code protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
TAGNUMBER **65**	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
1 - TOTAL		Enter your settings here	
11 unit	L		
12 decimals	0000000		
13 K-factor	0000001		
14 decimals K-factor	0		
2 - FLOWRATE		Enter your settings here	
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 K-factor	0000001		
25 decimals K-factor	0		
26 calculation / pulses	010		
27 cut-off time	30.0 sec.		
3 - DISPLAY		Enter your settings here	
31 function	total		
32 backlight	off		
33 brightness	5		
4 - POWER MANAGEMENT		Enter your settings here	
41 LCD-new	1 sec.		
42 mode	operational		
5 - FLOWMETER		Enter your settings here	
51 signal	coil-lo		
6 - OTHERS		Enter your settings here	
61 model	F012-P	F012-P	F012-P
62 software version	03.____.____	03.____.____	03.____.____
63 serial number	_ _ _ _ _ _ _	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
64 pass code	0000		
65 tagnumber	0000000		

NOTES

NOTES

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 on the Daniel Measurement and Control, Inc. 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**	**Pyrophoric**	**Poison Gas**
Cyanides	Sulfides	CorrosiveOxidizer	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: _____

The sales and service offices of Daniel Measurement and Control are located throughout the United States and in major countries overseas.
Please contact Daniel Measurement Services at
11100 Brittmoore Park Drive, Houston, Texas 77041, or phone (713) 827-6314
for the location of the sales or service office nearest you.
Daniel Measurement Services offers both on-call and contract maintenance service designed to provide single-source responsibility for all Daniel products.