F&J SPECIALTY PRODUCTS, INC.

The Nucleus of Quality Air Monitoring Programs

EMERGENCY RESPONSE AIR SAMPLING SYSTEM

Digital Flowmeter Technology 75 LPM DF Series

DF-75L-Li

DF-75L-AC

TECHNICAL MANUAL

Rev.: 04 November 2013
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EMERGENCY RESPONSE SAMPLING SYSTEM
— Digital Flowmeter Technology —
F&J Model DF-75L-Li

NOTABLE FEATURES:

- State-of-the-Art Electronics
- Operating Modes
  — Line Power (110VAC – 250VAC)
  — On-Board Batteries
  — Automobile Cigarette Lighter
- Long-lasting Lithium ion battery
- Battery Charging Circuit operable from Line Power Input
- Lightweight — ~17.5 lbs. (8.0 kg)
- Maximum Flow: 65 to 75 LPM; typical
- Bright LED Display
- Automatic Flow Control Feature
- Flowrate and Volume totalizations displayed are corrected to a factory settable Reference Temperature and Pressure (4 options available)
- Auto shut-off on time or volume
- Battery Life Indicator

GENERAL DESCRIPTION:

F&J Model DF-75L-Li is a lightweight, small footprint, DC voltage powered air sampling system operable from (1) on-board 14.8 VDC; 15.6 Ah Lithium ion battery, (2) line power, or (3) automobile cigarette lighter socket.

The DF-75L-Li is well suited for emergency response sampling activities where users do not know whether line power will be available and for alternative energy power source applications when line power is not available.

The automatic flow control feature with the F&J Digital Flowmeter technology provides maximum flexibility for emergency response sampling responsibilities. The set flowrate is maintained automatically in case of dust loading and does not require operator attention.

Typical flow range is 30-75 SLPM (1.1 -2.6 SCFM).

Rev.: 20 May 2008

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DF-75L-Li Battery Powered Air Sampler Specifications

Pump Type: Dual diaphragm high efficiency

Maximum Flowrate:
75 LPM – Typical w/47 mm FP47M glass fiber media
100 LPM – Free air flow capacity

Power Source:
Internal –
14.8 VDC Battery Pack
Lithium Ion; 15.6 Ah
External –
Line Power; 110VAC or 250VAC
Automobile Cigarette Lighter – 12VDC

Battery Charging System:
Internal System which charges from line Power.

Operating Time on Batteries:
8 - 10 hours @ 56 LPM w/FP-47M
glass fiber media

Current Draw: 3 A maximum

Filter Holder Fitting: 3/8 FNPT quick disconnect

Handle: Durable metal

Weight: 15.3 lbs. (7 kg)

Dimensions: 8”×9”×12” (20 × 23 × 30 cm)

Display: Bright LED (6 character; 1.2 cm H)

Elapsed Time: DD:HH:MM up to 168 hours

Flow Control:
Adjustable from keypad between 30-75 LPM

Flow Accuracy: ±4.0% of Full Scale

Factory Settable Reference T and P

Classical STP	0ºC, 1 ATM
Normal T and P	20ºC, 1 ATM
Modified Normal T and P	70ºF, 1 ATM
Standard Ambient T and P	25ºC, 1 ATM

OPTIONS:

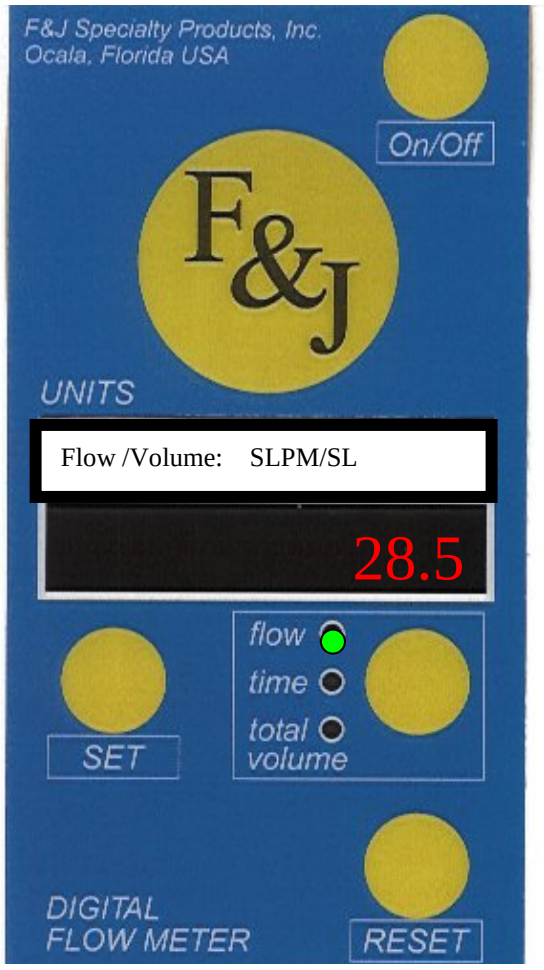
- Data Storage Device (P/N: 232FCDSD)
- 1 GB Secure Digital Card (P/N: 372239)
- Flash card Reader (P/N: SDDR-199-A20)

Standard Combination Filter Holders Available:

FILTER HOLDER MODEL	CHARCOAL CARTRIDGE DIMENSIONS	PARTICULATE PAPER DIAMETER
FJ-05P	F&J Model B	2” or 50 mm
FJ-21P	F&J Model C	2” or 50 mm
FJ-35P	F&J Model B	47 mm
FJ-46P	F&J Model C	47 mm
FJ-51P	F&J Model M	2” or 50 mm
FJ-53P	F&J Model M	47 mm

Available Engineering Units for Flow and Volume:
sccm/ scc
SLPM / SLP
SCFM / SCF
SCMH / SCM

Digital Flowmeter Keypad/Display



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EMERGENCY RESPONSE SAMPLING SYSTEM
— Digital Flowmeter Technology —
F&J Model DF-75L-AC

NOTABLE FEATURES:

- State-of-the-Art Electronics
- Operating Modes
  — Line Power (110VAC – 250VAC)
  — Automobile Cigarette Lighter
- Lightweight — ~11 lbs. (52,9 kg)
- Maximum Flow: 65 to 75 LPM; typical
- Bright LED Display
- Automatic Flow Control Feature
- Flowrate and Volume totalizations displayed are corrected to a factory settable Reference Temperature and Pressure (4 options available)
- Auto shut-off on time or volume

GENERAL DESCRIPTION:

F&J Model DF-75L-AC is a lightweight, small footprint, DC voltage powered air sampling system operable from (1) on-board 14.8 VDC; 15.6 Ah Lithium ion batteries, (2) a 12-15 VDC power source such as solar panels or other alternative energy sources.

The DF-75L-AC is well suited for alternative energy air sampling activities where users do not know whether line power will be available and for alternative energy power source applications when line power is not available. The unit may be operated from solar power or wind power source through either the AC input or DC input.

The automatic flow control feature with the F&J Digital Flowmeter technology provides maximum flexibility for emergency response sampling responsibilities. The set flowrate is maintained automatically in case of dust loading and does not require operator attention.

Typical flow range is 30-75 SLPM (1.1 -2.6 SCFM).

Rev.: 21 May 2008

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DF-75L-AC AC/DC Powered Air Sampler Specifications

Pump Type: Dual diaphragm high efficiency

Maximum Flowrate:
75 LPM – Typical w/47 mm FP47M glass fiber media
100 LPM – Free air flow capacity

Power Source:
Line Power; 110VAC or 250VAC
Automobile Cigarette Lighter – 12VDC

Current Draw: 4 A maximum

Filter Holder Fitting: 3/8 FNPT quick disconnect

Handle: Durable metal

Weight: 11 lbs. (5 kg)

Dimensions: 8”×9”×12” (20 × 23 × 30 cm)

Operating Temperature Ranges:
0ºF to 122ºF (-18ºC to 50ºC)

Display: Bright LED (6 character; 1.2 cm H)

Elapsed Time: DD:HH:MM up to 168 hours

Flow Control:
Adjustable from keypad between 30-75 LPM

Flow Accuracy: ± 4.0% of Full Scale

Factory Settable Reference T and P

Classical STP	0ºC, 1 ATM
Normal T and P	20ºC, 1 ATM
Modified Normal T and P	70ºF, 1 ATM
Standard Ambient T and P	25ºC, 1 ATM

OPTIONS:

- Data Storage Device (P/N: 232FCDSD)
- 1 GB Secure Digital Card (P/N: 372239)
- Flash card Reader (P/N: SDDR-199-A20)

Standard Combination Filter Holders Available:

FILTER HOLDER MODEL	CHARCOAL CARTRIDGE DIMENSIONS	PARTICULATE PAPER DIAMETER
FJ-05P	F&J Model B	2” or 50 mm
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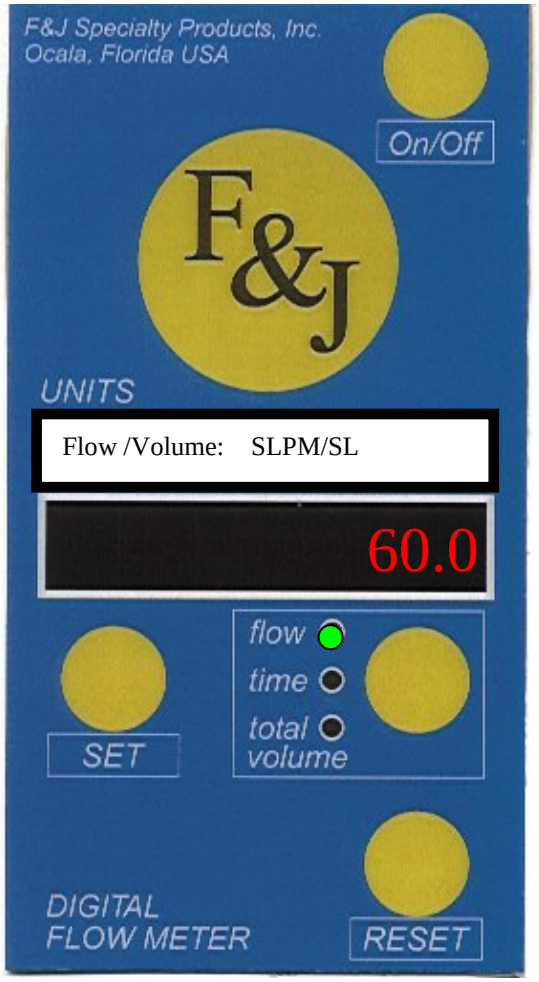
FJ-46P	F&J Model C	47 mm
FJ-51P	F&J Model M	2” or 50 mm
FJ-53P	F&J Model M	47 mm

Available Engineering Units for Flow and Volume:
sccm/ scc
SLPM / SLP
SCFM / SCF
SCMH / SCM

Digital Flowmeter Keypad/Display



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HAZARD ALERT LABELS

This is the hazard alert symbol: 

This symbol is utilized throughout the manual to notify the user or maintenance personnel to proceed with caution.

When you see this symbol, be aware that personal injury or property damage is possible. The hazard is explained in text following the symbol.

Read this information carefully before proceedings.

The following is an explanation of the two (2) different types of hazards:

WARNING Severe personal injury or death can occur if hazard is ignored.

CAUTION Minor injury or property damage can occur if hazard is ignored.

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Installation Instructions for DF Battery Air Samplers

The 75 LPM DF Battery Emergency Response Air Sampling System has been shipped in a corrugated box(es). Open each container, remove the air sampler from the shipping container and perform the following inspections:

1. Confirm that the instrument calibration documentation arrived with the unit.

2. Confirm that the serial number and model number on the instrument Manufacturer's Data Plate matches the information stated on the calibration documents.

3. Confirm the line power requirements stated on the Manufacturer's Data Plate matches the line power available.

CAUTION

4. Confirm that the instrument as received has no visible damage or loose components. Particularly check for loose screws and that no observable damage to the air sampler has occurred in transit.

5. Plug the air sampler into the local line power using the power cord provided after confirmation of line power compatibility in step 3 above. If a local style plug is required, install the plug in accordance with local electrical code prior to proceeding. Plug the unit into a grounded receptacle.

WARNING

NOTE: F&J recommends that the Air Sampler is operated to the point of discharge, followed by a complete charge on a once per month frequency.

6. Refer to the operating instructions part of this manual titled "OPERATING FEATURES and INSTRUCTIONS" for instructions on how to operate the instrument.

7. Install the filter media to be utilized with the instrument.

8. Turn on the DFM electronics by pressing the On/Off button on the DFM keypad. The button is located in the upper-right corner of the DFM.

9. After referring to the operating instructions portion of this manual and mastering the basic operating techniques, confirm the unit air flow sensors are functioning properly by setting various flow rates, then viewing the DFM display.

The instrument may now be placed in service. Please refer to the operating instruction portion of this manual for details on the operation of these instruments.

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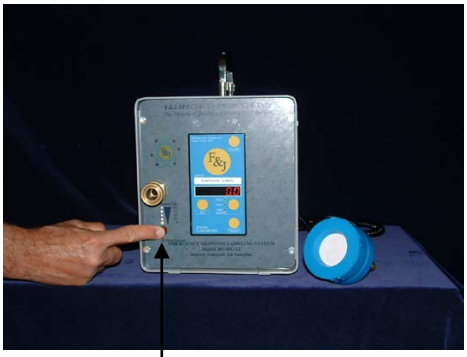
OPERATING FEATURES and INSTRUCTIONS

The 75 LPM DF Battery Series air samplers have all the operational components conveniently accessible to the user. Model DF-75L-AC and DF-75L-Li air sampler's pertinent components are illustrated below in Figure 1 through Figure 3.

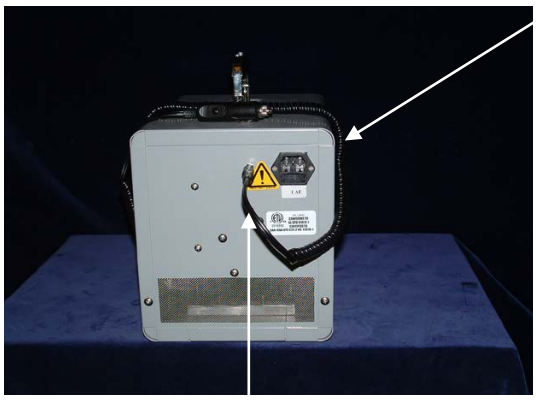


Battery Capacity Indicator

Figure 1
DF-75L-AC and DF-75L-Li

RS 232 Port
Figure 2

AC Receptacle



External DC Power Input

Figure 3
DF-75L-Li and DF-75L-AC Rear View

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OPERATING FEATURES and INSTRUCTIONS (Cont.)

POWER SOURCE

The 75 LPM DF Battery air samplers can be powered from any of the following power sources:

1. A 110VAC or 230VAC line power via the three-prong electrical connector at the rear of the enclosure. This line power is converted to 12 VDC power through a universal transformer accepting AC line voltage from 100VAC to 250VAC.
2. A 12 VDC Automobile Cigarette Lighter or Accessory socket. This connection is located at the rear of the air sampler.
3. An internal 12 VDC lead acid or 14.8 VDC Lithium ion battery when external AC or DC power is not available. The AC line voltage will charge the internal lead acid or Lithium ion battery.

ON-OFF SWITCH

The ON/OFF switch is on the Digital Flowmeter. This enables the user to turn the air sampler on and off with one switch.

FUSES

The 75 LPM DF Battery Series Units have a 3 amp fuse in the AC socket (PN CEINF).

ELECTRICAL FLOW CONTROL

The 75 LPM DF Battery air samplers utilize motor speed flow control. This is adjusted in the setup process of the Digital Flowmeter (DFM).

FLOW MEASUREMENT

Flow is indicated on the LED display when the UNITS green LED is in the FLOW position on the DFM. Various flowmeter ranges and flow measurement units are selectable at the time of purchase since they are set at the factory.

DIGITAL FLOWMETER CALIBRATION

The Digital Flowmeter calibration accuracy should be verified on a once per year frequency absent any suspected or observed damage to the unit. A factory calibration is recommended at the time of known or suspected damage to the unit.

PUMP CAPACITY

The maximum sampling flow rate achievable by the 75 LPM DF Battery Series air samplers is dependent upon the flow restriction characteristics of the charcoal filter and/or particulate filter utilized. In general, coarser mesh charcoal, larger diameter filter paper and/or more porous filter paper will enable one to achieve higher flow rates. The end user must determine the specific objectives of the sampling application and utilize the proper combination of filters and flow rate to achieve the desired objectives.

BATTERY CAPACITY INDICATOR

There are 5 LEDs under the quick disconnect that indicate the percentage of battery charge available. When the white button under the column of LEDs is pressed, an LED will illuminate. The 5 LEDs indicate 100%, 75%, 50%, 25% or 0% battery capacity.

BATTERY CHARGING INDICATOR

The red LED under the Battery Capacity Indicator illuminates when the battery is charging.

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OPERATING FEATURES and INSTRUCTIONS (Cont.)

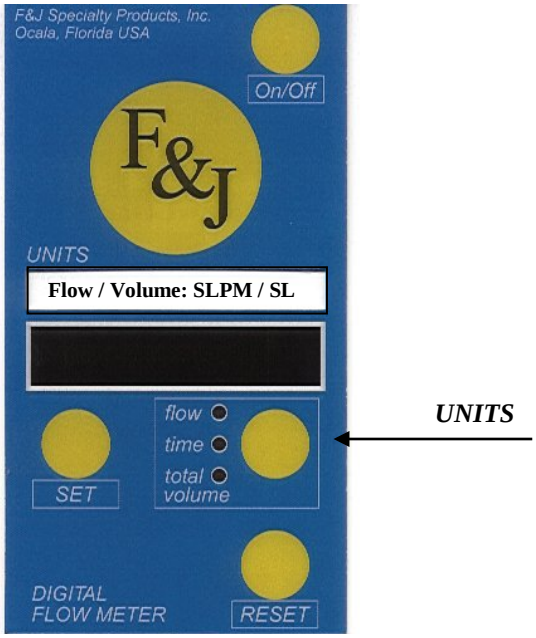
The Digital Flowmeter:

The Digital Flowmeter (DFM) is the control panel of the air sampler. Through the DFM, the operator activates the features of the instrument, as well as monitor the flow parameters.

The keypad for the DFM series of air samplers has the following features:

1. Four keypad buttons
2. 6 character LED display of 0.5 inch (1.2 cm) height
3. Label indicating the engineering units for the flow represented by the digits displayed by the LED

These engineering units are factory set and can not be changed in the field.



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OPERATING FEATURES and INSTRUCTIONS (Cont.)

Keypad Buttons and Their Functions

ON-OFF: The ON-OFF button is located in the upper right corner of the DFM module.

Pressing the ON-OFF button while the air sampler is connected to line power but not running will place the unit in standby mode. Power is enabled to the DFM.

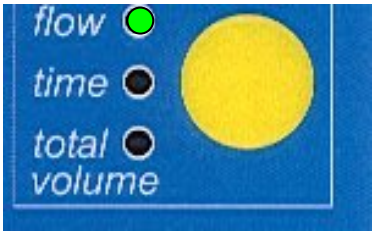
RESET: The RESET button is located in the lower right hand corner of the DFM module.

The RESET button is utilized to start and stop the air sampler motor, to commence a sampling event or to terminate a sampling event, when manual on/off is enabled.
Note: The DFM must be in flow mode for Reset to function as a pump On-Off button.

The accumulated elapsed time and accumulated total volume are not automatically reset to zero when the air sampler is started. This feature allows the operator to temporarily suspend sampling for maintenance, to implement a different set up, or to enable different features.

Note: In Time display mode, the RESET button zeros the elapsed time. In Total Volume display mode, the RESET button zeros total volume.

UNITS: The UNITS button is located on the right side of the DFM module. Pressing the UNITS button enables an operator to display flow, elapsed time, or total volume by advancing the green LED to the different positions.



The default position of the green LED is the Flow position upon start up or return to power after a power outage.

Pressing the UNITS button once moves to the Elapsed Time (***time***) position displayed in HHH:MM (Hours-Minutes mode).
Pressing the UNITS button when the green LED is in the ***time*** position advances to the ***total volume*** position.
NOTE: Do not assume that total volume and elapsed time are zero when flow is zero. Check both the elapsed time and total volume values prior to commencing a sample event.

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OPERATING FEATURES and INSTRUCTIONS (Cont.)

In Time display mode, the colon (:) blinks when the motor is turned on and is continuously illuminated when the air sampler is in stand-by condition. The blinking colon also indicates that the elapsed time accumulation is in progress.

SET: The SET button is located on the left side of the DFM. The SET button is utilized to set, enable, or disable one or more of the available features listed below:

- Automatic Shut-Off on time
- Automatic Shut-Off on volume
- Activation of Flow Control
- Selection of Data Frequency
- Selection of Actual or Standard Flow

Engineering Units

The engineering units for flow and volume are listed on the label above the LED display. The engineering units, selectable by the user at the time of purchase, are as follows:

Flow	Volume
SCFM	SCF
SLPM	SL
SCMH	SCM
sccm	scc

A user can not switch engineering units in the field. The Digital Flowmeter electronic unit must be returned to the factory to change the engineering units and to recalibrate the system sensors.

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RS232 Communications Port

General

Most models of the Digital Flowmeter have the RS232 communications port enabled.

The DFM transmits a fixed length, comma delimited ASCII string of data. The data string is comprised of the following parameters in its general format.

dd.hh.mm,ttt.t.F,bb.bb.In Hg, dd.dd In H_2O (aaaaaaaaa or ccccccccc), uuuuu, [….],vvvvvvvvv,UUU

Where:

dd,hh:mm	-	elapsed time in day.hour: minute format
ttt.t. T	-	temperature [ºF] or [ºC]
bb.bb. InHg	-	barometric (inlet) pressure [InHg] or [mm Hg]
dd.dd InH_2O	-	differential pressure [InH_2O] or [mm Hg]
aaaaaaaaa	-	ambient flow with 3, 2 or 1 decimal digit resolution up to 99999, or in x.xxxEyyy format for larger numbers. This format ensures the possible best resolution even for large values. Ambient flow has an “a” as prefix
ccccccccc	-	corrected flow (same format as for the ambient flow) but it has an “S” prefix
uuuuu	-	Engineering Unit for flow: SCFM, SLPM, sccm or SCMH or aCFM, aLPM, accm or aCMH if ambient flow is selected
[…]	-	optional values for Totalizer model
vvvvvvvvv	-	Total volume (same format as for the ambientflow)
UUU	-	Engineering Unit for total volume: SCF, SL, scc or SCM or aCFM, aL, acc or aCMH

The engineering units change according to customer selection. The […] data (total flow and engineering units are sent out when the Totalizer option is enabled.)

An example of a data string utilizing English units is illustrated below.

0.00:21,77.2 F, 30.74 InHg, 2.98 In H_2O, 2.72SCFM, 50.21SCF

Data transmission frequency is operator selectable at once per second, once per minute, once per 6 minutes, and once per hour from the serial port.

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Serial Data Utilization

Any device that can accept serial data through a communications port can receive the data and store it automatically as a text string that can ultimately be imported to a spreadsheet or database. The part number for this Data Storage Device is 232FCDSD. The 1 GB Secure Digital Card part number is 372239, and the PC Flash Card Reader part number is 515177.

F&J has a field instrument that is uniquely designed to accept the serial communications from the Digital Flowmeter as well as any other instrument that has a serial communications port. Please request information and specifications on F&J's Multi-Function Datalogger and Controller (P/N: MFDC-1).

Actual Flow Feature

A purchaser may select to display actual flow rate and totalized actual volume or flow rate and volume at one of four factory settable reference temperature and pressure conditions.

For F&J Standard Temperature and Pressure instrumentation, the options for reference T and P are as follows:

Standard Temperature:	0ºC, 20ºC, 21.1ºC (70ºF) or 25ºC
Standard Pressure:	1 atmosphere (760 mm Hg)

NOTE: F&J does not recommend the installation of the Actual Flow options for sampling activities of more than 8 hours in duration or if sample volumes or resultant data are to be compared between different plant locations throughout the state or country.

Re-calibration Frequency

The Digital Flowmeter calibration accuracy should be verified on a once per year frequency absent any suspected or observed damage to the unit. A factory calibration is recommended at the time of known or suspected damage to the unit.

Test Mode

The Digital Flowmeter has a test mode that provides the user with calibration data. The following procedure allows entry into the test mode:

1. With the DFM off, press and hold the UNITS and RESET buttons while pressing the On-Off button. All LEDs light and the program number appears.
2. When the program number appears, release the UNITS and RESET buttons. Example: PR XXX. The following information appears in sequence:
    - Engineering Units. Example: E.U. SL (Engineering Units – Standard Liters)
    - Venturi or Orifice used for factory calibration. Example: 812 or D812
    - Serial Number of the DFM, which should be the same as the serial number on the air sampler. Example: SN.8062
    - Date calibrated. Example: 10.20.04
3. After the above information appears, the DFM displays random digits. This signifies the end of the test mode. You must turn off the DFM to exit text mode. Press the On-Off button again to start in normal mode.

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Setup Enabled Features

The DFM may have one or more optional features enabled. These features are only enabled at the factory when the customer purchases the feature.
Note: Because of LED dimming, press the SET button twice to advance to each feature. Pressing the Set button once brightens the LEDs.

Press On-Off

- Place the DFM in standby mode by pressing the ON-OFF button if the power to the DFM is not activated. The LEDs are visible in standby mode.
- Press the SET button to advance to the first enabled feature.
  Note: If a feature is not enabled, it will not appear in the display.

Automatic Shut-Off on Time Feature

OFFT: Y or N appears on the display. You have the option to temporarily disable this feature by pressing the UNITS or RESET button to change the Y to an N.

The time setting screen displays hhh:mm (hours: minutes). Any time value can be set from 0:01 to 168:00 hr:min.

1. Set the **minutes** value first. Press the UNITS button to increase the minutes value or the RESET button to decrease the minutes value.
2. Press the SET button to move to the hours set-up screen. Press the UNITS button to increase the **hours** value or the RESET button to decrease the hours value.
   NOTE: If the hours value has changed pressing the SET button allows the customer to go back to the minutes setup screen.
3. Press the SET button to move to the next feature.

Automatic Shut-Off on Volume Feature

OFFV: Y or N appears on the display. You have the option to temporarily disable this feature by pressing the UNITS or RESET button to change the Y to an N.
Any volume value can be set from 0.01E00 to 9.99E99
Note: The "V" in the "OFFV" is actually a "U." This is because of the segments of the LED display.
NOTE: The automatic shut-off on volume feature generally is not enabled if the automatic shut-off on time has been enabled. However, it is physically possible to have both enabled. The shut-off feature that is most restrictive will occur first and thus terminate the sampling event.

1. Set the **exponent** value first. Press the UNITS button to increase the exponent value or the RESET button to decrease the exponent value.
2. Press the SET button to move to the **digits** set-up screen. Press the UNITS button to increase the digits value or the RESET button to decrease the digits value.
   NOTE: If digits to the right of the decimal point have changed, pressing SET takes the customer back to the exponent setup screen.

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3. Press the SET button to move to the next feature.

Activation of Flow Control

Fl.C.3 Y or N appears on the display.
(Fl.C.3 for DF-75L-12 and DF-75L-Li)

1. Press the UNITS or RESET buttons to change from Y to N. A **Y** enables flow control. An **N** disables flow control, and the motor runs at maximum.
2. Press the SET button again to set the flow rate. Use the UNITS button to increase the flow rate. Use the RESET button to decrease the flow rate.
3. Press the SET button to move to the next feature.

Selection of Serial Data Frequency Feature

SIO.: 1S, 1m, 6m or 1hr appears on the display. Press the UNITS or RESET button to change the frequency at which data is to be sent to a data storage device. Press the SET button to advance to the next feature.

Selection of Actual or Standard Flow Feature

Act. F. : Y or N appears in the display. Press the UNITS or RESET button to change this value. Selecting a **Y** provides Actual Flow readings on the display. Selecting an **N** provides Standard Flow readings on the display. Press the SET button to advance to SAVE.

Save the Settings

SAVE: Y appears on the display if you have made changes to the setup. If no changes were made, the program returns to the regular display mode.

1. Press the UNITS or RESET buttons to change from Y to N.
2. Press the SET button to save the changes. **DONE** appears in the display briefly, then the program returns to the regular display mode.

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OPERATING FEATURES and INSTRUCTIONS (Cont.)

Operating Instructions

Starting and Stopping an Air Sample Event

Starting a New Air Sample Event

1. If the air sampler is not already on, press the ON-OFF button.
2. Press the UNITS button to view the elapsed time value and total volume value to ensure that these values are zero.
   Note: If these values are not zero, press the RESET button when the green LED is in the Time position to zero the elapsed time. Press the RESET button when the green LED is in the Total Volume position to zero the total volume value.
3. Press the UNITS button to return the green LED to the flow position.
4. If the motor is not running, press the RESET button to start the sample event.

Temporary Suspension of an Air Sample Event

1. Ensure that the UNITS LED is in the Flow position, then PRESS the RESET button to shut off the pump motor. The accumulated elapsed time and accumulated volume up to the time of suspension is saved and viewable by the operator.
   Note: Elapsed time is not counted when the pump motor is off. The Total Volume value is frozen because Flow is zero when the pump motor is off.
2. Press the RESET button with the UNITS in the flow mode to resume the sample event.

Terminating an Air Sample Event

1. Press the RESET button with the UNITS in the flow mode if the pump is operating. This turns off the pump motor and preserves the elapsed time and total volume values.
2. Obtain and record the elapsed time and total volume values.
3. Press the ON-OFF button to turn off the air sampler.
4. Remove the filter(s) from the filter holder for laboratory analysis.

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FILTER HOLDERS

The 75 LPM DF Battery Series Air Samplers accepts a standard F&J plastic combination filter holder. Filter holders are available for F&J Model B, Model C and Model M radioiodine adsorption cartridges in combination with either 47mm or 2.0-inch diameter particulate filter paper. The F&J combination filter holders have dual O-Rings and/or gaskets to ensure that the entire airflow path is through the filter cartridge and not around it.

Twisting any two of the three separate segments of the filter holder in opposite directions can disassemble the filter holder. The entire filter holder may be removed from the air sampler by disengagement of the quick disconnect coupling. Conversely, the filter holder can be installed by connecting the quick disconnect coupling between the filter holder and pump chassis. Extra filter holders may be purchased separately.

F&J plastic filter holders available for the Low Volume Series Air Sampler are listed below:

MODEL #	DESCRIPTION
FJ-05P	Open-face plastic combination; 2.0” particulate – F&J Model B charcoal cartridge; 3/8” FPT
FJ-21P	Open-face plastic combination; 2.0” particulate – F&J Model C charcoal cartridge; 3/8” FPT
FJ-35P	Open-face plastic combination; 47 mm particulate – F&J Model B charcoal cartridge; 3/8” FPT
FJ-46P	Open-face plastic combination; 47 mm particulate – F&J Model C charcoal cartridge; 3/8” FPT
FJ-51P	Open-face plastic combination; 2.0” particulate – F&J Model M metal can, charcoal cartridge; 3/8” FPT
FJ-53P	Open-face plastic combination; 47 mm particulate –F&J Model M metal can, charcoal cartridge; 3/8” FPT

F&J manufactures filter holders of aluminum and stainless steel to meet specific customer requirements. Refer to the F&J catalog Filter Holder section for a complete description of the models currently available from F&J.

FILTER PAPER

F&J can supply customers with various different glass fiber grades of filter paper or cellulose grades of filter paper. Consult F&J about the optimum filter paper to utilize for your application.

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SENSORS

FLOW SENSOR:

The Digital Flowmeter Battery Series Air Samplers com equipped with a precision-machined differential pressure sensor. The relationship of the differential pressure across the sensor as a function of flowrate is stored in the microprocessor and utilized as the starting value to determine the flowrate and totalized volume corrected to a reference temperature and pressure. The purchaser selects the conditions at the time of purchase. Four choices are available.

TEMPERATURE SENSOR:

A thermistor temperature sensor is placed in-line in the air stream at the entrance to the venturi to accurately measure the temperature of the air that is flowing through the flow sensor. The accuracy of the temperature sensor is +/- 0.9ºF (0.5ºC).

DIFFERENTIAL PRESSURE SENSOR:

A precision electronic differential pressure sensor measures the differential pressure across the flow sensor. The total system accuracy of the digital flowmeter air sampler flow sensor and the differential sensor electronics is accurate to ± 4%.

The electronic differential pressure sensor offset value is automatically calibrated once per minute to eliminate sensor drift problems. Once per minute the electronic value correlating to a differential pressure of 0.00 inches of water is measured and stored in the on board computer. This ensures that all flow rate determinations for flow rate are unaffected by sensor electronic drift. This is especially important for low differential pressure measurements.

PRESSURE SENSOR:

A precision pressure sensor accurately measures the absolute pressure at the inlet of the flow sensor to ± 1% over the measured range.

The sensors are calibrated across the range of approximately 22 inches to 29.92 inches of mercury. This corresponds to an approximate range of 7000 feet elevation down to sea level. The reference value for pressure correction has been chosen to be 1 atmosphere of pressure (29.92” Hg). A custom reference for unique customer requirements is available as an option for a fee.

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CORRECTIONS TO A REFERENCE TEMPERATURE AND PRESSURE

FLOW RATES:

The differential pressure measurements of the differential flow sensor as a function of flow rate are determined during the calibration process and stored in the system microprocessor.

The calculated flow rate value at the pressure and temperature conditions of the field flow measurements (often referred to as actual flow) is determined and subsequently corrected to a reference temperature and pressure condition that has been set at the factory.

One atmosphere pressure is the default reference pressure.

The equation utilized to correct the flow at field conditions to a reference T and P is as follows:

$$\textbf{Flow (REF)} = \text{Flow (Actual)} \bullet \left[\frac{\text{T REF}}{\text{T ACT}}\right] \bullet \left[\frac{\text{P ACTUAL}}{29.92\text{: Hg (760mm Hg)}}\right]$$

Reference temperature options that are factory settable are 0ºC, 20ºC, 70ºF and 25ºC.

Definitions of different reference T and P conditions

Classical STP	0Cº, 1 Atm
Normal T and P	20ºC, 1 Atm
Modified Normal T and P	21.1ºC (70ºF), 1 Atm
Standard Ambient T and P	25ºC, 1 Atm

TOTALIZED SAMPLE VOLUME:

Totalized sample volume values are corrected to standard temperature and pressure also. Totalized volume is calculated by adding up the incremental volume calculations stored in the memory for the collection period frequency. The incremental corrected volume is calculated from the formula.

$$\textbf{V} \text{ incremental} = \text{Flow Rate (Corrected)} \times \text{Time Interval}$$

$$\text{Totalized Volume} \sum_{i=1}^{n} V \text{ (Incremental) } i$$

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Low Voltage Limiting System Description

The F&J battery powered air sampler has a battery low voltage limiting system installed, which will prevent complete discharge of the battery.

The low voltage limiting circuitry promotes longer battery life and increases the number of charging cycles.

This low voltage limiting circuitry is factory-preset. Once the battery voltage reaches the factory-preset level, the instrument will shut down and go into a safe mode. An operator will still be able to retrieve the elapsed time and accumulated volume data to the time of shut down.

The operating time on a single charge cycle will primarily depend on the motor amperage draw.

Higher flow rates and filter media with greater airflow resistance will effectively increase amperage draw and thus shorten the operating run time of the air sampler.

Factory Preset Low Voltage Values

1) Lithium ion Battery: 12V
2) Lead Acid Battery: 10.5V

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CALIBRATION VERIFICATION INSTRUCTIONS

General

The calibration of 75 LPM DF Battery Series air samplers should be verified periodically. Good air monitoring practice guidelines recommend a minimum of at least once per year calibration frequency.

A calibration verification should be made immediately after each repair involving the Digital Flowmeter, or the motor. Additionally, a calibration verification should be performed at any time there is a suspicion of erroneous readings or if a different filter media is utilized than that upon which the air sampler was originally calibrated.

A flow calibration instrument having an accuracy of ± 1% of full scale or better is recommended for the calibration verification.

The calibration verification procedure involves the comparison of the flow value displayed on the Digital Flowmeter Air Samplers to the flow value displayed on the reference calibrator. The filter media to be utilized during sampling should also be utilized during the calibration process.

F&J recommends the utilization of either its CD-812-1 (110VAC) or CD-812E-1 (230VAC) 1% accuracy Digital Airflow Calibrator as the reference flow device for the DF-75L-12 and DF-75L-Li. The Compact Digital Calibrator has a moveable flow sensor to facilitate calibration in the field.

Connecting the calibrator to the Air Sampler:

To perform the calibration verification, adaptors are needed to interface the reference calibrator to the air sampler inlet. For the DF Battery Series Air Samplers, the adaptor is mounted to the particulate section of the filter holder and onto the flow output of the calibrator, as illustrated in Figure 5 below.

Figure 5 Calibration

Note: Be sure to insert the proper filter media into the air sampler filter holder prior to attaching the adaptor to the air sampler.

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CALIBRATION INSTRUCTIONS

The adaptor secures to the air sampler with a quick connect fitting and to the calibrator with the attached tubing. During the verification, the adaptor replaces the filter holder.

NOTE: Be sure to insert the proper filter media into the air sampler adaptor prior to attaching the adaptor to the air sampler.

Performing the Calibration:

- Ensure the air sampler and the calibrator are on a level surface
- Ensure the Calibrator has warmed up at least 10 minutes
- Confirm the filter paper in the air sampler is the same filter paper to be utilized for the sampling activity.

1. The Digital Flow Meter Series Air Sampler indicates flow rate at a reference T and P. The F&J Digital Calibrator also displays flow rate at a reference temperature and pressure. Therefore, a direct comparison can be made between them if the reference T and P are the same for the calibrator and the air sampler.

2. Set the calibrator to display the same engineering units that the air sampler is reading (CFM or LPM). Confirm that the filter paper is installed and that there isn't air leakage in the system.

3. Start the air sampler and adjust to sample at or near maximum flow. Allow the flow to stabilize prior to documenting the comparison of flows. This stabilization period may take three to four minutes. Allow both the calibrator and the air sampler to operate approximately 10 minutes prior to commencing step No. 4 below.

4. Compare the flow rate on the calibrator with the reading on the air sampler and record this information on the calibration data sheet (the following page). It may be necessary to average the readings over a 15-20 second period if there are fluctuations in the flow rate value.

5. Repeat the same process for three other air sampler flow rates whose range is in the area of interest for sampling. This step is not necessary if you always sample at a specific flow rate.

6. Compute the deviations and the % deviations for each of the readings and record on the calibration data sheet.

7. Sign and date the data sheet.

8. Investigate any unacceptable deviations between the calibrator and the air sampler.
   Note that air leakage is the most probable cause for large deviations between the air sampler and the calibrator.

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Digital Flow Meter Series
Calibration Verification Procedure Data Sheet

	(1) DF Air Sampler (REF) flow CCM, CFM , LPM or CMH	(2) Reference Calibrator (REF) flow CCM, CFM, LPM or CMH	(3) Deviation	(4) % of Deviation F.S.
Flow Rate 1	_____	_____	_____	_____
Flow Rate 2	_____	_____	_____	_____
Flow Rate 3	_____	_____	_____	_____
Flow Rate 4	_____	_____	_____	_____

Record reference values (2) and Air Sampler values (1) in same units

Deviation (3) = Reference Calibrator Value (2) – Air Sampler value (1)

$$\% \text{ of Deviation Full Scale} = \frac{(3) \times 100}{\textbf{Full Scale Accuracy Value}}$$

Digital Flow Meter Low Volume Series Acceptable Deviation = 4.0% of Full Scale
Full Scale Accuracy Value for various models covered by this operator manual are as follows:

DF-75L-Li = ± 3 SLPM
DF-75L-AC = ± 3 SLPM

NOTE: The reference T and P of the reference calibrator and the device under test should be the same, otherwise one instrument's display value for flow must be corrected to the same reference T and P conditions of the other instrument.

MAINTENANCE INSTRUCTIONS

WARNING

PRIOR TO PERFORMING ANY MAINTENANCE, DISCONNECT THE AIR SAMPLER CORD FROM THE POWER SOURCE.

CAUTION DISASSEMBLY or ATTEMPTED REPAIRS:
If accomplished incorrectly, repairs can create an electrical shock hazard. It is recommended that repairs be made by a qualified electrician or technician or be returned to F&J SPECIALTY PRODUCTS, INC.

REMOVE THE FRONT PLATE

1. Unplug the air sampler from the power source.

2. Remove the filter holder and quick disconnect from the air sampler.

3. Remove the (4) four sheet metal screws from the front plate of the air sampler.

4. Carefully, move the front plate (with DFM and Battery Gauge Indicator) away from the front of the instrument.

5. Disconnect all the electric and sensor connections to the DFM and Battery Gauge Indicator. Refer to the spare parts list and electrical diagram on the following pages. These connections are for the following:
    - Pump/Motor
    - 12VDC
    - RS232 to optional Datalogger
    - Temperature Sensor
    - Differential Pressure Sensors
    - Battery Gauge Indicator

6. Set the front plate with DFM aside.

7. Remove the (2) two screws from the left side of the instrument. These screws hold the orifice tube in place. Pull the orifice tube straight out through the front of the air sampler.

8. If you are sending the DFM back to F&J, you must send the orifice tube with temperature sensor and the DFM. These items are serviced and calibrated as a complete set.

9. With the front plate out of the way, you can now get to the following parts:motor, battery, and power supply.
    - Pump
    - Battery Charger Circuit
    - Power supply
    - Battery

10. After you make necessary repairs, replace the orifice and front plate by performing the above steps in reverse order.

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DF-75L-Li Series Parts List

Part Number	Description	Part Number	Description
QD38FMR	Quick Disconnect	**DF-VTH**	Orifice Tube Holder
STIK5023	Rubber Feet	**H2085**	Handle
75LPMPUMP	75 LPM Pump	**4C-175(156)15-CP144-1**	2.60”D Diaphragm

ELECTRICAL PARTS

Part Number 110-120VAC; 50/60Hz	Description	Part Number 220-240VAC; 50/60Hz
LIP-18650	Lithium ion Battery 15.6 Ah	**LIP-18650**
F3AMP	Fuse; 3 Amp	**F3AMP**
310005	12 VDC Motor, 60 Watts	**310005**
310006	18 VDC Motor; 60 Watts	**310006**
AN37105	AC Power Cord	**AN37106**
CEINF	AC Socket/Line Filter	**CEINF**
LVDFMVHCV.2	Digital Flowmeter, 60 Watt	**LVDFMVHCV.2**
BATCHGG4	Battery Charger Circuit	**BATCHGG4**
BATIND3	Battery Gauge Indicator	**BATIND3**
GTPS107	Power Supply, 20V/4.5A	**GTPS107**

OPTIONS

Part Number	Description	Part Number
232FCDSD	Data Storage Device	**232FCDSD**
372239	2+ GB Secure Digital Card	**372239**
SDDR-199-A20	PC Flash Card Reader	**SDDR-199-A20**
CD-812V.2-1	Compact Digital Calibrator; 1% accuracy, 15-115 LPM	**CD-812EV.2-1**

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DF-75L-AC Series Parts List

Part Number	Description	Part Number	Description
QD38FMR	Quick Disconnect	**DF-VTH**	Orifice Tube Holder
STIK5023	Rubber Feet	**H2085**	Handle
75LPMPUMP	75 LPM Pump	**4C-175(156)15-CP144-1**	2.60”D Diaphragm
HB3812	Exhaust Port Hose Barb	**HB3838**	Intake Port Hose Barb

ELECTRICAL PARTS

Part Number 110-120VAC; 50/60Hz	Description	Part Number 220-240VAC; 50/60Hz
F3AMP	Fuse; 3 Amp	**F3AMP**
310005	12 VDC Motor, 60 Watts	**310005**
310006	18 VDC Motor; 60 Watts	**310006**
AN37105	AC Power Cord	**AN37106**
CEINF	AC Socket/Line Filter	**CEINF**
LVDFMFVHCV.2	Digital Flowmeter, 15-115 LPM	**LVDFMFVHCV.2**
GTPS108	Power Supply, 12V/6.6A	**GTPS107**

OPTIONS

Part Number	Description	Part Number
232FCDSD	Data Storage Device	**232FCDSD**
372239	2+ GB Secure Digital Card	**372239**
SDDR-199-A20	PC Flash Card Reader	**SDDDR-199-A20**
CD-812V.2-1	Compact Digital Calibrator; 1% accuracy, 15-115 LPM	**CD-812EV.2-1**

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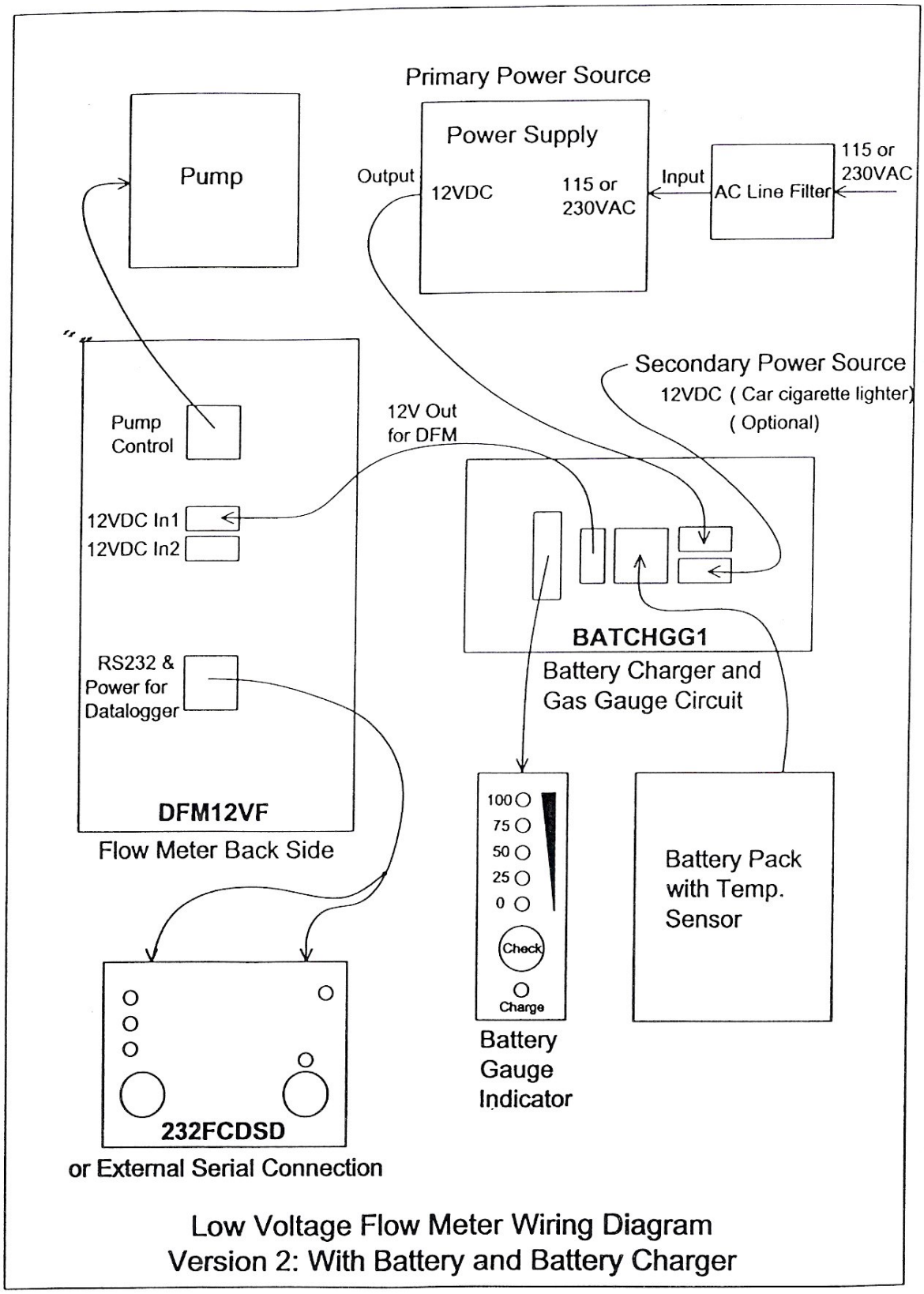
ELECTRICAL WIRING DIAGRAM for DF-75L-Li



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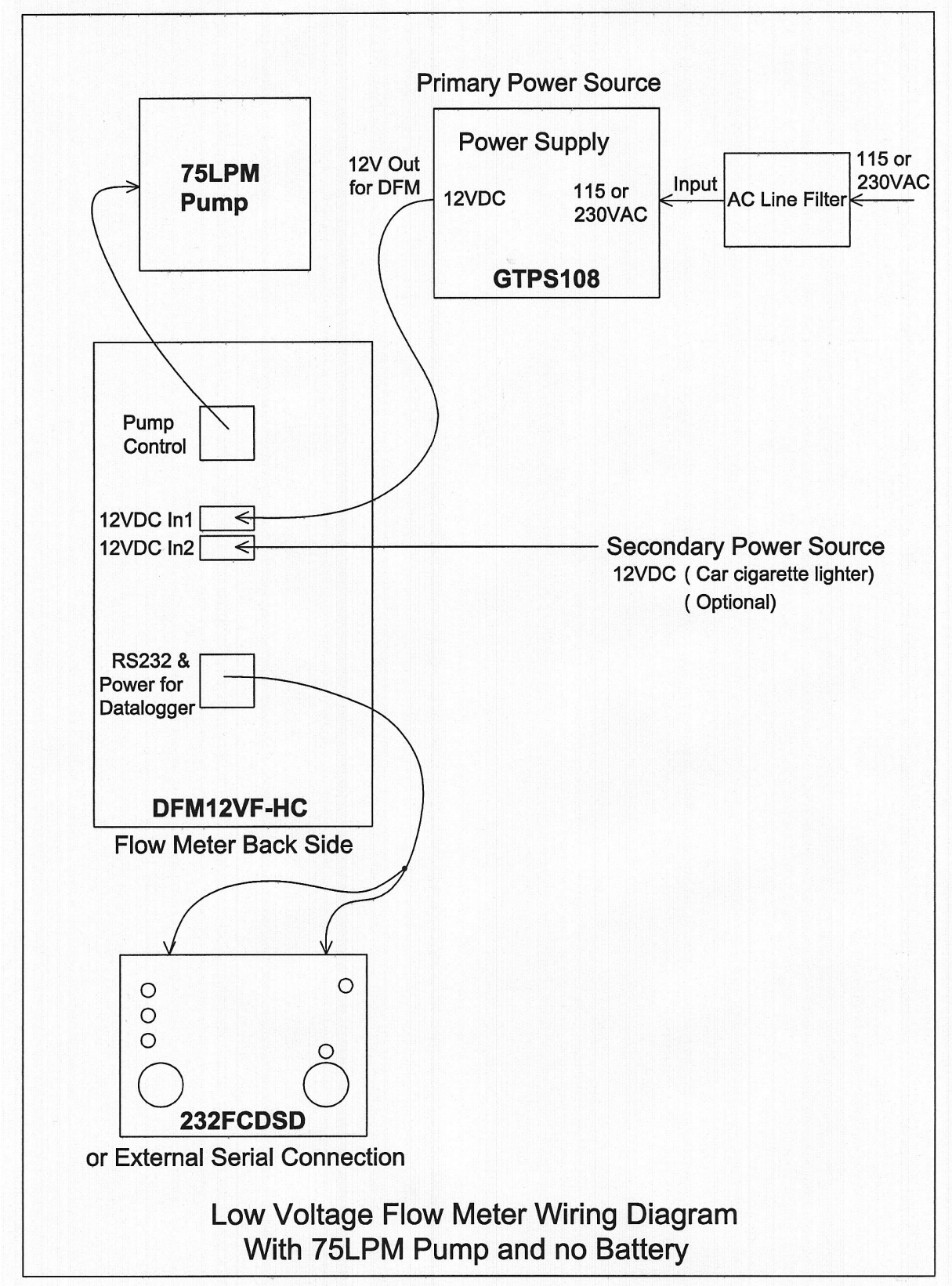
ELECTRICAL WIRING DIAGRAM for DF-75L-AC



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WARRANTY

Limited Warranty: The Seller represents and warrants to the Purchaser that any equipment manufactured by Seller and bearing Seller's name plate to be free from defects in material or workmanship, under proper and normal use and service, as follows: if, at any time within 1 year from the date of sale, the Seller receives written notification from Purchaser, that in Purchaser's opinion, the equipment is defective and returns the equipment to the Seller's originating factory prepaid and the Seller's inspection finds the equipment to be defective in material or workmanship, the Seller will promptly correct it by either, at Seller's option, repairing any defective part or material or replacing it free of charge and return shipped lowest cost transportation prepaid. (If Purchaser requests premium transportation, Purchaser will be billed for transportation costs.) If inspection by the Seller does not disclose any defect in material or workmanship, the Seller's regular charges for repair or replacement will apply. Any replacement or repair will be warranted for the remainder of the original warranty or thirty (30) days, whichever is longer.

Sole Remedy: Seller's entire liability and Purchaser's exclusive remedy shall be limited to the repair or the replacement of materials or parts as herein described.

Limitations: Notwithstanding the warranty provisions set forth herein, this warranty shall be effective only if installation, use and maintenance is in accordance with Seller's instructions and written notice of a defect is received by the Seller within the period herein provided. Seller shall have no warranty obligations with respect to any failures of the equipment which are the result of accident, abuse, misapplication, extreme power surge or extreme electromagnetic field.

Disclaimer of Warranties: This warranty is the sole and exclusive warranty offered by Seller and is in lieu of any other warranties written, oral or implied; specifically without limitation, there is no warranty of merchantability or fitness for any purpose, even if Purchaser has been informed of such purpose.

LIMITATION OF LIABILITY

The Seller shall not be liable for any claim for consequential or incidental loss or damage arising or alleged to have risen from any delay in delivery, malfunction, failure of the equipment or Seller's inability to provide maintenance services for hardware or software related to the products. Accordingly, Purchaser agrees that Seller shall not be responsible to Purchaser for any loss-of-profit, indirect, incidental special or consequential damages arising out of the use of products or services. The Seller's liability for any other loss or damage arising out of or connected with the manufacture, sale or use of the equipment sold or service provided in a maintenance service contract, including liability that arises from any claim based on breach or repudiation of contract, warranty, tort, or otherwise, shall not in any event exceed the price of the equipment or services supplied by Seller. Seller reserves the right make changes, at any time without notice, in prices, colors, materials, specifications and models; and to discontinue models.

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SERVICE INFORMATION

For all work not covered under warranty, F&J SPECIALTY PRODUCTS, INC. will repair any instrument for the cost of parts and labor as quoted. If major components must be replaced, F&J SPECIALTY PRODUCTS, INC. will notify the customer before proceeding with repairs. When returning any instrument for service, please include a Purchase Order marked: "Repair – Cost not to exceed $250.00 without customer authorization". Please provide the following information with your instrument:

Company Name:
Address:
Telephone:
Fax:
Contact Name:
Serial Number(s):
Date of Purchase:
Service Required or Description of Problem:

You must first obtain an RMA number prior to returning any product. Obtain your RMA number by calling F&J SPECIALTY PRODUCTS, INC. (352) 680-1177 or (352) 680-1178. To expedite service and repairs, have your Business Name and/or Customer Number handy.

Please ensure that all products returned to F&J contain no hazardous materials. Any obviously contaminated product received will be returned to the customer. All products scheduled for service must be received within 30 days of the RMA number issuance date. Unauthorized products will be returned to the customer.

TECHNICAL SUPPORT SERVICES

Technical Assistance: **(352) 6580-1177 / (352) 680-1178**
Fax: **(352) 680-1454**
Email: **fandj@fjspecialty.com**
Web Site: **www.fjspecialty.com**
Hours: **Monday – Friday**
8:00 AM to 4:30 PM (EST)

If you need additional information or help during installation or normal use of this product, contact F&J SPECIALTY PRODUCTS, INC. Technical Support. Our customer support staff will attempt to answer your installation questions by phone or issue a service authorization number for repair or replacement of your product. Unauthorized returns will not be accepted. When calling for support, please have your product serial number and product model available.

Shipping Address: F&J SPECIALTY PRODUCTS, INC.
404 Cypress Road
Ocala, Florida 34472
USA

Fast & Friendly Customer Service

Ordering by phone
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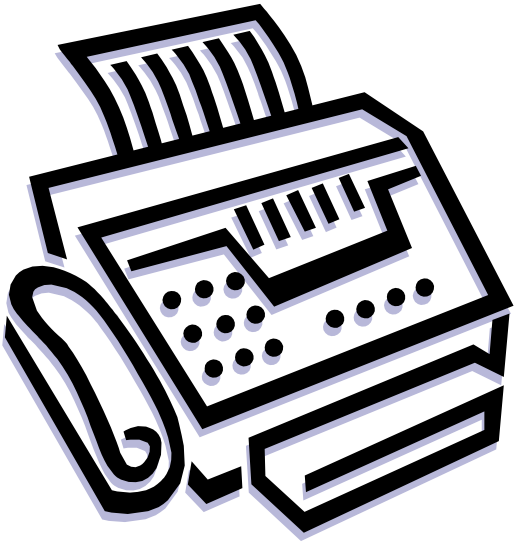

Ordering by Fax
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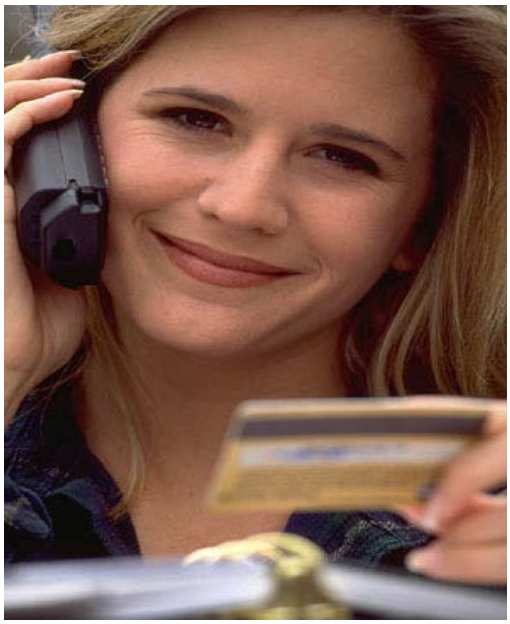

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