

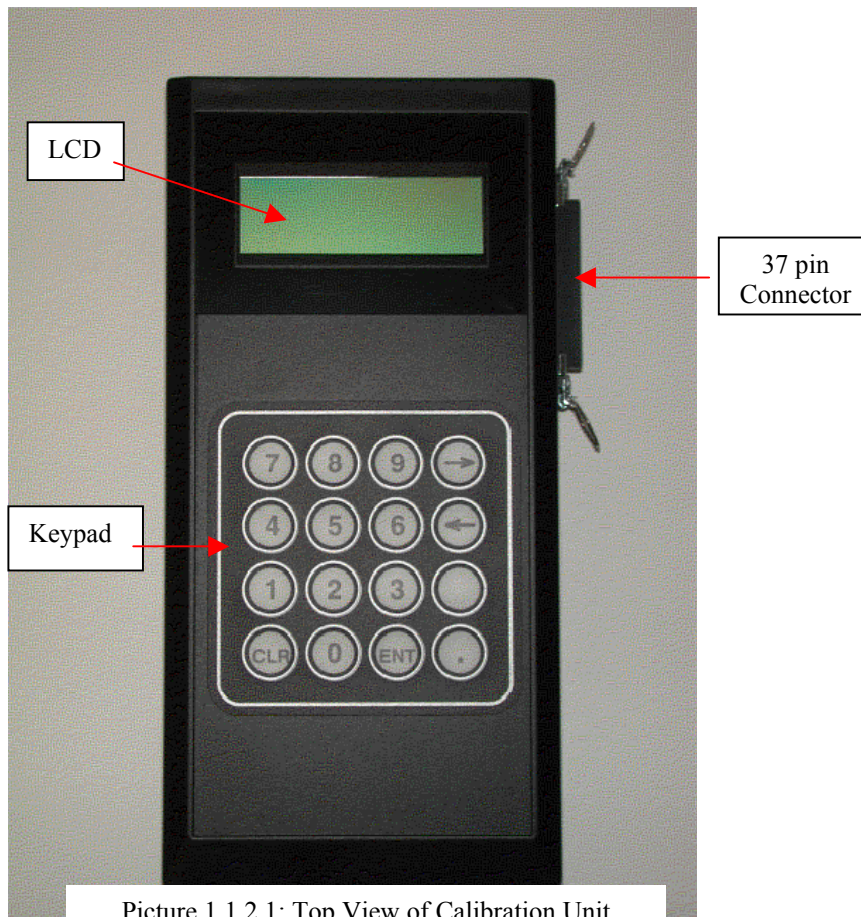
1. Introduction

1.1 Overview

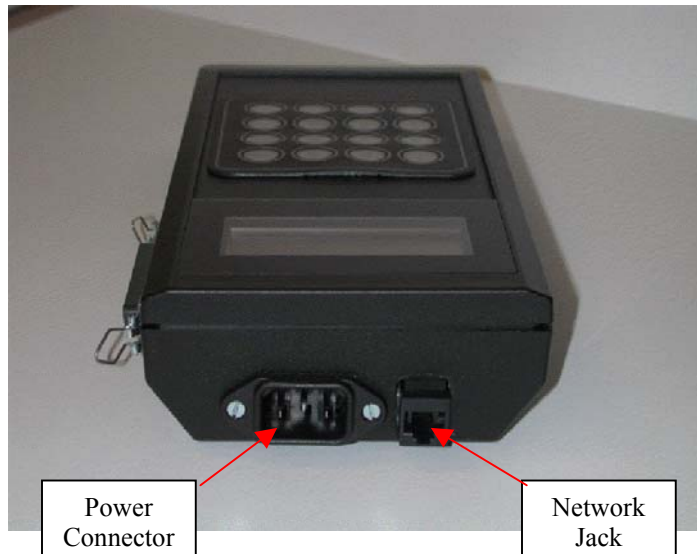
The purpose of this document is to provide documentation for the Rolling Float Meter (RFM) Calibration Unit. This document covers only the Calibration Unit menus and assumes that the reader is familiar with the installation and operation of the RFM.

1.2 Communication

The RFM calibration unit was designed to provide a user with a quick and simple way to calibrate the RFM. To accomplish this two different interfaces are available. The first is a menu driven LCD display built into the unit, and the other is a standard windows graphical user interface (gui) that communicates with the unit over a TCP/IP network. A picture of the unit is given below.



Picture 1.1.2.1: Top View of Calibration Unit



Picture 1.1.2.2: RJ45 Network jack and 3 prong power connector

2. Basic Operation

The RFM is a meter that is used to measure fluid flow in a partially full pipe. It is normally instrumented with two sensors, which are a pot to measure the arm position and a proximity sensor to measure the velocity of the wheel. The Voltage measured at the pot is used to calibrate the meter and the wheel velocity is used to determine the presence of low fluid flow typical 5-10 gpm and above. The Calibration Unit (CU) reads the pot Voltage and the pulses generated by the wheel sensor and produces three analog outputs which are: 1. Calculated Flow Rate, 2. Calculated Wheel Velocity, and 3. Raw Pot Voltage. The outputs can be in one of the four formats: 0-5 Volt, 0-20 mA, 4-20 mA or 0-24 mA. The analog outputs can easily be converted to values since they are linearly proportional to the MaxFlow and MaxVel parameters.

A typical calibration would be performed by first entering a calibration point for zero flow (i.e. when no fluid is flowing through the pipe) and then gradually increasing flow through the pipe and taking four or five additional calibration points. Normally a separate flow meter is used or the flow is calculated based on measured pump strokes to determine a flow reading. When the points are entered the CU is calibrated and ready for operation.

3. Built-in Menus

3.1 Main Menu

1 – Param Setup
2 – Calibrate
3 – Run
4 – Network Mode

A picture of the Main Menu is shown above. Select any one of the four modes by entering the corresponding number on the keypad.

3.2 Param Setup

Chooses “1” from the Main Menu to edit the parameters. This will affect the performance of the unit. The table below contains a list of the parameters in the order they are presented along with a description.

Parameter	Range	Description
Max Flow	500-90000	Sets the flow range of the output
MaxFps	5-50	Sets the velocity range of the output
MinVel	0-10	If the velocity of the wheel is greater than MinFps than the current output for flow will be MinFlow if the current calibrate flow is less than MinFlow which ever is higher.
MinFlow	0-50	See description above
Output	0-5 Volts 4-20 ma 0-20 ma 0-24 ma	Defines the output format.
Units	Feet per second Meters per second	Units used to display wheel velocity
IP Address		Sets the IP address for the unit. It is important that this be set correctly if the network interface is going to be used.

When entering this mode the parameters are displayed one at a time and changes can be made from the displayed selection using the arrow keys. The “ENT” key saves the selected value and the display shows the

next parameter. For entering the IP address move the cursor with the arrow keys and then press the number on the keypad. When done entering the IP address press “ENT”. All the parameters will be saved in memory and the display shows the Main Menu.

3.3 Calibrate Menu

The calibration menu is for editing and adding calibration points. The following menu is displayed.

```

1 – Add Points
2 – Man Add Points
3 – Edit Points
CLR – Main Menu
    
```

1 – Add Points Menu

```

GPM _____
Volts #.###      #ave

ENT ← CLR
    
```

The figure above shows the “Add Points” Menu. This menu displays the current pot Voltage, makes measurements and enters the average Voltage with a corresponding flow in the CU memory as a calibration point. A calibration point is entered on the keypad with the value of the actual flow. This can be from a calibrated flow meter or determined by calculation based on pump strokes. Press the “ENT” key. Holding the “ENT” key pressed down will allow the CU calibration program to measure multiple input values from the RFM and calculate a running average of the Voltage of the arm pot. “#ave” displays the time in seconds that is used in the average calculation. When the “ENT” key is released the GPM value and the average Voltage are entered as a calibration point. When done with entering the calibration points, use the “CLR” key to return to the previous menu. The “←” (left-arrow) key can be used to correct typing mistakes.

2 – Man Add Points

```

GPM _____
Volts _ . ____

ENT ← CLR
    
```

The figure above shows the “Man Add Points” menu. This mode requires manual input for both the GPM value and the corresponding (average) Voltage. Type a flow value and push “ENT” then type the Voltage and press “ENT” again. Both values will be cleared and the calibration point is saved. Another calibration point can then be entered. Use the “←” arrow key to backspace the cursor for correcting mistakes. Use the “CLR” key to return to the previous menu.

3 – Edit Pts

```
GPM ####  
Volts #.###  
  
Delete(ENT) <-> CLR
```

The “Edit Pts Menu” displays the calibrated points that are stored in memory. Undesired calibration points can be deleted. Pressing the “ENT” key will delete the displayed point. The “←” and “→” keys allows back and forward scrolling through the table of calibration points. The “CLR” key returns the program to the previous menu.

3.4 Run Menu

```
Run Mode (CLR)  
Volts #.###  
Flow #####  
Fps ##.##
```

The “Run Menu” is selection 3 on the Main Menu. When the unit is in “Run Mode” the CU reads the Voltage from the pot and the pulses from the wheel sensor. The outputs are linearized values for flow and velocity based on the parameter settings. Depending on the mode setting the outputs are Voltage or Current signals. Use the “CLR” key to return to the Main Menu.

3.5 Network Mode Menu

```
Network Mode (CLR)  
Volts #.###  
Flow #####  
Fps ##.##
```

The “Network Menu” is selected by pressing 4 on the Main Menu. This mode performs the same tasks as Run Mode (i.e. reading the raw outputs of the RFM and providing filtered and calibrated outputs). In this mode the unit is connected through the local area network and can be controlled from a remote computer. For more information see Network Interface.

4. Local Area Network

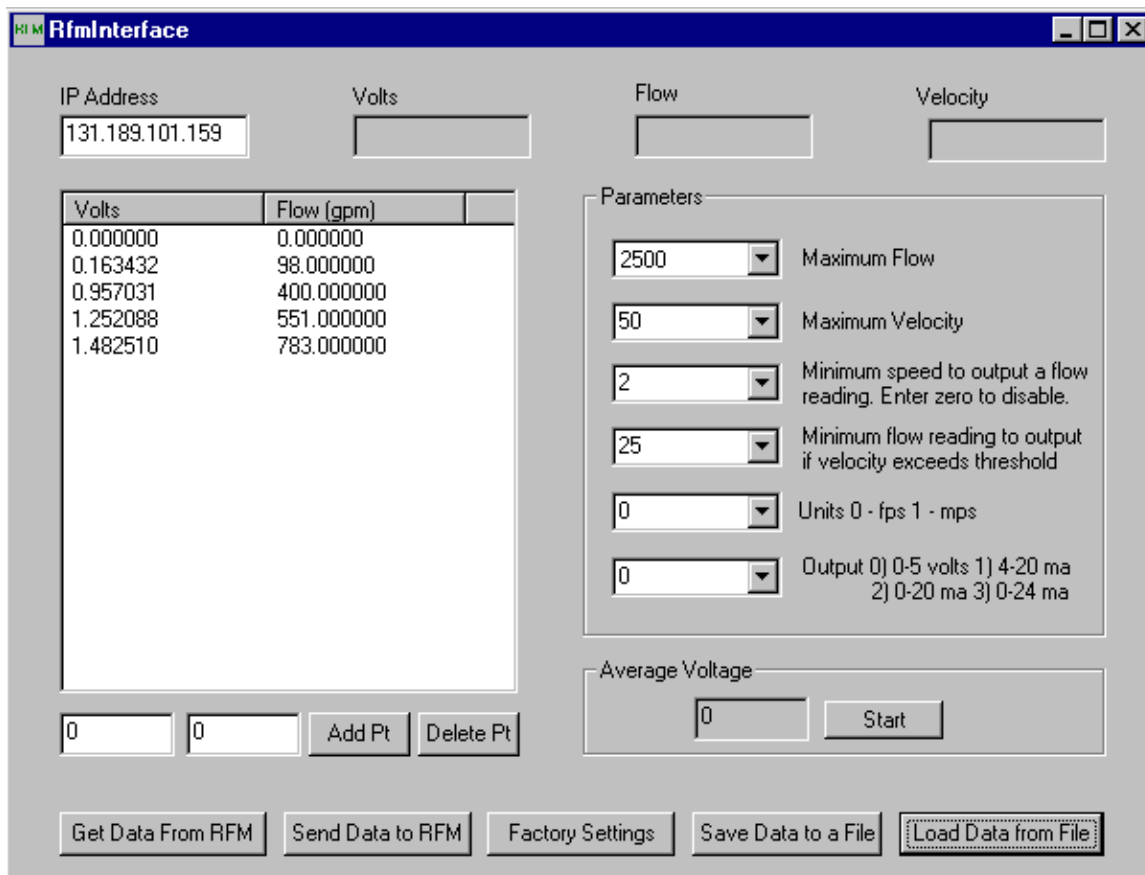
4.1 Network Interface

The network interface was developed to provide a graphical user interface (gui) on a remote computer with the same functionality as the built-in menu system. To run the gui interface program the remote computer should have installed Windows 95/98 installed with the local area network properly setup and running. The remote computer hosting the gui application and the CU, calibration unit, must be on the same subnet. The CU broadcasts datagrams containing the current flow, velocity and pot Voltage every two seconds using port 5000. A screen shot of the gui is shown hereafter. In order to launch the application on the remote computer, click on the RFM icon or run RfmInterface.exe from the command line.

4.2 Setting up the connection

The steps given below should be in order to connect the gui with the Calibration Unit:

1. Set the IP address of the unit. The IP address is set in the Parameter Setup menu.
2. Start the RfmInterface program on the remote PC that has access to the Calibration Unit via the network.
3. Enter the calibration unit's IP address in the RfmInterface program.



The following is a description of each button:

Add Pt – This button will add the Voltage and Flow values in the edit boxes next to it to the list box above it.

Delete Pt – This button is used to delete points from the list box.

Start/Stop – When this button is pressed and released then a running average calculation is started with continuous arm level measurements (Volt) and displayed in the edit box next to the button. The measurements and average calculations are completed when this button is pressed and released again.

Get Data From RFM – Retrieve the current calibration points and parameters settings from the calibration unit.

Send Data to RFM – Send the calibration points and parameters from the gui to the calibration unit where it is stored in memory.

Factory Settings – Brings up the factory settings dialog box.

Save Data To File – Saves the currents calibration and parameters to a file on the pc.

Load Data from File – Load previously saved calibration points and parameters from a file.

5. Electrical Connections

The RFM controller unit electrical interface comprises circuits for external dc power, sensor inputs, and analog dc outputs. Characteristics and requirements for each are as follows:

5.1 Power Connector

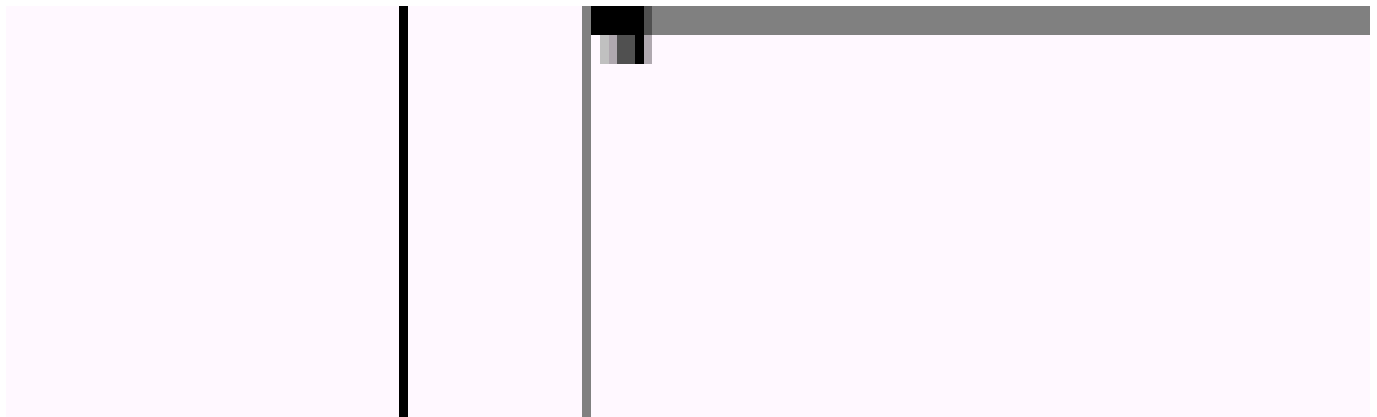
The RFM can be powered with a three-prong universal power cord. The CU supply is auto-ranging 90-264VAC/47-63Hz and draws approximately 0.6A.

5.2 TCP-IP Connection

A standard RJ-45 receptacle is used to receive a drop cable from a local area network.

5.3 Sub D-37 Pin Connector

A standard D-sub 37 socket connector is used for the electrical interface with the intrinsically safe barrier box or user custom interface panel. The socket layout and signal assignment is shown hereafter.



<i>DB 37 PIN</i>	<i>CU SIGNAL</i>	<i>RFM SIGNAL</i>	<i>DESCRIPTION</i>	<i>DB 9 PIN</i>
1	In Channel 0 (V)	Input Channel Arm	Voltage mode	
2	In Channel 1 (V)	Spare Channel	Voltage mode	
3	In Channel 2 (V)	Spare Channel	Voltage mode	
4	In Channel 3 (V)	Spare Channel	Voltage mode	
5	In Channel 0 (I)	Input Channel Arm	Current Mode	
6	In Channel 1 (I)	Spare Channel	Current Mode	
7	In Channel 2 (I)	Spare Channel	Current Mode	
8	In Channel 3 (I)	Spare Channel	Current Mode	
9	No Connection	Reserved	Not Used	
10	Out Channel 0 (V)	Calculated Flow	Voltage mode	DB9-1-1
11	Out Channel 1 (V)	Calculated Speed	Voltage mode	DB9-1-2
12	Out Channel 2 (V)	Arm Level	Voltage mode	DB9-1-3
13	Out Channel 3 (V)	Spare	Voltage mode	DB9-1-4
14	Out Channel 0 (I)	Calculated Flow	Current Mode	DB9-2-2
15	Out Channel 1 (I)	Calculated Speed	Current Mode	DB9-2-2
16	Out Channel 2 (I)	Arm Level	Current Mode	DB9-2-3
17	Out Channel 3 (I)	Spare	Current Mode	DB9-2-4
18	TXSR (Program cable)			
19	Status (Program cable)			
20	+24 VDC Out			
21	VDC Common			
22	In Channel 0 COM	Input Channel Arm	Any Mode	DB9-1/2-6
23	In Channel 1 COM	Spare Channel	Any Mode	DB9-1/2-7
24	In Channel 2 COM	Spare Channel	Any Mode	DB9-1/2-8
25	In Channel 3 COM	Spare Channel	Any Mode	DB9-1/2-9
26	Pulse In (+)	Wheel Sensor	NPN Transistor	
27	Pulse In (-)	Wheel Sensor	Common	
28	RXS0 (Prgrm Cbl)			
29	Prog COM (Prgrm Cbl)			
30	Prog +V (Prgrm Cbl)			
31	Out Channel 0 COM	Calculated Flow	Any Mode	
32	Out Channel 1 COM	Calculated Speed	Any Mode	
33	Out Channel 2 COM	Arm Level	Any Mode	
34	Out Channel 3 COM	Spare	Any Mode	
35	*Reset (Prgrm Cbl)			
36	SMODE 0 (Prgrm Cbl)			
37	SMODE 1 (Prgrm Cbl)			

5.4 Sub D-9 Pin Connector

PIN # D9 PLUG	AUXILIARY SIGNAL DESCRIPTION	COLOR	PIN D9 REC
1	NO CONNECTION	BRN	N/C
2	CH0	RED	2
3	CH1	OR	3
4	CH2	YEL	4
5	CH3	GRN	5
6	CH0 COM	BLU	6
7	CH1 COM	VIO	7
8	CH2 COM	WHT	8
9	CH3 COM	BLK	9
	SHIELD	BLANK	

PIGTAIL PIN AND WIRE DATA.

6. Trouble Shooting

If a network connection can not be established check the following before calling DCS:

1. Is the calibration unit is in Network Mode?
2. Check that IP address is set and being used and has no conflict with other network devices or units.
3. If the Voltage, velocity and flow values are being updated and a connection can not be established the IP address is probably wrong.
4. Try to ping the unit from the PC. If this fails there is either a problem with the IP address or the physical connection.
5. Check the cable that is used between CU and network hub/switch and/or computer. Direct connections without hub/switch will require a cross connect cable. Standard drop cable to the hub/switch is a straight connect cable.
6. If no flow, velocity or Voltage readings appear but the other network function work then the remote computer and the Calibration Unit are not on the same subnet.