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EMF16 and Model 201 Graphics Software
for Win 98/NT/ME/2K/XP/Vista/Win7/Win8 and Win10

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1 Getting Started

Minimum Hardware Requirements

Any computer capable of running Windows
One serial port, or one USB port with a USB-to-RS232 converter
Windows 98/ME/Win2000/XP/Win7/8/10 or newer

Before you begin

You need either a Lawson Labs Model 201 or an EMF16.

If you are using a USB to RS232 converter, you must use the correct system driver. Simply allowing Windows to pick the default driver is rarely successful. These protocol converters come with disks and installation instructions. Almost always, you will be instructed to install the driver *before* plugging in the protocol converter.

In all cases, you will need to download and install the free application software from the Lawson Labs website - www.lawsonlabs.com. Navigate to the EMF16 or Model 201 page and select the VB graphics code for download.

2 Hardware Installation

The EMF16 and Model 201 are both supplied with wall-mount power supplies. If the power supply is of the interchangeable plug variety, install the appropriate mains plug first. Be certain it snaps all the way into place, or a shock hazard will result when the removable plug stays behind in the outlet.

Plug in the power supply at both ends. The Model 201 is a very low power devices, so no power switch is necessary. For lowest power consumption when not in use, use a switched power outlet.

Note: Make certain that the power jack is plugged all the way into the instrument. Failure to do so can short-circuit the power supply, resulting in subsequent failure. The power supplies have an internal thermal fuse. If it blows, the power supply will not be not repairable.

The serial cable plugs into both the EMF16 or Model 201 and your computer. If a USB converter is used, remember that each physical USB connector is treated individually, so it

is best to always use the same one. The COM port assigned will change when you change physical USB connectors.

You will need to know the COM port number for your connection. Find it by locating the Device Manager and selecting Ports. If the COM port to be used is assigned a number higher than 9, reassign a lower number by right-clicking on the port and selecting Properties. Click the Port Settings tab and click the Advanced button. Select the desired COM number from the drop-down list. Click OK and exit back out of the Device Manager.

3   Software Installation

At www.lawsonlabs.com, navigate to the Model 201 or EMF16 page and select Software.
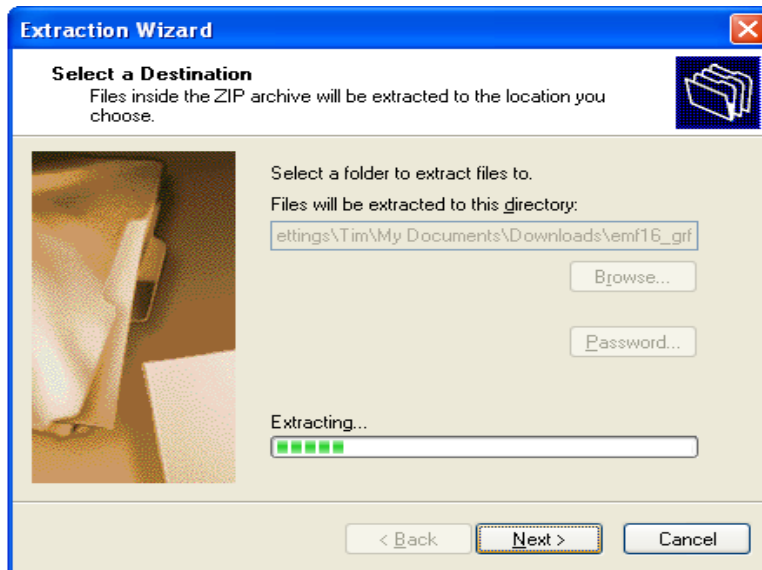
Click the graphing application link to download the archived files.

The following screen shots show the EMF16 sequence. The Model 201 sequence is equivalent.
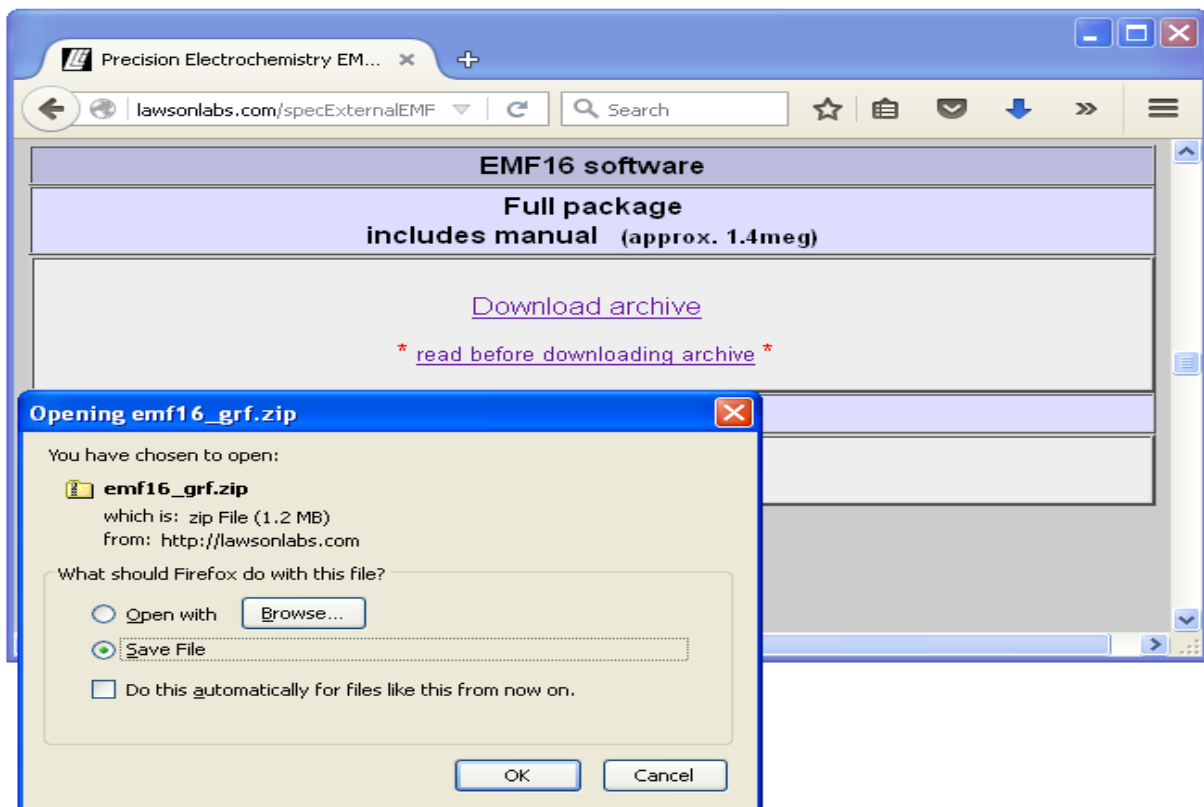
Save the file EMF16_grf.zip.

Locate EMF16_grf.zip where your browser places downloaded files, then rght click on the zip file and chose "Extract All".
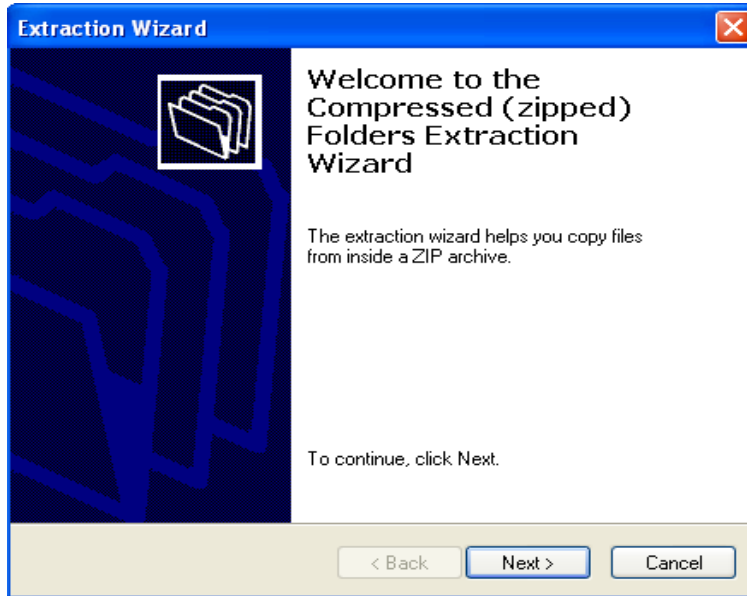
Click Next to continue.

The default location for extracted files will be in a sub-folder called EMF16_grf. You probably would prefer another name and location. Click the Browse button to navigate to

the desired location.

You can create a new folder first, if desired, or you can copy the extracted files to the desired final location afterward.

After extraction, click Finish.
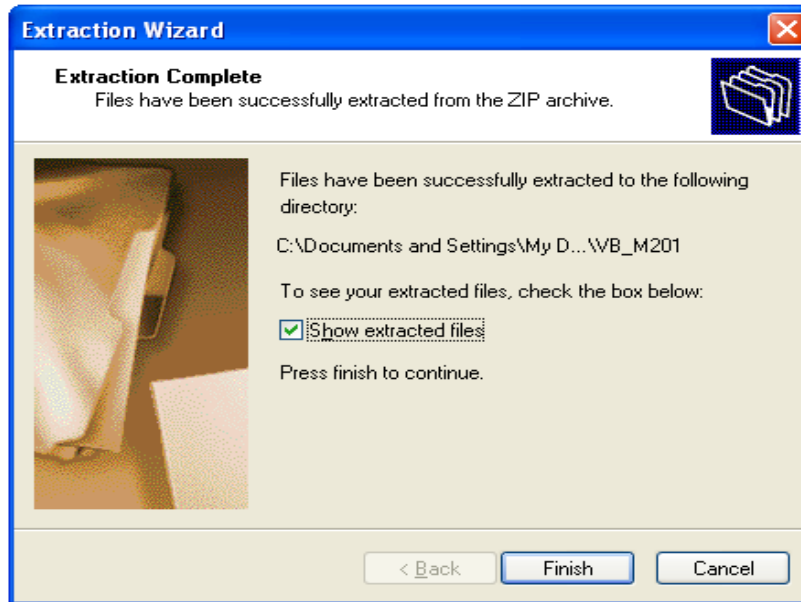
EMF16_grf.exe is your application. The other files should take care of themselves.
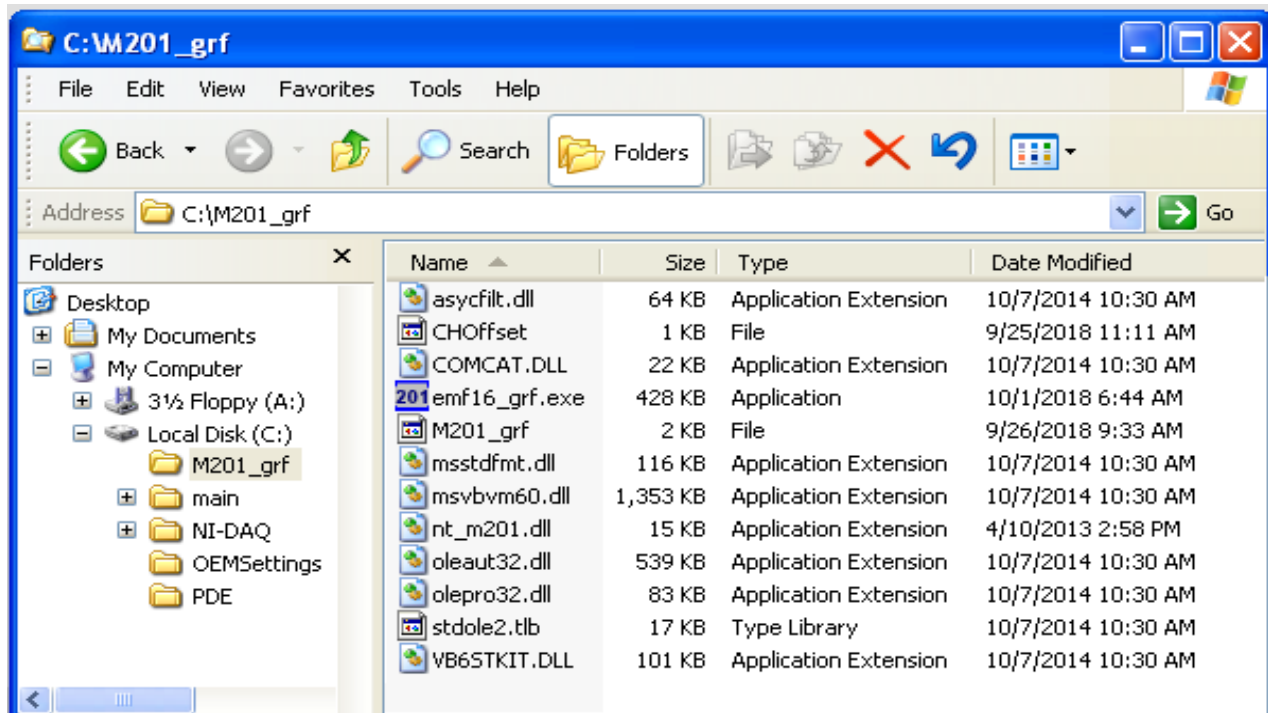
It is no longer necessary to "Run as Administrator" the first time. Run EMF16_grf.exe or M201_grf.exe. If you see a security warning, ignore it, (or select more info,) then click Run.

4 Operation

A. Location of controls

You should see the main panel on your screen. Controls and indications are numbered below, with a key for easier locating.
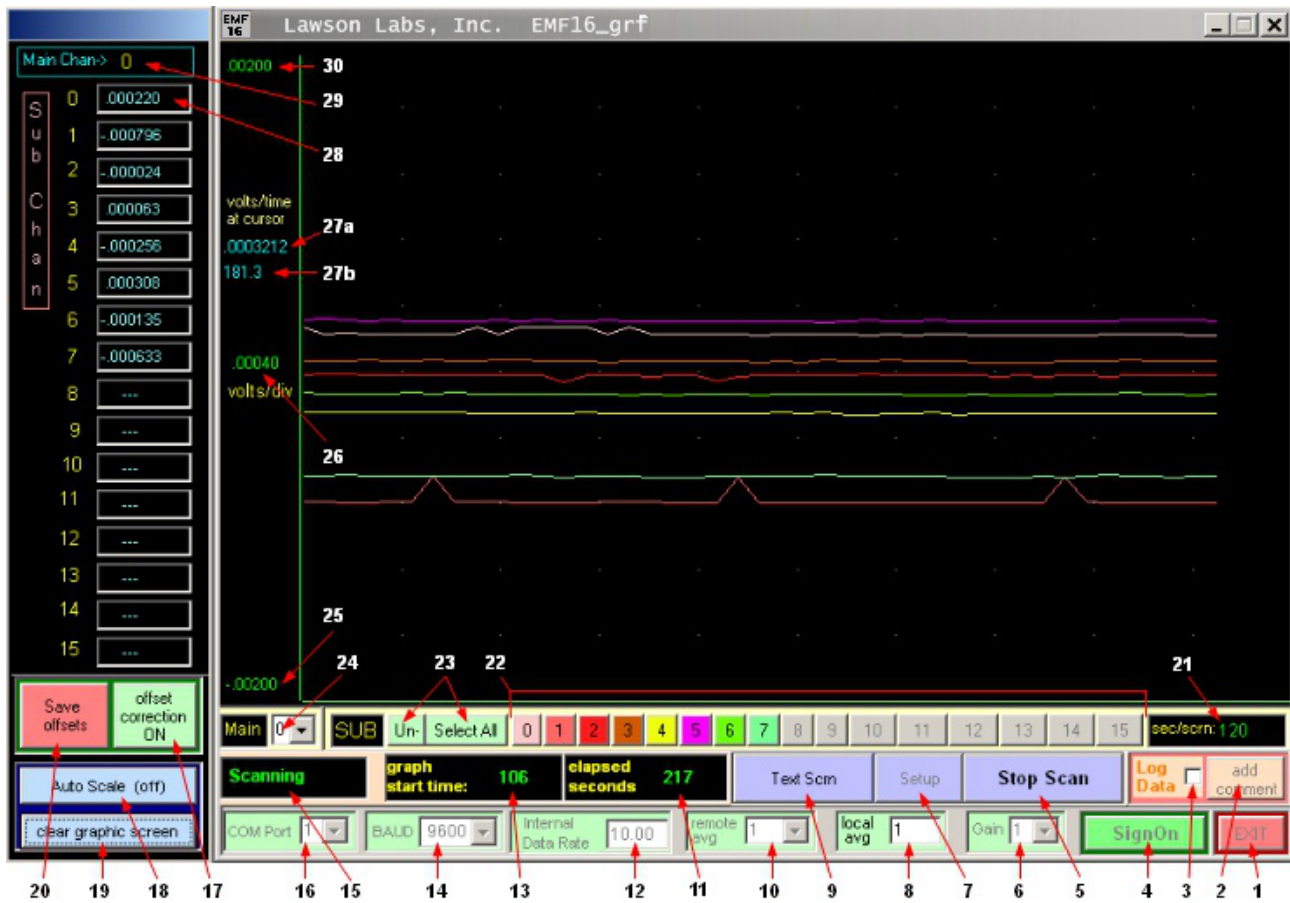
1. Click to exit. You will prompted to optionally save any changed settings.

2. Add a comment to a data file - active when Log Data is checked, only.

3. Writes data to a file in the application folder when checked. You can uncheck and recheck the box as you like. The data file shows data marked with the elapsed time, so gaps indicate Unchecked periods.

4. Click to establish communications (only needed once per session).

5. Toggles between Start and Stop Scan.

6. Hardware gain, in powers of 2. Gain is not reflected in voltage readings.

7. Click for Setup screen. Not available during scanning.

8. A running average, performed in the host computer. You can enter any number between

1 and 32. A running average does not affect your scanning rate. Higher numbers yield smoother data, but longer settling times. Averaged data are written to the data file.

9. Toggle between text and graphics display (does not affect data collection).

10. Remote Average is sent to the instrument during sign-on. Increased remote averaging at the minimum internal data rate produces the best effective resolution.

11. During a run, the total elapsed time, in seconds, since the start of the run.

12. The Internal Data Rate is crucial for noise reduction. Normally, it should be set to line frequency, or an integer division of line frequency.

13. During a run, the elapsed time in seconds at the left-hand edge of the graphics screen.

14. Select the BAUD rate. 4800 is recommended for both legacy serial ports and for USB-to-Serial converters.

15. Instrument Status

16. You must enter the Com Port number for your unit here.

17. Toggle Offset Correction On and Off. When Off, data is uncorrected. When ON, saved offsets are subtracted from each data point.

18. Toggles Auto Scaling for the vertical axis. Toggle off and on a second time for immediate effect.

19. Clears the graphics screen, and begins plotting at the left margin.

20. Use Save Offsets with caution. The present readings will be saved for subtraction from subsequent data. Normally done only once when all readings are confirmed to be very close to zero. Typical offset values are less than 1 mv.

21. Enter the desired duration for one graphics screen here and press the Enter key to apply.

22. Click a channel number to toggle whether this channel is plotted. Only channels selected in the setup will be available. Adding or removing a channel from the plot does not change the scanning sequence or the data logging files. It does change the Autoscaling.

23. Shortcut buttons to select all or none of the active channels.

24. Main Channel - The Model 201 has 6 main channels. Each can have up to 16 sub-

channels. One block of sub-channels can be selected at any time. The EMF16 uses the sub-channels on the first Main Channel. (Numbering can be zero based. When it is 1-based, labels match for the EMF16. (See the .ini file section for this control.)

25. Edit the negative full scale voltage here when Auto Scale is toggled off. Must be less than positive full scale . Press Enter key to apply. Graph scale settings are saved for future sessions when exiting. Saved graph settings can be restored by stopping and restarting the scan.

26. Volts per vertical division. This number is calculated, and can not be edited.

27. Voltage and time at the mouse pointer at any position on the graph panel. 27a is the voltage, 27b is the time.

28. Data in volts is displayed here during a run. Up to 16 sub-channels can be displayed at one time.

29. Main Channel, selected in #24, shows here.

30. Edit the positive full scale voltage when Autoscale is toggled off. Must be greater than negative full scale . Press Enter key to apply. Graph scale settings are saved for future sessions. Saved graph settings can be restored by stopping and restarting the scan.

B. Text Screen

The scan number and up to 64 data points are displayed. Only the text screen will display more than 16 sub-channels all at once.
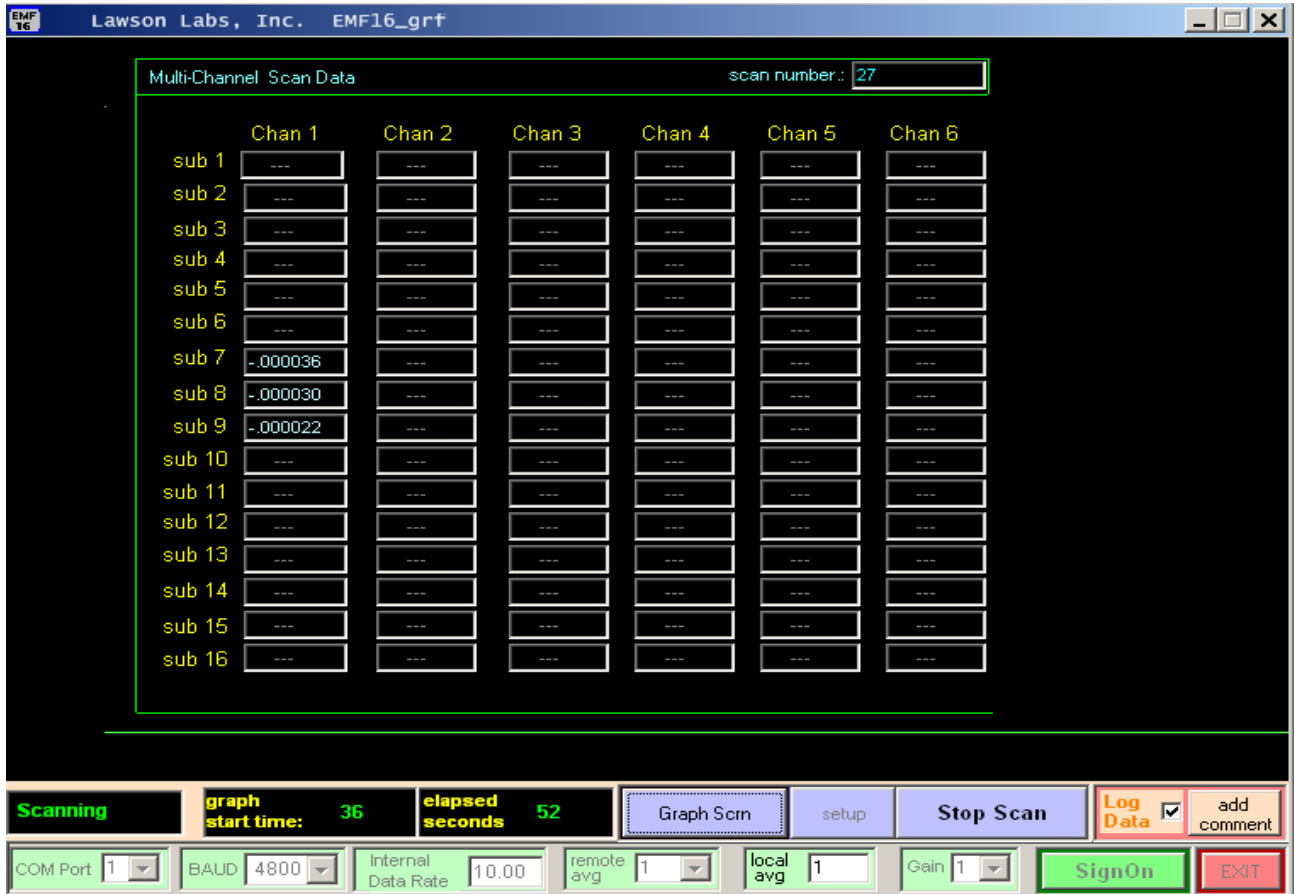
Click the "Graph Scrn" button to return to the graphics panel

C. Basic Operation

1. Start the software.

2. Enter the Com Port number in the lower left.

3. Select the BAUD rate. 4800 is recommended for both legacy serial ports and for USB-to-Serial converters.

4. For best noise performance, set the internal data rate to 10 Hz. If you want fastest scanning with good noise performance, select 50 or 60 Hz to match your line frequency. Preferred Intermediate choices are integer divisions of line frequency. For 60 Hz line, best choices would be 60 Hz, 30 Hz, 20 Hz, 15 Hz, 12 Hz, and 10 Hz (divide by 1, 2, 3, 4, 5 or 6). For 50 Hz line, best choices would be 50 Hz, 25 Hz, 16.67 Hz, 12.5 Hz, and 10 Hz.

When scanning multiple channels, if you are looking for higher scan rates that require setting the internal data rate above line frequency, set the internal data rate to 2, 4 or 8 times the line frequency. Then, set Remote Average to 2, 4, or 8, to match.

5. Change the running average, if desired.

6. Click the SignOn button to establish communication. The Status indication should show Ready.

7. Define your data collection as described in Scan Setup, below.

8. Click Start Scan to begin data collection, and Stop Scan to end.

D. Scan Setup

Click Scan Setup to bring up the scan setup screen.
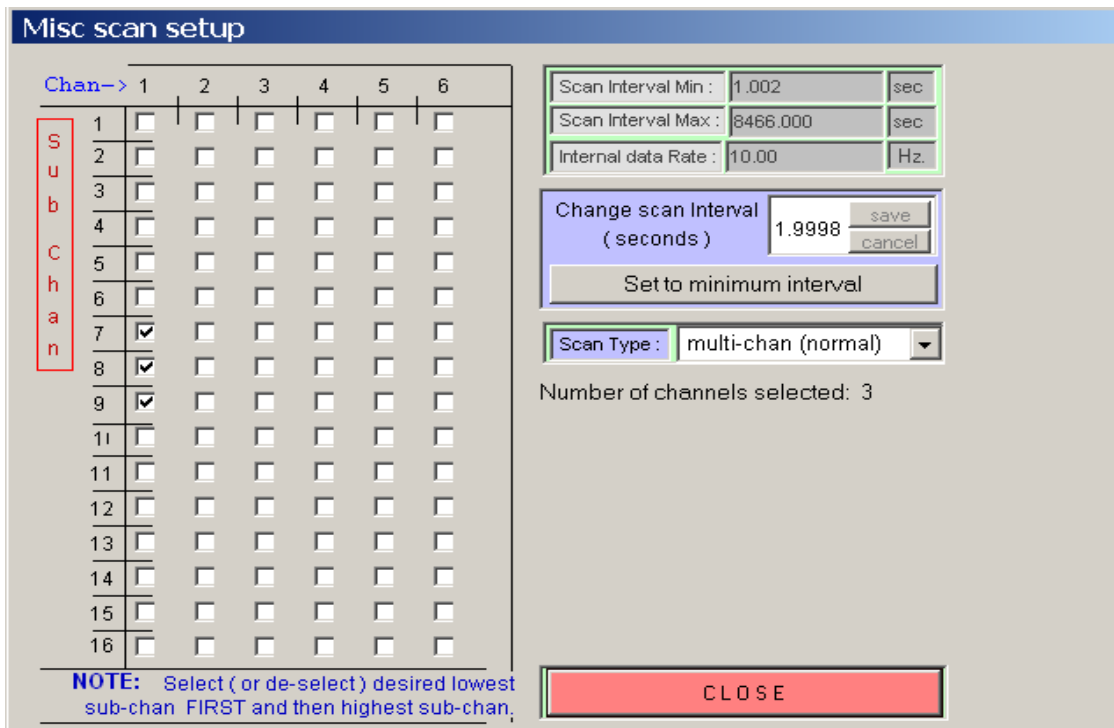
First, Select Scan type:

Single channel scanning is the fastest. It proceeds at up to the internal data rate. Multi-channel scanning is slower, due to settling times. Cal scanning adds a zero and full scale reading to each scan, so it takes a little longer.

Next, Select Channels:

Check first and last boxes in the matrix to include channels in a scan. Any vertical block of adjacent channels is allowed. Any Main Channel can be included or excluded from the scan. One of the multi-channel scanning options must be selected in order to activate more than one channel. With the standard EMF16, the first column is available. With a standard Model 201, the first row is available. With 6 multiplexers, all 64 channels can be scanned.

Finally, Set Scan Interval:

Enter seconds in the "Change scan" interval box to set the Scan interval. The Internal Data Rate, and maximum and minimum allowed scan intervals are shown for reference.

The minimum and maximum scan interval, in seconds, is calculated from the Internal Data Rate, averaging, and the number of selected channels. The scan interval must fall between the maximum and minimum. Click "Set to minimum interval" for fastest scanning.

If you make any changes to the scan set up, you will be given a choice of "save and recalculate" or "cancel and leave". If you save, the recalculated data will be shown. Click the Close button to return to the main panel.

E. Offsets

1. Each EMF channel has its own small offset associated, typically less than 1 mV. These offsets can be stored and used to cause each channel to read zero when the input is shorted. To create an offset file, begin a scan with all inputs active and electrically shorted using the terminator plugs provided. Put the ground switch, or jumpers, in the SAFE position. Set to "Not Using Offsets" to confirm that all channels are reading within a few millivolts of zero. After a few minutes, click Save Offsets. You will be prompted to confirm, since the old offsets will be lost. Confirm by selecting "Use Offsets". All readings should be very near zero.

2. Thereafter, those offset corrections will be stored and available each time you start your software. For corrected or uncorrected data, toggle the Use offsets button.
Offsets are stored for one block of 16 sub-channels, only. This is fine for an EMF16, which has slight offsets associated with each sub-channel due to the buffering. The Model 201

has little or no channel to channel offset variation, so the offset feature is not generally needed with a Model 201.

NOTE: If you save offsets without zero volts applied, or with floating input channels, or without a ground connection, subsequent data may be drastically shifted. You can always turn off "Use offsets" to confirm uncorrected data. When used to correct for internal offset errors, voltages will not change by more than a few millivolts when you toggle Use offsets.

F. Data Files

The data files are placed in the working directory and are named using the starting date and time for scanning. For example, the file shown below is named "11-14-2015_13.56.19.txt". A new file is created for each Start Scan. Checking and unchecking the Log box during a scan will result in time gaps in your log file. Note that the first column in the file shows the time in seconds since beginning the scanning run. Data is in volts. Below is a sample 3-channel data file with the inputs shorted recording at a 1.002 second interval. Logging was turned off between 12 and 24 seconds.

```
Time / s     1 - 7        1 - 8        1 - 9
0000000.0    -.000031     -.000029     -.000034
0000001.0    -.000032     -.000030     -.000038
0000002.0    -.000036     -.000027     -.000037
0000003.0    -.000035     -.000029     -.000042
0000004.0    -.000032     -.000039     -.000043
0000005.0    -.000036     -.000035     -.000037
0000006.0    -.000037     -.000033     -.000040
0000007.0    -.000045     -.000028     -.000037
0000008.0    -.000032     -.000032     -.000041
0000009.0    -.000039     -.000030     -.000035
0000010.0    -.000034     -.000030     -.000040
0000011.0    -.000035     -.000032     -.000041
0000012.0    -.000038     -.000033     -.000036
0000025.1    -.000035     -.000028     -.000041
0000026.1    -.000030     -.000026     -.000032
0000027.1    -.000028     -.000030     -.000034
0000028.1    -.000034     -.000030     -.000034     your comment here
0000029.1    -.000034     -.000035     -.000037
0000030.1    -.000036     -.000030     -.000038
0000031.1    -.000031     -.000032     -.000040
0000032.1    -.000038     -.000029     -.000039

Hz Noise Filter:   400
Averaging / subcycle:    1
Minimal System Interval:       1.002
Applied Interval:       1.002
Started:    11/20/15, 4:25:13 p
Finished:   11/20/15, 4:25:48 p
```

At 28 seconds, a comment was inserted. The comment appears in the file when Enter is pressed to record it.

Data files are compatible with those written by L-EMF-DAC software.

NOTE: Depending on your computer's User Access Control settings, the data files may appear in your VirtualStore path instead of in your application directory.

ALSO: Some Regional and Language settings can corrupt the data files. If there is a question, set to English(USA) in the Control Panel to confirm. Contact the factory for a long-term solution.

G.   .INI file, 0 based vs 1 based

There is a file called M201_GRF.ini placed in your application directory that contains your saved settings. Normally, you do not need to concern yourself with this file at all.

There is one setting in the ini file that cannot be changed from inside the application. Original labeling for the Model 201 was for programmers, who understand the logic of starting from zero when counting. The first channel on the Model 201 is labeled "0". Most of us prefer to start counting from 1. The first channel on the EMF16 is labeled 1.

IsEMF=1   ; The channel labeling for the Model 201 is for programmers, and is 0 based
               ; The labeling for the EMF16 users is 1 based. Set to 0 for 0 based labeling.

H.   RTD Temperature Probe option for the EMF16, only

If you have the RTD Temperature Probe Option, edit M201_GRF.ini (in your Application directory).

Change
IsRTD=0
to
IsRTD=1
and save the file.

Then, A/D channel 2, subchannel 1 (one-based labeling) will be dedicated for temperature in degrees C if you select it in the scan set up screen. That temperature will appear on the main panel and will show in your log files.

NOTE: The Save Offsets function does not interact with the temperature probe readings.

5 Troubleshooting

A. Can't connect

1. Wrong Com Port number?

Double check that the selected Com Port matches the assigned Port. See the Hardware Installation, Section 2, above.

Remember that USB to serial converters change Com port numbers when they are plugged into different USB connectors.

2. Is there a duplicate application open, or another program open that talks to the same instrument?

You cannot share the instrument between open applications. The first program will own it, and will block out all other applications.

3. Was there a recent software lock-up?

If an application accessing the instrument is not allowed to close properly, you may need to reboot the computer to regain access to the serial port.

If the serial connection is through a USB converter, try unplugging the converter from the computer for a few seconds. Replug and try to sign on again.

4. Double check cable and power.

For an EMF 16:
Is the POWER light on? If not, is the power cable fully plugged in?

Does the RUN light turn on when you try to sign on?
If so lower the BAUD rate and try again.
If not, the Com port is not doing anything at all. Double check the Com port selection and cabling.

5) Lower the BAUD rate and try again.

6) If you are using a USB to serial converter, be certain it was installed according to the manufacturer's directions.

B. Noisy data

1. The internal data rate and averaging may not match your line frequency. See Section **C 4** above.

2. Open channels can cause increased noise. Connect unused input channels to ground. For the EMF 16 use the terminators on unused channels. For the Model 201, remember to ground unused minus inputs, too.

3. The EMF 16 has a cable on the back for earth grounding. Connecting that ground cable to a metal water pipe or ground rod ground may improve noise rejection and should not cause a ground loop. The center screw on a wall outlet may be better than no ground connection.

4. There may be another grounding issue. There should be one, and only one ground for each input pair. No ground will cause problems, and duplicate grounds will form ground loops. See the "Application Guidance" pdf linked on the main page for your hardware.

C. Wrong data

If the data is incomprehensible, set language settings to English from the control panel.

Turn OFF offsets. Incorrect offsets will corrupt your data.

Set the Baud rate to 4800. If that doesn't fix the problem, continue below.

Almost always other wrong data issues are due to input connection problems. The "Application Guidance" pdf is your best resource. Look to the grounding first.

Make certain all inputs are connected to intact electrodes or in-range potentials, or are shorted with terminators.

Check the grounding switch if an EMF16 . The SAFE position is a good place to start. For optimum performance you will want to use the DIFF position for true differential inputs. In all cases three wires are needed for optimum true differential connections. Those are + in, - in, and ground. Only the instrument input current should flow in the + and - wires. Any ground current will flow in the third wire.

For EMF 16, optimal connections, true differential:

One and only one non-critical connection from each solution to Ground at the instrument.
Reference electrode to REFERENCE input (minus in)
Working electrode(s) to positive input(s)

Next best:

Without the solution ground wire, use the SAFE switch (or jumper) position.

NOTE: If any one channel is driven outside the specified input range, other channels may read incorrectly.

D. Occasional large data excursion, say, twice a minute to twice an hour.

Usually means missing ground connection. See above.

E. Step changes at erratic intervals, sometimes followed by long settling times.

This is the classic ground loop symptom. Step changes may correlate with HVAC or with cycling of other equipment. Locate and remove the redundant ground connection.

F. Anti-virus software blocks operation.

Some Anti-virus programs are over-aggressive regarding special-purpose software. Your EMF16_grf program file may be quarantined or deleted. This anti-virus behavior reduces the utility of your computer rather than enhancing it. There will be a mechanism to tell the anti-virus software that EMF16_grf.exe is wanted. You may have to dig into the anti-virus documentation in order to find out how to mark EMF16_grf so that it is not disturbed.

G. Scan errors or loss of communication.

1) Set the BAUD rate to 4800

2) If you are using a USB to serial converter, did you install it using the disk that came with it? If not, the generic driver is likely the problem. Locate the original disk or get the proper driver on-line. Then uninstall and reinstall the USB to serial converter.

3) Turn off power-saving on the serial & USB ports. Port hibernation will cause the application to halt. Unpredictable error messages will appear, depending on the timing of hibernation.

4) Improper grounding can place extreme demands on the optical isolation in the serial interface. Ideally, both M201/EMF16 and the host computer have their grounds independently connected to Earth ground.

H. Garbled log files or textual voltage display.

Some Regional and Language settings can corrupt the data files. If there is a question, set to English(USA) in the Control Panel to confirm. A "," instead of a "." for the decimal is known to cause issues in some cases. Contact the factory for a long-term solution.

EMF 16 BLOCK DIAGRAM

EMF-16
BLOCK
DIAGRAM

IN 1
IN 2
IN 3
IN 4
IN 5
IN 6
IN 7
IN 8

UPPER
ROW
BNC

All inputs should be within 6 volts of Ground

IN 9
IN 10
IN 11
IN 12
IN 13
IN 14
IN 15
IN 16

LOWER
ROW
BNC

Install terminators on all unsued channels

16-Channel Multiplexer

To Computer Serial Port

Optical Isolation

OUTPUT +
         -

Data System

A
B
C
D

Channel Selection

Power In

DIFF

SAFE

COMMON

Reference Input

GROUND

Grounding Switch

CHASSIS GROUND

Ground Lug

19

EMF 16 8-CHANNEL DIFFERENTIAL OPTION BLOCK DIAGRAM

Input Channel 1 +
Input Channel 1 -
Input Channel 2 +
Input Channel 2 -
Input Channel 3 +
Input Channel 3 -
Input Channel 4 +
Input Channel 4 -
Input Channel 5 +
Input Channel 5 -
Input Channel 6 +
Input Channel 6 -
Input Channel 7 +
Input Channel 7 -
Input Channel 8 +
Input Channel 8 -

EMF16 16 channel Differential Version

Top row of BNC connectors

8-channel multiplexer

Install terminators on both top and bottom row for all unused channels

Differential output

9
10
11
12
13
14
15
16

Bottom row of BNC connectors

8-channel multiplexer

Bottom row of BNC connectors is not recommended for providing a ground path for in-use channels

Channel selection

A separate ground wire to the solution is a better method

Chassis ground

All inputs must be no more than six volts from GROUND

A   B   C

Ground Lug

GROUND