Magnetic Measurement Lab
Stretch Coil Integral Measurement System Operation
METHOD OF PROCEDURE

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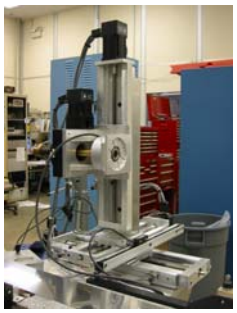
Introduction

This document provides a Method of Procedure (MOP) for the operations of the Stretched Coil ID Magnetic Field Integral Measurement System. The system is designed to measure ID Field Integrals. It consists of two Motorized Precision Stage Assemblies, Assembly A and B. Each assembly has three linear stages and one rotary stage, motorized by servo motors. Assembly A has a rotary encoder on the rotary stage and a linear encoder on the X linear stage.



Motorized Precision Stage Assemblies

Servo Motor

Rotary Stage

Linear Encoder

Rotary Encoder

The control and the data acquisition part of the system consists of a PXI based computer control card, an FPGA data acquisition card, hosted in an PXI shelf.

PXI-8174 Embedded PXI Controller

PXI-7831R FPGA Reconfigurable Data Acquisition Card

PXI-1002 PXI Shelf

The signal gets amplified by a DC Signal Pre-amplifier before feed into the FPGA card.

Ectron 428-O DC Signal Conditioner

This document is intended to provide operators a quick guide of the Integral Measurement System operation. Please refer to the User's Guide of the system and the User's Manual of the sub-systems for detailed information.

Method of Procedure

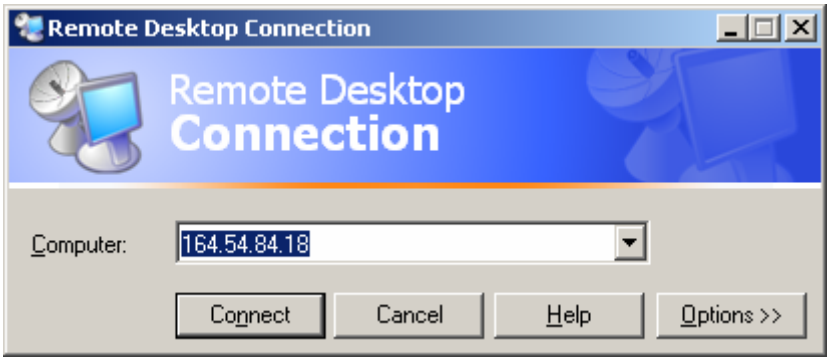
Before launching the software system, the hardware sub-system connections have to be checked and powered on. If any of the sub-system is not connected and powered on appropriately, the software system will inform you that the specific hardware system is not connected or power up or communication port address is not set correctly.

Step 1. Check all the cables, the network cables to the PXI shelf and the host computer, the smart motor RS-232 communication cables, the smart motor power supply cables, the rotary encoder cable, the linear encoder coble, and the coil signal cables are properly connected and secured.

Step 2. The two smart motor power supplies are powered on.

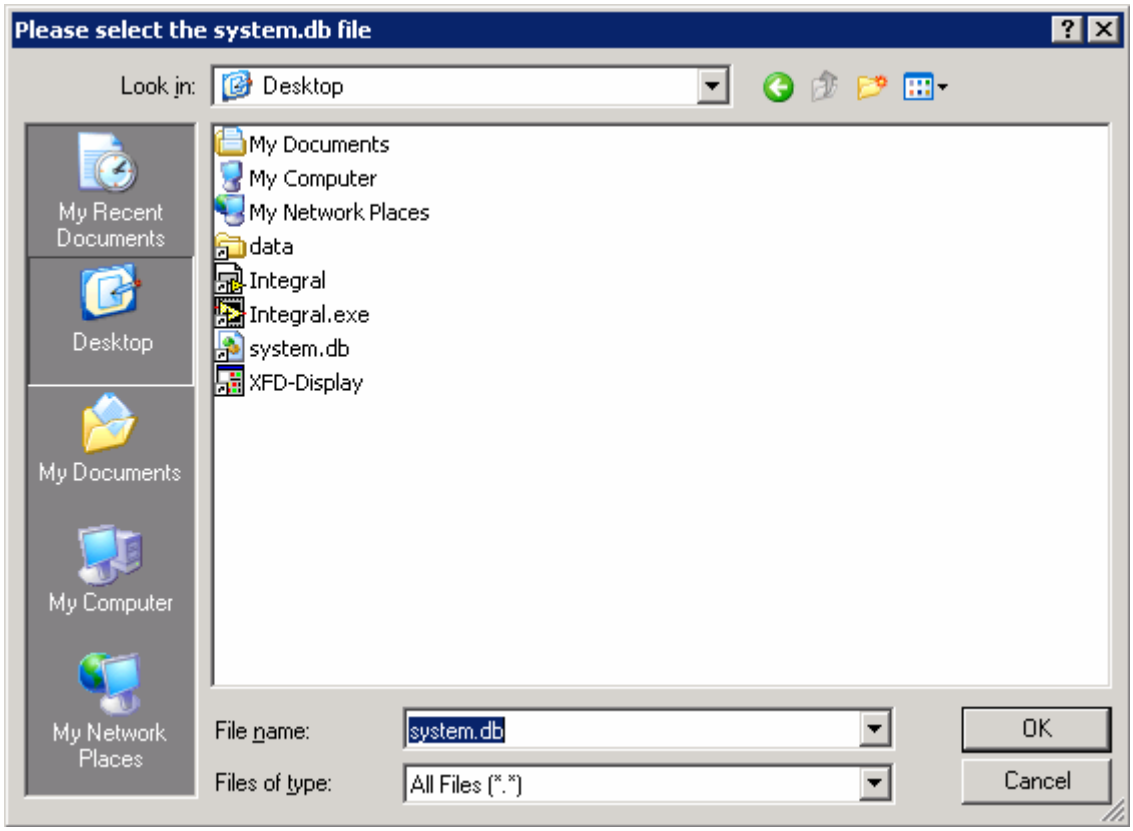
Step 3. The PXI shelf is powered up.

Step 4. Log on to any APS host computer. Start **Remote Desktop Connection** from **Start**, **Programs**, **Accessories**, and **Communications**. In the **Computer** field, type in **164.54.84.18**, click **Connect**.



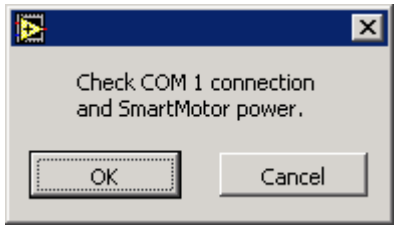
Step 5. Launch the Integral Measurement Control Software by double click the IntCtl icon on the Remote Desktop.

Step 6. The system will prompt you with a window ask for the right path to load the system.db file.

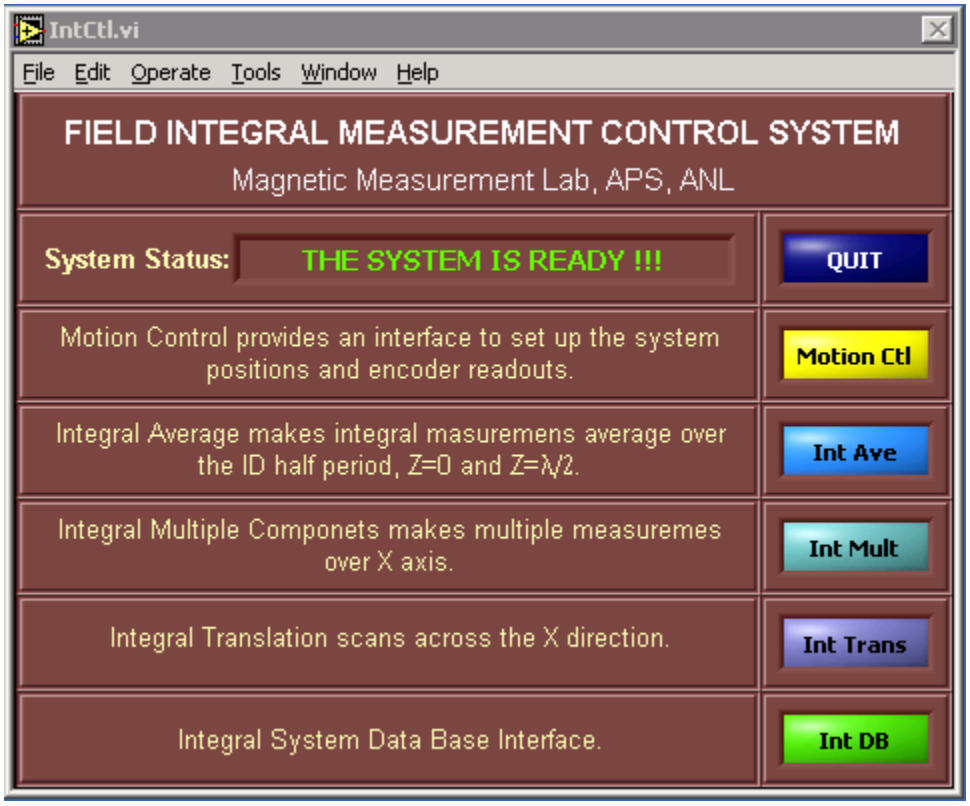


Select the right path where your system.db file is located.

Step 7. If the following window pops up, check the appropriate cable connections, power cables, and address settings, and click OK button to continue.



If the servo motors are not initialized, the system will try to initialize the motors automatically. If every thing is ok the following system main interface window will show with the status of “THE SYSTEM IS READY!!!”



SYSTEM PREPARATION PROCEDURE

Before each measurement, collect all the information about the ID to be measured. The preparation procedure includes the following steps:

Step 8. Collect the ID information including:

- The manufacture.
- The part number.
- The serial number.
- The period (in millimeters).
- The environment temperature.
- Other information as necessary.

Step 9. Check all the control cable connections from the ID control racks to the ID motors and encoders. Check all the power switches are on in the control racks. Launch the ID Control MEDM windows. Test the ID control system and make sure the ID gap moves accordingly.

SYSTEM ALIGNMENT PROCEDURE

After the preparation, the system needs to be properly aligned, before measurements scan can be executed.

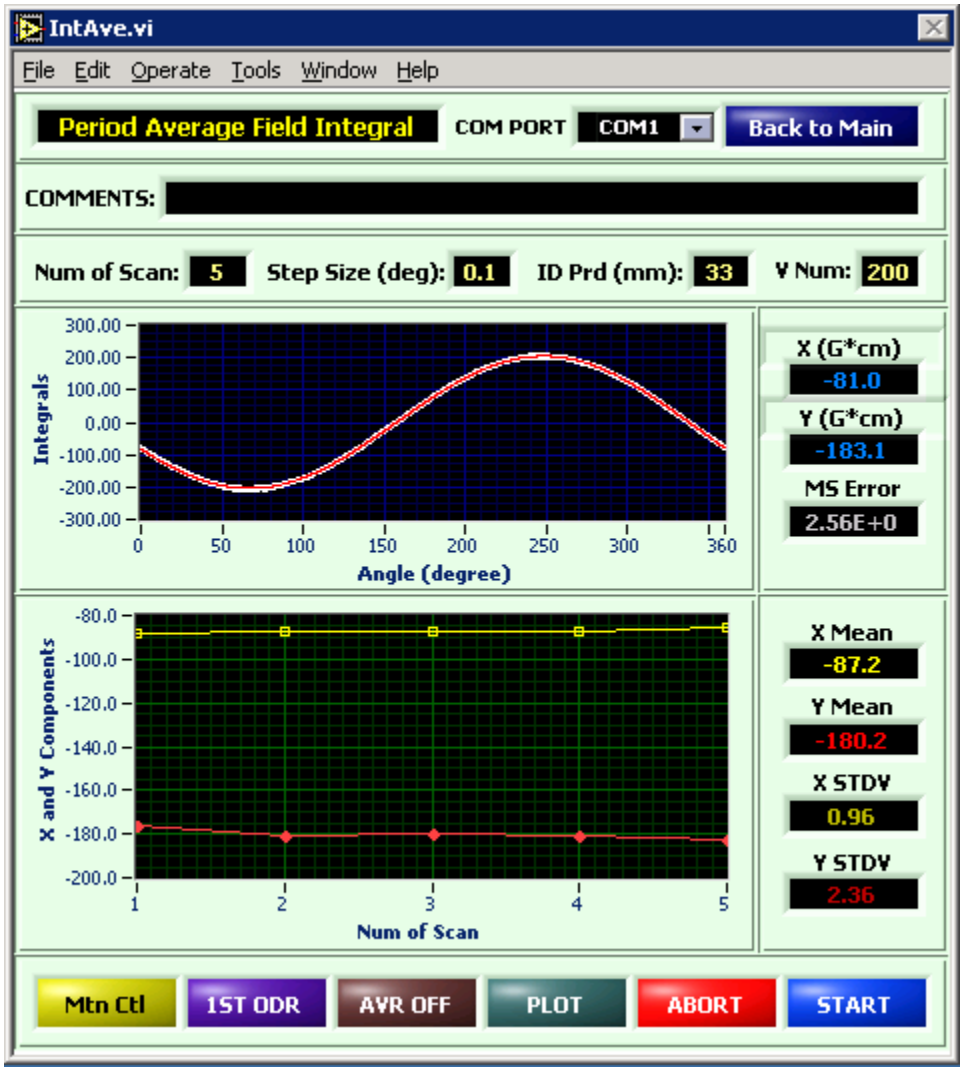
Step 10. Align ID gap leveled horizontally, in the reach of the coil system center within about one inch in distances.

Step 11. Click the **Motion Ctl** control button in the Field Integral Measurement control interface window to launch the Advanced Motion Control interface window. Use the motion control interface to carefully move the coil into the center of the ID gap by move the Y axis to level the coil axis to the gap level and then move the X axis to slide the coil to the center of the gap. *Reset the linear encoder readouts and motor readouts to zero*.

Step 12. If the rotary tables have been pre-surveyed into the position to level the coil vertically, move the rotary tables to the zero rotary encoder readout position. Otherwise, resurvey the coil level position by moving the rotary tables till the coil is leveled in line with the ID gap. *Reset the rotary encoder readout to zero. Reset all motor positions to zero.* Click the **RETURN TO MAIN** control button to close the motion control window and go back to the main window.

FIELD INTEGRAL AVERAGE MEASUREMENT PROCEDURE

Click the **Int Ave** control button in the Main Control Windows to launch the Integral Average Field Measurement Control Interface window.



Before you click the **START** control button, the following Steps have to be completed.

Step 13. Enter the ID information of the probe needs to be calibrated into the **COMMENTS** field.

Step 14. Enter the number of scans for the measurement in the **Num of Scan** field.

Step 15. Select the appropriate measurement step size in the **Step Size (deg)** field.

Step 16. Enter the ID period in the **ID Prd (mm)** field.

Step 17. Select the coil measurement order by clicking **1st ORDER/2nd ORDER** control button.

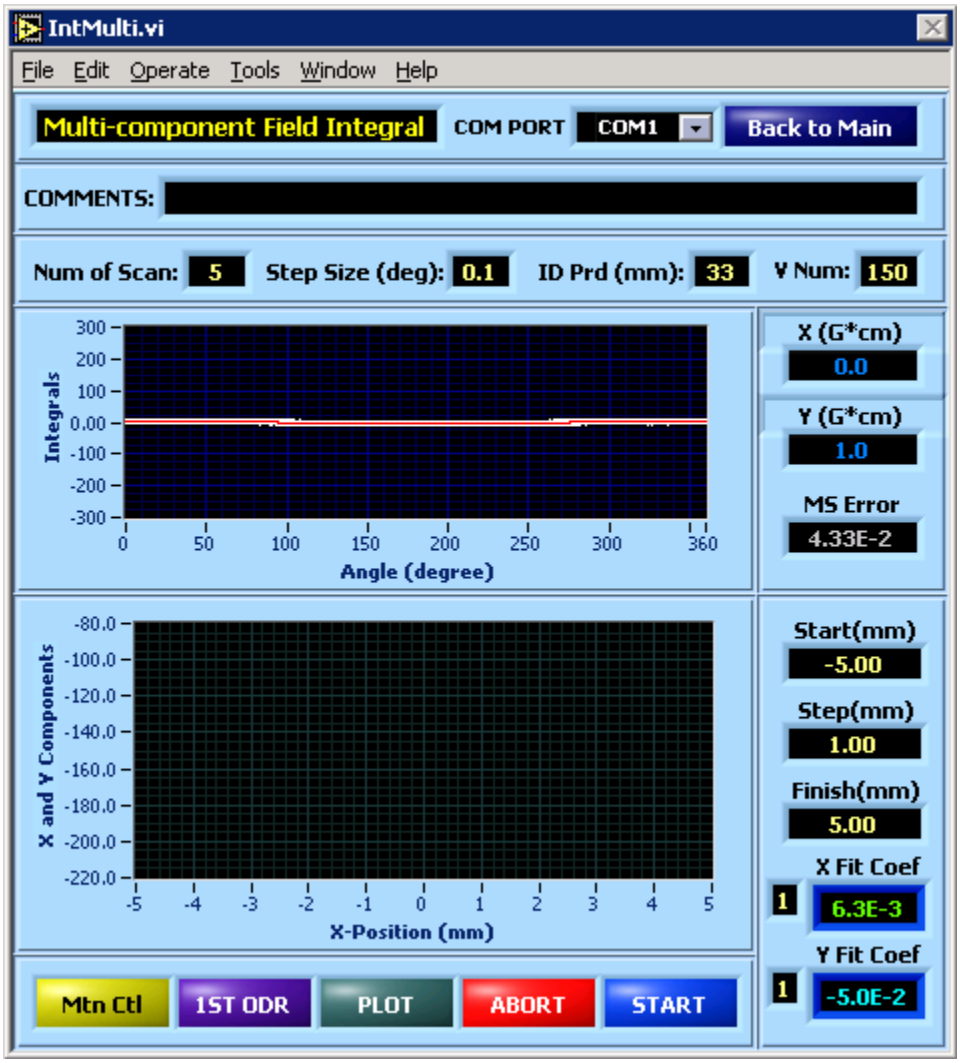
Step 18. Select the measure average over the ID period by clicking **AVR OFF/AVR ON** control button.

Step 19. Click the **START** control button, the system will prompt you with a window to select the path and name of the file to save the measurement data. Select the right path, enter the data name and click **OK**, the system will start the measurements.

Step 20. After the measurements are completed, the program will set all the stages to the original positions. You may go back to **Data Plotting** section to find out how to plot the calibration data, or enter new parameters, click **START** control button to start another measurement. Otherwise, click the **Back to Main** to close the window and go back to the Main Control Window.

MULTI SCAN MEASUREMENT PROCEDURE

Click the **Int Mult** control button in the Main Control Windows to launch the Multi Scan Field Measurement Control Interface window.



Before you click the **START** control button, the following Steps have to be completed.

Step 21. Enter the ID information of the probe needs to be calibrated into the **COMMENTS** field.

Step 22. Enter the number of scans for the measurement in the **Num of Scan** field.

Step 23. Select the appropriate measurement step size in the **Step Size (deg)** field.

Step 24. Enter the ID period in the **ID Prd (mm)** field.

Step 25. Enter the X axis start position relative to the center position of the ID gap where the coil is aligned in the **Start (mm)** field.

Step 26. Enter the scan step in the **Step (mm)** field.

Step 27. Enter the X axis finish position relative to the center position of the ID gap where the coil is aligned in the **Finish (mm)** field.

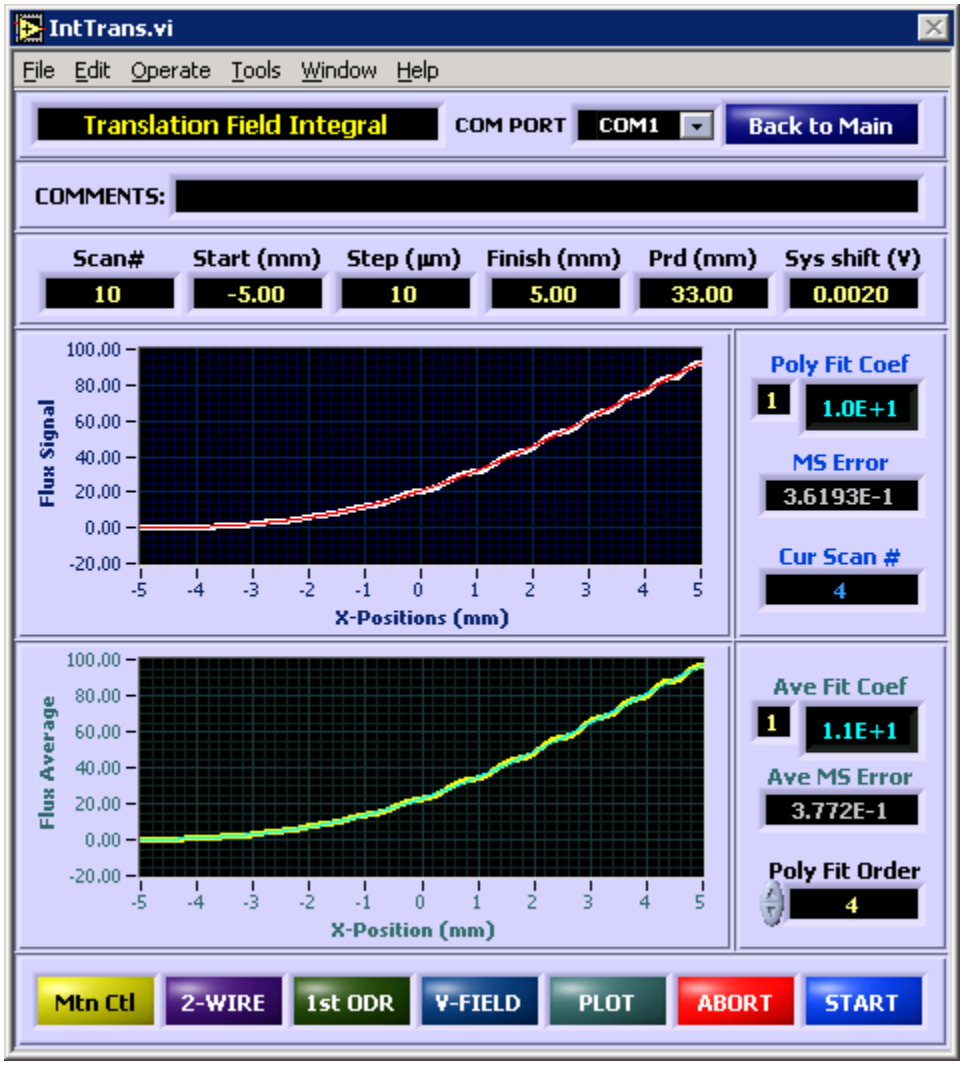
Step 28. Select the coil measurement order by clicking **1st ORDER/2nd ORDER** control button.

Step 29. Click the **START** control button, the system will prompt you with a window to select the path and name of the file to save the measurement data. Select the right path, enter the data name and click **OK**, the system will start the measurements.

Step 30. After the measurements are completed, the program will set all the stages to the original positions. You may go back to **Data Plotting** section to find out how to plot the calibration data, or enter new parameters, click **START** control button to start another measurement. Otherwise, click the **Back to Main** to close the window and go back to the Main Control Window.

TRANSLATION INTEGRAL MEASUREMENT PROCEDURE

Click the **Int Trans** control button in the Main Control Windows to launch the Translation Integral Measurement Control Interface window.



Before you click the **START** control button, the following Steps have to be completed.

Step 31. Enter the ID information of the probe needs to be calibrated into the **COMMENTS** field.

Step 32. Enter the number of scans for the measurement in the **Scan#** field.

Step 33. Enter the X axis start position relative to the center position of the ID gap where the coil is aligned in the **Start (mm)** field.

Step 34. Select the appropriate measurement step size in the **Step (µm)** field.

Step 35. Enter the X axis finish position relative to the center position of the ID gap where the coil is aligned in the **Finish (mm)** field.

Step 36. Enter the ID period in the **ID Prd (mm)** field.

Step 37. Select or enter the Polynomial fitting order in the **Poly Fit Order** field. You may change the value in this field as the system is in the state of measurement.

Step 38. Select the coil measurement mode by clicking **2-WIRE/1-WIRE** control button. *Make sure the coil physical setting reflects the mode selection*.

Step 39. Click the **START** control button, the system will prompt you with a window to select the path and name of the file to save the measurement data. Select the right path, enter the data name and click **OK**, the system will start the measurements.

Step 40. After the measurements are completed, the program will set all the stages to the original positions. You may go back to **Data Plotting** section to find out how to plot the calibration data, or enter new parameters, click **START** control button to start another measurement. Otherwise, click the **Back to Main** to close the window and go back to the Main Control Window.

Trouble Shooting

If one of the motor power supply gets a power recycle, the motor address will get lost. The system will pop up a window inform user that the power supply or COM port got disconnected. User has to power off both power supplies, power back one, and reinitialize the motor addresses by click the **INIT** control button in the Advanced Motion Control window.