Multi-Instrument Automation Server Interfaces

Version 1.7

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# TABLE OF CONTENTS

1. USING MULTI-INSTRUMENT AS AN AUTOMATION SERVER ........................................... 4

2. MULTI-INSTRUMENT AUTOMATION SERVER INTERFACE SPECIFICATIONS ........... 4
   2.1 SHOWWINDOW ........................................... 4
   2.2 OPENWINDOW ........................................... 5
   2.3 CLOSEWINDOW ......................................... 6
   2.4 MOVETWINDOW ......................................... 6
   2.5 TILERWINDOW .......................................... 7
   2.6 SHOWMENU ............................................. 7
   2.7 HIDEMENU ............................................. 8
   2.8 SHOWTOOLBAR ......................................... 8
   2.9 HIDETOOLBAR .......................................... 8
   2.10 SHOWTITLEBAR ......................................... 9
   2.11 HIDETITLEBAR ......................................... 9
   2.12 SETSIGNALLGENERATORPARAMETERS .............. 10
   2.13 UPDATEMULTITONEITEM ......... 14
   2.14 SETNUMBEROFMULTITONEITEMS ............... 15
   2.15 LOADWFLIBRARY ..................................... 16
   2.16 STARTDAO ........................................... 16
   2.17 STOPDAO ............................................ 16
   2.18 GETDAOSTATUS ...................................... 16
   2.19 SETDAQPARAMETERS ...................... 17
   2.20 SETVIEWPARAMETERS ....................... 20
   2.21 STARTDAQ .......................................... 22
   2.22 STOPDAQ ............................................ 22
   2.23 RECORD ............................................. 22
   2.24 GETDAQSTATUS ...................................... 22
   2.25 GETDDP ............................................. 23
   2.26 LOADPANELSETTINGFILE .................. 23
   2.27 LOADFILE ........................................... 23
   2.28 SAVEFILE ........................................... 24
   2.29 OSCILLOSCOPEEXPORT ....................... 24
   2.30 SPECTRUMANALYZEREXPORT ............... 24
   2.31 LOCKGUI ............................................ 24
   2.32 UNLOCKGUI .......................................... 25
   2.33 UNLOCK ................................................ 25
   2.34 GETADCDEVICECOUNT ............ 26
   2.35 GETDACDEVICECOUNT ................ 26
   2.36 SETDACDEVICE ..................................... 26
   2.37 SETDACDEVICECOUNT ............ 26
   2.38 GETADCDEVICENAME ............... 27
   2.39 GETDACDEVICENAME ................ 27
   2.40 GETADCDEVICESIZE ................. 28
   2.41 GETDACDEVICESIZE ................. 28
   2.42 SETUDDP ........................................... 28

3. MULTI-INSTRUMENT AUTOMATION CLIENT PROGRAM DEVELOPMENT GUIDE ........... 29
   3.1 BASIC FILES OF MULTI-INSTRUMENT AUTOMATION SERVER ........................................ 29
   3.2 MULTI-INSTRUMENT AUTOMATION SERVER REGISTRATION ........................................ 29
   3.3 MULTI-INSTRUMENT AUTOMATION SERVER CLSID AND PROGID ...................... 30
   3.4 OBTAIN DERIVED DATA POINTS (DDPS) FROM HIDDEN MULTI-INSTRUMENT ........... 30

4. SAMPLE AUTOMATION CLIENT PROGRAMS ........................................... 31
   4.1 TESTAUTOMATION WRITTEN IN VISUAL BASIC 6.0 ........................................ 31
   4.2 TESTAUTOMATION WRITTEN IN VISUAL C++ 6.0 ........................................ 32
   4.3 TESTAUTOMATION WRITTEN IN VISUAL C# 2012 ........................................ 33
4.4 TEST AUTOMATION WRITTEN IN PYTHON 3.7.3 .................................................................34

5. AN AUTOMATION CLIENT AND SERVER INTEGRATION EXAMPLE..................................35
1. Using Multi-Instrument as an Automation Server

ActiveX is the general name for a set of Microsoft technologies that allows you to reuse code and link individual programs together to suit your computing needs. Based on COM (Component Object Model) technologies, ActiveX is an extension of a previous technology called OLE (Object Linking and Embedding). Each program does not need to regenerate components, but rather, reuse components to give you the power to combine applications together. ActiveX Automation is a subset of the Microsoft’s ActiveX technologies. ActiveX Automation applications interact in a Client/Server model, where the Automation Server exposes objects which can be controlled by the Automation Client (also known as the Automation Controller).

Multi-Instrument offers support for ActiveX Automation as a server, i.e. ActiveX Automation Server (also known as OLE Automation Server, or simply Automation Server). An Automation Client program can control and share the data with the Multi-Instrument Automation Server through the interfaces that the Multi-Instrument Automation Server exposes. In this way, Multi-Instrument can be seamlessly integrated into other applications as a reusable binary component.

In the following chapters, the Multi-Instrument Automation Server Interfaces will be described and the sample Automation Client programs in Visual Basic 6.0, Visual C++ 6.0, Visual C# 2012, and Python 3.7.3 will be provided.

2. Multi-Instrument Automation Server Interface Specifications

2.1 ShowWindow

The ShowWindow function sets the specified window's show state.

```c
void ShowWindow(
  long nWindowID, // Window ID
  long nCmdShow   // show state of window
);
```

**Parameters**

- `nWindowID` Window ID. It specifies which window to operate.
  - 0: Mainframe
  - 1: Oscilloscope
  - 2: Spectrum Analyzer
  - 3: Multimeter
  - 4: Generator
  - 5: Spectrum 3D Plot
  - 60~67: Data Logger
  - 80~87: DDC
  - 89: DDP Array Viewer
90~105: DDP Viewer

\textit{nCmdShow}

Specifies how the window is to be shown. It must be one of the following values:

0: SW_HIDE, hides this window and passes activation to another window;
1: SW_SHOWNORMAL, activates and displays the window. If the window is
minimized or maximized, Windows restores it to its original size and
position;
2: SW_SHOWMINIMIZED, activates the window and displays it as an icon;
3: SW_SHOWMAXIMIZED, activates the window and displays it as a
maximized window;
4: SW_SHOWNOACTIVATE, displays the window in its most recent size and
position. The window that is currently active remains active;
5: SW_SHOW, activates the window and displays it in its current size and
position;
6: SW_MINIMIZE, minimizes the window and activates the top-level window
in the system’s list;
7: SW_SHOWMINNOACTIVE, displays the window as an icon. The window
that is currently active remains active;
8: SW_SHOWNA, displays the window in its current state. The window that is
currently active remains active;
9: SW_RESTORE, activates and displays the window. If the window is
minimized or maximized, Windows restores it to its original size and
position.
100: Set the “Show Edit” flag, applicable only if \textit{nWindowID} = 4 (Signal
Generator)
101: Reset the “Show Edit” flag, applicable only if \textit{nWindowID} = 4 (Signal
Generator)

\textbf{Remarks}

Except the Mainframe window, which is opened automatically once the Multi-Instrument
Automation Server is launched and closed once the Multi-Instrument Automation Server is
shut down, the rest of windows in Multi-Instrument must be in open state while
ShowWindow is called. These windows can be opened using OpenWindow function and
closed using CloseWindow function.

The Oscilloscope, Spectrum Analyzer, Multimeter and Spectrum 3D Plot windows are child
windows of the Mainframe window. Thus, hiding the Mainframe window will hide all of
them. Data Acquisition can still be performed when the mainframe window is hidden.

\textbf{2.2 OpenWindow}

The OpenWindow function opens the specified window.

\begin{verbatim}
void OpenWindow(
    long nWindowID, // Window ID
);\end{verbatim}
Parameters

**nWindowID**

Window ID. It specifies which window to operate.

1: Oscilloscope
2: Spectrum Analyzer
3: Multimeter
4: Generator
5: Spectrum 3D Plot
60~67: Data Logger
80~87: DDC
89: DDP Array Viewer
90~105: DDP Viewer

2.3 CloseWindow

The CloseWindow function closes the specified window.

```c
void CloseWindow(
    long nWindowID, // Window ID
);
```

Parameters

**nWindowID**

Window ID. It specifies which window to operate.

1: Oscilloscope
2: Spectrum Analyzer
3: Multimeter
4: Generator
5: Spectrum 3D Plot
60~67: Data Logger
80~87: DDC
89: DDP Array Viewer
90~105: DDP Viewer

2.4 MoveWindow

The MoveWindow function changes the position and dimensions of the specified window.

```c
void MoveWindow(
    long nWindowID, // Window ID
    long nX, //Horizontal Position
    long nY, //Vertical Position
    long nWidth, //Width
    long nHeight, //Height
    long nRepaint //Repaint Flag
);
```
**Parameters**

*nWindowID*

Window ID. It specifies which window to operate.
- 0: Mainframe
- 1: Oscilloscope
- 2: Spectrum Analyzer
- 3: Multimeter
- 4: Generator
- 5: Spectrum 3D Plot
- 60~67: Data Logger
- 80~87: DDC
- 89: DDP Array Viewer
- 90~105: DDP Viewer

*nX*

Specifies the new position of the left side of the window.

*NY*

Specifies the new position of the top of the window

*nWidth*

Specifies the new width of the window

*nHeight*

Specifies the new height of the window

*nRepaint*

Specifies whether the window is to be repainted.

### 2.5 TileWindow

The TileWindow function tiles the windows horizontally or vertically within the mainframe of Multi-Instrument. The windows that can be tiled are: Oscilloscope, Spectrum Analyzer, Multimeter, and Spectrum 3D Plot.

```c
void TileWindow(
    long nPattern, //Tile Pattern
);
```

**Parameters**

*nPattern*

It specifies how the windows to be tiled.
- 0: Horizontally
- 1: Vertically

### 2.6 ShowMenu

The ShowMenu function shows the specified menu.
void ShowMenu(
long nMenuID //Menu ID
)

Menu ID. It specifies which menu to operate.
0: Mainframe Menu.

2.7 HideMenu

The HideMenu function hides the specified menu.

void HideMenu(
long nMenuID //Menu ID
)

Menu ID. It specifies which menu to operate.
0: Mainframe Menu.

2.8 ShowToolbar

The ShowToolbar function shows the specified toolbar.

void ShowToolbar(
long nToolbarID //Toolbar ID
);

Parameters
nToolbarID

Toolbar ID. It specifies which toolbar to operate
0: All Toolbars
1: Sampling Toolbar
2: Instrument Toolbar
3: Oscilloscope View Toolbar
4: Spectrum Analyzer View Toolbar
5: Multimeter View Toolbar
6: Spectrum 3D View Toolbar
7: Hot Panel Setting Toolbar

2.9 HideToolbar

The HideToolbar function hides the specified toolbar.

void HideToolbar(
long nToolbarID //Toolbar ID
);

Parameters
nToolbarID

Toolbar ID. It specifies which toolbar to operate
0: All Toolbars
1: Sampling Toolbar
2: Instrument Toolbar
3: Oscilloscope View Toolbar
4: Spectrum Analyzer View Toolbar
5: Multimeter View Toolbar
6: Spectrum 3D View Toolbar
7: Hot Panel Setting Toolbar

2.10 ShowTitlebar

The ShowTitlebar function shows the specified titlebar.

```c
void ShowTitlebar(
    long nTitlebarID //Titlebar ID
);
```

**Parameters**

-nTitlebarID

Titlebar ID. It specifies which titlebar to operate

0: Mainframe Titlebar
1: Oscilloscope View Titlebar
2: Spectrum View Titlebar
3: Multimeter View Titlebar
4: Signal Generator Titlebar
5: Spectrum 3D Plot
60~67: Data Logger
90~105: DDP Viewer

2.11 HideTitlebar

The HideTitlebar function hides the specified toolbar.

```c
void HideTitlebar(
    long nTitlebarID //Titlebar ID
);
```

**Parameters**

-nTitlebarID

Titlebar ID. It specifies which titlebar to operate

0: Mainframe Titlebar
1: Oscilloscope View Titlebar
2: Spectrum View Titlebar
3: Multimeter View Titlebar
4: Signal Generator Titlebar
2.12 SetSignalGeneratorParameters

The SetSignalGeneratorParameters function sets the parameters of the Signal Generator.

```c
void SetSignalGeneratorParameters(
    long nLoopBackMode,   //Loopback Mode
    long nSamplingFrequency, //Sampling Frequency
    long nSamplingChannels, //Sampling Channels
    long nSamplingBitResolution, //Sampling Bit Resolution
    long nWaveformA, //Waveform for Channel A
double dFrequencyA, //Frequency for Channel A
double dAmplitudeA, //Amplitude for Channel A
    long nWaveformB, //Waveform for Channel B
double dFrequencyB, //Frequency for Channel B
double dAmplitudeB, //Amplitude for Channel B
double dPhaseDifference,  //Phase Difference between Channels
                        //A & B
    long nMaskMode, //Mask Mode
double dMaskOn, //Mask On Period
double dMaskOff, //Mask Off Period
    long nFadeMode, //Fade Mode
double dFadeIn, //Fade In Period
double dFadeOut, //Fade Out Period
    double dTotalDuration, //Total Duration
    long nLoop, //Loop Flag
    long nSweepMode, //Sweep Mode
double dStartA, //Start Frequency/Amplitude for Channel A
double dEndA,  //End Frequency/Amplitude for Channel A
double dStartB, //Start Frequency/Amplitude for Channel B
double dEndB,  //End Frequency/Amplitude for Channel B
    long nLinearLogA, //Linear/Log Sweep Flag for Channel A
    long nLinearLogB, //Linear/Log Sweep Flag for Channel B
double dDutyCycleA, //Duty Cycle for Channel A
double dDutyCycleB, //Duty Cycle for Channel B
    long nMLSLength //MLS Length
);
```

**Parameters**

**nLoopBackMode**

- **Loopback Mode:**
  - 0: No Loopback
  - 1: iA=oA, iB=oB
  - 2: iA=oA, iB=oA
  - 3: iB=oA
  - 4: Sync. No Loopback
  - 5: Sync. iB=oA
  - 6: Sync. iB←oA

**nSamplingFrequency**

- **Sampling Frequency:**
  - 0: 2kHz
1: 4kHz
2: 8kHz
3: 11.025kHz
4: 16kHz
5: 22.05kHz
6: 32kHz
7: 44.1kHz
8: 48kHz
9: 64kHz
10: 88.2kHz
11: 96kHz
12: 176.4kHz
13: 192kHz
14: 200kHz

Note: The above options are valid if sound card MME is chosen as the DAC device in Multi-Instrument. Otherwise, the indexed sampling frequencies may be different from the above. Please check the Multi-Instrument software to see the options available for a specific DAC device.

nSamplingChannels
Sampling Channels:
0: A
1: A&B

Note: The above options are valid if sound card MME is chosen as the DAC device in Multi-Instrument. Otherwise, the indexed sampling channels may be different from the above. Please check the Multi-Instrument software to see the options available for a specific DAC device.

nSamplingBitResolution
Sampling Bit Resolution:
0: 8 Bit
1: 16 Bit
2: 24 Bit

Note: The above options are valid if sound card MME is chosen as the DAC device in Multi-Instrument. Otherwise, the indexed sampling bit resolution may be different from the above. Please check the Multi-Instrument software to see the options available for a specific DAC device.

nWaveformA
Waveform for Channel A:
0: None
1: Sine
2: Rectangle
3: Triangle
4: SawTooth
5: WhiteNoise
6: PinkNoise
7: MultiTones
8: Arbitrary (via Waveform Library File)
9: MLS

Note: if nWaveformA is set to 7 or 8, nWaveformB should also be set to 7 or 8 respectively, too.

dFrequencyA
Frequency value in Hz for Channel A. It must be less than or equal to ½ of the sampling frequency.

dAmplitudeA
Amplitude value in DAC engineering unit for Channel A. It must be within the full-scale DAC range.

nWaveformB
Waveform for Channel B:
0: None
1: Sine
2: Rectangle
3: Triangle
4: SawTooth
5: WhiteNoise
6: PinkNoise
7: MultiTones
8: Arbitrary (via Waveform Library File)
9: MLS

Note: if nWaveformB is set to 7 or 8, nWaveformA should also be set to 7 or 8 respectively, too.

dFrequencyB
Frequency value in Hz for Channel B. It must be less than or equal to ½ of the sampling frequency.

dAmplitudeB
Amplitude value in DAC engineering unit for Channel B. It must be within the full-scale DAC range.

dPhaseDifference
Phase Difference value in degree between the two channels. It must be in the range of −180~180 degree.

nMaskMode
Mask Mode:
0: No Mask
1: Mask with Phase Lock
2: Mask with No Phase Lock

dMaskOn
Mask On period in second.

dMaskOff
Mask Off period in second.

nFadeMode
Fade Mode:
0: No Fade
1: Fade

dFadeIn
Fade In period in second.

dFadeOut
Fade Out period in second.

dTotalDuration
Total Duration in second. Under non-sweep mode, it specifies the duration of the output signal, if nLoop=0. Under sweep mode, it specifies the sweep duration instead.

nLoop
It specifies whether the output signal should be repeated in loop. Under non-sweep mode, the Total Duration will be ignore if nLoop=1.
0: No Loop
1: Loop

nSweepMode
Sweep mode:
0: No Sweep
1: Frequency Sweep
2: Amplitude Sweep

dStartA
Start frequency in Hz under frequency sweep mode for Channel A, or start amplitude in DAC engineering unit under amplitude sweep mode for Channel A.

dEndA
End frequency in Hz under frequency sweep mode for Channel A, or end amplitude in DAC engineering unit under amplitude sweep mode for Channel A.

dStartB
Start frequency in Hz under frequency sweep mode for Channel B, or start amplitude in DAC engineering unit under amplitude sweep mode for Channel B.

dEndB
End frequency in Hz under frequency sweep mode for Channel B, or end amplitude in DAC engineering unit under amplitude sweep mode for Channel B.

nLinearLogA
Linear/Log sweep Mode for channel A:
  0: Linear
  1: Log

Linear/Log sweep Mode for channel B:
  0: Linear
  1: Log

Duty Cycle (0~100) for Channel A, applicable only if the waveform is rectangle.

Duty Cycle (0~100) for Channel B, applicable only if the waveform is rectangle.

MLS length, applicable only if the waveform is MLS.
  0: 127
  1: 225
  2: 511
  3: 1023
  4: 2047
  5: 4095
  6: 8191
  7: 16383
  8: 32767
  9: 65535
  10: 131071
  11: 262143
  12: 524287
  13: 1048575
  14: 2097151
  15: 4194303
  16: 8388607
  17: 16777215

Remarks
This function can only be called after the Signal Generator is opened. Calling this function will have no effect when the Signal Generator of Multi-Instrument is in running state.

2.13 UpdateMultiToneItem
The UpdateMultiToneItem function updates the specified Multitone item.

```c
void UpdateMultiToneItem(
  long nChannelNo, //Channel No.
  long nItemNo,     //Item No.
  long nWaveform,   //Waveform
  long nFrequency,  //Frequency
  double dRelativeAmplitude, //Relative Amplitude
```
double dPhase  //Phase
);

**Parameters**

nChannelNo

Channel No.:
  0: Channel A
  1: Channel B

nItemNo

Item No.. It must be in the range of 0~31.

nWaveform

Waveform:
  1: Sine
  2: Rectangle
  3: Triangle
  4: SawTooth
  5: WhiteNoise
  6: PinkNoise

nFrequency

Frequency value in Hz. It must be less than or equal to \( \frac{1}{2} \) of the sampling frequency and greater than 0 Hz.

dRelativeAmplitude

Relative Amplitude value. It is recommended to use a value in the range of 0~1. It is dimensionless.

dPhase

Initial Phase value in degree. It must be in the range of –180~180 degree.

**Remarks**

This function should be called just after calling SetSignalGeneratorParameters function to set the waveform for both channels to be MultiTones.

### 2.14 SetNumberOfMultiToneItems

The SetNumberOfMultiToneItems function sets the number of MultiTone items for both Channels A & B.

```c
void SetNumberOfMultiToneItems (  
long nCountA,  //Number of MultiTone items in Channel A  
long nCountB  //Number of MultiTone items in Channel B  
);
```

**Parameters**

nCountA

Number of MultiTone items in Channel A. It must be in the range of 0~31;
**nCountB**
Number of MultiTone items in Channel B. It must be in the range of 0~31;

**Remarks**
This function should be called just after calling SetSignalGeneratorParameters function to set the waveform for both channels to be MultiTones.

### 2.15 LoadWFLibrary

The LoadWFLibrary function loads the waveform library file.

```c
void LoadWFLibrary (LPCTSTR sWFLibraryFileName); //Waveform library file name
```

**Parameters**
- **sWFLibraryFileName**
  Waveform library file name.

**Remarks**
This function should be called just after calling SetSignalGeneratorParameters function to set the waveform for both channels to be WFLibrary.

### 2.16 StartDAO

The StartDAO function starts the Signal Generator. This function can only be called after the Signal Generator is opened. Signal output can still be performed when the Signal Generator panel is hidden.

```c
void StartDAO();
```

### 2.17 StopDAO

The StopDAO function stops the Signal Generator. This function can only be called after the Signal Generator is opened.

```c
void StopDAO();
```

### 2.18 GetDAOStatus

The GetDAOStatus function returns the DAO status. DAO is the short form for “Data Output”.

long GetDAOStatus()

**Return Values**
0: Stopped
1: Running

### 2.19 SetDAQParameters

The SetDAQParameters function sets the DAQ parameters. DAQ is the short form for “Data Acquisition”.

```c
void SetDAQParameters(
    long nSamplingFrequency, //Sampling Frequency
    long nSamplingChannels,   //Sampling Channels
    long nSamplingBitResolution, //Sampling Bit Resolution
    long nRecordLength,       //Record Length
    long nTriggerMode,        //Trigger Mode
    long nTriggerSource,      //Trigger Source
    long nTriggerEdge,        //Trigger Edge
    long nTriggerLevel,       //Trigger Level
    long nTriggerDelay,       //Trigger Delay
    long nRangeA,             //Range for Channel A
    long nRangeB,             //Range for Channel B
    long nCouplingTypeA,      //Coupling Type for Channel A
    long nCouplingTypeB,      //Coupling Type for Channel B
    long nProbeSwitchPositionA, //Probe Switch Position for Ch. A
    long nProbeSwitchPositionB //Probe Switch Position for Ch. B
)
```

**Parameters**

- **nSamplingFrequency**
  - Sampling Frequency:
    - 0: 2kHz
    - 1: 4kHz
    - 2: 8kHz
    - 3: 11.025kHz
    - 4: 16kHz
    - 5: 22.05kHz
    - 6: 32kHz
    - 7: 44.1kHz
    - 8: 48kHz
    - 9: 64kHz
    - 10: 88.2kHz
    - 11: 96kHz
    - 12: 176.4kHz
    - 13: 192kHz
    - 14: 200kHz
Note: The above options are valid if sound card MME is chosen as the ADC device in Multi-Instrument. Otherwise, the indexed sampling frequencies may be different from the above. Please check the Multi-Instrument software to see the options available for a specific ADC device.

**nSamplingChannels**

Sampling Channels:
0: A
1: A&B

Note: The above options are valid if sound card MME is chosen as the ADC device in Multi-Instrument. Otherwise, the indexed sampling channels may be different from the above. Please check the Multi-Instrument software to see the options available for a specific ADC device.

**nSamplingBitResolution**

Sampling Bit Resolution:
0: 8 Bit
1: 16 Bit
2: 24 Bit

Note: The above options are valid if sound card MME is chosen as the ADC device in Multi-Instrument. Otherwise, the indexed sampling bit resolution may be different from the above. Please check the Multi-Instrument software to see the options available for a specific ADC device.

**nRecordLength**

Record Length per frame of the oscilloscope.

**nTriggerMode**

Trigger Mode:
0: Auto
1: Normal
2: Single
3: Slow

Note: The above options are valid if sound card MME is chosen as the ADC device in Multi-Instrument. Otherwise, the indexed sampling bit resolution may be different from the above. Please check the Multi-Instrument software to see the options available for a specific ADC device.

**nTriggerSource**

Trigger Source:
0: A
1: B

Note: The above options are valid if sound card MME is chosen as the ADC device in Multi-Instrument. Otherwise, the indexed sampling bit resolution may be different from the above. Please check the Multi-Instrument software to see the options available for a specific ADC device.
**nTriggerEdge**

Trigger Source:
- 0: Up
- 1: Down
- 2: Up or Down
- 3: Jump
- 4: Differential

Note: The above options are valid if sound card MME is chosen as the ADC device in Multi-Instrument. Otherwise, the indexed sampling bit resolution may be different from the above. Please check the Multi-Instrument software to see the options available for a specific ADC device.

**nTriggerLevel**

Trigger Level, adjustable from –100%~100% depending on the ADC device used.

**nTriggerDelay**

Trigger Delay, adjustable from –100%~100% depending on the ADC device used.

**nRangeA**

ADC Range for Channel A, available options depending on the ADC device used.

**nRangeB**

ADC Range for Channel B, available options depending on the ADC device used:

**nCouplingTypeA**

Coupling Type for Channel A, available options depending on the ADC device used:
- 0: AC
- 1: DC

**nCouplingTypeB**

Coupling Type for Channel B, available options depending on the ADC device used:
- 0: AC
- 1: DC

**nProbeSwitchPositionA**

Probe Switch Position for Channel A, depending on the probe used.
- 0: 1
- 1: 2
- 2: 3

**nProbeSwitchPositionB**

Probe Switch Position for Channel B, depending on the probe used.
- 0: 1
- 1: 2
- 2: 3
Remarks
Calling this function will have no effect when the DAQ of Multi-Instrument is in running state.

2.20 SetViewParameters

The SetViewParameters sets the parameters of different views of Multi-Instrument.

```c
void SetViewParameters(
  long nViewID, //View ID
  long nViewType, //View Type
  long nParameter1, //Parameter 1
  long nParameter2, //Parameter 2
  long nParameter3, //Parameter 3
  long nParameter4, //Parameter 4
  long nParameter5, //Parameter 5
  long nParameter6, //Parameter 6
  long nParameter7, //Parameter 7
  long nParameter8, //Parameter 8
  long nParameter9, //Parameter 9
  long nParameter10, //Parameter 10
  double dParameter11, //Parameter 11
  double dParameter12 //Parameter 12
)
```

Parameters

**nViewID**

View ID:
- 0: Oscilloscope
- 1: Spectrum Analyzer
- 2: Multimeter
- 3: Spectrum 3D Plot

**nViewType**

View Type:

For Oscilloscope:
- 0: A&B
- 1: A+B
- 2: A-B
- 3: A×B
- 4: A|B

For Spectrum Analyzer:
- 0: Amplitude Spectrum
- 1: Phase Spectrum
- 2: Auto Correlation
- 3: Cross Correlation
4: Coherence Function
5: Transfer Function
6: Impulse Response

For Multimeter
0: RMS
1: dBV
2: dBu
3: dB SPL
4: dB(A)
5: dB(B)
6: dB(C)
7: Frequency Counter
8: RPM
9: Counter
10: Duty Cycle
11: F/V
12: Cycle RMS
13: Cycle Mean
14: Vibrometer

For Spectrum 3D Plot
0: Waterfall
1: Spectrogram

nParameter1
View Parameter 1:
For Oscilloscope: Reserved.
For Spectrum Analyzer: Index of FFT Size options.
For Multimeter: Counter Trigger Level (-100%~100%) for Channel A.
For Spectrum 3D Plot: Index of T Range options.

nParameter2
View Parameter 2:
For Oscilloscope: Reserved.
For Spectrum Analyzer: Index of Window Function options.
For Multimeter: Counter Trigger Level (-100%~100%) for Channel B.
For Spectrum 3D Plot: Tilt Angle (0~90 degree) of T axis

nParameter3
View Parameter 3:
For Oscilloscope: Reserved.
For Spectrum Analyzer: Index of Window Overlap options.
For Multimeter: Counter Trigger Hysteresis (0%~100%) for Channel A.
For Spectrum 3D Plot: Height Percentage (5%~90%) of Y axis

nParameter4
View Parameter 4:
For Oscilloscope: Reserved.
For Spectrum Analyzer: Reserved.
For Multimeter: Counter Trigger Hysteresis (0%~100%) for Channel B.
For Spectrum 3D Plot: Reserved.

\( nParameter5 \sim nParameter10 \)
Reserved.

\( dparameter11 \)
View Parameter 11:
   For Oscilloscope: Reserved.
   For Spectrum Analyzer: Reserved.
   For Multimeter: Counter Frequency Divider for Channel A.
   For Spectrum 3D Plot: Reserved.

\( dparameter12 \)
View Parameter 12:
   For Oscilloscope: Reserved.
   For Spectrum Analyzer: Reserved.
   For Multimeter: Counter Frequency Divider for Channel B.
   For Spectrum 3D Plot: Reserved.

### 2.21 StartDAQ

The StartDAQ function starts the DAQ.

```c
void StartDAQ()
```

### 2.22 StopDAQ

The StopDAQ function stops the DAQ.

```c
void StopDAQ()
```

### 2.23 Record

The Record function starts the DAQ in record mode.

```c
void Record()
```

### 2.24 GetDAQStatus

The GetDAQStatus function returns the DAQ status. DAQ is the short form for “Data Acquisition”.

```c
long GetDAQStatus()
```

**Return Values**
0: Stopped
1: Running

2.25 GetDDP

The GetDDP function returns the requested DDP value. DDP is the short form for “Derived Data Point”.

```c
double GetDDP(
    LPCTSTR sDDPName //DDP Name
)
```

**Parameters**

`sDDPName`

DDP name, DDP is the short form for “Derived Data Point”.

**Return Values**

1.0E40: failed.
Others: the current value of the DDP.

2.26 LoadPanelSettingFile

The LoadPanelSettingFile function loads a specified panel setting file, which can be used to set DAQ, DAO and View parameters. Those functions such as SetSignalGeneratorParameters, UpdateMultiToneItem, SetNumberOfMultiToneItems, LoadWFLibrary, SetDAQParameters and SetViewParameters introduced previously set only a limited number of parameters whereas LoadPanelSettingFile function can be used to set almost all parameters.

```c
void LoadPanelSettingFile(
    LPCTSTR sPanelSettingFileName //Panel Setting File name
)
```

**Parameters**

`sPanelSettingFileName`

Panel Setting File name.

Note: To load a panel setting file, the DAQ and DAO must be in stop state.

2.27 LoadFile

The LoadFile function loads the specified wave file or TXT file.

```c
void LoadFile(
```
LPCTSTR sFileName //File name

Parameters
sFileName
File name to be loaded.

2.28 SaveFile

The SaveFile function saves the wave data to the specified file.

void SaveFile(
LPCTSTR sFileName //File name
)

Parameters
sFileName
File name to be saved.

2.29 OscilloscopeExport

The OscilloscopeExport function exports the wave data to the specified TXT file.

void OscilloscopeExport(
LPCTSTR sFileName //File name
)

Parameters
sFileName
File name to be exported.

2.30 SpectrumAnalyzerExport

The SpectrumAnalyzerExport function exports the data in the spectrum analyzer to the specified TXT file.

void SpectrumAnalyzerExport(
LPCTSTR sFileName //File name
)

Parameters
sFileName
File name to be exported.

2.31 LockGUI
The LockGUI function locks the GUI of Multi-Instrument. GUI is the short form for “Graphical User Interface”.

```c
void LockGUI()
```

### 2.32 UnlockGUI

The UnLockGUI function unlocks the GUI of Multi-Instrument. GUI is the short form for “Graphical User Interface”.

```c
void UnlockGUI()
```

### 2.33 Unlock

The Unlock function unlocks the MI automation server so that it can be controlled by an Automation client program via its exposed interfaces. This function must be called before any Automation interfaces can be used.

```c
void Unlock(
    long nSerialNumberPart1, // serial number part 1
    long nSerialNumberPart2, // serial number part 2
    long nSerialNumberPart3, // serial number part 3
    long nSerialNumberPart4 // serial number part 4
)
```

**Parameters**

- `nSerialNumberPart1`  
  Part 1 of the serial number of the MI automation server.

- `nSerialNumberPart2`  
  Part 2 of the serial number of the MI automation server.

- `nSerialNumberPart3`  
  Part 3 of the serial number of the MI automation server.

- `nSerialNumberPart4`  
  Part 4 of the serial number of the MI automation server.

Note that:

1. The serial number has a format of part1-part2-part3-part4, where each part contains four characters in hex format

2. For copy-protected MI automation server, such as the trial version, the softkey activated version, or the USB hardkey activated version, a generic serial number F65A-7C8A-D92E-18EC should be used.
3. For not-copy-protected MI automation server, which is usually the case for OEM, a customer specific serial number will be given when the server is purchased from Virtins Technology.

### 2.34 GetADCDeviceNo

The GetADCDeviceNo function returns the ADC Device No. currently being used.

```c
long GetADCDeviceNo()
```

**Return Values**

ADC Device No.

### 2.35 GetDACDeviceNo

The GetDACDeviceNo function returns the DAC Device No. currently being used.

```c
long GetDACDeviceNo()
```

**Return Values**

DAC Device No.

### 2.36 SetADCDeviceNo

The SetADCDeviceNo function sets the ADC Device No. to be used.

```c
void SetADCDeviceNo(long nADCDeviceNo)
```

**Parameters**

*nADCDeviceNo*

ADC Device No.

**Return Values**

ADC Device No.

Note: To change the ADC Device No., the DAQ must be in stop state.

### 2.37 SetDACDeviceNo

The SetDACDeviceNo function sets the DAC Device No. to be used.

```c
void SetDACDeviceNo(long nDACDeviceNo)
```

**Parameters**

*nDACDeviceNo*
2.38 GetADCDeviceCount

The GetADCDeviceCount function returns the number of ADC Devices in the same Device Category (e.g. SoundCardMME, VT DAQ 1, etc.) in the system.

`long GetADCDeviceCount()`

**Return Values**
ADC Device Count.

Note: To change the DAC Device No., the DAO must be in stop state.

2.39 GetDACDeviceCount

The GetDACDeviceCount function returns the number of DAC Devices in the same Device Category (e.g. SoundCardMME, VT DAO 1, etc.) in the system.

`long GetDACDeviceCount()`

**Return Values**
DAC Device Count.

2.40 GetADCDeviceName

The GetADCDeviceName function returns the name of the ADC Device specified by the Device No..

`BSTR GetADCDeviceName(long nADCDeviceNo)`

**Parameters**

- `nADCDeviceNo`
  
  ADC Device No.

**Return Values**
ADC Device Name.

2.41 GetDACDeviceName

The GetDACDeviceName function returns the name of the DAC Device specified by the Device No..

`BSTR GetDACDeviceName(long nDACDeviceNo)`

**Parameters**
**nDACDeviceNo**
DAC Device No.

**Return Values**
DAC Device Name.

### 2.42 SetUDDP

The SetUDDP function assigns a value to a UDDP inside Multi-Instrument. UDDP is the short form for “User Defined Data Point”. The UDDP window in Multi-Instrument must be open but there is no need to define the UDDP manually in Multi-Instrument as its definition will be set by this function.

```c
void SetUDDP(
LPCTSTR sUDDPName //UDDP Name
double dValue
)
```

**Parameters**

- **sUDDPName**
  UDDP name, UDDP is the short form for “User Defined Data Point”. Supported UDDP names are UDDP1(UU) ~ UDDP16(UU)
- **dValue**
  The value assigned to the UDDP.

3.1 Basic Files of Multi-Instrument Automation Server

For OEM customer, the following files are the basic files required to run the Multi-Instrument Automation Server:

(1) MI.exe, MIIs.exe, MIu.exe
(2) Scins.cfg
(3) VScopeResENUS.dll
(4) ADCDevice.ddb
(5) DACDevice.ddb
(6) SoundCardMMEDAQ.dll if a sound card will be used as the ADC device
(7) SoundCardMMEDAO.dll if a sound card will be used as the DAC device
(8) VTDAQ1.dll if a VTDAQ1 device will be used as the ADC device
(9) VTDAO1.dll if a VTDAO1 device will be used as the DAC device

The type library file:

(1) MI.tlb

is also provided, which can be used during client program development.

Some hardware devices such as VT DSOs come with some hardware specific configuration files. These files should also be included in the developed software package. For VT DSOs, these files can be found in Multi-Instrument’s installation directory\HardwareConfig\….

3.2 Multi-Instrument Automation Server Registration

An automation server must be registered in the system first before it can be used by a client program. It will be automatically registered if you run the Multi-Instrument program with admin right once in the system. Just right click the MI icon on the desktop and select “Run as administrator”. Alternatively, the following commands can be used to register and unregister the automation server.

To register Multi-Instrument Automation Server, run the following command:

MI /regserver

To un-register Multi-Instrument Automation Server, run the following command:

MI /unregserver

Under Windows Vista or above, these commands must be run with the admin right. To run the command line with admin right, simply click the Start button and type “cmd” in the Instant Search field, and press CTRL+SHIFT+ENTER instead of just ENTER.
3.3 Multi-Instrument Automation Server CLSID and ProgID

CLSID: 688C2F6F-CA63-4D40-83D9-C30CA6524780
ProgID: MI.Automation

3.4 Obtain Derived Data Points (DDPs) from Hidden Multi-Instrument

As indicated in the interface specifications in Chapter 2, it is possible to show or hide the GUI components of Multi-Instrument individually, such as windows, toolbars, menus, title bars. The Derived Data Points generated from the Oscilloscope, Spectrum Analyzer and Multimeter windows will still be available through GetDDP() as long as the respective window is opened (through OpenWindow()), irrespective of whether that window or the entire Mainframe is shown or hidden (through ShowWindow()). In other words, it is possible to obtain DDPs with Multi-Instrument fully running in the background.
4. Sample Automation Client Programs

4.1 TestAutomation written in Visual Basic 6.0

The program TestAutomation demonstrates how to use the Automation interfaces exposed by the Multi-Instrument Automation Server to control the Multi-Instrument program. There are four lines of push buttons on the top of Multi-Instrument program (see screenshot above). The labels on these buttons are self-explanatory. You can use these buttons to control the Multi-Instrument program.

To launch the Automation Server in Visual Basic, only two lines of codes are required:

```vba
Dim TestMI As Object
Set TestMI = CreateObject("MI.Automation")
```

After that, you can use any Automation interfaces by simply calling:

```vba
Call TestMI.xxxx
```

where xxxx is the interfacing API documented in Chapter 2. Note that you must call the Unlock function with the correct serial number first before you can use other interfacing APIs.
4.2 TestAutomation written in Visual C++ 6.0

It has the same functionality as its counterpart in Visual Basic, as shown above. Among the project files, there are two files named: MI.h and MI.cpp. They were generated by “Add Class” from the type library “MI.tlb” using the MFC ClassWizard.

To launch the Automation Server in Visual C++, only three lines of codes are required

1. AfxOleInit() // It is in InitInstance() in TestAutomation.cpp
   It is used to initialize the OLE library.

2. IAutomation m_Automation // It is in TestAutomationDlg.h

3. m_Automation.CreateDispatch("MI.Automation")
   // It is in OnInitDialog() in TestAutomationDlg.cpp

The above (2) and (3) creates an IDispatch object and attaches it to the COleDispatchDriver object. After this, you can use any Automation interfaces by simply calling:

   M_Automation.xxxx

where xxxxx is the interfacing API documented in Chapter 2. Note that you must call the Unlock function with the correct serial number first before you can use other interfacing APIs.
4.3 TestAutomation written in Visual C# 2012

It has the same functionality as its counterpart in Visual Basic, as shown above.

To launch the Automation Server in Visual C#, only two lines of codes are required:

```
Type objType = System.Type.GetTypeFromProgID("MI.Automation");
dynamic MIautomation = System.Activator.CreateInstance(objType);
```

After that, you can use any Automation interfaces by simply calling:

```
MIautomation.xxxx
```

where `xxxx` is the interfacing API documented in Chapter 2. Note that you must call the `Unlock` function with the correct serial number first before you can use other interfacing APIs.
4.4 TestAutomation written in Python 3.7.3

It has the same functionality as its counterpart in Visual Basic, as shown above.

To launch the Automation Server in Python, only two lines of codes are required:

```python
import win32com.client
MIautomation = win32com.client.Dispatch("MI.Automation")
```

After that, you can use any Automation interfaces by simply calling:

```python
MIautomation.xxxx
```

where `xxxx` is the interfacing API documented in Chapter 2. Note that you must call the Unlock function with the correct serial number first before you can use other interfacing APIs.
5. An Automation Client and Server Integration Example