Multi-Instrument Automation Server Interfaces

Version 1.12

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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.

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

Parameters

nWindowID

Window ID. It specifies which window to operate.

-1: All
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

90~121: DDP Viewer

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 *nWindowID* = 4 (Signal Generator)
101: Reset the "Show Edit" flag, applicable only if *nWindowID* = 4 (Signal Generator)

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.

2.2 OpenWindow

The OpenWindow function opens the specified window.

```
void OpenWindow(
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
90~121: DDP Viewer

2.3 CloseWindow

The CloseWindow function closes the specified window.

```
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
90~121: DDP Viewer

2.4 MoveWindow

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

```
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.

-2: Set MainframeStickyMoveFlag to TRUE, the rest of parameters are ignored.
-1: Set MainframeStickyMoveFlag to FALSE, the rest of parameters are ignored.
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
90~121: DDP Viewer
Note: if MainFrameStickyMoveFlag=TRUE, moving the Mainframe will move the rest of windows together.

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.

```
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.

```
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
90~121: DDP Viewer

2.11 HideTitlebar

The HideTitlebar function hides the specified toolbar.

```
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.

```
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

nLinearLogB

Linear/Log sweep Mode for channel B:

0: Linear
1: Log

dDutyCycleA

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

dDutyCycleB

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

nMLSLength

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.

```
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 ½ 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.

```
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.

```
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.

```
void StartDAO()
```

2.17 StopDAO

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

```
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".

```
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.

```
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: dBSPL
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~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.

```
void StartDAQ()
```

2.22 StopDAQ

The StopDAQ function stops the DAQ.

```
void StopDAQ()
```

2.23 Record

The Record function starts the DAQ in record mode.

```
void Record()
```

2.24 GetDAQStatus

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

```
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".

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

Parameters

sDDPName

Two types of names are supported:
(1) DDP name, DDP is the short form for "Derived Data Point".
(2) DDP viewer's value and alarm limits in the following forms:

- xx or xxx for value, where xx or xxx represents the Window ID of a DDP viewer, which is in the range of 90~121.
- xx.LL or xxx.LL for Low-Low Limit
- xx.L or xxx.L for Low Limit
- xx.H or xxx.H for High Limit
- xx.HH or xxx.HH for High-High Limit

Return Values
1.0E40: failed.
Others: the current value of the DDP or DDP viewer's properties.

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.

```
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. If the main frame is hidden, the loaded windows and panels will also be hidden.

2.27 LoadFile

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

```
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".

```
void LockGUI()
```

2.32 UnlockGUI

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

```
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 the its exposed interfaces. This function must be called before any Automation interfaces can be used.

```
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.

nSerialNumberPart1

Part 2 of the serial number of the MI automation server.

nSerialNumberPart1
Part 3 of the serial number of the MI automation server.

nSerialNumberPart1
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.

```
long GetADCDeviceNo()
```

Return Values
ADC Device No.

2.35 GetDACDeviceNo

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

```
long GetDACDeviceNo()
```

Return Values
DAC Device No.

2.36 SetADCDeviceNo

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

```
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.

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

Parameters
nDACDeviceNo
DAC Device No.

Return Values
DAC Device No.

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

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.

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.

```
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.

2.43 AckDDPAlarm

This function is used to acknowledge a DDP alarm.

```
void AckDDPAlarm(
long nWindowID // Window ID
);
```

Parameters
nWindowID
Window ID. It specifies which DDP Viewer's alarm to acknowledge.

90~121: DDP Viewer 1~32.

2.44 CopyToClipboard

The CopyToClipboard function copies data in a specified window to Windows clipboard or a shared memory. An ActiveX automation client or other programs can paste them out later or read from the shared memory.

```
BOOL CopyToClipboard(
long nWindowID, // Window ID
long nMode, // Mode
);
```

Parameters

nWindowID

Window ID. It specifies which window to operate.

1: Oscilloscope
2: Spectrum Analyzer
3: Nil
4: Nil
5: Spectrum 3D Plot
60~67: Data Logger
80~87: DDC
89: DDP Array Viewer
90~121: DDP Viewer

nMode

Mode. It specifies what kind of data to be copied.

0: Copy As Text
1: Copy As Bitmap, not applicable for DDP Array Viewer and DDP Viewer.
2: Copy As Binary to a shared memory named "Local\\MISharedMemory". Windows API - OpenFileMapping() and MapViewOfFile() can be used to obtain a pointer to the binary data in the memory. The first 80 bytes of the binary data contain the header information, as shown below:
(1) DWORD [0]: total number of bytes including header
(2) DWORD [1]: number of bytes per data item, which is always 8 for a 64-bit double.
(3) 64-bit double [0]: equals to DDP – "NumberOfFrames".
(4) 64-bit double [1]~[8]: reserved.
The binary data following the header are stored in 64-bit double-precision floating-point format. These data are the same as those obtained using the "Copy As Text" command, except they exclude the sequential numbers that often appear in the first column and the regularly spaced time or frequency data that often appear in the second column. An absolute time stamp (e.g. in Data Logger and Spectrum 3D Plot) is stored in two consecutive doubles: Time in seconds since midnight (00:00:00), January 1, 1970, and fraction of a second in milliseconds.

Return Values

True: Successful

False: Failed

2.45 LoadFileWithCurrentPanelSetting

The LoadFileWithCurrentPanelSetting function loads the specified wave file or TXT file with the current panel setting.

```
void LoadFileWithCurrentPanelSetting(
LPCTSTR sFileName //File name
)
```

Parameters

sFileName

File name to be loaded.

2.46 SetSignalGeneratorDCoffsets

The SetSignalGeneratorDCoffsets function sets the DC offsets of the Signal Generator.

```
void SetSignalGeneratorDCoffsets(
double dDCoffsetA //DC offset for Signal Generator Channel A
double dDCoffsetB //DC offset for Signal Generator Channel B
)
```

Parameters

dDCoffsetA

DC offset in DAC engineering unit for Signal Generator Channel A.

dDCoffsetB

DC offset in DAC engineering unit for Signal Generator Channel B.

3. Multi-Instrument Automation Client Program Development Guide

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, MIs.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

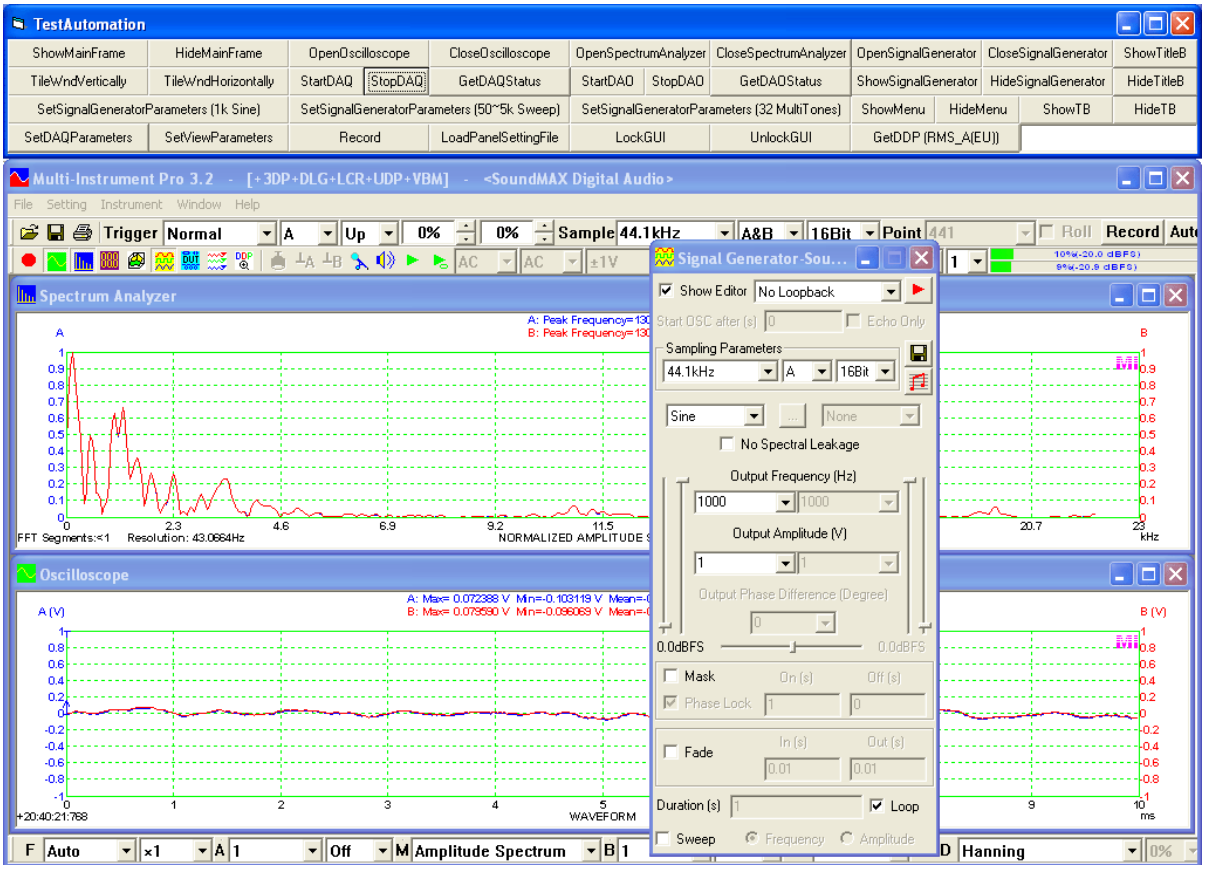
CLSID: 688C2F6F-CA63-4D40-83D9-C30CA6524780
ProgID: MI.Automation

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:

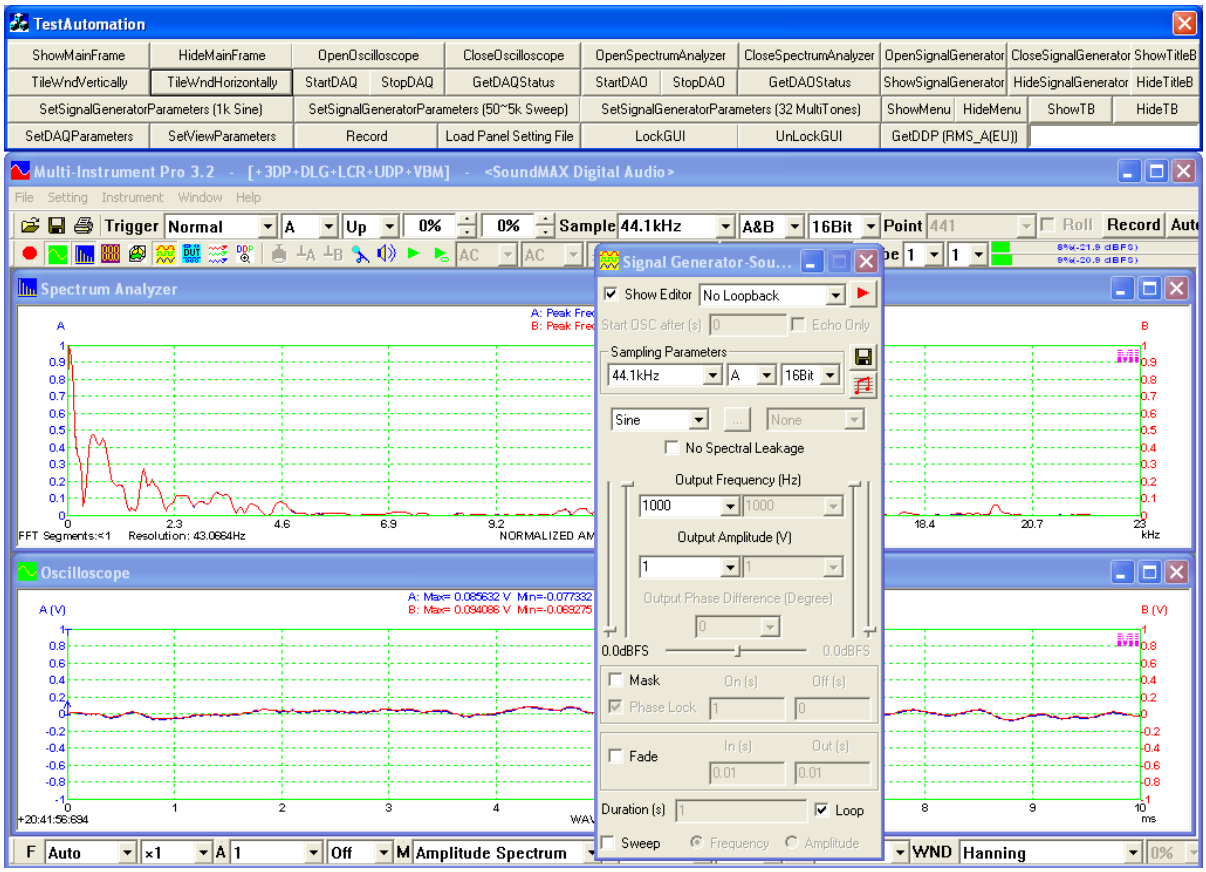
```
Dim TestMI As Object
Set TestMI = CreateObject("MI.Automation")
```

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

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

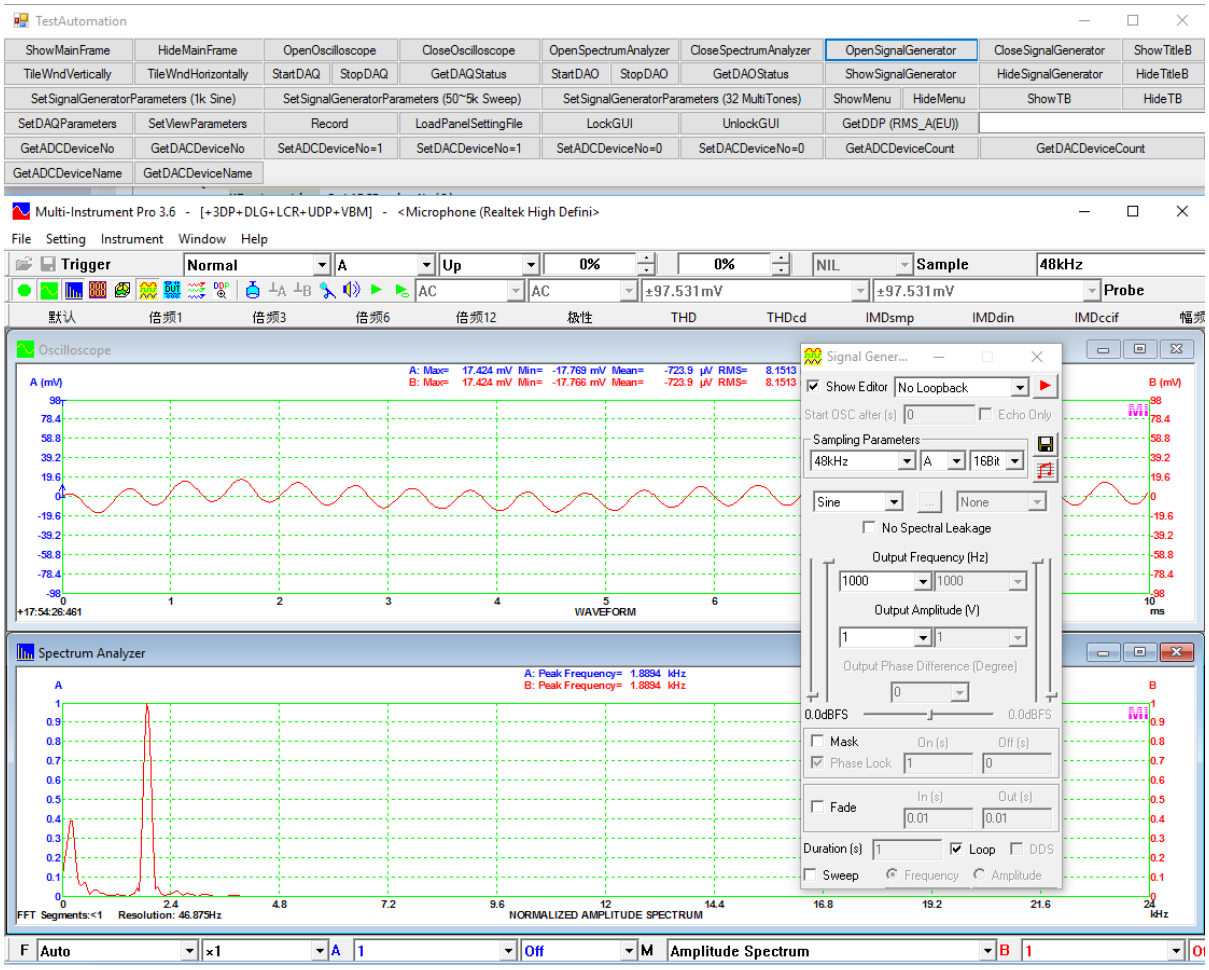
(3) `m_Automation.CreateDispatch("MI.Automation")`
// It is in OnInitDialog() in TestAutomationDlg.cpp

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 `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.

4.3 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:

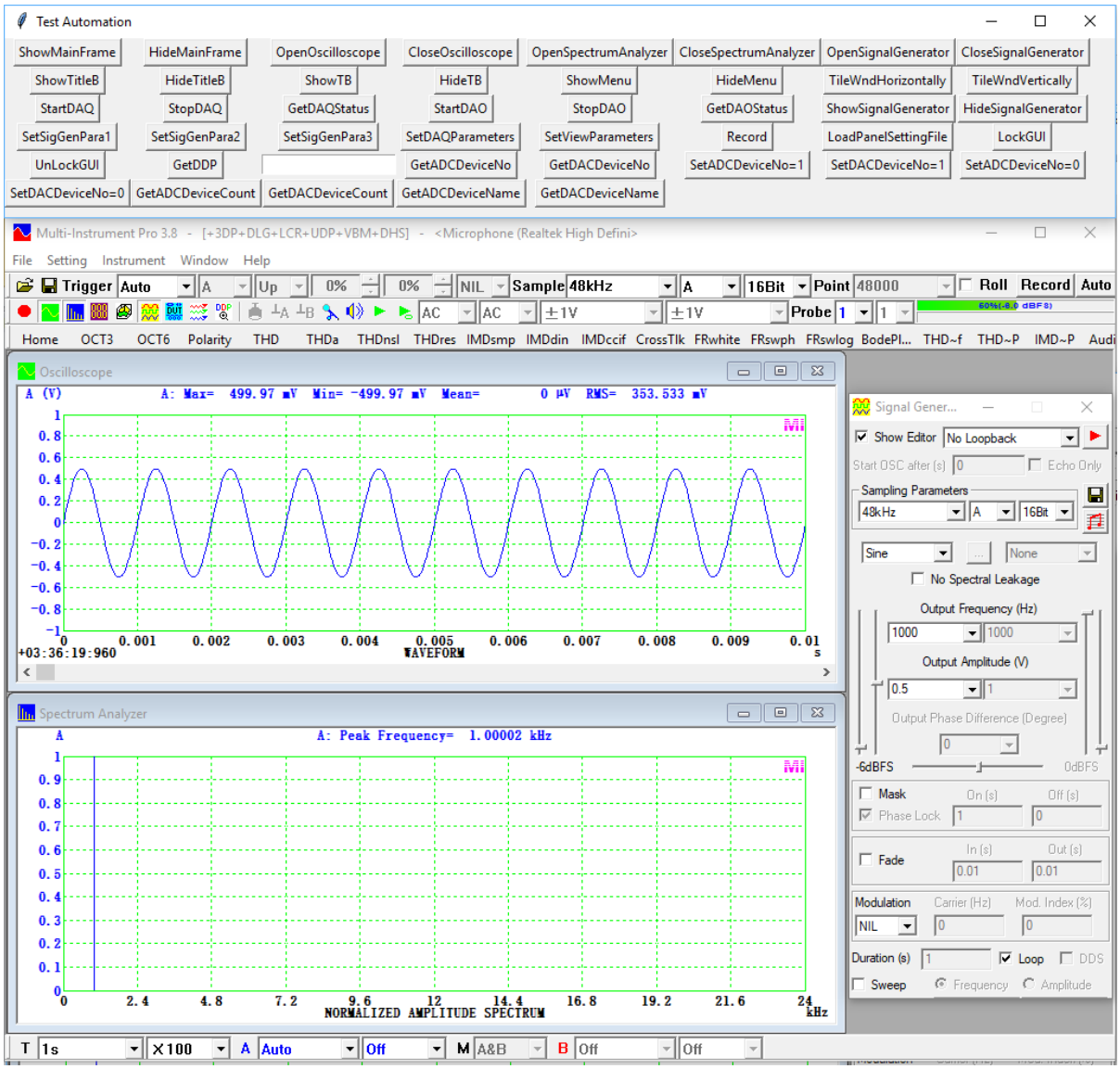
```
Type objType = System.Type.GetTypeFromProgID("MI.Automation");
dynamic MIautomation=System.Activator.CreateInstance(objType);
```

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:

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

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.

5. An Automation Client and Server Integration Example