Orchid-16

Functional Driver User Manual

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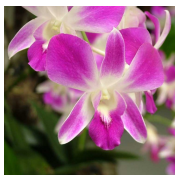
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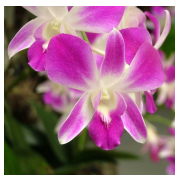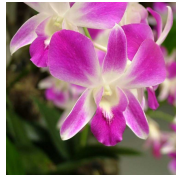| Revision	Date	Author	Remarks
1.0.0	10 July 2010	Jieyun Huang Michael Xu	First Release with listing of all functions
1.1.0	25 Aug 2010	Jieyun Huang	Add GetMeasMode_ByChannel( ) and GetForceMode_ByChannel( ) functions Output measurement result array as string for use in VB6
1.1.1	27 Aug 2010	Jieyun Huang	Split measure result array and result string into two function
1.2.0	06 Sep 2010	Jieyun Huang Michael Xu	Add get clamp alarm status function Add clamp level check Specify function input and output parameters
2.0.0	22 Dec 2010	Jieyun Huang	Add ini file for parameter configuration Add Set Relay function
2.1.0	23 Jan 2011	Michael Xu	Removed ini file. Revamped all function definitions to include FlexRIO device name. Load calibration data. Configure voltage range. Set time out.
2.1.0.1	12 Oct 2011	Michael Xu	Removed description for LoadCalibrationData( ) as this function is incorporated into Initialization. Added calibration data description to Initialization( ).

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1 Configuration Functions

1.1 Initialization

int32_t Initialization(char DeviceName[], int32_t *NumOfChannels, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function obtains FlexRIO reference for the specified FlexRIO device, detects Orchid resources and returns total number of available Orchid channels for the particular FlexRIO resource. It also initializes Orchid hardware to the default status. This must be the first function call before any other functions.

Intialization function loads the calibraton data from the EEPROM of the Orchid hardware and save it as a local calibration file.

If there are 2 Orchid cards connected to a single FlexRIO, make sure these 2 Orchid cards are set to different EEPROM address: 0 and 1. For more details, refer to the hardware installation guide.

- For Orchid card connected to FlexRIO adapter J2 connector, leave header J16 and J17 open to set the EEPROM address to 0.
- For Orchid card connected to FlexRIO adapter J3 connector, short J16 with a jumper to set the EEPROM address to 1.

✎

The first time Initialization is run on a new PC, it will take a couple of minutes to read out all the data from the hardware. Subsequently, it will load the data from the calibration file and hence the initialization time will be much shorter.

Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

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Output:

- **NumOfChannels** is a 32-bit integer that specifies total number available Orchid channels. It should be either 16 or 32 depending on how many Orchid cards are connected to the FlexRIO.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

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1.2 ResetAll

int32_t ResetAll(char DeviceName[], char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function performs a hardware reset on all Orchid devices connected to the specified FlexRIO resource and restores them to initialization status.
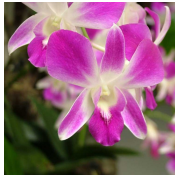
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

1.3 CloseAll

int32_t CloseAll(char DeviceName[], char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function closes the specified FlexRIO reference that has been opened by Initialization. It should be the last function to call, upon completion of all test functions.
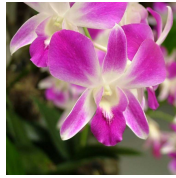
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

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1.4 ConfigureVoltageRange

int32_t ConfigureVoltageRange(char DeviceName[], int32_t ModuleA1Voltage, int32_t ModuleA2Voltage, int32_t ModuleB1Voltage, int32_t ModuleB2Voltage, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function configures the output voltage range of Orchid card's individual modules. These settings should match the actual hardware configuration. For more details, refer to the hardware installation guide.

If there are 2 Orchid cards connected to a single FlexRIO, these 2 Orchids are known as A and B. Orchid A is connected to FlexRIO adapter J2 connector. Orchid B is connected to FlexRIO adapter J3 connector. Each Orchid has two modules (8 channels on each module) known as 1 and 2.

By default, upon initialization, Orchid cards' modules are configured as -11.25V~+11.25V voltage range. Therefore it is not necessary to use this function when using Orchid under the default voltage range.
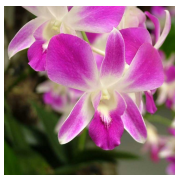
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ModuleA1Voltage** is a 32-bit integer that specifies the voltage range of Module 1 on Orchid A. 0 = -11.25V~+11.25V, 1 = 0V~+22.5V, 2 = -16.25V~+6.25V
- **ModuleA2Voltage** is a 32-bit integer that specifies the voltage range of Module 2 on Orchid A. 0 = -11.25V~+11.25V, 1 = 0V~+22.5V, 2 = -16.25V~+6.25V
- **ModuleB1Voltage** is a 32-bit integer that specifies the voltage range of Module 1 on Orchid B. 0 = -11.25V~+11.25V, 1 = 0V~+22.5V, 2 = -16.25V~+6.25V
- **ModuleB2Voltage** is a 32-bit integer that specifies the voltage range of Module 2 on Orchid B. 0 = -11.25V~+11.25V, 1 = 0V~+22.5V, 2 = -16.25V~+6.25V
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

1.5 SetGlobalTimeOut

int32_t SetGlobalTimeOut(int32_t TimeOutMs, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function sets the milliseconds to wait before time out when writing to or reading from Orchid hardware. Negative value means never time out, e.g. TimeOutMs = -1.

Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **TimeOutMs** is a 32-bit integer that specifies the time out value. Unit is millisecond.
- **ErrorMsgLen** is a 32-bit integer that specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2 PPMU Functions

2.1 Force Voltage by Channel

int32_t FV_ByChannel(char DeviceName[], char ChannelList[], double ForceVoltageValue_V, char CurrentRange[], double ICH_uA, double ICL_uA, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function sets the selected channels to force voltage mode. ICH and ICL should be within current range and ICH must be 5% of current range greater than ICL at least.
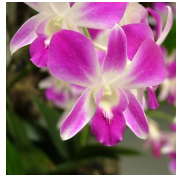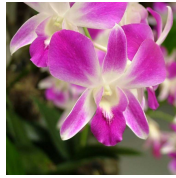
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceVoltageValue_V**: double, voltage level to be forced and should be within the power domain system selected when initilization. Unit is V.
- **CurrentRange**: string, selects the current range, value {Ext 80mA, 2mA, 200uA, 20uA, 5uA, default = 2mA}.
- **ICH_uA**: double, current clamp high level and it should be winthin the selected current range. Unit is μA.
- **ICL_uA**: double, current clamp low level and it should be winthin the selected current range. Unit is μA.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.2 Force Current by Channel

int32_t FI_ByChannel(char DeviceName[], char ChannelList[], double ForceCurrentValue_uA, char CurrentRange[], double VCH_V, double VCL_V, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function sets the selected channels to force current mode. VCH and VCL should be within the device voltage range. VCH must be greater than VCL and there should be at least 500mV gap between them.
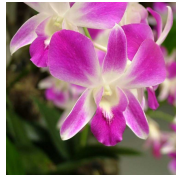
Return Value:

Return vaule is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceCurrentValue_uA**: double, current to be forced and should be winthin the selected current range. Unit is µA.
- **CurrentRange**: string, selects the current range, value {Ext 80mA, 2mA, 200uA, 20uA, 5uA, default = 2mA}.
- **VCH_V**: double, voltage clamp high level and it should be within the power domain system selected when initilization. Unit is V.
- **VCL_V**: double, voltage clamp low level and it should be within the power domain system selected when initilization. Unit is V.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.3 Force High-Z by Channel

int32_t ForceHighZ_ByChannel(char DeviceName[], char ChannelList[], char ErrorMsg[], int32_t ErrorMsgLen)

Description:

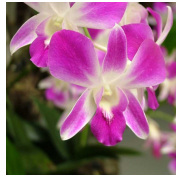This function sets selected channel to force high-Z mode.

Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.4   Measure Voltage by Channel

int32_t MV_ByChannel(char DeviceName[], char ChannelList[], double Result_V[], int32_t ResultLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function measures the selected channel voltage value. The result is output as a 1-D array in the same sequence as channel input.
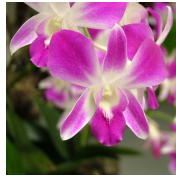
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ResultLen**: 32-bit integer, number of element in the Result_V array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **Result_V**: 1-D double array, measured channel voltage value in the same sequence as channel input, unit is V. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.5 Measure Current by Channel

int32_t MI_ByChannel(char DeviceName[], char ChannelList[], double Result_uA[], int32_t ResultLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function measures the selected channel current value. The result is output as a 1-D array in the same sequence as channel input.
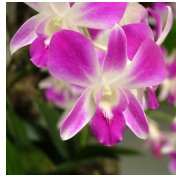
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ResultLen**: 32-bit integer, number of element in the Result_uA array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **Result_uA**: 1-D double array, measured channel current value in the same sequence as channel input, unit is µA. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.6   Get Force Mode by Channel

int32_t GetForceMode_ByChannel(char DeviceName[], char ChannelList[], int32_t ForceMode[], int32_t ForceModeLen, int32_t CurrentRange[], int32_t CurrentRangeLen, double ForceValue[], int32_t ForceValueLen, int32_t ClampEnabled[], int32_t ClampEnabledLen, double CLH[], int32_t CLHLen, double CLL[], int32_t CLLLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function returns the force mode parameters of the selected channels. Each parameter is returned as a 1-D array.

Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.
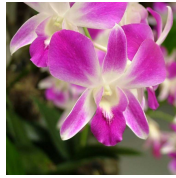
Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceModeLen**: 32-bit integer, number of element in the ForceMode array to be retrieved.
- **CurrentRangeLen**: 32-bit integer, number of element in the CurrentRange array to be retrieved.
- **ForceValueLen**: 32-bit integer, number of element in the ForceValue array to be retrieved.
- **ClampEnabledLen**: 32-bit integer, number of element in the ClampEnabled array to be retrieved.
- **CLHLen**: 32-bit integer, number of element in the CLH array to be retrieved.
- **CLLLen**: 32-bit integer, number of element in the CLL array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ForceMode**: 1-D integer array, selected channel force mode in the same sequence as channel input, value{0 = FV mode, 1 = FI mode, 2 = ForceHigh-Z mode}. Array size is equal to the number of channels.
- **CurrentRange**: 1-D integer array, channel selectd current range in the same sequence as channel input, value{0 = 5uA, 1 = 20uA, 2 = 200uA, 3 = 2mA, 4 = Ext80mA}. When channel is in Force High-Z mode, the current range should be ingored. Array size is equal to the number of channels.
- **ForceValue**: 1-D double array, channel force value in the same sequence as channel input. When channel is in FV mode, unit is V. When channel is in FI mode, unit is μA. When channel is in force

High-Z mode, the force value should be ingored. Array size is equal to the number of channels.

- **ClampEnabled**: 1-D integer array, channel clamp function enabled or not in the same sequence as channel input, value{0 = Disabled, 1 = Enabled}. When channel is in FV mode, the clamp is current clamp. When channel is in FI mode, the clamp is voltage clamp. When channel is in Force High-Z mode, clamp is voltage clamp. Array size is equal to the number of channels.
- **CLH**: 1-D double array, channel clamp high level in the same sequence as channel input. When channel is in voltage clamp, unit is V. When channel is in current clamp, unit is µA. When channel's ClampEnabled function is Disabled, the clamp value should be ingored. Array size is equal to the number of channels.
- **CLL**: 1-D double array, channel clamp low level in the same sequence as channel input. When channel is in voltage clamp, unit is V. When channel is in current clamp, unit is µA. When channel's ClampEnabled function is Disabled, the clamp value should be ingored. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.
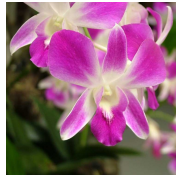
2.7 Get Measure Mode by Channel

int32_t GetMeasureMode_ByChannel(char DeviceName[], char ChannelList[], int32_t MeasureMode[], int32_t MeasureModeLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function returns the current measure mode of the selected channels. The result is output as a 1-D array in the same sequence as channel input.
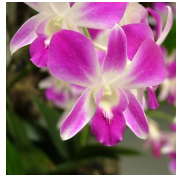
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **MeasureModeLen**: 32-bit integer, number of element in the MeasureMode array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **MeasureMode**: 1-D integer array, channel current measure mode in the same sequence as channel input, value{0 = MI mode, 1 = MV mode, 2 = Mtemp mode, 3 = Disabled}. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.8 Get Clamp Alarm Status by Channel

int32_t GetClampAlarmStatus_ByChannel(char DeviceName[], char ChannelList[], int32_t ClampAlarm[], int32_t ClampAlarmLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function returns the clamp alarm status of the selected channels. The result is output as a 1-D array in the same sequence as channel input.
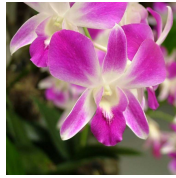
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ClampAlarmLen**: 32-bit integer, number of element in the ClampAlarm array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ClampAlarm**: 1-D integer array, channel clamp alarm status in the same sequence as channel input, value{0 = No Alarm, 1 = Alarm}. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.9 Force Voltage Measure Voltage by Channel

int32_t FVMV_ByChannel(char DeviceName[], char ChannelList[], double ForceVoltageValue_V, char CurrentRange[], double ICH_uA, double ICL_uA, double Result_V[], int32_t ResultLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function forces voltage to selected channel and then measures the voltage. ICH and ICL should be within current range and ICH must be 5% of current range greater than ICL at least. The result is output as a 1-D array in the same sequence as channel input.
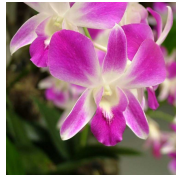
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceVoltageValue_V**: double, voltage level to be forced and should be within the power domain system selected when initilization. Unit is V.
- **CurrentRange**: string, selects the current range, value {Ext 80mA, 2mA, 200uA, 20uA, 5uA, default = 2mA}.
- **ICH_uA**: double, current clamp high level and it should be winthin the selected current range. Unit is µA.
- **ICL_uA**: double, current clamp low level and it should be winthin the selected current range. Unit is µA.
- **ResultLen**: 32-bit integer, number of element in the Result_V array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **Result_V**: 1-D double array, measured channel voltage value in the same sequence as channel input, unit is V. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

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2.10 Force Voltage Measure Current by Channel

int32_t FVMI_ByChannel(char DeviceName[], char ChannelList[], double ForceVoltageValue_V, char CurrentRange[], double ICH_uA, double ICL_uA, double Result_uA[], int32_t ResultLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function forces votlage to the selected channel and then measures the current. ICH and ICL should be within current range and ICH must be 5% of current range greater than ICL at least. The result is output as a 1-D array in the same sequence as channel input.
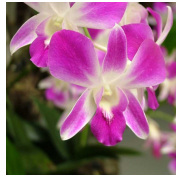
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceVoltageValue_V**: double, voltage level to be forced and should be within the power domain system selected when initilization. Unit is V.
- **CurrentRange**: string, selects the current range, value {Ext 80mA, 2mA, 200uA, 20uA, 5uA, default = 2mA}.
- **ICH_uA**: double, current clamp high level and it should be winthin the selected current range. Unit is µA.
- **ICL_uA**: double, current clamp low level and it should be winthin the selected current range. Unit is µA.
- **ResultLen**: 32-bit integer, number of element in the Result_uA array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **Result_uA**: 1-D double array, measured channel current value in the same sequence as channel input, unit is µA. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.11 Force Current Measure Voltage by Channel

int32_t FIMV_ByChannel(char DeviceName[], char ChannelList[], double ForceCurrentValue_uA, char CurrentRange[], double VCH_V, double VCL_V, double Result_V[], int32_t ResultLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function forces current for the selected channel and then measures the voltage. VCH and VCL should be within the power domain system selected when initilization. VCH must be greater than VCL and there should be 500mV gap between them at least. The result is output as a 1-D array in the same sequence as channel input.
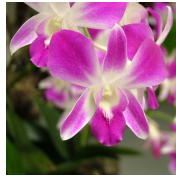
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceCurrentValue_uA**: double, current to be forced and should be winthin the selected current range. Unit is μA.
- **CurrentRange**: string, selects the current range, value {Ext 80mA, 2mA, 200uA, 20uA, 5uA, default = 2mA}.
- **VCH_V**: double, voltage clamp high level and it should be within the power domain system selected when initilization. Unit is V.
- **VCL_V**: double, voltage clamp low level and it should be within the power domain system selected when initilization. Unit is V.
- **ResultLen**: 32-bit integer, number of element in the Result_V array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **Result_V**: 1-D double array, measured channel voltage value in the same sequence as channel input, unit is V. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

2.12 Force Current Measure Current by Channel

int32_t FIMI_ByChannel(char DeviceName[], char ChannelList[], double ForceCurrentValue_uA, char CurrentRange[], double VCH_V, double VCL_V, double Result_uA[], int32_t ResultLen, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function forces current for the selected channel and then measures the current. VCH and VCL should be within the power domain system selected when initilization. VCH must be greater than VCL and there should be 500mV gap between them at least. The result is output as a 1-D array in the same sequence as channel input.
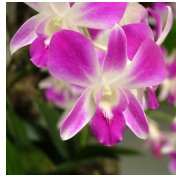
Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **ChannelList**: string, list of the channel number to perform PPMU function. Each section is delimited by comma. The input can be a single number or several channels including start and stop channels, e.g. 0,2,1,1,0-3.
- **ForceCurrentValue_uA**: double, current to be forced and should be winthin the selected current range. Unit is μA.
- **CurrentRange**: string, selects the current range, value {Ext 80mA, 2mA, 200uA, 20uA, 5uA, default = 2mA}.
- **VCH_V**: double, voltage clamp high level and it should be within the power domain system selected when initilization. Unit is V.
- **VCL_V**: double, voltage clamp low level and it should be within the power domain system selected when initilization. Unit is V.
- **ResultLen**: 32-bit integer, number of element in the Result_uA array to be retrieved.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **Result_uA**: 1-D double array, measured channel current value in the same sequence as channel input, unit is μA. Array size is equal to the number of channels.
- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.

3   Other Functions

3.1   SetRelayDriver

int32_t SetRelayDriver(char DeviceName[], int32_t RelaySettingsA, int32_t RelaySettingsB, char ErrorMsg[], int32_t ErrorMsgLen)

Description:

This function sets the status of 16 relay drivers available on Orchid card. As it is possible to connect 2 Orchid cards to 1 FlexRIO, there are two input parameters for each of the 2 Orchid cards. RelaySettingsA is for Orchid card connected to FlexRIO adapter's J2 connector. RelaySettingsB is for Orchid card connected to FlexRIO adapter's J3 connector.

Return Value:

Return value is a 32-bit integer value. No error happens if the value is 0. Others value indicates error happens. Check ErrorMsg to get error information when value is not 0.

Input:

- **DeviceName** is a string that specifies the FlexRIO resource name (RIO0, RIO1, RIO2 etc.). FlexRIO alias name is not accepted. Only 1 resource name is allowed.
- **RelaySettingsA** is a 32-bit integer. Bit 0 to bit 15 are for relay output 0-15 respectively. High 16 bits are ignored. 0 disables the relay driver and 1 enables the relay driver.
- **RelaySettingsB** is a 32-bit integer. Bit 0 to bit 15 are for relay output 0-15 respectively. High 16 bits are ignored. 0 disables the relay driver and 1 enables the relay driver.
- **ErrorMsgLen** is a 32-bit integer specifies the length of ErrorMsg to be retrieved.

Output:

- **ErrorMsg** is a string that indicates error or warning message when return value is not 0.