VersaSTAT Developers Kit (VDK)
Manual
Version 2.20
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1.0 Overview

The VersaSTAT Developers Kit (VDK) contains a .NET Assembly (Control) that provides control and data retrieval functionality of all VersaSTAT based instruments. This control can be used with any programming language that supports .NET 3.5 Assemblies, such as Microsoft Visual Studio and LabView. Examples for both are provided and explained below.

As the VersaSTAT Developers Kit (VDK) is a free product, Princeton Applied Research can only provided limited support. The VDK is provided "AS IS" and does not include any warranty of any type.

2.0 Boosters

If a booster is used, ensure that all experiments are set to 2mA current range and the electrometer is set to "DIFFERENTIAL".

3.0 Programmers Reference

Below is the complete list of methods and properties provided by the control.

Instrument class (allows connection to instrument):

Methods:

int FindNext(int iStartIndex) - returns the serial number of the next available instrument. The iStartIndex parameter is used if more than one instrument is attached to the USB. To request the Serial Number for the first instrument, iStartIndex should be 0.

bool Connect(int iSerialNumber) – Connects to the instrument specified by the iSerialNumber parameter. Returns true if successful, false if not.

void Close() – Closes the connection to the instrument.

string GetSerialNumber() – Returns the serial number of the currently connected instrument.

string GetModel() – Returns the model of the currently connect instrument (ie VersaSTAT 3 – 400).

string GetOptions() – Returns the options of the currently connected instrument (ie FRA).

bool GetIsLowCurrentInterfacePresent() – Returns true if LCI is connected, otherwise false.

Properties:

Immediate Immediate – Returns a reference to the Immediate Class

Experiment Experiment – Returns a reference to the Experiment Class

Immediate Class (allows immediate control of the instrument)

Methods:

void SetCellOn() – Turns the instruments Cell On
void SetCellOff() – Turns the instruments Cell Off

void SetCellExternal() – Sets the instrument to use the External Cell
void SetCellInternal() – Sets the instrument to use the Internal Cell

void SetModePotentiostat() – Sets the instrument to potentiostatic mode
void SetModeGalvanostat() – Sets the instrument to galvanostat mode

void SetIRange_2A() – Sets the current range to 2A
void SetIRange_200mA() – Sets the current range to 200mA
void SetIRange_20mA() – Sets the current range to 20mA
void SetIRange_2mA() – Sets the current range to 2mA
void SetIRange_200uA() – Sets the current range to 200uA
void SetIRange_20uA() – Sets the current range to 20uA
void SetIRange_2uA() – Sets the current range to 2uA
void SetIRange_200nA() – Sets the current range to 200nA
void SetIRange_20nA() – Sets the current range to 20nA (if instrument is able)
void SetIRange_4nA() – Sets the current range to 4nA (if instrument is able)
void SetIRange_2nA() – Sets the current range to 2nA (if Low Current Interface is attached)
void SetIRange_200pA() – Sets the current range to 200pA (if Low Current Interface is attached)
void SetIRange_20pA() – Sets the current range to 20pA (if Low Current Interface is attached)
void SetIRange_4pA() – Sets the current range to 4pA (if Low Current Interface is attached)

void SetDCPotential(float fVoltage) – Sets the output DC potential to the amount provided with the fVoltage parameter, in Volts. Note this value must be within the instruments capability.

void SetDCCurrent(float fCurrent) – Sets the output DC current to the amount provided with the fCurrent parameter, in Amps. Calling this method also changes to Galvanostat mode and sets the current range to the correct value. WARNING: Once cell is enabled after setting the DC current, do not change to potentiostatic mode or change the current range, these will affect the value being applied to the cell. Note this value must be within the instruments capability.

void SetACFrequency(float fFrequency) – Sets the output AC Frequency to the value provided with the fFrequency parameter, in Hz. Note this value must be within the instruments capability.

void SetACAmplitude(float fRMSAmplitude) – Sets the output AC Amplitude to the value provided with the fRMSAmplitude parameter, in RMS Volts. Note this value must be within the instruments capabilities.

void SetACWaveformOn() – Enables the AC Waveform

void SetACWaveformOff() – Disables the AC Waveform

void UpdateStatus() – This method retrieves the status information from the instrument (it also causes the instrument to auto-range the current if an experiment sequence is not in progress). Call this prior to calling the status methods below.

double GetE() – Returns the latest stored E value
double GetI() – Returns the latest stored I value
int GetOverload() – Returns the latest overload information. 0 indicates no overload, 1 indicates I (current) Overload, 2 indicates E, Power Amp or Thermal Overload has occurred.
bool GetBoosterEnabled() – Returns the status of the booster switch, if enabled, true is returned, otherwise false is returned.
bool GetCellEnabled() – Returns the status of the cell, if enabled, true is returned, otherwise false is returned.
string GetIRange() – Returns the current range the instrument is on. Values will be either 2A, 200mA, 20mA, 2mA, 200uA, 20uA, 2uA, 200nA, 20nA or 4nA.
void SetIsolationModeOn() – For the VersaSTAT 3F ONLY
void SetIsolationModeOff() – For the VersaSTAT 3F ONLY
void SetACNotchFilter_None() - For the VersaSTAT 3F ONLY
void SetACNotchFilter_50Hz() - For the VersaSTAT 3F ONLY
void SetACNotchFilter_60Hz() - For the VersaSTAT 3F ONLY
void SetACFilters_Normal() - For the VersaSTAT 3F ONLY
void SetACFilters_Aggresive() - For the VersaSTAT 3F ONLY
void SetACFilters_MoreAggressive() - For the VersaSTAT 3F ONLY

void SetAutoIRangeOn() – Enables (default is enabled) automatic current ranging while an experiment is not running.

void SetAutoIRangeOff() –Disables automatic current ranging while an experiment is not running. This is useful when wanting to apply a DC current in immediate mode.

Experiment Class (sets up action sequences and retrieves data)

Methods:

string GetActionList() – Returns a list of comma delimited action names that are supported by the instrument that is currently connected.

void Clear() – Clears the current sequence of actions

void Start() – Starts the sequence of actions in the instrument that is currently connected.

void Stop() – Stops the sequence of actions that is currently running in the instrument that is currently connected.

void Skip() – Skips the currently running action and immediately starts the next action. If there is no more actions to run, the sequence is simply stopped.

bool IsSequenceRunning() – Returns true if a sequence is currently running on the connected instrument, false if not.

int GetNumPointsAvailable() – Returns the number of points that have been stored by the instrument after a sequence of actions has begun. Returns -1 when all data has been retrieved from the instrument.

Float GetLastMeasuredOC() – Returns the last measured Open Circuit value. This value is stored at the beginning of the sequence (and updated anytime the "AddMeasureOpenCircuit" action is called).

- The following Action Methods can be called in order to create a sequence of Actions. For example, AddOpenCircuit(string) could be called, then AddEISPotentiostatic(string) called. This would create a sequence of two actions, when started, the open circuit experiment would run, then the impedance experiment.

bool AddOpenCircuit(string strParameters) – Adds the Open Circuit experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddLinearScanVoltammetry(string strParameters) – Adds the Linear Scan Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddCyclicVoltammetry(string strParameters) – Adds the Cyclic Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddMultiCyclicVoltammetry(string strParameters) – Adds the Multi-cycle Cyclic Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddStaircaseLinearScanVoltammetry(string strParameters) – Adds the Staircase Linear Scan Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddStaircaseCyclicVoltammetry(string strParameters) – Adds the Staircase Cyclic Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddStaircaseMultiCyclicVoltammetry(string strParameters) – Adds the Staircase Multi-cycle Cyclic Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddChronoamperometry(string strParameters) – Adds the Chronoamperometry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddChronopotentiometry(string strParameters) – Adds the Chronopotentiometry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddChronocoulometry(string strParameters) – Adds the Chronocoulometry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddRecurrentPotentialPulses(string strParameters) – Adds the Recurrent Potential Pulses experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddRecurrentGalvanicPulses(string strParameters) – Adds the Recurrent Galvanic Pulses experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddFastPotentialPulses(string strParameters) – Adds the Fast Potential Pulses experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddFastGalvanicPulses(string strParameters) – Adds the Fast Galvanic Pulses experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddSquarewave(string strParameters) – Adds the Squarewave experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddDiffPulseVoltammetry(string strParameters) – Adds the Differential Pulse Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddNormalPulseVoltammetry(string strParameters) – Adds the Normal Pulse Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddReverseNormalPulseVoltammetry(string strParameters) – Adds the Reverse Normal Pulse Voltammetry experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddZeroResistanceAmmeter(string strParameters) – Adds the Zero Resistance Ammeter (ZRA) experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddGalvanicCorrosion(string strParameters) – Adds the Galvanic Corrosion experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddCyclicPolarization(string strParameters) – Adds the Cyclic Polarization experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddCorrosionOpenCircuit(string strParameters) – Adds the Corrosion Open Circuit experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddLinearPolarizationResistance(string strParameters) – Adds the Linear Polarization Resistance experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddTafel(string strParameters) – Adds the Tafel experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddPotentiostatic(string strParameters) – Adds the Potentiostatic experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddPotentiodynamic(string strParameters) – Adds the Potentiodynamic experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddGalvanostatic(string strParameters) – Adds the Galvanostatic experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddGalvanodynamic(string strParameters) – Adds the Galvanodynamic experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddEISPotentiostatic(string strParameters) – Adds the EIS Potentiostatic experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddEISGalvanostatic(string strParameters) – Adds the Galvanostatic experiment to the Action Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

bool AddMeasureOpenCircuit() – Forces the VersaSTAT to measure the open circuit, to do this the cell will be turned off momentarily.

bool AddLoop() – Allows a single or group of actions to be repeated n number of times.

bool AddAutoCurrentRangeSetup(string strParameters) – Adds Auto Current Range Setup action to the Sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddDACControl(string strParameters) – Adds the DAC Control action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddEnergyOpenCircuit(string strParameters) – Adds the Energy Open Circuit action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddMultiVertexScan(string strParameters) – Adds the Multi-Vertex Scan action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddConstantPotential (string strParameters) – Adds the Constant Potential action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddConstantCurrent(string strParameters) – Adds the Constant Current action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddConstantPower(string strParameters) – Adds the ConstantPower action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

Bool AddConstantResistance(string strParameters) – Adds the ConstantResistance action to the sequence. Returns true if action added successfully. See Table #1 for information on the required parameters.

- The following Data Retrieval Methods can be called at any time after an Action Sequence has started. Use the "GetNumPointsAvailable()" method to determine the number of points to retrieve. Data is always returned as an array of doubles. Parameter iStart is the starting index location of the data to be retrieved, parameter iNumPoints is the number of points to retrieve. For more detailed information on type, please refer to the instruments manual.

double [] GetDataPotential(int iStart, int iNumPoints)
double [] GetDataCurrent(int iStart, int iNumPoints)
double [] GetDataElapsedTime(int iStart, int iNumPoints)
double [] GetDataPoint(int iStart, int iNumPoints)
double [] GetDataCharge(int iStart, int iNumPoints)
double [] GetDataSyncADCInput(int iStart, int iNumPoints)
double [] GetDataCurrentRange(int iStart, int iNumPoints)
double [] GetDataForwardCurrent(int iStart, int iNumPoints)
double [] GetDataReverseCurrent(int iStart, int iNumPoints)
double [] GetDataDeltaCurrentFR(int iStart, int iNumPoints)
double [] GetDataDeltaCurrentRF(int iStart, int iNumPoints)
double [] GetDataAppliedPotential(int iStart, int iNumPoints)
double [] GetDataFrequency(int iStart, int iNumPoints)
double [] GetDataImpedanceMagnitude(int iStart, int iNumPoints)
double [] GetDataImpedanceReal(int iStart, int iNumPoints)
double [] GetDataImpedanceImaginary(int iStart, int iNumPoints)
double [] GetDataImpedancePhase(int iStart, int iNumPoints)
double [] GetDataAdmittanceMagnitude(int iStart, int iNumPoints)
double [] GetDataAdmittanceReal(int iStart, int iNumPoints)
double [] GetDataAdmittanceImaginary(int iStart, int iNumPoints)
double [] GetDataAdmittancePhase(int iStart, int iNumPoints)
double [] GetDataCapacitanceMagnitude(int iStart, int iNumPoints)
double [] GetDataCapacitanceReal(int iStart, int iNumPoints)
double [] GetDataCapacitanceImaginary(int iStart, int iNumPoints)
double [] GetDataVACMagnitude(int iStart, int iNumPoints)

double [] GetDataVACReal(int iStart, int iNumPoints)
double [] GetDataVACImaginary(int iStart, int iNumPoints)
double [] GetDataVACPhase(int iStart, int iNumPoints)
double [] GetDataIACMagnitude(int iStart, int iNumPoints)
double [] GetDataIACReal(int iStart, int iNumPoints)
double [] GetDataIACImaginary(int iStart, int iNumPoints)
double [] GetDataIACPhase(int iStart, int iNumPoints)
double [] GetDataAAIChn0(int iStart, int iNumPoints)
double [] GetDataAAIChn1I(int iStart, int iNumPoints)
double [] GetDataAAIChn2(int iStart, int iNumPoints)
double [] GetDataAAIChn3(int iStart, int iNumPoints)
double [] GetDataSegment(int iStart, int iNumPoints)
double [] GetDataEGain(int iStart, int iNumPoints)
double [] GetDataIGain(int iStart, int iNumPoints)
double [] GetDataSqrtOfFrequency(int iStart, int iNumPoints)
double [] GetDataOneOverSqrtOfFrequency(int iStart, int iNumPoints)
double [] GetDataOneOverCapacitance(int iStart, int iNumPoints)
double [] GetDataOneOverCapacitanceSquared(int iStart, int iNumPoints)
double [] GetDataInductance(int iStart, int iNumPoints)

Table #1 (Action Parameters)

Action	Parameters 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Common	RDE	L1T	L1D	L1V																													
Open Circuit	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	CTU	BW	LBW	ERS																	
LSV	IP	Vs	FP	Vs	SR	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW											
CV (Single)	IP	Vs	VP	Vs	VH	AH	FP	Vs	SR	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW							
CV (Multi)	IP	Vs	VP	Vs	VH	AH	VP	Vs	VH	AH	SR	C	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	FP	Vs	LBW		
Staircase LSV	IP	Vs	FP	Vs	SH	ST	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW									
Staircase CV (Single)	IP	Vs	VP	Vs	VH	AH	FP	Vs	SH	ST	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW					
Staircase CV (Multi)	IP	Vs	VP	Vs	VH	AH	VP	Vs	VH	AH	SH	ST	C	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	FP	Vs	LBW
Chronoamperometry	IP	Vs	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW												
Chronopotentiometry	IC	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	EM	EF	IF	LCO	CTU	BW	LBW																	
Chronocoulometry	IP	Vs	PE	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW											
Recurrent Pot Pulses	PP	Vs	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW												
Recurrent Gal Pulses	PC	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	EM	EF	IF	LCO	CTU	BW	LBW																	
Fast Potential Pulses	PP	Vs	Dur	PP	Vs	Dur	PP	Vs	Dur	PP	Vs	Dur	NP	TPP	C	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	BW	LBW	PP	Vs	Dur
Fast Galvanic Pulses	PC	Dur	PC	Dur	PC	Dur	PC	Dur	PC	Dur	NP	TPP	C	AM	IR	EM	EF	IF	L1T	L1D	L1V	L2T	L2D	L2V	CTU	LCO	BW	LBW					
Sq. Wave Voltammetry	IP	Vs	FP	Vs	PH	SH	F	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW									
Diff. Pulse Voltammetry	IP	Vs	FP	Vs	PH	PW	SH	SW	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW								
Norm. Pulse Voltammetry	IP	Vs	FP	Vs	PW	SH	SW	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW									
Rev. Norm. Pulse Volt.	IP	Vs	FP	Vs	PW	SH	SW	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	UD	UP	BW	LBW									
ZRA	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	CTU	BW	LBW																		
Galvanic Corrosion	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	CTU	BW	LBW	AM																	
Cyclic Polarization	IP	Vs	VP	Vs	FP	Vs	SH	ST	T	SL	TL	IR	AM	EM	EF	IF	LCO	CTU	iRC	BW	LBW												
Corrosion Open Circuit	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	CTU	BW	LBW	ERS																	
Linear Polarization Resistar	IP	Vs	FP	Vs	SH	ST	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	BW	LBW											
Tafel	IP	Vs	FP	Vs	SH	ST	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	BW	LBW											
Potentiostatic	IP	Vs	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	BW	LBW													
Potentiodynamic	IP	Vs	FP	Vs	SH	ST	L1T	L1D	L1V	L2T	L2D	L2V	IR	AM	EM	EF	IF	LCO	CTU	iRC	BW	LBW											
Galvanostatic	IC	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	AM	EM	EF	IF	LCO	CTU	BW	LBW																
Galvanodynamic	IC	Vs	FC	Vs	SH	ST	L1T	L1D	L1V	L2T	L2D	L2V	AM	EM	EF	IF	LCO	CTU	BW	LBW													
Electrochecmical Noise	TPP	Dur	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	CTU	BW	NS	LBW																	
Split LPR	Cma	Vs	Ama	Vs	SH	ST	AM	L1T	L1D	L1V	L2T	L2D	L2V	IR	EM	EF	IF	LCO	CTU	iRC	BW	RD	RDR	LBW									
Galvanic Control LPR	IC	FC	SH	ST	AM	L1T	L1D	L1V	L2T	L2D	L2V	EM	EF	IF	LCO	CTU	BW	LBW															

Action	Parameters 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Potentiostatic EIS	SF	EF	AP	PS	NP	DQ	MD	IP	Vs	IR	EM	LCO	CTU	BW	LBW																		
Galvanostatic EIS	SF	EF	AC	PS	NP	DQ	MD	IC	EM	LCO	CTU	BW	LBW																				
Loop	NB	I																															
Auto Current Range Setup	MA	MI	ICR																														
Measure Open Circuit																																	
DAC Control	IP																																
Energy Open Circuit	TPP	Dur	DR	dE	IR	AM	EM	ERS	EF	IF	BW	LBW	L1T	L1D	L1V	DTR	CTU																
Multi-Vertex Scan	IP	Vs	VP	Vs	VH	AH	VP	Vs	VH	AH	FP	Vs	SH	ST	IR	AM	EM	EF	IF	BW	LBW	iRC	UD	UP	L1T	L1D	L1V	L2T	L2D	L2V	LCO	CTU
Constant Potential	IP	Vs	TPP	Dur	DR	dI	dQ	IR	AM	EM	EF	IF	BW	LBW	iRC	UD	UP	L1T	L1D	L1V	L2T	L2D	L2V	LCO	CTU								
Constant Current	IC	TPP	Dur	DR	dE	dQ	AM	EM	EF	IF	BW	LBW	L1T	L1D	L1V	L2T	L2D	L2V	LCO	CTU													
Constant Power	PWR	CD	CL	TPP	Dur	DR	dE	dQ	AM	EM	EF	IF	BW	LBW	L1T	L1D	L1V	L2T	L2D	L2V	LCO	CTU											
Consant Resistance	RES	TPP	Dur	DR	dE	dQ	Irs	AM	EM	EF	IF	BW	LBW	L1T	L1D	L1V	L2T	L2D	L2V	LCO	CTU												

** Note, see Table #2 for Acronym Definitions

Table #2 (Parameter Acronym Definition

Parameter Acronym	Definition	Units		Parameter Values
IP	Initial Potential	V		User value -10 to 10 (could be “NOT USED” for Multi-Cycle CV)
IC	Initial Current	A		User value -.650 to .650
Vs	Versus			VS OC, VS REF or VS PREVIOUS
VP	Vertex Potential	V		User value -10 to 10 (could be “NOT USED” for Multi-Vertex Scan)
VH	Vertex Hold	s		User value
AH	Acquire data during Vertex Hold			YES or NO
FP	Final Potential	V		User value -10 to 10 (could be “NOT USED” for Multi-Cycle CV)
TPP	Time Per Point	s		User value .00001 to ?
Dur	Duration	s		User value .00001 to ?
C	Cycles	#		User value
SH	Step Height	V		User value
ST	Step Time	s		User value
L1T	Limit 1 Type			NONE, CURRENT, POTENTIAL or CHARGE
L1D	Limit 1 Direction			< or >
L1V	Limit 1 Value			User value
L2T	Limit 2 Type			NONE, CURRENT, POTENTIAL or CHARGE
L2D	Limit 2 Direction			< or >
L2V	Limit 2 Value			User value
IR	Current Range		*	AUTO, 2A, 200MA, 20MA, 2MA,200UA,20UA,2UA,200NA, 20NA or 4N
EM	Electrometer			AUTO, SINGLE ENDED or DIFFERENTIAL
EF	E Filter		**	AUTO, NONE, 200KHZ, 1KHZ, 1KHZ, 100HZ 10HZ, 1HZ
IF	I Filter		**	AUTO, NONE, 200KHZ, 1KHZ, 1KHZ, 100HZ, 10HZ, 1HZ
LCO	Leave Cell On			YES or NO
CTU	Cell To Use			INTERNAL or EXTERNAL
iRC	Enable/Disable iR Compensation			ENABLED or DISABLED
UD	User defined the amount of iR Comp	ohms		User value
UP	Use previously determined iR Comp			YES or NO
PE	Pre-Electrolosis time	s		User value
PP	Pulse Potential	V		User value
CP	Pulse Current	A		User value
PH	Pulse Height	V		User value
SR	Scan Rate	V/s		User value
F	Frequency	Hz		User value
PW	Pulse Width	s		User value
SW	Step Width	s		User value
T	Threshold Enable			DISABLED or ENABLED
SL	Start Level	V		User value
TL	Threshold Level	A		User value
AM	Acquisition Mode			AUTO, NONE, 4/4 or AVERAGE
SF	Start Frequency	Hz		User value
EF	End Frequency	Hz		User value
AP	Amplitude (Potential)	V		User value
AC	Amplitude (Current)	A		User value
PS	Point Spacing			LOGARITHMIC or LINEAR
NP	Number of Points (Frequencies to test)			User value (When Log value is Points per Decade)
DQ	Data Quality			User value 0 to 10 (default to 1)

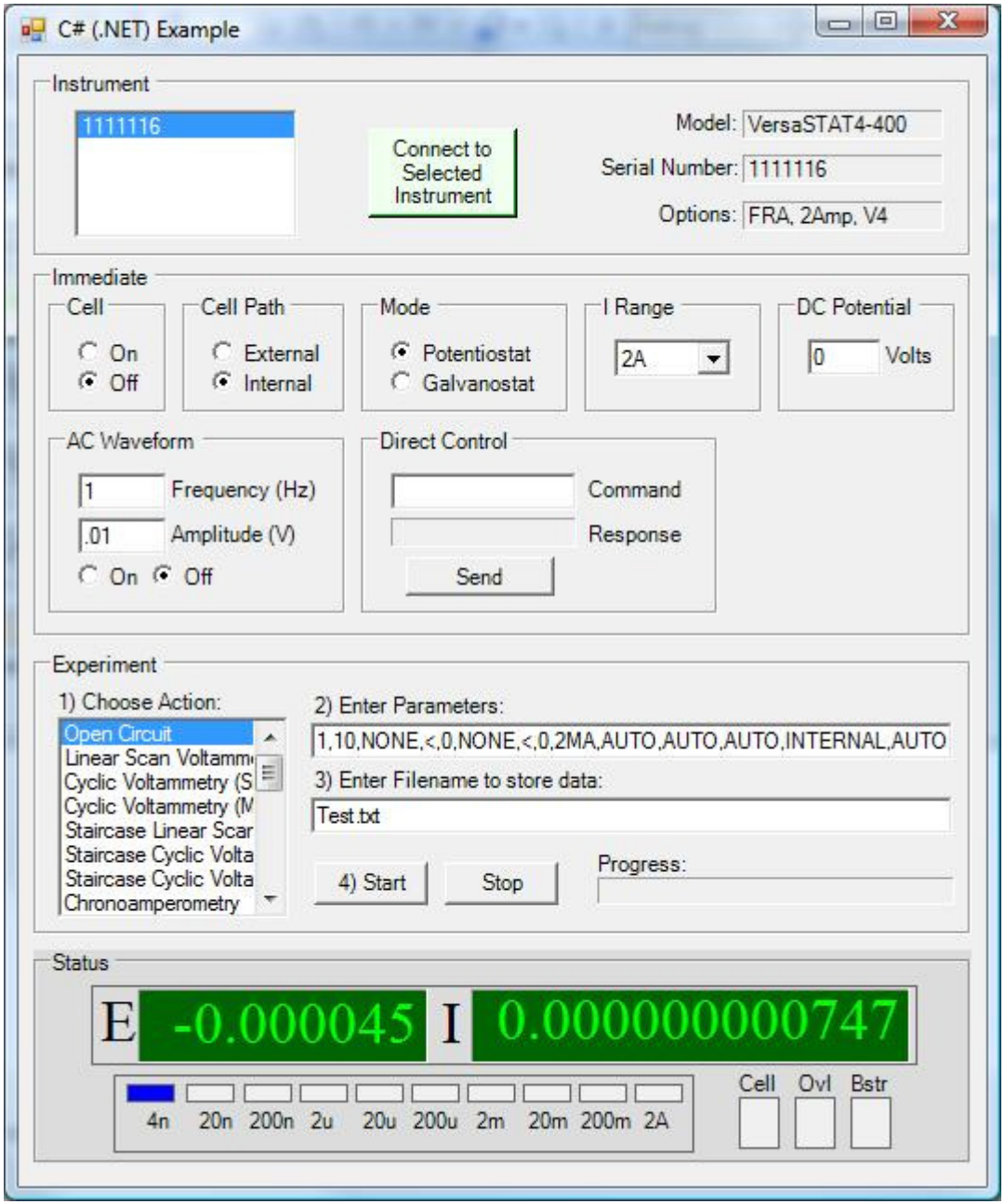
MD	Measurement Delay	s		User value (Delay between impedance points)
BW	Bandwidth		***	AUTO, HIGH STABILITY, 1MHZ, 100KHZ, 1KHZ
RDE	RDE Speed	V		Provides a voltage on the DAC Out, located on rear of instrument
NA	Number of actions back			Number of actions back in the sequence (1 would repeat the last action)
I	Number of iterations			How many times to loop
MA	Maximum Current Range to use		*	AUTO, 2A, 200MA, 20MA, 2MA,200UA,20UA,2UA,200NA, 20NA or 4NA
MI	Minimum Current Range to use		*	AUTO, 2A, 200MA, 20MA, 2MA,200UA,20UA,2UA,200NA, 20NA or 4NA
ICR	Initial Current Range		*	AUTO, 2A, 200MA, 20MA, 2MA,200UA,20UA,2UA,200NA, 20NA or 4NA
NS	Number of Segments	V		User value
RD	Rest Duration	s		User value (rest time between segments)
RDR	Rest Drift Rate	mV/min		User value (rest until drift rate is obtained)
LBW	Low Current Interface Bandwidth		****	AUTO, NORMAL, SLOW, VERY SLOW
ERS	E Resolution			AUTO, HIGH, LOW
DTR	Drift Rate	mV/min		User value (limits the drift rate)
PWR	Power	W		User value
CD	Current Direction			DISCHARGING OR CHARGING
CL	Current Limit	A		User value (absolute)
RES	Resistance	ohms		User value
DR	Delta Resolution			User value
dE	Delta Potential	V		User value
dI	Delta Current	A		User value
dQ	Delta Charge (Capacity)	C		User value

**** 20NA and 4NA only available on some instruments***
*****100Hz, 10Hz and 1Hz only available on some instruments***
****** High Stability, 1MHz, 100kHz and 10kHz only available on some instruments***
******* NORMAL, SLOW and VERY SLOW only available when the Low Current Interface is attached***

Programming Examples

3.1 Visual Studio

All sources to a C# .NET example is provided in the “\C# Example” folder. This example can be compiled and ran, as is. To add the “VersaSTATControl” to a different project, simply add a reference to the VersaSTATControl file. Then create an instance of the class.

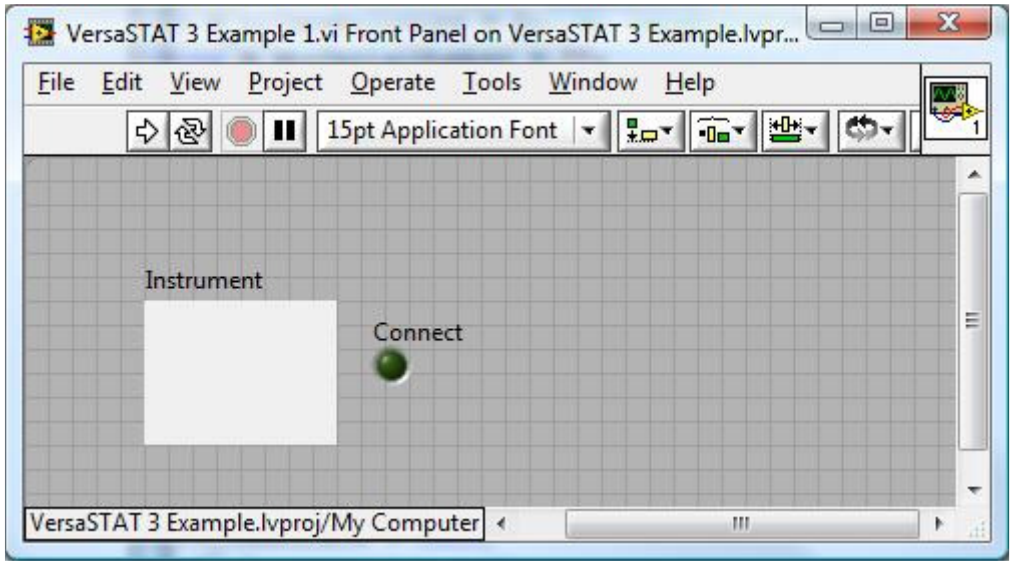

C# (.NET) Example
Instrument
1111116
Connect to Selected Instrument
Model: VersaSTAT4-400
Serial Number: 1111116
Options: FRA, 2Amp, V4
Immediate
Cell
On
Off
Cell Path
External
Internal
Mode
Potentiostat
Galvanostat
I Range
2A
DC Potential
0
Volts
AC Waveform
1
Frequency (Hz)
.01
Amplitude (V)
On
Off
Direct Control
Command
Response
Send
Experiment
1) Choose Action:
Open Circuit
Linear Scan Voltamm
Cyclic Voltammetry (S
Cyclic Voltammetry (M
Staircase Linear Scar
Staircase Cyclic Volta
Staircase Cyclic Volta
Chronoamperometry
2) Enter Parameters:
1,10,NONE,<,0,NONE,<,0,2MA,AUTO,AUTO,AUTO,INTERNAL,AUTO
3) Enter Filename to store data:
Test.txt
4) Start
Stop
Progress:
Status
E
-0.000045
I
0.000000000747
4n
20n
200n
2u
20u
200u
2m
20m
200m
2A
Cell
Ovl
Bstr

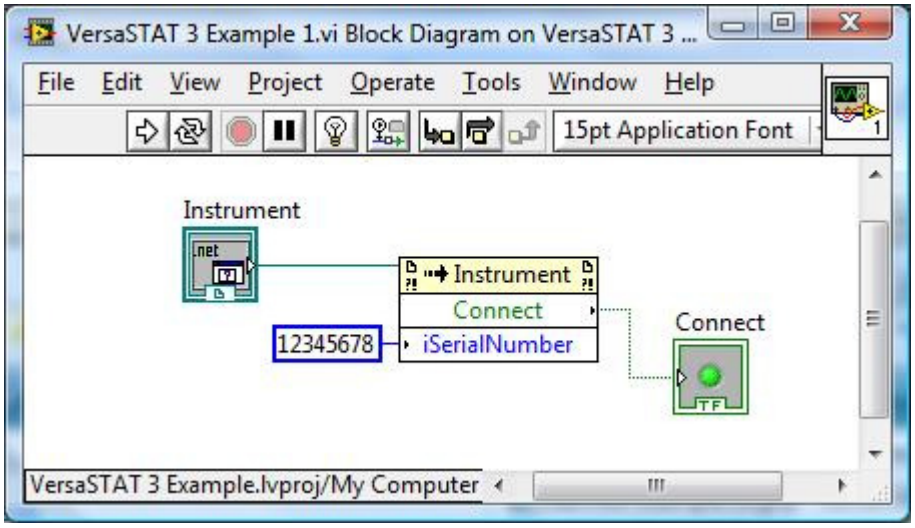
3.2 LabView

All sources to LabView examples are located in the "LabView Example" folder. Example #1 is to show how to add the .NET Control to a .vi. Example #2 shows how to run an experiment where the user defines some of the required parameters via text controls. Example #3 shows how to run "any" experiment, but parameters are entered as a string of text. This example also shows how to use the immediate commands to control the instrument.

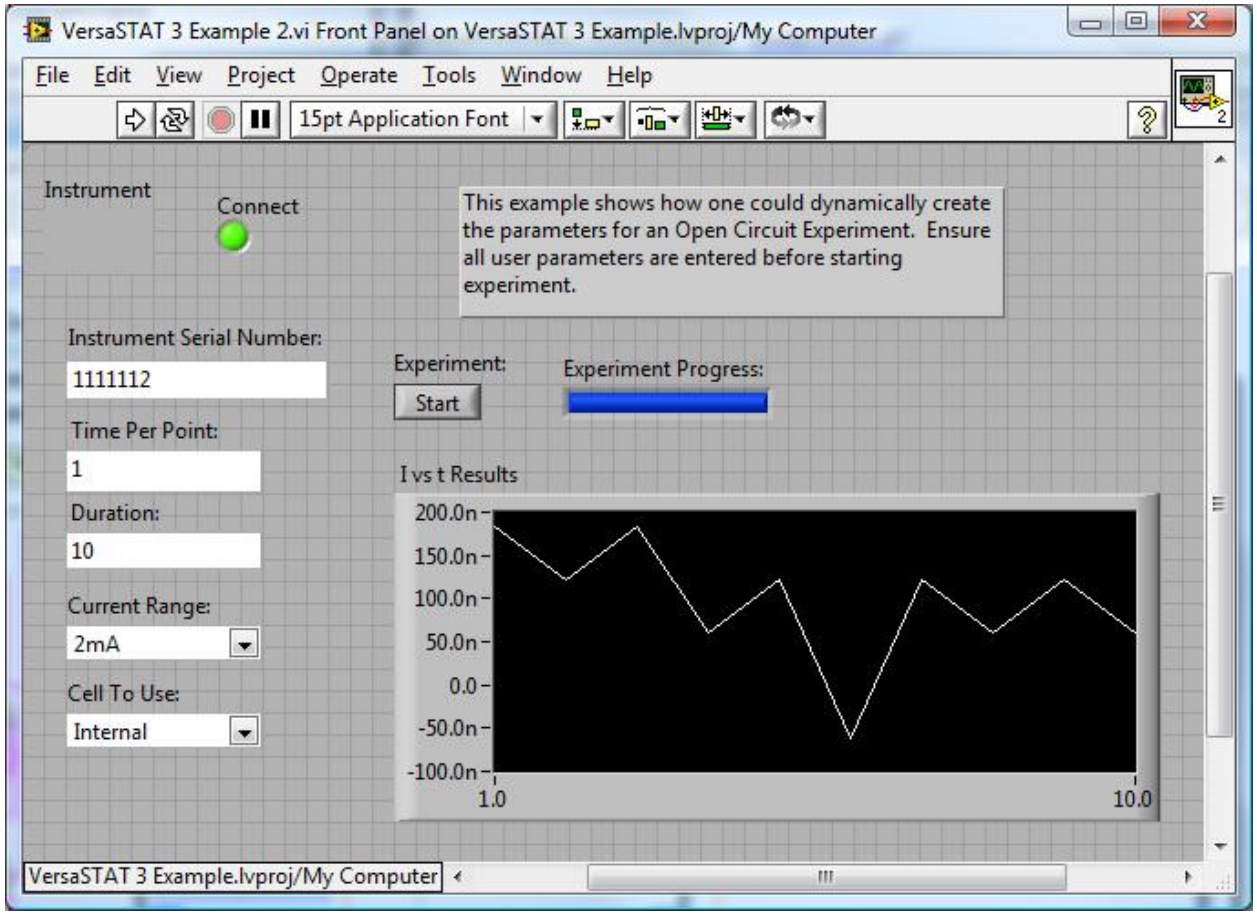
Example #1

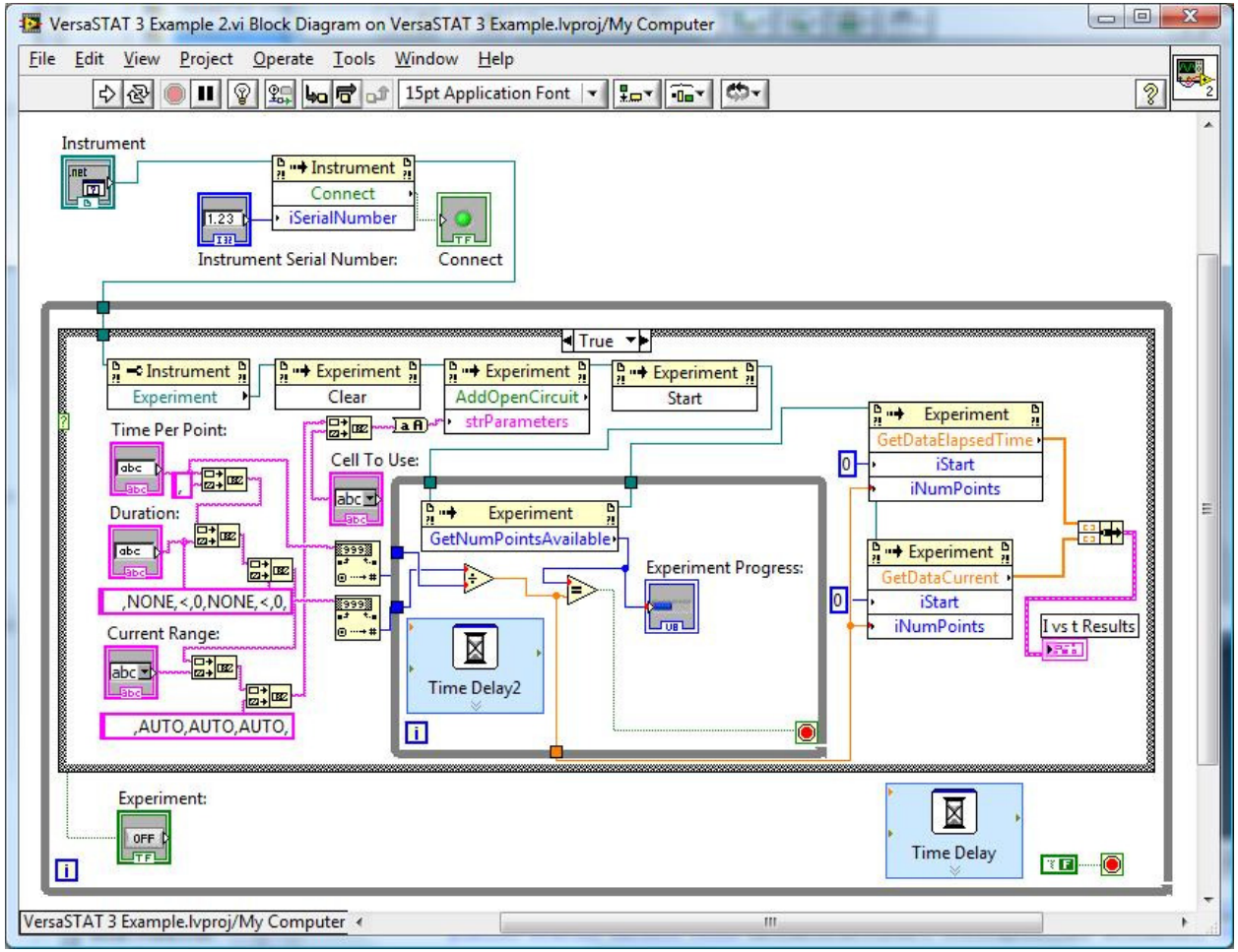
1. Create a new or open a .vi.
2. Add a ".NET Container Control" to the .vi.
3. Right click on the .NET Container and select "Insert .NET Control".
4. Click the "Browse" button.
5. Locate the "VersaSTATControl.dll" file and select it, press OK button.
6. Select "Instrument", press OK button.
7. Open "Block Diagram" window.
8. Right click on "Instrument", select "Create", then "Method for V3Control.Instrument class".
9. Select the "Connect(int32 iSerialNumber)" method.
10. Wire from ".NET Instrument" to the top right (reference) of the method Node.
11. Right click on left side of "iSerialNumber", select "Create", then select "Constant".
12. Enter Serial Number of the Instrument to communicate with.
13. Right click on the right side of "Connect", select "Create", then select "Indicator".
14. Run the .vi, if the Instrument is powered on and attached to the PC, the connect LED should light.


VersaSTAT 3 Example 1.vi Front Panel on VersaSTAT 3 Example.lvpr...
File Edit View Project Operate Tools Window Help
15pt Application Font
Instrument
Connect
VersaSTAT 3 Example.lvproj/My Computer

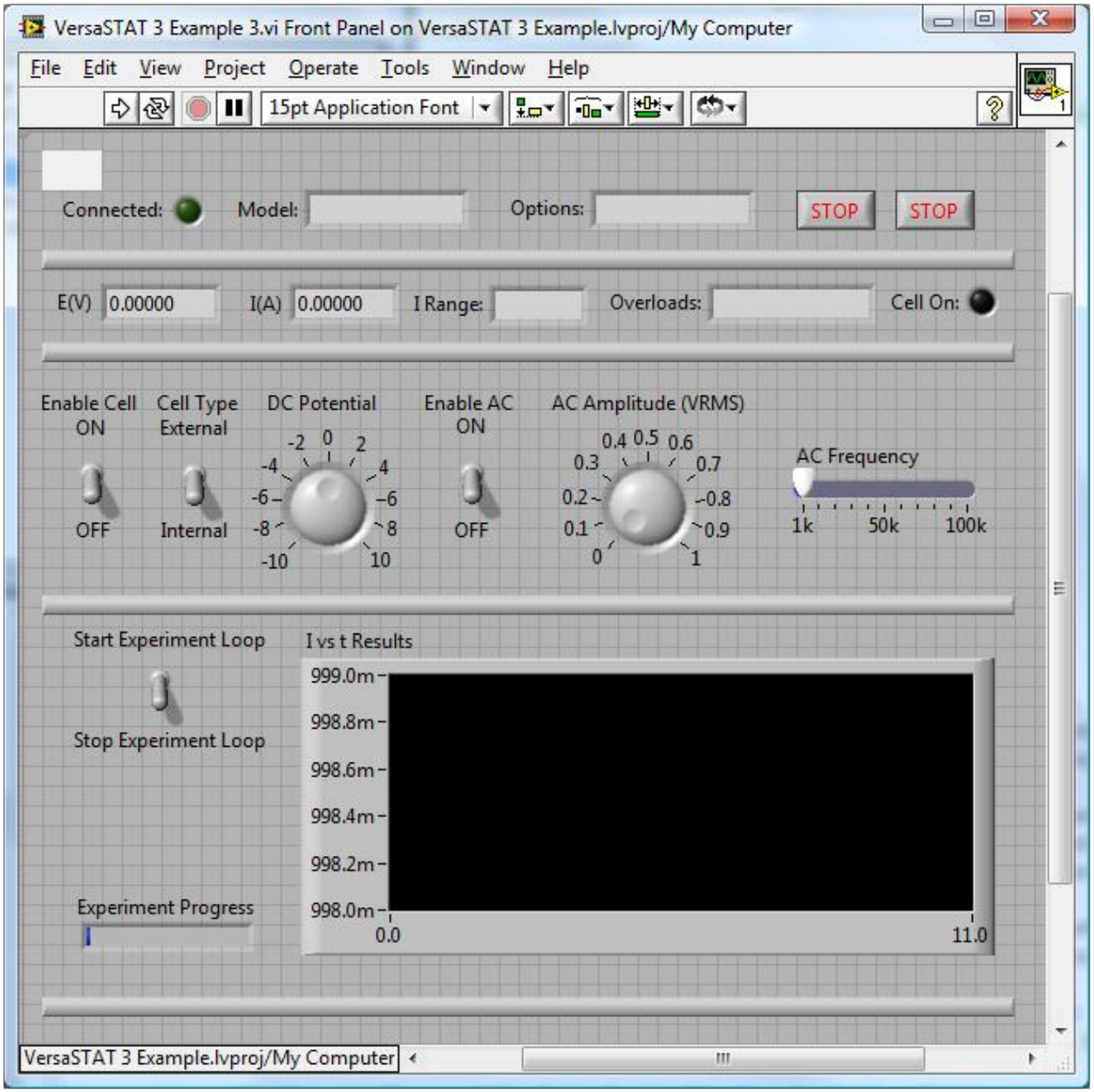

VersaSTAT 3 Example 1.vi Block Diagram on VersaSTAT 3 ...
File Edit View Project Operate Tools Window Help
15pt Application Font
Instrument
.net
Instrument
Connect
12345678
iSerialNumber
Connect
TF
VersaSTAT 3 Example.lvproj/My Computer

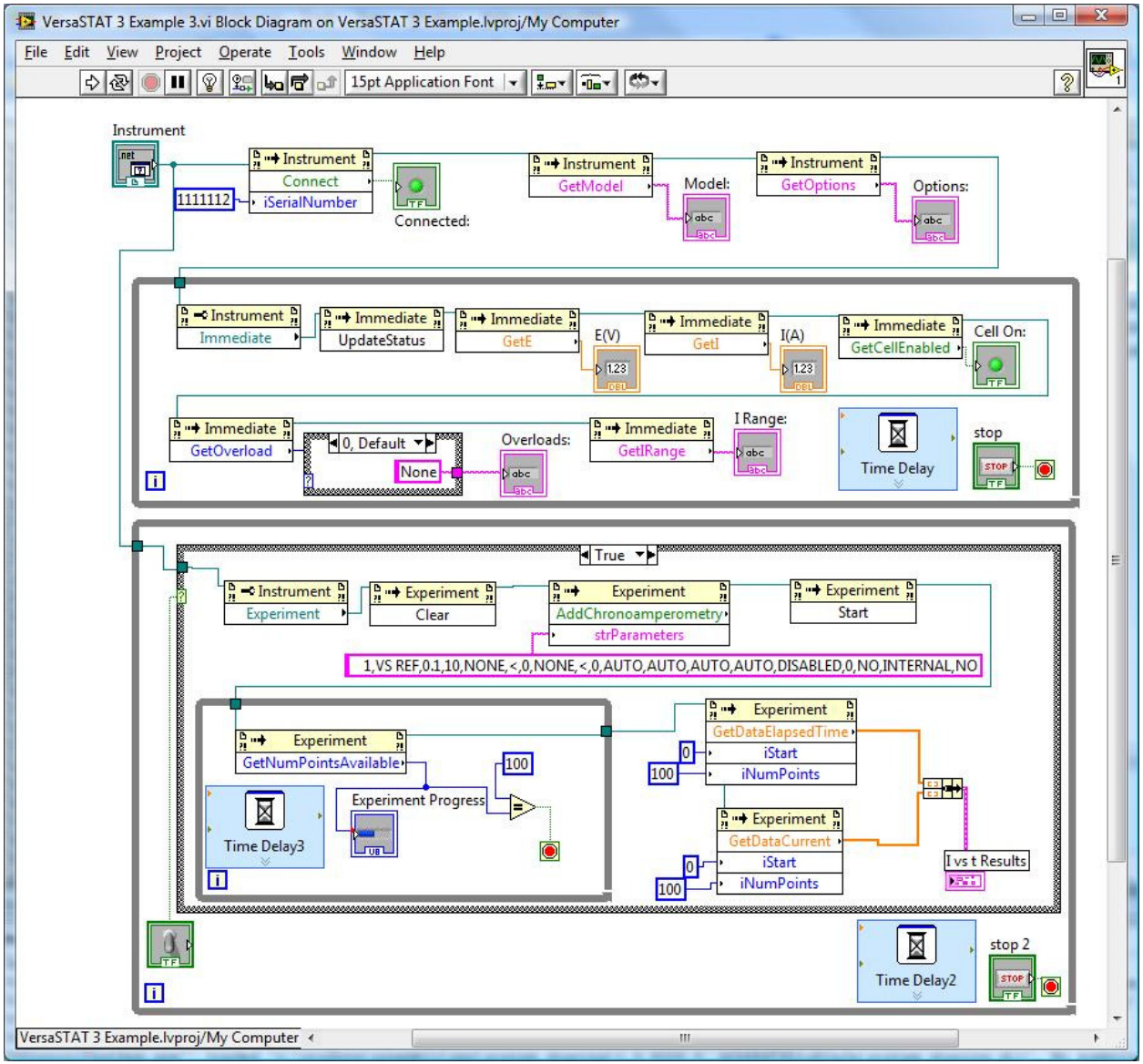
Example #2


VersaSTAT 3 Example 2.vi Front Panel on VersaSTAT 3 Example.lvproj/My Computer
File Edit View Project Operate Tools Window Help
15pt Application Font
Instrument
Connect
This example shows how one could dynamically create the parameters for an Open Circuit Experiment. Ensure all user parameters are entered before starting experiment.
Instrument Serial Number:
1111112
Experiment:
Start
Experiment Progress:
Time Per Point:
1
Duration:
10
I vs t Results
200.0n
150.0n
100.0n
50.0n
0.0
-50.0n
-100.0n
1.0
10.0
Current Range:
2mA
Cell To Use:
Internal
VersaSTAT 3 Example.lvproj/My Computer


VersaSTAT 3 Example 2.vi Block Diagram on VersaSTAT 3 Example.lvproj/My Computer
File Edit View Project Operate Tools Window Help
15pt Application Font
Instrument
Instrument
Connect
iSerialNumber
Instrument Serial Number:
Connect
True
Instrument
Experiment
Experiment
Clear
Experiment
AddOpenCircuit
strParameters
Experiment
Start
Time Per Point:
Cell To Use:
Duration:
,NONE,<,0,NONE,<,0,
Current Range:
,AUTO,AUTO,AUTO,
Experiment
GetNumPointsAvailable
Experiment Progress:
Time Delay2
Experiment
GetDataElapsedTime
iStart
iNumPoints
Experiment
GetDataCurrent
iStart
iNumPoints
I vs t Results
Experiment:
OFF
Time Delay
VersaSTAT 3 Example.lvproj/My Computer

Example #3


VersaSTAT 3 Example 3.vi Front Panel on VersaSTAT 3 Example.lvproj/My Computer
File Edit View Project Operate Tools Window Help
15pt Application Font
Connected:
Model:
Options:
STOP
STOP
E(V) 0.00000
I(A) 0.00000
I Range:
Overloads:
Cell On:
Enable Cell ON
OFF
Cell Type External
Internal
DC Potential
-2 0 2 -4 4 -6 -6 -8 8 -10 10
Enable AC ON
OFF
AC Amplitude (VRMS)
0.4 0.5 0.6 0.3 0.7 0.2 0.8 0.1 0.9 0 1
AC Frequency
1k 50k 100k
Start Experiment Loop
Stop Experiment Loop
I vs t Results
999.0m
998.8m
998.6m
998.4m
998.2m
998.0m
0.0
11.0
Experiment Progress
VersaSTAT 3 Example.lvproj/My Computer


VersaSTAT 3 Example 3.vi Block Diagram on VersaSTAT 3 Example.lvproj/My Computer
File Edit View Project Operate Tools Window Help
15pt Application Font
Instrument
Instrument Connect iSerialNumber
1111112
Connected:
Instrument GetModel
Model:
Instrument GetOptions
Options:
Instrument Immediate
Immediate UpdateStatus
Immediate GetE
E(V)
Immediate GetI
I(A)
Immediate GetCellEnabled
Cell On:
Immediate GetOverload
0, Default
None
Overloads:
Immediate GetIRange
I Range:
Time Delay
stop
True
Instrument Experiment
Experiment Clear
Experiment AddChronoamperometry
strParameters
Experiment Start
1,VS REF,0.1,10,NONE,<,0,NONE,<,0,AUTO,AUTO,AUTO,AUTO,DISABLED,0,NO,INTERNAL,NO
Experiment GetNumPointsAvailable
100
Experiment Progress
Time Delay3
Experiment GetDataElapsedTime
0
iStart
100
iNumPoints
Experiment GetDataCurrent
I vs t Results
Time Delay2
stop 2
VersaSTAT 3 Example.lvproj/My Computer