

## Appendix A: Summary of Dynamic-Link Libraries

Namespace: Breathing Engine

Class: CO2ValueGenerator

Summary: Represents a numeric waveform generator. Will combine WaveType components with specified parameters to create a waveform of interchanging rising and falling exponential curves. See Section 3.2.4.1 for further description.

### Methods

	Name	Definition
private	OnValueGenerated(CO2EventArgs e)	Calls <i>CO2ValueGeneratedEventHandler</i> to manage numeric ETCO2 value generated.
private	GenerateCoordinates(int, double, double, WaveType, double)	Inputs the specified maximum ETCO2 value, Tau A, and Tau B and the elapsed time to <i>GetETCO2Point</i> and formats output as <i>CO2EventArgs</i> for specified duration of specified waveform. Calls <i>OnValueGenerated</i> with <i>CO2EventArgs</i> as event argument.
public	CombineWaveform()	Combines <i>GenerateCoordinates</i> method for each WaveType in series. Default order of WaveTypes is expiration -- intrapause -- inspiration -- interpause.
private	GetETCO2Point(double, int, double, WaveType)	Returns ETCO2 point value (double) in for specified elapsed time in a waveform with specified amplitude, Tau, and WaveType.

### Properties

	Name	Definition
public	MaximumETCO2	Sets the maximum ETCO2 value (int).
public	Tau_A	Sets the tau value (double) that corresponds to exponential rising curve in expiration WaveType.
public	Tau_B	Sets the tau value (double) that corresponds to exponential falling curve in inspiration WaveType.
public	ExpirationDuration	Sets the expiration WaveType duration (double).
public	InspirationDuration	Sets the inspiration WaveType duration (double).
public	IntrapauseDuration	Sets the intrapause WaveType duration (double).
public	InterpauseDuration	Sets the interpause WaveType duration (double).
public	CurareCleftDuration	Sets the curare cleft WaveType duration (double).
public	CurareCleftCheckbox	Sets curare cleft display properties (bool) to include or omit curare cleft in waveform. If true, WaveType order is expiration -- curare cleft -- intrapause -- inspiration -- interpause.
public	ManualVentilationsCheckbox	Sets waveform to display manual ventilations (bool) at set respiratory rate. If true, WaveType order is expiration(fixed, short duration) -- intrapause -- inspiration(fixed, short duration).
public	ManualVentilationAutomodeDuration	Sets respiratory rate (double) for <i>ManualVentilationsCheckbox</i> .
public	ManualVentilationsManualMode	Sets waveform to display manual ventilations (bool) at respiratory rate that matches provider actions via TCP communication with pressure sensor in bag valve mask. See Section 3.2.4.2 for complete description. Uses <i>TelnetReceiver</i> class. If true, WaveType order is intrapause until manual ventilation indicated by pressure sensor -- inspiration(fixed, short duration) -- interpause(while manual ventilation indicated) -- expiration(fixed, short duration).
public	ManualVentilationsKeyPress	Sets waveform to display manual ventilations (bool) at respiratory rate that matches CTRL keypress. If true, WaveType order is intrapause until manual ventilation indicated by CTRL keypress -- inspiration(fixed, short duration) -- interpause(while key pressed) -- expiration(fixed, short duration).

### Events

	Name	Definition
public	CO2ValueGeneratedEventHandler	Represents the method that will handle the CO2ValueGenerated event of a BreathingEngine object.

Namespace: Breathing Engine

Class: TelnetReceiver

Summary: Provides TCP connection capabilities to ArduinoUno TCP client.

### Methods

	Name	Definition
public	SetUpStream()	Connects to ArduinoUno TCP client.
public	FindVent()	Reads from TCP client and returns true if stream value is greater than threshold
public	CloseStream()	Ends stream and connection with client.

Namespace: Breathing Engine

Class: PressureSensorPoint

Summary: Provides format for managing data from ArduinoUno pressure sensor.

### Properties

	Name	Definition
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## Appendix A: Summary of Dynamic-Link Libraries

public	time	Gets or Sets the time elapsed (double).
public	sensorValue	Gets or Sets the numeric value from the sensor (double).

Namespace: Breathing Engine

Class: CO2EventArgs

Summary: Contains the data for a ETCO2 value generated event.

### Methods

	Name	Definition
public	CO2EventArgs(double, double, double)	Receives specified time, ETCO2 value, and respiratory rate.

### Properties

	Name	Definition
public	TimeValue	Gets or sets elapsed time (double).
public	CO2Value	Gets or sets numeric ETCO2 value that corresponds to time (double).
public	RespRate	Gets or sets respiratory rate (double).

Namespace: C5ProtocolUtilities

Class: Decoder

Summary: Translates Capnostat5 byte packets to numeric ETCO2 values.

### Methods

	Name	Definition
public	PacketID(byte[])	Labels packet type. Returns ETCO2 value (double) if packet is of CO2 Waveform data type (using <i>ETCO2ValueID</i> ) and returns packet type for all other packets.
public	ETCO2ValueID(byte[])	Returns ETCO2 waveform value (double) from a packet of CO2 Waveform data type.
public	GetMaxETCO2(byte[])	Returns maximum ETCO2 value (double) from a packet of appropriate data type.
public	GetRespRate(byte[])	Returns respiratory rate value (double) from a packet of appropriate data type.

Namespace: C5ProtocolUtilities

Class: Encoder

Summary: Translates numeric ETCO2 values to Capnostat5 byte packets.

### Methods

	Name	Definition
public	ZolPacketFromETCO2Value(double)	Returns encoded byte packet containing numeric ETCO2 value.
public	ZolPacketFromETCO2Value_ETCO2(double, int)	Returns encoded byte packet containing numeric ETCO2 value and maximum ETCO2 value.
public	ZolPacketFromETCO2Value_RespRate(double, int)	Returns encoded byte packet containing numeric ETCO2 value and respiratory rate

Namespace: C5TransmitUtility

Class: SignalTransmitter

Summary: Sends generated byte packets to serial stream at sensor-specific timing protocols.

### Methods

	Name	Definition
private	OnPacketSent(byte[])	Calls <i>PacketSentEventHandler</i> to manage specified byte packet.
public	SignalTransmitter(string)	Receives string and sets as COM port identifier.
public	ConfigureSerialPort(string)	Receives string and sets as COM port identifier.
public	StartSending()	Starts new thread for serial communication and assigns <i>BeginTransmission</i> as the ThreadStart Delegate.
private	BeginTransmission()	Configures and opens serial port. Calls <i>HandshakeAndSendPackets</i> to begin data transmission. Throws an exception if serial port undefined or incorrectly defined
private	HandshakeAndSendPackets()	Sends series of byte packets that make up "Handshake" once to serial port stream, each time using <i>SendBytePacket</i> . References C5ProtocolUtilities Encoder to continuously encode etco2 value (set by <i>EtCO2Value</i> ) and uses <i>SendBytePacket</i> to send encoded packet to serial port stream.
private	SendBytePacket()	Writes each byte packet to underlying serial stream. Initiates <i>OnPacketSent</i> event handler.
public	StopSending()	Stops sending of data. Closes serial port.

### Properties

	Name	Definition
public	EtCO2Value()	Sets ETCO2 value (double).
public	RespRate()	Sets respiratory rate value (double).
public	MaxAmplitude()	Sets maximum amplitude ETCO2 value (double).

## Events

	Name	Definition
public	PacketSentEventHandler	Represents the method that will handle the PacketSent event of a SignalTransmitter object.

Namespace: C5ReceiveUtilities

Class: SerialReceiver

Summary: Receives data packets from Capnostat5 sensor and translates to numeric ETCO2 values.

## Methods

	Name	Definition
protected	OnValueFound(ValueEventArgs)	Calls <i>ValueFoundEventHandler</i> to manage decoded ETCO2 value.
protected	OnMaxETCO2Update(MaxETCO2EventArgs)	Calls <i>MaxETCO2EventHandler</i> to manage decoded maximum ETCO2 value.
protected	OnRespRateUpdate(RespRateEventArgs)	Calls <i>RespRateEventHandler</i> to manage decoded respiratory rate value.
public	SerialReceiver(string)	Receives string and sets as COM port identifier.
public	ConfigureSerialPort(string)	Receives string and sets as COM port identifier.
public	StopReceiving()	Stops receipt of data. Closes serial port.
public	StartReceiving()	Starts new thread for serial communication and assigns <i>BeginReceive</i> as the ThreadStart Delegate.
private	BeginReceive()	Configures and opens serial port. Creates new <i>SerialDataReceivedEventHandler</i> each time serial data is received and assigns <i>PacketFinder</i> as the event handler delegate.
public	PacketFinder(object, SerialDataReceivedEventArgs)	Reads each received byte and groups into complete byte packets. Uses <i>C5ProtocolUtilities Decoder</i> to translate packets into numeric ETCO2 values. Calls <i>ValueFoundEventHandler</i> , <i>MaxETCO2EventHandler</i> , and/or <i>RespRateEventHandler</i> to manage identified values.
private	Checksum(byte[])	Returns bool indicative of correct/incorrect checksum byte in appropriate byte packets.

## Events

	Name	Definition
public	ValueFoundEventHandler	Represents the method that will handle the ValueFound event of a SerialReceiver object.
public	MaxETCO2EventHandler	Represents the method that will handle the MaxETCO2 event of a SerialReceiver object.
public	RespRateEventHandler	Represents the method that will handle the RespRate event of a SerialReceiver object.

Namespace: C5ReceiveUtilities

Class: PointListSerializer

Summary: Translates ETCO2 (time, value) data to XML and saves file.

## Methods

	Name	Definition
public	PointListSerializer()	Creates and formats new XML document.
public	XMLAdder(double, double)	Adds specified time value and ETCO2 value as paired data set to XML document.
public	SaveXML(string)	Saves XML document to specified path.

Namespace: C5ReceiveUtilities

Class: MaxETCO2EventArgs

Summary: Provides data for the MaxETCO2 event.

## Methods

	Name	Definition
public	MaxETCO2EventArgs(double)	Receives specified maximum ETCO2 value.

## Properties

	Name	Definition
public	MaxETCO2	Gets or sets maximum ETCO2 value (double).

Namespace: C5ReceiveUtilities

Class: ValueEventArgs

Summary: Provides data for the ValueFound event.

## Methods

	Name	Definition
public	ValueEventArgs(double)	Receives specified ETCO2 value.

## Properties

	Name	Definition
public	ETCO2Value	Gets or sets ETCO2 value (double).

Namespace: C5ReceiveUtilities

Class: RespRateEventArgs

Summary: Provides data for the RespRate event.

## Methods

	Name	Definition
public	RespRateEventArgs(double)	Receives specified respiratory rate value.

## Properties

	Name	Definition
public	RespRate	Gets or sets respiratory rate value (double).

Namespace: PPTools

Class: PPMethods

Summary: Collects data points from bitmap image of waveform and saves as XML file.

## Methods

	Name	Definition
protected	OnPixValGenerated(PixValEventArgs)	Calls <i>PixValGeneratedEventHandler</i> to manage identified pixel count.
public	StartAnalyzing(double, double, string, double, double)	Steps through <i>print</i> , <i>Grayscale</i> , <i>ContrastProcessImage</i> , <i>PixelsToPoints</i> , and <i>print_points</i> to generate first estimate of collecting ETCO2 value points from drawn waveform using specified amplitude constant, time constant, filename, and contrast threshold.
public	print(Bitmap, bool)	Prints bitmap to screen. If bool true, prompts user to re-enter distance on bitmap that corresponds to time constant.
public	Grayscale(string)	Translates specified color bitmap to grayscale and returns new bitmap. Calls <i>sprint</i> method.
public	ContrastProcessImage(bitmap, double)	Identifies all pixels that have a shade within a specified threshold range. Returns pixels as a list of points. Calls <i>print</i> method.
public	PixelsToPoints(List<Point>, double[], double)	Translates specified pixel list to numeric time and ETCO2 values using specified spacing values and specified bitmap height. Returns points formatted as List<double[]>.
public	print_points(Point[], int, int, double, double, double)	Draws points to new bmp with specified point list, height, width, amplitude constant, and ratio of pixels to one point. Uses <i>print</i> method.
public	PointArrayToXML(List<double[]>, string)	Uses <i>C5ReceiveUtilities PointListSerializer</i> to save specified points to a specified XML file.

## Events

	Name	Definition
public	PixValGeneratedEventHandler	Represents the method that will handle the PixValGenerated event of a PPTools object.

Namespace: PPTools

Class: PixValEventArgs

Summary: Provides data for the PixVal event.

## Methods

	Name	Definition
public	PixValEventArgs(double)	Receives pixel count.

## Properties

	Name	Definition
public	PixelValue	Gets or sets the pixel count that corresponds to numeric constants (double).