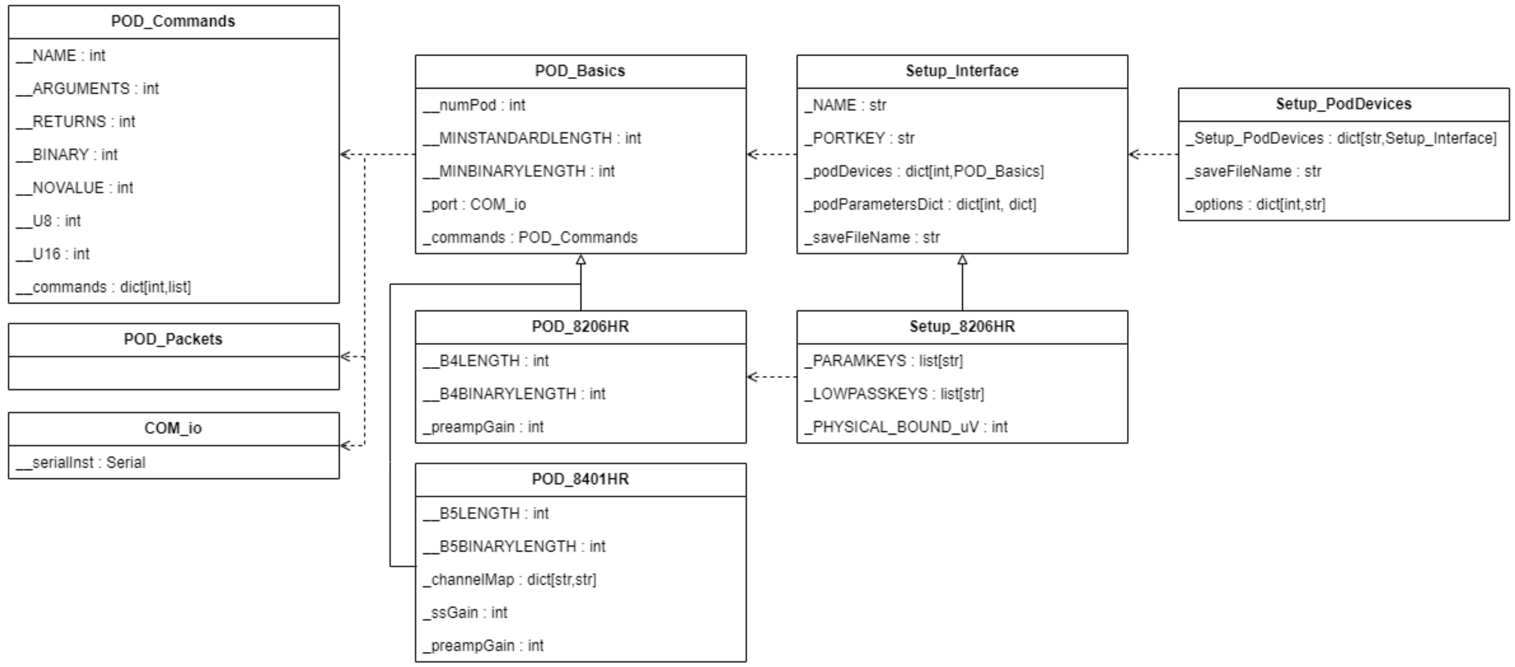
Welcome!		
Message		

This document contains information about all the classes in the Python-POD_API. Each class has its own sheet which describes the class's origin, parent and child classes, imports, global and instance variables, and all methods with details about its parameters, returns, and exceptions.

Classes		
Name		**Class Diagram**
Setup_PodDevices		
Setup_Interface		
Setup_8206HR		
POD_8206HR		
POD_8401HR		
POD_Basics		
POD_Packets		
POD_Commands		
COM_io		



Definitions		
Word	**Context**	**Definition**
Parent	Class	Class that another class inherits from.
Child	Class	Class that inherits from another class. Children can overwrite/reimplement methods from the parent.
Local	Import origin	The imported program file that is directly accessible from the user's computer, often in the same or nearby directory.
Enviornment	Import origin	The imported program was installed into the user's python enviornment.
Class	Variable scope	The variable is global to the class, meaning all class instantiations have the same variable. Changing this variable affects all class instances.
Instance	Variable scope	The variable is specific to the class instance. All class instances have this variable, but the value can be different. Changing the value of this variable in one class does not affect others.
Dunder	Methods type	"Dunder" comes from "double underscore" in reference to methods surrounded by two underscores. They allow a class to use the built-in functions and operators of Python.
Instance	Methods type	Method that can only be called on an instantiated class object. Ex: MyClassObejct = MyClass(); MyClassObejct.InstanceMethod(). Instance methods have "self" as the first parameter.
Static	Methods type	Method that does not need an instantiated object to be called. Ex: StaticMethodReturnValue = ClassName.StaticMethod()
Parameter	Methods	Variables in a function declaration. Ex: MyFunction(parameter1, parameter 2,...)
Return	Methods	The value stored when a function returns to the caller.

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
Setup_PodDevices	Setup_PodDevices.py	Setup_PodDevicesallows a user to set up and stream from any number of POD devices. The streamed data is saved to a file	N/A	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
time	Enviornment	For timing the duration of methods				
os	Enviornment	Used for file handling				
Thread	Enviornment	Used to stream from multiple POD devices and ask for user input concurrently.	threading			
floor	Enviornment	For rounding numbers	math			
Setup_8206HR	Local	For managing active 8206HR POD devices	Setup_8206HR			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
_setupPodDevices	Instance	Dictionary containing the Setup_Interface subclasses for each POD device.	{ '8206-HR' : Setup_8206HR() }	dict[str,Setup_Interface]		
_saveFileName	Instance	String containing the path, filename, and file extension to a file to save streaming data to. The filename will be extended with "_<DEVICE NAME>_<DEVICE NUMBER>" for each device.	Set by user	str		
_options	Instance	Dictionary listing the different options for the user to complete	{ 1 : 'Start Streaming.', 2 : 'Show current settings.', 3 : 'Edit save file path.', 4 : 'Edit POD device parameters.', 5 : 'Connect a new POD device.', 6 : 'Reconnect current POD devices.', 7 : 'Generate initialization code.', 8 : 'Quit.' }	dict[int,str]		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
__init__	Dunder	Initializes the class. Sets the default values of the class instance variables. Calls functions to complete the class setup.	saveFile:str|None=None podParametersDict:dict[str,dict|None]|None={'8206-HR':None}	String describing the directory path and filename with an extension Dictionary of POD devices and their respective initialization dictionaries.	N/A	N/A
__del__	Dunder	Deletes all POD device setup objects	N/A	N/A	N/A	N/A
GetPODparametersDict	Instance	Gets the POD device initialization dictionaries for all device types	N/A	N/A	Dictionary whose keys are the POD device name, and value the setup dictionary.	N/A
GetSaveFileName	Instance	Gets the name of the class object's save file	N/A	N/A	String of the save file name and path (_saveFileName)	N/A
GetOptions	Instance	Gets the dictionary of setup options	N/A	N/A	Dictionary listing the different options for the user to complete (_options)	N/A
SetupPODparameters	Instance	Sets up each POD device type. Used in initialization.	podParametersDict:dict[str,dict|None]={'8206-HR':None}	Dictionary of all POD devices initialization. The keys are the device name and the entries are the initialization dictionaries.	N/A	N/A
SetupSaveFile	Instance	Gets the path/file name from the user and stores it. Used in initialization.	saveFile:str|None=None	String of the save file, which includes the directory path, filename, and file extension	N/A	N/A
Run	Instance	Prints the options and askes the user what to do. Loops until 'Quit' is chosen.	N/A	N/A	N/A	N/A
_PrintOptions	Instance	Prints options available for user	N/A	N/A	N/A	N/A
_AskOption	Instance	Asks user which option to do	N/A	N/A	Integer number representing an option key	User input must be an integer that is a key in the options dictionary.
_DoOption	Instance	Performs the methods associated with the user selected option	choice: int	Integer number representing an option key	N/A	N/A
_Stream	Instance	Streams data from all POD devices and prints the execution time.	N/A	N/A	Float of the execution time in seconds	N/A
_ShowCurrentSettings	Instance	Displays the POD device settings for all devices, and then prints the save file name	N/A	N/A	N/A	N/A
_EditSaveFilePath	Instance	Asks the user for a new file name and path, then sets the value to the POD devices.	N/A	N/A	N/A	N/A
_EditCheckConnect	Instance	Displays the POD devices parameters, asks the user to edit the device, and then reconnects the device for each POD device type.	N/A	N/A	N/A	N/A
_ConnectNewDevice	Instance	Asks the user for the POD device type, then it sets up that device	N/A	N/A	N/A	N/A
_Reconnect	Instance	Reconnects all POD devices	N/A	N/A	Bool that is true if all devices were successfully connected. False otherwise	N/A
_PrintInitCode	Instance	Prints code that can be used to initialize and run SetupPodDevices with the current parameters.	N/A	N/A	N/A	N/A

_PrintSaveFile	Instance	Prints the file path and name that data is saved to. Note that the device name and number will be appended to the end of the filename,	N/A	N/A	N/A	N/A
_CheckFileExt	Static	Checks for valid file extension	f	file name or extension	True if extension is in goodExt list, False otherwise	N/A
			fIsExt:bool=True	Boolean flag that is true if f is an extension, false otherwise		
			goodExt:list[str]=['.csv','.txt','.edf']	List of valid file extensions		
			printErr:bool=True	Boolean flag that, when true, will print an error statement		
_GetFilePath	Static	Asks user for a path and filename to save streaming data to.	N/A	N/A	String of the file path, name, and extension.	Filename must end in .csv, .txt, or .edf
_GetFileName	Static	Asks the user for a filename	N/A	N/A	String of the file name and extension	Filename must end in .csv, .txt, or .edf
_SetFilenameToDevices	Instance	Sets the filename to each POD device type	N/A	N/A	N/A	N/A
_StreamAllDevices	Instance	Streams data from all the devices. User is asked to click enter to stop streaming. Data is saved to file. Uses threading.	N/A	N/A	N/A	N/A
_AskToStopStream	Instance	Asks user to press enter to stop streaming. The program will then prompt all POD devices to end stream.	N/A	N/A	N/A	N/A
_TimeFunc	Static	Runs a function and gets the calculated execultion time	func: 'function'	function/method name	Float of the execution time in seconds rounded to 3 decimal places	N/A

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
Setup_Interface	Setup_PodInterface.py	Setup_Interface provides the basic interface of required methods for subclasses to implement. SetupPodDevices.py is designed to handle any of these children.	N/A	Setup_8206HR	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
os	Enviornment	For file path handling.				
EdfWriter	Enviornment	For writing to EDF files.	pyedflib			
Thread	Enviornment	For streaming from multiple POD devices.	threading			
IOBase	Enviornment	For return annotations for text file operations.	io			
COM_io	Local	For getting available COM ports.	SerialCommunication			
POD_Basics	Local	For annotating POD devices as function parameters.	BasicPodProtocol			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
_NAME	Class	Device name, should be overwritten by child subclasses.	'GENERIC'	str		
_PORTKEY	Class	Dictionary key for the COM port.	'Port'	str		
_podDevices	Instance	Dict of pod device objects. MUST have keys as device#	{}	dict[int,POD_Basics]		
_podParametersDict	Instance	dictionary of device information. MUST have keys as device#, and each value must have {'_PORTKEY': str, ...other values...}	{}	dict[int,dict]		
_saveFileName	Instance	string filename: <path>/file.ext. The device name and number will be appended to the filename	''	str		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
_GetParam_onePODdevice	Instance	(Interface) Prompts the user to input all device setup parameters	forbiddenNames: list[str]	List of port names that are already used.	Dictionary of the device parameters.	N/A
_DisplayPODdeviceParameters	Instance	(Interface) Display all the pod device parameters in a table	N/A	N/A	N/A	N/A
_ConnectPODdevice	Instance	(Interface) Write setup commands to initialize the POD device with the user's parameters	deviceNum: int	Integer key for the device#	True for successful connection, false otherwise	N/A
			deviceParams: dict	dictionary of the device parameters.		
_StreamThreading	Instance	(Interface) Stream data and save data to a file. Each POD device has its own thread	N/A	N/A	dictionary with the key as the device# and value as the thread object	N/A
_StopStream	Instance	(Interface) Tell POD devices to stop streaming	N/A	N/A	N/A	N/A
_OpenSaveFile_TXT	Static	(Interface) Open a text file and write column names	fname: str	String file name	opened file object IOBase	
_OpenSaveFile_EDF	Instance	(Interface) Create an EDF file and write all channel information.	fname: str	String file name	EdfWriter file object	N/A
			devNum: int	Integer of the device#		
__init__	Dunder	Initializes the class instance variables	N/A	N/A	N/A	N/A
__del__	Dunder	Disconnects all POD devices.	N/A	N/A	N/A	N/A
SetFileName	Instance	Sets the filename to save data to. Note that the device name and number will be app0ended to the end.	fileName: str	String file name	N/A	N/A
GetPODparametersDict	Instance	Gets a dictionary whose keys are the device number and the value is the device parameters dict.	N/A	N/A	N/A	N/A
SetupPODparameters	Instance	Sets the parameters for the POD devices.	podParametersDict:dict[int,dict]|None=None	dictionary of the device parameters for all devices.	N/A	N/A
_SetNumberOfDevices	Instance	Asks the user for how many devices they want to setup	name: str	Name of the POD device type.	N/A	N/A
_ConnectAllPODdevices	Instance	Connects all POD devices	N/A	N/A	True if all devices are successfully connected, false otherwise.	N/A
_DisconnectAllPODdevices	Instance	Disconnects all POD devices by deleted all POD obejcts.	N/A	N/A	N/A	N/A
_AddPODdevice	Instance	Asks the user for the parameters for the new device. A new device# is generated.	N/A	N/A	N/A	N/A
_SetParam_allPODdevices	Instance	First gets the number of POD devices, then asks the user for the information for each device.	N/A	N/A	N/A	N/A
_ChoosePort	Static	Asks the user to select a COM port.	forbidden:list[str]=[]	List of port names that are already used.	String name of the port.	N/A
_GetPortsList	Static	Gets the names of all available ports.	forbidden:list[str]=[]	List of port names that are already used.	List of port names	N/A
_ValidateParams	Instance	Displays a table of the parameters of all devices, then asks the user if everything is correct. The user can then edit the parameters of a device.	N/A	N/A	N/A	N/A
_EditParams	Instance	Asks the user which device to edit, and then asks them to re-input the device parameters	N/A	N/A	N/A	N/A
_SelectPODdeviceFromDictToEdit	Instance	Asks the user to select a valid device number. The input must be an integer number of an existing device.	N/A	N/A	Integer for the device#	N/A
_GetForbiddenNames	Instance	Generates a list of port names used by the active pod devices. There is an option to exclude an additional name from the list.	key:str='Port'	String key to access the _podParametersDict	list of string names of ports in use.	N/A
			exclude:str|None=None	String port name to exclude from the returned list		
_PrintDeviceNumber	Instance	Prints a title with the device#	num: int	Integer of the device#	N/A	N/A
_OpenSaveFile	Instance	Opens a save file for a given device	devNum: int	Integer of the device#	Open IOBase for a text file, or EdfWriter for EDF file.	N/A

_BuildFileName	Instance	Appends the device name and number to the end of the file name.	devNum: int	Integer of the device#	String file name.	N/A
_Stream	Instance	Tests that all devices are connected then starts streaming data	N/A	N/A	Dictionary with integer device# keys and Thread values.	Test connection failed.
_TestDeviceConnection	Instance	Writes a PING packet, then reads the response. A connection is successful if PING is read back	pod: POD_Basics	POD device	True for successful connection, false othersise	N/A
_TestDeviceConnection_All	Instance	Tests the connection of all POD devices	N/A	N/A	True when all devices are successfully connected, false otherwise	N/A
_AskYN	Static	Asks the user a yes or no question	question: str	String containing the question	True for yes, false otherwise.	N/A

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
Setup_8206HR	Setup_8206HR.py	Setup_8206HR provides the setup functions for an 8206-HR POD device.	Setup_Interface	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**	**As**		
texttable	Enviornment	For displaying the parameters in a table.				
os	Enviornment	For file name handling.				
numpy	Enviornment	For arrays.		np		
Thread	Enviornment	For streaming from multiple devices simultaneously.	**threading**			
EdfWriter	Enviornment	For writing to EDF files.	**pyedflib**			
IOBase	Enviornment	For return annotations for text files.	**io**			
Setup_Interface	Local	For inheritance.				
POD_8206HR	Local	For communicating with 8206-HR POD devices				
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
_PARAMKEYS	Class	List of dictionary keys for device parameters	[Setup_Interface._PORTKEY, 'Sample Rate','Preamplifier Gain','Low Pass']	list[str]		
_LOWPASSKEYS	Class	List of dictionary keys for the Low Pass parameter.	['EEG1','EEG2','EEG3/EMG']	list[str]		
_PHYSICAL_BOUND_uV	Class	Physical max/-min stream value in uV	4069	int		
_NAME	Class	Name of the POD device. Overwritten from Parent	'8206-HR'	str		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
_ConnectPODdevice	Instance	Creates a POD_8206HR object and write the setup parameters to it.	deviceNum: int	Integer of the device#	True of connection was successful, false otherwiae.	N/A
			deviceParams: dict[str,(str|int|dict[str,int])]	Dictionary of the device#'s parameters		
_GetParam_onePODdevice	Instance	Asks the user to input all the device parameters	forbiddenNames: list[str]	List of port names already used by other devices	Dictionary of device parameters	N/A
_ChooseSampleRate	Static	Asks user for the sample rate.	N/A	N/A	Integer number between 100-2000 Hz for the sample rate	Sample rate must be an integer between 100-2000
_ChoosePreampGain	Static	Asks user for the preamplifier gain of their POD device	N/A	N/A	Integer 10 or 100 for the preamplifier gain	Gain must be an integer value of 10 or 100
_ChooseLowpass	Static	Builds dictionary of all lowpass filters	N/A	N/A	Dictionary containing lowpass filters (EEG1, EEG2, EEG3/EMG)	N/A
_ChooseLowpassForEEG	Static	Asks user for lowpass value for a given EEG	eeg: str	String describing the current EEG (EEG1, EEG2, EEG3/EMG)	Integer number between 11-500 Hz for EEG	User input must be an integer between 11-500
_DisplayPODdeviceParameters	Instance	Prints a table containing the parameters for all POD devices	N/A	N/A	N/A	N/A
_OpenSaveFile_TXT	Static	Opens a text file and write the column names	fname: str	String filename	Opened file	N/A
_OpenSaveFile_EDF	Instance	Opens EDF file and write header	fname: str	String filename	Opened file	N/A
			devNum: int	Integer device number		
_WriteDataToFile_TXT	Static	Writes data to an open text file	file: IOBase	opened write file	N/A	N/A
			data: list[np.ndarray]	List of 3 items, one for each channel		
			sampleRate: int	Integer sample rate in Hz		
			t: float	integer time (in seconds) corresponding to the data		
_WriteDataToFile_EDF	Static	Writes data to an open EDF file	file: EdfWriter	opened EDF file	N/A	N/A
			data: list[np.ndarray]	List of 3 items, one for each channel		
_StreamThreading	Instance	Opens a save file, then creates a thread for each device to stream and write data from.	N/A	N/A	Dictionary with keys as the device# and values as the started Thread.	N/A
_StreamUntilStop	Instance	Streams data from a POD device and saves data to file. Stops looking when a stop stream command is read.	pod: POD_8206HR	POD device	N/A	N/A
			file: IOBase|EdfWriter	open file		
			sampleRate: int	Integer sample rate in Hz		
_StopStream	Instance	Write a command to stop streaming data to all POD devices	N/A	N/A	N/A	N/A
_uV	Static	Converts volts to microVolts, rounded to 6 decimal places	voltage: float|int	number of volts	number of uV	N/A

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
POD_8206HR	PodDevice_ 8206HR.py	Handles communication using an 8206HR POD device.	POD_Basics	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
POD_Basics	Local	For inheritance	BasicPodProtocol			
POD_Packets	Local	For handling POD packets	PodPacketHandling			
POD_Commands	Local	For command constants	PodCommands			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
__B4LENGTH	Class	Constant containing the number of bytes for a full Binary4 packet	16	int		
__B4BINARYLENGTH	Class	Constant containing the number of bytes for binary data in a Binary4 packet	8	int		
_preampGain	Instance	Preamplifier gain	10 or 100	int		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
__init__	Dunder	Runs when an instance is constructed. It runs the parent's initialization. Then it updates the _commands to contain the appropriate commands for an 8306HR POD device.	port: str|int	String of the serial port to be opened. Used when initializing the COM_io instance.	N/A	N/A
			preampGain: int	Preamplifier gain. Must be 10 or 100.		
			baudrate:int=9600	Integer baud rate of the opened serial port. Used when initializing the COM_io instance.		
UnpackPODpacket_Binary	Static	Overwrites the parent's method. Separates the components of a binary4 packet into a dictionary.	msg: bytes	Bytes string containing a complete binary4 Pod packet: STX (1 byte) + command (4 bytes) + packet number (1 bytes) + TTL (1 byte) + ch0 (2 bytes) + ch1 (2 bytes) + ch2 (2 bytes) + checksum (2 bytes) + ETX (1 byte)	A dictionary containing 'Command Number', 'Packet #', 'TTL', 'Ch0', 'Ch1', and 'Ch2' in bytes.	An exception is raised if (1) the packet does not have the minimum number of bytes, (2) does not begin with STX, or (3) does not end with ETX.
TranslatePODpacket_Binary	Static	Overwrites the parent's method. Unpacks the binary4 POD packet and converts the values of the ASCII-encoded bytes into integer values and the values of binary-encoded bytes into integers. Channel values are given in Volts.	msg: bytes	Bytes string containing a complete binary4 Pod packet: STX (1 byte) + command (4 bytes) + packet number (1 bytes) + TTL (1 byte) + ch0 (2 bytes) + ch1 (2 bytes) + ch2 (2 bytes) + checksum (2 bytes) + ETX (1 byte)	A dictionary containing 'Command Number', 'Packet #', 'TTL', 'Ch0', 'Ch1', and 'Ch2' as numbers.	N/A
TranslatePODpacket	Instance	Overwrites the parent's method. Determines if the packet is standard or binary, and translates accordingly. Adds a check for the 'GET TTL PORT' command.	msg: bytes	Bytes string containing either a standard or binary packet	A dictionary containing the unpacked message in numbers	N/A
_TranslateTTLbyte_ASCII	Static	Separates the bits of each TTL (0-3) from a byte.	ttlByte: bytes	One Byte string for the TTL (ASCII encoded)	Dictionary of the TTLs. 1 when input, 0 when output.	N/A
_TranslateTTLbyte_Binary	Static	Separates the bits of each TTL (0-3) from a byte.	ttlByte: bytes	One Byte string for the TTL (binary encoded)	Dictionary of the TTLs. 1 when input, 0 when output.	N/A
_BinaryBytesToVoltage	Instance	Converts a binary bytes value read from POD device and converts it to the real voltage value at the preamplifier input	value: bytes	Bytes string containing voltage measurement	A number containing the voltage in Volts [V].	N/A
_Read_Binary	Instance	After receiving the prePacket, it reads the 8 bytes(TTL+channels) and then reads to ETX (checksum+ETX).	prePacket: bytes	Bytes string containing the beginning of a POD packet: STX (1 byte) + command number (4 bytes)	Byte string for a binary4 POD packet.	N/A
			validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation		

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
POD_8401HR	PodDevice_8401HR.py	Handles communication using an 8401HR POD device.	POD_Basics	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
POD_Basics	Local	For inheritance	BasicPodProtocol			
POD_Packets	Local	For handling POD packets	PodPacketHandling			
POD_Commands	Local	For command constants	PodCommands			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
__B5LENGTH	Class	number of bytes for a Binary 5 packet	31	int		
__B5BINARYLENGTH	Class	number of binary bytes for a Binary 5 packet	23	int		
_channelMap	Instance	Dictionary of the channel lables	Set by _GetChannelMapping(). Dictionary keys are ['A','B','C','D']	dict[str,str]|None		
_ssGain	Instance	Dictionary of the second stage gain for all four channels	1, 5, or None. Dictionary keys are ['A','B','C','D']	dict[str,int|None]		
_preampGain	Instance	Dictionary of the preamplifier gain for all four channels.	10, 100, or None. Dictionary keys are ['A','B','C','D']	dict[str,int|None]		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
__init__	Dunder	Runs when an instance is constructed. It runs the parent's initialization. Then it updates the _commands to contain the appropriate commands for an 8401HR POD device. Sets the _channelMap, _ssGain, and _preampGain.	port: str|int	String of the serial port to be opened. Used when initializing the COM_io instance.	N/A	An exception is raised if (1) the ssGain or preampGain have improper keys, (2) the device/sensor does not exist, (3) the ssGain was given bad values, or (4) the preampGain was given bad values
			deviceName: str	String of the corresponding device/sensor name		
			ssGain:dict[str,int|None]={'A':None,'B':None,'C':None,'D':None}	Dictionary of the secondary stage gain		
			preampGain:dict[str,int|None]={'A':None,'B':None,'C':None,'D':None}	Dictionary of the preamplifier gain		
			baudrate:int=9600	Integer baud rate of the opened serial port. Used when initializing the COM_io instance.		
UnpackPODpacket_Binary	Static	Overwrites the parent's method. Separates the components of a binary5 packet into a dictionary.	msg: bytes	Bytes string containing a complete binary5 Pod packet: STX (1 byte) + command (4) + packet number (1) + status (1) + channels (9) + analog inputs (12) + checksum (2) + ETX (1)	A dictionary containing 'Command Number', 'Packet #', 'Status', 'Channels', 'Analog EXT0', 'Analog EXT1', 'Analog TTL1', 'Analog TTL2', 'Analog TTL3', 'Analog TTL4', in bytes.	An exception is raised if (1) the packet does not have the minimum number of bytes, (2) does not begin with STX, or (3) does not end with ETX.
TranslatePODpacket_Binary	Instance	Overwrites the parent's method. Unpacks the binary5 POD packet and converts the values of the ASCII-encoded bytes into integer values and the values of binary-encoded bytes into integers. The channels and analogs are converted to volts (V).	msg: bytes	Bytes string containing a complete binary5 Pod packet: STX (1 byte) + command (4) + packet number (1) + status (1) + channels (9) + analog inputs (12) + checksum (2) + ETX (1)	A dictionary containing 'Command Number', 'Packet #', 'Status', 'CH3', 'CH2', 'CH1', 'CH0', 'Analog EXT0', 'Analog EXT1', 'Analog TTL1', 'Analog TTL2', 'Analog TTL3', 'Analog TTL4', as numbers.	N/A
TranslatePODpacket	Instance	Overwrites the parent's method. Determines if the packet is standard or binary, and translates accordingly. Specially handlesTTL packet payloads.	msg: bytes	Bytes string containing either a standard or binary packet	A dictionary containing the unpacked message in numbers	N/A
GetChannelMapping	Static	Get the channel mapping (channel labels for A,B,C,D) for a given device.	device: str	String for the device/sensor name.	Dictionary with keys A,B,C,D with values of the channel names. Returns None if the device name does not exist.	N/A
GetTTLbitmask_Int	Static	Builds an integer, which represents a binary mask, that can be used for TTL command arguments.	ext0:bool=0	boolean bit	Integer number to be uses as a bit mask	N/A
			ext1:bool=0	boolean bit		
			ttl4:bool=0	boolean bit		
			ttl3:bool=0	boolean bit		
			ttl2:bool=0	boolean bit		
			ttl1:bool=0	boolean bit		
_Voltage_PrimaryChannels	Static	Converts a value to a voltage for a primary channel.	value: int	Value to be converted to voltage	Number of the voltage in volts [V]. Returns value if no gain is given (no-connect).	N/A
			ssGain:int|None=None	Second stage gain		
			PreampGain:int|None=None	Preamplifier gain		
_Voltage_PrimaryChannels_EEGEMG	Static	Converts a value to a voltage for an EEG/EMG primary channel.	value: int	Value to be converted to voltage	Number of the voltage in volts [V].	N/A
			ssGain: int	Second stage gain		
			PreampGain: int	Preamplifier gain		
_Voltage_PrimaryChannels_Biosensor	Static	Converts a value to a voltage for a biosensor primary channel.	value: int	Value to be converted to voltage	Number of the voltage in volts [V].	N/A
			ssGain: int	Second stage gain		
_Voltage_SecondaryChannels	Static	Converts a value to a voltage for a secondary channel.	value: int	Value to be converted to voltage	Number of the voltage in volts [V].	N/A
_Read_Binary	Instance	After receiving the prePacket, it reads the 23 bytes (binary data) and then reads to ETX (checksum+ETX).	prePacket: bytes	Bytes string containing the beginning of a POD packet: STX (1 byte) + command number (4 bytes)	Byte string for a binary5 POD packet.	N/A
			validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation		

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
POD_Packets	PodPacket Handling.py	Collection of methods for creating and interpreting POD packets	N/A	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
N/A	N/A	N/A	N/A			
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
STX	Static	Get STX in bytes. STX marks the starting byte of a POD Packet	N/A	N/A	Bytes for STX (0x02)	N/A
ETX	Static	Get ETXin bytes. ETX marks the end byte of a POD Packet	N/A	N/A	Bytes for ETX(0x03)	N/A
IntToAsciiBytes	Static	Converts an integer value into ASCII-encoded bytes. First, it converts the integer value into a usable uppercase hexadecimal string. Then it converts the ASCII code for each character into bytes. Lastly, it ensures that the final message is the desired length. Example: if value=2 and numBytes=4, the returned ASCII will show b'0002', which is '0x30 0x30 0x30 0x32' in bytes.	value: int	Integer value to be converted into ASCII-encoded bytes	Bytes that are ASCII-encoded conversions of the value parameter.	N/A
			numBytes: int	Number bytes to be the length of the ASCII-encoded message.		
AsciiBytesToInt	Static	Converts a ASCII-encoded bytes message into an integer. It does this using a base-16 conversion.	msg_b: bytes	Bytes message to be converted to an integer. The bytes must be base-16 or the conversion will fail.	Integer result from the ASCII-encoded byte conversion.	N/A
BinaryBytesToInt	Static	Converts binary-encoded bytes into an integer	msg: bytes	Bytes message holding binary information to be converted into an integer.	Integer result from the binary-encoded bytes message.	N/A
			byteorder:str='big'	Ordering of bytes. 'big' for big endian and 'little' for little endian.		
			signed:bool=False	Boolean flag to mark if the msg is signed (True) or unsigned (False)		
ASCIIbytesToInt_Split	Static	Converts a specific bit range in an ASCII-encoded bytes object to an integer.	msg: bytes	Bytes message holding binary information to be converted into an integer.	Integer result from the ASCII-encoded bytes message in a given bit range.	N/A
			keepTopBits: int	Integer position of the msb of desired bit range		
			cutBottomBits: int	Integer number of lsb to remove		
BinaryBytesToInt_Split	Static	Converts a specific bit range in a binary-encoded bytes object to an integer	msg: bytes	Bytes message holding binary information to be converted into an integer.	Integer result from the binary-encoded bytes message in a given bit range.	N/A
			keepTopBits: int	Integer position of the msb of desired bit range		
			cutBottomBits: int	Integer number of lsb to remove		
			byteorder:str='big'	Ordering of bytes. 'big' for big endian and 'little' for little endian.		
			signed:bool=False	Boolean flag to mark if the msg is signed (True) or unsigned (False)		
Checksum		Calculates the checksum of a given bytes message. This is achieved by summing each byte in the message, inverting, and taking the last byte.	bytesIn: bytes	Bytes message containing POD packet data	Two ASCII-encoded bytes containing the checksum for bytesIn	N/A
BuildPODpacket_Standard		Builds a standard POD packet -- STX (1 byte) + command number (4 bytes) + optional packet (? bytes) + checksum (2 bytes) + ETX (1 bytes) -- as bytes.	commandNumber: int	Integer representing the command number. This will be converted into a 4 byte long ASCII-encoded bytes string.	Bytes string of a complete standard POD packet	N/A
			payload:bytes|None=None	bytes string containing the payload		
PayloadToBytes	Static	Converts a payload into a bytes string	payload: int|bytes|tuple[int|bytes]	Integer, bytes, or tuple containing the payload	Bytes string of the payload	Raises an Exception when the payload argument is an incorrect type or formatted incorrectly.
			argSizes: tuple[int]	Tuple of the argument sizes		

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
POD_Basics	BasicPodProtocol.py	Handle basic communication with a POD device, including reading and writing packets and packet interpretation.	N/A	POD_8206HR POD_8401HR	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
COM_io	Local	For opening and connecting serial COM ports	SerialCommunication			
POD_Packets	Local	For handling POD packets	PodPacketHandling			
POD_Commands	Local	Used to contain all POD commands in the class instance	PodCommands			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
__numPod	Class	Integer equal to the number of POD_Basics class instances. Incremented on construction and decremented on destruction	0	int		
__MINSTANDARDLENGTH	Class	integer minimum number of bytes in a standard POD packet	8	int		
__MINBINARYLENGTH	Class	integer minimum number of bytes in a binary POD packet	15	int		
_port	Instance	Open serial port via COM_io class instance	COM_io	COM_io		
_commands	Instance	Command handler POD_Commands class instance	POD_Commands	POD_Commands		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
__init__	Dunder	Runs when an instance of POD_Basics is constructed. It initializes the instance variable for the COM port communication (_port) and for the command handler (_commands). It also increments the POD device counter (__NUMPOD).	port: str|int baudrate:int=9600	String of the serial port to be opened. Used when initializing the COM_io instance. Integer baud rate of the opened serial port. Used when initializing the COM_io instance.	N/A	N/A
__del__	Dunder	Runs when an instance is destructed. It decrements the POD device counter (__NUMPOD)	N/A	N/A	N/A	N/A
GetNumberOfPODDevices	Static	Get the POD device counter	N/A	N/A	Integer of the number of class instances (__NUMPOD).	N/A
UnpackPODpacket_Standard	Static	Converts a standard POD packet into a dictionary containing the command number and payload (if applicable) in bytes.	msg: bytes	Bytes message containing a standard POD packet: STX (1 byte) + command number (4 bytes) + optional packet (? bytes) + checksum (2 bytes) + ETX (1 bytes)	A dictionary containing the POD packet's 'Command Number' and 'Payload' (if applicable) in bytes.	An exception is raised if (1) the msg does not have the minimum number of bytes in a standard pod packet, (2) does not begin with STX, and (3) does not end with ETX.
UnpackPODpacket_Binary	Static	Converts a variable-length binary packet into a dictionary containing the command number, binary packet length, and binary data in bytes.	msg: bytes	Bytes message containing a variable-length POD packet: STX (1 byte) + command number (4 bytes) + length of binary (4 bytes) + checksum (2 bytes) + ETX (1 bytes) '+ binary (LENGTH bytes) + checksum (2 bytes) + ETX (1 bytes)	A dictionary containing the 'Command Number', 'Binary Packet Length', and 'Binary Data' in bytes.	An exception is raised if (1) the msg does not have the minimum number of bytes in a standard pod packet, (2) does not begin with STX, (3) does not end with ETX., and (4) does not have an ETX after standard packet.
TranslatePODpacket_Standard	Instance	Unpacks the standard POD packet and converts the ASCII-encoded bytes values into integer values.	msg: bytes	Bytes message containing a standard POD packet	A dictionary containing the POD packet's 'Command Number' and 'Payload' (if applicable) in integers.	N/A
TranslatePODpacket_Binary	Static	Unpacks the variable-length binary POD packet and converts the values of the ASCII-encoded bytes into integer values and leaves the binary-encoded bytes as is.	msg: bytes	Bytes message containing a variable-length POD packet	A dictionary containing the 'Command Number' and 'Binary Packet Length' in integers, and 'Binary Data' in bytes.	N/A
_ValidateChecksum	Static	Validates the checksum of a given POD packet. The checksum is valid if the calculated checksum from the data matches the checksum written in the packet.	msg: bytes	Bytes message containing a POD packet: STX (1 bytes) + data (? bytes) + checksum (2 bytes) + ETX (1 byte).	Returns True if the checksum is correct, false otherwise.	An exception is raised if the msg does not begin with STX or end with ETX.
GetDeviceCommands	Instance	Gets the dictionary containing the class instance's available POD commands.	N/A	N/A	Dictionary containing the available commands and their information. Formatted as key(command number) : value([command name, number of argument ASCII bytes, number of return bytes, binary flag])	N/A
SetBaudrateOfDevice	Instance	If the port is open, it will change the baud rate to the parameter's value	baudrate: int	Integer baud rate to set for the open serial port.	True if successful at setting the baud rate, false otherwise	N/A
UnpackPODpacket	Static	Determines if the packet is standard or binary, and unpacks accordingly.	msg: bytes	Bytes string containing either a standard or binary packet	A dictionary containing the unpacked message in bytes	N/A
TranslatePODpacket	Instance	Determines if the packet is standard or binary, and translates accordingly.	msg: bytes	Bytes string containing either a standard or binary packet	A dictionary containing the unpacked message in numbers	N/A
WriteRead	Instance	Writes a command with optional payload to POD device, then reads (once) the device response.	cmd: str|int payload:int|bytes|tuple[int|bytes]=None validateChecksum:bool=True	An integer representing the command number. None when there is no payload. If there is a payload, set to an integer value or a bytes string. Set to True to validate the checksum. Set to False to skip validation	Bytes string containing a POD packet beginning with STX and ending with ETX. This may be a standard packet, binary packet, or an unformatted packet (STX+something+ETX).	N/A
		Builds a POD packet and writes it to a POD device via	cmd: str|int	An integer representing the command number.		An exception is raised if (1) the command does not

GetPODpacket	Instance	Builds a POD packet and writes it to a POD device via COM port. If an integer payload is give, the method will convert it into a bytes string of the length expected by the command. If a bytes payload is given, it must be the correct length.	payload:int|bytes|tuple[int|bytes]=None	None when there is no payload. If there is a payload, set to an integer value, bytes string, or tuple	Returns the bytes string of the POD packet.	exist for the instance, (2) a payload is not given when the command expects one, (3) the payload (given in bytes) is the size not expected by the command, or (4) the payload is given as a type other than integer or bytes.
WritePacket	Instance	Builds a POD packet and writes it to the POD device.	cmd: str|int	An integer representing the command number.	Returns the bytes string that was written to the POD device	N/A
			payload:int|bytes|tuple[int|bytes]=None	None when there is no payload. If there is a payload, set to an integer value, bytes string, or tuple		
ReadPODpacket	Instance	Reads a complete POD packet, either in standard or binary format, beginning with STX and ending with ETX. Reads first STX and then starts recursion.	validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation	Bytes string containing a POD packet beginning with STX and ending with ETX. This may be a standard packet, binary packet, or an unformatted packet (STX+something+ETX).	N/A
_ReadPODpacket_Recursive	Instance	Reads the command number. If the command number ends in ETX, the packet is returned. Next, it checks if the command is allowed. Then, it checks if the command is standard or binary and reads accordingly, then returns the packet.	validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation	Bytes string containing a POD packet beginning with STX and ending with ETX. This may be a standard packet, binary packet, or an unformatted packet (STX+something+ETX).	N/A
_Read_GetCommand	Instance	Reads one byte at a time up to 4 bytes to get the ASCII-encoded bytes command number. For each byte read, it can (1) start the recursion over if an STX is found, (2) returns if ETX is found, or (3) continue building the command number.	validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation	4 byte long string containing the ASCII-encoded command number.	An exception is raised if the command number is not allowed for the POD device
_Read_ToETX	Instance	Reads one byte at a time until an ETX is found. It will restart the recursive read if an STX is found anywhere.	validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation	Bytes string ending with ETX	N/A
_Read_Standard	Instance	Reads the payload, checksum, and ETX. Then it builds the complete standard POD packet in bytes.	prePacket: bytes	Bytes string containing the beginning of a POD packet: STX (1 byte) + command number (4 bytes)	Bytes string for a complete standard POD packet	An exception is raised if the checksum is invalid (only if validateChecksum=True)
			validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation		
_Read_Binary	Instance	Reads the remaining part of the variable-length binary packet. It first reads the standard packet (prePacket+payload+checksum+ETX). Then it determines how long the binary packet is from the payload of the standard POD packet and reads that many bytes. It then reads to ETX to get the checksum+ETX.	prePacket: bytes	Bytes string containing the beginning of a POD packet: STX (1 byte) + command number (4 bytes)	Bytes string for a variable-length binary POD packet	An exception is raised if the checksum is invalid (only if validateChecksum=True)
			validateChecksum:bool=True	Set to True to validate the checksum. Set to False to skip validation		

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
POD_Commands	PodCommands.py	Manages a dictionary containing available commands for a POD device.	N/A	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
N/A	N/A	N/A	N/A			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
__NAME	Class	index key for the command name for __commands list values	0	int		
__ARGUMENTS	Class	index key for the number of bytes in an argument for __commands list values	1	int		
__RETURNS	Class	index key for the number of bytes in the return for __commands list values	2	int		
__BINARY	Class	index key for the binary flag for __commands list values	3	int		
__NOVALUE	Class	Integer used to mark when a list item in __commands means 'no value' or undefined.	-1	int		
__U8	Class	Number of bytes for an unsigned 8-bit value	2	int		
__U16	Class	Number of bytes for an unsigned 16-bit value	4	int		
__commands	Instance	Dictionary containing the available commands for a POD device. Each entry is formatted as { key(command number) : value([command name, number of argument ASCII bytes, number of return bytes, binary flag) }	POD_Commands.GetBasicCommands()	dict[int,list[str|tuple[int]|bool]]		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
__init__	Dunder	Runs whan an instance is constructed. It sents the commands dictionary to the basic command set.	N/A	N/A	N/A	N/A
NoValue	Static	Gets value of __NOVALUE	N/A	N/A	Value of __NOVALUE	N/A
U8	Static	Gets value of __U8	N/A	N/A	Value of __U8	N/A
U16	Static	Gets value of __U16	N/A	N/A	Value of __U16	N/A
GetBasicCommands	Static	Creates a dictionary containing the basic POD command set (0,1,2,3,4,5,6,7,8,9,10,11,12)	N/A	N/A	N/A	N/A
GetCommands	Instance	Gets the contents of the current command dictionary (__commands)	N/A	N/A	N/A	N/A
RestoreBasicCommands	Instance	Sets the current commands (__commands) to the basic POD command set.	N/A	N/A	N/A	N/A
AddCommand	Instance	Adds a command entry to the current commands dictionary (__commands) if the command does not exist	commandNumber: int	Integer of the command number	True if the command was successfully added, False if the command could not be added because t already exists.	N/A
			commandName: str	String of the command's name		
			argumentBytes: tuple[int]	Integer of the number of bytes in the argument		
			returnBytes: tuple[int]	Integer of the number of bytes in the return		
			isBinary: bool	Boolean flag to mark if the command is binary (True) or standard (False)		
RemoveCommand	Instance	Removes the entry for a given command in __commands dictionary.	cmd: int|str	integer command number or string command name.	True if the command was successfully removed, False if the command does not exist.	N/A
CommandNumberFromName	Instance	Gets the command number from the command dictionary using the command's name	name: str	string of the command's name	Integer representing the command number. If the command could not be found, return None.	N/A
ArgumentBytes	Instance	Gets the tuple for the number of bytes in the argument for a given command.	cmd: int|str	integer command number or string command name.	Tuple representing the number of bytes in the argument for cmd. If the command could not be found, return None.	N/A
ReturnBytes	Instance	Gets the tuple for the number of bytes in the return for a given command.	cmd: int|str	integer command number or string command name.	Tuple representing the number of bytes in the return for cmd. If the command could not be found, return None.	N/A
IsCommandBinary	Instance	Gets the binary flag for a given command	cmd: int|str	integer command number or string command name.	Boolean flag that is True if the command is binary and False if standard. If the command could not be found, return None.	N/A
DoesCommandExist	Instance	Checks if a command exists in the __commands dictionary	cmd: int|str	integer command number or string command name.	True if the command exists, false otherwise.	N/A

Class						
Name	**File**	**Description**	**Parent**	**Child**	**Author**	
COM_io	SerialCommunication.py	Handle serial communication (read/write) using COM ports.	N/A	N/A	Thresa Kelly	
Imports						
Name	**Origin**	**Description**	**From**			
serial.tools.list_ports	Enviornment	For accessing the COM ports on the computer	N/A			
Variables						
Name	**Scope**	**Description**	**Value**	**Type**		
__serialInst	Instance	Serial object to set the port and baud rate to. It can be opened or closed.	Serial	serial.Serial		
Methods						
Name	**Type**	**Description**	**Parameter Name**	**Parameter Purpose**	**Return**	**Exception**
GetCOMportsList	Static	Finds all the available COM ports on the user's computer and appends them to an accessible list.	N/A	N/A	List containing the names of available COM ports	N/A
__init__	Dunder	Runs when the object is constructed. It initialized the __serialInst to a given COM port with a set baudrate.	port: str|int	String of the serial port to be opened.	N/A	N/A
			baudrate:int=9600	Integer baud rate of the opened serial port.		
__del__	Dunder	Runs when the object is destructed. It closes the serial port, if open.	N/A	N/A	N/A	N/A
__BuildPortName	Instance	Converts the port parameter into the "COM"+<number> format	port: str|int	Name of a COM port. Can be an integer or string.	N/A	N/A
IsSerialOpen	Instance	Returns True if the serial instance port is open, false otherwise	N/A	N/A	N/A	N/A
IsSerialClosed	Instance	Returns False if the serial instance port is open, True otherwise	N/A	N/A	N/A	N/A
CloseSerialPort	Instance	Closes the instance serial port if it is open.	N/A	N/A	N/A	N/A
OpenSerialPort	Instance	First, it closes the serial port if it is open. Then, it opens a serial port with a set baud rate.	port: str|int	String of the serial port to be opened.	N/A	Raises an exception if the given port does not exist.
			baudrate:int=9600	Integer baud rate of the opened serial port.		
SetBaudrate	Instance	If the port is open, it will change the baud rate to the parameter's value	baudrate: int	Integer baud rate to set for the open serial port.	True if successful at setting the baud rate, false otherwise	N/A
GetPortName	Instance	Gets the name of the open port.	N/A	N/A	If the serial port is open, it will return a string of the port's name. If the port is closed, it will return None.	N/A
Read	Instance	Reads a specified number of bytes from the open serial port.	numBytes: int	Integer number of bytes to read	If the serial port is open, it will return a set number of read bytes. If it is closed, it will return None.	N/A
ReadLine	Instance	Reads until a new line ('\n') from the open serial port.	N/A	N/A	If the serial port is open, it will return a complete read line. If closed, it will return None.	N/A
ReadUntil	Instance	Reads until a set character from the open serial port.	eol: bytes	end-of-line character	If the serial port is open, it will return a read line ending in eol. If closed, it will return None.	N/A
Write	Instance	Write a set message to the open serial port.	message: bytes	byte string containing the message to write	N/A	N/A