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Objective

This BLE example project demonstrates how to use the BLE Component's Automation IO profile feature and related APIs.

Overview

This example project configures the CY8CKIT-042-BLE PSoC 4 Pioneer Kit as an Automation Input Output Server (AOIS) with two instances of a Digital characteristic, two instances of an Analog characteristic, and an Aggregate characteristic:

- The value of the CapSense[®] Linear Slider position is used as the input parameter for Instance 0 of the Analog characteristic. Instance 1 of the Analog characteristic is used for setting the Current Digital-to-Analog Converter (IDAC) output current.
- The value of the **SW2** button is used as the input parameter for Instance 0 of the Digital characteristic and for indication of the Analog characteristic.
- Instance 1 of the Digital characteristic is used for the blue LED control on the CY8CKIT-042-BLE PSoC 4 Pioneer Kit

In this example project, security connection (Mode 1, Level 4 option) is enabled with the passkey-based authenticated man-inthe-middle (MITM) attack prevention and automatic fallback to the legacy authenticated MITM mode if security connection is not supported by the peer device or selected BLE device family.

This example supports all the GATT sub-procedures defined in the AIOS specification.

Requirements

Tool: PSoC Creator 4.0 or later

Programming Language: C (GCC 4.9 or later)

Associated Parts: PSoC 4 BLE parts

Related Hardware: CY8CKIT-042-BLE PSoC 4 Pioneer Kit with the CY8CKIT-143A PSoC[®] 4 BLE 256-KB Module and CY5677 CySmart BLE 4.2 USB Dongle that supports Security Connection

Design

This example project consists of the following components:

- Bluetooth Low Energy (BLE)
- Current Digital-to-Analog Converter (IDAC)
- Capacitive Sensing (CapSense)
- Universal Asynchronous Receiver-Transmitter (UART)
- LEDs
- SW2

The schematic is shown in Figure 1.

This project demonstrates the functionality of the BLE Component configured as the AIO Server. It is designed to work with the CySmart PC application.



After a startup, the device initializes the BLE Component. For proper operation, the Component requires several callback functions to receive events from the BLE Stack. The AppCallBack() function is used to receive general BLE events. Another callback (AiosCallBack()) is used to receive events specific to the service-attribute operations.

The CYBLE_EVT_STACK_ON event indicates the successful initialization of the BLE Stack. After this event is received, the Component starts fast advertising with the packet structure as configured in the BLE Component Customizer (Figure 7).

The SW2 button on CY8CKIT-042 BLE is used to do the following:

- Accept the password displayed on a Windows terminal application such as HyperTerminal or PuTTy (This can also be done by pressing y on HyperTerminal. Optionally, the example project can use legacy Security Mode 1 Level 3 (Authenticated pairing with encryption.)
- Change the value of the Digital characteristic
- Present an indication of the Aggregate characteristic
- Exit the low-power mode

The IDAC is used for the output value of Analog characteristic Instance 1.

The CapSense Linear Slider is used as the input value of Analog characteristic Instance 0.

The green LED on CY8CKIT-042 BLE indicates that BLE is in advertisement mode.

The red LED indicates that the Automation IO Server is disconnected or is in the low-power mode.

The blue LED is used to indicate the state of Digital characteristic Instance 1.

The UART is used to print debug information and scan commands from a terminal.

Figure 1. BLE Automation Input Output Server Example Project Schematic





Design Considerations

This code example is designed for the PSoC 4 BLE family and associated with the CY8CKIT-042-BLE PSoC 4 Pioneer Kit. The design is easily portable to other PSoC BLE devices and kits, typically by just changing the device and Components' pin assignments.

Hardware Setup

1. Connect the BLE Pioneer Kit to the computer's USB port, as Figure 2 shows.

Figure 2. Connect USB Cable to J13



2. Connect the BLE Dongle to one of the USB ports on the computer.

Figure 3. Connect BLE Dongle to USB Port





Software Setup

Using UART for Debugging

A HyperTerminal program is required in a PC to receive the debug information. If you do not have a HyperTerminal program installed, download and install any serial port communication program. Freeware such as HyperTerminal, Bray's Terminal, or Putty are available on the web:

- 1. Connect the PC and kit with a USB cable.
- 2. Open the device manager program in your PC, find the COM port to which the kit is connected, and note the port number.
- 3. Open the HyperTerminal program and select the COM port to which the kit is connected.
- 4. Configure the baud rate, parity, stop bits, and flow control information in the HyperTerminal configuration window. The default settings are: baud rate – 115200, parity – none, stop bits – 1 and flow control – XON/XOFF. These settings have to match the configuration of the PSoC Creator UART Component in the project.
- 5. Start communicating with the device as explained in the project description.

Components

Table 1 lists the PSoC Creator Components used in this example, as well as the hardware resources used by each Component.

Component	Hardware Resources
BLE	BLE Subsystem
UART	GPIO rx – P1[4], tx – P1[5]
IDAC	GPIO P3[0]
CapSense	GPIO P4[0] – Cmod P2[1] - P2[5] – Linear Slider
Advertising_LED	GPIO P3[6]
Digtal_Output_LED	GPIO P3[7]
LowPower_LED	GPIO P2[6]
SW2	GPIO P2[7]

Table 1. List of PSoC Creator Components

Parameter Settings

BLE Component

The BLE Component is configured as the Automation IO Profile in the Automation IO Server (GATT Server) Profile role with the settings shown in the figures below.



Figure 4. GATT Settings

General Profiles GAP Settings L2CAP Settings	Advanced Built-in			4
Image: Second Secon	Characteristic: Digital The Digital characteristi state of an IO Module's UUID: 2A56 Name Fields Digital Properties	c is used to digital signa Type 2bit	expose a als. Length	and change th Value
C Digital C Digital C Digital C Characteristic Presentation Format C Characteristic User Description C Value Trigger Setting C Analog C Characteristic Presentation Format C Characteristic User Description C Value Trigger Setting C Aggregate C Aggregate C Aggregate C Characteristic Presentation Format C Digital 2 C Characteristic User Description C Characteristic User Description C Characteristic User Description C Value Trigger Setting C C Analog 2 C Characteristic Presentation Format C Characteristic Presentati	Read Write WriteWithoutRespon Notify Indicate Permissions	IS®		

Figure 5. GAP Settings

General Profiles GAP Set	tings L2CAP Settings Advanced Bu	uilt-in	
General Peripheral role Advertisement settings Advertisement packet Scan response packet Peripheral preferred conne Security	Device address Public address (Company ID - Company Silicon generated "Company assigne You can use the user configuration to store the public device address f	v assigned): 00A050-00001F ed" part of device address i section of the supervisory flash for mass production.	
	Device name:	Automation IO	
	Appearance:	Unknown	
	Attribute MTU size (bytes):	23	
	Link layer max TX payload size (bytes):	27	
	Link layer max RX payload size (bytes):	27	
	Adv/Scan TX power level (dBm):	0 -	
4 111	ConnectionTX power level (dBm):	0 🔹	
No.			



General Profiles GAP Set	tings L2CAP Settings Ad	vanced Built-in	٩				
General Peripheral role	Discovery mode:	General					
Advertisement settings	Advertising type:	Connectable undirected advertising					
Scan response packet	Filter policy:	Scan request Any Connect request Any					
- Security	Advertising channel map:	All channels					
	Advertising interval Fast advertising interval: Minimum (ms): Maximum (ms):	20 🚖 30 🜩					
	Slow advertising interva						
	Minimum (ms):	1000					
	Maximum (ms):	2500					
Restore Defaults	☑ Timeout (s):	150 <u>*</u>					

Figure 6. GAP Settings: Advertisement Settings



me: BLE_1							
General Profiles GAP Set	ings L2CAP Settings Advanced Built-In						
General	Advertisement data settings:	Advertisement packet:					
- Advertisement settings	Name Value	Description	Value	Inde			
Advertisement packet	Ģi√ Flags	= AD Data 1: < <flags>></flags>					
- Scan response packet	General discoverable mode	Length	0x02	[0]			
Security	BR/EDR not supported		0x01	[1]			
	😑 🗹 Local Name	BR/EDR not supported General discoverable mode	0x06	[2]			
	Local name Complete	AD Data 2: < <local name="">></local>					
	TX Power Level	Length	0x0E	[3]			
	Slave Connection Interval Range		0x09	[4]			
	🗄 🗹 Service UUID	-'A'	0x41	[5]			
	L V Automation IO	'u'	0x75	[6]			
	Service Solicitation		0x74	[7]			
	• Service Data	-'o'	0x6F	[8]			
	Service Manager TK Value	'm'	0x6D	[9]			
	Appearance	···'a'	0x61	[10]			
	Public Target Address	T	0x74	[11]			
	🕀 📃 Random Target Address	-7	0x69	[12]			
	Advertising Interval	'o'	0x6F	[13]			
	LE Bluetooth Device Address	'n'	0x6E	[14]			
	E LE Role		0x20	[15]			
	• URI		0x49	[16]			
	Manufacturer Specific Data	-'0'	0x4F	[17]			
		AD Data 3: << Complete list of 16-bit UUIDs available>>					
		Length	0x03	[18]			
			0x03	[19]			
		Service: Automation IO					
		-[0]	0x15	[20]			
		[1]	0x18	[21]			
Restore Defaults							



Figure 8. Security Settings

General Profiles GAP Settin	gs / L2CAP Settings / Advan	ced 🖌 Built-in				
Peripheral role	Security mode:	Mode 1				
Advertisement settings Advertisement packet	Security level:	Authenticated LE Secure Connections pairing with encryption	•			
- Scan response packet	Strict pairing:	No	•			
Security	I/O capabilities:	Display	•			
	Keypress notifications:	No	Ŧ			
4 111 1	Bonding requirement:	Bonding	•			
	Encryption key size (bytes):	16				

IDAC

Figure 9 shows the settings for the IDAC Component. See the IDAC Component datasheet for additional information.

Config	ure Built-	in		4
Polarity		-	Resolution	
Positiv	e (Source)		🔘 8-bit	
Negati	ve (Sink)		9 7-bit	
Value			Range	
uA:	240.0	-	O-152.4 uA (1.2 uA/bit)	
8 bit hex:	64		O-304.8 uA (2.4 uA/bit)	
Note: cha field reca	nging any v culates the	alue others		

Figure 9. IDAC Component Parameters

CapSense

Figure 10 shows the settings for the CapSense Component. See the CapSense Component datasheet for additional information.

Figure 10. CapSense Component's Basic Tab

Ba	sic Advanced Buit-in	X Delete C5	D tunin	a mode:	SmartSense (Full A	∢ Ito-Tune)
Гуре	Name	Sensing mode	Sen	sing elerr	ent(s)	Finger capacitance
D	LinearSlider0	CSD (Self-cap)	5	Segme	ents	1 pF
+				_		
Sensi						



Operation

- 1. Build and program the BLE Automation IO Server project into the CY8CKIT-042 PSoC[®] 4 Pioneer Kit with a PSoC 4 BLE device.
- 2. Run a Windows terminal application such as HyperTerminal or PuTTy.
- 3. To use the CySmart Windows application as the BLE Automation IO Client, connect the CySmart BLE dongle to a USB port on the PC (Figure 3).
- 4. Launch the CySmart application and select the connected dongle in the dialog window.
- 5. Reset the development kit to start advertising by pressing the SW1 button on the BLE Pioneer Kit.
- 6. Click the Start Scan button to discover available devices. Click Stop Scan.
- 7. Select Automation IO in the list of available devices and click Connect button:

Figure 11. CySmart Window

E CySmart 1.2	all and the second second]	X
<u>File Tools</u>	<u>H</u> elp								
🚯 Select Dongle	🎭 Configure Master Settin	gs 🛠 Manage	PSMs 🛱	Disconnect					
Master									
Discovered devic	es								
🔣 Start Scan 💆	Connect R Add to Whitel	ist 🚺 Update I	Firmware		Adv	ertisement data Scan response data			
# Device	Bluetooth Address	Address Type	RSSI	Advertisement Type	E+ 1	2			
1 Automation IO	00:A0:50:00:00:1F	Public	-39 dBm	Connectable undirected	Desc	sription	Value	Index	×
2 T	11:23:20:01:00:00	Public	-79 dBm	Connectable undirected	⊟ A	D Data 0: < <flags>></flags>			Ξ
3 Peer Device	56:DC:DD:69:3F:94	Random	-74 dBm	Connectable undirected		Length of this data	0x02	[0]	
4 PTS-CGMP-10	00:1B:DC:07:32:1C	Public	-79 dBm	Connectable undirected	Ē	< <flags>></flags>	0x01	[1]	
5 PTS-WSP-873	00:1B:DC:07:31:87	Public	-79 dBm	Connectable undirected	_	E Flag Data: 0x06	0x06	[2]	
						- LE Limited Discoverable Mode	OFF		
Device List				, P		LE General Discoverable Mode	ON		
+ Add Rem	ove 🗊 Clear 🚺 Refresh					- BR/EDR Not Supported	ON		
	ove menear	Identity Adv	droce W/b	itolict Bond List Dotails	Daw	Simultaneous I E and RD/EDD to Same Device Canable (Centroll	OFF	1	_
Device Address		Identity Add	JIESS WI	Intelist Dond List Details	02.01	106:0F:09:41:75:74:6F:6D:61:74:69:6F:6F:20:49:4F:03:03:15:18			
					02.01	100.0E100.117.00.101.0E101.0E120.10.111.00.00.10.10			
									-
					_			_	
Log									
Clear Log	Save Log								
[12:57:31:684] : 'Cor [12:57:31:684] :	Status: BLE_STATUS_OK	bd							
							_	_	.::

- 8. Click Stop Scan and Start Scan in CySmart. Select the IPS device.
- 9. Click **Pair**. Click **Yes** to the pairing request received from the peer device.
- 10. Compare the displayed passkeys on both devices. Click **Yes** on CySmart and **y** on the terminal application (or **SW2** button) to confirm the comparison pairing procedure.
- 11. Click **Discover All Attributes**, and then click **Read All Characteristics** in the CySmart application. Observe the received characteristic values.
- 12. To read a slider position, touch the linear slider on the CY8CKIT-042 PSoC 4 Pioneer Kit (Figure 12) and observe the slider position in the terminal program.







13. Select Analog characteristic Instance 0 (handle 0x0017) in CySmart and click **Read Value.** The received value should be the same as the slider position in the terminal program. See Figure 13. For detailed information about the CapSense Component, refer to the CapSense Component datasheet.

Figure 13. Reading Slider Pos	ition
-------------------------------	-------

E CySmart	2.0									X
<u>File T</u> oo	ols <u>H</u> elp									
Select Do	ongle 🧆 O	onfigure N	Aaster Settings 🛠 Manage PSMs 🛱 Dis	connect						
Master Auto	omation IO [(00:A0:50:00	:00:1F]							
Attributes								Attribute Details Send Comm	ands	
Oiscover .	All Attribu	tes 😍 Pa	air 🛛 🗷 Enable All Notifications 🙆 Disal	ole All Notifications	View: Ca	ategory 👻 🖽 💶		Handle: 0x0017	N2 10	
Handle		UUID	UUID Description	Value		Properties	*	UUID: 0x2A58		
<mark>⊝-Ch</mark> a	aracteristic I	Declaration	1					UUID Description:		
e c	0x0016	0x2803	Characteristic Declaration	02:17:00:58:2A				Value:		
	0x0017	0x2A58		2A:00		0x02		2A:00		2
	0x0018	0x2904	Characteristic Presentation Format							
	0x0019	0x2901	Characteristic User Description						-	
	- 0x001A	0x290A						Read Value	Write Value	•
	- 0x001B	0x290E						Descention	Carbled	
	-0x001C	0x2906	Valid Range					Properties	Enabled	-
<mark>⊡-Ch</mark> a	aracteristic I	Declaratio	ו					Broadcast		-
⊟-C	0x001D	0x2803	Characteristic Declaration	22:1E:00:5A:2A			=	Read		-
	-0x001E	0x2A5A		00:00:00:00:00		0x22		Write without response		-
	0x001F	0x2902	Client Characteristic Configuration					Vvrite	-	-
<mark>⊡-Ch</mark> a	aracteristic I	Declaration	1					Induly		-
⊟-C	0x0020	0x2803	Characteristic Declaration	0E:21:00:56:2A				Indicate	-	-
	0x0021	0x2A56		00		0x0E		Authenticated signed writes		
	0x0022	0x2904	Characteristic Presentation Format				-	Extended properties		
Attributes L	2CAP Chan	nels Con	ection Details	1			5			
Log										
💼 <u>C</u> lear Log) 🕌 <u>S</u> ave L	.og								
[19:04:32:874]	: 'Command	Complete	event received							
[13.04.32.0/4]	I. Statu	S. DLC_51	4105_0K							-
										.d



14. To set the IDAC current, select Analog characteristic Instance 1 (handle 0x0028) in CySmart, enter the value in the Value window, and click Write Value (Figure 14).

CvSmai	+20								_ 0
Cyshia									
File IC	ongla en (opfiques	Master Settings St Manage BSMs # D	icconnect					
Master Al	Itomation IO I	00·A0·50·00		Isconnect					
Attributes								Attribute Details Send C	ommands
Oiscove	er All Attribu	ites 📀 P	air 🛛 💶 Enable All Notifications 🙆 Disa	able All Notifications	View: C	ategory 👻 🖽 🖬		Handle: 0x	0028
Handle		UUID	UUID Description	Value		Properties	-	UUID: 0x	2A58
	0x001E	0x2A5A		00:00:00:00		0x22		UUID Description:	
	- UXUU IF	0x2902	Client Characteristic Configuration					Value:	
		Declaratio	n Characteristic Declaration	05-21-00-56-24		1		11:00	
	0x0020	0x2003	Characteristic Declaration	00.00		0-05	-		
	0x0021	0x2A30	Charactoristic Procontation Format	00		OXOE	-		
	0x0022	0x2901	Characteristic User Description				-	Rea	d Value
	0x0020	0x290A		0			-	Properties	Enabled
	- 0x0025	0x290F					-	Broadcast	
	0x0026	0x2909		0			1	Read	
<u>⊟</u> -C	haracteristic	Declaratio	n				Ŧ	Write without response	
1 E	0x0027	0x2803	Characteristic Declaration	0E:28:00:58:2A			4	Write	~
	0x0028	0x2A58		11:00		0x0E		Notify	
	-0x0029	0x2904	Characteristic Presentation Format					Indicate	
	- 0x002A	0x2901	Characteristic User Description	Ĉ.			H	Authenticated signed v	vrites
-	- 0x002B	0x290A						Extended properties	
	- 0x002C	0x290E				5 F		5	
	0x002D	0x2906	Valid Range				*		
Attributes	L2CAP Char	nels Con	nection Details	•					
.og									
<u> C</u> lear Lo	og 🔛 Save	Log							
19:15:28:80	8]: 'Comman 8]: Statu	d Complete is: BLE ST	'event received ATUS OK						
	11 - 040 (280-280								

Figure 14. Setting IDAC Current

15. Observe the result in the terminal program. Also, you can measure the IDAC output current between P3.0 and GND pins on the CY8CKIT-042 PSoC 4 Pioneer Kit using an ammeter (Figure 15).



Figure 15. IDAC Current Measurement



16. The max value of the IDAC current is 304.8 μA (2.4 μA/bit). The max value for Analog characteristic Instance 1 is 127.

For detailed information about the IDAC, refer to the IDAC Component datasheet.

- 17. Do the following to control the LEDs from CySmart :
 - Turn the blue LED ON: Write 1 to the Digital characteristic Instance 1 (handle 0x0021).
 - Turn the blue LED OFF: Write 0 to the Digital characteristic Instance 1 (handle 0x0021).
- 18. To execute the previous operation, do the following:
 - Select the Digital characteristic Instance 1 (handle 0x0021) in CySmart.
 - Enter the required value in the Value window.
 - Click Write Value (Figure 16).

Figure 16. LED Control

ibutes							Attribute Details Send Comman	ıds
Discove	er All Attribu	ites 📀 P	air 🛛 Enable All Notifications 🖉 Disa	ble All Notifications	View: C	ategory 🔻 陆 💶 👳	Handle: 0x0021	
ndle	- IMULLE	UUID	UUID Description	Value		Properties	UUID: 0x2A56	
	0x001E	0x2902	Client Characteristic Configuration	00.00.00.00		0.22	UUID Description:	
E-C	haracteristic	Declaratio					Value:	
	0x0020	0x2803	Characteristic Declaration	0E:21:00:56:2A			01	
	0x0021	0x2A56		01		0x0E		
1	0x0022	0x2904	Characteristic Presentation Format					-
	- 0x0023	0x2901	Characteristic User Description				Read Valu	e 🔻 Write Valu
	- 0x0024	0x290A					Properties	Enabled
1	- 0x0025	0x290E					Broadcast	
	0x0026	0x2909					Read	
E-CI	haracteristic	Declaratio	in .				Write without response	✓
-	0x0027	0x2803	Characteristic Declaration	0E:28:00:58:2A			Write	~
	0x0028	0x2A58		11:00		0x0E	Notify	
	-0x0029	0x2904	Characteristic Presentation Format	0		=	Indicate	
	-0x002A	0x2901	Characteristic User Description				Authenticated signed writes	
	-0x002B	0x290A	0	0			Extended properties	
ributos	- 0x002C		nection Details					
inDutes		an a ge a a			_			
	(1) -							



19. To read the **SW2** button, select the Digital characteristic Instance 0 (handle 0x0010) in CySmart and click **Read** Value (Figure 17).

		1	• • • • • • • • • • • • • • • • • • •					
Select Dongle *	Configure	Master Settings 🛪 Manage PSMs 🟮 D	isconnect					
ttributes	[00.A0.50.0						Attribute Details Son	d Commondo
Discover All Attrib	ites 🎝 🖡	Pair I Enable All Notifications I Dis	able All Notifications	View	Category -		Line dies	0-0010
			Value	view.	Properties			0x2056
iandie i⇒ 0x000B	0x2803	Characteristic Declaration	20:0C:00:05:2A		Fioperiles		UUID Description:	UZAJO
0x0000	0x2A05	Service Changed	20.00.00.00		0x20		Value:	
0x0000	0x2902	Client Characteristic Configuration				-	01	
Primary Service De	claration							
	0x2800	Primary Service Declaration	15:18		<u></u>	_		
- Characteristic	Declaratio	20					Deer	Malua 🔽 Maita Malu
	0x2803	Characteristic Declaration	02:10:00:56:2A			-	Read	value value
0x0010	x2A56		01		0x02	Ξ	Properties	Enabled
- 0x0011	0x2904	Characteristic Presentation Format					Broadcast	
-0x0012	0x2901	Characteristic User Description			5	_	Read	
- 0x0013	0x290A	F				-	Write without respo	nse
0x0014	0x290F				5		Write	
0x0015	0x2909					-	Notify	
- Characteristic	Declaratio	20				_	Indicate	
	0x2803	Characteristic Declaration	02·17·00·58·2A			_	Authenticated signe	ed writes
0x0017	0x2A58		24:00		0x02		Extended properties	5
- 0x0018	0x2904	Characteristic Presentation Format				-	-	
Attributes		Inection Details						
Clear Log La Sava	Log							
	LUG							

Figure 17. LED Control



 To aggregate the characteristic indication, click Enable ALL Notifications in CySmart and press the SW2 button on the CY8CKIT-042 PSoC 4 Pioneer Kit. Observe the indicated value in the Aggregate characteristic (handle 0x001E) value window (Figure 18).

Select Master ttribute Disco	t Dongle 👒 C Automation IO [s over All Attribu	onfigure 00:A0:50:00 tes	Master Settings 🛠 Manage PSMs 💆 Di 2001F] air 🖪 Enable All Notifications 🞯 Disa	sconnect ble All Notifications	View:	Category 💌	82,	Attribute Details Handle:	Send Comman 0x001E	ds
landle	andle UUID UUID Description Value Properties				*	UUID: 0x2A5A				
þ	Characteristic	Declaratio	'n			· .		UUID Descripti	ion:	
	⊡ 0x0016	0x2803	Characteristic Declaration	02:17:00:58:2A				Value:		
	- 0x0017	0x2A58		00:00		0x02		01:1E:00:00:00		
	- 0x0018	0x2904	Characteristic Presentation Format							
	- 0x0019	0x2901	Characteristic User Description							
	- 0x001A	0x290A	··						Read Value	Write Value
	- 0x001B	0x290E						Proportion		nabled
	0x001C	0x2906	Valid Range					Properties	1	Induled
þ	Characteristic	Declaratio	n			22		Droadcast		
	⊡ 0x001D	0x2803	Characteristic Declaration	22:1E:00:5A:2A				Keau		
	0x001E)x2A5A		01 1E:00 00:00		0x22	H	Write	esponse	
	-0x001F	0x2902	Client Characteristic Configuration	02:00				vvnte		
þ	Characteristic	Declaratio	in 🖉			32	<u>1</u>	Indicate		
	B 0x0020	0x2803	Characi Digital	Analog	Analog	1		Authenticate		
-0x0021 0x2A56 Characteristic 0 Characteristic 1										
	- 0x0022	0x2904	Characteristics	Linear Slider	AC value			Extended prop	berties	
Attribute	L2CAP Char	nels Con	Characteristic Lloss Description				7			
oa							_			
- J Clear		00								
2.27.50	·349] · Attrib	ute Handle	: 0x001E							

Figure 18. Aggregate Characteristic Indication

For detailed information about the CySmart Central Emulation Tool, refer to the CySmart User Guide.



Related Documents

Table 2 lists all relevant application notes, code examples, knowledge base articles, device datasheets, and Component datasheets.

Application Not	es					
AN91267	Getting Started with PSoC [®] 4 BLE	Introduces PSoC [®] 4 BLE, an ARM® Cortex™-M0 based Programmable System-on-Chip (PSoC) with a Bluetooth Low Energy.				
AN94020	Getting Started with PRoC™ BLE	Introduces PRoC [™] BLE, an ARM® Cortex®-M0 based programmable radio-on-chip with Bluetooth Low Energy.				
AN91184	PSoC 4 BLE - Designing BLE Applications	Shows how to design the BluetoothLow Energy (BLE) application based on PSoC 4 BLE, using standard profiles defined by the Bluetooth SIG included in the BLE Component in PSoC Creator. Demonstrates how to build an application with the BLE Health Thermometer Profile on the CY8CKIT-042-BLE kit.				
Videos						
PSoC 4 BLE 101	: Intro to Bluetooth Low Energy	This is the first installment of a series of getting-started videos on Cypress Bluetooth Low Energy solutions.				
PSoC 4 BLE 101	: 2 Configuring a Find Me Profile with BLE	Using Cypress Pioneer kit with a PSoC 4 Radio module. Alan Hawse walks you through a simple example for a find-me tag application.				
PSoC 4 BLE 101 Firmware	: 3 Finishing the Find Me Application with	In this lesson, we take the Find Me profile you configured in the previous video and add the firmware required to make it work on the PSoC 4 BLE device.				
PSoC 4 BLE 101 with CySmart	: 4 Adding Battery Level Service and Testing	This lesson takes the Find Me profile built in the first two lessons and adds a Battery Level service.				
PSoC 4 BLE 101 Energy	: 5 Using CapSense with Bluetooth Low	In this BLE lesson, we show how to use PSoC Creator's Custom Service to quickly and easily add a CapSense® slider to a BLE (Bluetooth Low Energy) design.				
PSoC 4 BLE 101 Energy Modes	: 6 Extending Battery Life with PSoC Low	Adds power savings into your BLE designs easily using PSoC and PSoC Creator. In the last lesson, we created Find Me peripheral with the Battery Level service.				
Software and D	rivers					
CySmart – Bluete	ooth® LE Test and Debug Tool	CySmart is a Bluetooth® LE host emulation tool for Windows PCs. The tool provides an easy-to-use Graphical User Interface (GUI) to enable customers to test their Bluetooth LE peripheral applications.				
PSoC Creator C	component Datasheets					
Bluetooth Low E	nergy (BLE) Component	The Bluetooth Low Energy (BLE) Component provides a comprehensive GUI-based configuration window to facilitate designing applications requiring BLE connectivity.				
PSoC 4 Serial Co	ommunication Block (SCB) Component	Supports a PSoC 4 multifunction hardware block that implements I ² C, SPI UART, and EZI2C communications				
Device Docume	ntation					
PSoC® 4: PSoC 4XX7_BLE Family Datasheet Programmable System-on-Chip (PSoC®)						
PSoC® 4: PSoC	4XX8_BLE Family Datasheet - Programmable	System-on-Chip (PSoC®)				
PSoC® 4: PSoC	4XX8 BLE 4.2 Family Datasheet Programmab	le System-on-Chip (PSoC®)				
Development K	it (DVK) Documentation					
Bluetooth® Low	Energy Pioneer Kit (CY8CKIT-042-BLE)					

Table	2	Related	Documents
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Document History

Document Title: CE217613 - Bluetooth Low Energy (BLE) Automation IO

Document Number: 002-17613

Revision	ECN	Origin of Change	Submission Date	Description of Change
**	5550104	AZOV	12/12/2016	New code example.



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