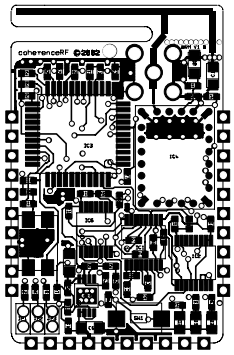
2.4GHZ BLUETOOTH TRANSCEIVER MODULE PROGRAMMING GUIDE

BRM01

Introduction



The coherenceRF BRM allows fast development of sophisticated wireless applications by embedding the complexities of the radio. This allows the BRM to present a very simple API to the Host device, thus significantly easing wireless integration into the customer's end product.

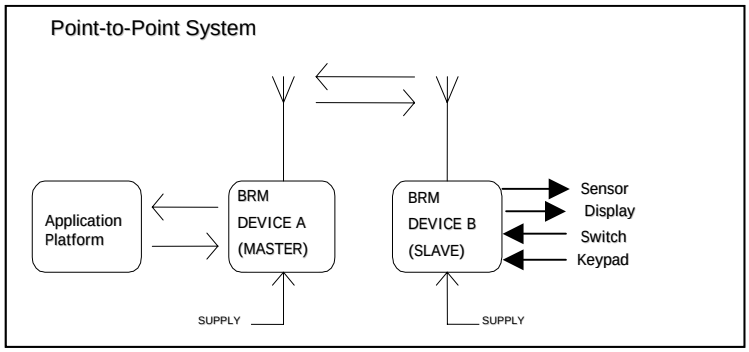
This document describes the programming requirements for the BRM when used in the 'Enhanced' mode of operation. Enhanced mode provides a non-transparent interface allowing a more flexible and complex system to be built.

System Scenarios

Before detailing the programmer's interface, it is useful to understand the possible system architectures.

Fixed Point to Point

This describes the most basic system architecture. Data is always sent to and received from the same device.
The Basic or Enhanced mode of operation can handle this.

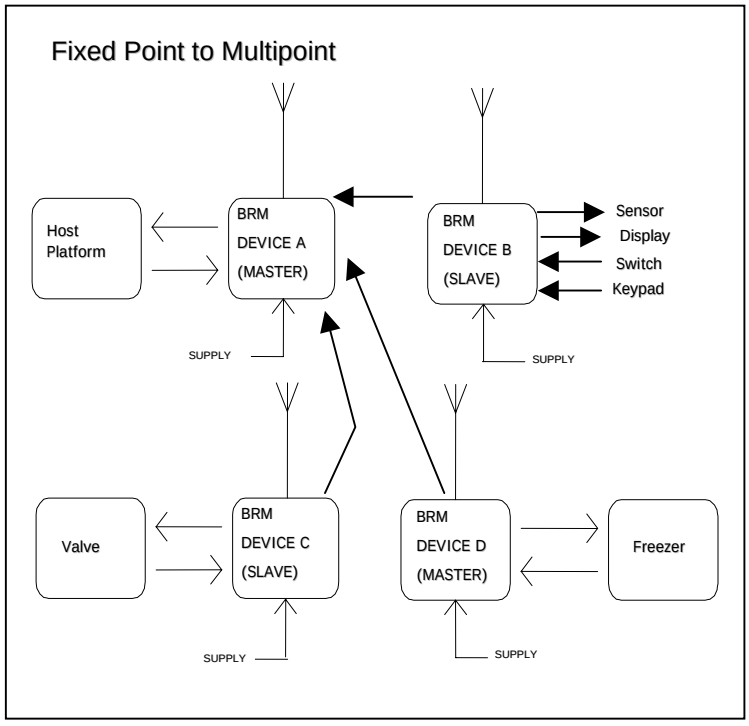


Fixed Point to Multi-Point

This is another basic system architecture. Each BRM sets up a connection to a fixed BRM, but may also accept a connection from any known BRM. The Basic or Enhanced mode of operation can handle this.

The example shows devices B, C and D fixed to device A.
The term 'Master' denotes only the device that initialises the connection.

A Typical application might be where devices B, C or D set-up a connection to A when an event occurs which must be reported.

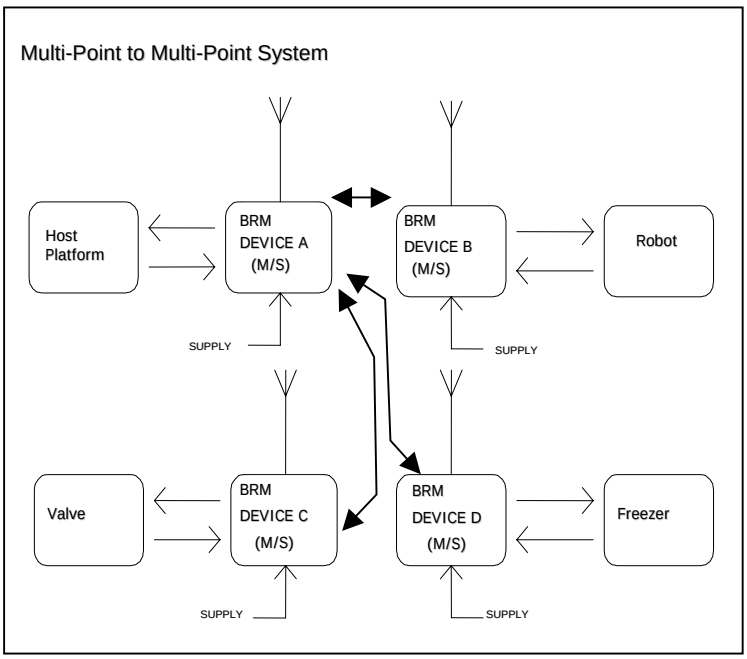


Multi-Point To Multi-Point

This is a more flexible architecture. Each BRM can set-up a connection to any other BRM, providing they are known to each other.

This architecture is only supported by the Enhanced mode of operation.

A Typical application might be where device A sets-up a connection to B, C and D in turn, requesting status data from each one.



Version Information

Note: This data sheet refers to BRM01 modems with firmware versions 0.29 or later. The firmware version is labelled on the modules

Table of Contents

Commands, Responses and Events

When the BRM is set to 'Enhanced ' mode several commands are available to the Host system.

General Rules

- Except when sending or receiving payload data, or stated otherwise, commands, responses and events are constructed using ASCII codes – i.e.. In the range from 0x00 to 0x7F.
- Commands always result in a response and new commands must not be sent until a response to the previous command has been received.
- Responses consist of at least 1 Command Echo Byte and 2 ASCII Coded Status Bytes.
- Status "00" = success
- Return parameters are not sent for non "00" responses
- Events occur from time to time and indicate connection failures and other critical events. Events always comprise at least 3 bytes. The first byte indicates the type of event and the second and third bytes indicate the status.

Summary

The table below provides a summary of the commands supported in V0.29 Firmware.

Commands

Name	Code	Parameter(s)	Description
Add Device To Index	"A"	Address (12), ID (2)	Adds a device to the local index
Connect To Device	"C"	ID (2)	Requests a data connection to a BRM
Disconnect Device	"D"	---------	Disconnects the currently connected remote BRM
GPIO	"G"	Direction (2) Function (2) Initialise (2)	Sets the GPIO pin functions (In/Out/ADC, Initial state)
GPIO Output	">"	ID (2), Mask (2)	Outputs a GPIO bit mask to the GPIO pins
GPIO Input	"<"	ID (2), Null (2)	Inputs a byte which is a bit mask of the GPIO pins
GPIO Measure	"$"	ID (2), Pin (2)	Performs an ADC measurement on a GPIO pin
Device Address	"I"	ID (2)	Gets the device address stored in the local BRM
Set Local Name	"l"	Name (16)<CR>	Sets a new local name for the local BRM
Local Name	"L"	---------	Gets the local BRM's name
Local Address	"K"	---------	Gets the local BRM's address
Remote Device Name	"N"	ID (2)	Requests the name from a remote BRM
Reset	"R"	---------	Performs a power-on-reset
Quality	"Q"	---------	Requests the link quality for a connection
Connect Voice Device	"V"	ID (2)	Requests a voice+data connection to a device
Sleep	"Z"	---------	Sets BRM into low power sleep mode

Events

Type	Code	Parameters	Description
Connect	"C"	Status (2), Device ID (2)	Connect occurred from device
Disconnect	"D"	Status (2), Device ID (2)	Disconnect occurred from device - See Status Codes
Transaction complete	"S"	Status (2)	The data packet has completed. See Status Codes

Detailed Descriptions

Add Device To Index

This command allows known devices to be added to the local BRM's device list. Once in the device list each connectable BRM is represented by an Index number. This allows incoming and outgoing connection requests to be validated and identified.

Command Code (1 byte)	Parameter 1 – BRM Address (12 bytes 0-9, A-F)	Parameter 2 – Index ID (2 bytes 00-1F)
"A"	"xxxxxxxxxxxx"	"xx"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
"A"	"xx"

*See Status Codes for meanings

Connect To Device

This command requests an immediate connection to the device whose Index ID is provided in the parameter. This is useful for testing purposes.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)
"C"	"xx"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Device ID (2 bytes 00-1F)
"C"	"xx"	"xx"

*See Status Codes for meanings

Disconnect Device

This command requests an immediate disconnection from the currently connected remote device. This command should be used after the local device has finished communicating to the remote device.

Command Code (1 byte)
"D"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Device ID (2 bytes 00-1F)
"D"	"xx"	"xx"

*See Status Codes for meanings

GPIO Set-up

This command configures the GPIO functions for the BRM. Use this command to change the default settings for the GPIO pins if used.

Command Code (1 byte)	Parameter 1 – Direction (2 bytes C0-FF)	Parameter 2 – Function (2 bytes 00-FF)	Parameter 3 – Initialise (2 bytes 00-FF)
"G"	"xx"	"xx"	"xx"

Direction Parameter

These two BCD bytes represent a bit mask to define which of the GPIO pins are inputs or outputs. Bits 0 to 5 control the GPIO pins GPIO0 to GPIO5 respectively. Bits 6 and 7 are reserved and should be set to '1'. The GPIO pin will behave as an input and when the direction bit is set to '1' and an output when set to a '0'. By default GPIO pins are inputs. An example is given below:

Direction Value	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
FF	Input	Input	Input	Input	Input	Input
C3	Output	Output	Output	Output	Output	Output

Function Parameter

These two BCD bytes control the function of the GPIO pins. Valid codes are shown below;

Function Value	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
06	D I/O	D I/O	D I/O	D I/O	D I/O	D I/O
0E	D I/O	D I/O	D I/O	D I/O	D I/O	ADC
0F	D I/O	D I/O	REF+	REF-	D I/O	ADC
05	D I/O	D I/O	REF+	D I/O	ADC	ADC
0D	D I/O	D I/O	REF+	REF-	ADC	ADC
0C	ADC	D I/O	REF+	REF-	ADC	ADC
03	ADC	D I/O	REF+	ADC	ADC	ADC
02	ADC	D I/O	ADC	ADC	ADC	ADC

Initialise Parameter

This parameter defines the initial Logic State of each GPIO pin when it is defined as an output. Values above 0x3F are not allowed. The two BCD bytes represent the bit mask of the 6 GPIO lines as given in the example below:

Initialise Value	GPIO5	GPIO4	GPIO3	GPIO2	GPIO1	GPIO0
3F	High	High	High	High	High	High
26	High	Low	Low	High	High	Low

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
"G"	"xx"

*See Status Codes for meanings

GPIO Output

This command outputs a bit mask to the GPIO pins device whose Index ID is provided in parameter 1. GPIO pins that are defined as outputs will be set to the level provided in the parameter 2 bit mask.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)	Parameter 2 – Bit Mask (2 bytes 00-FF)
“>”	“xx”	“xx”

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
“>”	“xx”

*See Status Codes for meanings

GPIO Input

This command returns the digital level on the GPIO pins of the device whose Index ID is provided in parameter 1. Values returned for GPIO pins that are not defined as digital inputs should be disregarded.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)	Parameter 2 – Null (2 bytes 00)
“<”	“xx”	“00”

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	GPIO Input Bit Mask (2 bytes 0-9, A-F)
“<”	“xx”	“xx”

*See Status Codes for meanings

GPIO Measure

This command returns the analogue level of the GPIO pin defined in parameter 2 from the device whose Index ID is provided in parameter 1. Values returned for GPIO pins that are not defined as analogue inputs should be disregarded.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)	Parameter 2 – GPIO Pin (2 bytes 00,01,02,03,05)
“$”	“xx”	“xx”

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Analogue 10 bit value (2 bytes 0x0-03ff)
“$”	“xx”	0-4096

*See Status Codes for meanings

The analogue reference for the ADC measurement depends upon the Function Parameter of the GPIO set-up command.

Device Address

This command gets the device address for the device whose Index ID is provided in the parameter. This allows verification of the device address entry against the Index ID.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)
"I"	"xx"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Device Address (12 bytes 0-9, AF)
"I"	"xx"	"xxxxxxxxxxxx"

*See Status Codes for meanings

Local Address

This command gets the local device address.

Command Code (1 byte)
"K"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Device Address (12 bytes 0-9, AF)
"K"	"xx"	"xxxxxxxxxxxx"

*See Status Codes for meanings

Local Name

This command gets the device name from the local device.

Command Code (1 byte)
"L"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Device Name (0-21 byte null terminated string)
"L"	"xx"	"abcdefghijklmnopqrst" 0x00

*See Status Codes for meanings

Set Local Name

This command sets the local name.

Command Code (1 byte)	Parameter 1 – Name (1-16 byte string) <CR> (<16 char)
"l"	"abcdefghijklmnop"0x00

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
"l"	"xx"

*See Status Codes for meanings

Remote Device Name

This command requests the device name from the remote device whose Index ID is provided in the parameter. The BRM attempts to make a temporary connection to the device and if successful requests its Name. This allows a friendly Nametag to be used for each remote device. It can take several seconds for the response to come back.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)
"N"	"xx"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Device Name (0-21 byte null terminated string)
"N"	"xx"	"abcdefghijklmnopqrst" 0x00

*See Status Codes for meanings

Quality

This command gets the link quality for a device connection. The link quality response returns a hex coded string in the range '00' to 'FF'. The higher the value the better the link quality.

Command Code (1 byte)
"Q"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)	Link Quality (2 bytes 0-9, A-F)
"Q"	"xx"	"xx"

*See Status Codes for meanings

Reset

This command performs a power-on-reset on the local BRM.

Command Code (1 byte)
"R"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
"R"	"xx"

*See Status Codes for meanings

Connect Voice Device

This command requests an immediate voice and data connection to the device whose Index ID is provided in the parameter. This command is valid for a voice enabled remote device with external CODEC. First a standard data connection is attempted. If this is successful a voice connection is added. This provides a full duplex 64kb/s voice link with CVSD encoding over the air.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)
"V"	"xx"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
"V"	"xx"

*See Status Codes for meanings

Sleep

This command puts the local BRM into sleep mode in order to reduce power consumption to a minimum. Sending a command at any time will wake the BRM.

Command Code (1 byte)	Parameter 1 – Index ID (2 bytes 00-1F)
"Z"	"xx"

Response Code (1 byte)	Status Code * (2 bytes 0-9, A-F)
"Z"	"xx"

*See Status Codes for meanings

Status Codes

Below is the list of possible response status codes

Response Code	Meaning
00	Command Completed Successfully
01	Unknown Command
02	No Connection
03	General Failure
04	Connection Request Failed
05	Authentication Failed
08	Connection Failed
09	No More Connections Allowed
0B	Already Connected
0E	Connection Rejected
10	Remote Device Failed To Respond
11	Invalid Feature
12	Invalid Parameter
13	Remote Device Ended Connection
15	Remote Device Is About To Power Off
16	Connection Ended By Local Host
1F	Unspecified Error

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