



Electrochemical Alcohol Detection Module

BM22S3331-1

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Features

- Breath alcohol concentration (BrAC) measurement characteristics
 - ♦ Effective range: 0.000mg/L~2.000mg/L
 - ♦ Error: 0mg/L ~ -0.040mg/L or 0 ~ -10%, the one with the larger absolute value is taken into use @ 0°C ~ 40°C
 - ♦ Resolution: 0.001mg/L (BrAC), 1mg/100mL (BAC)
- Operating voltage: 3.0V~5.5V
- Operating Current @ 25°C
 - ♦ Operating Current (Enable DC-DC): ≤500mA @ 5V
 - ♦ Operating Current (Disable DC-DC): ≤18mA @ 5V
 - ♦ Sleep Current: ≤6μA @ 5V
- Communication interface: UART 9600bps, 8-N-1



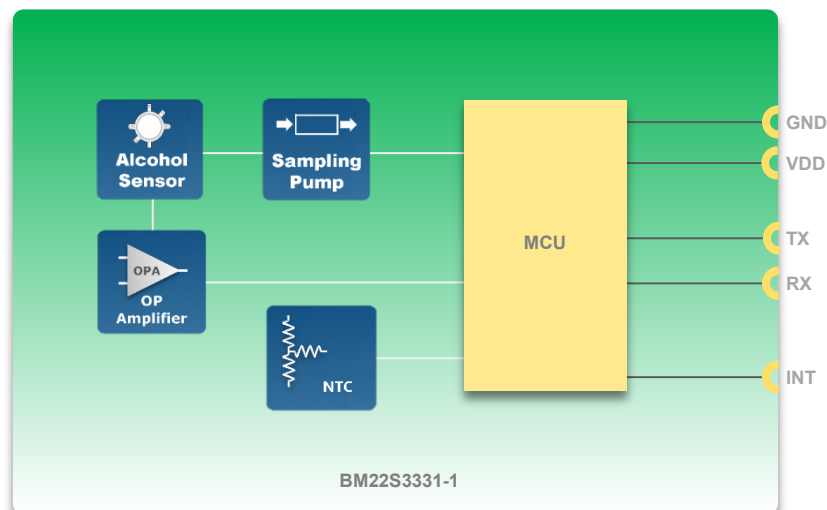
General Description

The BM22S3331-1 is a breath alcohol concentration detection module. The module adopts electrochemical alcohol sensor to quantitatively detect the alcohol concentration in exhaled breath. With the temperature compensation, it has the advantages of high detection accuracy and fast zeroing. The module receives host commands and outputs the digital results through the UART interface. The module has been calibrated before leaving the factory and is suitable for use in breath and fast screening breathalyzers products.

Applications

- Breath Breathalyzers
- Fast Screening Breathalyzers
- Pre-service Breathalyzers

Block Diagram



Pin Assignment



Pin Description

Pin	Function	Type	Description
1	GND	PWR	Negative power supply, ground
2	VDD	PWR	Positive power supply
3	TX	O	Module UART data transmit pin
4	RX	I	Module UART data receive pin
5	INT	O	Command completion prompt pin, defaults to high after power-on/reset. After the host sends a command to enable DC-DC, detect alcohol concentration or calibrate, the INT can be used to determine whether the module has completed executing commands. High: Incompleted Low: Completed Note: When INT outputs low, the host sends the corresponding read commands: read charge result, read test data, read calibration result. After reading the data, INT will output a high level

Legend: PWR: Power;

I: Digital input;

O: Digital output

Technical Specifications

Absolute Maximum Ratings

Power Supply Voltage	GND-0.3V~GND+6.0V
Input Voltage	GND-0.3V~V _{DD} +0.3V
Total Power Consumption (In normal mode, when the DC-DC is disabled).....	≤90mW @ 5.0V
Operating temperature.....	0°C~40°C
Operating humidity	15%~90%RH
Storage Temperature.....	-10°C~70°C

Note: Here emphasises the module maximum tolerable parameters only. The “Absolute Maximum Ratings” only represents the parameter range that will not cause damage to the module, and does not represent that it can operate normally within this range. Functional operation of the devices at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect module reliability.

Recommended Operating Conditions

- Operating temperature: 23°C±5°C
- Relative humidity: 50% ± 30%
- Ambient total hydrocarbon concentration: no more than 0.002%

Module Characteristics

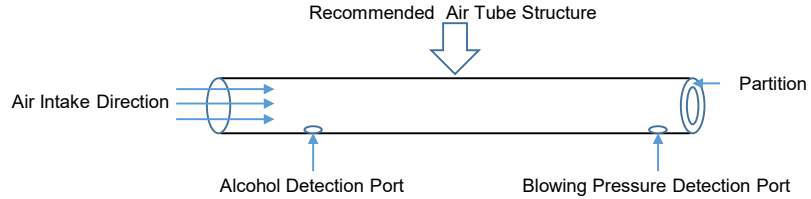
V_{DD}=5V

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Effective Range (BrAC)	—	0	—	2.000	mg/L
Breath Alcohol Measurement Error (BrAC)	—	0mg/L ~ -0.040mg/L or 0 ~ -10%, the one with the larger absolute value is taken into use @ 0°C ~ 40°C			
Breath Alcohol Measurement Resolution (BrAC)	—	—	0.001	—	mg/L
Temperature Measurement Range	—	0	—	50	°C
Temperature Measurement Error	—	—	—	±1	°C
Temperature Measurement Resolution	—	—	0.01	—	°C
Response Time	0~2.000mg/L(BrAC)	—	10	—	s
Zeroing Time	—	—	20	—	s
Communication Interface	5-pin, UART, 9600 (8-N-1)				
Alcohol Sensor Types	Electrochemical fuel cell				
Calibration Period	6 months				
Module Size	L×W×H: 75mm×30mm×18.5mm				

Note: The maximum temperature measurement range is the maximum temperature range that can be measured by the NTC, but it does not represent the operating temperature. Exceeding the operating temperature specification may cause accuracy to deviate from the specification and irreversible damage to the electrochemical alcohol sensor.

Consideration

1. Pay attention to the module wiring to ensure that the positive and negative of the power supply should not be reversed.
2. It is recommended to wait 3min ~ 5min between two detections.
3. The module should prevent from impact and vibration, which may cause damage to the module.
4. The air inlet of the sensor on the module should not be blocked and contaminated.
5. The module should not be used in environments containing corrosive gases, which could cause permanent damage to the sensor.
6. There is no blowing pressure sensor on the module, it needs to be designed by the customer. It is recommended to match with module, the BME21M621, or digital air pressure sensor, the BM62S2201-1.
7. In the shell design, it is required to fix the module in the structure to prevent the failure caused by loosening after operating for a long time.
8. The module is required to be used with a blowpipe, which should be designed by the customer.
9. There are two main points to consider when designing the blowing structure: Firstly, there should be a partition in the blowpipe to generate pressure resistance. Secondly, the blowing direction of the blowpipe needs to be fixed, and the alcohol detection port should be perpendicular to the air inlet direction and in front of the blow pressure detection port, slightly away from the partition. The blowing pressure detection port should be close to the partition. The suggested structure is shown in the figure below. It is recommended that the design of the module air inlet be placed into the alcohol detection port as shown in the figure below, and the total thickness of the shell and air tube should not exceed 3mm.



D.C. Electrical Characteristics

Ta=25°C, V_{DD}=5V

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{DD}	Operating Voltage	—	3.0	—	5.5	V
I _{DD}	Operating Current	In normal mode (Enable DC-DC)	—	—	500	mA
		In normal mode (Disable DC-DC)	—	13	18	mA
I _{STB}	Sleep Current	In sleep mode	—	1	6	uA
V _{IL}	Input Low Voltage	—	0	—	0.2V _{DD}	V
V _{IH}	Input High Voltage	—	0.8V _{DD}	—	V _{DD}	V

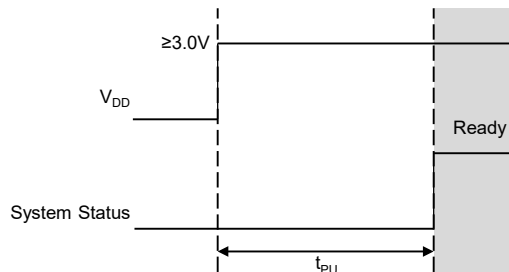
A.C. Electrical Characteristics

System Timing

Ta=25°C, V_{DD}=5V

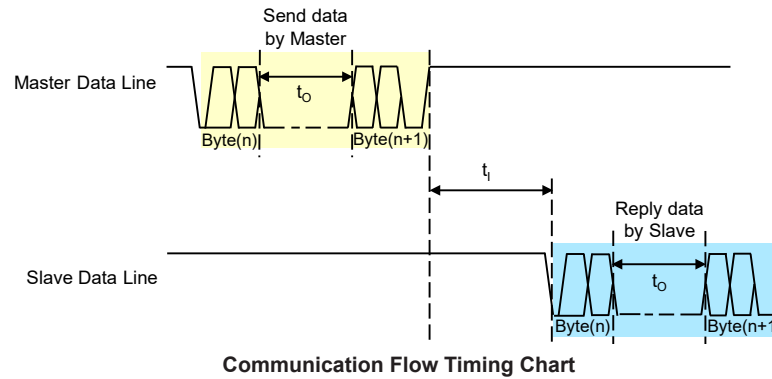
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{PU}	Power-on Time	Starting from V _{DD} ≥3.0V to communication allowed	—	600	—	ms
t _i	Command Interval Time	—	—	39	65	ms
t _o	Time Interval between Two Bytes of Data Frame when Module Sent	—	0.06	—	5	ms
	Time Interval Allowed between Two Bytes of Data Frame when Module Received ^(Note)	—	0.06	—	45	ms
Baud rate	UART Allowed Baud Rate	—	9408	9600	9792	bps

Note: When the host sends the command, it should refer to the specification. If the t_o is greater than 45ms, the module regards that the host sends timeout, the module will not respond at this time. If the t_o is less than 0.06ms, the module is disable to process data in time at which point the module will not respond.



System Power-on Timing Chart

Note: System ready represents that the module has completed system initialisation and can receive commands from the host.



Functional Description

System Description

The module completes initialization within approximately 600ms after power-on/reset and then enters the normal mode (disable DC-DC), at which time the module can communicate with the host normally and perform the corresponding actions according to the host's commands. The module provides sleep and reset commands allowing the host to set the module to enter low power mode by sending a sleep command, or to reset the module by sending a reset command. Refer to the Communication Protocol section for detailed communication method.

Operating Principle

The module obtains the amplified current signal from the electrochemical alcohol sensor, then calculates the current breath alcohol concentration BrAC value by using the dynamic integration method. This value can be converted into blood alcohol concentration BAC value according to the corresponding multiplier (with a default multiple of 2200). The module integrates a NTC to obtain the alcohol sensor temperature, and then achieves temperature compensation within a wide temperature range.

Calibration Operation

The module has been calibrated before leaving the factory, users can recalibrate the module as needed through calibration commands. However, the module does not support restoring factory settings. Once the user recalibrates, it will not be possible to revert to the factory calibration values.

1. Complete the whole calibration process when calibrating: firstly, calibrate the concentration. It is recommended to use the typical exhaled alcohol concentrations of 0.100mg/L (typical), 0.400mg/L (typical), 1.500mg/L (typical) at 20°C and calibrate from lowest to the highest concentration. Then calibrate temperature compensation at 10°C, 20°C, 30°C and 40°C, without a specific order.
2. The breath alcohol concentration of the module is recommended to be calibrated with primary or secondary alcohol standard gas, using a three-point calibration from lowest to the highest concentrations. The calibration ambient temperature is 20°C. The first point of calibration is recommended to be 0.100mg/L, the second point is recommended to be 0.400mg/L, and the third point is recommended to be 1.500mg/L.
3. The module temperature compensation calibration is recommended to a primary or secondary alcohol standard gas at 0.400 mg/L at 10°C, 20°C, 30°C, and 40°C for calibration. Note that the alcohol concentration used in the four temperature compensation should be the same, otherwise it will lead to temperature compensation calibration failed.

The self-calibration is performed as follows:

1. Concentration calibration is sequential from the first point to the third point, while temperature compensation calibration, without a specific order.
2. Place the module in clean air, and then send the enable DC-DC command. After the charging is completed, connect the air tube with primary or secondary standard alcohol gas to the blowing tube, and then start the air intake, The air flow rate is adjusted to 15L/min until the total gas volume reaches the requirements of GB/T 21254-2017. Then send the calibration command, after the calibration is finished, send the obtain the result command. Refer to the Communication Protocol chapter for detailed command.
3. The recommended calibration interval between the first and second calibrations is 5min to ensure that the internal response of the sensor is stabilised.
4. Using the calibration command for alcohol concentration calibration. After calibrating the three alcohol concentration points, the alcohol display calibration command is used to determine the curve of the three concentration points. At this time the final alcohol concentration calibration is completed.
5. Using the calibration command to complete the temperature compensation calibration.
6. Refer to the Communication Protocols section for detailed calibration Commands.

Communication Interface

The communication between the host and the module is done through a question-and-answer method. The host first sends a command to the module, and the module responds to the host, where the module comes with an ID matching mechanism and will only respond to commands that match its own ID (ID \neq 0x00) or commands with a special ID (ID = 0x00). Refer to the following for protocol details.

Communication Protocol

Host Sending Frame Format

Frame Header (2-Byte)	Module Categories Code (1-Byte)	Module ID (1-Byte)	Command (1-Byte)	Data Length (1-Byte)	Data (n-Byte)	Checksum (1-Byte)
0x42, 0x4D	0x64	MID	HCMD	LEN	Data0~DataN	CS

Module Response Frame Format

Frame Header (2-Byte)	Module Categories (1-Byte)	Module ID (1-Byte)	Command (1-Byte)	Data Length (1-Byte)	Data (n-Byte)	Checksum (1-Byte)
0x42, 0x4D	0x64	MID	RCMD	LEN	Data0~DataN	CS

- Frame Header: Fixed to 0x42, 0x4D
- Module category code: Fixed to 0x64
- MID: Module ID, factory default is 0x01
 - ♦ The MID is used to specify the response module ID in the host sending frame
 - MID = 0x00 (used for special commands, for example, the set ID command and the read ID command): All different ID modules will respond
 - MID = 0x01~0xFF (used for general commands): only modules with matching ID will respond
 - ♦ In the module response frame, MID = response module ID or 0x00 (in response to the set ID command or read ID command)

- HCMD: Host command code
 - 0x01: Query the module status
 - 0x02: Detect the alcohol concentration
 - 0x03: Read the detection data
 - 0x04: Set the blood alcohol concentration threshold
 - 0x05: Read the blood alcohol concentration threshold
 - 0x06: Module reset (not restore the factory settings, only restart the module)
 - 0x07: Set the Module ID
 - 0x08: Read the module ID
 - 0x09: Sleep
 - 0x0A: Wake up
 - 0x0B: Read the alcohol sensor temperature
 - 0x0C: Set the blood alcohol conversion multiplier
 - 0x0D: Read the blood alcohol conversion multiplier
 - 0x0E: Calibration
 - 0x0F: Read the calibration result
 - 0x10: Alcohol display calibration
 - 0x11: Enable DC-DC
 - 0x12: Read the charging result
 - 0x13: Check the NTC status
- RCMD: Module respond host command code. RCMD = HCMD +0x80
- LEN: Number of Data0~DataN bytes, when LEN = 0, it indicates that there is no data
- CS: Frame checksum, CS= (Frame header + Module category code + Module ID + Command + Data length + Data) + 1

Command Description

Query the Module Status (0x01)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42 0x4D	0x64	MID	0x01	0x00	—	CS
Module response	Frame Header	Module Categories	Module ID	Command	Data Length	Data	Checksum
	0x42 0x4D	0x64	MID	0x81	0x01	Data0 ^(Note)	CS

Note:

Data0	Module current status	0x00: Free 0x01: Charging 0x02: Detecting 0x03: Sleeping 0x04: Calibrating
Example: MID=1 Host sending (HEX): 42 4D 64 01 01 00 0B Module response (HEX): 42 4D 64 01 81 01 00 8A		

Detect the Alcohol Concentration (0x02)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42 0x4D	0x64	MID	0x02	0x00	—	CS
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42 0x4D	0x64	MID	0x82	0x01	Data0 ^(Note)	CS

Note:

Data0	Module processing results	0xAA: The host command is correct, the module will process according to the command 0x55: Host command error
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 02 00 0A Module response (HEX): 42 4D 64 01 82 01 AA DF</p> <p>Note:</p> <ol style="list-style-type: none"> Send the enable DC-DC command first. Then send this command after confirming that the charging is completed and successful to complete a normal alcohol concentration detection. After the host correctly sends the detection command, the module INT pin turns from high to low or the module status is free, it indicates that the detection is completed and the detection data can be read. When the data is not read, the INT pin remains low until the data is read by the host, it will restore to the high. 		

Read the Detection Data (0x03)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42 0x4D	0x64	MID	0x03	0x00	—	CS
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42 0x4D	0x64	MID	0x83	0x09	Data0~Data8 ^(Note)	CS

Note:

Data0	BrAC high byte	Example: Data0 = 0x01, Data1 = 0x6B. The initial value = 0x016B = 363 (Decimal) This indicates that BrAC = 0.363 mg/l.
Data1	BrAC low byte	Note: When the BrAC exceeds the maximum range of 2.5mg/L, it will output the maximum value, Data0 = 0x09, Data1 = 0xC4
Data2	BAC high byte	Example: Data2 = 0x00, Data3 = 0x4F The initial value = 0x004F = 79 (Decimal). This indicates that BAC = 79mg/100mL
Data3	BAC low byte	Note: The BAC specification related to blood alcohol conversion multiple and BrAC. When the blood alcohol conversion multiple is 2200, the maximum range of BAC (non-effective range) is BrAC×2200, that is, 2.500mg/L (BrAC) × 2200 = 550mg/100mL (BAC). At this time, when BAC exceeds the maximum range (non-effective scale), it will output the maximum value, Data2 = 0x02 and Data3 = 0x26
Data4	Detection result	0x00: No drinking 0x01: Drinking 0x02: Drunk
Data5	Alcohol sensor temperature high byte	Example: Data5 = 0x0A, Data6 = 0x9A The initial value = 0 x0a9a = 2714 (Decimal)
Data6	Alcohol sensor temperature low byte	This indicates that the temperature = 27.14°C Note: When Data5 = 0x27, Data6 = 0x10, this indicates that the temperature is out of the specification range

Data7	Blood alcohol conversion multiple high byte	Example: Data7 = 0x08, Data8 = 0x98 The initial value = 0 x0898 = 2200 (Decimal) This indicates that the blood alcohol conversion multiple is 2200
Data8	Blood alcohol conversion multiple low byte	
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 03 00 09 Module response (HEX): 42 4D 64 01 83 09 01 6B 00 4F 01 0A 9A 08 98 80</p> <p>Note:</p> <ol style="list-style-type: none"> Before sending this command, ensure that the alcohol concentration detection has been completed once. Otherwise, the previous detection data will be returned. During power on or reset, the initial data Data0 to Data8 are all 0xFF. After the module completes the response of the detected data, the INT pin will restore from the low to the high. 		

Setting the Blood Alcohol Concentration Thresholds (0x04)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x04	0x02	Data0~Data1 ^(Note1)	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x84	0x01	Data0 ^(Note2)	CS

Note1:

Data0	Drinking threshold setting value	Example: Data0 = 0x14 The initial value = 0x14= 20 (Decimal) This indicates that the BAC = 20mg/100mL Note: The input range is 0 ~ 220BAC
Data1	Drunk threshold setting value	Example: Data1 = 0x50 The initial value = 0x50= 80 (Decimal) This indicates that the BAC = 80mg/100mL Note: The input range is 0 ~ 220BAC. Please enter a number greater the drinking threshold.

Note2:

Data0	Module processing result	0xAA: The host command execution is completed and successful 0x55: Execution failed
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 04 02 14 50 A2 Module response (HEX): 42 4D 64 01 84 01 AA DD</p>		

Reading the Blood Alcohol Concentration Threshold (0x05)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x05	0x00	—	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x85	0x02	Data0~Data1 ^(Note)	CS

Note:

Data0	Drinking threshold reading value	Example: Data0 = 0x14 The initial value = 0x14= 20 (Decimal) This indicates that the BAC = 20mg/100mL
Data1	Drunk threshold reading value	Example: Data1 = 0x50 The initial value = 0x50= 80 (Decimal) This indicates that the BAC = 80mg/100mL
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 05 00 07 Module response (HEX): 42 4D 64 01 85 02 14 50 21</p> <p>Note: The factory default drinking threshold is 20mg/100mL (BAC) and the factory default drunk threshold is 80mg/100mL(BAC)</p>		

Module Reset (0x06)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x06	0x00	—
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x86	0x01	Data0 ^(Note)

Note:

Data0	Module processing result	0xAA: The host command is correct, the module will process according to the command 0x55: Execution failed
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 06 00 06 Module response (HEX): 42 4D 64 01 86 01 AA DB</p> <p>Note:</p> <ol style="list-style-type: none"> Only restart the module instead of restoring factory settings. After reset, the detected data will be initialised to 0xFF, the calibration result is 0x00, the charging result is 0x00, and the INT pin is restored to the high by default. The time from the completion of the response to the execution of the reset action of the module, and then from the completion of the reset to the communication is available is about 700ms in total. 		

Set the Module ID (0x07)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	0x00	0x07	0x01	Data0 ^(Note1)
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	0x00	0x87	0x01	Data0 ^(Note2)

Note1:

Data0	Module ID setting value	Example: Data0 = 0x01 The initial value = 0x01= 1 (Decimal) This indicates that the Module ID = 1 Note: The module ID ranges from 1 to 255
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Note2:

Data0	Module processing result	0xAA: The host command execution is completed and successful 0x55: Execution failed
<p>Example: Host sending (HEX): 42 4D 64 00 07 01 01 04 Module response (HEX): 42 4D 64 00 87 01 AA DB</p> <p>Note: 1. The module ID is stored in the MCU and will not be lost when power off. The factory ID of the module is 0x01 by default, users can modify it by the setting the module ID command. 2. Because the ID of different modules will respond to this command, when setting ID, only one module should be connected to the bus.</p>		

Read the Module ID (0x08)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	0x00	0x08	0x00	—
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	0x00	0x88	0x01	Data0 ^(Note)

Note:

Data0	Module ID reading value	Example: Data0 = 0x01 The initial value = 0x01= 1 (Decimal) This indicates that the Module ID = 1 Note: The Module ID ranges from 1 to 255
<p>Example: Host sending (HEX): 42 4D 64 00 08 00 05 Module response (HEX): 42 4D 64 00 88 01 01 83</p> <p>Note: Because the ID of different modules will respond to this command, when reading the ID, only one module should be connected to the bus.</p>		

Sleep (0x09)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x09	0x00	—
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x89	0x01	Data0 ^(Note)

Note:

Data0	Module processing result	0xAA: The host command is correct, the module will process according to the command 0x55: Execution failed
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 09 00 03 Module response (HEX): 42 4D 64 01 89 01 AA D8</p> <p>Note: 1. Module enters sleep mode about 50ms after responding to host. 2. The module needs to be woken up by the wake up command, otherwise, the module will respond (HEX): 42 4D 64 01 81 01 03 87.</p>		

Wake Up (0x0A)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x0A	0x00	— CS
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x8A	0x01	Data0 ^(Note) CS

Note:

Data0	Module processing result	0xAA: The host command has completed and the module has woken up successfully 0x55: Execution failed
<p>Example: MID =1 Host sending (HEX): 42 4D 64 01 0A 00 02 Module response (HEX): 42 4D 64 01 8A 01 AA D7</p> <p>Note: After the module wakes up successfully, the host can send other commands immediately</p>		

Read the Alcohol Sensor Temperature (0x0B)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x0B	0x00	— CS
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x8B	0x02	Data0~Data1 ^(Note) CS

Note:

Data0	Alcohol sensor temperature high byte	<p>Example: Data0 = 0x0A, Data1 = 0x01 The initial value = 0x0A01 = 2561 (Decimal) This indicates that the temperature = 25.61°C Note: When Data0 = 0x27, Data1 = 0x10, it indicates that the temperature is out of specification range</p>
Data1	Alcohol sensor temperature low byte	
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 0B 00 01 Module response (HEX): 42 4D 64 01 8B 02 0A 01 74</p> <p>Note: After the host sends this command correctly, the module will immediately detect the temperature of the alcohol sensor at this time and respond to the host.</p>		

Set the Blood Alcohol Conversion Multiple (0x0C)							
Item	Command Description						
Host sending	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x0C	0x02	Data0~Data1 ^(Note1) CS
Module response	Frame Header	Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x8C	0x01	Data0 ^(Note2) CS

Note1:

Data0	Blood alcohol conversion multiple high byte	<p>Example: Data0 = 0x08, Data1 = 0x98 The initial value = 0x0898 = 2200 (Decimal) This indicates that the blood alcohol conversion multiple is 2200</p>
Data1	Blood alcohol conversion multiple low byte	

Note2:

Data0	Module processing result	0xAA: The host command execution is completed and successful 0x55: Execution failed
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 0C 02 08 98 5E Module response (HEX): 42 4D 64 01 8C 01 AA D5</p> <p>Note: The blood alcohol conversion multiple factory default value is 2200, which can be modified by setting the blood alcohol conversion multiple command.</p>		

Read Blood Alcohol Conversion Multiple (0x0D)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x0D	0x00	—	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x8D	0x02	Data0~Data1 ^(Note)	CS

Note:

Data0	Blood alcohol conversion multiple high byte	<p>Example: Data0 = 0x08, Data1 = 0x98 The initial value = 0x0898 = 2200 (Decimal) This indicates that the blood alcohol conversion multiple is 2200</p>
Data1	Blood alcohol conversion multiple low byte	
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 0D 00 FF Module response (HEX): 42 4D 64 01 8D 02 08 98 DD</p>		

Calibration (0x0E)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x0E	0x01	Data0 ^(Note1)	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x8E	0x01	Data0 ^(Note2)	CS

Note1:

Data0	Calibration point	<p>0x01: 1st calibration point for alcohol concentration 0x02: 2nd calibration point for alcohol concentration 0x03: 3rd calibration point for alcohol concentration 0x04: Compensation calibration at 10 °C 0x05: Compensation calibration at 20 °C 0x06: Compensation calibration at 30 °C 0x07: Compensation calibration at 40 °C</p>
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Note2:

Data0	Module processing result	0xAA: The host command is correct, the module will process according to the command 0x55: Execution failed
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 0E 01 01 FC Module response (HEX): 42 4D 64 01 8E 01 AA D3</p> <p>Note:</p> <ol style="list-style-type: none"> 1. Send the enable DC-DC command first. Then send this command after confirming that the charging is completed and successful to complete a normal alcohol concentration calibration or temperature compensation calibration. 2. When the module completes calibration, if the INT pin turns from high to low or the module state is free, it indicates that the calibration is completed and the calibration result can be read. When the calibration result is not read, the INT pin remains low until the calibration result is read by the host, it will restore to the high. 3. The alcohol concentration calibration is calibrated sequentially from the first to the third point, while the temperature compensation calibration without a specific order. 4. Follow the steps on the calibration operation page to perform the appropriate calibration and temperature compensation calibration. 5. After the calibration of the three alcohol concentration points is completed, the alcohol concentration calibration can be completed by using the alcohol display calibration command. 		

Read Calibration Result (0x0F)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x0F	0x00	—	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x8F	0x04	Data0~Data3 ^(Note)	CS

Note:

Data0	Module processing result	0xAA: Calibration successful 0x55: Calibration failed
Data1	Calibration point	0x01: 1st calibration point for alcohol concentration 0x02: 2nd calibration point for alcohol concentration 0x03: 3rd calibration point for alcohol concentration 0x04: Compensation calibration at 10 °C 0x05: Compensation calibration at 20 °C 0x06: Compensation calibration at 30 °C 0x07: Compensation calibration at 40 °C
Data2	Alcohol sensor temperature high byte	Example: Data2 = 0x09, Data3 = 0xF8 The initial value = 0x09F8 = 2552 (Decimal) This indicates that the temperature = 25.52°C Note: When Data2 = 0x27, Data3 = 0x10, it indicates that the temperature is out of the specification range
Data3	Alcohol sensor temperature low byte	
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 0F 00 FD Module response (HEX): 42 4D 64 01 8F 04 AA 01 09 F8 CD</p> <p>Note:</p> <ol style="list-style-type: none"> 1. Execute the calibration command first, and after the host sends the calibration command correctly, if the INT pin turns from high to low or the module state is free, it indicates that the calibration is completed and the calibration result can be read. When the calibration result is not read, the INT pin remains low until the calibration result is read by the host, it will restore to the high. The initial data Data0~Data3 are all 0x00 when there is no calibration or power on/reset. 2. After reading the calibration result, the INT pin will restore to the high. 		

Alcohol Indicator Calibration (0x10)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x10	0x05	Data0~Data4 ^(Note1)	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x90	0x02	Data0~Data1 ^(Note2)	CS

Note1:

Data0	First or second point BrAC value high byte	Example: Data0 = 0x00, Data1 = 0x64 The initial value = 0x0064 = 100 (Decimal) This indicates that the BrAC = 0.100mg/L Note: The input range is 0 ~ 2000. It need to input the actual concentration value
Data1	First or second point BrAC value low byte	
Data2	Second or third point BrAC value high byte	Example: Data2 = 0x01, Data3 = 0x78 The initial value = 0x0178 = 376 (Decimal) This indicates that the BrAC = 0.376mg/L Note: The input range is 0 to 2000. It need to input the actual concentration value
Data3	Second or third point BrAC value low byte	
Data4	Alcohol concentration curve	0x01: The first alcohol concentration curve, Data0~Data1 need to input the BrAC value of first point alcohol concentration, the Data2~Data3 need to input the BrAC value of second point alcohol concentration. 0x02: The second alcohol concentration curve, Data0~Data1 need to input the BrAC value of second point alcohol concentration, Data2~Data3 need to input the BrAC value of the third point alcohol concentration.

Note2:

Data0	Module processing result	0xAA: The host command execution is completed and successful 0x55: Execution failed
Data1	Alcohol concentration curve	0x01: The first alcohol concentration curve 0x02: The second alcohol concentration curve
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 10 05 00 64 01 78 01 19 Module response (HEX): 42 4D 64 01 90 02 AA 01 CF</p> <p>Note:</p> <ol style="list-style-type: none"> 1. Please complete the three point calibration of alcohol concentration first, then establish two alcohol concentration curves through this command. After that, the alcohol concentration calibration process will be complete. 2. Orders: 1st calibration point BAC value < 2nd calibration point BAC value < 3rd calibration point BAC value, otherwise the calibration will fail. 3. When the host sends data, the value of Data0~Data1 should be less than Data2~Data3. 		

Enable DC-DC (0x11)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x11	0x00	—	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x91	0x01	Data0 ^(Note)	CS

Note:

Data0	Module processing result	0xAA: The host command is correct, the module will process according to the command 0x55: Execution failed
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 11 00 FB Module response (HEX): 42 4D 64 01 91 01 AA D0</p> <p>Note:</p> <ol style="list-style-type: none"> 1. Use the query module status command to determine that the module is free then enable the DC-DC to charge the pump. 2. If the detect alcohol concentration command, the calibration command or the sleep command is not sent in time after the charging is completed, the DC-DC is in the enable state at this time. 		

Read the Charging Result (0x12)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x12	0x00	—	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x92	0x01	Data0 ^(Note)	CS

Note:

Data0	Module processing result	0xAA: The host command execution is completed and the charging is completed 0x55: Charging failed 0x00: Not charged
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 12 00 FA Module response (HEX): 42 4D 64 01 92 01 AA CF</p> <p>Note:</p> <ol style="list-style-type: none"> 1. Firstly, through the query module status command to query whether the module has been changed from charging to free, in which case the command can be sent to read the charging result, or read the status of the INT pin, when it is low, it indicates that the charging result can be read. The initial data Data0 is 0x00 when not being charged or during power-on/reset. 2. After successfully reading the charging result, the INT pin will restore to the high. 		

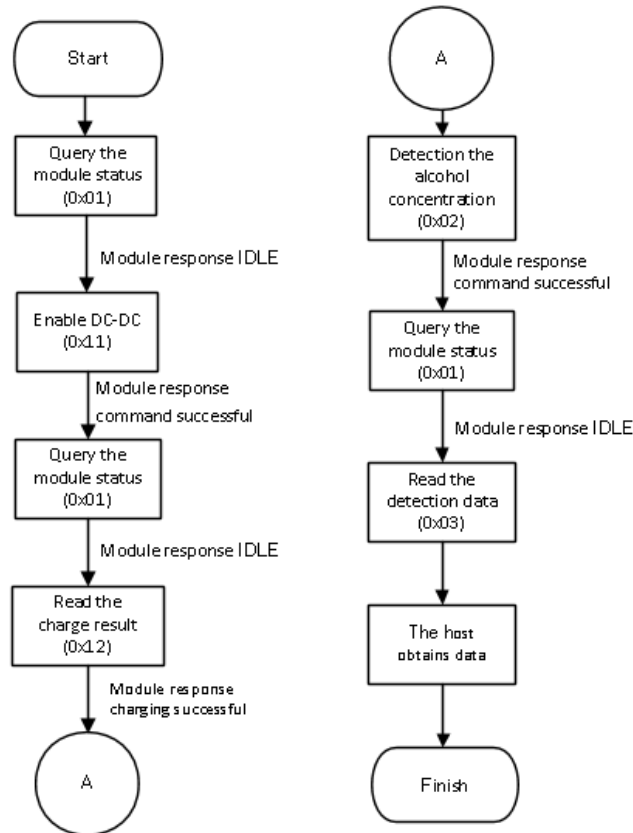
Read the NTC Status (0x13)								
Item	Command Description							
Host sending	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x13	0x00	—	CS
Module response	Frame Header		Module Categories Code	Module ID	Command	Data Length	Data	Checksum
	0x42	0x4D	0x64	MID	0x93	0x01	Data0 ^(Note)	CS

Note:

Data0	NTC status	0x00: The NTC is normal 0x01: The NTC is open 0x02: The NTC is short
<p>Example: MID=1 Host sending (HEX): 42 4D 64 01 13 00 F9 Module response (HEX): 42 4D 64 01 93 01 00 78</p>		

Usege Example

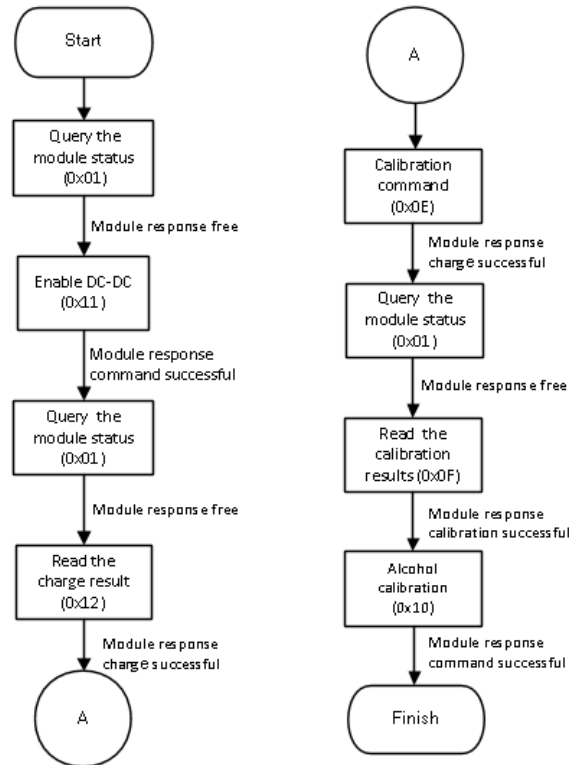
1. Flowchart for detecting alcohol concentration in a single breath (Only provide the sequence of sending commands)



Single Breath Alcohol Concentration Detection Flowchart

- (1) The host sends the query module status command (0x01) to ensure that the module is in Free State.
- (2) The host sends the nable DC-DC command (0x11), and then determines whether the processing result of the command by the module is 0xAA, which indicates that the host command is correct, and the module will process according to the command. After that, the module status can be queried (0x01), when the module status is free or INT pin output is low, it indicates that the module is fully charged, and then send the read charging result (0x12), after determining that the charging result is successful the 3) step can be performed
- (3) The host sends the alcohol concentration detection command (0x02), and then determines whether the processing result of the command by the module is 0xAA, which indicates that the host command is correct, and the module will process according to the command. After that, the module status can be queried (0x01), when the module status is free or the INT pin output is low, it indicates that the module has finished detecting; and then the read detection data command (0x03) can be sent to get the corresponding data.

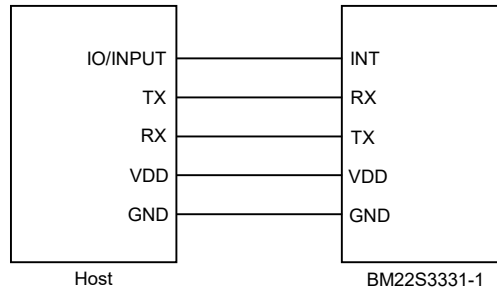
2. Flowchart for performing an alcohol concentration calibration and a temperature compensation calibration (Only provide the sequence of sending commands).



Single Alcohol Concentration Calibration and Temperature Compensation Calibration Flowchart

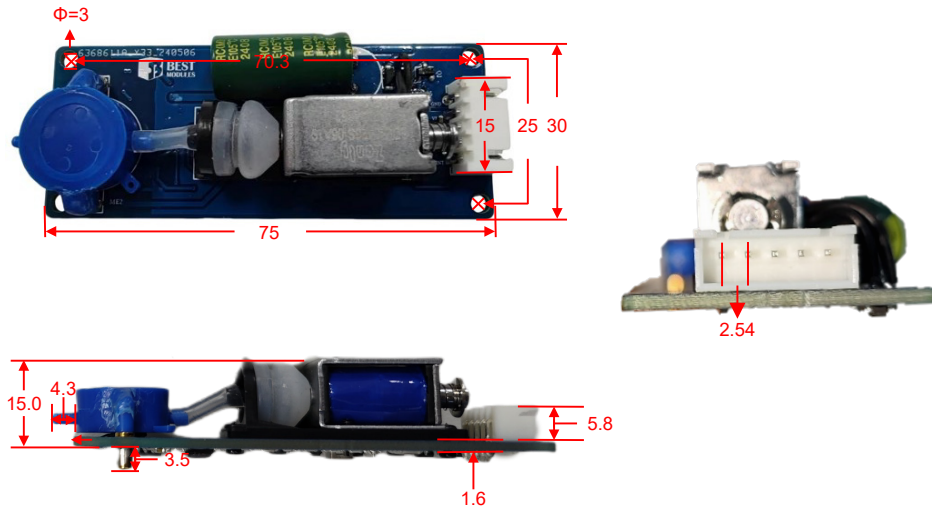
- (1) (2) Steps 1 and step 2 are the same as steps 1 and step 2 for single breath alcohol concentration detection
- (3) First, calibrate the 1st calibration point of alcohol concentration, the host sends the calibration command (0x0E), and then determines whether the processing result of the command by the module is 0xAA, which indicates that the host command is correct, and the module will process according to the command. After that, the module status can be queried (0x01), when the module status is free or INT pin output is low, it indicates that the module calibration is complete, and then read calibration result command (0x0F) can sent to determine that the calibration is successful (0xAA) and that the temperature is in the expected range.
- (4) Repeat steps 1, 2, 3 to complete the alcohol concentration calibration point 2 calibration and alcohol concentration calibration point 3 calibration in order, and then complete the temperature compensation calibration at 10 °C, 20 °C, 30 °C, 40 °C, without a specific order. At this time, the temperature compensation calibration has been completed, Step 5) is required for alcohol concentration calibration
- (5) The host sends the alcohol value calibration (0x10), establishing the conversion relationship between the 1st calibration point of alcohol concentration and the 2nd calibration point of alcohol concentration, and then determines whether the processing result of the command by the module is 0xAA, which indicates that the host command execution is completed and successful, and so on to establish the conversion relationship between the 2nd calibration point of alcohol concentration and the 3rd calibration point of alcohol concentration. At this step, the module has completed the alcohol concentration calibration and temperature compensation calibration, the module can be used for alcohol concentration detection.

Application Circuits



Dimensions

单位 : mm



Reference Information

Modification History

Data	Author	Issue	Modification Information
2024.10.09	杨运祺	V1.00	First Version

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