Home Automation Control and Indoor Air Quality Monitor Command Set

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FBXUF01 Command Set for FBXHAC (Home Automation Control) and AQM (Air Quality Monitor)

TODO

Contents:

Introduction

This document provides the detailed information of the protocol interface for all home automation control (HAC) and indoor air quality monitor (AQM) products. This "command set" is a common interface that interacts between machine to machine to send and receive commands from a distant location.

The whole setup comprises of 4 sections:

1. FBXUF01: This is the computer interfacing hardware (USB based) that can accept commands from users. In this document this unit is mentioned as "Master" at many places
2. FBXHAC01: This is the driver unit for home automation electrical appliances. It has driving ports that controls the electrical loads directly. In this document this unit us mentioned as "Slave driver" or "Slave HAC" at many places
3. FBXAQM: These are sensor modules that are used for air quality monitoring and other household gas monitoring. In this document this unit is mentioned as "Slave AQM" at many places
4. FBXGW01: This is a bridge unit between Wiil and wireless devices

The master unit (FBXUF01) connects to the computer or PC via a USB (A to B cable), and logically operates on the COM port of the computer. It is basically a serial data interface. The master machine can also be connected by a (USB master controller), or any other computer alike system that enable to operate serial communication over USB port

Practically the master controller can communicate with any number of slave unit (HAC or AQM) machines. The interface protocol consists of two types of transactions:

- Command from master to slave [*this is same as commands from user to master*]
- Command from slave to master [*this is same as commands from master to user*]

Technical details of the serial interface:

- Baud = 9600 or 115200 (depending on factory settings)
- Parity = None
- Data bits = 8
- Stop bit = 1
- Handshake = None

Commands from user to master (for slave unit) are of 20 byte format (ascii values) for each encoded value.

Command Format from user to master

fbx_	Cmd	_	Addr [MSB]	Addr [LSB]	Port Number	Data High	Data Low	Channel	_	0x0D
4 bytes	1 byte	1byte	2 bytes	2 bytes	2 bytes	2 bytes	2 bytes	2 bytes	1 byte	1 byte

Preamble	**fbx_**	**0x66 0x62 0x78 0x5F**	See Note* below for the preamble explanation
Cmd	**t _**	**0x74 0x5F**	Transmit command to control the slave unit
	p_	**0x70 0x5F**	Ping command to query or get status from the slave unit
Addr	-	**0x00 to 0xFF**	Address of the HAC / AQM slave unit (see examples) The address needs to fed in using ascii characters ONLY
Port number	-	**0x00 to 0xFF**	For HAC: Individual port numbers for electrical appliances For AQM: Port number is the sensor value (see Note †)
Data High	-	**0x00 to 0xFF**	For HAC: 0x00 (port to turn OFF), 0xFF (port to turn ON), for other valuesintermediate value for dimming control (see example) For AQM: Not Applicable (NA) 0x00 (this field is NOT checked by the master)
Data Low	-	**0x00 to 0xFF**	For HAC: Reserved (not used at present) For AQM: Not Applicable (NA) 0x00 (this field is NOT checked by the master)
Channel	-	**0x00 to 0xFF**	Operating channel frequency of the master to slave interaction. This field is internally decoded for data encryption for sending data
0x0D	-	**0x0D**	Trailer / closing command – hard coded to 0x0D

Master can also receive "\r" or 0x0D as a reset command to immediately stop radio transactions (following to which the master responds back with "e" or 0x065)

Command Format from master to user

Preamble	Addr [MSB]	Addr [LSB]	Data Byte 1	Data Byte 2	Data Byte 3	Channel	_	0x0D
1 bytes	2 bytes	2 bytes	2 bytes	2 bytes	2 bytes	2 bytes	1 byte	1 byte

Preamble	**s**	**0x73**	Success (with all the trailing fields)
	f	**0x66**	Failure (without fields DataByte2, DataByte3, Channel and _
	e	**0x65**	Echo (without any other trailing field)
Addr	-	**0x00 to 0xFF**	Address of the HAC / AQM slave unit (see examples) The address needs to fed in using ascii characters ONLY
Addr	-	**0x00 to 0xFF**	Address of the HAC / AQM slave unit (see examples) The address needs to fed in using ascii characters ONLY
Port number	-	**0x00 to 0xFF**	For HAC: Individual port numbers for electrical appliances For AQM: Port number is the sensor value (see Note †)
Data High	-	**0x00 to 0xFF**	For HAC: 0x00 (indicating port is OFF), 0xFF (indicating port is ON), for other values intermediate value indicates dimmed value of the port (see example) For AQM: This field contains the sensor value (MSB side)
Data Low	-	**0x00 to 0xFF**	For HAC: Reserved (not used at present) For AQM: This field contains the sensor value (LSB side)
Channel	-	**0x00 to 0xFF**	Operating channel frequency of the master to slave interaction. This field is internally decoded for data encryption for sending data
0x0D	-	**0x0D**	Trailer / closing command – hard coded to 0x0D

Notes:

***** Preamble:
"fbx_" is the header of the packet format that enters the master module. There is a large amount of uncontrollable data that enters the master unit when connected to a WiFi router or gateway FBXGW01. To filter out the data appropriately this preamble word is needed

"s" success. This is response from the HAC or AQM slave machines to the master controller on account of successful acceptance of data packets

"f" failure. This is the response from HAC or AQM slave machines to the master or from master to the user that the "t" or "p" command was not executed. Failure in response can happened because of any of the following 3 reasons:

1) Slave unit HAC or AQM is out of reach (out of range of radio communication)
2) Slave unit HAC or AQM is switched OFF (radio controller is power down)
3) Hardware malfunction in the sensor or driver ports

"e" echo. This is in response of "\r" or 0x0D or carriage return. Echo responding indicates that the machines is active and can respond back to the user. It also resets the radio controller and frees it immediately from any of the presently occupied activity viz. transmission, reception or sensor calculation

† **DataByte 1 (Port number)**
The port number can be anywhere from 0x00 to 0xFF for HAC driver ports.

Value	Description	Destination
0x00 – 0xFE	Indicates individual driver port	HAC slave driver
0xFF	Indicates all ports	HAC slave driver (0xFF is not valid for AQM)
0x01	Temperature Sensor	AQM sensors
0x02	Humidity Sensor	AQM sensors
0x03	CO2 (Carbondioxide) Sensor	AQM sensors
0x04	CO (Carbon-mono-oxide) Sensor	AQM sensors
0x05	HCHO (Formaldehyde) Sensor	AQM sensors
0x06	C6H6 (Benzene) Sensor	AQM sensors
0x07	Toluene Sensor	AQM sensors
0x08	H2S (Hydrogen Sulphide) Sensor	AQM sensors
0x09	Alcohol Sensor	AQM sensors
0x0A	LPG Sensor	AQM sensors

- Formaldehyde (HCHO) gas concentration is in decimal value, which is represented by databyte2 and databyte 3. Example, Formaldehyde value is 0.02ppm then databyte2 = 0x00 and databyte3 = 0x02. If concentration is 0.20 then databyte2 = 0x00 and databyte3 = 0x14 (hex value of 20). Similarly, for concentration is 12.53 then databyte2 = 0x0C and databyte3 = 0x35 (hex value of 53)
- For other gases concentration is directly mapped to 2 data bytes. Example, for CO2 concentration is 495ppm (0x01EF), databyte2 = 0x01 and databyte3 = 0xEF
- For temperature and humidity, databyte2 contains the (hex) value and databyte3 = 0x00

Examples:

Example 1: To drive a port ON (this will make an electrical appliance connected to a HAC driver ON)
Assume FBXHAC01 address is 0xA532 (Actual address in decimal is 42290)
Port = 0x05 (5th port)
ON = 0xFF
DataByte3 = 0x00 (reserved)
Channel number = 0x12 (Actual channel number is decimal 18)

Command from the user to the master can be either of the following

fbx_t_A53205FF0012_\r
or
0x66 0x62 0x78 0x5F 0x74 0x5F 0x41 0x35 0x33 0x32 0x30 0x35 0x46 0x46 0x30 0x30 0x31 0x32 0x5F 0x0D
or
fbx_t_a53205ff0012_\r
or
0x66 0x62 0x78 0x5F 0x74 0x5F 0x61 0x35 0x33 0x32 0x30 0x35 0x66 0x66 0x30 0x30 0x31 0x32 0x5F 0x0D

Example 2: To check (ping / get status) of the port value of electrical appliance connected to HAC driver
Assume FBXHAC01 address is 0xA532 (Actual address in decimal is 42290)
Port = 0x05 (5th port)
Assume port is presently ON (user cannot drive these bits, as it will contain the status)
DataByte3 = 0x00 (reserved)
Channel number = 0x12 (Actual channel number is decimal 18)

fbx_p_A53205000012_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x41 0x35 0x33 0x32 0x30 0x35 0x30 0x30 0x30 0x30 0x31 0x32 0x5F 0x0D
or
fbx_p_a53205000012_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x61 0x35 0x33 0x32 0x30 0x35 0x30 0x30 0x30 0x30 0x31 0x32 0x5F 0x0D

In response to this the master will send back:
sA53205FF00\r (incase of success)
or
fA53205\r (incase of failure)

Example 3: To bring back the master to IDLE state (and stop and transmission or reception)

\r

In response to this the master will send back:
e

Example 4: To drive PWM (intermediate value to a port value connected to HAC driver)
Assume FBXHAC01 address is 0xA532 (Actual address in decimal is 42290)
Port = 0x05 (5th port)
Assume port is presently ON (user cannot drive these bits, as it will contain the status)
DataHigh = 0x00, 0x0x01, 0x02….to 0x09, 0x0A, 0xFF (valid values)
DataLow = 0x00 (12 levels of dimming control 0x00, 0x01, 0x02, 0x03, 0x04, 0xFF)
Channel number = 0x12 (Actual channel number is decimal 18)

fbx_p_A53205010012_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x41 0x35 0x33 0x32 0x30 0x35 0x30 0x31 0x30 0x30 0x31 0x32 0x5F 0x0D
or
fbx_p_a53205010012_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x61 0x35 0x33 0x32 0x30 0x35 0x30 0x31 0x30 0x30 0x31 0x32 0x5F 0x0D

In response to this the master will send back:
sA5320501 00\r (incase of success)
or
fA53205\r (incase of failure)

Example 5: To drive PWM (intermediate value to a port value connected to HAC driver)
Assume FBXHAC01 address is 0xA532 (Actual address in decimal is 42290)
Port = 0x05 (5th port)
Assume port is presently ON (user cannot drive these bits, as it will contain the status)
DataHigh = 0x00 to 0xFF
DataLow = 0x01 (All 255 values 0x00 to 0xFF)
Channel number = 0x12 (Actual channel number is decimal 18)

fbx_p_A53205020112_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x41 0x35 0x33 0x32 0x30 0x35 0x30 0x32 0x30 0x31 0x31 0x32 0x5F 0x0D
or
fbx_p_a53205020112_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x61 0x35 0x33 0x32 0x30 0x35 0x30 0x32 0x30 0x31 0x31 0x32 0x5F 0x0D

In response to this the master will send back:
sA532050201\r (incase of success)
or
fA53205\r (incase of failure)

Example 6: To check the value of temperature from AQM

Assume AQM address is 0xB782 (Actual address in decimal is 46978)
Port = 0x01 (Temperature sensor)
DataByte2 = 0x00 (reserved)
DataByte3 = 0x00 (reserved)
Channel number = 0x25 (Actual channel number is decimal 37)

fbx_p_B78201000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x42 0x37 0x38 0x32 0x30 0x31 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D
or
fbx_p_b78201000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x62 0x37 0x38 0x32 0x30 0x31 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D

In response to this the master will send back:
sB782011600\r (incase of success, this means temperature is 22.00 °C) (22 decimal is 0x16)
or
fB78205\r (incase of failure)

Example 7: To check the value of humidity from AQM

Assume AQM address is 0xB782 (Actual address in decimal is 46978)
Port = 0x02 (Humidity sensor)
DataByte2 = 0x00 (reserved)
DataByte3 = 0x00 (reserved)
Channel number = 0x25 (Actual channel number is decimal 37)

fbx_p_B78202000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x42 0x37 0x38 0x32 0x30 0x32 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D
or
fbx_p_b78202000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x62 0x37 0x38 0x32 0x30 0x32 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D

In response to this the master will send back:
sB782022D00\r (incase of success, this means temperature is 45%rH) (45 decimal is 0x2D)
or
fB78202\r (incase of failure)

Example 8: To check the value of CO2 concentration from AQM
Assume AQM address is 0xB782 (Actual address in decimal is 46978)
Port = 0x03 (CO2 sensor)
DataByte2 = 0x00 (reserved)
DataByte3 = 0x00 (reserved)
Channel number = 0x25 (Actual channel number is decimal 37)

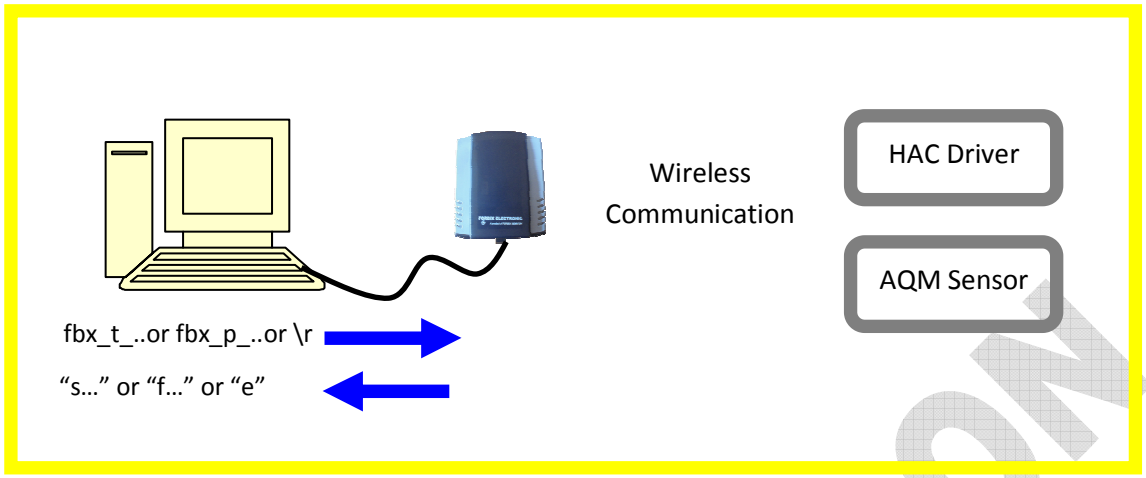
fbx_p_B78203000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x42 0x37 0x38 0x32 0x30 0x33 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D
or
fbx_p_b78203000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x62 0x37 0x38 0x32 0x30 0x33 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D

In response to this the master will send back:
sB7820301E7\r (incase of success, this means temperature is 487ppm) (487 decimal is 0x01E7)
or
fB78203\r (incase of failure)

Example 9: To check the value of HCHO (Formaldehyde) concentration from AQM
Assume AQM address is 0xB782 (Actual address in decimal is 46978)
Port = 0x05 (HCHO sensor)
DataByte2 = 0x00 (reserved)
DataByte3 = 0x00 (reserved)
Channel number = 0x25 (Actual channel number is decimal 37)

fbx_p_B78205000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x42 0x37 0x38 0x32 0x30 0x35 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D
or
fbx_p_b78205000025_\r
or
0x66 0x62 0x78 0x5F 0x70 0x5F 0x62 0x37 0x38 0x32 0x30 0x35 0x30 0x30 0x30 0x30 0x32 0x35 0x5F 0x0D

In response to this the master will send back:
sB782050004\r (incase of success, this means temperature is 0.04ppm)
or
fB78205\r (incase of failure)



Internal Architecture

- TODO (for HAC)
- TODO (for AQM)
- Range of communication

The range of wireless system is within 30-50 meters in indoor conditions and around 100-150 meters in open line of sight conditions. It is suggested to keep the machine away from vicinity of metals, concrete structures, wood and water (for better range of communication). Radio machines can also interact with our repeater systems for improved performance in communication range. It is always suggested to keep all FORBIX SEMICON radio machines upright (antenna pointing towards the sky). For both FBXHAC and FBXAQM machines, the antenna is vertically mounted.

FBXAQM machines are fit to be used ONLY for indoor purposes. Do not expose to acidic and oily environments.
Exposing to places that might exceed specified values of temperature, humidity, or VOC gases might damage the internal sensor operation. Details of FBXAQM models are available as a part of specification document.

Use for the intend purpose

The equipment (device, module) may only be used for the application cases specified in the Catalogue and the user manual and only in connection with devices and components recommended and approved by FORBIX SEMICON.

FORBIX SEMICON machines should NOT be opened without prior permission from the manufacturer. Warranty void otherwise.

Exclusion of liability

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9. Document History

Revision / Date	Approved	Description / Changes
Aug-2014	Yes	Initial Release (pending TODO items)
Oct-2014	Yes	Modified AQM sensor values and examples