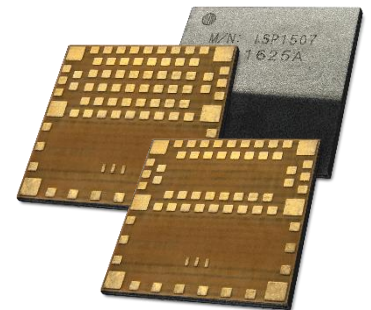


BLE AT Command Set ISP15 & ISP18 series



Application Note AN200301

Introduction

Scope

This document gives details on how to use AT commands to control Insight SiP's modules.

Contents

1.	Overview.....	3
1.1.	Introduction.....	3
1.2.	Connection to host.....	3
1.3.	Mode	4
1.4.	BLE Connection.....	4
2.	Getting started.....	5
2.1.	Using the development kit.....	5
2.2.	Setting the central side device	5
2.2.1.	Using nRF ToolBox.....	5
2.2.2.	Using another development kit.....	6
3.	AT commands list	7
3.1.	Format and syntax	7
3.2.	Standard Commands.....	8
3.2.1.	AT.....	8
3.2.2.	ATZ.....	8
3.2.3.	ATE	8
3.2.4.	ATI.....	8

3.3.	Custom Commands	9
3.3.1.	AT+DEEPSLEEP	9
3.3.2.	AT+FACTORYRESET	9
3.3.3.	AT+DCDC	10
3.3.4.	AT+UART	10
3.3.5.	AT+BLECONNSTATE	11
3.3.6.	AT+BLETXP	11
3.3.7.	AT+BLEPHY	12
3.3.8.	AT+BLEADVPARAM	13
3.3.9.	AT+BLECONNPARAM	13
3.3.10.	AT+BLEADDR	14
3.3.11.	AT+BLENAM	14
3.3.12.	AT+BLEADVERTISE	15
3.3.13.	AT+BLERSSI	15
3.3.14.	AT+BLEDISCONNECT	15

1. Overview

1.1. Introduction

This solution allows using an Insight SiP module as a BLE peripheral device. The device is controlled by a host (external microcontroller or computer terminal) using AT-style command set.

When connected to a central device with the adequate service the module will act as an “over the air” UART connection.

Currently supported modules are ISP1507-AX and ISP1807-LR.

1.2. Connection to host

The connection between the host and the module is as follow:

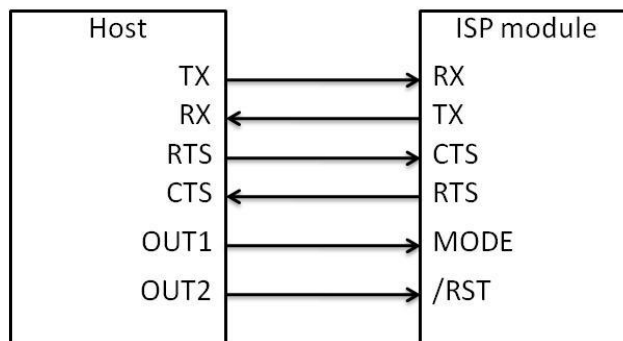


Figure 1: Host - Module connection

The pin assignment for the ISP module is described below.

Pin name	Pin number	Description
TX	34	UART TX
RX	32	UART RX
RTS	36	UART RTS (Only if flow control enabled)
CTS	33	UART CTS (Only if flow control enabled)
MODE	35	Mode selection: High = Data mode Low = Configuration mode
/RST	13	Reset

1.3. Mode

When the module is in configuration mode, all received data from UART are parsed and interpreted as AT command. No data is transmitted to or received from the BLE service.

In this mode the UART is always configured as follow:

- ✚ Baud rate: 38400
- ✚ Flow control: Disabled

When the module is in data mode, all received data from UART are transmitted to the BLE service and vice versa. In this mode the UART can be user-configured.

1.4. BLE Connection

The module is configured as a BLE peripheral device with the Nordic UART Service (NUS). Therefore, a central device with a NUS client service is needed to establish a connection.

2. Getting started

2.1. Using the development kit

1. Connect the test board (ISP1507-AX-TB or ISP1807-LR-TB) to the ISP130603 Interface Board with the 3 FPC cables (0.5 mm pitch, provided in the Development Kit). Connect the provided USB cable from the Interface Board ISP130603 to your computer.
2. On the ISP130603 Interface Board, using cables or jumpers connect:
 - P0_08 to RXD
 - P0_06 to TXD
 - P0_07 to CTS (Only if using hardware flow control)
 - P0_05 to RTS (Only if using hardware flow control)
 - P0_04 to GND
3. If not already done, flash the module with the BLE AT command firmware.
4. Using a terminal (such a RealTerm), configure the port with the following parameters:
 - Baud rate: 38400
 - Parity: None
 - Data bits: 8
 - Stop bits: 1
 - Hardware Flow Control: None
5. Test the communication by sending AT<CR> or AT<LF>. The module should answer with OK.

2.2. Setting the central side device

For evaluation purpose, the 2 easiest ways to set up a central device is to:

- Use a smartphone with nRF ToolBox.
- Use an nRF52 based board with the NUS client example installed (ble_app_uart_c).

2.2.1. Using nRF ToolBox

1. On your smartphone start nRF ToolBox and select UART.
2. Connect to the device (Default name ISP_BLE_UART).
3. Slide the screen to the right to reveal a terminal.
4. On the Interface Board, connect P0_04 to VCC.
5. You can now send and receive messages in both directions.

2.2.2. Using another development kit

1. Connect a second test board on a second ISP130603 Interface Board with the 3 FPC cables (0.5 mm pitch, provided in the Development Kit). Connect the provided USB cable from the Interface Board ISP130603 to your computer.
2. Using cable or jumpers connect:
 - P0_08 to RXD
 - P0_06 to TXD
3. Flash the module NUS client example located in the Nordic SDK: nRF5_SDK_16.0.0_98a08e2\examples\ble_central\ble_app_uart_c.
Once flashed the central-side device should automatically connect to the peripheral side. By default the example is configured to echo all data.
4. On the peripheral-side Interface Board, connect P0_04 to VCC.
5. You can now send and receive messages in both directions.

3. AT commands list

3.1. Format and syntax

The format is based on the Hayes AT-style command. The custom AT command set can be declined in 3 categories:

Type	Description	Syntax
Set	Set values or perform actions	<CMD>=... or <CMD>
Read	Check values	<CMD>?
Test	Test existence and provide info	<CMD>=?

The rules are the following:

- ✚ Every command starts with "AT".
- ✚ Commands are case sensitive.
- ✚ Parameters are not case sensitive.
- ✚ Commands can be terminated by <CR> or <LF>.
- ✚ Every command (except the reset command) is followed by a final response. The final response ends with <CR><LF>.
- ✚ Read and Test commands gives an additional response before the final response. The additional response ends with <CR><LF>.

The final response format is:

<Status><CR><LF>

Where <Status> can be:

- ✚ OK: Command run successfully.
- ✚ UNKNOWN_CMD: The command is unknown.
- ✚ ERROR_NOT_SUPPORTED: The command exists but the type (set, read or test) is not supported.
- ✚ ERROR_INVALID_PARAM: There is an error in one of the parameters.
- ✚ ERROR_INVALID_LENGTH: The parameter is too long.
- ✚ ERROR_INVALID_STATE: The command cannot be executed in the current state.
- ✚ ERROR: All others errors.

The additional response format is:

<CMD(without AT)>: <Returned value><CR><LF>

3.2. Standard Commands

3.2.1. AT

The module responds with "OK". This command can be used to check if communication between the host and the module.

Examples:

```
AT
OK
```

3.2.2. ATZ

Reset module.

Examples:

```
ATZ
```

3.2.3. ATE

Enable or disable echo of input commands.

Examples:

```
ATE=1
OK
```

```
ATE=0
OK
```

3.2.4. ATI

Display module information:

- Module name
- Device ID
- Firmware version

Examples:

```
ATI
ISP507-AX
AABBCCDDEEFF1122
1.0.0
OK
```


3.3. Custom Commands

3.3.1. AT+DEEPSLEEP

Go to deep sleep mode.

In this mode the module is in its lowest power consumption mode. It can only leave deep sleep by performing a reset.

Type	Input parameters	Additional response	Final response
Set	-	-	OK
Test	-	-	OK

Note:

The module will go to deep sleep mode before sending the Final response. This means that host will not receive an "OK" acknowledgement.

Examples:

```
AT+DEEPSLEEP=?
OK
```

```
AT+DEEPSLEEP
```

3.3.2. AT+FACTORYRESET

Clear configuration from the non volatile memory and perform reset.

Type	Input parameters	Additional response	Final response
Set	-	-	OK
Test	-	-	OK

Note:

The module will reset before sending the Final response. This means that host will not receive an "OK" acknowledgement.

Examples:

```
AT+FACTORYRESET=?
OK
```

```
AT+FACTORYRESET
```

3.3.3. AT+DCDC

Enable or disable the DC-DC converter.

Type	Input parameters	Additional response	Final response
Set	Mode		OK ERROR_INVALID_PARAM
Read		Mode	OK
Test		All accepted parameters	OK

Parameters:

Mode =

- 0 = Disable
- 1 = Enable

Examples:

AT+DCDC=1
OK

AT+DCDC?
+ DCDC: 1
OK

AT+DCDC=?
+DCDC: (0,1)
OK

3.3.4. AT+UART

Configure the serial interface when used in data mode.

Type	Input parameters	Additional response	Final response
Set	Flow control Baudrate		OK ERROR_INVALID_PARAM
Read		Flow control Baudrate	OK
Test		Accepted parameters	OK

Parameters:

Flow control=

- 0 = Disable
- 1 = Enable

Baud rate=1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 or 1000000

Examples:

AT+UART=0,115200
OK

AT+UART?
+ DCDC: 0,115200
OK

AT+UART=?
+UART:(0,1),(1200,2400,4800,9600,19200,38400,57600,115200,230400,460800,921600,1000000)
OK

3.3.5. AT+BLECONNSTATE

Get the BLE connection state (Connected / Not connected).

Type	Input parameters	Additional response	Final response
Read	-	State	OK
Test	-	-	OK

Parameters:

State =
- 0 = Not Connected
- 1 = Connected

Examples:

AT+BLECONNSTATE?
+ BLECONNSTATE: 1
OK

AT+BLECONNSTATE=?
OK

3.3.6. AT+BLETXP

Set BLE Transmit power (in dBm).

Type	Input parameters	Additional response	Final response
Set	TXP		OK ERROR_INVALID_PARAM
Read		TXP	OK
Test		Accepted parameters	OK

Parameters:

For ISP1507-AX:

TXP = -40, -20, -16, -12, -8, -4, 0, 3, or 4

For ISP1807-LR:

TXP = -40, -20, -16, -12, -8, -4, 0, 3, 4, 5, 6, 7 or 8

Examples:

AT+BLETXP=4
OK

AT+BLETXP?
+ BLETXP: 4
OK

AT+BLETXP=?
+BLETXP: (-40, -20, -16, -12, -8, -4, 0, 3, 4)
OK

3.3.7. AT+BLEPHY

Change the PHY mode (1M, 2M or Coded)

Type	Input parameters	Additional response	Final response
Set	TX PHY RX PHY	-	OK ERROR_INVALID_PARAM
Read	-	TX PHY RX PHY	OK
Test	-	Accepted parameters	OK

Parameters:

TX PHY =

- 0 = Auto
- 1 = 1M
- 2 = 2M
- 4 = Coded

RX PHY =

- 0 = Auto
- 1 = 1M
- 2 = 2M
- 4 = Coded

Examples:

AT+PHY=2,2
OK

AT+PHY?
+PHY: 2,2
OK

AT+PHY =?
+PHY: (0,1,2),(0,1,2)
OK

3.3.8. AT+BLEADVPARAM

Change BLE advertising interval

Type	Input parameters	Additional response	Final response
Set	Interval (in ms)	-	OK ERROR_INVALID_PARAM
Read	-	Interval (in ms)	OK
Test	-	Accepted parameters	OK

Examples:
AT+BLEADVPARAM=500
OK

AT+BLEADVPARAM?
+BLEADVPARAM: 500
OK

AT+BLEADVPARAM=?
+BLEADVPARAM: (20-10240)
OK

3.3.9. AT+BLECONNPARAM

Change BLE connection parameters

Type	Input parameters	Additional response	Final response
Set	Min connection interval (in ms) Max connection interval (in ms) Latency Timeout (in 10 ms)	-	OK ERROR_INVALID_PARAM
Read	-	Min connection interval (in ms) Max connection interval (in ms) Latency Timeout (in 10 ms)	OK
Test	-	(7.5-4000),(7.5-4000),(0-500),(10-32000)	OK

Examples:

```
AT+BLECONNPARAM=20,50,0,3000
+BLECONNPARAM: 1
OK
```

```
AT+BLECONNPARAM?
+BLECONNPARAM: 20,50,0,3000
OK
```

```
AT+BLECONNPARAM=?
+BLECONNPARAM: (7.5-4000), (7.5-4000), (0-500), (10-32000)
OK
```

3.3.10. AT+BLEADDR

Display BLE address.

Type	Input parameters	Additional response	Final response
Read	-	Address in hex format	OK
Test	-	-	OK

Examples:

```
AT+BLEADDR?
+BLEADDR: FE-DC-BA-98-76-54
OK
```

3.3.11. AT+BLENAME

Change the BLE advertising name.

Type	Input parameters	Additional response	Final response
Set	Name (26 char max)		OK ERROR_INVALID_PARAM ERROR_INVALID_LENGTH
Read	-	Name (26 char max)-	OK
Test	-	-	OK

Examples:

```
AT+BLENAME=MyName
OK
```

```
AT+BLENAME?
+BLENAME: MyName
OK
```

```
AT+BLENAME=?
OK
```

3.3.12. AT+BLEADVERTISE

Start or stop the BLE advertising.

Type	Input parameter	Additional response	Final response
Set	State	-	OK ERROR_INVALID_PARAM
Read	-	-	OK
Test	-	Accepted parameters	OK

Parameters:

State =

- 0 = Disable

- 1 = Enable

Examples:

AT+BLEADVERTISE=1

OK

AT+BLEADVERTISE=?

OK

3.3.13. AT+BLERSSI

Get last BLE RSSI.

Type	Input parameter	Additional response	Final response
Read	-	RSSI (in dBm)	OK
Test	-	-	OK

Examples:

AT+BLERSSI?

+ BLERSSI: -64

OK

AT+BLERSSI =?

OK

3.3.14. AT+BLEDISCONNECT

Disconnect from BLE peer device.

Type	Input parameter	Additional response	Final response
Set			OK
Test			OK

Examples:

AT+BLEDISCONNECT

OK