

Bluetooth Communication Module IFD8540 Operation Manual

Revision History

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Bluetooth Communication Module IFD8540 Operation Manual

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Chapter 1 Introduction

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1.1 Introduction

Thank you for choosing Delta IFD8540 module. Before using the module, please read this manual for proper installation and operation.

The IFD8540 is a Bluetooth communication module that provides MODBUS (RS-232/RS-485) conversion to Bluetooth and vice versa. You can create software configuration with Delta communication software HWCONFIG 4.0 via RS-232/RS-485/USB.

The characteristics of the IFD8540 modules are as follows.

1. Support MODBUS protocol.
2. Isolate communications from power, strong noise immunity.
3. Use the external control button for Bluetooth group, MODBUS station or combination of particular communication format and baud rate.
4. Support using Reset button to restore default values.
5. Provides communication lighting (BLE, COM) control to easily detect errors.

1.2 General specification

Item	Specification
Operation temperature	0°C ~ 60°C
Storage temperature	-40°C ~ 85°C
Operation humidity	5~95%, non-condensing
Storage humidity	5~95%, non-condensing
Operating environment	Corrosive gases do not exist
Installation	Inside a control box
Pollution degree	2
Degree of protection	IP40
Vibration immunity	Tested with: 5 Hz \leq f \leq 8.4 Hz, constant amplitude 3.5 mm; 8.4 Hz \leq f \leq 150 Hz, constant acceleration 1g Duration of oscillation: 10 sweep cycles per axis on each direction of the 3 mutually perpendicular axes International standards: IEC61131-2, IEC 68-2-6 (TEST Fc)
Shock	Tested with: Half-sine wave: Strength of shock 15 g peak value, 11 ms duration; Shock direction: The shocks in each direction per axis, on 3 mutually perpendicular axes (total of 18 shocks) International standards: IEC 61131-2 & IEC 60068-2-27 (TEST Ea)
Certificates	EN62368-1, UL61010
Permissible air pressure	Operation: 1080 ~ 795hPa (-1000 ~ 2000m above sea level) Storage: 1080 ~ 660hPa (-1000 ~ 3500m above sea level)

1.3 Communication interface specification

1.3.1 Wireless

Item	Specification
Connector	SMA
Interface	Bluetooth
Transmission speed	1M/2Mbps
Communication protocol	SIG mesh, Instaburst mesh, GATT (Peripheral mode ONLY)
Frequency	2.402 ~ 2.480GHz
Security measure	128bit AES-COM
Communication range	Environment without obstacles or interference SIG Mesh/GATT: approx.50m Instaburst Mesh: approx.10m
Data transmission speed	15Kbps (SIG Mesh) 160Kbps (Instaburst Mesh) 2Mbps (GATT)
Max. Bluetooth packet	244bytes
Antenna	3dBi antenna + 1.5m extension cord

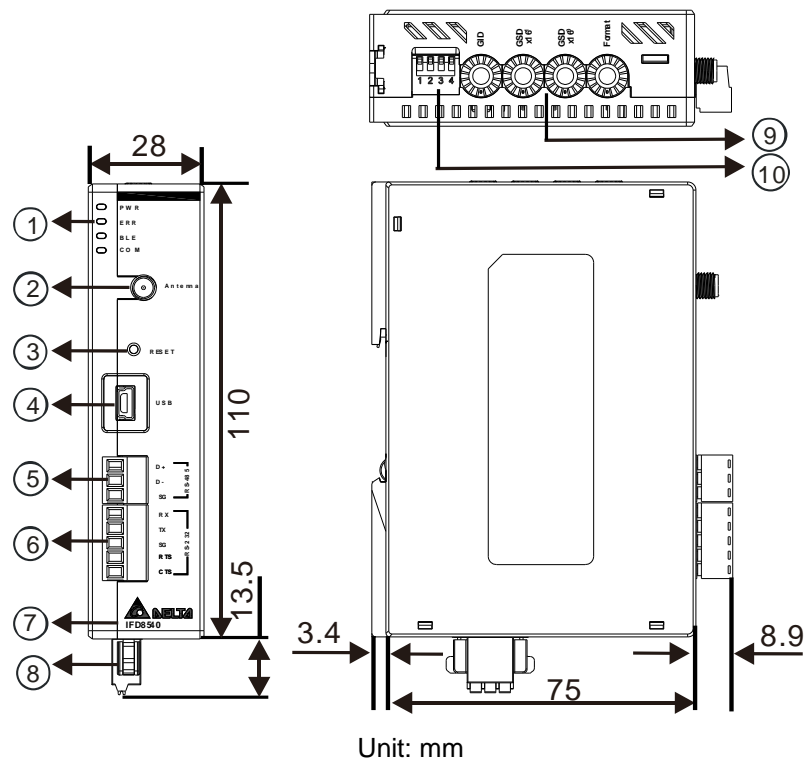
1.3.2 Serial communication

Item	RS-232/RS-485 Specification
Connector	Terminal block
Transmission speed	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Communication protocol	MODBUS/ transparent transmission mode
Item	USB Specification
Connector	Mini type
Transmission speed	12Mbps
Communication protocol	USB 2.0 (Full Speed)

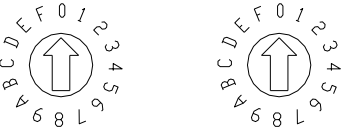
1.4 Power, weight and electric specification

Item	Specification
Power supply voltage	12 ~ 48 VDC
Insulation voltage	500V
Consumed power (W)	2W
Weight (g)	115g

1.5 Dimensions and parts descriptions

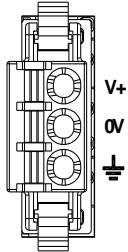


No.	Name	Description
1	POWER LED (Green)	Power LED status indicator ON: Normal power supply OFF: No power input
	ERR LED (Red)	Module status indicator OFF: No error ON: Hardware error Flashing (200ms ON/OFF): BLE module communication failure, control button parameter setting failure
	BLE LED	BLE module communication status indicator OFF: No communication Flashing (200ms ON/OFF): Communicating

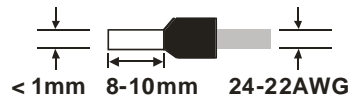
No.	Name	Description	
	COM LED	Serial communication status display OFF: No communication Flashing (200ms ON/OFF): Communicating (LED based on software setting is RS-485 TX or RX, RS-232 TX or RX)	
2	Antenna connector	SMA	
3	Reset button	Press for 3 sec. to restore default values	
4	USB port	Provides mini USB communication interface	
5	RS-485 terminal block	Provides RS-485 communication interface	
6	RS-232 terminal block	Provides RS-232 communication interface	
7	Model name	Model name	
8	Power supply terminal	DC 12~48V input	
9	Group (GID)	Setting Bluetooth group ID Actual group ID = button value (0~F)(decimal 0~15) + C000 (decimal 49152)	
	Slave ID. (SID)	 Set MODBUS slave ID, permissible range is from 01 to F7; when setting is 00, software settings are adopted.	
	Communication format	Setup particular communication format, permissible range is 0~4 0: 9600bps 7E1 MODBUS ASCII (DELTA PLC) 1: 9600bps 7N2 MODBUS ASCII (DELTA VFD) 2: 19200bps 8N1 MODBUS ASCII 3: 115200bps 8N1 MODBUS RTU 4: 19200bps 8N1 MODBUS RTU 5~F: Reserve When direction for communication is BLE←→RS-485, the RS-485 control format is implemented; when direction is BLE←→RS-232, the RS-232 control format is implemented.	
10	Bluetooth settings	DIP1	OFF: Parameter based on software setting ON: Parameter based on hardware setting
		DIP2=ON & DIP3=ON:	Enable MODBUS replace slave ID function and change the slave ID received from BLE to replace slave ID, then send through the serial channel (replace slave ID by default: 1)
		DIP4	OFF: BLE←→RS-485 direction
			ON: BLE←→RS-232 direction

1.6 Pin definition and wiring

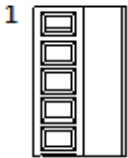
- Power supply terminal block

Diagram	Terminal	Description
	V+	Voltage input (12~48 VDC)
	0V	0V
	⏏	Ground

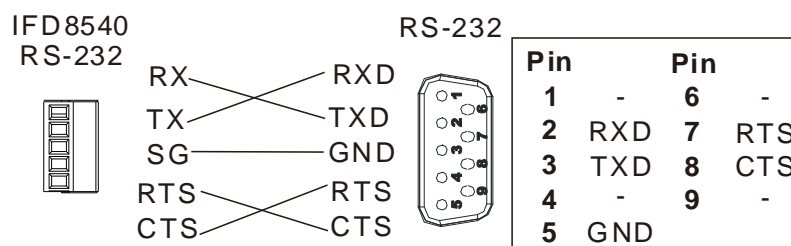
Note: For wiring, please use 24-22AWG single or multi-conductor cables to connect the terminal block and along with needle terminals (bore diameter less than 1mm) for wiring. Specification is shown below. Use only 75°C copper conductor.




- RS-232 terminal block

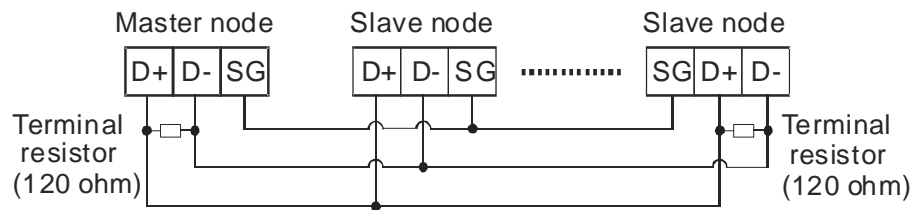
Diagram	Terminal no.	Definition	Description
	1	RX	Receive data
	2	TX	Transmit data
	3	SG	Reference ground
	4	RTS	Request transmission
	5	CTS	Clear transmission

Wiring recommendation

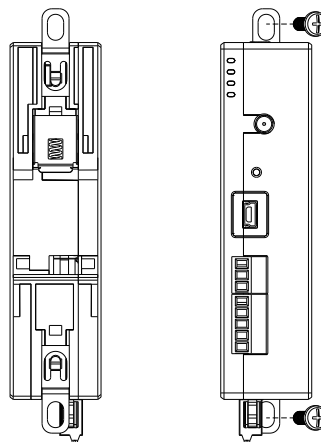


- RS-485 terminal block

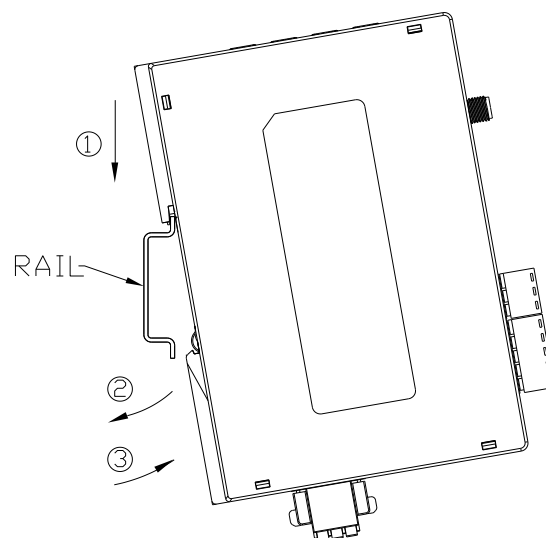
Diagram	Terminal no.	Definition	Description
	1	D+	Positive data
	2	D-	Negative data
	3	SG	Reference ground

Wiring recommendation**1.7 Installment**

- Locking screw method: Use M4 for direct screws-fittings (see below).



- Installing and dismantling aluminum DIN rail: Attach the back trench of the device to the mounting rail in arrow ① direction and push the device against the rail in arrow ② direction. To dismantle, first push down the device in arrow ① direction and follow arrow ③ direction to release the device.



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Chapter 2 Control Register (CR) List & MODBUS

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2.1 Control register (CR) List

The chapter contains information about control register that allows users to send MODBUS command via USB/RS232/RS485/BLE as well as read and modify IFD8540 parameters. The start address begins at 0x0000.

CR#	Attribute	CR name	Note	Default value
0	O R/W	MODBUS slave ID	1~247	247
1	O R/W	Communication direction	0: RS232<->BLE 1: RS485<->BLE	1
2	O R/W	Replace slave ID function	0: Disable 1: Enable	0
3	O R/W	Replace slave ID	Replace slave ID (1~247)	1
4	O R/W	RS232 protocol	0: MODBUS ASCII 1: MODBUS RTU 2: Transparent	0
5	O R/W	RS232 baud rate	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200	3
6	O R/W	RS232 communication format	0: 7e1 1: 7e2 2: 7o1 3: 7o2 4: 7n1 5: 7n2 6: 8e1 7: 8e2 8: 8o1 9: 8o2 10: 8n1 11: 8n2	0
7	O R/W	RS232 CTS_RTS	0: Disable 1: Enable	0
8		Reserve		
9	O R/W	RS232 send delay	0~60000 (unit: ms)	0
10	O R/W	RS485 protocol	0: MODBUS ASCII 1: MODBUS RTU 2: Transparent transmission	0

2

CR#	Attribute		CR name	Note	Default value
11	O	R/W	RS485 baud rate	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200	3
12	O	R/W	RS485 communication format	0: 7e1 1: 7e2 2: 7o1 3: 7o2 4: 7n1 5: 7n2 6: 8e1 7: 8e2 8: 8o1 9: 8o2 10: 8n1 11: 8n2	0
13			Reserve		
14			Reserve		
15	O	R/W	RS485 send delay	0~60000 (unit: ms)	0
16	O	R/W	COM LED	COM LED control display 0: RS485 TX 1: RS485 RX 2: RS232 TX 3: RS232 RX	0
17-19			Reserve		
20	O	R/W	BLE protocol	0: SIG Mesh 1: Instaburst Mesh 2: GATT	0
21-22			Reserve		
23	O	R/W	BLE address	0: System auto-setting address 16#0001 ~ 16#7FFF	0
24	O	R/W	BLE group ID	16#C000~16#FEFF	49152
25	O	R/W	BLE TTL	16#0001~16#007F	4
26-31			Reserve		
32-47	O	R/W	Name	User-defined equipment name	0
48-63	O	R/W	UUID	User-defined ID	0
64-67			Reserve		
Symbol definition: O means retentive type. X means non-retentive type. R means read data ONLY. R/W means to read or write data.					

2.2 MODBUS communication

- Function codes supported

Function code	Description
0x03	Read register
0x06	Write single register
0x10	Write multiple registers
0x17	Read/ write multiple registers

- Exception codes supported

Exception code	Description
0x01	Illegal function
0x02	Illegal data address
0x03	Illegal data value
0x04	Slave station failure

- Element type and address

Type	MODBUS address (Hex)	MODBU 5 digit address (Dec)	MODBUS 6 digit address (Dec)	Number
CR	0x0000~0x0044	00001~00069	000001~000069	68

Chapter 3 Software Configuration

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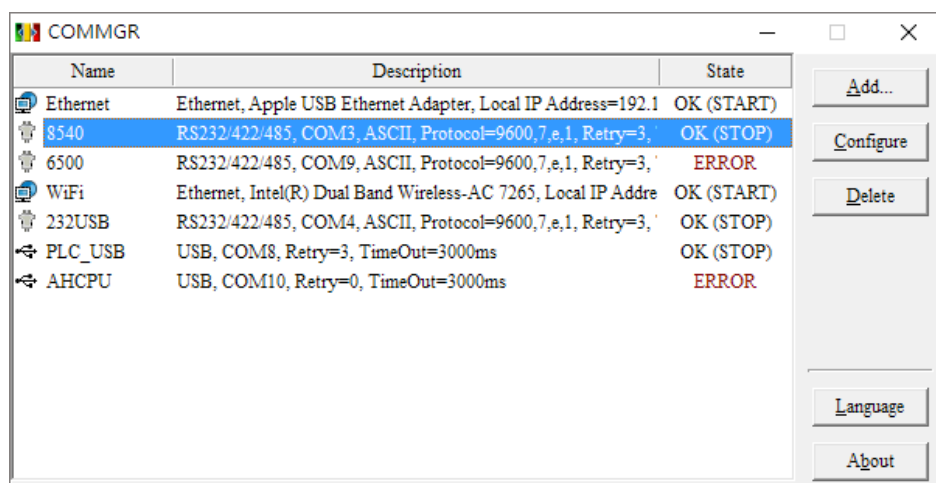
3.1 Software Configuration

3.1.1 Software description

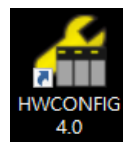
Users must install two basic software - HWCONFIG 4.0 and COMMGR before operating the modules. The main function of COMMGR is being the medium software between a PC end and a device that manages communication interface of devices, while HWCONFIG 4.0 is for setting module parameters.

3.1.2 Procedures

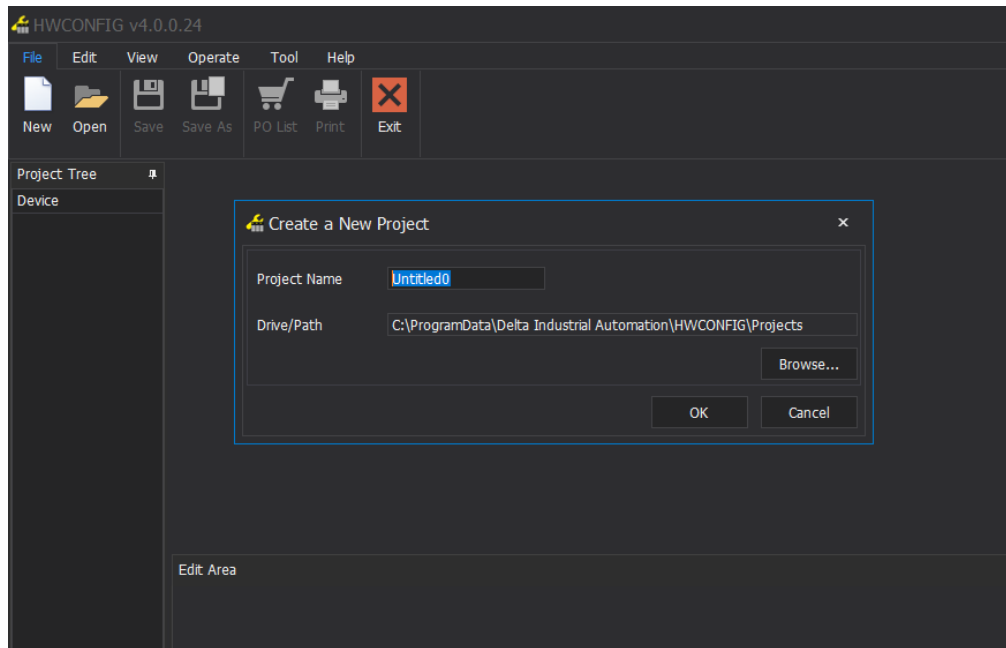
Step 1: Add IFD8540 communication interface in COMMGR. For communication type, select RS232/422/485 and the name is IFD8540 or choose an easily identifiable name. When setting is complete, close COMMGR window but the software continues to operate with graphic shown in the system list.



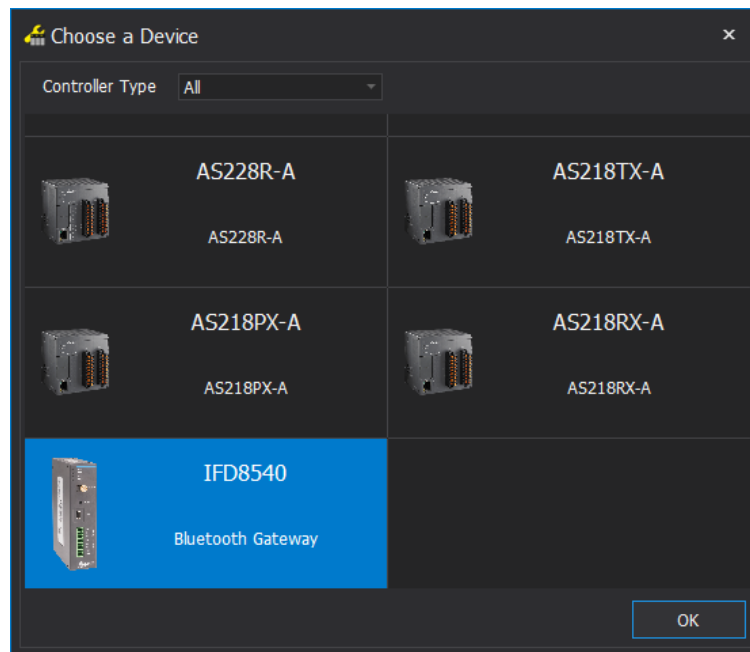
Step 2: Next, click HWCONFIG 4.0



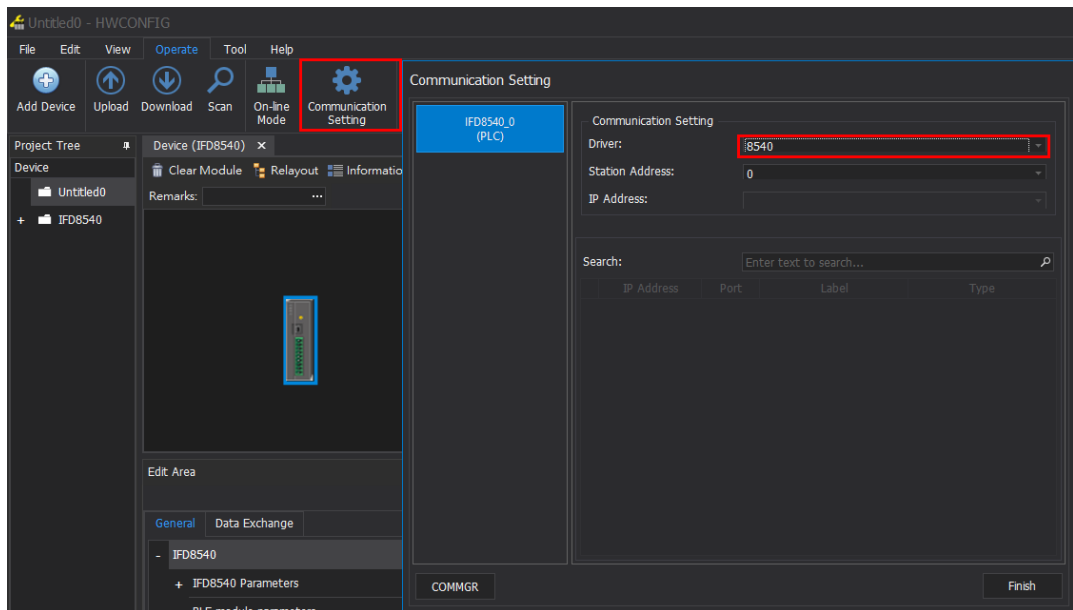
Step 3: Create a new project.

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Step 4: For device option, choose IFD8540 and the HWCONFIG4.0 loads the default parameters of the device. Please refer to chapter 2 for parameter details.



Step 5: Before operating the software, choose **Communication Setting** under **Operate** tab and choose the channel that is already setup in COMMGR.



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Users can click **Upload** under **Operate** tab to view IFD8540 parameters on the software. In addition, click **Download** to write modified parameters in IFD8540. Please use online mode to check IFD8540 firmware version. The IFD8540 does not support the scanning function of the software.

3.2 Parameter Settings

Module parameters contain IFD8540 parameters and BLE (Bluetooth Low Energy) parameters. Both parameter categories is divided into Basic and Advanced settings. The Basic is defined as parameters modified via a button and is controlled by DIP- switch (DIP1); when DIP is ON and the button parameter is within legal range, the system adopts the button value or use the software value instead. As for Advanced, the software downloads and controls its parameters.

In the parameter list, the value that is different from default uses another color for display.

General		Data Exchange				
IFD8540		Basic				
Name	Value	Unit	Default	Minimum	Maximum	
MODBUS Slave ID	247		247	1	247	
Replace Slave ID Function	Disable		Disable	-	-	
RS485 Protocol	MODBUS RTU		MODBUS ASCII	-	-	
RS485 baudrate	19200	bps	9600	-	-	
RS485 communication format	8E1		7E1	-	-	

3.2.1 Basic setting

The IFD8540 controls serial communication parameters and the basic setting includes button and DIP-switch parameters.

General		Data Exchange			
- IFD8540		Basic			
- IFD8540 Parameters					
Basic					
Advance					
+ BLE module parameters					
Name	Value	Unit	Default	Minimum	Maximum
MODBUS Slave ID	247		247	1	247
Replace Slave ID Function	Disable		Disable	-	-
RS485 Protocol	MODBUS ASCII		MODBUS ASCII	-	-
RS485 baudrate	9600	bps	9600	-	-
RS485 communication format	7E1		7E1	-	-

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Name	Description
MODBUS slave ID	<ol style="list-style-type: none"> The IFD8540 slave ID. When RS-485/232 receives slave ID commands for MODBUS, IFD8540 auto-responds and does not transfer via Bluetooth. In corresponds to SID button, MODBUS slave ID is set when DIP1 is OFF or DIP1 is ON and SID is 0x00.
Replace slave ID function	<ol style="list-style-type: none"> When enabled, the IFD8540 Bluetooth interface will not respond to slave ID commands for MODBUS but transfer the commands as replaces slave ID via serial communication and send the response back to MODBUS master. Enable from IFD8540 slave. Setup replace slave ID in Advanced parameter setting, default value is 1. When DIP1 is ON and DIP2, DIP3 is also set to ON, the function is enabled.
RS485 protocol	<ol style="list-style-type: none"> Converts MODBUS ASCII and MODBUS RTU, accepts only MODBUS commands. When Bluetooth connection uses RS485, select transparent transmission mode and the command content is not restricted. All received data is send via Bluetooth.
RS485 baud rate	Setup baud rate
RS485 communication format	Setup communication format

3.2.2 Advanced setting

The IFD8540 controls serial communication parameters, but Advance setting does not provide button or DIP-switch and becomes effective once settings are complete without using DIP-switch.

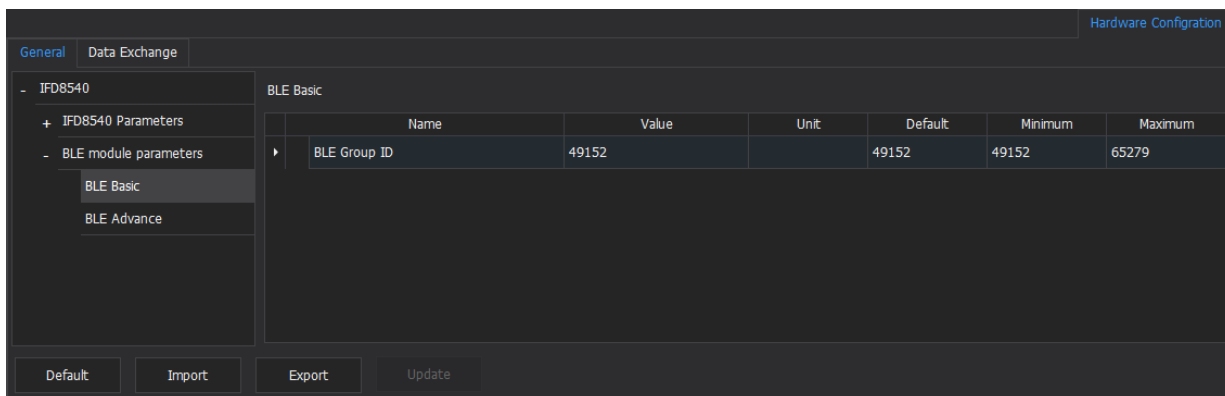
General		Data Exchange			
- IFD8540		Advance			
- IFD8540 Parameters					
Basic					
Advance					
+ BLE module parameters					
Name	Value	Unit	Default	Minimum	Maximum
Communication Direction	RS485<->BLE		RS485<->BLE	-	-
Replace Slave ID	1		1	1	247
RS232 Protocol	MODBUS ASCII		MODBUS ASCII	-	-
RS232 baudrate	9600	bps	9600	-	-
RS232 Communication format	7E1		7E1	-	-
RS232 CTS_RTS	Disable		Disable	-	-
RS232 send delay	0	ms	0	0	60000
RS485 send delay	0	ms	0	0	60000
COM LED	RS-485 TX LED		RS-485 TX LED	-	-

Name	Description
Communication direction	Setup Bluetooth and corresponding serial communication to RS232 or RS485.
Replace slave ID	Setup replace slave ID together with replace slave ID function in Basic setting.
RS232 protocol	1. Converts MODBUS ASCII and MODBUS RTU, accepts only MODBUS commands. 2. When Bluetooth connection uses RS232, select transparent transmission mode and the command content is not restricted. All received data is send via Bluetooth.
RS232 baud rate	Setup baud rate
RS232 communication format	Setup communication format
RS232 CTS_RTS	When flow control for communication is enabled, data for transmission will first send RTS (Request to Send) to confirm the other side is ready to receive, once the message is received, a CTS (Clear to Send) is send.
RS232 send delay	When Bluetooth receives data but delays sending to the other side via RS232.
RS485 send delay	When Bluetooth receives data but delays sending to the other side via RS485.
COM LED	Setup receive or transmit over RS232/RS485 to control COM LED indicators.

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3.2.3 BLE basic setting

BLE controls Bluetooth module parameters. The Basic setting content includes BLE group ID and corresponding GIP button. Those with the same GID in IFD8540 can receive data send by one another. The group ID shown in HWCONFIG4.0 is an actual value based on GID button value plus 49152 (range 16#C000~16#FEFF).



3.2.4 BLE advance setting

BLE controls Bluetooth module parameters, but Advance setting does not provide button or DIP-switch and becomes effective once settings are complete without using DIP-switch.

The screenshot shows a software configuration window for the IFD8540 device. The 'Data Exchange' tab is active, and the 'BLE Advance' sub-tab is selected. A table displays the following parameters:

Name	Value	Unit	Default	Minimum	Maximum
BLE Protocol	SIG Mesh		SIG Mesh	-	-
BLE Unicast Addr	0		0	0	32767
BLE TTL	4		4	1	127

Buttons for 'Default', 'Import', 'Export', and 'Update' are visible at the bottom of the configuration area.

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Name	Description
BLE protocol	<p>Select communication mode:</p> <ol style="list-style-type: none"> 1. SIG Mesh: Standard Mesh mode, those with the same group ID can communicate with each other, the communication range expands as the number of nodes increases. 2. Instaburst Mesh: Its function is similar to SIG Mesh, but communication efficiency can be slightly higher for short distance (<10m). 3. GATT: The standard communication protocol for BLE to transmit data. It is one-to-one communication, and can support BLE communication equipment including smartphones and PCs.
BLE address	Generally, the BLE address do not change but please contact our technicians if adjustment is required.
BLE TTL	TTL (Time To Live) refers to the amount of time that a packet is set to pass a node and the amount of its existence is to minus 1. Generally, the setting do not change but please contact our technicians if adjustment is required.

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Chapter 4 Troubleshooting

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4.1 Troubleshooting

4.1.1 Basic troubleshooting steps

This chapter includes the possible errors that can occur during operation and the causes or response in handling these situations. Before confirming the cause of error, users need to inspect the following:

- Must operate under safe environment (consider environmental, electronic, and vibration safeties).
- Connect power supply correctly.
- Secure the terminal and cable installations.
- All LED indicators are in normal condition.
- Set all switches correctly.

4

4.1.2 Clear the error states

When the device is in error condition, use the following troubleshooting methods to clear the errors. However, the system will continue to show errors if the error source is not corrected.

- (1) Disconnect and turn it on again.
- (2) Press reset button to reset the device to default settings.

4.1.3 ERROR LED indicators

Flash Notification	Error Description	Troubleshooting Method
Stays ON	Hardware damaged	(1) Press reset button to reset the device to default settings. (2) Contact the factory.
0.1 second ON, 0.1 second OFF	1) BLE module communication failure 2) Restoring to default values 3) Slave station setting error 4) Knob value undefined	1) No need to handle. 2) No need to handle. 3) Reset station number. 4) Check knob value setting is correct
OFF	No error	No need to handle.

Chapter 5 EMC Standards

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5.1 EMC Standards

5.1.1 EMI

Port	Frequency range	Level (Standard)	Reference
Outer shell (radiated) (measured at a distance of 10 meters)	30-230 MHz	40 dB ($\mu\text{V}/\text{m}$) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB ($\mu\text{V}/\text{m}$) quasi-peak	
Outer shell (conducted)	0.15-0.5 MHz	79 dB (μV) quasi-peak	EN 61000-6-4
		66 dB (μV) average	
	0.5-30 MHz	73 dB (μV) quasi-peak	
		60 dB (μV) average	

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5.1.2 EMI (RF)

Port	Frequency range	Level (Standard)	Reference
Bluetooth sending (radiated) (measured at a distance of 3 meters)	30-47MHz	36 dB ($\mu\text{V}/\text{m}$) quasi-peak	EN300328
	47-74MHz	54 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	74-87.5 MHz	36 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	87.5-118 MHz	54 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	118-174 MHz	36 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	174-230 MHz	54 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	230-470 MHz	36 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	470-862 MHz	54 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	862-1000 MHz	36 dB ($\mu\text{V}/\text{m}$) quasi-peak	
	1000-1275 MHz	30 dB ($\mu\text{V}/\text{m}$) quasi-peak	
Bluetooth receiving (radiated) (measured at a distance of 3 meters)	30-1000 MHz	57 dB ($\mu\text{V}/\text{m}$) quasi-peak	EN300328
	1000-1275 MHz	47 dB ($\mu\text{V}/\text{m}$) quasi-peak	

5.1.3 EMS

Environmental phenomenon	Reference	Test		Test level
Electrostatic discharge	IEC 61000-4-2	Contact		± 4 kV
		Air		± 8 kV
Radio frequency electromagnetic field Amplitude modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	2.0-2.7 GHz	1 V/m
			1.4-2.0 GHz	3 V/m
			80-1000 MHz	10 V/m
Power frequency magnetic field	IEC 61000-4-8	60 Hz		30 A/m
		50 Hz		30 A/m

5.1.4 Conducted immunity test

Environmental phenomenon		Fast transient burst	High energy surge	Radio frequency interference
Reference standard		IEC 61000-4-4	IEC 61000-4-5	IEC 61000-4-6
Interface/Port	Specific interface/port	Test level	Test level	Test level
Data transmission	Shielded cable	1 kV	1 kV CM	10 V
	Unshielded cable	1 kV	1 kV CM	10 V
	DC power	2 kV	0.5 kV CM 0.5 kV DM	10 V

MEMO