

DX-LR01 SERIAL APPLICATION GUIDE

Version: 2.0

Date: 2023-08-20





Update Record

Version	Date	Description	Author
V1.0	2022/12/11	Initial Version	SML
V1.1	2023/05/12	Optimize Instructions	SML
V2.0	2023/08/20	Optimize Air Speed Level	SML

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Content

1.1. Serial Port Basic Parameters -4 1.2. Default RF Basic Parameters of the Module -4 1.3. Transmission And AT Command Mode -4 2. PC Test Tools -5 2.1. PC Test Software -5 2. Serial Port Usage -6 3.1. Module Test Minimal System -6 3.1. Module Usage Examples -6 4. Detailed Explanation Of Related AT Commands -9 4.1. Command Format Description -9 4.1. Command Format Description -9 4.2. Response Format Instructions -9 4.3. Examples Of AT Commands -10 5.4. Test Command -10 5.2. Test Command -10 5.2. Test Command -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial-Port Bud Rate -11 5.2.4. Set/Query—Serial-Port Bud Rate -12 5.2.5. Set/Query—Serial-Port Bud Rate -12 5.2.6. Set/Query—Working Mode -12 5.2.7. Set/Query—Working Mode -12 5.2.6. Set/Query—Working Chample -14 5.3.1.	1. Introduction	4	t -
1.2. Default RF Basic Parameters of the Module -4 1.3. Transmission And AT Command Mode -4 2. PC Test Tools -5 2.1. PC Test Software -5 2.1. PC Test Software -5 3. Serial Port Usage -6 3.1. Module Test Minimal System -6 3.2. Module Usage Examples -6 4.1. Command Format Description -9 4.1. Command Format Description -9 4.3. Examples Of AT Commands -10 5. AT Command -10 5.1. Basic Commands -10 5.2. Test Commands -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial Port Baud Rate -11 5.2.4. Set/Query—Serial-Port Stop Bit -12 5.2.5. Set/Query—Serial-Port Stop Bit -12 5.2.6. Set/Query—Serial-Port Stop Bit -12 5.2.7. Set/Query—Verking Mode -12 5.2.8. Software Reset -14 5.2.9. Factory Reset -14 5.2.1. Enter Or Exit AT Command Mode -12 5.2.3. Set/Query—Serial-Port Stop Bit	1.1. Serial Port Basic Parameters	4	4 -
1.3. Transmission And AT Command Mode. 4 2. PC Test Tools 5 2.1. PC Test Software 5 3. Serial Port Usage 6 3.1. Module Test Minimal System 6 3.2. Module Usage Examples 6 4.1 Command Format Description 9 4.1. Command Format Description 9 4.1. Command Format Instructions 9 4.2. Response Format Instructions 9 4.3. Examples Of AT Commands 10 5.1. Basic Commands 10 5.2. Test Command -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial-Port Baud Rate -11 5.2.4. Set/Query—Serial-Port Baud Rate -12 5.2.5. Set/Query—Working Mode -12 5.2.8. Software Reset -14 5.3. Module RF Parameter Configuration of Module Air Rate and Communication Distance) -15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) -15 5.4. Set/Query-Device Address -16 5.4. Set/Query-Transmit Power -17	1.2. Default RF Basic Parameters of the Module	4	4 -
2. PC Test Tools	1.3. Transmission And AT Command Mode	4	4 -
2.1. PC Test Software -5 3. Scrial Port Usage -6 3.1. Module Test Minimal System -6 3.2. Module Usage Examples -6 4. Detailed Explanation Of Related AT Commands -9 4.1. Command Format Description -9 4.1. Command Format Instructions -9 4.3. Examples Of AT Commands -10 5.1. Basic Commands -10 5.1. Basic Commands -10 5.2. Test Command -10 5.2. Test Command -10 5.2. Test Command -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial-Port Baud Rate -11 5.2.4. Set/Query—Serial-Port Parity Bit -12 5.2.5. Set/Query—Working Mode -12 5.2.6. Set/Query—Working Mode -14 5.2.7. Set/Query—Power Consumption Mode -14 5.2.8. Software Reset -14 5.2.9. Factory Reset -14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communi	2. PC Test Tools	5	5 -
3. Serial Port Usage -6 - 3.1. Module Test Minimal System -6 - 3.2. Module Usage Examples -6 - 4. Detailed Explanation Of Related AT Commands -9 - 4.1. Command Format Description -9 - 4.2. Response Format Instructions -9 - 4.3. Examples Of AT Commands -10 - 5. AT Command -10 - 5.1. Basic Commands -10 - 5.2. Test Command -10 - 5.2.1. Enter Or Exit AT Command Mode -10 - 5.2.2. Query configuration information -10 - 5.2.3. Set/Query—Serial-Port Bate -11 - 5.2.4. Set/Query—Serial-Port Stop Bit -12 - 5.2.5. Set/Query—Serial-Port Parity Bit -12 - 5.2.6. Set/Query—Working Mode -12 - 5.2.7. Set/Query—Working Mode -14 - 5.2.8. Software Reset -14 - 5.2.9. Astory Reset -14 - 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 - 5.4. Module RF Parameter Configuration of Module Air Rate and Communication Distance -15 - 5.4. Set/Query-Tone-Click Configuration of Module Air Rate and Communication Distance -15 -	2.1. PC Test Software		5 -
3.1. Module Test Minimal System -6 3.2. Module Usage Examples -6 4. Detailed Explanation Of Related AT Commands -9 4.1. Command Format Description -9 4.2. Response Format Instructions -9 4.3. Examples Of AT Commands -10 5. AT Command -10 5.1. Basic Commands -10 5.2. Test Command -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial-Port Baud Rate -11 5.2.4. Set/Query—Serial-Port Parity Bit -12 5.2.5. Set/Query—Serial-Port Parity Bit -12 5.2.6. Set/Query—Working Mode -12 5.2.7. Set/Query—Working Mode -14 5.2.9. Factory Reset -14 5.2.9. Factory Reset -14 5.3. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameter Configuration (General Configuration) -16 5.4.1. Set/Query-Tevice Address -16 5.4.2. Set/Query-Device Address -16 5.4.3. Set/Query-Termsmit Power -17 5.5.4.	3. Serial Port Usage	6	5 -
3.2. Module Usage Examples 6 4.1. Command Format Description -9 4.1. Command Format Instructions -9 4.2. Response Format Instructions -9 4.3. Examples Of AT Commands -10 5.1. Basic Commands -10 5.2. Test Command -10 5.2.1 Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial Port Baud Rate -11 5.2.4. Set/Query—Serial Port Baud Rate -11 5.2.5. Set/Query—Serial-port Stop Bit -12 5.2.6. Set/Query—Serial-port Mode -12 5.2.7. Set/Query—Working Mode -12 5.2.8. Software Reset -14 5.2.9. Factory Reset -14 5.3.1. Set/Query—One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameter Configuration (General Configuration) -16 5.4.1. Set/Query-Urvice Address -16 5.4.2. Set/Query-Transmit Power -17 5.5. Module RF parameter configuration (differentiated configuration) -17	3.1. Module Test Minimal System	(6 -
4. Detailed Explanation Of Related AT Commands -9 4.1. Command Format Description -9 4.2. Response Format Instructions -9 4.3. Examples Of AT Commands -10 5. AT Command -10 5. AT Commands -10 5.1. Basic Commands -10 5.2. Test Command -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial Port Baud Rate -11 5.2.4. Set/Query—Serial-port Stop Bit -12 5.2.5. Set/Query—Serial-port Stop Bit -12 5.2.6. Set/Query—Working Mode -12 5.2.7. Set/Query—Power Consumption Mode -14 5.2.8. Software Reset -144 5.2.9. Factory Reset -144 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) -15 5.4.1. Set/Query-Device Address -16 5.4.2. Set/Query-Device Address -16 5.4.3. Set/Query-Transmit Power -17 5.5.4. Module RF Parameter configuration (differentiated	3.2. Module Usage Examples	(6 -
4.1. Command Format Description -9 4.2. Response Format Instructions -9 4.3. Examples Of AT Commands -10 5. ATC Command -10 5.1. Basic Commands -10 5.2. Test Command -10 5.2. Test Command -10 5.2. Test Command -10 5.2. Query configuration information -10 5.2.3. Set/Query—Serial Port Baud Rate -11 5.2.4. Set/Query—Serial-port Stop Bit -12 5.2.5. Set/Query—Serial-port Nobel -12 5.2.6. Set/Query—Working Mode -12 5.2.7. Set/Query—Working Mode -14 5.2.8. Software Reset -14 5.2.9. Factory Reset -14 5.2.9. Factory Reset -14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) -16 5.4.1. Set/Query-Devcice Address -16 5.4.2. Set/Query-Devcice Address -16 5.4.3. Set/Query-Transmit Power -17 5.5.4. Module RF Parameter configuration (differentiated configuration) -17 <	4. Detailed Explanation Of Related AT Commands	9) -
4.2. Response Format Instructions -9 4.3. Examples Of AT Commands -10 5. AT Command -10 5. AT Command -10 5. I. Basic Commands -10 5.2. Test Command -10 5.2. Test Command -10 5.2.1. Enter Or Exit AT Command Mode -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial Port Baud Rate -11 5.2.4. Set/Query—Serial-port Stop Bit -12 5.2.5. Set/Query—Serial-port Parity Bit -12 5.2.6. Set/Query—Working Mode -14 5.2.7. Set/Query—Power Consumption Mode -14 5.2.8. Software Reset -14 5.2.9. Factory Reset -14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameters (Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameter configuration (General Configuration) -16 5.4.1. Set/Query-Device Address -16 5.4.2. Set/Query-Transmit Power -17 <t< td=""><td>4.1. Command Format Description</td><td> 9</td><td>9 -</td></t<>	4.1. Command Format Description	9	9 -
4.3. Examples Of AT Commands - 10 5. AT Command - 10 5.1. Basic Commands - 10 5.2. Test Commands - 10 5.2.1. Enter Or Exit AT Command Mode - 10 5.2.2. Query configuration information - 10 5.2.3. Set/Query—Serial Port Baud Rate - 11 5.2.4. Set/Query—Serial-port Stop Bit - 12 5.2.5. Set/Query—Serial-port Vor Bit - 12 5.2.6. Set/Query—Working Mode - 12 5.2.7. Set/Query—Power Consumption Mode - 14 5.2.8. Software Reset - 14 5.2.9. Factory Reset - 14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance - 15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance - 15 5.4. Module RF Parameter Configuration (General Configuration) - 16 5.4.1. Set/Query-Device Address - 16 5.4.2. Set/Query-Transmit Power - 17 5.5. Module RF parameter configuration (differentiated configuration) - 17 5.5.1. Query - RF bandwidth - 17 5.5. Set/Query - Spreading Factor - 18 5.5.3. Set/Query - Spreading Factor -	4.2. Response Format Instructions	9	9 -
5. AT Command -10 5.1. Basic Commands -10 5.2. Test Command -10 5.2. Test Command -10 5.2. Test Command -10 5.2. Test Corn Exit AT Command Mode -10 5.2. Query configuration information -10 5.2.2. Query configuration information -10 5.2.3. Set/Query—Serial-port Baud Rate -11 5.2.4. Set/Query—Serial-port Stop Bit -12 5.2.5. Set/Query—Working Mode -12 5.2.6. Set/Query—Working Mode -12 5.2.7. Set/Query—Power Consumption Mode -14 5.2.8. Software Reset -14 5.2.9. Factory Reset -14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) -15 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance -15 5.4. Module RF Parameter Configuration (General Configuration) -16 5.4.1. Set/Query-Device Address -16 5.4.3. Set/Query-Transmit Power -17 5.5.1. Query - RF bandwidth -17 5.5.3. Set/Query-Spreading Factor -18 5.5.3. Set/Query-Spreading Factor -18 <td>4.3. Examples Of AT Commands</td> <td> 10</td> <td>0 -</td>	4.3. Examples Of AT Commands	10	0 -
5.1. Basic Commands - 10 5.2. Test Command - 10 5.2.1. Enter Or Exit AT Command Mode - 10 5.2.2. Query configuration information - 10 5.2.3. Set/Query—Serial Port Baud Rate - 11 5.2.4. Set/Query—Serial-port Baud Rate - 11 5.2.5. Set/Query—Serial-port Parity Bit - 12 5.2.6. Set/Query—Working Mode - 12 5.2.7. Set/Query—Ower Consumption Mode - 14 5.2.9. Factory Reset - 14 5.2.9. Factory Reset - 14 5.2.9. Factory Reset - 14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) - 15 5.4. Module RF Parameter (One-Click Configuration of Module Air Rate and Communication Distance) - 16 5.4.1. Set/Query-Device Address - 16 5.4.2. Set/Query-Device Address - 17 5.5.5. Module RF parameter configuration (differentiated configuration) - 17 5.5.1. Query - RF bandwidth - 17 5.5.3. Set/Query—From Chainel - 18 5.5.3. Set/Query - FC oding Rate - 18 5.5.5. Set/Query - KP bandwidth - 17 5.5.5. Set/Query - CRC Check - 18	5. AT Command	- 10) -
5.2. Test Command - 10 5.2.1. Enter Or Exit AT Command Mode - 10 5.2.2. Query configuration information - 10 5.2.3. Set/Query—Serial Port Baud Rate - 11 5.2.4. Set/Query—Serial-port Stop Bit - 12 5.2.5. Set/Query—Working Mode - 12 5.2.6. Set/Query—Working Mode - 12 5.2.7. Set/Query—Working Mode - 12 5.2.8. Software Reset - 14 5.2.9. Factory Reset - 14 5.2.9. Factory Reset - 14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) - 15 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance - 16 5.4.1. Set/Query-Vorking Channel - 16 5.4.2. Set/Query-Vorking Channel - 16 5.4.3. Set/Query-Transmit Power - 17 5.5.1. Query - RF bandwidth - 17 5.5.3. Set/Query-RF Coding Rate - 18 5.5.3. Set/Query-Spreading Factor - 18 5.5.5. Set/Query-Spreading Factor - 18 5.5.5. Set/Query-Vorking Rate - 18 5.5.5. Set/Query-LFC Check - 18 5.5.5. Set/Query-LFC Check -	5.1. Basic Commands	10	0 -
5.2.1. Enter Or Exit AT Command Mode - 10 5.2.2. Query configuration information - 10 5.2.3. Set/Query—Serial Port Baud Rate - 11 5.2.4. Set/Query—Serial-port Stop Bit - 12 5.2.5. Set/Query—Serial-port Parity Bit - 12 5.2.6. Set/Query—Over Consumption Mode - 12 5.2.7. Set/Query—Power Consumption Mode - 14 5.2.8. Software Reset - 14 5.2.9. Factory Reset - 14 5.2.9. Factory Reset - 14 5.3.1. Set/Query—One-Click Configuration of Module Air Rate and Communication Distance) - 15 5.4. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) - 16 5.4.1. Set/Query - One-Click Configuration (General Configuration) - 16 5.4.1. Set/Query - Working Channel - 16 5.4.2. Set/Query - Device Address - 16 5.4.3. Set/Query-Transmit Power - 17 5.5.1. Net/Query - RF bandwidth - 17 5.5.2. Set/Query—RF Coding Rate - 18 5.5.3. Set/Query - Spreading Factor - 18 5.5.5. Set/Query - CRC Check - 18 5.5.5. Set/Query - I/Q Signal Inversion - 19 6. Value-added Service	5.2. Test Command	10	0 -
5.2.2. Query configuration information 10 5.2.3. Set/Query—Serial Port Baud Rate 11 5.2.4. Set/Query—Serial-port Stop Bit 12 5.2.5. Set/Query—Working Mode 12 5.2.6. Set/Query—Working Mode 12 5.2.7. Set/Query—Power Consumption Mode 14 5.2.8. Software Reset 14 5.2.9. Factory Reset 14 5.2.9. Factory Reset 14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) 15 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance 16 5.4.1. Set/Query - Working Channel 16 5.4.2. Set/Query-Device Address 16 5.4.3. Set/Query-Transmit Power 17 5.5.1. Query - RF coding Rate 17 5.5.3. Set/Query-RF Coding Rate 18 5.5.3. Set/Query-CRC Check 18 5.5.5. Set/Query - I/Q Signal Inversion 19 5.6. Error Code List 19	5.2.1. Enter Or Exit AT Command Mode	- 10	0 -
5.2.3. Set/Query—Serial Port Baud Rate - 11 5.2.4. Set/Query—Serial-port Stop Bit - 12 5.2.5. Set/Query—Serial-port Parity Bit - 12 5.2.6. Set/Query—Working Mode - 12 5.2.7. Set/Query—Power Consumption Mode - 14 5.2.8. Software Reset - 14 5.2.9. Factory Reset - 14 5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) - 15 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) - 16 5.4. Module RF Parameter Configuration (General Configuration) - 16 5.4.1. Set/Query - Working Channel - 16 5.4.2. Set/Query-Device Address - 16 5.4.3. Set/Query-Transmit Power - 17 5.5.1. Query - RF bandwidth - 17 5.5.2. Set/Query - RF Coding Rate - 18 5.5.3. Set/Query - Spreading Factor - 18 5.5.5. Set/Query - I/Q Signal Inversion - 18 5.5.5. Set/Query - I/Q Signal Inversion - 19 6. Value-added Services - 19	5.2.2. Query configuration information	10	0 -
5.2.4. Set/Query—Serial-port Stop Bit. 12 5.2.5. Set/Query—Serial-port Parity Bit 12 5.2.6. Set/Query—Working Mode 12 5.2.7. Set/Query—Power Consumption Mode 14 5.2.8. Software Reset 14 5.2.9. Factory Reset 14 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance 15 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance 15 5.4. Module RF Parameter Configuration (General Configuration) 16 5.4.1. Set/Query - Working Channel 16 5.4.2. Set/Query-Device Address 16 5.4.3. Set/Query-Transmit Power 17 5.5.1. Query - RF bandwidth 17 5.5.2. Set/Query—RF Coding Rate 18 5.5.3. Set/Query - Spreading Factor 18 5.5.4. Set/Query - CRC Check 18 5.5.5. Set/Query - I/Q Signal Inversion 19	5.2.3. Set/Query—Serial Port Baud Rate	1	1 -
5.2.5. Set/Query—Serial-port Parity Bit 12 5.2.6. Set/Query—Working Mode 12 5.2.7. Set/Query—Power Consumption Mode 14 5.2.8. Software Reset 14 5.2.9. Factory Reset 14 5.3.0. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) 15 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) 16 5.4. Module RF Parameter Configuration (General Configuration) 16 5.4.1. Set/Query - Working Channel 16 5.4.2. Set/Query-Transmit Power 17 5.5.1. Query - RF bandwidth 17 5.5.2. Set/Query—RF Coding Rate 18 5.5.3. Set/Query - WCR Check 18 5.5.4. Set/Query - I/Q Signal Inversion 18 5.5.5. Set/Query - I/Q Signal Inversion 19 6. Value-added Services 19	5.2.4. Set/Query—Serial-port Stop Bit	12	2 -
5.2.6. Set/Query—Working Mode 12 - 5.2.7. Set/Query—Power Consumption Mode 14 - 5.2.8. Software Reset 14 - 5.2.9. Factory Reset 14 - 5.3.1 Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) 15 - 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) 16 - 5.4. Module RF Parameter Configuration (General Configuration) 16 - 5.4.1. Set/Query - Working Channel 16 - 5.4.2. Set/Query-Device Address 16 - 5.4.3. Set/Query-Transmit Power 17 - 5.5. Module RF parameter configuration (differentiated configuration) 17 - 5.5.1. Query - RF bandwidth 17 - 5.5.2. Set/Query—RF Coding Rate 18 - 5.5.3. Set/Query - Spreading Factor 18 - 5.5.4. Set/Query - I/Q Signal Inversion 19 - 5.6. Error Code List 19 - 5.6. Error Code List 19 -	5.2.5. Set/Query—Serial-port Parity Bit	12	2 -
5.2.7. Set/Query—Power Consumption Mode - 14 - 5.2.8. Software Reset - 14 - 5.2.9. Factory Reset - 14 - 5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) - 15 - 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance) - 15 - 5.4. Module RF Parameter Configuration (General Configuration) - 16 - 5.4.1. Set/Query - Working Channel - 16 - 5.4.2. Set/Query-Device Address - 16 - 5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query - Spreading Factor - 18 - 5.5.4. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.2.6. Set/Query—Working Mode	12	2 -
5.2.8. Software Reset - 14 - 5.2.9. Factory Reset - 14 - 5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) - 15 - 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance - 15 - 5.4. Module RF Parameter Configuration (General Configuration) - 16 - 5.4.1. Set/Query - Working Channel - 16 - 5.4.2. Set/Query-Device Address - 16 - 5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.3. Set/Query-Spreading Rate - 18 - 5.5.3. Set/Query - Spreading Factor - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.2.7. Set/Query—Power Consumption Mode	14	4 -
5.2.9. Factory Reset - 14 - 5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) - 15 - 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance - 15 - 5.4. Module RF Parameter Configuration (General Configuration) - 16 - 5.4.1. Set/Query - Working Channel - 16 - 5.4.2. Set/Query-Device Address - 16 - 5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query - Spreading Factor - 18 - 5.5.4. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.2.8. Software Reset	14	4 -
 5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance) 15 - 5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance 15 - 5.4. Module RF Parameter Configuration (General Configuration) 16 - 5.4.1. Set/Query - Working Channel 16 - 5.4.2. Set/Query-Device Address 16 - 5.4.3. Set/Query-Transmit Power 17 - 5.5. Module RF parameter configuration (differentiated configuration) 17 - 5.5.1. Query - RF bandwidth 17 - 5.5.2. Set/Query—RF Coding Rate 5.5.3. Set/Query - Spreading Factor 5.5.4. Set/Query - I/Q Signal Inversion 19 - 5.6. Error Code List 19 - 5.6. Value-added Services 	5.2.9. Factory Reset	- 14	4 -
5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance - 15 - 5.4. Module RF Parameter Configuration (General Configuration) - 16 - 5.4.1. Set/Query - Working Channel - 16 - 5.4.2. Set/Query-Device Address - 16 - 5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query - Spreading Factor - 18 - 5.5.4. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and Communication Distance)	- 1:	5 -
5.4. Module RF Parameter Configuration (General Configuration) - 16 - 5.4.1. Set/Query - Working Channel - 16 - 5.4.2. Set/Query-Device Address - 16 - 5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query—Spreading Factor - 18 - 5.5.4. Set/Query - CRC Check - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.3.1. Set/Query-One-Click Configuration of Module Air Rate and Communication Distance	1:	5 -
5.4.1. Set/Query - Working Channel - 16 - 5.4.2. Set/Query-Device Address - 16 - 5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query—Spreading Factor - 18 - 5.5.4. Set/Query - CRC Check - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.4. Module RF Parameter Configuration (General Configuration)	10	6 -
5.4.2. Set/Query-Device Address - 16 5.4.3. Set/Query-Transmit Power - 17 5.5. Module RF parameter configuration (differentiated configuration) - 17 5.5.1. Query - RF bandwidth - 17 5.5.2. Set/Query—RF Coding Rate - 18 5.5.3. Set/Query—Spreading Factor - 18 5.5.4. Set/Query - CRC Check - 18 5.5.5. Set/Query - I/Q Signal Inversion - 19 5.6. Error Code List - 19 6. Value-added Services - 19	5.4.1. Set/Query - Working Channel	10	6 -
5.4.3. Set/Query-Transmit Power - 17 - 5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query—Spreading Factor - 18 - 5.5.4. Set/Query - CRC Check - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.4.2. Set/Query-Device Address	16	6 -
5.5. Module RF parameter configuration (differentiated configuration) - 17 - 5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query—Spreading Factor - 18 - 5.5.4. Set/Query - CRC Check - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.4.3. Set/Query-Transmit Power	- 1′	7 -
5.5.1. Query - RF bandwidth - 17 - 5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query—Spreading Factor - 18 - 5.5.4. Set/Query - CRC Check - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.5. Module RF parameter configuration (differentiated configuration)	- 1′	7 -
5.5.2. Set/Query—RF Coding Rate - 18 - 5.5.3. Set/Query—Spreading Factor - 18 - 5.5.4. Set/Query - CRC Check - 18 - 5.5.5. Set/Query - I/Q Signal Inversion - 19 - 5.6. Error Code List - 19 - 6. Value-added Services - 19 -	5.5.1. Query - RF bandwidth	- 1′	7 -
5.5.3. Set/Query—Spreading Factor	5.5.2. Set/Query—RF Coding Rate	18	8 -
5.5.4. Set/Query - CRC Check	5.5.3. Set/Query—Spreading Factor	18	8 -
5.5.5. Set/Query - I/Q Signal Inversion 19 - 5.6. Error Code List 19 - 6. Value-added Services	5.5.4. Set/Query - CRC Check	18	8 -
5.6. Error Code List	5.5.5. Set/Query - I/Q Signal Inversion	19	9 -
6. Value-added Services 19 -	5.6. Error Code List	19	9 -
	6. Value-added Services	- 19) -

Picture Index

Figure 1	serial port software diagram	- 5	; -
Figure 2	Module minimum system diagram	- 6	<u>,</u> -



1. Introduction

DX-LR01 is a low-power LoRa module developed by Shenzhen Daxia Longque Technology Co., Ltd. for intelligent wireless data transmission. It uses the domestic ASR6601 SOC chip, which integrates a Sub 1GHz RF transceiver, Arm China STAR-MC1 microprocessor, built-in Flash storage, and SRAM. This module supports interfaces such as UART, I2C, and I2S, as well as IO port control and ADC collection. It features low power consumption, high performance, long-distance communication, and networking capabilities. It is suitable for various application scenarios in the IoT field, such as smart metering, smart logistics, smart buildings, smart cities, and smart agriculture.

1.1. Serial Port Basic Parameters

• Module serial port default parameters: 9600bps/8/n/1 (Baud/Data /No Parity/Stop Bits)

1.2. Default RF Basic Parameters of the Module

- Module Operating Mode: Transparent transmission
- Module Power Consumption Mode: High efficiency mode
- Module Air Data Rate and Communication Distance Level: Level 0
- Module Frequency Band: 433MHz
- Module Address: ffff
- Module Bandwidth: 125KHz
- Module Spreading Factor: SF12
- Module RF Coding Rate: 4/6
- Module Air Data Rate Configuration: 244bit/s
- Module CRC Check: No check
- Module Preamble Length: 8
- Module IQ Signal: Not inverted
- Module Transmit Power: 22dB

1.3. Transmission And AT Command Mode

- **Transmission Mode:** After powering on, the module enters transmission mode and is ready to start transmitting data.
- AT Command Mode: While in transmission mode, switch to AT command mode by sending "+++". The module will then respond to AT commands. To return to transmission mode, send "+++" to exit AT command mode.



2.PC Test Tools

2.1. PC Test Software

For PC-side testing, please download and install the sscom5.13.1 serial port software from the provided documentation package. The serial port software interface is shown below:

↓ ■ SSCOM V5.13.1 串口/网络数据调试器,作者:大虾丁丁,2618058@qq.com	m. QQ群:52502449(最新版本)		
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 联系作者	大虾论坛		
A 3	涿条字符串发送│stm32/GD32 ISP│STC	/TAP15 TSP	
	一把动加克 循环反因 多条帮助	与Aini 峭	够 延时 🖣
) HE	xx 字符串(双击注释)	点击发送 王三	ms
	+++		1 1000
	AT+HELP		3 1000
	AT+BAUD	次迎语	2 1000
	AT+STUP		0 1000
	AITTAKL	<u>5九汪祥</u>	0 1000
	AITSLEEFZ	<u>6九汪祥</u>	0 1000
	ATTERAULI		0 1000
	ATTADOG		0 1000
	AT+T0	<u>りて注释</u> 10工注释	0 1000
	AT+BW	11天注释	0 1000
	AT+CB	12天注释	0 1000
	AT+SF7	13开注释	0 1000
	AT+CRC1	14开注释	0 1000
	AT+FQ	15开注释	0 1000
	AT+TP	16无注释	0 1000
	AT+ADDR	17无注释	0 1000
	AT+TX	18无注释	0 1000
	AT+CHANNDEL11	19无注释	0 1000 🖵
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▲ 美田串口 / 更多串口设置 / 加时间戳和分包显示, 超时时间	目: 20 ms 第1 字节 至 末尾 ▼ 加林	交验 <mark>None ▼</mark>	<u>.</u>
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Figure 1 serial port software diagram



3. Serial Port Usage

3.1. Module Test Minimal System



Figure 2 Module minimum system diagram

3.2. Module Usage Examples

1. Module and module transparent transmission

- 1) Connect the serial port and power supply to both DX-LR01 modules.
- 2) Send "+++" to enter the AT command mode on the modules
- 3) Set both modules to transparent transmission mode using the command "AT+MODE0".
- 4) Configure both LR01 modules to the same rate level using the command "AT+LEVEL". For example, to set the level to 1, send the command "AT+LEVEL1".
- 5) (Data transmission is possible only when the RF parameters of both modules are the same. If you configured the parameters yourself, you can use the AT+HELP command to compare the basic RF parameters of both modules to ensure they are identical.)
- 6) Power cycle the modules or use the "AT+RESET" command to restart them. The command will take effect after the restart.
- 7) One module sends data, and the other module will receive the data.
- 8) (Note: LoRa is a half-duplex protocol, so only one module can transmit at any given time.)





2. Module and module fixed-point transmission

- 1) Connect the serial port and power supply to both DX-LR01 modules.
- 2) Send "+++" to enter the AT command mode on the modules.
- 3) Use the "AT+MODE1" command to set the module working mode to fixed-point transmission mode.
- 4) Configure both LR01 modules to the same rate level using the command "AT+LEVEL". For example, to set the level to 1, send the command "AT+LEVEL1".
- 5) (Data transmission is possible only when the RF parameters of both modules are the same. If you configured the parameters yourself, you can use the AT+HELP command to compare the basic RF parameters of both modules to ensure they are identical.)
- 6) Power cycle the modules or use the AT+RESET command to restart them. The command will take effect after the restart.
- 7) Select the transmission mode as HEX.
- 8) Fixed-point transmission uses a proprietary protocol on LoRa, so data must be transmitted in a specific format for proper reception.
- 9) The transmission format is as follows: device address (2 bytes in hexadecimal) + channel (1 byte in hexadecimal) + data (in hexadecimal).
- 10) Commands:
 - AT+MAC: This command can be used to query or modify the device address of the current module.
 - AT+CHANNEL: This command can be used to query or modify the operating channel of the current module.

Example:

If the receiving module's address is 0001 and the channel is 01, and the transmitting module sends the data aabbcc, the transmitted data content would be: 000101aabbcc (hexadecimal: 00 01 01 61 61 62 62 63 63).





3. Modules and module broadcast transmission

1) Connect the serial port and power supply to both DX-LR01 modules.

2) Send "+++" to enter the AT command mode on the modules.

3) Use the "AT+MODE2" command to set the module's operating mode to broadcast transmission mode.

4) Configure the rate level of both LR01 modules to be the same using the "AT+LEVEL" command. For example, to set the level to 1, send the command "AT+LEVEL1".

5) (Data transmission is only possible when the RF parameters of both modules are the same. If you configured the parameters yourself, you can use the "AT+HELP" command to compare the basic RF parameters of both modules to ensure they are identical.)

6) Power cycle the modules or use the AT+RESET command to restart them. The command will take effect after the restart.

- 7) Send "+++" to exit AT command mode and enter transmission mode.
- 8) Select HEX as the transmission mode.
- 9) Broadcast transmission uses a proprietary protocol on LoRa, so data must be transmitted in a specific format for proper reception.
- 10) The transmission format is as follows: channel (1 byte in hexadecimal) + data (in hexadecimal).
- Command: AT+CHANNEL can be used to query or modify the operating frequency of the current module.

Example:

The receiving module channel is 01, and the transmitting module sends data aabbcc, so the sent data content is: 01aabbcc (hexadecimal: 01 61 61 62 62 63 63)





4. Detailed Explanation Of Related AT Commands

4.1. Command Format Description

AT+Command<param1, param2, param3> <CR><CF>

- All commands start with AT, end with <CR><LF>, In the table showing commands and responses in this document, <CR><LF> is omitted, and only commands and responses are displayed.
- All AT command characters are uppercase.
- <>The content inside is optional, If there are multiple parameters in the command, Separate by comma ",", The angle brackets are not included in the actual command.
- <CR>stands for "carriage return" r, corresponding hex is 0X0D.
- <LF>stands for "line feed" \n, corresponding hex is 0X0A.
- The command is executed successfully, the corresponding command is returned and ends with OK, and EEROR=<> if it fails, The content of "<>" is the corresponding error code (Please refer to 5.5.)

4.2. Response Format Instructions

+Indication<=param1, param2, param3><CR><CF>

- Response commands start with a plus sign "+" and end with.
- The response parameter follows the equals sign "=".



If there are multiple response parameters, they will be separated by commas ",".

4.3. Examples Of AT Commands

Example: Modify the baud rate of the LoRa device to 128000 Send: AT+BAUD9 Return: OK

5.AT Command

5.1. Basic Commands

5.2. Test Command

Function	Command	Response	Description
Test	AT	OK	

5.2.1. Enter Or Exit AT Command Mode

Function	Command	Response	Description
Enter Or Exit AT Command Mode	+++	Exit AT or Entry AT	Exit AT: Exit AT Command Mode Entry AT: Entry AT Command Mode The power-on default is transmission mode
Remark:			

1. It will automatically reset when exiting AT command mode.

2. This command will not be saved when power is off.

5.2.2. Query configuration information

Function	Command	Response	Description
Query module basic configuration information	AT+HELP	LoRa Parameter: +VERSION= <version> MODE:<mode> LEVEL:<level> SLEEP:<sleep> Frequency:<frequency> MAC:<mac></mac></frequency></sleep></level></mode></version>	LoRa Parameter: LoRa Parameter <version>: version <mode>: data transmission mode <level>: air rate configuration <sleep>: power consumption mode <frequency>: operating frequency <mac>: device address <bandwidth>: RF bandwidth</bandwidth></mac></frequency></sleep></level></mode></version>



LR01 SERIAL APPLICATION GUIDE

Bandwidth:<bandwidth> Spreading Factor:<spreading factor> Coding rate:<coding rate> CRC:<crc> Preamble:<preamble> IQ:<iq> Power:<power> <spreading factor>: spreading factor <coding rate>: RF coding rate <crc>: CRC check <preamble>: preamble length <iq>: whether the IQ signal is flipped <power>: transmission power

Example:

Query module basic information

Send: AT+HELP

Return: ====

LoRa Parameter:

+VERSION=V1.0.0

MODE:0

 $LEVEL{:}0>>244.140625bps$

SLEEP:2

Frequency: 43300000 hz >> 0

MAC:ffff

Bandwidth:0

Spreading Factor:12

Coding rate:2

CRC:0(false)

Preamble:8

IQ:0(false)

Power:22dBm

5.2.3. Set/Query—Serial Port Baud Rate

Function	Command	Response	Description
Query Baud Rate	AT+BAUD	+BAUD= <baud></baud>	 <baud>Baud rate corresponding serial number 1: 1200 6: 38400 2: 2400 7: 57600 3: 4800 8: 115200 4: 9600 9: 128000</baud>
Set Baud rate	AT+BAUD <baud></baud>	ОК	5: 19200 default value: 4(9600)

Remark:

After setting this command, you need to restart it to take effect.



5.2.4. Set/Query—Serial-port Stop Bit

Function	Command	Response	Description	
Query Serial-port Stop Bit	AT+STOP	+STOP= <param/>	< param>Serial number 0: 1 Stop Bit 1: 2 Stop Bit	
Set Serial-port Stop Bit	AT+STOP <param/>	OK	Default value: 0	
Remark:				

After setting this command, you need to restart it to take effect.

5.2.5. Set/Query—Serial-port Parity Bit

Function	Command	Response	Description
Query parity bit	AT+PARI	+PARI= <param/>	< param>Serial number 0: No Parity 1: Odd parity
Set parity bit	AT+PARI <param/>	OK	2: Even parity Default value: 0
Remark:			

After setting this command, you need to restart it to take effect.

5.2.6. Set/Query—Working Mode

Function	Command	Response	Description
Query Working Mode	AT+MODE	+MODE= <param/>	param: 0, 1, 2 0: Transparent transmission 1: Fixed-point transmission
Set Working Mode	AT+MODE <param/>	+MODE= <param/> OK	2: Broadcast transmission Default: 0

Remark:

After setting this command, a restart is required for it to take effect.

- Transparent transmission data format: Directly send data
- Fixed-point transmission data format: Device address (2 bytes in hexadecimal) + Channel number (1 byte in hexadecimal) + Data (in hexadecimal)
- Broadcast transmission data format: Channel number (1 byte in hexadecimal) + Data (in hexadecimal)



Example:

1. Transparent Transmission:



2、Fixed-Point Transmission:



3 Broadcast Transmission:





5.2.7. Set/Query—Power Consumption Mode

Function	Command	Response	Description
Query Power Consumption Mode	AT+SLEEP	+SLEEP= <param/>	< param>Serial number 0: Sleep mode 1: Air wake-up mode
Set Power Consumption Mode	AT+SLEEP <param/>	ОК	2: High time efficiency mode Default value: 2
Remark			

1. **Sleep Mode:** In this mode, both the MCU and RF enter a sleep state. The module is woken up by the UART when data is received. This mode does not save settings; every time the module enters sleep mode, it needs to be activated by a command.

2. Over-the-Air Wake-Up Mode:

- A. In this mode, the module performs CAD detection every four seconds (the total sleep time is 4 seconds minus the CAD detection time). If the module detects data, it will switch to receive mode. After receiving the data, it automatically returns to sleep mode. During sleep, the RF is asleep, but the MCU is not.
- B. When using over-the-air wake-up mode, both the receiver and the transmitter should be in over-the-air wake-up mode to send and receive data.

C、 This mode allows for settings to be saved.

3. **High-Efficiency Mode:** In this mode, the module is always in receive mode and can receive data from other devices at any time. When the module's UART receives data from the main control unit, it switches to transmit mode to send the data out. After transmission is complete, it switches back to receive mode.

Note: **CAD Explanation:** LoRa CAD (Channel Activity Detection) is a technology used in LoRa networks to detect channel activity. It helps determine if there is activity (such as transmissions from other devices) on a specified physical channel to aid devices in selecting appropriate transmission times and avoiding collisions.

5.2.8. Software Reset

Function	Command	Response	Description
Software Reset	AT+RESET	OK Power On	

5.2.9. Factory Reset

Function	Command	Response	Description
Factory Reset	AT+DEFAULT	OK Power On	



5.3. Module RF Parameters (One-Click Configuration of Module Air Rate and

Communication Distance)

5.3.1. Set/Query-One-Click Configuration of Module Air Rate and

Communication Distance

Function	Command	Response	Description
Query module parameters	AT+LEVEL	+LEVEL = <param/>	<pre><param/>: 0-7, Air speed and communication</pre>
Set module parameters	AT+LEVEL <param/>	ОК	distance configuration, with eight gears Default value: 0

Remark:

1. You can select different levels based on your data volume and communication distance (refer to the table

below for data volume and distance). The larger the air rate, the faster the data can be sent.

2. This command sets the RF bandwidth, RF coding rate, and spreading factor, making it ready for direct use.

3、 The transmission and reception devices must have the same LEVEL setting to send and receive data.

4. After setting this command, a restart is required for it to take effect.

Note: The table below shows the configuration parameters for different levels under the premise of a coding rate of CR=4/6. The outdoor distance (clear line-of-sight) and urban distance listed are for reference only; the actual distance should be based on empirical measurements.

LEVEL (gear)	SF (spreading factor)	BW (bandwidth KHz)	Air Character Rate(bit/s)	Outdoor Distance(Km)	Urban Distance(Km)
0	12	125	244	8.0	3.8
1	11	125	447	7.5	2.8
2	10	125	813	5.7	2.8
3	9	125	1464	5.3	2.7
4	8	125	2604	5.2	2.7
5	7	125	4557	5.0	2.7
6	6	125	7812	4.5	2.7
7	5	125	13020	4.1	2.5

5.4. Module RF Parameter Configuration (General Configuration)

5.4.1. Set/Query - Working Channel

Function	Command	Response	Description
Query Working Channel	AT+CHANNEL	+ CHANNEL= <param/>	param: 00-1E (hexadecimal) Starts at 433Mbz
Set Working Channel	AT+CHANNEL <param/>	+CHANNEL= <param/> OK	Increases to 1400Khz Defaults: 00

Remark:

1. This module has 31 general channels configured. For more channels, please contact our staffs.

2. After setting this command, a restart is required for it to take effect.

3. When multiple receiving devices are too close to the transmitting device, it may cause receiving devices on different channels to receive the data. Therefore, it is recommended to keep a considerable distance between the transmitting device and the receiving devices.

Note: The following table is a comparison of the operating frequency bands of different channels, unit: Mhz.

Channel	Operating Frequency	Channel	Operating Frequency
00	433	10	455.4
01	434.4	11	456.8
02	435.8	12	458.2
03	437.2	13	459.6
04	438.6	14	461
05	440	15	462.4
06	441.4	16	463.8
07	442.8	17	465.2
08	444.2	18	466.6
09	445.6	19	468
0A	447	1A	469.4
0B	448.4	1B	470.8
0C	449.8	1C	472.2
0D	451.2	1D	473.6
0E	452.6	1E	475
0F	454		

5.4.2. Set/Query-Device Address

Function	Command	Response	Description
Query Device Address	AT+MAC	+MAC= <param/> <param/>	param:



Set Device Address	AT+MAC <param/> ,	+MAC= <param/> <param/>	Hexadecimal, one byte
	<param/>	OK	Default setting. III
Remark:			
After setting this com	mand, a restart is required	for it to take effect.	
Example:			
Set the module addres	s to 0a01		
Send: AT+MAC0a,01			
Return: +MAC=0a01			
OK			

5.4.3. Set/Query-Transmit Power

Function	Command	Response	Description	
Query transmit power	AT+POWE	+POWE= <param/>	norom: 0.22dB (integer value)	
Set transmit power	AT+POWE <param/>	+POWE= <param/> OK	Default setting: 22dB	
Remark:				

ITCHIAI K.

After setting this command, a restart is required for it to take effect.

Example:
Modify the transmit power to 10dB
Send: AT+POWE10
Return: +POWE=10
OK

5.5. Module RF parameter configuration (differentiated configuration)

5.5.1. Query - RF bandwidth

		Kesponse	Description
Query RF A bandwidth	T+BW	+BW= <param/>	<param/> : 0 0: 125K Default value: 0

Remark:

If you need other RF bandwidth, please contact our staff.



5.5.2. Set/Query—RF Coding Rate

Function	Command	Response	Description
Query RF Coding Rate	AT+CR	+CR= <param/>	<param/> : 1-4 1: 4/5 2: 4/6 3: 4/7
Set RF Coding Rate	AT+CR <param/>	+CR= <param/> OK	4: 4/8 Default value: 2
Remark:			

After setting this command, a restart is required for it to take effect.

5.5.3. Set/Query—Spreading Factor

Function	Command	Response	Description
Query Spreading Factor	AT+SF	+SF= <param/>	<pre><param/>: 5-12 5: SF5 6: SF6 7: SF7 8: SF8 9: SF9 10: SF10</pre>
Set Spreading Factor	AT+SF <param/>	+SF= <param/> OK	11: SF11 12: SF12 Default value: 12
Remark:			

After setting this command, a restart is required for it to take effect.

5.5.4. Set/Query - CRC Check

Function	Command	Response	Description
Query CRC Check	AT+CRC	+CRC= <param/>	<pre>>: 0, 1</pre>
			0: Turn off CRC check
Set CRC Check	AT+CRC <param/>	OK	1: Turn on CRC check
			Default value: 0

Remark:

After setting this command, a restart is required for it to take effect.



5.5.5. Set/Query - I/Q Signal Inversion

Function	Command	Response	Description
Query if I/Q Signal is Inverted	AT+IQ	+IQ = <param/>	<param/> : 0, 1
Set I/Q Signal Inversion	AT+IQ <param/>	ОК	0: I/Q signal not inverted 1: I/Q signal inverted Default value: 0

Remark:

1. After setting this command, a restart is required for it to take effect.

2. Explanation of IQ Inversion: IQ inversion refers to the phase inversion of the received IQ signal in LoRa communication. This operation can be performed before or after demodulation to change the phase of the signal, thereby achieving different functionalities or optimizing performance.

5.6. Error Code List

The detailed information of the error code in ERROR= is listed as follows:

Return value	Error message description	
101	Parameter length error	
102	Parameter format error	
103	Parameter data error	
104	Command error	

6. Value-added Services

To meet the various functional requirements of customers, we can provide the following technical value-added services:

- Module program customization, such as: IO function port customization, AT command customization, broadcast package customization, etc.
- Module PCB hardware customization, which can be customized to the hardware requirements required by customers.
- Various Bluetooth solution customization, you can customize a full set of Bluetooth software and hardware solutions according to customer needs.
- Full set of networking solution customization, you can customize a full set of networking and gateway solutions according to customer needs.

If you have the above customization requirements, please contact our business personnel directly