LoRaWAN® Solenoid Valve Controller

UC51x Series

Communication Protocol

Revision History

Date	Doc Version	Description
Feb. 23, 2021	V 1.0	Initial version
Dec. 1, 2021	V 1.1	Valve control sequence supports 00
Feb. 25, 2022	V 2.0	Add schedule settings and other commands based on hardware 2.0
June 15, 2022	V 2.1	Add the example of GPIO type is DI
Nov. 21, 2022	V 2.2	Add DI type uplink packet

Contents

1. Overview

UC51x Series use the standard Milesight IoT payload format based on IPSO. All data are based on following format, the Data field should follow little endian:

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

Channel	Description
01	Battery
03	Valve 1
04	Pulse Counter 1 (GPIO1)
05	Valve 2
06	Pulse Counter 2 (GPIO2)
07	Digital Input 1 (GPIO1)
08	Digital Input 2 (GPIO1)
ff	Device information/Control package

Note:

1) All explanations and examples in this document are based on HEX format.
2) For all Milesight IoT decoder examples please find files on https://github.com/Milesight-IoT/SensorDecoders

2. Uplink Payload

Uplink payloads of UC51x Series are made up of device information and sensor data.

2.1 Device Information

UC51x series will report basic device information every time it joins the network.

Channel	Type	Data Size/Byte	Description
ff	01(Protocol Version)	1	01=> V1
	09 (Hardware Version)	2	02 10 => V2.1
	0a (Software Version)	2	02 02 => V2.2
	0b (Power On)	1	Device is on
	0f (Device Type)	1	00 = Class A, 01 = Class B, 02 = Class C
	16 (Device SN)	8	16 digits

Example:

ff0bff ff0101 ff166415a51585070020 ff090210 ff0a0202 ff0f00					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0b (Power On)	ff (reserved)	ff	01 (Protocol Version)	01 (V1)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	16 (Device SN)	64 15 a5 15 85 07 00 20	ff	09 (Hardware version)	0210 (V2.1)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0a (Software version)	0202 (V2.2)	ff	0f (Device Type)	00 (Class A)

2.2 Sensor Data

UC51x series reports valve and pulse data according to reporting interval (20 mins by default) or when the valve status changes. **Battery level is reported every 6 hours for UC511 and every 12 hours for UC512.**

Note: every GPIO interface can only upload either Pulse Counter value or DI status according to configurations.

Channel	Type	Data Size/Byte	Description
01	75 (Battery Level)	1	Unit: %
03 (Valve 1)	01 (Valve)	1	00 = closed, 01 = open
04 (GPIO 1)	c8 (Counter)	4	Unsigned
05 (Valve 2)	01 (Valve)	1	00 = closed, 01 = open
06 (GPIO 2)	c8 (Counter)	4	Unsigned
07 (GPIO 1)	01 (DI)	1	00 = closed, 01 = open
08 (GPIO 2)	01 (DI)	1	00 = closed, 01 = open

Example:

017564 030101 04c84f000000 050100 080100					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
01	75 (Battery)	64 => 100%	03 (Valve 1)	01 (Valve)	01 => Open
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
04 (GPIO 1)	c8 (Pulse Counter)	4f 00 00 00 => 00 00 00	05 (Valve 2)	01 (Valve)	00 => Closed

		4f = 79			
Channel	**Type**	**Value**			
08 (GPIO 2)	01 (DI)	00 => Closed			

3. Downlink Payload

Downlink is used for controlling the UC51x via network server remotely. Downlink port (Application port) is 85 by default and can be configured via ToolBox.

3.1 Valve Control

UC51x supports instant valve control via downlink payload. Before control via these commands, ensure the device does not have any schedule plan, otherwise these commands will not work.

Basic format:

Channel	Type	Control Field	Sequence	Time Control (Option)	Flow Control (Option)
ff	1d	1 Byte	1 Byte (01 to ff or 00)	3 Bytes (Unit: s)	4 Bytes

Control Field:

Bit	7	6	5	4-2	1-0
Description	0: Disable time control 1: Enable time control	0: Disable flow control 1: Enable flow control	0: Valve close 1: Valve open	000	00: Valve 1 01: Valve 2

Note:

1) If you set the sequence as 01 to ff, the sequence should be increased after it has been used in one command sent to devices. For example, if you use command ff 1d 20 01 (sequence 01) to control the valve successfully, the next command should be ff 1d 20 02 (sequence 02). Wrong sequence will cause command invalid.

2) If the sequence is up to ff (255), please use sequence beginning as 01.

3) If the device receives the control command, it will send reply message start with “fe”; if the command take effect, the device will send one more packet to update the current valve status. For example, if you send command ff 1d 21 01,

Control success: fe 1d 21 01+ 05 01 01 06 c8 00 00 00 00

Control failure: fe 1d 21 01

Examples:

1. Open the valve 2 right away.

ff1d2100			
Channel	**Type**	**Control Field**	**Sequence**
ff	1d	21 => 0010 0001 Bit5: 1 => valve open Bit0-1: 01 => valve 2	00

2. Open the valve 1 for 60s.

ff1da0003c0000				
Channel	**Type**	**Control Field**	**Sequence**	**Time Control**
ff	1d	a0 => 1010 0000 Bit7: 1 => enable time control Bit5: 1 => valve open Bit0-1: 00 => valve 1	00	3c 00 00=>00 00 3c=60s

3. Open the valve 2 until the pulse counter 2 increases 16 pulses.

ff1d610010000000				
Channel	**Type**	**Control Field**	**Sequence**	**Flow Control**
ff	1d	61 => 0110 0001 Bit6: 1 => enable flow control Bit5: 1 => valve open Bit0-1: 01 => valve 2	00	10 00 00 00 => 00 00 00 10 = 16

4. Open the valve 1 until the 60s passes or pulse counter 1 increases 6 pulses.

ff1de0003c000006000000					
Channel	**Type**	**Control Field**	**Sequence**	**Time Control**	**Flow Control**
ff	1d	e0 => 1110 0000 Bit7: 1 => enable time control Bit6: 1 => enable flow control Bit5: 1 => valve open Bit0-1: 00 => valve 1	00	3c 00 00 => 00 00 3c = 60s	06 00 00 00 => 00 00 00 06 = 6

3.2 Schedule Setting

UC51x series supports setting schedule plan to open or close valves at specific time.

3.2.1 Time Setting

1. Set the time zone.

Channel	Type	Description
ff	17	2 Bytes, UTC timezone * 10

Examples:

ff17ecff		
Channel	**Type**	**Value**
ff	17	ec ff => ff ec = -20 the time zone is UTC-2

ff171400		
Channel	**Type**	**Value**
ff	17	14 00 => 00 14 = 20 the time zone is UTC+2

2. Sync the time to device from network server. Ensure the device LoRaWAN version is 1.0.3 or later before sending command.

ff4a00		
Channel	**Type**	**Value**
ff	4a (Sync the time)	00

3.2.2 Set Plan

Basic format:

Channel	Type	Number	Control Field	Repeat Field	Start Time	End Time	Water Volume (Pulse)
ff	4d	1Byte 01 to 10 (1~16)	1 Byte	1 Byte	1 Byte (hour) +1 Byte (minute)	1 Byte (hour) +1 Byte (minute)	2 Bytes

Control Field:

Bit	7	6	5-2	1-0

Description	0: Disable this plan 1: Enable this plan	0: Close 1: Open	0000	01: valve 1 10: valve 2 11: valve 1 & valve 2

Repeat Field:

Bit	7	6	5	4	3	2	1	0
Plan Repeat Day	0	Sunday	Saturday	Friday	Thursday	Wednesday	Tuesday	Monday
Description	When the corresponding bit is set as 1, the plan will execute every this day of the week							

Note:

1) If you set two plans with the same number, the later plan will cover the previous plan.
2) If repeat field is 00, the plan will only execute once.

Examples:

1. Add plan 1: control valve 1 to open from 9:00 to 9:05, this plan is enabled and only execute once.

ff4d01c100090009050000							
Channel	**Type**	**Number**	**Control Field**	**Repeat Field**	**Start Time**	**End Time**	**Water Volume (Pulse)**
ff	4d	01	c1 => 1100 0001	00	0900	0905	0000

2. Add plan 10: control valve 2 to open from 20:55 to 21:00, this plan is disabled and execute every weekend (Saturday and Sunday).

ff4d0a4260143715000000							
Channel	**Type**	**Number**	**Control Field**	**Repeat Field**	**Start Time**	**End Time**	**Water Volume (Pulse)**
ff	4d	0a => 10	42 => 0100 0010	60 => 0110 0000 = Sunday and Saturday	Byte 1: 14 => 20 Byte 2: 37 => 55	Byte: 15 => 21 Byte 2: 00	0000

3. Add plan 2: control valve 1 and valve 2 to open from 10:25 to 10:30 or until pulse counter 1 and pulse counter 2 increase total 6 pulses , this plan is disabled and execute every day.

ff4d02437f0a190a1e0600							
Channel	**Type**	**Number**	**Control Field**	**Repeat Field**	**Start Time**	**End Time**	**Water Volume (Pulse)**
ff	4d	02	43 => 0100 0011	7f => 0111 1111 = Everyday	Byte1: 0a => 10 Byte 2: 19 => 25	Byte1: 0a => 10 Byte 2: 1e => 30	0600 => 0006

3.2.3 Check Plan Content

Channel	Type	Value
ff	4c	Plan number 01 to 10 (1~16)

Example: Check plan 1 content.

ff4c01		
Channel	**Type**	**Value**
ff	4c	01 = plan 1

Reply:

fe4c01c1010905090a0a00			
Channel	**Type**	**Number**	**Value**
fe	4c	01 = plan 1	c1 = 1100 0001 => plan enable, open valve 1 01 = 0000 0001 => every Monday 0905 => start time is 9:05 090a => end time is 9:10 0a00 => 000a = pulse increase 10

3.2.4 Check and Set Plan Status

Basic format 1:

Channel	Type	Command	Value
ff	4b	00: get plan status 01: set plan status 02: delete plan	2 Bytes Every bit indicate one plan 1: enable ; 0: disable or delete

Basic format 2:

Channel	Type	Command	Number	Enable
ff	4b	03: set one plan status 04: delete one plan	1 Byte, 01 to 10 (1~16)	01: enable 00: disable or delete

Note: When the device has multiple schedule plan settings that are conflicted, the device will only execute one plan whose item number is largest.

Example:

1. Check plan enable or disable status.

ff4b000000			
Channel	**Type**	**Command**	**Value**
ff	4b	00 = get	0000

Reply:

fe4b000200			
Channel	**Type**	**Command**	**Value**
fe	4b	00 = get	02 00 => 00 02 = 0000 0000 0000 0010 Only plan 2 is enabled, other are disabled or do not have content

2. Set plan 2 as enable and others as disabled.

Type 1:

ff4b010200			
Channel	**Type**	**Command**	**Value**
ff	4b	01 = set	02 00 => 00 02 = 0000 0000 0000 0010 Plan 2 are enabled and other are disabled

Type 2:

ff4b030201				
Channel	**Type**	**Command**	**Number**	**Value**
ff	4b	03 = set	02	01 = enabled

3. Delete plan 10.

Type 1:

ff4b02fffd			
Channel	**Type**	**Command**	**Value**

ff	4b	02 = delete	ff fd => fd ff = 1111 1101 1111 1111 Bit10 = 0 means Delete plan 10

Type 2:

ff4b040a00				
Channel	**Type**	**Command**	**Number**	**Value**
ff	4b	04 = delete	0a = 10	00 = deleted

3.3 Set Reporting Interval

Channel	Type	Description
ff	03 (Set Reporting Interval)	2 Bytes, unit: s

Example:

ff03b004		
Channel	**Type**	**Value**
ff	03	b0 04 => 04 b0 = 1200s=20 minutes

3.4 Zero Reset the Pulse Count Value

Channel	Type	Counter	Command
ff	4e	01: counter 1 02: counter 2	00 = reset

Example:

ff4e0100			
Channel	**Type**	**Counter**	**Command**
ff	4e	01: counter 1	00

3.5 Reboot the Device

ff10ff		
Channel	**Type**	**Value**
ff	10	ff (Reserved)

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