Outdoor Environment Monitoring Sensor

Featuring LoRaWAN®

EM500 Series

Communication Protocol

Revision History

Date	Doc Version	Description
June 8, 2021	V 1.0	Initial version
July 13, 2021	V 1.1	Add Soil Moisture Definition
April 12, 2022	V 1.2	Add reboot downlink command

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1. Overview

EM500 Series use the standard Milesight IoT payload format based on IPSO. All data are based on following format:

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

Note:

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

2. Sensor Data (Uplink)

EM500 series report sensor data according to reporting interval (10min by default) and battery level **every 24 hours**. When joining network, EM500 series will send a whole package including sensor data and battery level.

2.1 Data Definition

Sensor	Type ID (hex)	Data Type	Data Resolution	Model
Temperature	67	INT16	0.1 °C	EM500-PT100, EM500-SMTC, EM500-CO_2
Humidity	68	UINT8	0.5 %RH	EM500-CO_2, EM500-SMT/SMTC
Barometric Pressure	73	UINT16	0.1 hPa	EM500-CO_2
Battery	75	UINT8	1 %	All
Depth	77	INT16	1 cm	EM500-SWL
Pressure	7b	UINT16	1 kPa	EM500-PP
Concentration	7d	UINT16	1 ppm	EM500-CO_2
Conductivity	7f	UINT16	1 us/cm	EM500-SMTC
Distance	82	UINT16	1 mm	EM500-UDL
Light	94	UINT32	1 Lux	EM500-LGT
Soil Moisture	ca	UINT16	0.01%RH	EM500-SMT/SMTC

2.2 Data Example

EM500-CO_2

017564 03671001 046871 057d6704 06736827					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	67 (Temperature)	10 01=>01 10 =272 Tem=272*0.1=27.2°C
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**

04	68 (Humidity)	71=>113 Hum=113* 0.5=56.5%	05	7d (CO_2)	67 04 => 04 67 =1127 ppm
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
06	73 (Barometric Pressure)	68 27=>27 68=10088 Pressure= 10088*0.1 =1008.8 hPa			

EM500-LGT

017564 039432870000					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	94(Light)	32 87 00 00=> 00 00 87 32 =34610 Lux

EM500-PP

017564 037b0a00					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	7b(Pressure)	0a 00=>00 0a =10 kPa

EM500-PT100

017564 0367faff					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	67 (Temperature)	fa ff=>ff fa = -6 Tem= -6*0.1= -0.6°C

EM500-SMT/SMTC

017564 03671001 04cad804 057ff000					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	67 (Temperature)	10 01=>01 10 =272 Tem=272*0.1= 27.2°C
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
04	ca (Soil Moisture)	d8 04=>04 d8=1240 Hum=1240* 0.01=12.4%	05	7f (Conductivity)	f0 00 => 00 f0=240 μs/cm

Note: if firmware version is below 2.34, the soil moisture type ID is 68 and resolution is 0.5% RH.

EM500-SWL

017564 03770200					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	77(Depth)	02 00=>00 02 =2 cm

EM500-UDL

017564 03821e00					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
01	75 (Battery)	64 => 100%	03	82(Distance)	1e 00=>00 1e =30 mm

3. Device Information (Uplink)

EM500 series report basic information of device whenever joining the network.

Channel	Type	Description
ff	01(Protocol Version)	01=>V1
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0b (Power On)	Device is on
	0f (Device Type)	00: Class A, 01: Class B, 02: Class C
	16 (Device SN)	16 digits

Examples:

ff0101 ff090140 ff0a0114 ff166410908243750001					
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
ff	01(Protocol Version)	01=>V1	ff	09 (Hardware Version)	01 40 => V1.4
Channel	**Type**	**Data**	**Channel**	**Type**	**Data**
ff	0a(Software Version)	01 14 => V1.14	ff	16 (Device SN)	6410908243750001

4. Downlink Payload

Downlink is used for controlling the EM500 via network server remotely. Downlink port (Application port) is 85 by default and can be configured via ToolBox.
When the channel range is 1~253, the format is:

Channel1	Data1	Reserved	Channel2	Data2	Reserved	Data3	...
1 Byte	2 Byte	ff	1 Byte	2 Byte	ff	1 Byte	...

When the channel is 255(ff), the format is:

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

Example:

1. Configure Reporting Interval as 20 mins

ff 03 b0 04		
Channel	**Type**	**Data**
ff	03(Set Reporting Interval)	b0 04 => 04 b0 = 1200s=20 mins

2. Reboot the device.(Note: only hardware V2.0 and above device supports)

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

-END-