

Spec for SL300EU

LoRaWAN CO2 Sensor



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SL300EU is long range low power CO2 sensor based on Semtech SX1262, which is standard LoRaWAN Class A compatible and is widely adopted in Environment Monitoring, Green House, Smart Agriculture etc.

Main features:

NDIR Tech for CO2 Sensor

2.9 inch screen local display

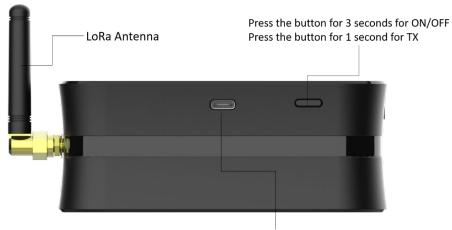
Type-C for Local Configuration

Internal Battery Up to 2 Years

LoRa SX1262, Long Range Low Power

LoRaWAN Class A Compatible

1. Details:



Type-C for Local Configuration



Parameter	Feature
CPU	M0+
Wireless	LoRaWAN(SX1262)
Encryption	AES128 Optional
Power	Built-in Li-battery (Changeable, and No Recharge)
Working Temperature	-45℃~+ 85℃
Working Humidity	0-100%RH
Communication	Half duplex
Response Time	Less than 15 Seconds
CO2 Measuring Range	400ppm-10000ppm
CO2 Accuracy	±(30ppm+3%)
Power Capacity	38000mAh
Lifespan	2 Years, Data Uploading for Every 10 mins
Data Speed	300bps-62.5k bps
Size	115mm*80mm*45mm
TX Power	22dBm Max
RX Sensitivity	-140 dBm
Frequency	CH 470MHz~510MHz EU 868MHz US 915MHz

2. Size: 123mm*778mm*48mm

3. Installation:

Lay the product flat on the table



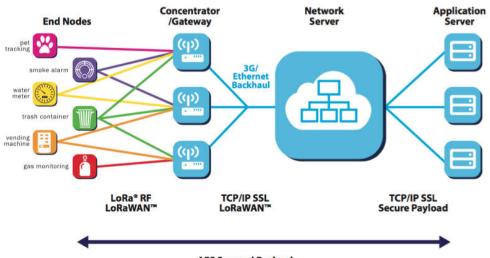


Hang on the wall



4. Connect to LoRaWAN Network

LoRaWAN Network Structure



AES Secured Pavload

SL300EU CO2 sensor is based on standard LoRaWAN Class A, so you can connect to any LoRaWAN network as below:

SL300EU sensor data uplink format with LoRaWAN by ABP, ABP parameter as below: AppKey: 11223344556677889900aabbccddeeff

ADDR: Sensor ID as display on screen

DEVUI: Customer can add 4 bytes based on sensor ID displayed on screen, or customer can read 8 bytes ID through UART with Rejeee AT command.



Connecting to The Things Network, please make sure choose manually connect and ABP as below:

Register end device

From The LoRaWAN Device Repository M	anually	
LoRaWAN version ⑦*		
MAC V1.0		
Regional Parameters version ⑦*		
PHY V1.0		
Frequency plan ⑦*		
Europe 863-870 MHz (SF12 for RX2)	v	
Over the air activation (OTAA) Activation by personalization (ABP) Denne muticast group (ABP & Multicast) Additional LoRaWAN class capabilities ⑦		
None (class A only)	~	
	v	
Network defaults ⑦		
Network defaults ⑦		
Network defaults ⑦ Use network's Rx and frequency defaults Cluster settings ⑦		

5. Wireless LoraWAN Sensor Data Format

Header	DevAddr	FCtrl	SeqNo		Sensor Da	ta	CRC
1Byte	4Bytes	1Byte	2Bytes	Data 1		Data N	2 Bytes
Header	DevAddr	FCtrl	SeqNo	Type+ Data N Bytes	Type+Data N Bytes	Type+Data N Bytes	CRC16= Header to Body

LoRaWAN Format:

In order to connect to LoRaWAN network, the sensor support ABP data uploading.

AT+SIP=02(Start LoRaWAN format)

AT+AK=<32 Hex Chars>, which means AppKey, NwkSKey and AppSKey share the same secret key.

AT+ADDR=<8 Hex Char> or AT+ADDR? That means customers can set his own ADDR

or choose sensor ADDR as LoRaWAN DevAddr.

AT+TFREQ=<8 Hex Char> according to different zone to set the starting



frequency(By default, there are 8 frequencies), If the area standard frequency

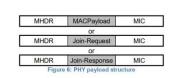
point is discontinuous, AT+NET=00 can be used to fix the transmission frequency

point.

Picture as below, FRMPayload is sensor data, MIC replaces CRC.

PHYPayload:

MACPavload.



FHDR FPort FRMPayload

				FRMPayload	/lessage)	MIC
			Data 1		Data N	4 Bytes
MHDR	FHDR	FPort	Type+Data	Type+Data	Type+Data	
			N Bytes	N Bytes	N Bytes	

6. Sensor Data Definition

Device(0x00)

Туре		Value								
1 Byte	2 Byte									
Status	Version	Level	Reserve							
	3bit	1 bit								
0x00	000 x xxxx yyyyyyy									
	First 3 is version, la	ast 5 is battery level								

CO2/CH4/CO etc.(0x30)

Туре	Length	Value	Value
1 Byte	1 Byte	1 Byte	4 Byte
0x30	0x05	0x01 CH4	Resolution ratio is 0.01
		0X02 CO	CH4 is 0.01%LEL
		0X03 HS	CO/HS/CO2/NH3 is 0.01ppm
		0X04 CO2	
		0X05 NH3	

For Example:

03 3D 36 01 CF 00 00 42 00 3F 24 30 05 04 00 00 C3 50 xx xx

30 is gas

05 is length

04 is CO2

00 00 C350 is the content of 500.00ppm

xx xx is CRC, The calculation shall be based on the actual content

7. CRC checkout

Here below is the CRC check algorithm for this document:



```
static uint16 t get crc16(uint16 t inData, uint16 t outData) {
outData = (outData >> 8) | (outData << 8);</pre>
outData ^= inData;
outData ^= (outData & 0xff) >> 4;
outData ^= outData << 12;
outData ^= (outData & 0xff) << 5;</pre>
return outData;
}
static uint16_t cal_crc16(const uint8_t *pData, const uint32_t len)
{
uint32 t i = 0;
uint16_t crc16 = 0xFFFF;
for (i = 0; i < len; i++) {
crc16 = get_crc16(*(pData++), crc16);
}
return crc16;
```

```
}
```

8. Local Configuration:

Note: Factory reset data uploading is every 10 mins, customers can change data uploading frequency as below:

Connect sensor with a USB-C cable to computer for local configuration, through local configuration, you can change the packet frequency. Download config tool here: <u>http://www.rejeee.com/#/w</u>, unpack the document as below:

Double click ConfigTool.exe to the page below, this is the factory reset parameter, and you can change each one to connect to other network, but normally customer only need to change data uploading frequency.

R	Ī	オ	トう	-		打	吏		11	矢下	1	2	-	ム月	とと		
	R	E	J	E	Ε	E	Т	E	¢	Н	Ν	0	L	0	G	γ	

4 LoRa module c	onfig tool								- 🗆 X
SenceMode More	e								
SerialPort : CON	13 - USB-SERIAL CH34	40 (C 🗸 🛛 Refresh	Baudrate :	9600 ~ P	arity :	8N1 ~ 💋	Close		Serial Open
Device Information	ı	Settings(Blue is Ofte	en,T is TX, R is	RX)					AT Interactive message
🤹 ReadConfig		📄 UpdateConfig							Humidity: 53.09%], Level 31[3.615V] ^
Modulation:	LORA	Modulation :	01 - LoRa	~]	NetMode :	00 - Fix	~	<: +ATI: 2, 1007
NetMode:	Node to Node	TFrequency :		470.3	Mhz	RFrequency :	50	00.3	Mhz <: NET:
	470300kHz 500300kHz	Bandwidth(BW) :	07 - 125K	~] hz	TxPower(POW) :		22	dBm <: TFREQ: 470300kHz <: RFREQ: 500300kHz <: POW: 22dBm
Power:	22dBm	TSF :		7]	RSF :		12	<pre></pre>
Bandwidth:	125kHz	CodeRate(CR) :	01 - 4/5	~]	SyncWord(SYNC) :		52	<: RSF: 12 <: CR: 4/5
SpreadingFactor:	7,12	Inverted(TIQ) :	00 - OFF	~	1	Inverted(RIQ) :	01 - ON	~	<: MODE: LORA
CodeRate:	4/5	LCP :		20	secs	LFT :	1	800	<pre><: SYNC: 0x34 <: PREM: 16,10</pre>
SyncWord:	0x34			20]		I	800	<: FIX: 0,0 <: CRC: ON
Preamble:	16,10	Backoff(NB) :		4]				<: TIQ: OFF
CRC:	ON	BaudRate(BRATE) :	03 - 9600bp	ps v]	Parity(PAR) :	00 - None	~	<: RIQ: ON <: SEQ: OFF
IQ Inverted:	OFFON		SetBaud	rate	-				<: IP: ON <: AES: ON
LowDataRate:	0,0	AES Key(Hex) :	000000000	000000000000000000000000000000000000000	000000	00			<: ACK: OFF
LinkCheckPeriod:	20		Set AE		ar AES	Clear LCP	Reset		<pre>. <: LDR: 0,0 <: LCP: 20</pre>
LifeTime:	1800		Set AL	is Cle	ar AES	Clear LCP	Reset		<: LFT: 1800 <: RXW: 0
SEQ/IP:	OFFON								<: FNB: 0x84
AES:	ON								<: TYPE: 0x00 <: MIN: -50
ACK:	OFF								<: MAX: 150 >: ATI
FNB:	0x84								<: +ATI: 2, 1007
TYPE:	0x00								>: ATT <: ER08
Version(ATI):	2,1007								· · · · · · · · · · · · · · · · · · ·
		Contribut	tors: felix.liu@	rejeee.com		www.rejeee.com			

Following below steps to change packet uploading frequency:

- 1. Refresh
- 2. Open the serial port

senceMode	dule config tool More		_				- 0	×
	COM3 - USB-SERIAL CH	340 (C 🗸 Refresh	Baudrate : 9600 V P	Parity : 🛛 8N1 🗸 🍠	Open 2			
Device Inform	nation	Settings(Blue is Ofte	n,T is TX, R is RX)			AT Interac	tive message	
🕏 ReadConfi	ig	🔚 UpdateConfig				<: MAX: >: ATI	150	^
NetM TFI RFI	ation: LORA Node to Node REQ: 470300kHz REQ: 500300kHz ower: 22dBm	Modulation : TFrequency : Bandwidth(BW) : TSF :	01 - LoRa → 470.3 07 - 125K → 7	NetMode : Mhz RFrequency : hz TxPower(POW) : RSF :	500.3 22	<: +ATI: >: AT+CFG Mhz <: NET: <: TFREQ dBm <: RFREQ <: POW: <: SF:	? Node to Node 470300kHz 500300kHz 22dBm 125kHz 7	
SpreadingFa Codef SyncW	vidth: 125kHz actor: 7,12 Rate: 4/5 Vord: 0x34 mble: 16,10	CodeRate(CR) : Inverted(TIQ) : LCP : Backoff(NB) :	01 - 4/5 ~ 00 - OFF ~ 3 4	SyncWord(SYNC) : Inverted(RIQ) : secs LFT :		<pre></pre>	12 4/5 LORA 0x34 16,10 0,0 ON OFF	
	CRC: ON rted: OFFON		03 - 9600bps v SetBaudrate	Parity(PAR) :	00 - None ~	<: RIQ: <: SEQ: <: IP: <: AES: <: ACK:	ON OFF ON ON	
LinkCheckPe		AES Key(Hex) :	O000000000000000000000000000000000000	ar AES Clear LCP	Reset		0,0 3 1800	
	Q/IP: OFFON AES: ON ACK: OFF					<pre><: FNB: <: FNB: <: TYPE: <: MIN: <: MAX: >: ATI</pre>	0x84 0x00 -50 150	
т	FNB: 0x84 TYPE: 0x00 (ATI): 2,1007					>: AII <: +ATI: >: ATT <: ER08	2, 1007	
version((ATT): 2,1007		ors: felix.liu@rejeee.com	www.rejeee.com				

- 3. Read config information
- 4. Update the date uploading frequency for LCP and LFT. LCP is the frequency for sensor data collecting, LTF is the frequency for data uploading.

toRa module co SenceMode More														×
	3 - USB-SERIAL CI	H340 (C	~ Refresh	Baudrate : 9600	~ P	arity :	8N1 ~ 🦻	Close				Config F	Read Su	iccess
Device Information		Sett	ings(Blue is Ofte	en,T is TX, R is RX)							AT Interactive	e message		
🕏 ReadConfig		₿] U	IpdateConfig								<: ER08			^
Modulation:	LORA		Modulation :	01 - LoRa	~		NetMode :	00 - Fix	~		<: ER00			
NetMode:	Node to Node		TFrequency :		470.3	Mhz	RFrequency :		500.3	Mhz	>: AT+CFG? <: NET:	Node to Node		
TFREQ:	470300kHz	Bi	andwidth(BW) :	07 - 125K	~	hz	TxPower(POW) :		22	dBm	<: TFREQ: <: RFREQ:	470300kHz 500300kHz		
RFREQ:	500300kHz	-	TSF :	07 - 125K			RSF :			1	<: POW: <: BW:	22dBm 125kHz		
Power:			ISF :		7		KSF :		12		<: TSF:	7		
Bandwidth:			CodeRate(CR) :	01 - 4/5	~		SyncWord(SYNC) :		52]	<: RSF: <: CR:	12 4/5		
SpreadingFactor:			Inverted(TIQ) :	00 - OFF	~		Inverted(RIQ) :	01 - ON	~	1	<: MODE: <: SYNC:	LORA 0x34		
CodeRate:		4	LCP :		20	secs	LFT :		1800		<: PREM:	16,10		
SyncWord:			Backoff(NB) :								<: FIX: <: CRC:	0, 0 ON		
Preamble:					4						<: TIQ: <: RIQ:	OFF		
CRC:		Bau	dRate(BRATE) :	03 - 9600bps	~		Parity(PAR) :	00 - None	~		<: SEQ: <: IP:	OFF		
IQ Inverted:				SetBaudrate							<: AES:	ON		
LowDataRate:			AES Key(Hex) :	000000000000000000000000000000000000000	0000000000	000000	0]	<: ACK: <: LDR:	OFF 0,0		
LinkCheckPeriod:				Set AES	Cle	ar AES	Clear LCP	Rese	t		<: LCP:	20		
LifeTime:											<: LFT: <: RXW:	1800 0		
SEQ/IP:	the second s										<: FNB: <: TYPE:	0x84 0x00		
AES:											<: MIN:	-50		
ACK:	_										<: MAX: >: ATI	150		
FNB:											<: +ATI:2,1 >: ATT	007		
TYPE:	0x00										<: ER08			
Version(ATI):	2,1007													

5. Update config, and when configuration update successfully, close the config tool, and local configuration has been finished.

SerialPort : COM3 - USB-SERIAL C	H340 (C V Refresh	Baudrate : 9600 v P	arity: 8N1 v 🎤 C	lose		Config Update Succe
Device Information	Settings(Blue is Ofte	en,T is TX, R is RX)			AT	Interactive message
SeadConfig	🔛 UpdateConfig	5				+ATI: 2, 1007 AT+LCP=0014
Modulation: LORA	Modulation :	01 - LoRa 🗸 🗸	NetMode :	00 - Fix ~	<:	OK
NetMode: Node to Node	TFrequency :	470.3	Mhz RFrequency :	500.3	Mhz <;	AT+CFG? NET: Node to Node
TFREQ: 470300kHz	Bandwidth(BW) :	07 - 125K v	hz TxPower(POW) :	22		TFREQ: 470300kHz RFREQ: 500300kHz
RFREQ: 500300kHz Power: 22dBm	TSF :	7	RSF :	12		POW: 22dBm BW: 125kHz
Bandwidth: 125kHz	CodeRate(CR) :	01 - 4/5 System Notice		× 52		TSF: 7 RSF: 12 CR: 4/5
SpreadingFactor: 7,12	Inverted(TIQ) :			current Y	K:	MODE: LORA
CodeRate: 4/5		Congratulatio	ons, your configuration update	successful.	K: 1 K: K:	SYNC: 0x34 PREM: 16,10
SyncWord: 0x34	LCP :			1800	<:	FIX: 0,0
Preamble: 16,10	Backoff(NB) :			ок	<: (:)	CRC: ON TIQ: OFF
CRC: ON	BaudRate(BRATE) :	03 - 9600bps ~	Parity(PAR) :	00 - None 🗸		RIQ: ON SEQ: OFF
IQ Inverted: OFFON		SetBaudrate				IP: ON AES: ON
LowDataRate: 0,0	AES Key(Hex) :	000000000000000000000000000000000000000	0000000		1 Ki	ACK: OFF
LinkCheckPeriod: 20						LDR: 0,0 LCP: 20
LifeTime: 1800		Set AES Cle	ar AES Clear LCP	Reset	K.	LFT: 1800
SEQ/IP: OFFON						RXW: 0 FNB: 0x84
					Ki Ki	TYPE: 0x00
AES: ON					<.	MIN: -50
ACK: OFF					<: >: .	MAX: 150
FNB: 0x84					<:	+ATI: 2, 1007
TYPE: 0x00					>: .	ATT ER08
Version(ATI): 2,1007					N	EROO

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