1 Overview

Senticon LoraWan devices have three basic types of messaging: -

- Automatic transmission of Measurements, Setpoints and Outputs from Device to the Gateway (Uplink)
- Packaged Write of up to 6 values to the Device (Downlink)
- Single Write to the Device (Downlink)

The below figure illustrates the automatic transmission of data by the Uplink and packaged write Downlink.

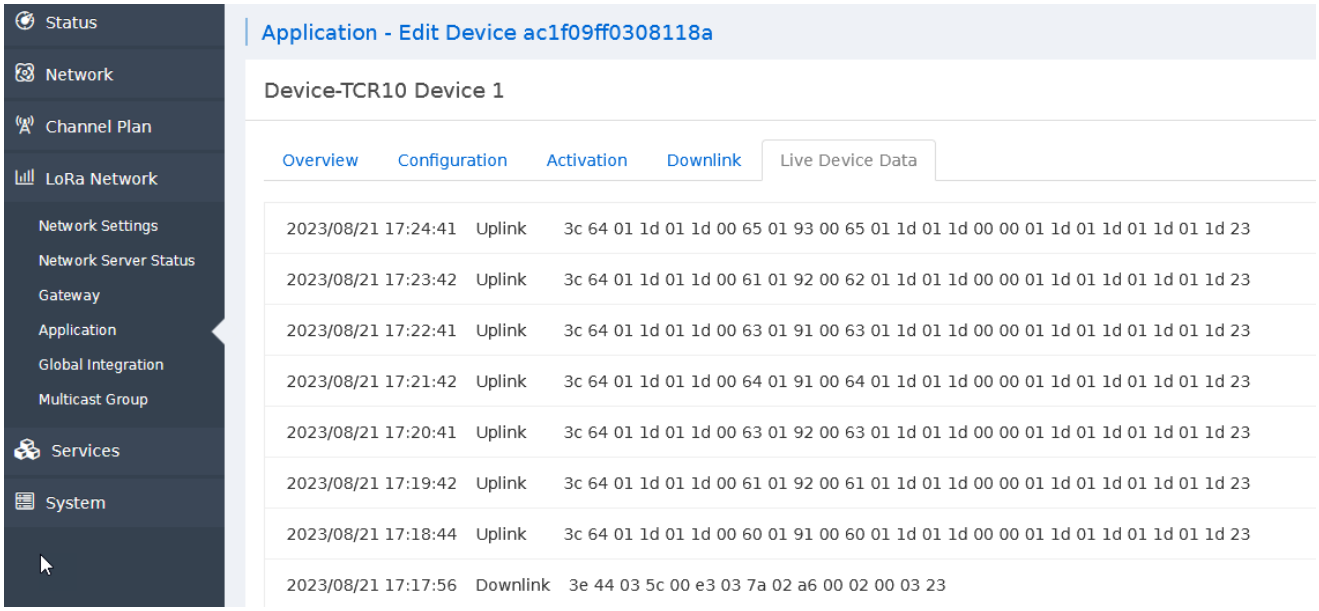
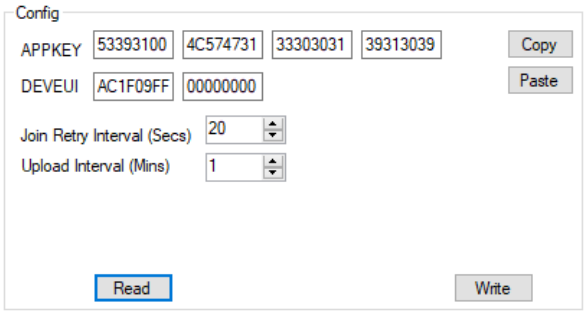


Figure 1: Automatic Uplink Message and Package Write (Downlink) Message Example.

The Automatic Upload interval can be configured by the Device Configuration Tool.



2 Automatic Uplink Payload Format

The Senticon devices send automatically, the following payload format that consists of 27 bytes of the data, to the LoraWan network.

```
<d <Reg1> <Reg2> <Reg3> <Reg4> <Reg5> <Reg6> <Reg7> <Reg8> <Reg9> <Reg10> <Reg11> <Reg12> #

<d = signifies automated message from the device; ASCII in HEX '0x3c64'
<RegX>; = 16-bit value (2-bytes) of Register X, 12 registers
# = end of message; ASCII to HEX = 0x23
```

The Register value that is transmitted is configured in the device configuration under the LORA menu. Each register can be configured to read any of the valid registers from the device. E.g. to read temperature that resides in the Register 400 of the device, Reg1 is configured with value of 400 (default configuration). The LoraWan interface then requests the value from the Register 400 (=temperature) and transmits the value using 16-bit message (e.g. 'x011d' = 285 / 100 = 28.5°C).

Please consult the corresponding product data sheet for the available registers.

Note: If non-existing register is configured to the Uplink Register 1-12 parameter, or if the register value is set to 0, the device will return FFFF.

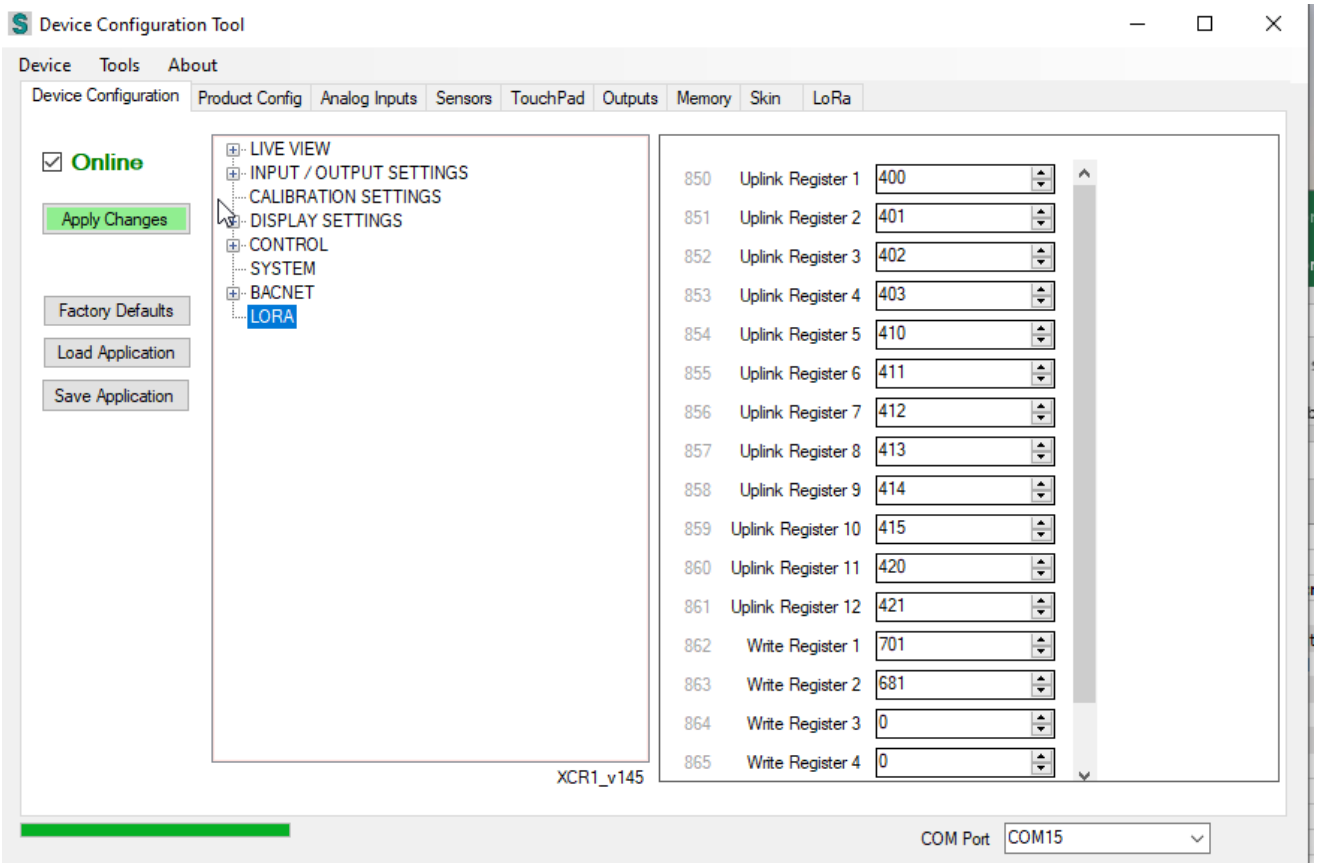


Figure 2: Configuration of Automatic Uplink Message Registers using the Device Configuration Tool.

The default settings for the Automatic Uplink Registers are as follows: -

For QTCR10/QCR10 devices

<Reg1> = 400 – Temperature Sensor, Signed 16-bit value (2-bytes) of temperature x10 in HEX e.g. 28.5°C sends 285 = 0x011d

<Reg2> = 401 – Humidity Sensor, Unsigned 16-bit value (2-bytes) of humidity x10 in HEX e.g. 67.2% sends 672 = 0x02a0

<Reg3> = 402 – CO2 Sensor, Unsigned 16-bit value (2-bytes) of CO2 x1 in HEX e.g. 1270ppm sends 1270 = 0x04f6

<Reg4> = 403 – VOC Sensor, Unsigned 16-bit value (2-bytes) of VOC x1 in HEX e.g. 130index sends 130 = 0x0082

<Reg5> = 410 – Universal Input 1, Signed 16-bit value (2-bytes) of UI1 x10 in HEX e.g. 27.8°C sends 278 = 0x0116

<Reg6> = 411 – Universal Input 2, Signed 16-bit value (2-bytes) of UI2 x10 in HEX e.g. 20.0°C sends 200 = 0x00c8

<Reg7> = 412 – Y1 Output, Unsigned 16-bit value (2-bytes) of Y1 x10 in HEX e.g. 56.7% sends 567 = 0x0237

<Reg8> = 413 – Y2 Output, Unsigned 16-bit value (2-bytes) of Y2 x10 in HEX e.g. 100.0% sends 1000 = 0x03e8

<Reg9> = 414 – Y3 Output, Unsigned 16-bit value (2-bytes) of Y3 x10 in HEX e.g. 100.0% sends 1000 = 0x03e8

<Reg10> = 415 – Y4 Output, Unsigned 16-bit value (2-bytes) of Y4 x10 in HEX e.g. 20.6% sends 206 = 0x00ce

For QCR/TCR

<Reg11> = 420 – Calculated Setpoint, Signed 16-bit value (2-bytes) of calculated setpoint x10 in HEX e.g. 16.8°C sends 168 = 0x00a8

<Reg12> = 421 – Calculated Aux Setpoint, Signed 16-bit value (2-bytes) of calculated setpoint x10 in HEX e.g. 30.9°C sends 309 = 0x0135

Example of Uplink Message is illustrated in Figure 3 and Table 1 shows how the uplink message can be converted to Human Readable Values.

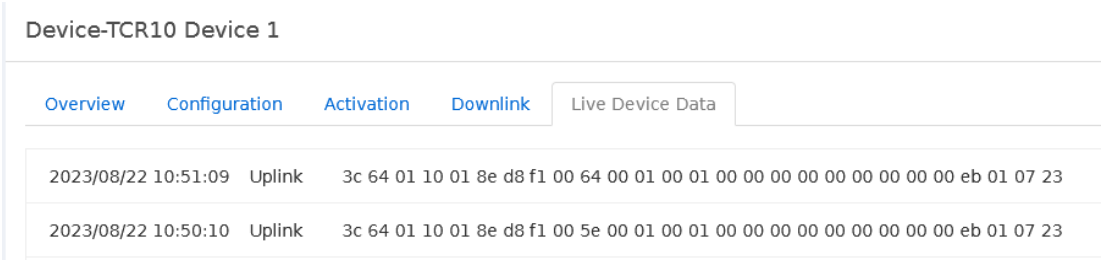


Figure 3: Example of the Uplink Message Data Received on the LoraWan gateway using the default configuration.

LORA AUTOMATED UPLINK MESSAGE					
Returned LORA Message					
3c 64 01 10 01 8e d8 f1 00 64 00 01 00 01 00 00 00 00 00 00 00 00 00 eb 01 07 23					
Message Breakdown	**Returned Message Parts**		**Returned Integer**	**Default Reg**	**Default Reg Description**
Message Prefix	3c 64	<d			
Register 1	01 10	0110	272	400	Temperature Sensor
Register 2	01 8e	018e	398	401	Humidity Sensor
Register 3	d8 f1	d8f1	55537	402	CO2 Sensor
Register 4	00 64	0064	100	403	VOC Sensor
Register 5	00 01	0001	1	410	UI1
Register 6	00 01	0001	1	411	UI2
Register 7	00 00	0000	0	412	Y1
Register 8	00 00	0000	0	413	Y2
Register 9	00 00	0000	0	414	Y3
Register 10	00 00	0000	0	415	Y4
Register 11	00 eb	00eb	235	420	Calculated Multi-Stage Setpoint
Register 12	01 07	0107	263	421	Calculated Aux Setpoint
Message End	23	#			
Note: In most cases the Returned Integer is divided by 10 to get decimal value. Please refer to data sheet for the particular register scaling.					

Table 1. Example Uplink Message Conversion to Human Readable Values (Returned Integer). Please note than depending on the parameter being sent the Integer value is then divided by 10 to get the actual value. E.g. returned temperature field is 272 / 10 = 27.2°C.

3 Package Write Message Payload Format

The Senticon devices have packaged write message option, that consists of 15 bytes of the data – 6x Senticon device registers. The packaged write allows the LoraWan gateway to send on a single message number of control signals and settings to the Senticon device.

```
>D <Reg1> <Reg2> <Reg3> <Reg4> <Reg5> <Reg6>#
```

```
>D = signifies message from the gateway; ASCII in HEX '0x3e44'
<RegX>; = 16-bit value (2-bytes) of Register X, 6 registers
# = end of message; ASCII to HEX = 0x23
```

The Register value that is transmitted is configured in the device configuration under the LORA menu.

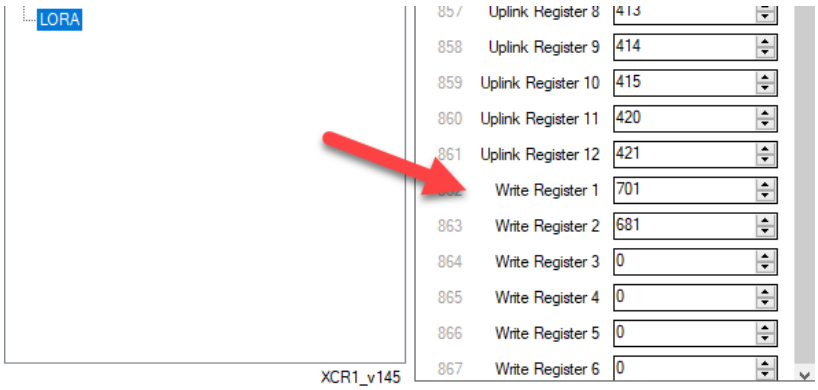


Figure 4: Configuration of Package Write Message Registers using the Device Configuration Tool.

The default registers for the package write are:-

For QTCR10/QCR10 devices

```
<Reg1> = 701 – Multi-Stage Loop Nominal Setpoint, Signed 16-bit value (2-bytes) x10 in HEX e.g. 22.5°C x10 = 225 -> 0x0016
<Reg2> = 681 – Override Control Mode (0=Occupied/1=Unoccupied/2=Off), Unsigned 16-bit value (2-bytes) x1 in HEX e.g. 1 x1 = 1 -> 0x0001
<Reg3> = 0 -> Not in use
<Reg4> = 0 -> Not in use
<Reg5> = 0 -> Not in use
<Reg6> = 0 -> Not in use
```

The table and images below illustrate the package write message format, corresponding configuration on the device configuration tool and example downlink message on a gateway.

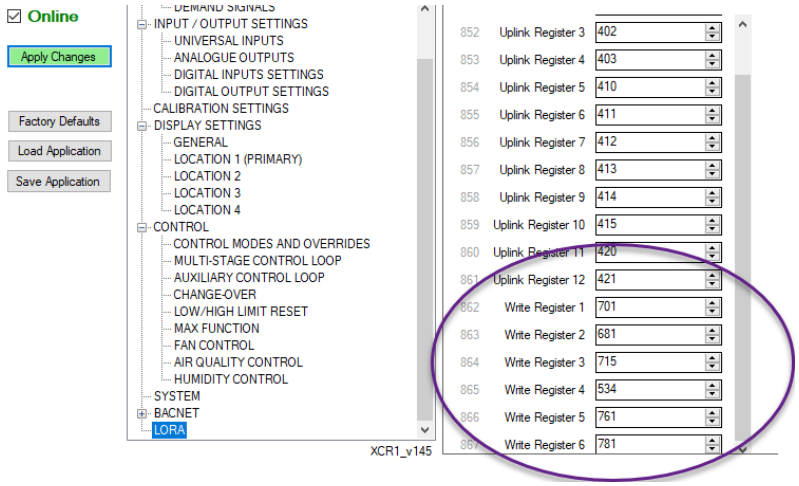


Figure 5: Example Configuration of Package Write Message Registers on the Device Configuration Tool.

LORA PACKAGED WRITE DOWNLINK MESSAGE				
Message Breakdown	**Value to Write**	**Raw Value to Write**	**Value in HEX**	**Reg Description**
Message Prefix		>D	3E44	
Register 1	23.5	235	00EB	Nominal Setpoint
Register 2	2	2	0002	Override Control Mode (2=OFF)
Register 3	26.3	263	0107	Auxiliary Loop Setpoint
Register 4	78.7	787	0313	Y1 Analogue Output Override
Register 5	800	800	0320	CO2 Control Loop Setpoint
Register 6	55	55	0037	Humidity Setpoint
Message End		#	23	
LORA MESSAGE WRITE				
3E4400EB00020107031303200037 23				

Table 2: Example Package Write Message construction for the Lorawan Gateway.

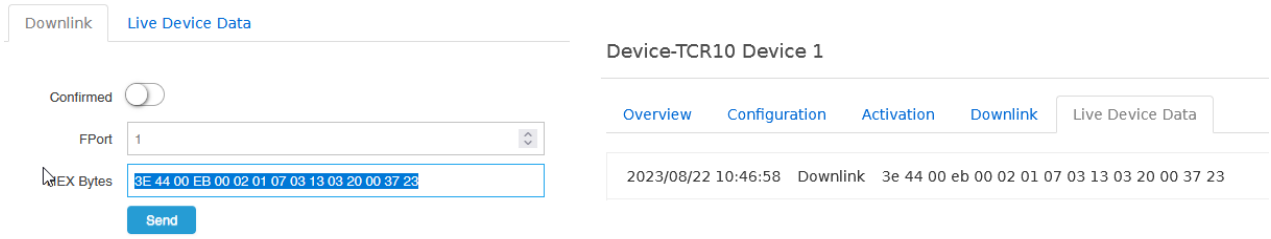


Figure 6: Example Package Write Message send on the LoraWan Gateway.

4 Single Write Payload Message (Request Information / Writing Settings)

It is also possible for the gateway to request any available information from the devices and/or write settings back to device using single write message. This is done using packaging Senticon's common data access protocol to the LoraWan payload.

WARNING: Single parameter write / data request does not support buffering. If multiple requests are required to be sent to a device, a delay must be implemented on the gateway between the messages. Alternatively monitor the response from the device before transmitting the next message.

4.1 Requesting Data from the Device

The common data access protocol follows the following format to request the information: -

```
>p <4-byte Register> #
```

where

```
>p = specifies data request from the device, 0x3E70
```

```
<4-byte Register> = the device data register in HEX format e.g. Temperature Sensor Register is 400 = 0x0190
```

```
# = end of message; ASCII to HEX = 0x23
```

The device will respond

```
<p <4-byte register> <8-bytes data> #
```

where

```
<p = specifies data received from the device
```

```
<4-byte Register> = the device data register in HEX format e.g. Temperature Sensor Reg is 400 = 0x0190
```

```
<8-bytes data> = the current value received in 8-bytes e.g. 0x000000C3 = 195 (19.5°C)
```

```
# = end of message; ASCII to HEX = 0x23
```

Few examples are illustrated in the table below for QCR controllers.

Parameter	Reg	Reg Hex	Request	LORA Request ASCII Coded Hex Payload	Returned LORA ASCII Coded Hex Payload	Returned String	Returned HEX Value	Returned Decimal
Temperature Sensor	400	190	>p0190#	3E 70 30 31 39 30 23	3c 70 30 31 39 30 30 30 30 30 30 30 43 33 23	<p0190000000C3#	000000C3	195
Humidity Sensor	401	191	>p0191#	3E 70 30 31 39 31 23	3c 70 30 31 39 31 30 30 30 30 30 31 31 34 23	<p019100000114#	00000114	276

4.2 Writing Settings to the Device

It is also possible to write to any setting on the device using the Senticon's common data protocol. The format is as follows to write a setting to the device. Once the device has accepted the new setting, it will acknowledge the new value.

```
>P <4-byte Register> <8-bytes data> #
```

where

```
>P = specifies data request from the device, 0x3E50
```

```
<4-byte Register> = the device data register in HEX format e.g. Temperature Sensor Register is 400 = 0x0190
```

```
<8-bytes data> = the current value being sent in 8-bytes e.g. 0x00000334 = 820
```

```
# = end of message; ASCII to HEX = 0x23
```

The device will respond to the successful write with the following message: -

```
<p0 <4-byte Register> <8-bytes data> #
```

Few examples are illustrated in the table below for QCR controllers.

Parameter	Reg	Reg Hex	Write Value	HEX	Request	LORA Request ASCII Coded	Returned LORA ASCII Code	Returned String	Returned HEX Value	Returned Integer
Override Control Mode	681	2A9	1	0001	>P02A900000001#	3E 50 30 32 41 39 30 30 30 30 30 30 30 31 23	3c 70 30 32 41 39 30 30 30 30 30 30 30 31 23	<p02A900000001#	00000001	1
Main Loop Nominal Setpoint (SPnom)	701	2BD	225	00E1	>P02BD000000E1#	3E 50 30 32 42 44 30 30 30 30 30 30 45 31 23	3c 70 30 32 42 44 30 30 30 30 30 30 46 32 23	<p02BD000000F2#	000000F2	242
Aux Setpoint	715	2CB	190	00BE	>P02CB000000BE#	3E 50 30 32 43 42 30 30 30 30 30 30 42 45 23	3c 70 30 32 43 42 30 30 30 30 30 30 42 45 23	<p02CB000000BE#	000000BE	190
CO2 Setpoint	761	2F9	820	0334	>P02F900000334#	3E 50 30 32 46 39 30 30 30 30 30 33 33 34 23	3c 70 30 32 46 39 30 30 30 30 30 33 33 34 23	<p02F900000334#	00000334	820
Humidity Setpoint	781	30D	57	0039	>P030D00000039#	3E 50 30 33 30 44 30 30 30 30 30 30 33 39 23	3c 70 30 33 30 44 30 30 30 30 30 30 33 39 23	<p030D00000039#	00000039	57
VOC Setpoint	770	302	120	0078	>P030200000078#	3E 50 30 33 30 32 30 30 30 30 30 37 38 23	3c 70 30 33 30 32 30 30 30 30 30 37 38 23	<p030200000078#	00000078	120
Data Send Interval	847	34F	1	0001	>P034F00000001#	3E 50 30 33 34 46 30 30 30 30 30 30 31 23	3c 70 30 33 34 46 30 30 30 30 30 30 31 23	<p034F00000001#	00000001	1
Storing Settings to NonVol Memory	811	32B	1	0001	>P032B00000001#	3E 50 30 33 32 42 30 30 30 30 30 30 31 23	3c 70 30 33 32 42 30 30 30 30 30 30 31 23	<p032B00000001#	00000001	1

Tip: You can use Reg847 to change the device's LoraWan transmission interval. After change please also apply storage to the Non Volatile memory by setting Reg811 to 1.