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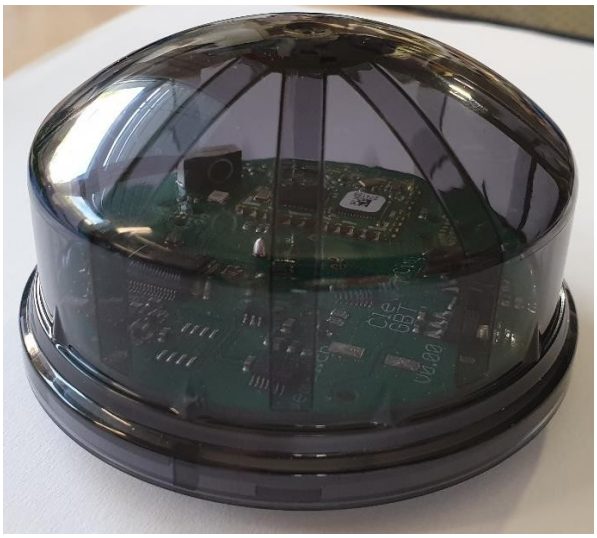
January 11, 2022
Version: 1.10/Wem

GreenBox – Instructions DRAFT

GBC3



GB Tiny (Zhaga/Dali)



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1 Version Control

Documentation:

GBC	GB Tiny	FW	Docs	Date	Who	Change	Comments
1.00		2.06	1.00	March 23, 2021	To whom	Basic version	
1.01						Update Firmware	
		2.07	1.01	April 21, 2021	To whom	OTAA Update USB Read/Write Protection Indicator Expanded (LED) Time Synchronization A0: Trigger reset	Password, Initialization Repeated up to 8 times if no response
1.01		2.08	1.02	April 26, 2021	To whom	Adjust 10 Astro Values Individually	
			1.03	May 3, 2021	To whom	Integrating ChirpStack: Instructions for a Firmware Update with MX Cube	USB Firmware Update
1.04				June 7, 2021	To whom	USB power diode reinforced	Approx. 2 failures out of 500 devices External permanent storage prepared
1.01/1.04		Oct. 2	1.04	June 7, 2021	To whom	the LoRa Init Com LED flashes Time synchronization shortened when the time is incorrect / repeat interval adjusted Offline (no network server)	Previously, operation LED Time filter (data prior to 2021 is discarded) COM LED is blinking
		2.20	1.10	08/02/21	To whom	GB-Tiny integrated (Zhaga)	Dali interface

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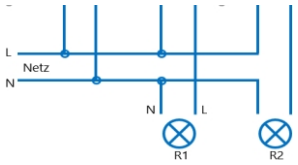
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2 GBC Connections

Connection of the relay contacts (example)

Current measurement is separate on both paths.





3 Test button

GBC3

Pushbutton located beneath the rubber cover (terminals):

Press Relay 1	On
Press Relay 1+2	On
Press Relay 1+2	Off

Note: If the relays are not activated, they will automatically turn off after approximately 2 minutes if they were turned on by pressing the button.



GB Tiny

Button and USB port on the bottom:

Press	20%
Press	100%
Press	Off

Note: The light will automatically turn off after approximately 2 minutes if it was turned on by pressing the button.



4 Display

GBC3

RDY	green	Operation
ERR	red	Error
COM	green	Indicates communication R1
	Yellow	Relay 1
R2	yellow	Relay 2



	RDY	ERR	COM	R1	R1
One	Ready	Error		On, timer	
Flashing	Invalid time		Offline*	On, manual	
Rapid flashing Flashing	Password protected	Incorrect password	Initialize LoRa communication		
Off				Off	

* Not logged in to a network server (offline)

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GB Tiny

3-color LED



Note: The display (LED) can be turned off (see *"Turning Off the Display"*)
The settings also allow for continuous display.

	RDY green	ERR red	COM blue
One	Ready	Error	
Blinking	Invalid time		Offline*
Rapid flashing Flashing	Password protected	Incorrect password	Initializing LoRa communication
Off			

* Not logged in to a network server (offline)

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5 USB interface, device data, settings

GBC3

USB port located beneath the rubber cover (terminals)

Connect the USB-C port to a PC. An external drive is now available containing 2 text files



Note: When connected, the device is powered and thus ready for operation.

GB Tiny

USB port located on the bottom of the device.

Connect the USB-C port to a PC. An external drive containing 2 text files is now available



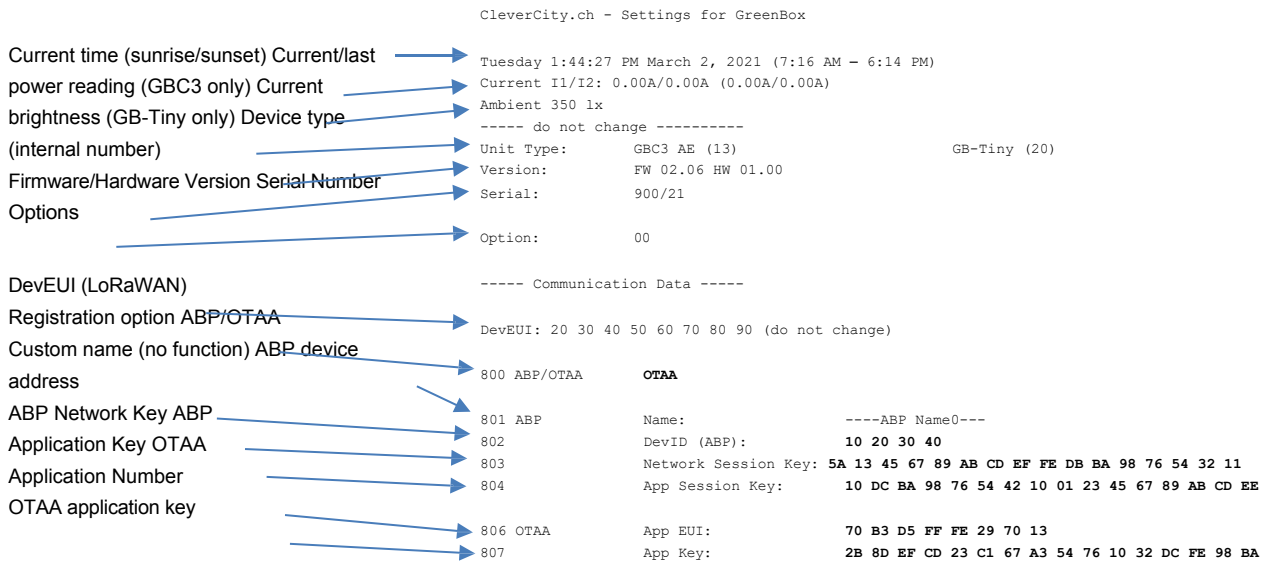
Note: When connected, the device is powered and ready for use.

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5.1 Device Data (*Settings.txt*)

This data is device-specific. Each device will be different.



Only data with a number at the beginning of the line can be adjusted

Note: During LoRa stack initialization, the green LED flashes rapidly

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5.2 Parameters (*Params.txt*)

This data is application-specific, meaning all devices in the system can have the same settings (can be copied to all devices)

Disable periodic status LED transmission (GB-Tiny only)

Group definition:
Transmission delay
Send a reception acknowledgment
Send status upon change Requires an acknowledgment upon transmission

Current data (GBC3 only) Brightness (GB-Tiny only) Astronomical location

Daylight saving time switch Time offset from Greenwich Periodic time synchronization

Scheduling Programs

For Astro, always enter minutes as a 2-digit number:

e.g.		
	0 min must	be 00
	-5 min must	**be -05**
	10 min must be	be 10
	-10 min must	be -10

Group Data

Astro Table 4x19 Values

(4 lines: 605–608: line break because too long)
Display only if `600 Astro-Country 0000`

```
CleverCity.ch - Parameters for GreenBox

100 Auto Status 00h      (Status repetition every n hours, 0=off)

250 LED Display 09                  (9=auto, 0=no, 1=red, 2=green, 4=blue)

300 Group          000/201/101/010 (access group numbers)
301 Group Status 1                  (0=off, 1=on)
380 Tx Fix Delay 000 (802,000 ms)   (Tx Delay [10 ms], 0=auto)
390 Tx dynamic delay 0200/000500    (Tx Delay GBC-GBC [10 ms]/Start Serial Number
381 Send Ack       1                (0=off, 1=Send Ack/Nack)
382 Send Status 1                   (0=off, 1=Send Status on change)
383 Tx confirmed 0                  (0=no, 1=yes)
390 LED Display 09                  (9=auto, 0=no, 1=red, 2=green, 4=blue)

400 Alarm I1 0.0A/0.0A I2 0.0A/0.0A 30s (I1 Min/Max I2 Min/Max Delay)
450 Ambient        100 lx 00% 03 min (threshold/0=off Light/0=off Delay)
451 Auto Amb       00 min           (Ambient value repeats every n min, 0=off)

600 Astro-Country 0000 (0000 table)
                         0101 Zurich/0102 Lucerne/0103 St. Gallen
                         0201 Hamburg/0202 Hanover/0204 Frankfurt/0205 Munich
610 Daylight Saving 1               (0=off, 1=on)
612 Time UTC      +1       UTC+1h   (0=off, -10 .. 10h, EU=+1)
615 Time Sync      096     Time on Air every xx h (0=off, 1..900h)

------------ Program ----------------------------------------------

500 Program 0: K12 On Astro      10 MDMDFSS 99% 0h Active
501 Prog 1: K12 Off Astro        00 MDMDFSS 00% 3h Active
502 Prog 2: K-2 Off Time 23:30 MDMDFSS 99% 0h Active
503 Prog 3: K-2 On Time 06:30 MDMDFSS 99% 0h Active
504 Prog 4: K-- Off Time 00:00 ------- 00% 0h Passive
505 Prog 5: K-- Off Time 00:00 ------- 00% 0h Passive
506 Prog 6: K-- Off Time 12:00 AM ------- 00% 0h Passive
507 Prog 7: K-- Off Time 00:00 ------- 00% 0h Passive
508 Program 8: K-- Off Time 00:00 ------- 00% 0h Passive
509 Program 9: K-- Off Time 00:00 ------- 00% 0h Passive
510 Program 10: K-- Off Time 00:00 ------- 00% 0h Passive
511 Program 11: K-- Off Time 00:00 ------- 00% 0h Passive
512 Prog 12: K-- Off Time 00:00 ------- 00% 0h Passive
513 Prog 13: K-- Off Time 00:00 ------- 00% 0h Passive
514 Prog 14: K-- Off Time 00:00 ------- 00% 0h Passive
515 Prog 15: K-- Off Time 00:00 ------- 00% 0h Passive

------------ Broadcast -------------------------------------------

811 Broadcast 1 Name:                -Broadcast Name-
812                DevID (ABP):      00 00 00 00
813                Network Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
814                App Session Key:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

821 Broadcast 2 Name:                -Broadcast Name-
822                DevID (ABP):      00 00 00 00
823                Network Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
824                App Session Key:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

831 Broadcast 3 Name:                -Broadcast Name-
832                DevID (ABP):      00 00 00 00
833                Network Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
834                App Session Key:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

------------ Astro -----------------------------------------------

605 Sunrise:        0839 0835 0827 0814 0759 0740 0719 0657 0634 0611 0549 0527 0507
0449 0435 0425 0419 0418 0422
606                 0431 0443 0457 0513 0529 0546 0601 0619 0635 0652 0709 0726 0743
0759 0813 0825 0834 0839 0837
607 Sunset:         1638 1650 1704 1721 1738 1756 1813 1831 1848 1905 1922 1939 1955
2012 2027 2039 2048 2053 2053
608                 2048 2038 2024 2006 1946 1924 1901 1838 1814 1751 1729 1710 1653
1640 1630 1626 1627 1632 1642
```

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Only dates with a number at the beginning of the line can be set

Note: The Dali interface is always Channel 2/Relay 2
Note: During initialization of the LoRa stack, the green LED flashes rapidly

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5.3 Duplicating the data to other devices

1. Connect the device to USB
2. Read the original file from the GreenBox (Params.txt) by double-clicking it in File Explorer
3. Adjust the parameters in an editor and save them to the PC (so they're available at any time)
4. Save the file (*File -> File Save As...*) to the GreenBox drive (*save or replace)*
5. Remove the USB drive, plug it back in, and verify the data

CAUTION: The values must be in the same position and have the same number of digits (e.g., 003, not 3)

`300 Group`	`000/201/101/020 (access group numbers)`	Correct
`300 Group`	`201/101/020 (access group numbers)`	Incorrect
`300 Group`	`/201/101/020 (access group numbers)`	Incorrect

Note: Data from Params.txt and Settings.txt can be saved to a single file. All parameters can be adjusted using a three-digit number at the beginning of each line.

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5.4 Read and Write Protection (Password)

If a password is defined and enabled (see *USB Password*):

Params.txt

```
CleverCity.ch - Parameters for GreenBox

999 Password ********      (after entering the password, disconnect and reconnect the USB
...
```

Setting.txt

```
CleverCity.ch - Settings for GreenBox

999 Password ********      (After entering the password, disconnect and reconnect the USB
drive...
```

After entering the valid password, the USB drive must be removed and reinserted (Windows needs to re-read the files). Now all parameters are accessible and can be adjusted.

Note: Without a password, you cannot save a new file (it will not be accepted). Note: If the password is incorrect, the red LED will flash briefly

Note: When the password is enabled, access is immediately blocked (saving is also not possible).

Note: Password protection is automatically activated after 30 minutes (only when the device is turned on; if turned off, the remaining time is retained).

All characters from the ASCII character set can be used:

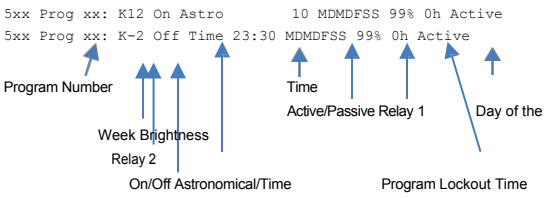
Hex	sym-symbol		Hex	sym-bol		Hex	sym-bol		Hex	sym-bol	
0x00	NULL	(null character)	0x20		(Space)	0x40	@	(At sign)	0x60	`	(Grave accent)
0x01	SOH	(Start of Header)	0x21	!	(Exclamation mark)	0x41	A	(Capital A)	0x61	a	(lowercase a)
0x02	STX	(Start of Text)	0x22	"	(Quotation mark; quotes)	0x42	B	(Capital B)	0x62	b	(lowercase b)
0x03	ETX	(End of Text)	0x23	#	(Number sign)	0x43	C	(Capital C)	0x63	c	(lowercase c)
0x04	EOT	(End of Transmission)	0x24	$	(dollar sign)	0x44	D	(Capital D)	0x64	d	(Lowercase d)
0x05	ENQ	(Enquiry)	0x25	%	(Percent sign)	0x45	E	(Capital E)	0x65	e	(lowercase e)
0x06	ACK	(Acknowledgement)	0x26	&	(Ampersand)	0x46	F	(Capital F)	0x66	f	(lowercase f)
0x07	BEL	(Bell)	0x27	'	(Apostrophe)	0x47	G	(Capital G)	0x67	g	(Lowercase g)
0x08	BS	(Backspace)	0x28	(	(round brackets)	0x48	H	(Capital H)	0x68	h	(Lowercase h)
0x09	HT	(Horizontal Tab)	0x29	)	(round brackets)	0x49	I	(Capital I)	0x69	i	(lowercase i)
0x0A	LF	(Line feed)	0x2A	*	(Asterisk)	0x4A	J	(Capital J)	0x6A	j	(lowercase j)
0x0B	VT	(Vertical Tab)	0x2B	+	(Plus sign)	0x4B	K	(Capital K)	0x6B	k	(lowercase k)
0x0C	FF	(Form feed)	0x2C	,	(Comma)	0x4C	L	(Capital L)	0x6C	l	(lowercase l)
0x0D	CR	(Carriage return)	0x2D	-	(hyphen)	0x4D	M	(Capital M)	0x6D	m	(lowercase m)
0x0E	SO	(Shift Out)	0x2E	.	(Dot, full stop)	0x4E	N	(Capital N)	0x6E	n	(lowercase n)
0x0F	SI	(Shift In)	0x2F	/	(Slash)	0x4F	O	(Capital O)	0x6F	o	(lowercase o)
0x10	DLE	(Data Link Escape)	0x30	0	(number zero)	0x50	P	(Capital P)	0x70	p	(lowercase p)
0x11	DC1	(Device control 1)	0x31	1	(number one)	0x51	Q	(Capital Q)	0x71	q	(lowercase q)
0x12	DC2	(Device control 2)	0x32	2	(number two)	0x52	R	(Capital R)	0x72	r	(lowercase r)
0x13	DC3	(Device control 3)	0x33	3	(number three)	0x53	S	(Capital S)	0x73	s	(lowercase s)
0x14	DC4	(Device control 4)	0x34	4	(number four)	0x54	T	(Capital T)	0x74	t	(lowercase t)
0x15	NAK	(Negative acknowledgement)	0x35	5	(number five)	0x55	U	(Capital U)	0x75	u	(Lowercase u)
0x16	SYN	(Synchronous idle)	0x36	6	(number six)	0x56	V	(Capital V)	0x76	v	(lowercase v)
0x17	ETB	(End of transmission block)	0x37	7	(number seven)	0x57	W	(Capital W)	0x77	w	(lowercase w)
0x18	CAN	(Cancel)	0x38	8	(number eight)	0x58	X	(Capital X)	0x78	x	(Lowercase x)
0x19	EM	(End of medium)	0x39	9	(number nine)	0x59	Y	(Capital Y)	0x79	y	(Lowercase y)
0x1A	SUB	(Substitute)	0x3A	:	(Colon)	0x5A	Z	(Capital Z)	0x7A	z	(lowercase z)
0x1B	ESC	(Escape)	0x3B	;	(Semicolon)	0x5B	[	(square brackets)	0x7B	{	(curly brackets or braces)
0x1C	FS	(File separator)	0x3C	<	(Less-than sign)	0x5C	\	(Backslash)	0x7C	|	(vertical bar, vbar)
0x1D	GS	(Group separator)	0x3D	=	(Equals sign)	0x5D	]	(square brackets)	0x7D	}	(curly brackets or braces)
0x1E	RS	(Record separator)	0x3E	>	(Greater-than sign)	0x5E	^	(Caret or circumflex accent)	0x7E	~	(Tilde; swung dash)
0x1F	US	(Unit separator)	0x3F	?	(Question mark)	0x5F	_	(underscore)	0x7F	DEL	(Delete)

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6 Time Schedule, Internal Clock, and Astro Calendar

6.1 Time Program

Program number: 0–15 Relay 1/Relay 2: -/1 -/2 Which relay should be switched on/off: on/off Operating Mode, Astro Astro. /Time: -90 – 90 min offset from the Astro calendar HH:MM hours and minutes (time) Day of the week: On which days of the week should the switch be activated? Brightness: Specifies the brightness (for relay 0–99) Active/Passive: Should the program be run? Yes/No	

Note: The DALI interface is always Channel 2/Relay 2

6.2 Set or synchronize time

Get time from network server (synchronize)

In the *Param.txt* file, you can specify the time interval at which synchronization should occur.	615 Time Synch **096** Time on Air every xx h (0=off, 1..900h)

Note: GreenBox retrieves the time according to the LoRa specification. This means that GreenBox uses the “DeviceTimeAns” MAC command from the LNS to synchronize its own time

Synchronize with PC time

Open the *Setting.txt* file and save it. When you save the file, the PC’s system time is adopted	

Daylight Saving Time

Enable/disable automatic daylight saving time switching	610 DayLightSave **1** (0=off, 1=on)

Time Zones

The synchronized time (network server) is based on Greenwich Mean Time. For Europe, this means a 1-hour correction is required.	612 Time UTC **+1** UTC+1h (0=off, -10 .. 10h, EU=+1)

6.3 Astronomical Calendar

An astro calendar is used for sunrise and sunset times. This depends on the geographic location	600 Astro-Country **0000** (0000 table) 0101 Zurich/0102 Lucerne/0103 St. Gallen 0201 Hamburg/0202 Hanover/0204 Frankfurt/0205 Munich

Switzerland	Zurich	ZH	01 01
	Lucerne	LU	01 02
	St. Gallen	SG	01 03

Germany	Hamburg	HH	02 01
	Hanover	H	02 02
	Cologne	K	02 03
	Frankfurt	F	02 04
	Munich	M	02 05

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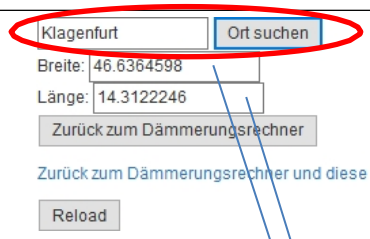
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6.3.1 Create an Astrological Calendar Table

Search for an astronomical location and determine the coordinates

https://sonnenaufgang-sonnenuntergang.de/GM/coords_plz.php?plz=

Enter a location and search...

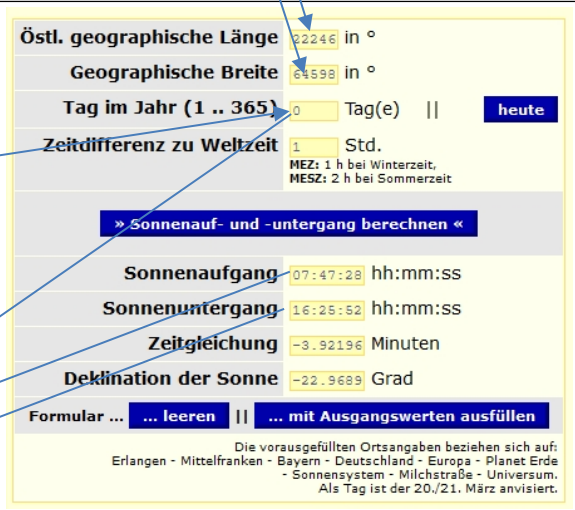


http://free-solutions.schleu.de/js/tool_rechner_sun-set.html

Convert longitude and latitude; enter days

0, 10, 20, …, 370

Create a table



Tag	0	10	20	..	370
SunRise	0747	0745	0739	...	0747
SunSet	1625	1636	1649	...	1630

Values: hhmm (hours and minutes, each 2 digits, joined together)

Note: Seconds are rounded up or down to the nearest minute

Example:

Mönchengladbach (Germany)

```
605 Sunrise       0839 0835 0827 0814 0759 0740 0719 0657 0634 0611 0549 0527 0507 0449 0435 0425 0419 0418 0422              Value   0–180
606               0431 0443 0457 0513 0529 0546 0601 0619 0635 0652 0709 0726 0743 0759 0813 0825 0834 0839 0837              Value 190–370
607 Sunset        1638 1650 1704 1721 1738 1756 1813 1831 1848 1905 1922 1939 1955 2012 2027 2039 2048 2053 2053              Value   0–180
608               2048 2038 2024 2006 1946 1924 1901 1838 1814 1751 1729 1710 1653 1640 1630 1626 1627 1632 1642              Value 190–370
```

Klagenfurt (A)

```
605 Sunrise:      0747 0745 0739 0729 0716 0700 0643 0624 0604 0543 0524 0505 0448 0433 0422 0413 0409 0409 0412              Value   0–180
606               0420 0429 0442 0455 0508 0522 0535 0548 0602 0616 0630 0644 0658 0711 0724 0734 0742 0746 0747              Value 190–370
607 Sunset:       1625 1636 1649 1703 1718 1732 1747 1801 1816 1830 1844 1858 1911 1925 1937 1947 1955 2000 2000              Value   0–180
608               2000 1948 1636 1922 1905 1850 1826 1806 1744 1724 1706 1649 1635 1624 1617 1614 1615 1621 1630              Value 190–370
```

This table can be copied into the text file below. It must be followed by a blank line.

Please check your entry: Unplug the USB and plug it back in; the values should then be displayed completely and correctly (the characters must be in the right places).

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7 Sensors

7.1 Current Measurement (GBC3 only)

7.2 Light Sensor (GB-Tiny only)

The GreenBox Tiny has a built-in brightness sensor. This sensor measures the current ambient brightness:

- Turns on the light (lamp brightness adjustable).
- Reports a status

A switching delay [min] ensures that brief changes are ignored.

	Application	
	Autonomous operation	**Brightness report**
LoRa	Yes/No	Yes
Status	A status is sent	
Process off	Light on	1. Status sent to network server 2. Network server sends group command 3. Turn on all lights
Sequence Bright	Light off	1. Status sent to network server 2. Network server sends group command 3. All lights turn off
Setting USB	450 Ambient 100 lx 50% 03 min (threshold/0=off Light/0=off Delay)	450 Ambient 100 lx 00% 03 min (threshold/0=off Light/0=off Delay)
Setting LoRa	xx 0A 00 00 64 32 03 xx: Group, Single Device 0x00	xx 0A 00 00 64 00 03 xx: Group, Single Device 0x00
Note		Ideally, several (e.g., 10 Tiny devices) are distributed throughout the city as light sensors. As soon as more than half of them return a status indicating they are ready to switch, all of them can be switched via the group command.

Note: A current ambient light measurement is taken. These readings may vary due to buildings, trees, etc. Before setting the lux value, read it back at the desired brightness (LoRa: xx 09) and then program it accordingly (LoRa: xx 0A yy desired brightness[hex]..)

To disable brightness measurement: Brightness threshold = 0

LoRa: xx 0A 00 **00 00** 00 00 USB 450 Ambient 000 lx 50% 03 min

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8 LoRa Communication

8.1 Command Structure

Payload			Remarks
Group	**Command**	**Data**	
0x00	0x20	0x01 0xFF	Group 0x00: Target Device Command 0x20: Toggle relay (static) Data 0x01: Relay 1 0xFF: >0 on Payload: 00 20 01 FF
0x00	0x20	0x01 0x00	Group 0x00: Addressed device Command 0x20: Toggle relay (static) Data 0x01: Relay 1 0x00: off Payload: 00 20 01 00
0x0F	0x01	0x02 0x00 0x32 0x00	Group 0x0F: Group 15 (0x0F) Command 0x01: Switch relay (timed) Data 0x02: Relay 2 0x00 0x32: Turn on for 50 minutes (32 hours → 50 days) Payload: 0F 01 02 00 32 00
0x00	0x10		Group 0x00: Target device Command 0x10: Retrieve GPS coordinates Data: - Payload: 00 10

Group	**Command**	**Data**	**Remarks**
0x00 0x01–FE 0xFF			Single device (main address only; does not respond to addresses 2 or 3) All devices (main address and addresses 2 and 3)
	0x00–FF		See table
		xx xx xx xx	See table
0x00 0x15 0xFF	0x01	0x02 0x00	Example: Turn off Relay 2 (00 01 02 00) Single device (15 01 02 00) Devices in Group 15 (FF 01 02 00) All devices

Example of communication: Relay switching (timed) and GPS coordinates (hex format)

	Command	**Channel**	**Data**	**Example**	**Response**
Relay 1 on Relay 1 off	01	01	FF FF 00 00 00 00	00 01 01 FF FF 00 00 01 01 00 00 00	00/01
Relay 2 on Relay 2 off	01	02	FF FF 00 00 00 00	00 01 02 FF FF 00 00 01 02 00 00 00	00/01

The group number must be entered first!

Note: When querying, always address individual devices (Group 0x00), otherwise data collisions will occur.

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8.2 Communication: Commands

Summary (Hex Format): Payload

1	2	3	4	5	6	7	8	9	10
Command	**Payload**								
00									
01	1 2	Duration [min]		Brightness [%]					
02 (RAM)	Program 1–16	Mon–Thu – Fri–Sun	Fri–Sun – Day	Mon–Thu – Month	Time H – (-)	Time M – Min	KSP	Brightness [%]	
03 (Flash)	Program 1–16	Mon–Thu – Fri–Sun	Fri–Sun – Day	Mon–Thu – Month	Time H – (-)	Time M – Min	KSP	Brightness [%]	
04									
05									
07									
08	1 2	Current K1 Min [0.1A]	Current K1 Max [0.1A]	Current K2 Min [0.1A]	Maximum current K2 [0.1A]	Delay [s]			
09									
0A	Repetition	Switch-on threshold [lux]		Action	Delay				
0C	Status Repeat [h]								
0D	Tx Delay dynamic		Start Serial Number						
0E	Tx Delay [10 ms]								
0F									
10	Astro Val	Sunset Val		Sunrise Valley					
11	Astronomical Location								
12	Car Sun/Winter	UTC							
13	Repeating Time Sync [h]								
1A	Current Time: h	Current time: m	Current time: s	Current Date: D	Current Date: M	Current date: Y			
1C	2. DevAdr (Group)								
1D	3. DevAdr (Group)								
1E	4. DevAdr (Group)								
1F	Grp On-Off	Grp A	Grp B	Grp C	Grp D				
20	1 2	Off – On (Brightness)							
30	Ack On-Off Status, Conf.								
34	LED On/Off								
40	0	Prog Active/Passive							
60									
90	On/Off	Password (8 bytes in ASCII: ' ' – '}' -> 0x20 – 0x7D)							
A0	Reset								

1
Uplink
0 – 1

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Summary (Hex Format): Uplink

1	2
Command	Channel
00	
01	81 82
02 (RAM)	Program 1: 80 Program 2: 81 … Prog. 16: 8F
03 (Flash)	Prog 1: 80 Prog 2: 81 … Prog. 16: 8F
04	Prog 1: 01 Program 2: 02 … Prog. 16: 10 K1: 11 K2: 12 Time: 13
05	
07	
08	81 82
09	
0A	80
0C	80
0D	80
0E	
0F	
10	80 92
11	80
12	80
13	80
1A	80
1C	
1D	
1E	
1F	80
20	
30	80
34	80
40	80
60	
90	80
A0	80

1	2	3	4	5	6	7	8	9	10	11
Command	Uplink									
00	Status K1	Status K2	Internal Values	Error						
01	1 2	Remaining operating time [min]		Brightness [%]						
02	Prog 0..F	t/d – Z/A	Fri–Sun – Day	Mon..Thu – Month	Time H – (-)	Time M – Min	KSP	Brightness [%]		
03	Prog 0..F	t/d – Z/A	Fri–Sun – Day	Mon..Thu – Month	Time H – (-)	Time M – Min	KSP	Brightness [%]		
04	Text response [ASCII]									
05	Last RX RSSI	Last RX SNR								
07	Current Value 1	Current value 2	Last active current value 1	Last active current value 2						
08	1 2	Current K1 min [0.1A]	K1 Max Current [0.1A]	Current K2 Min [0.1A]	Current K2 Max [0.1A]	Delay [s]				
09	Current lux value									
0A	Repetition	Switch-on threshold [Lux]		Action	Delay					
0C	Status Repeat [h]									
0D	Dynamic Tx Delay		Start Serial Number							
0E	Tx Delay [10 ms]									
0F	Device Type	Year of Manufacture	Serial Number		HW Version Hi	HW Version Low	SW Ver Hi	SW Ver Lo	Com Module	Option
Sunset Valley		Sunrise Val								
11	Astronomical location									
12	Car Sun/Winter	UTC								
13	Recurring Time Sync [h]									
1A	Current time: h	Current time: m	Current time: s	Current Date: D	Current Date: M	Current Date: Y	Sunset h	Sunset m	Sunrise h	Sunrise m
1F	Grp On-Off	Grp A	Grp B	Grp C	Grp D					
30	Ack On/Off Status, Conf.									
34	LED On/Off									
40	Prog Active/Passive									
10	GPS Latitude				GPS Longitude				No. of Satellites	
On/Off	Password (8 bytes in ASCII: ‘ ’ – ‘}’ -> 0x20 – 0x7D)									

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8.2.1 Relay/Brightness Switching: On-Off (0x20 - 3 bytes)

Command [Hex]	**Response** [Hex]	**Note**
20 0X HH	20 01/00	X: Channel 1/2/3 HH: Brightness [%] 0–99
e.g., 00 20 02 FF e.g., 00 20 03 32 e.g., 00 20 03 00	20 01/00	Plausibility check: Turn on K2 at 100% brightness Turn on K1 and K2 at 50% brightness **Turn off** K1 and K2

Note: The Dali interface is always Channel 2/Relay 2
Note: A brightness of 0% turns the light off; a brightness of 99% is interpreted as 100% (99% does not exist).
For the relay, a value greater than 0 turns it on, and 0 turns it off.
Note: The command remains active until a new action, such as a brightness adjustment,
requires a change. Note: When a change occurs, a new status is automatically sent.

8.2.2 Control Relay/Time-Controlled Brightness (0x01 - 5 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
01 0X YY YY HH	01 01/00	X: Channel 1/2/3 YYY: Time [min] 0–999 HH: Brightness [%] 0–99
01 8X	01 0X YY YY HH	Returns the current values (remaining time/countdown)
e.g., 00 01 01 **00 0A** 32 e.g., 00 01 02 **00 00** 00 e.g., 00 01 03 **FF FF** 64	01 01/00	Validation check: **Turn** K1 on for 10 minutes at 50% brightness; **turn** K2 **off** Turn on K1 and K2 **continuously**, 100% brightness
e.g., 00 01 81 e.g., 00 01 82	01 01 **00 08** 32 01 02 **00 0A** 64	K1 runs for another **8 minutes** at 50% K2 will run for another **10 minutes** at 100%

Note: The DALI interface is always Channel 2/Relay 2
Note: Time=0 turns off, Time=0xFF 0xFF/999 turns on continuously;
brightness 99% is interpreted as 100% (99% does not exist).
Note: The command to turn on (Time=0xFF 0xFF/999) or turn off (Time=0x00 0x00/0) remains in effect until a new action, such as a brightness adjustment, requires a change. Timers continue to run even if a new action is pending (OR logic).
Note: When a change occurs, a new status is automatically set.

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8.2.3 Switching program (0x02 - 9 bytes) RAM (do not use)

Command: 0x02 …
Same structure as switching programs … Flash

8.2.4 Switching program (0x03 - 9 bytes) Flash

Command [Hex]	**Response** [Hex]	**Note**
03 0X YA ZZ TT BB BB KS+P HH SS	03 01/00	X: Program No. 0-F Y: Switching Mode 0 Day T: Day See Table A: Time/Astronomical T/A BB: Time hh:mm Astronomical +0.mm (mm: 0–90) -0.mm K Channel See table S Switching Mode 0/1 (Off/On) P Passive/Active 0/2 HH Brightness 0–99 [%] SS Blocking time 0–9h ZZ Not used
03 8X	03 0X YA ZZ ZZ BB BB KS+P HH SS	Returns the current values
e.g., 00 03 0E 01 00 3F 01 0F 23 3C 01	03 01/00	Plausibility check: P15 Mon–Sun, 15 minutes before sunset; K2 On at 60%, 1-hour delay

Note: A brightness value of 99% is interpreted as 100% (99% does not exist).
Note: No time programs are executed during the lockout period (each channel individually); if no value is entered, SS=0. For example:

```
501 Prog 1: K12 Off Astro        00 MDMDFSS 00% 3 Active
503 Prog 3: K-2 On Time 06:30 MDMDFSS 99% 0 Active
```

Astro time: 04:50 SS=3h
Until 7:50 (04:30 + 3h), no clock activities are executed
is disabled and therefore will not run (before 07:50)

Note: The date function is out of service

Day

Mon	+0x00 0x01	The values are
Tue	+0x00 0x02	Added:
Wed	+0x00 0x04	e.g.
Thu	+0x00 0x08	Mon Tue Fri: 00:23
Fri	+0x00 0x10	Mon Tue Wed Thu Fri00:37
Sat	+0x00 0x20	Sun: 1:00
Sun	+0x00 0x40	Sat Sun: 1:40

Channel (Relay)

K1	+0x10	The values are
K2/Dali	+0x20	Added:
K3	+0x40	K1 K2: 3

8.2.5 Switching Programs: Switch Active/Passive (0x40 - 3 bytes) Flash

Command [Hex]	**Response** [Hex]	**Note**
40 00 AA AA	40 01/00	AAAA Program bit Active/Passive
40 80	40 AA AA	
e.g., 00 40 00 00 01	40 01/00	Only Program 0 is active
e.g., 00 40 00 00 0F	40 01/00	Programs 0–3 are active
e.g., 00 40 80	40 02 0F	Programs 0–3 and 9 are active

Program

P 0	+0x00 0x01	The values are
P 1	+0x00 0x02	Added:
P 2	+0x00 0x04	
P 3	+0x00 0x08	
P 4	+0x00 0x10	
..		
P F (P 15)	+0x80 0x00	

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8.2.6 Retrieve control programs in text format (0x04 - n bytes)

Command [Hex]	**Response** [ASCII]	**Note**
04 PP	04 PP "text ASCII"	PP: Program 0–15
e.g. 00 04 **00** **…** 00 04 **0E** 00 04 **0F**	2F 50 30 31 5F …	Program 0 … 14 15

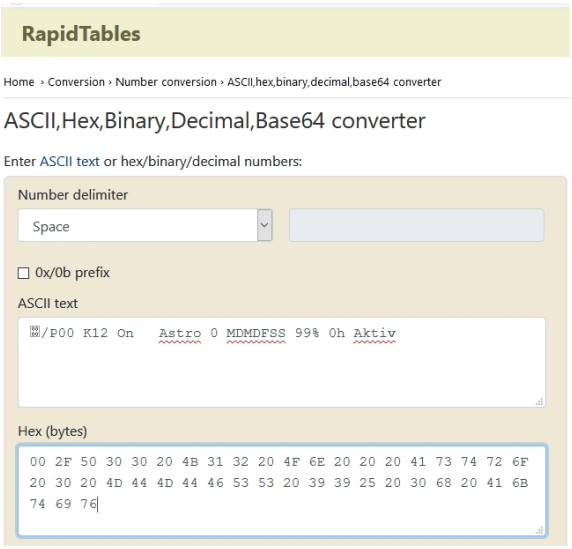
Note: The string can vary in length. The characters are in ASCII

You can view the text using a conversion program:

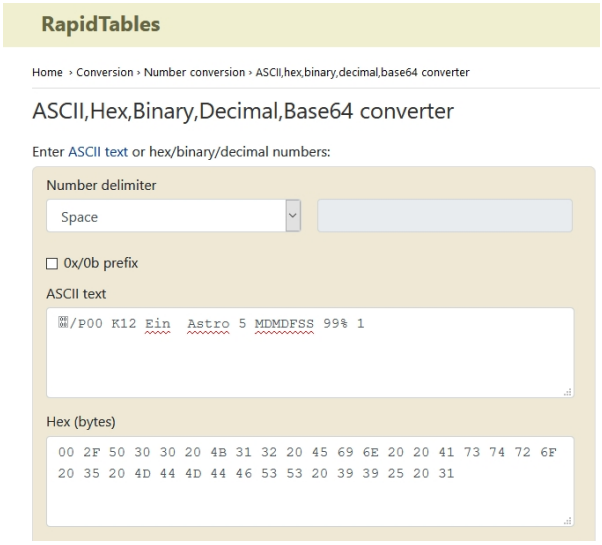
https://www.rapidtables.com/convert/number/ascii-hex-bin-dec-converter.html

Copy the hex string to *Hex (byte)*:

Starting with V2.04



through V2.03



0h Lockout time 1 1: Active, 0: Passive

Note: The 0 or 5 represents the offset of the astronomical calendar; the 1 returns the status (active/passive). Note: The DALI interface is always Channel 2/Relay 2

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8.2.7 Query reception level (0x05 - 3 bytes)

Command [Hex]	**Response** [Hex]	**Remarks**
05	05 XX YY	XX: RSSI (current reception) YY: SNR (current reception)
e.g., 00 05	05 32 0A	RSSI = -50 dB, SNR = 10 dB

8.2.8 Query current value (0x07 - 5 bytes)

Command [Hex]	**Response** [Hex]	**Note**
07	07 AA BB CC DD	AA: Current value of K1 BB: current value of K2 CC: Last active current value K1 DD: Last active current value K2
e.g., 00 07	07 AA BB CC DD	The values are output in hex

The values are specified in 0.1A increments; the **accuracy is approximately 0.5A.**

For unused or unmeasured channels, 0 is always output.

8.2.9 Current Limits – Alarm Window (0x08 - 6 bytes) (GBC3 only)

Command [Hex]	**Response** [Hex]	**Note**
08 AA BB CC DD EE	08 01/00	AA: Min. current value K1 for alarm [0.1A] BB: Min. current value K2 for alarm [0.1A] CC: Max. current value K1 for alarm [0.1A] DD: Max. current value K2 for alarm [0.1A] EE: Measurement delay [s], 0–200 s
08 80	08 AA BB CC DD EE	
e.g., 00 08 05 0A 00 00 32	08 01/00	I1: 05-1.0A, I2: Off, wait time 50s

The current check is delayed because certain lamp types have a slowly rising current. No alarm should be triggered (bus communication), and the error LED does not light up.
Note: The values should be calculated with a generous margin; otherwise, error messages will be generated continuously (measurement accuracy). Note: Values set to 0 are inactive.
Note: The DALI interface is always Channel 2/Relay 2

8.2.10 Current lux value (0x09 - x bytes) (GB-Tiny only)

Command [Hex]	**Response** [Hex]	**Comment**
09	09 AA AA	AA: current brightness
e.g., 00 09	09 00 64	Current brightness 100 lux

Note: This command is sent during automatic brightness reporting

8.2.11 Brightness Thresholds – Switching/Status (0x0A - 6 bytes) (GB-Tiny only)

Comm [Hex] **and**	**Response** [Hex]	**Note**
0A AA BB BB CC DD	0A 01/00	AA: Automatic repeat [min], 0=off Threshold BB: [lux], 0–1000 Brightness 0–99% (0=no CC: function) DD: Measurement delay [min], 0–200 s
0A 80	0A AA BB BB CC DD	
e.g. 00 0A 00 00 64 01 00	0A 01/00	No automatic transmission, 100 lx
00 0A 00 00 32 80 0A		No automatic transmission, 50 lx, sends status after 10 minutes
00 0A 05 00 00 00 00		Sends value every 5 minutes

The brightness-based switching is delayed so that a cloud, for example, does not trigger the device to turn on. No status message should be triggered (bus communication). This delay is adjustable
Note: The switching mechanism has a hysteresis of ±5 lux (prevents continuous switching).

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8.2.12 Send status repeatedly (0x0C - 2 bytes) Default 0

Command [Hex]	**Response** [Hex]	**Remarks**
0C RR	0C 01/00	RR Repeatedly send the status every RR hours, 0=Off
0C 80	0C 02	
e.g., 00 0C 02	0C 01/00	Sends a status update every 2 hours

8.2.13 Dynamically delay status message (0x0D - 5 bytes) Default 200/0

Command [Hex]	**Response** [Hex]	**Note**
0D AA AA BB BB	0D 01/00	AA Delays the transmission of the new status after the acknowledgment of receipt between two devices (consecutive serial numbers) 0x80 is used as a query BB Start serial number; this shortens the first acknowledgment
0D 80	0D AA AA BB BB	
e.g., 00 0D 00 C8 03 E8	0D 01/00	Delays transmission between devices by 200* [10 ms] = 2000 ms (2 s) The first device has a serial number of 1000 or higher

Automatic: 200 ms + (TxDelayDyn * SerialNumber [10 ms]) The lowest serial number must be greater than the input
Maximum delay: 20,000 (200 s)
Minimum serial number: 100

ATTENTION: The "Delay status message" (0x0E, fixed delay) must be set to 0 (disabled)

8.2.14 Delay status message (0x0E - 2 bytes) Default 0

Command [Hex]	**Response** [Hex]	**Note**
0E RR	0E 01/00	RR Delays sending the new status after the acknowledgment; 0=Automatic (default) 0x80 is used for a request for clarification
0E 80	0E RR	
e.g., 00 0E 32	0E 01/00	Delays transmission by 500 ms

Automatic: 200 ms + (TxDelayDyn * SerialNumber [10 ms]), see the corresponding section. Maximum delay: 200 (2 s)

8.2.15 Com Status (Send Ack, Send Status, etc.) (0x30 - 2 bytes)

Command [Hex]	**Response** [Hex]	**Note**
30 XV	30 01/00	X 0=Off, 1=sends status if new V 0=Off, 1=sends Ack/Nack 0=Off, 4=sends "confirmed"
30 80	30 01	
e.g. 00 30 01 00 30 00	30 01/00	Sends Ack/Nack upon receiving data Do not send status, do not send "not confirmed" No response to commands; do not send status

Note: The data is added together (e.g., sends status if new = 1 + send confirmed = 4, so both total 5) Note: Errors are always sent (last byte in status).

8.2.16 Turn display (LED) off, turn on permanently, automatic (0x34 – 2 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
34 VV	34 01/00	VV 0=Off 1=red 0x11=flashing red 2=green 0x12=green flashing 4=blue 0x14=blue flashing 9=automatic
34 80	34 11	Value 11: flashing red
e.g., 00 34 00 00 30 09	30 01/00	No display (all off) Green: Rdy, red: Err, blue: Com

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8.2.17 Device Information (0x0F - 11 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
0F	0F GG JJ RR RR AA AA BB BB CC GG	GG Device Type: see table JJ Year of manufacture RR Serial number AA Hardware version BB Software version CC GG Communication Module Options
e.g., 00 0F	0F 13 11 02 08 01 17 02 03 01 01	Device Type: GreenBox Compact 3 Serial Number: 17-0520 HW: V 01.23 SW: V 02.03 Com: 01 Option: 01

Device Type:	00 (0x00)	Standard Communication GreenBox		(without options) Standard
	01 (0x01)	GreenBox Classic		
	13 (0x0D)	GreenBox Compact 3		command set
	20 (0x14)		AE/S	
	200 (0xC8)	A GreenBox Tiny HSW 3110/3120		
Com:	00 (0x00)	None	Option:	00 (0x00) No option 01
	01 (0x01)	LoRa		(0x01) GPS
	02 (0x02)	GPRS		
	03 (0x03)	LTE		
	04 (0x04)	LAN		

8.2.18 Astronomical location (0x11 - 3 bytes)

Command [Hex]	**Response** [Hex]	**Note**
11 AA BB	11 01/00	AA Country See table BB City
11 80	11 AA BB	
e.g., 00 11 02 01	11 01/00	Hamburg

Switzerland	Zurich	ZH	01 01
	Lucerne	LU	01 02
	St. Gallen	SG	01 03
			01 04
			01 05
			01 06

Germany	Hamburg	HH	02 01
	Hanover	H	02 02
	Cologne	K	02 03
	Frankfurt	F	02 04
	Munich	M	02 05
			02 06

ATTENTION: The table for sunrise and sunset (value 0000 = custom table) is stored in the text file (not available via LoRa).

8.2.19 Astronomical Table (Astronomical Location=Table) (0x10 – 5 bytes)

Command [Hex]	**Response** [Hex]	**Note**
10 XX AA BB CC DD	10 01/00	XX Position [0-37] AA:BB Sunset HH:MM [Hex] CC:DD Sunrise HH:MM [Hex]
10 80 .. 10 A5	10 XX AA BB CC DD	
e.g., 00 10 81	10 01 08 23 10 32 (see table)	
e.g., 00 10 01 08 23 10 32 (see table)	10 01	

Example of an astro table (Params.txt):

```
605 Sunset:      0839 0835 0827 0814 0759 0740 0719 0657 0634 0611 0549 0527 0507 0449 0435 0425 0419 0418 0422
606              0431 0443 0457 0513 0529 0546 0601 0619 0635 0652 0709 0726 0743 0759 0813 0825 0834 0839 0837
607 Sunrise:     1638 1650 1704 1721 1738 1756 1813 1831 1848 1905 1922 1939 1955 2012 2027 2039 2048 2053 2053
608              2048 2038 2024 2006 1946 1924 1901 1838 1814 1751 1729 1710 1653 1640 1630 1626 1627 1632 1642
```

Note: Astrological times should always be given in standard time.

Note: A value is entered every 10 days, and the intervening days are calculated linearly.

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8.2.20 Time Zone Adjustment (0x12 - 3 bytes)

Command [Hex]	**Response** [Hex]	**Remarks**
12 AA BB	12 01/00	AA Automatic summer/winter time change BB Deviation from UTC (0 .. 10/-0 .. -10) +Offset 0x20
12 80	12 AA BB	
e.g., 00 12 01 21	12 01/00	Automatic Daylight Saving Time/Standard Time Switch Offset from UTC = +1h (EU)
e.g., 00 12 00 1E	12 01/00	No automatic daylight saving time change. Offset from UTC = -2h

Note: EU = +1h (default) -> 0x21
Note: Values are doubled, i.e., -5h -> 25 (Special characters cannot be transmitted.
Negative values are represented as 20-x, i.e., -5h → 0x20-0x05 → 1B (Special characters cannot be transmitted.)

8.2.21 Recurring Time Synchronization (LoRa) (0x13 - 3 bytes)

Command [Hex]	**Response** [Hex]	**Note**
13 AA AA	13 01/00	AA AA Time [h] between time synchronization events
13 80	13 AA AA	
e.g., 00 13 00 18	13 01/00	The time is automatically synchronized via LoRa every 24 hours (MAC command)
e.g., 00 13 80	13 00 19	Returns the repeat value [h]

Note: If *FF FF* is entered, time synchronization is triggered immediately (one-time only; value is not saved)

8.2.22 Current time, date (0x1A - 7 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
1A hh mm ss DD MM YY [hex]	1A 01/00	hh current hour mm current minute ss current second TT Current day MM current month YY Current year (+2000)
1A 80	1A hh mm ss DD MM YY SS SS SR SR	SS SunSet (Sunrise hh, mm) SR SunRise (Sunset hh, mm)
e.g., 00 1A 0B 32 30 02 07 14 05 21 15 19	1A 01/00	Dec Hex 11 0B Hour 11:50:00 50 32 Minute 00 00 sec 02 02 Day July 2, 2020 07 07 Month 20 14 Year
e.g., 00 1A 80	1A 0B 32 30 02 07 14 05 21 15 19	Hex Dec 0B 11 Hour 11:50:48 32 50 Minute 30 48 sec 02 02 Day July 2, 2020 07 07 Month 14 20 Year 05 05 SunSet h 05:33 21 33 SunSet m 15 21 SunRise h 9:25 p.m. 19 25 SunRise m

Note: It makes sense to send this as a group command (FF 1A..) so that everyone experiences the same runtime errors in real time.

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8.2.23 USB Access Password (0x90 - 10 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
90 AA B0 B1 B2 B3 B4 B5 B6 B7	90 01/00	AA 1 On/0 Off B0 B1 B2 B3 B4 B5 B6 B7 Password
90 80	90 AA B0 B1 B2 B3 B4 B5 B6 B7	
e.g., 00 90 01 31 32 33 34 35 36 37 38 00 90 00 xx xx xx xx xx xx xx xx	90 01/00	Password: On, '12345678' Password: Off

Note: Only ASCII characters are allowed (ASCII: ' ' – '}' -> 0x20 – 0x7D). The

following are allowed: 0–9, a–z, A–Z, and displayable special characters

8.2.24 Restart device (Reset) (0xA0 - 3 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
A0 80	90 01/00	Force a restart of the device
e.g., 00 A0 80	Device restarts and sends status	

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8.3 Communication: spontaneous transmission of changed values

8.3.1 Status, error message (0x00 - 11 bytes)

Command [Hex]	**Response** [Hex] - **immediate**	**Note**
-	00 S1 S2 II EE HH MM SS dd mm yy HH	S1S2: 2x Status: See Table II: internal values See Table EE: errors: see table Timestamp of the last change HH Hours MM Minutes SS Seconds tt Day mm Month yy Year HH Device-specific information
00		Manual query
GBC3 e.g., 00 00	00 00 00 00 00 01 02 03 04 05 14	Rel 1: Off Rel 2: Off Timestamp: No internal switching, no error 01:02:05 May 4, 20 May 4, 2020
	00 01 08 00 00 13 32 0A 08/04/14	Rel 1: Timed On Rel 2: Manual On Timestamp: No internal switching, no error 19:50:10 Aug 4, 2020 Aug. 4, 2020
	00 00 00 04 00 13 32 0A Aug 4, 2014	Rel 1: Off Rel 2: From timestamp: Internal circuit: Input 1, no error 19:50:10 Aug. 4, 20
	00 04 00 04 00 13 32 0A August 4, 2014	Rel 1: Input 1 On Internal circuit: Input 1 Rel 2: Off Timestamp: No error 7:50:10 Aug. 4, 2020
Tiny, Mini, Dali e.g., 00 00	00 00 00 00 00 01 02 03 04 05 14 **00**	Rel 1: Off Rel 2: Off Timestamp: No internal switching, no error 01:02:05 May 4, 2020 Brightness: May 4, 2020 **0%**
	00 00 03 02 00 02 02 03 04 05 14 **32**	Rel 1: Off Rel 2: Time+Amb Timestamp: Internal circuit: Brightness—no error 01:02:05 May 4, 20 May 4, 2020 Brightness: **50%**
	00 00 02 02 40 02 02 03 04 05 14 **64**	Rel 1: Off Rel 2: Ambient Timestamp: Internal Circuit: Brightness Error: Invalid time 01:02:05 May 4, 20 May 4, 2020 Brightness: **100%**

Note: The following bytes are device-specific (e.g., Tiny also includes the brightness value)

Status

Rel On: Time	+0x01	The values are
Brightness	+0x02	Added:
Input	+0x04	
Manual mode	+0x08	This resulted in a shift
	+0x10	
	+0x20	

Internal values

internal:	+0x01	The values are
Brightness	+0x02	Added:
Input 1	+0x04	
Input 2	+0x08	This has reached the threshold
	+0x10	Depending on the action, the following is then performed
	+0x20	switched

Note: The internal values are independent of the action; sensors can thus be queried (set a threshold, do not evaluate during an action).

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Error

Lamp error	K1	+0x01	The values are
	K2	+0x02	Added:
Burn time	K1	+0x04	
	K2	+0x08	
Programming error		+0x10	
Internal error		+0x20	
Invalid time Time Synchronization Error		+0x40 +0x80	

Note: Timestamp [hex] Hours:Minutes:Seconds Day.Month.Year Note:
The DALI interface is always Channel 2/Relay 2

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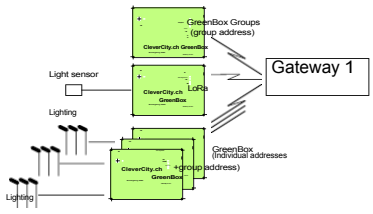
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8.4 Group Commands / Broadcast (ABP only)

All devices can be addressed, either individually or in groups (freely selectable).

Note: Commands for a single device are sent using its own DevAdr and group 0x00. With group 0xFF, all receiving devices with the same DevAdr (Slave: 2nd, 3rd, 4th DevAdr) are addressed.

8.4.1 Main Groups



A main group is created for each gateway. This group is identified by the ID number (DevAdr) of the *GreenBox group*. The following applies:

- The *GreenBox group* must be registered on the gateway.
- All GreenBoxes must have the same SF (default 12)
- All GreenBoxes must receive on the same channel
- All GreenBoxes must have the address set as the BC address (**2, 3, 4 Device Address**)

2, 3, 4 Device Address (0x1C/0x1D/0x1E - 5 bytes)

Command [Hex]	**Response** [Hex]	**Comment**
1C AA AA AA AA … 1D AA AA AA AA … 1E AA AA AA AA.	1D 01/00	AA AA AA AA: Device address (4 bytes) for Network Session Key Application Session Key Slave mode
00 1D 05 3F 2A 4F …	1D 01/00	Listening Address 2: 00 1D 05 3F 2A

e.g. DevAdr: 11 22 33 44 4-byte
NSK: A0 – AF 16 bytes
ASK: B0 – BF 16 bytes

GRP	Bf	DevAdr 4 bytes				Network Session Key 16 bytes														Application Session Key 16 bytes													
00	**1C**	11	22	33	44	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF

LoRa	Params.txt
00 1C 11 22 33 44 A0 … See example above	811 Broadcast 1 Name: -Broadcast Name- 812 DevID (ABP): 11 22 33 44 813 Network Session Key: A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AE AC AD AE AF 814 App Session Key: B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BE BC BD BE BF
00 1D 00 00 00 00 00 …	821 Broadcast 2 Name: -Broadcast Name- 822 DevID (ABP): 00 00 00 00 823 Network Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 824 App Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 1E 00 00 00 00 00 …	831 Broadcast 3 Name: -Broadcast Name- 832 DevID (ABP): 00 00 00 00 833 Network Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 834 App Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Note: The 3 broadcast addresses can have different keys.

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8.4.2 Subgroups

A single address can be used to form different subgroups:

Subgroup	1st byte	Remarks
Address individually	0x00	Command only for *GreenBox groups*
Groups 1–254	0x01 … 0xFE	Groups are freely programmable
Address all	0xFF	Command is executed by all devices in the main group

Up to 4 group numbers (plus 0xFF) can be programmed for each GreenBox. These can be adjusted via LoRa.

e.g., Block 1 No. 01 Block 2 No. 11
Neighborhood 1, Side Street, No. 02 Neighborhood 2, side street No. 12 Main streets No. F0
District 1 Main Street No. 03 District 2 Main Street No. 13 Side streets No.
F1 Now all neighborhoods can be grouped together, and all main streets
The GreenBox on the main street in District 1 will then have the following assignments:
No. 01 + No. 03 + No. F0
With this structure, all groups can be addressed with a single command.

The group number is the first byte that is sent, followed by the commands: 15 03 05 …
All group members numbered 15 receive the program command 03 05…

Subgroup 1–4 (0x1F – 5 bytes)

Command [Hex]	**Response** [Hex]	**Note**
1F AA BB CC DD EE	1F01/00	AA: Group status 0: Off (**no group byte**) BB CC DD EE: Group number 1–4 (1–254)
00 1F 80	1F AA BB CC DD EE	Returns the configured data
00 1F 01 15 25 00 00	1F 01/00	Group status 1: active Groups: 0x15 and 0x25
00 1F 01 15 25 26 30	1F 01/00	Group Status 1: active Groups: 0x15, 0x25, 0x26, and 0x30

Note: If the group byte is 0 (Groups: Off), all group numbers are accepted when the device is addressed directly.
The 2nd and 3rd device addresses are ignored (no function).
Note: Addressing all listeners requires the group status to be
active. Note: Group 0 means inactive

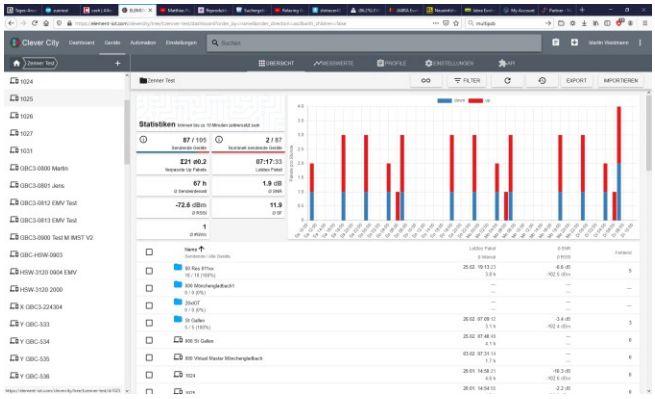
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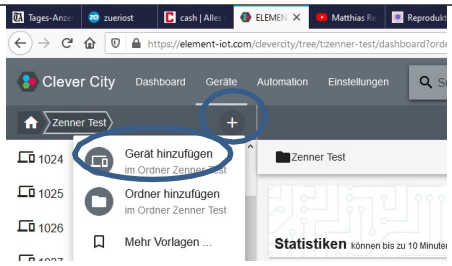
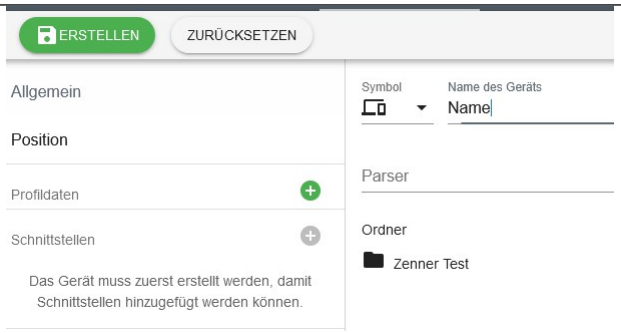
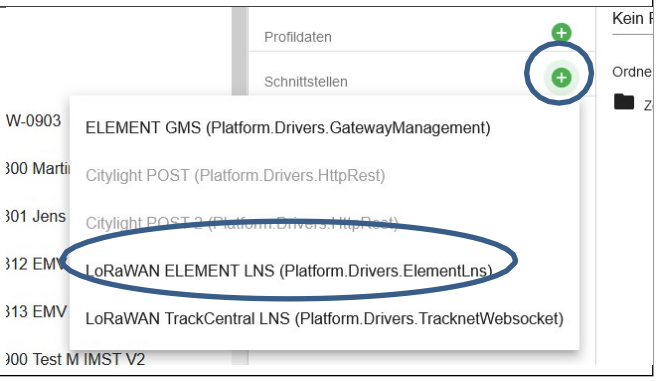
9 Network Server

9.1 Communication with ZENNER Connect (Element)

Device Overview



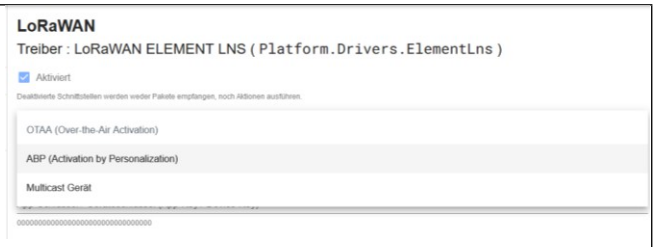
9.1.1 Add a new device

Integrate GreenBox (in Settings, press “+” and select “*Add* Device”)	
Enter the device name and press *“Create”*	
Press ‘+’ under Interface and select *LoRaWAN Element LNS*	

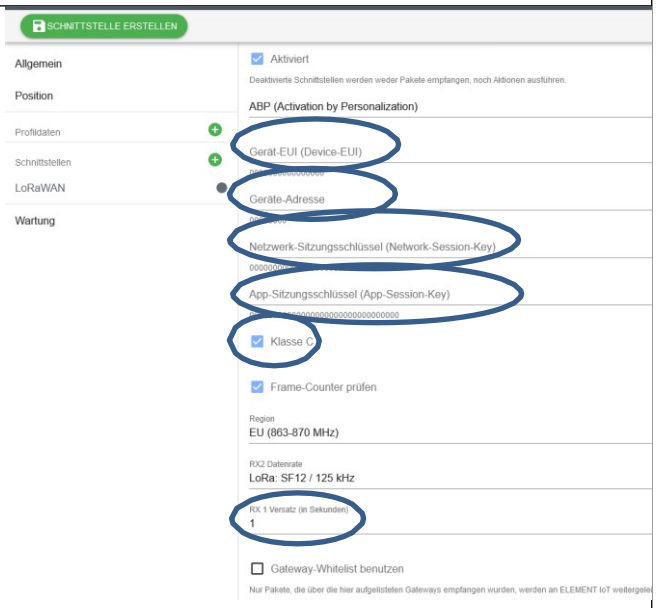
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Select ABP



Enter the data and save



Turn on Relay 1 for the device

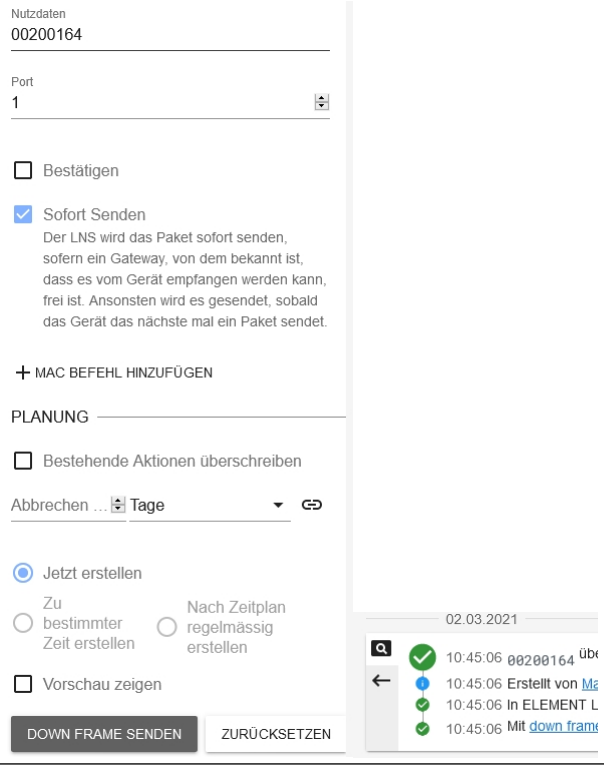
A downframe is created:



Communication (Packets)



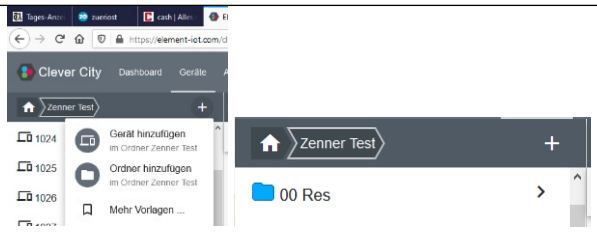
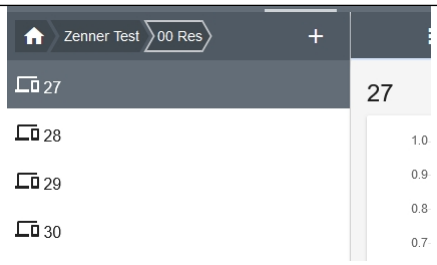
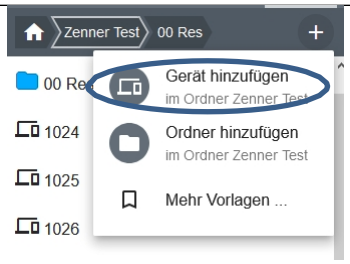
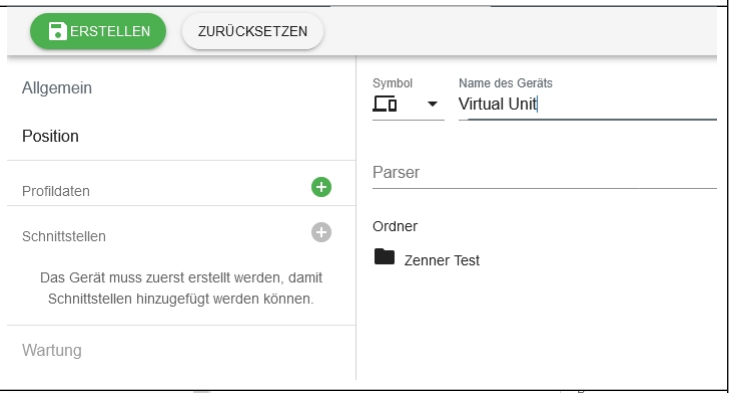
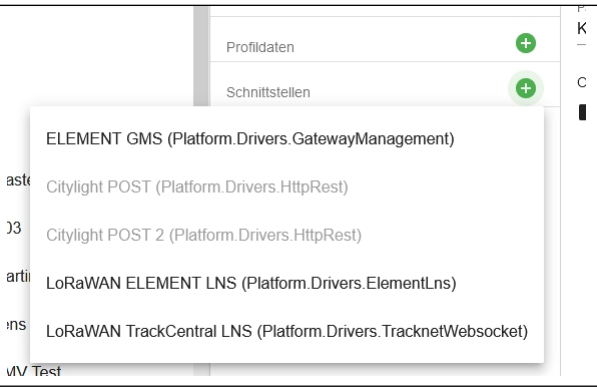
Select actions



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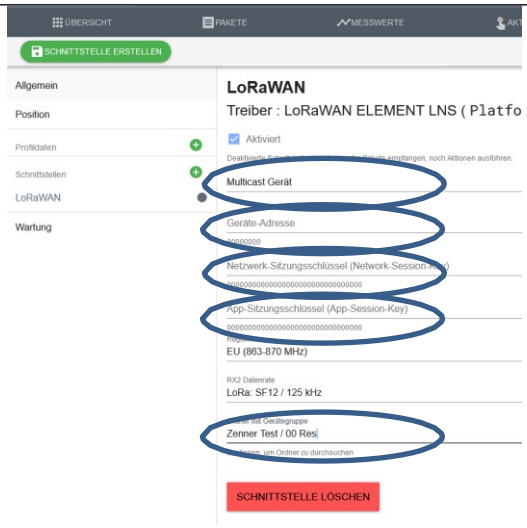
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9.1.2 Create a group with an element (Zenner)

Create a folder	
Open folder and add all devices; see *"Add New Device"*	
Create a virtual device	
Enter the group name and save	
Select the LoRaWAN Element LNS	

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Define multicast device (virtual device) - Device address - Key - Affected devices (folder) Note: For folders, enter the first letter; the corresponding selection will then appear	

9.1.3 GreenBox settings for group command

Connect the USB drive (the logical drive will appear in Explorer) Open Param.txt and adjust the values - Device address - Key Note: The data can be chosen freely but must match the input for the virtual device	--------- Broadcast ---------- 811 Broadcast 2 Name: Broadcast Name 812 DevID (ABP): 00 00 00 00 813 Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 814 App Session Key: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Enter subgroups - Who should be addressed (e.g., the first byte in the downframe determines who should respond: 1, 10 (0x0A)) -> Turn on Relay 1: **0A** 20 01 64 - Activate group command (status)	300 Group 001/010/000/000 (access group numbers) 301 Group Status 1 (0=off, 1=on)

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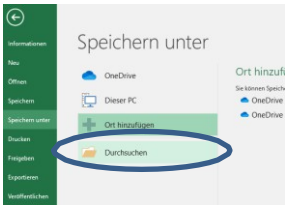
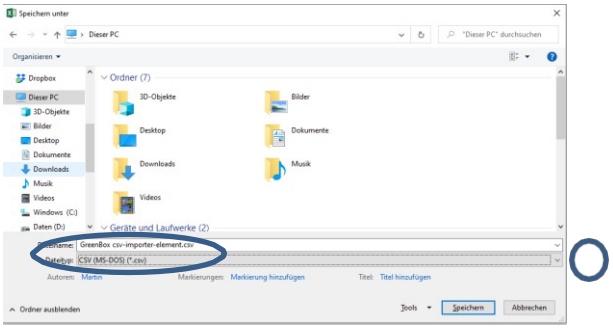
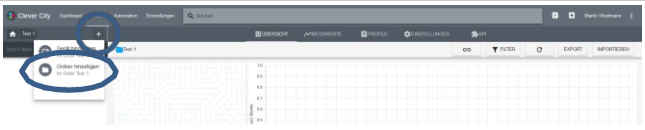
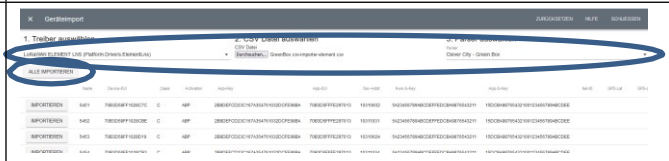
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9.1.4 Importing Devices (Zenner)

The header must be correct (1st row); the data starting from the 2nd row in Excel:

Name	Activation	Class	Device EUI	App Key	App EUI	Device Address	Nw-S-Key	App-S-Key	Net ID
5451	ABP	C	70 B3 D5 8F …	2B 8D EF CD 23 C1 67 A3 54 76 10 32 DC FE 98 BA	70B3D5FFFE297013	10310932	5A23456789…	15DCBA987…	
5452	ABP	C	70 B3 D5 8F …	2B 8D EF CD 23 C1 67 A3 54 76 10 32 DC FE 98 BA	70B3D5FFFE297013	10311031	5A23456789…	15DCBA987…	
5453	ABP	C	70 B3 D5 8F …	2B 8D EF CD 23 C1 67 A3 54 76 10 32 DC FE 98 BA	70B3D5FFFE297013	10310624	5A23456789…	15DCBA987…	
5454	ABP	C	70 B3 D5 8F …	2B 8D EF CD 23 C1 67 A3 54 76 10 32 DC FE 98 BA	70B3D5FFFE297013	10311034	5A23456789…	15DCBA987…	
5455	ABP	C	70 B3 D5 8F …	2B 8D EF CD 23 C1 67 A3 54 76 10 32 DC FE 98 BA	70B3D5FFFE297013	10311109	5A23456789…	15DCBA987…	

Name: any
Activation: ABP or OTAA
Class: C
Device EUI: Device EUI address (each device has its own address)
App Key: OTAA: Application Key (may be different for each device; security) App-EUI:
OTAA: Application EUI (application identification). Device-specific; all the same
Device-Addr: ABP: Device address; different for each device; can be freely chosen
Nw-S-Key: Network key; can be freely chosen for each device
App-S-Key: Application key; can be selected individually for each device

Export from Excel *File - Save As - …*	
- Select a file name - Set file type to **CSV** (MS-DOS) Then save	
Create a new folder - Select the + icon - Add folder	
Enter a name and save	
Select "Import"	
- Driver: LoRa Element LNS - CSV file: Select from directory - Parser (if available) GreenBox or similar The data is displayed in full and inserted correctly - Import All	 Green: imported Red: Error: Check data 

Note: Do not use special characters (they will not display correctly)

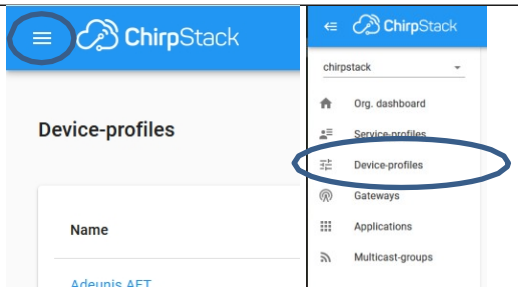
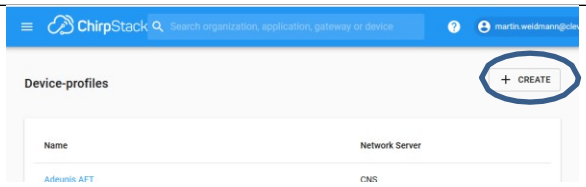
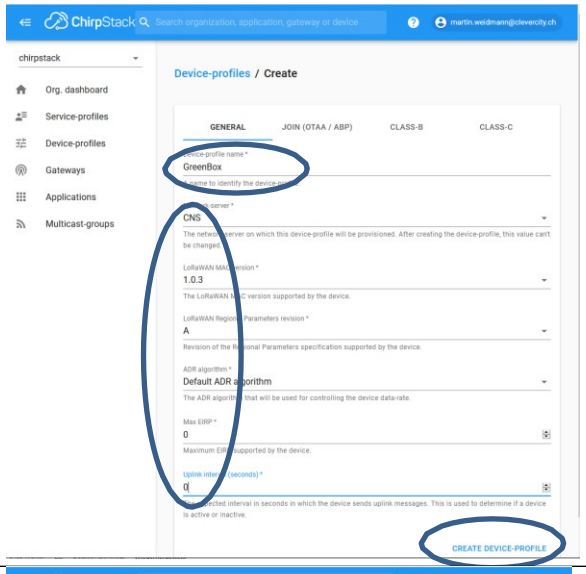
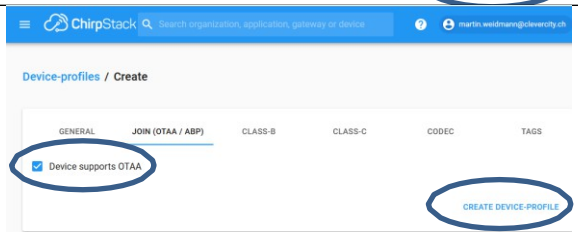
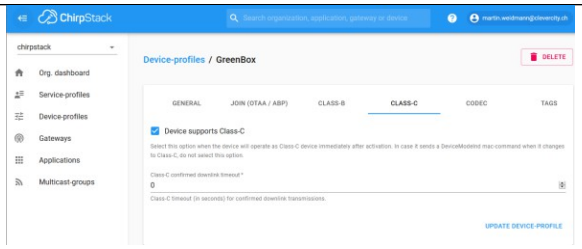
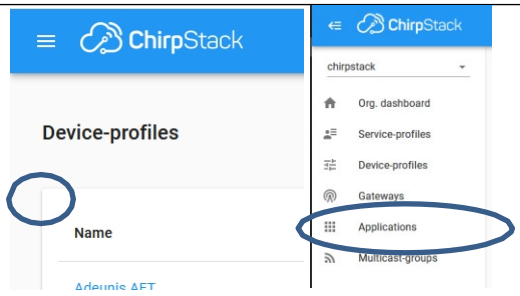
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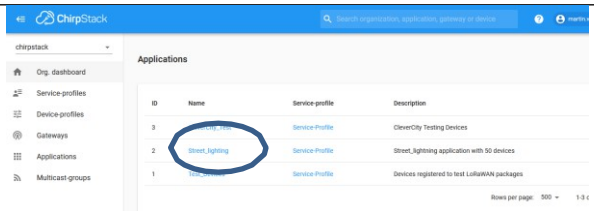
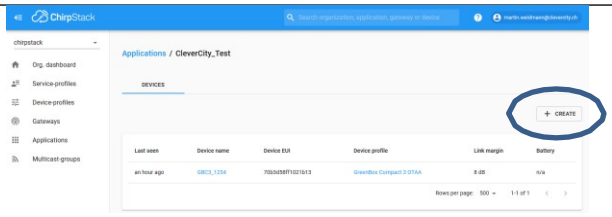
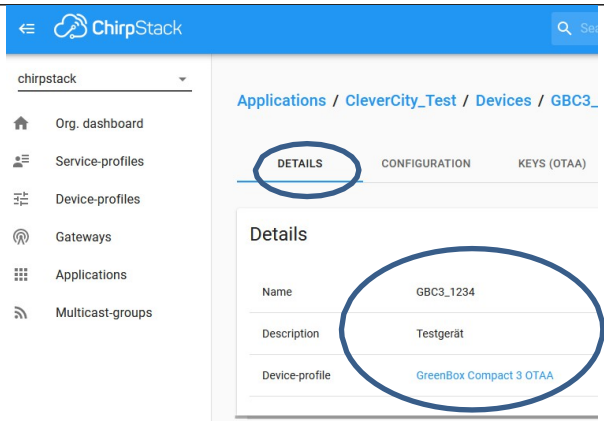
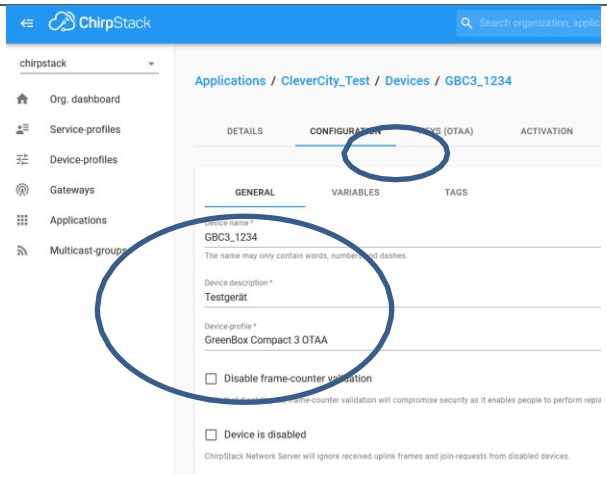
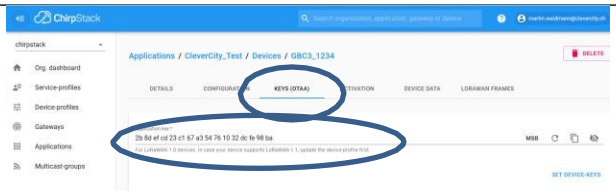
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9.2 Communication with ChirpStack

Device Profile	
Create a new device	
Device Data	
Select OTAA	
Class C	
Select Application	

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Select application	
Add a new device	
	
	
Enter OTAA Key	

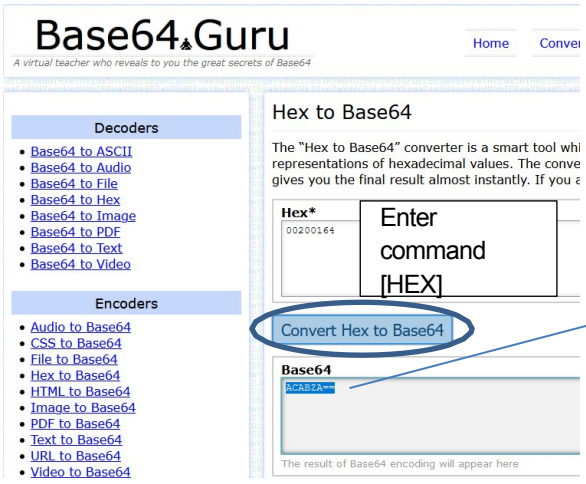
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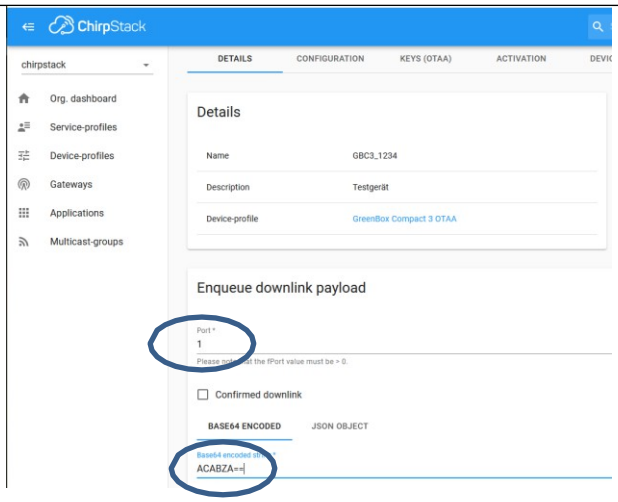
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9.2.1 Send downlink

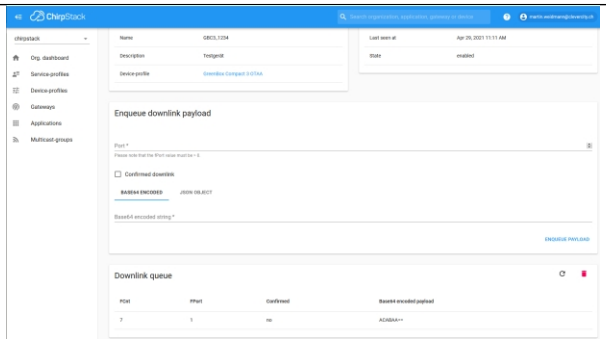
The lower window is only visible after the device has been registered.

https://base64.guru/converter/encode/hex





Transmission Check (Last Transmission)

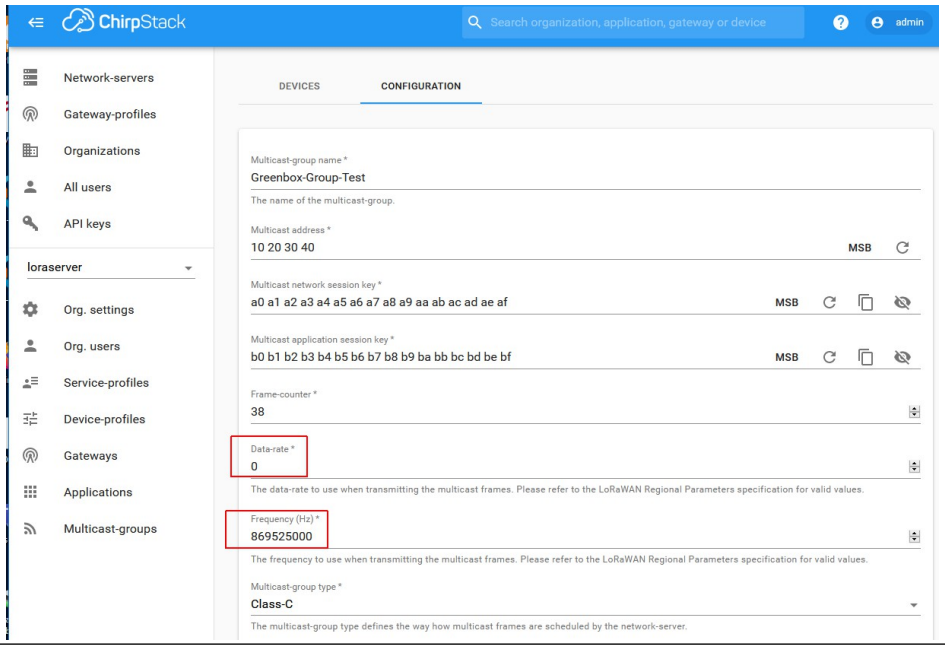
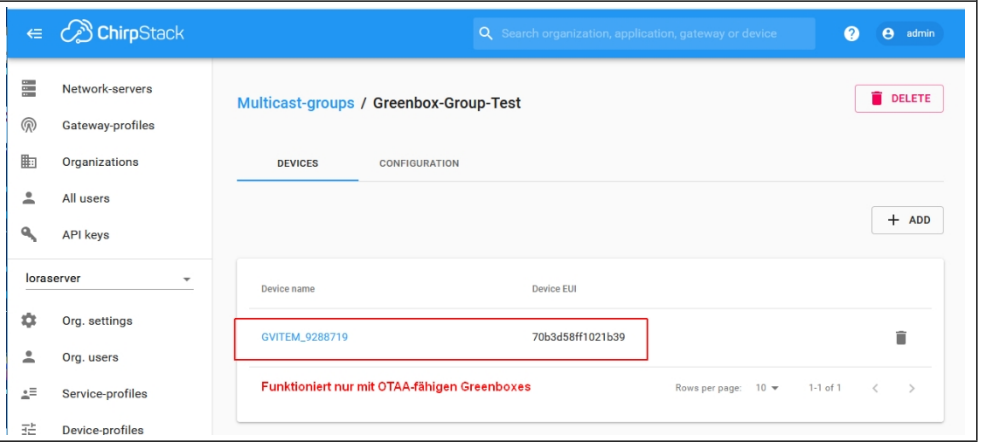


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9.2.2 Create groups

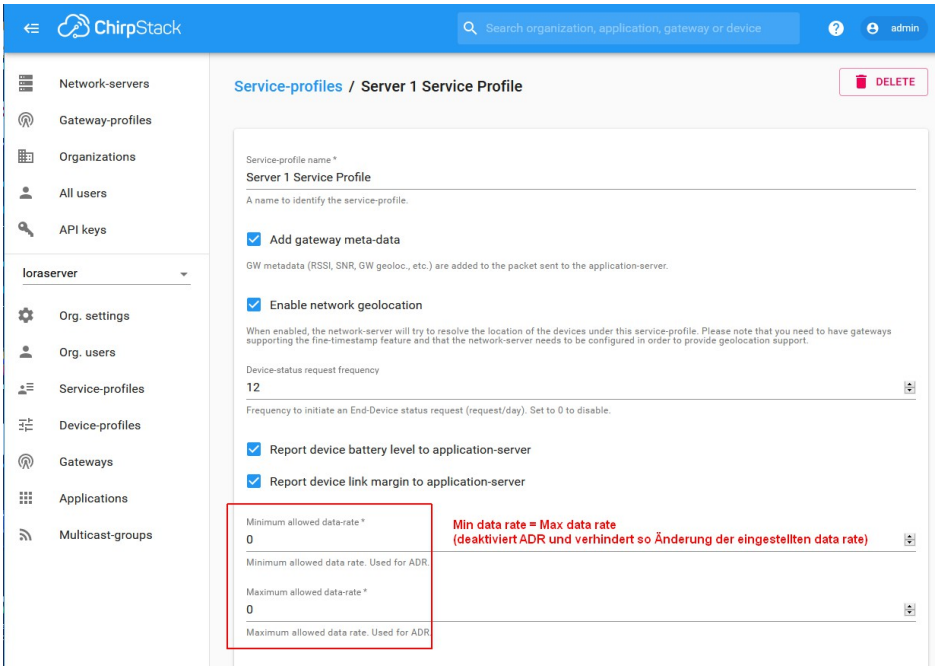
ChirpStack	Network Server	V3.9
	Application	V3.10

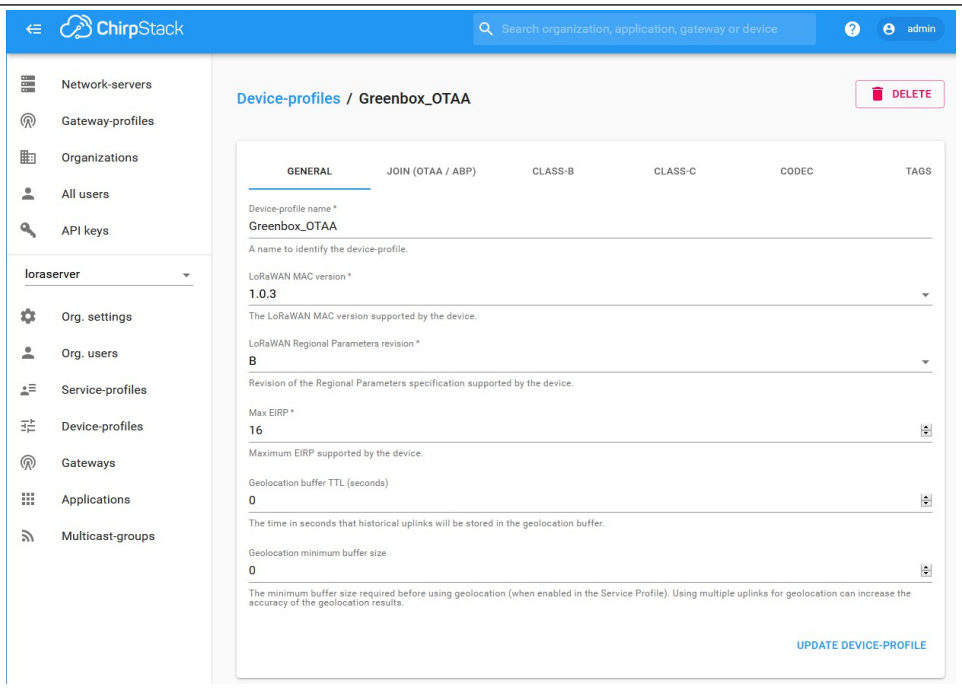
Create a new virtual device	
Select Device	

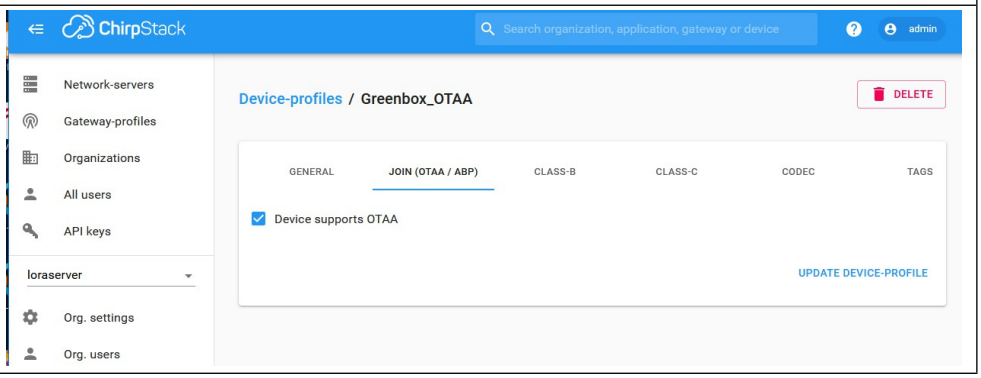
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Settings

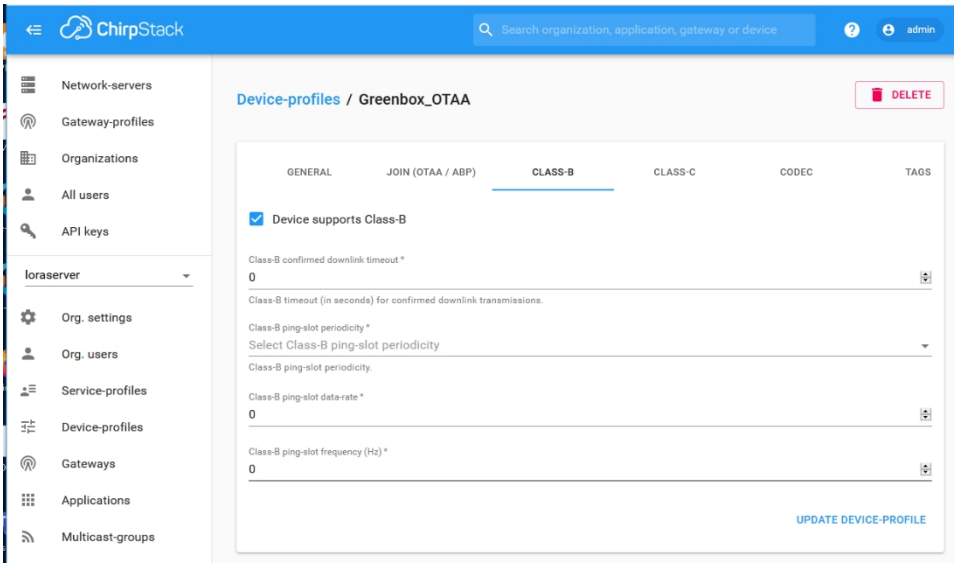


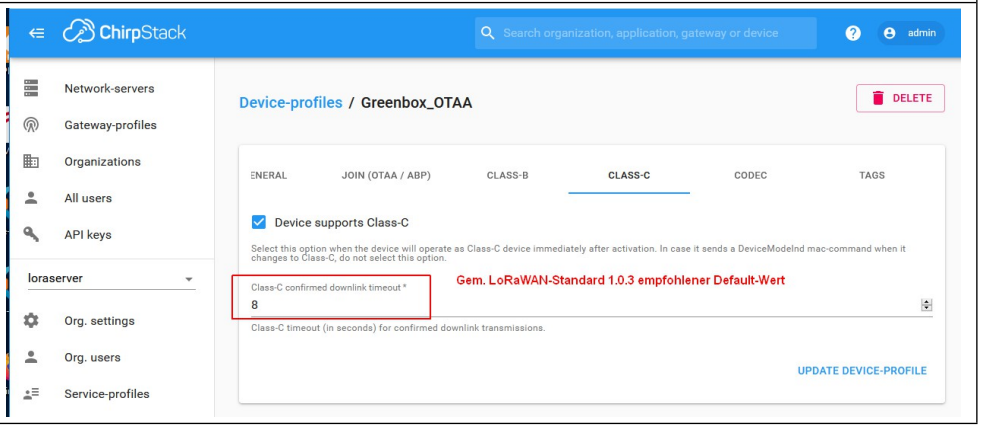




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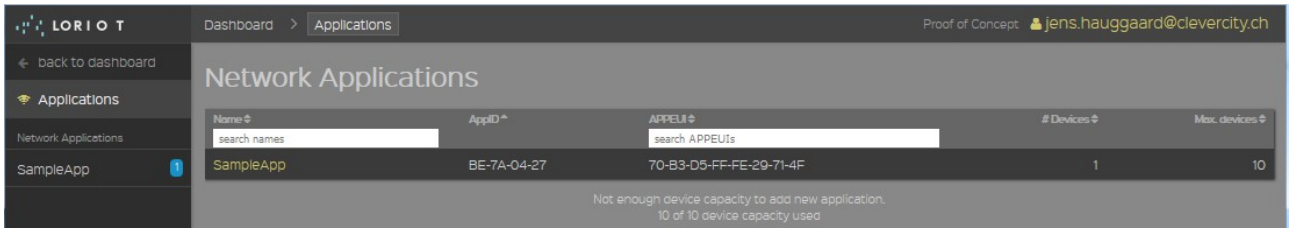


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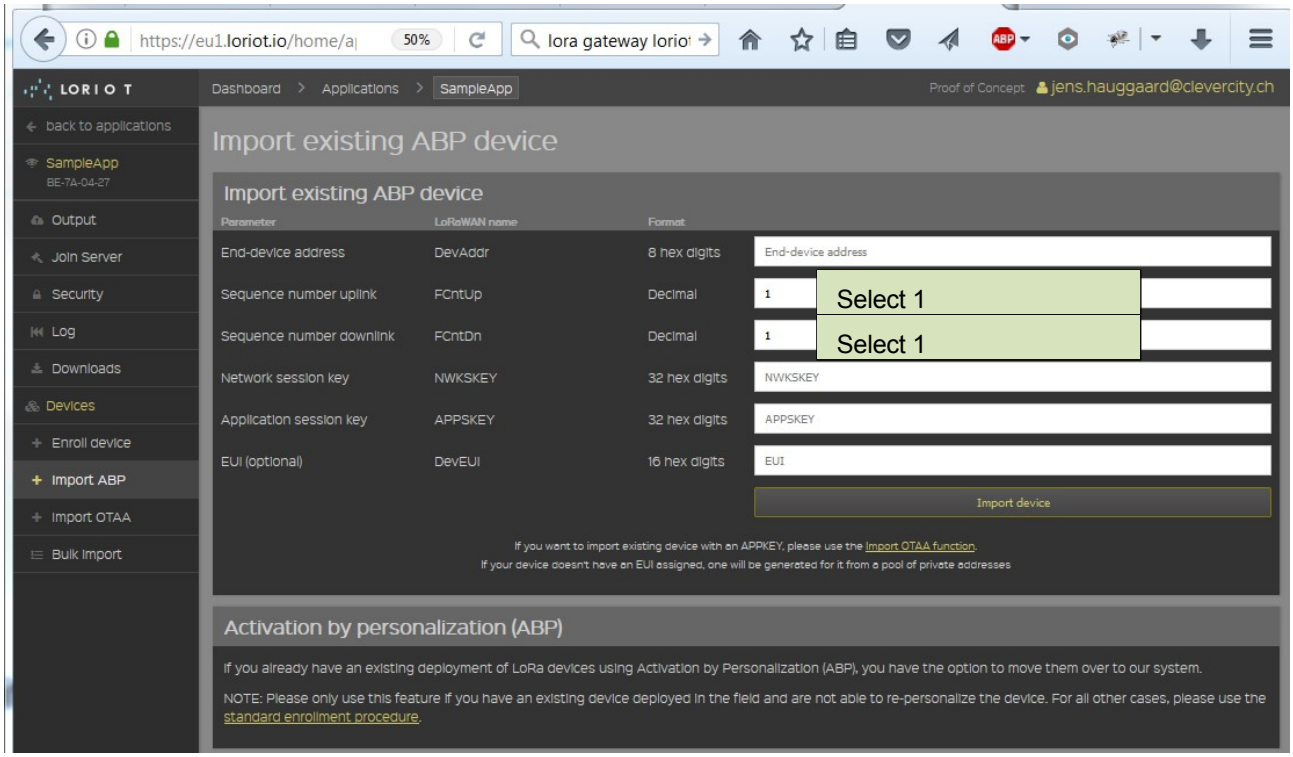
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9.3 Communication with Loriot

Device Overview



Integrate GreenBox

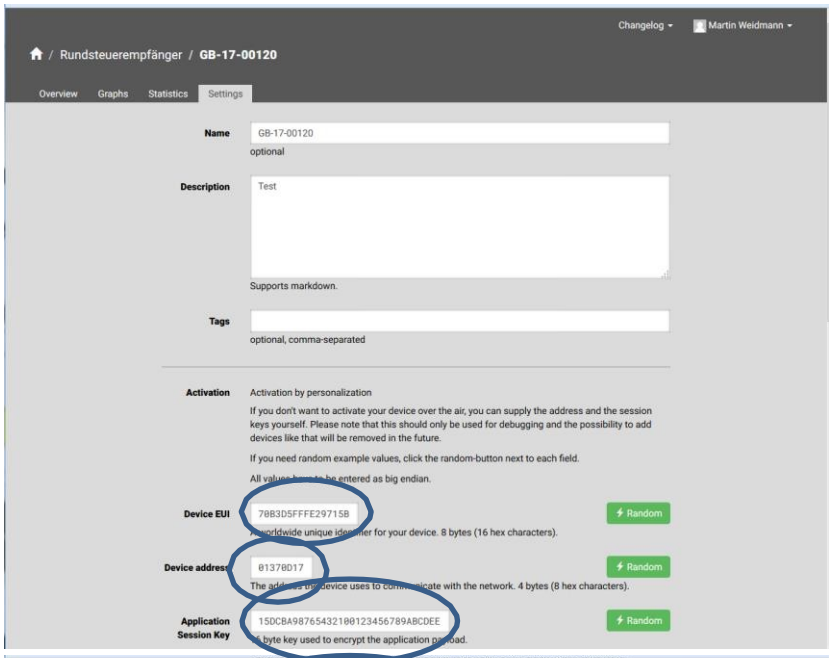


translated with DeepL
iot-shop

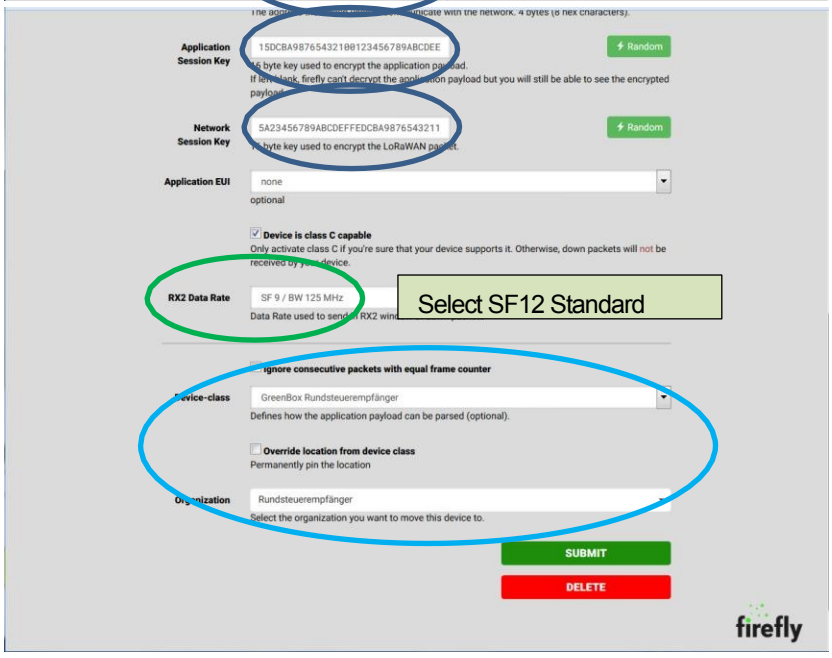
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9.4 Communication with DigiMondo FireFly

Integrate GreenBox



Import from table



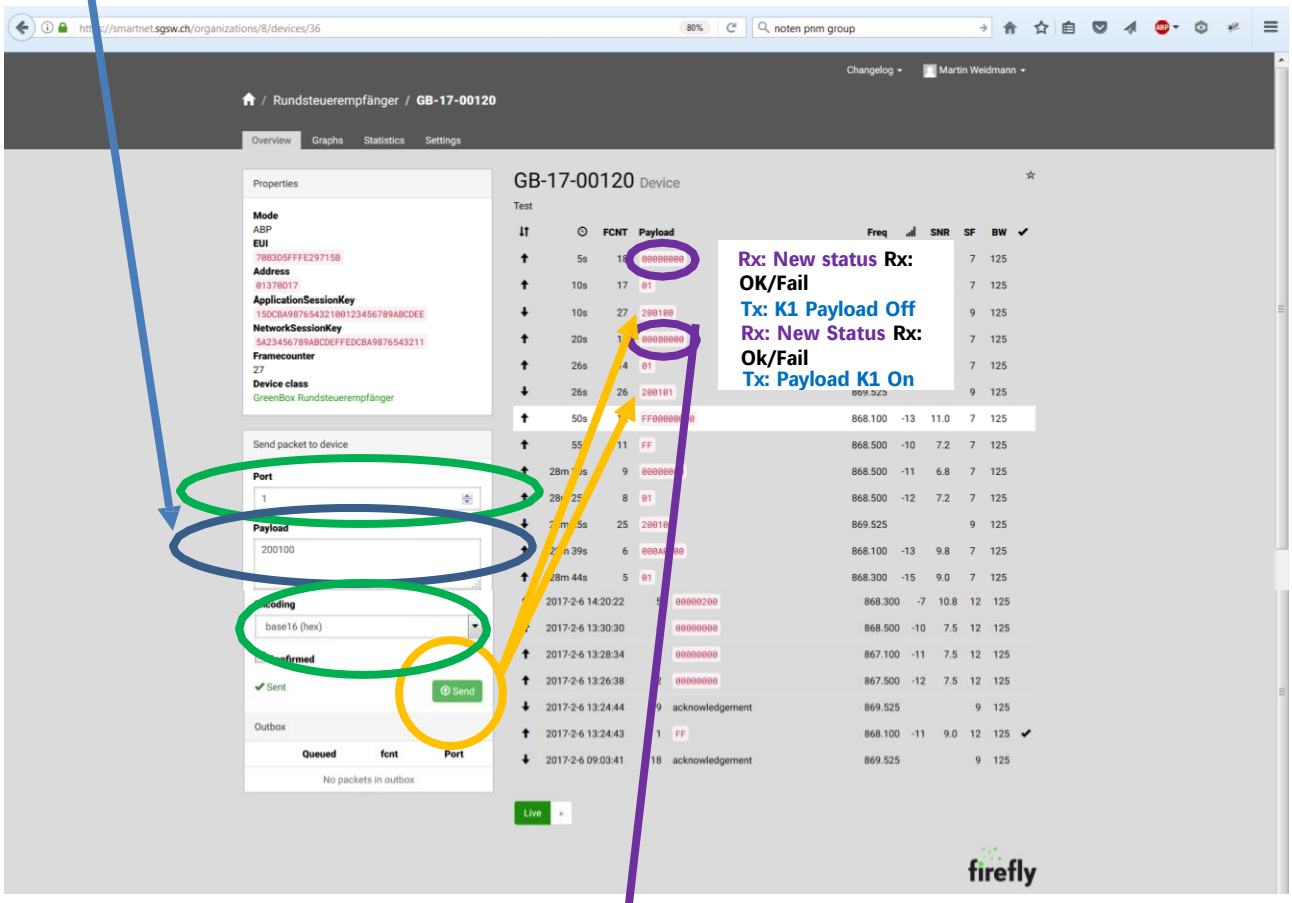
Must be defined

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Relay/Brightness Control: On-Off (0x20 - 3 bytes)

Command	Response	Note
20 0X HH	20 01/00	X: Channel 1/2/3 YYY: Time [min] 0–999 HH: Brightness [%] 0–99
00 20 01 64 00 20 01 00	20 01/00	Turn on K1 Turn off K1



Status, error message (0x00 - 5 bytes/sS - 10 characters)

Command	Response (immediate)	Comment
-	0x00 0xS1 0xS2 0xEe	SsSs: 2x Status: See table EE: Error: See table
	0x00 **0x08** 0x00 0x00 0x00 0x00 **0x00** 0x00 0x00 0x00	K1 on: Manual K1 off No error No error

Status

Rel On: Time	+0x01	+ 01	The values are Added:
Brightness	+0x02	+ 02	
Input	+0x04	+ 04	
Manual transmission	**+0x08**	+ 08	
	+0x10	+ 16	
	+0x20	+ 32	

For internal values, see table

Error

Lamp errors K1	+0x01	+ 01	The values are Added:
K2	+0x02	+ 02	
…	+0x..	+..	

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10 Update Firmware

Firmware update available only starting with SN 1000

10.1 Initialization after firmware update

setting.txt

1. Open file
2. Adjust Values/Old Files (*Params.txt* and *Settings.txt*)
3. Save and close
4. Wait about 1 minute
5. Remove the USB drive and reinsert it after about 30 seconds (all LEDs will light up briefly)
6. Save the files again (the flash memory is erased the first time)
7. Wait about 1 minute
8. Remove the USB drive and reinsert it after about 30 seconds (all LEDs will light up briefly)
9. Check the values in *Settings.txt* and *Params.txt*

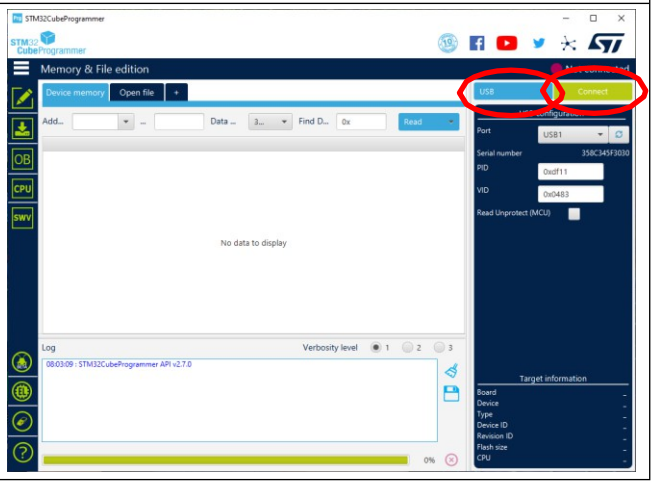
The communication parameters can be overwritten.

10.2 Update firmware (MX Cube Programmer) — detailed help

Read both text files and save them back to the device after the update.

ATTENTION: Both files must be saved a second time after powering off and then back on

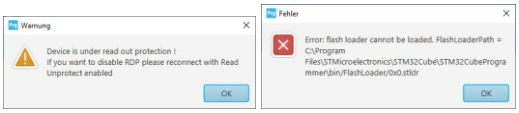
Install and launch https://www.st.com/en/development-tools/stm32cubeprog.html.

Hold down the button and plug in the USB cable (no power supply)	In some cases, the LEDs glow dimly
Start the program	
Interface: USB Do not select "Read unprotected"; press "Connect"	

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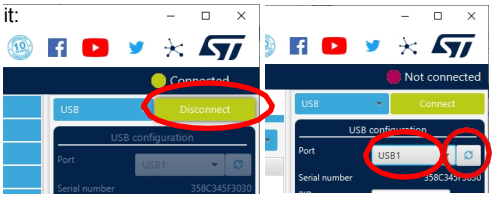
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For read-protected devices

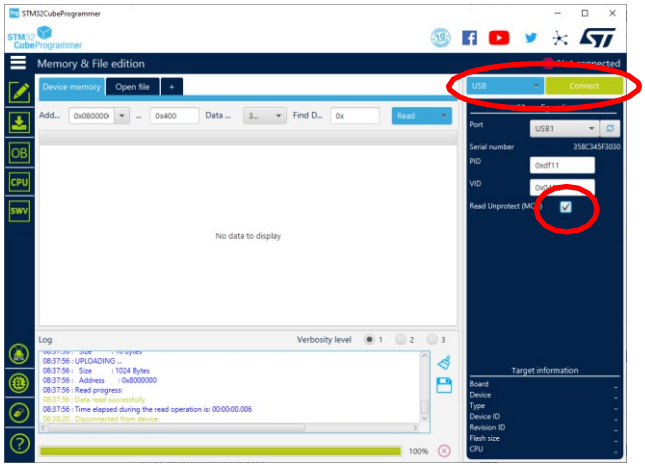


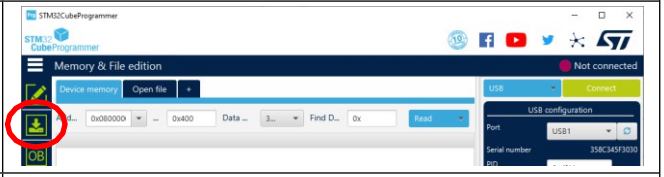
Repeat the process, **selecting *"Read Unprotected (MCU)"*** and wait until all LEDs have turned off.

Disconnect the device from USB and reconnect it:



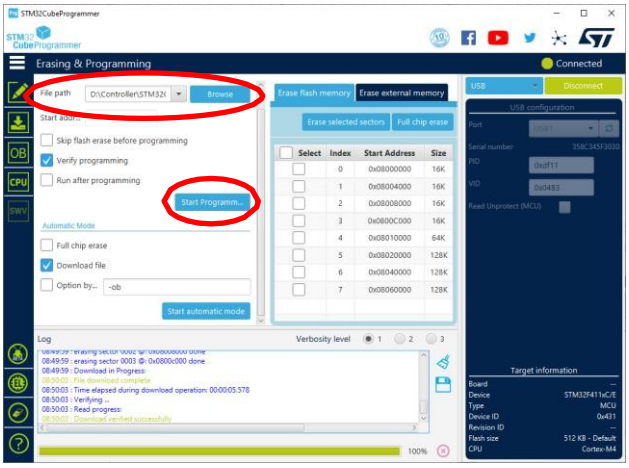
Do not select *"Read Unprotected (MCU)"*; press "Connect" (the flash drive is erased)





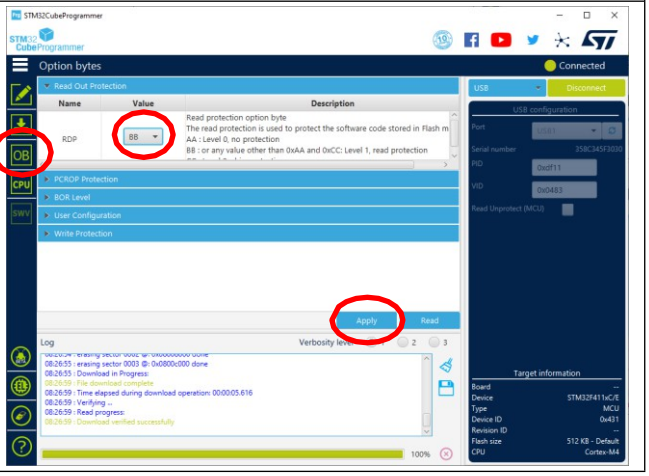
Load file

Press *Start Program*



Lock read access: RDP=BB (Level 1)

Confirm with Apply. Remove the device from USB…

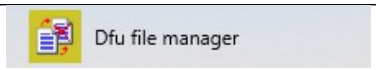
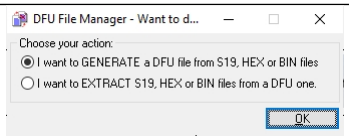
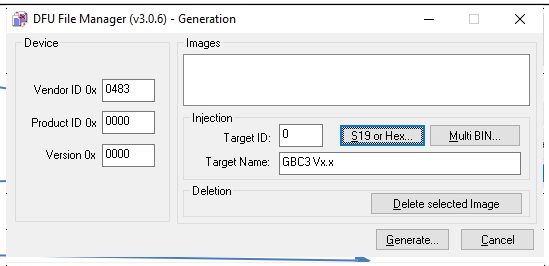
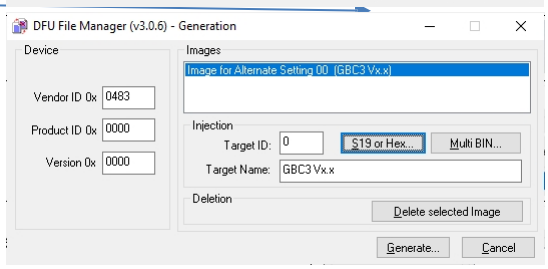
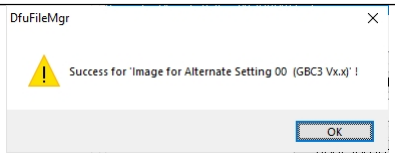


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10.3 Firmware update with DfUse

10.3.1 Create DFU file

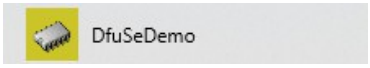
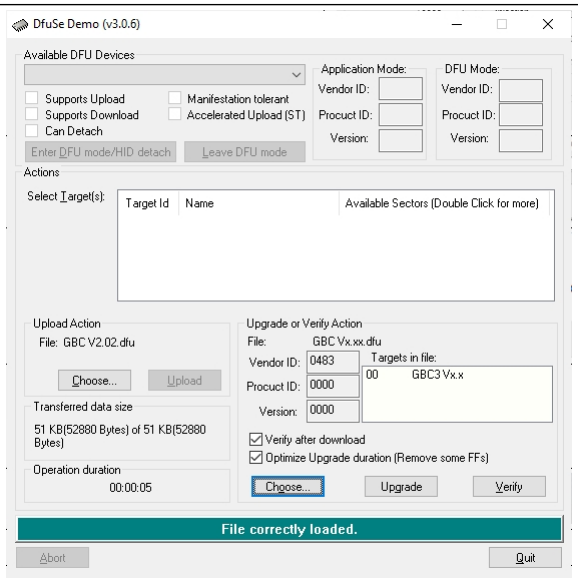
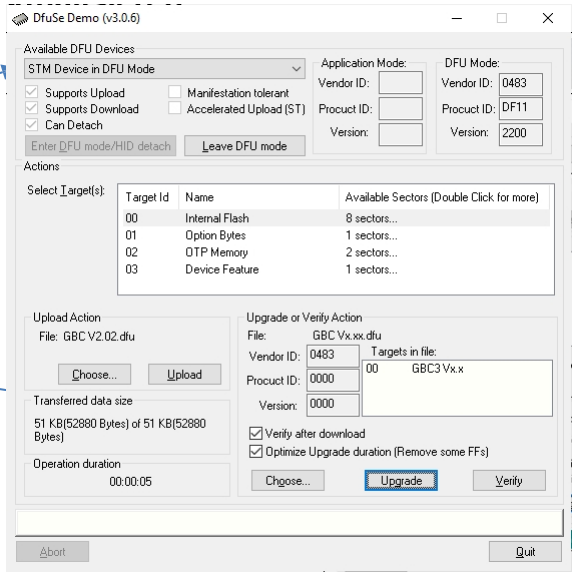
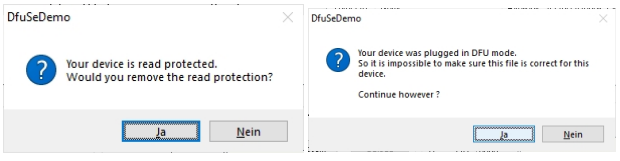
Start the program	
Create DFU file	
Select HEX file... Customize Target Name (overwrite) Generate (press the Device button)	 
Select save location and filename	
Message: File created	

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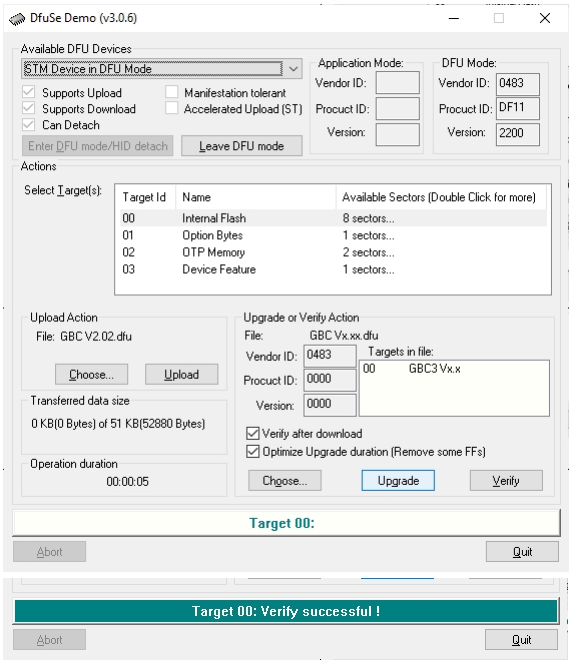
10.3.2 Update firmware (DfuSeDemo) – simple programming

Please read the original settings (copy setting.txt). These values will be deleted!

Start the program	
Click "Choose" to load the DFU file.	
Do not power the device (do not connect to the power source) **Hold down the button on the GBC and plug in the USB cable** (the LEDs remain off) "DFU Device" will now appear automatically Note: If no device is detected, the driver must be updated (update the DfuSe driver) Click “Verify” and “Optimize Up…”	
Upgrade Device locked: Unlock Remove the USB, press the button, and reinsert the USB	

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Press “Upgrade”	

ATTENTION: Initialization must be performed again

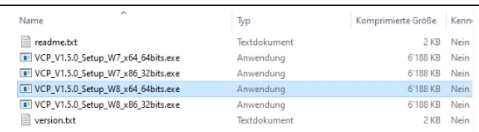
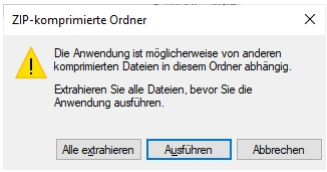
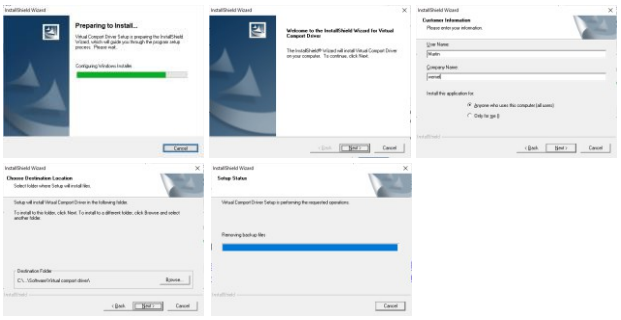
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10.3.3 Install the driver (Win7, Win8; not necessary for Win10)

https://www.st.com/en/development-tools/stsw-stm32102.html

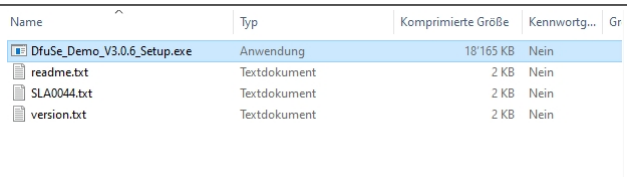
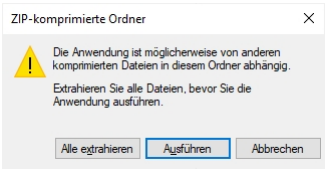
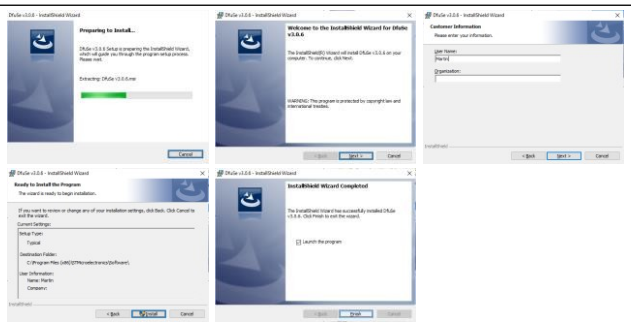
Installation:

Download the driver	
Run	
will be installed automatically	

10.3.4 Install software

https://my.st.com/content/my_st_com/en/products/development-tools/software-development-tools/stm32-software-development-tools/stm32-programmers/stsw-stm32080.html#

Installation:

Download software	
Double-click the application and run it	
Install the software - Enter your name	

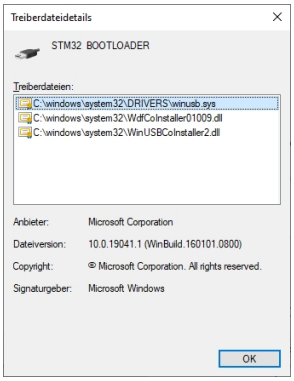
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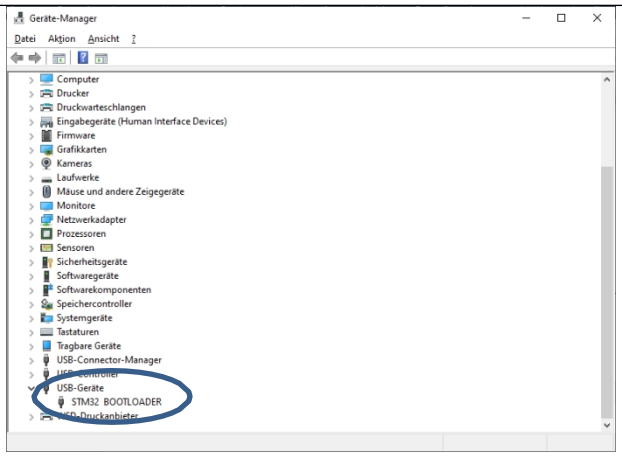
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10.3.5 Update DfuSe driver (Windows 10)

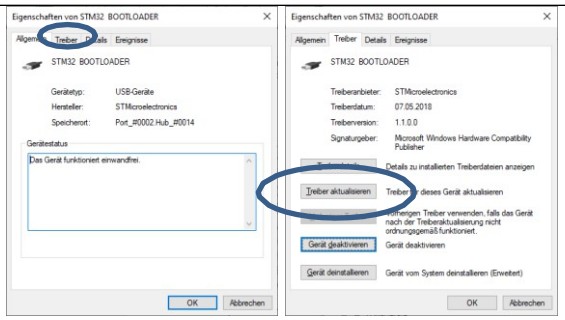
Check the current driver; open Device Manager

Note: Microsoft driver not working Driver signature:





Uninstall the current driver

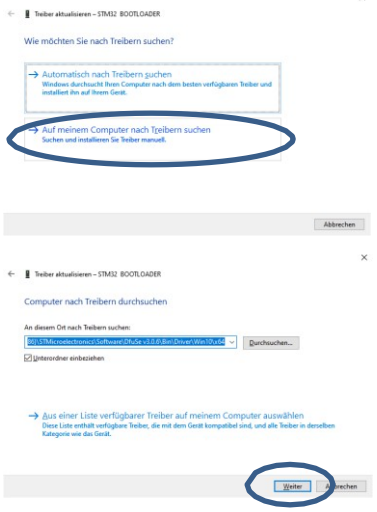


Download the driver from ST Micro (32-bit or 64-bit)

If this does not work:



In Windows, allow the *drivers without a validity rule*, then reconfigure them.



The driver is now updated…

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If your device is not recognized by the DFUse utility as "STM Device in DFU Mode," you must do the following:

1. Open Device Manager and search for a device called "STM32 Bootloader"
2. Right-click the device and select "Update driver," then choose "Browse my computer for drivers"
3. Select the following directory: "C:\Program Files (x86)\STMicroelectronics\Software\DfuSe v3.0.6\Bin\Driver"
   !!! DO NOT GO DEEPER !!!
4. Make sure "Include subfolders" is checked
5. Click Next and check to see if a new device named "STM Device in DFU Mode" appears and the driver is installed correctly….
6. You should now see a device named "STM Device in DFU Mode" in the DfuSe utility
   ---
7. If you do not see the mentioned device, repeat steps 1–4 and click "Let me pick from a list of available drivers on my computer"
8. Select the device “STM Device in DFU Mode” and click Next
9. You should now see a device in the DfuSe Utility.

11 Troubleshooting

Topic	Possible Cause	Solution	Notes
LEDs are blinking or dim	USB voltage too low	Use a powered USB hub	
No data via USB	USB-C charging cable without communication	Use a data cable	
	PC does not recognize external drives (security)	Request authorization from the IT department or use a different device	
No communication	LoRa SF selection	SF Blocked on the network server	By default, the spread factor for Rx2 is configured to SF12, as defined in the LoRa specification (Regional Parameter Document). However, the LNS could change this setting itself (using MAC commands or the Join Ac- accept)

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