



September 24, 2019

GNSS LEA-6T and LEA-M8T in iSync devices

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# Introduction

Current situation (2019):

#### **GNSS** integrated

The GNSS u-Blox LEA-M8T is hardware integrated in the following iSync product:

• GXClok-500

The GNSS u-Blox LEA-6T is integrated as mezzanine in the following iSync products:

- LNRClok-1500, can be integrated
- GRClok-1500, is always integrated
- GNSSource-2500. (GRClok-1500 inside)

### **GNSS on GDK-2**

The GNSS u-Blox LEA-6T is integrated in the following iSync products:

- GDK-2
- GPSReference 2000. (GDK-2 inside)
- GPS PicoReference. (GDK-2 inside)

The communication with the GNSS of these products is special. See Application Note "GNSS and GDK-2".

### Communication scheme between user, iSync and GNSS



Figure 1

(iSync means GXClok-500, LNRClok-1500 or GRClok-1500)

Usually the User communicates to the iSync with no access to the GNSS.

With the debugging command "@@@@GPS", a direct link can be established to the GNSS.

In such situation the iSync device doesn't listen to the user.

To cancel this direct link, send "@@@@".

# Configuration of the GNSS with the iSyncMgr

Recent iSyncMgr's have a GNSS configuration module that take advantage of the debugging commands @@@@GPS and @@@@ to configure the GNSS. iSyncMgr\_GXClok\_2018-03-16.exe is taken to illustrate the following description.

To launch the GNSS configuration, choose "Configure GNSS" on the Menu.

🎇 iSync GXClockUpDate_2018-03-16. Special LEA-xxT. Device: GXClock 🗙 🛛 🗌 🗌								
File Comma	nd Timing+Tracking	Serial Port	Update	Configure LEA-M8T	About			
Identification:	SPTSX0-002/00/2.10	2017-06-19						
Serial number:	G01367							
Status:	3	Refresh						

Figure 2

#### **Default configuration**

Configure LEA-M8T		– 🗆 X
LEA-M8T-0-10 (2017) Standard (GPS, Galileo, Gionass, QZSS) GPS only (LEA-6T like) BeiDou oriented (GPS, Galileo, BeiDou) Extension	Expected: EXT CORE 3.01 (111141) 00080000 ROM BASE 2.01 (75331) PWVER-TIM 1.10 PROTVER-22.00 MOD-LEA-M8T-0 FIS=0xEF4015 (100111) GPS.GLO.GAL.BDS SBAS.JMES.QZSS 01 20 ASCII #4G20xÿÿÿ+IIIEAI swVERSION ? PASS Extension ? PASS Extension ? PASS Steps: 1 Warnings: 0 Test iSync (2) Test u-4 (3) CONTI Stop Save Back Stop GNSS	Device: EXT CORE 3.01 (111141) 000880000 ROM BASE 2.01 (75331) FWVER-TIM 1.10 PROTVER=22.00 MOD=LEA-M8T-0 FIS=-0xEF4015 (100111) GPS.GLO.GAL.BDS SBAS.JMES.QZSS Blox / Start NUE STEP Repeat on Warning ▼ Stop on Error in flash to iSync on Return Start GNSS Return

Figure 3

If everything goes normal, the window should look like on Figure 3.

- If there is no data under "Device:", click more time on (2) "Test u-Blox/Start"
- It is heavily recommended that the 3 tests, sw VERSION, hw VERSION, Extension, pass. If not, contact SpectraTime.
- After clicking on (3) "CONTINUE", sometime later, the configuration should end with "0 Error"

#### Specific configuration

A more specific configuration can be chosen:

- Click on (1) "Test iSync" and then choose another configuration.
- Then click on (2) and (3)

## Getting more information from GNSS receiver

The GXClock has a reduced set of standard NMEA messages limited to \$GPZDA and \$GPRMC. It is possible to take profit of the rich messaging system of the LEA-xT by sending them out through the micro-Controller.

Terminal			×
	Send @@@@GPS	Sended:	
Received:			
		Re	turn

Figure 4

To initiate the link between the internal GPS port and the external serial port, send the debug command "@@@@GPS" from the "Terminal" window of an iSync Manager program. Immediately after the setting of the link, strange characters may be displayed in the "Received" box. It is binary from the GPS. To continue, close the "Terminal" window as well the iSync Manager program.

With the u-center program from U-Blox it is now possible to control the GNSS LEA-xT.



Figure 5

First, connect the right serial port with the corresponding icon or from the menu Receiver/Port. Then open the Message window with the short key F9 and make it big. The messages needed by the iSync for stationary timing are highlighted. With the help of the U-Blox documentation, it is now possible to cancel messages, make other messages active or fully change the LEA-6T configuration.

Important notes:

- The changes made "on the fly" are not saved in eeprom. By power down / Power ON the iSync, the old configuration comes back. But there is a way to save the current configuration in eeprom. (CFG/CFG). SpectraTime is not responsible of malfunction due to changes in the GPS configuration.
- With the standard configuration, the iSync will go in holdover, if it was in tracking, after the setting of the direct link to the GNSS. In fact the messages are no more decoded by the iSync in such situation. But it is possible to consider the GPS just as a "PPSREF generator" and to configure the iSync accordingly, see the Chapter: Tracking the internal GNSS while in communication with it.

To break the direct link to the GPS, run the iSync Manager, window "Terminal" and send "@@@@".

## Tracking the internal GPS while in communication with it.

It is possible to track the PPSREF of the internal GPS while staying in communication with it.:



To activate this option at power ON, cancel MAv parameter 0x22, bit 0. In such situation, it is also recommended to avoid any regular message from iSync by cancelling MAv parameters 0x0B and 0x0C.

# **Choosing the GNSS constellation**

This Chapter is not applicable to the LEA-6T.

The LEA-M8T is able to decode position information from different constellations. One or a mix of constellations can be chosen with u-center. From message window, activate UBX-CFG-GNSS.

## Standard configuration

- CFG (Config)  ANT (Antenna Settings)	UBX - CFG (Config) - GNSS (GNSS Config)	1
ANI (Antenna Settings)     BATCH (Batch mode output)     CFG (Configuration)     DAT (Datum)     DOSC (Disciplined Oscillator)     DOSC (Disciplined Oscillator)     DYNSEED (Dynamic Seed)     EKF (EKF Settings)     ESFGWT (Gyro+Wheeltick)     ESRC (External Source Config     FIXSEED (Fixed Seed)     EXX (Fix Now Mode)     GEOFENCE (Geofence Config     GNSS (GNSS Config)	Channels         ID       GNSS       Configure       Enable       min       max       Signals         0       GPS       IV       IV       8       16       IV       L1C/A         1       SBAS       IV       I       13       IV       L1C/A         2       Galileo       IV       IV       4       8       IV       E1         3       BeiDou       IV       IV       8       16       IV       B1         4       IMES       IV       IO       8       IV       L1C/A         5       QZSS       IV       IV       0       3       IV       L1S         6       GLONASS       IV       IV       8       14       IVIOF         7       IRNSS       INS       INS       INS       INS       INS	
HNR (High Nav Rate)     INF (Inf Messages)     ITFM (Jamming/Interference     LOGFILTER (Log Settings)     MSG (Messages)     NAV5 (Mavigation 5)     NAV5 (Navigation Expert 5)     NMEA (NMEA Protocol)	Number of channels available 32 Number of channels to use 32 Auto set For specific SBAS configuration use	

In this configuration, the 3 main constellations, GPS, Glonass and Galileo are activated. This configuration is settled by default in SpectraTime.

Figure 7

### **US GPS oriented configuration**

The US GPS being the basis constellation of this receiver, it is in fact currently (2018) safer to work with this constellation only:

- Strong signal with a multitude of space vehicles
- No problem of time mitigation
- The built in jamming indicator is not working if another constellation is active

🥵 Messages - UBX - CFG (Config) - GNS	S (GNSS	Config)						[	- 9	×
CFG (Config)	UBX - CFG (Config) - GNSS (GNSS Config)									
ANT (Antenna Settings)		(								_
BATCH (Batch mode output)					Channe	əls				
CFG (Configuration)	ID	GNSS	Configure	Enable	min	max	Signals			
DAT (Datum)	0	GPS	- -		8	16				
DGNSS (Differential GNSS coi	-	CDAC			1	2				
DOSC (Disciplined Oscillator)	1	3683				10	IN LIU/A			
DYNSEED (Dynamic Seed)	2	Galileo	✓		4	8	✓ E1			
EKF (EKF Settings)	3	BeiDou			8	16	🔽 B1			
ESFGWT (Gyro+Wheeltick)	4	IMES	<b>V</b>		0	8				
ESRC (External Source Config	E	0766			0	2		E Lite		
FIXSEED (Fixed Seed)	5	QZ33		_				LIS		
FXN (Fix Now Mode)	6	GLONASS	✓		8	14	✓ L10F			
GEOFENCE (Geofence Config	7	IRNSS								
GNSS (GNSS Config)										
HNR (High Nav Rate)	Number	of channels	available		22					
INF (Inf Messages)	Number	Number or channels available [32								
ITFM (Jamming/Interference	Number	Number of channels to use 32 🗖 Auto set								
LOGFILTER (Log Settings)										
MSG (Messages)	For spec	cific SBAS co	onfiguration u	se						
NAV5 (Navigation 5)			-							
NAVX5 (Navigation Expert 5)										~
i i NMEA (NMEA Protocol)	<									>
					_		_			
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#### Asian customer configuration

This configuration, which includes Beidou, is for user located in Asia.

CFG (Config)	UBX - CF	UBX - CFG (Config) - GNSS (GNSS Config)							^
	ID 0 1 2 3 4 5 6 7	GNSS GPS SBAS Galileo BeiDou IMES QZSS GLONASS IRNSS	Configure V V V V V V	Enable	Channe min 8 1 4 8 0 0 8	els max 16 3 16 16 8 3 3 14	Signals	s	
INF (Inf Messages) ITFM (Jamming/Interference LOGFILTER (Log Settings) MSG (Messages) NAV5 (Navigation 5)	Number of channels available 32 Number of channels to use 32 Auto set For specific SBAS configuration use								
NAVX5 (Navigation Expert 5)     NMEA (NMEA Protocol)	< 🛛			_	_		_	>	¥



# Testing the GPS jamming

If the iSync is placed near RF emitting devices, it can be helpful to see how the embedded GNSS receiver is jammed. The LEA-6T and LEA-M8T have useful tools to make some tests.

- First initiate a direct link to the GPS, with the debugging command "@@@@GPS", See Chapter before.
- Currently (2018), the jamming indicator works fine only if the constellation US GPS is selected alone. See the Chapter "Choosing the GNSS constellation".

Messages enabling the jamming indicator must be eventually activated, depending on how the LEA-xT is configurated :

- From UBX / NAV / SVINFO, activate the SV level indication. Right click / Enable message.
- From UBX / MON / HW, activate the jamming indication. Right click / Enable message



In SpectraTime we have 3 criteria to evaluate the jamming:

- 1. Regarding the signal level, it must be said that our GNSS antenna is not well located. Therefore we estimate that 1 SV with signal strength over 50 dBHz and 3 SV over 48 dBHz is a really good situation.
- 2. The "Jamming Status" is the most important criteria. It must be "Green, OK".
- 3. The "CW Jamming Indicator" is always under 4% in a not jamming situation. Values up to 10% are acceptable as long the "Jamming Status" is staying "Green, OK".