Sirius RTK GNSS Rover (F9P)

Compact & high-precision L1/L2 GNSS Rover based on U-blox ZED-F9P (GPS / GLONASS / BeiDou / Galileo)

Datasheet - In Production

Features

- 5V - 75mA power supply
- L1/L2 30dbi active antenna
- Optional RM3100 magnetometer
- LEDs status : Timepulse/Power/RTK
- Timepulse & External Interrupt
- USB/I²C/SPI/UART digital interfaces

Applications

- Drones
- Ground vehicles
- Precise navigation
- Automation of moving machinery

Description

The Sirius Rover F9P is an affordable compact and high precision L1/L2 GNSS RTK (Real Time Kinematic) device.

Based on the last generation of GNSS U-blox ZED-F9P modules, the Sirius F9P Rover offers reliable and fast convergence time to provide centimeter accuracy within seconds.

The device allows concurrent reception of GPS / GLONASS / BeiDou & Galileo to improve signal availability.

The optional embedded high precision RM3100 geomagnetic sensor allows the device to perform reliable magnetic field readings.

The JST-GH connectors make them perfect to be connected to a Pixhawk3Pro or any other autopilots.

The Sirius Rover F9P & Nylon PA12 case are guaranteed to operate over a temperature range of -20°C to +70°C.

Table 1. Device summary

Order ref code	Temperature range [°C]	Product size [mm]
0911A	-20 to +70	74.0 x 74.0 x 22.0

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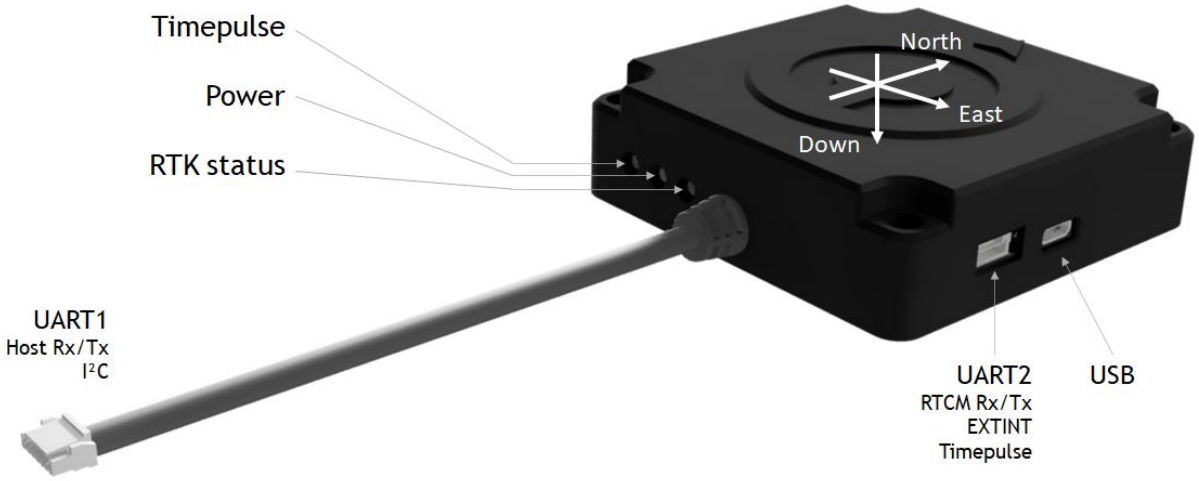
1. Block diagram and pin description

1.1 Block diagram

Figure 1. Sirius F9P Rover connectivity diagram & magnetometer orientation



1.2 LED description

Table 2. Sirius F9P Rover LED sequence status

LED name	Color	Light sequence	Comment
Timepulse	Green		Blinking LED when RTK fix is available
Power	Blue	● ● ● ●	Solid blue LED when powered ON
RTK status	Green	○ ○ ○ ○	3D fix mode / No RTK fix
		● ○ ● ○	RTK fix but no FIXED RTK fix
		● ● ● ●	FIXED RTK fix

1.3 Pin description

Figure 2. Sirius F9P Rover pinout

Table 3. Pinout configuration

	Pin	Name	Type	Function
UART 1	A1	GND	P	Ground reference
	A2	I2C SDA	I/O	I2C data
	A3	I2C SCL	I	I2C clock
	A4	UART1 TX	I/O	UART1 transmit
	A5	UART1 RX	I/O	UART1 receive
	A6	5V IN	P	5V input
UART 2	B1	5V IN	P	5V input
	B2	UART2 TX	I/O	UART2 transmit NMEA/RTCM data
	B3	UART2 RX	I/O	UART2 receive NMEA/RTCM data
	B4	EXTINT	O	External interrupt
	B5	TIMEPULSE	O	External interrupt based on Timepulse
	B6	GND	P	Ground reference

P : Power / I : Input / O : Output

2. Specifications

@Vdd = 5V, T = 25°C unless otherwise noted

Table 4. Sirius F9P Rover mechanical and electrical specifications

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Vusb	USB supply voltage		4.5	5.0	5.5	V
Vdd	Internal supply voltage			3.3		V
Vdd_IO	Supply voltage for I/O			3.3		V
Idd	Current consumption	with active antenna		130		mA
Vil	IO pin low level input voltage		0		0.8	V
Vih	IO pin high level input voltage		2		Vdd+ 0.3	V
Vol	IO pin low level output voltage	Iol = 2mA			0.4	V
Voh	IO pin high level output voltage	Ioh = 2mA	Vdd- 0.4			V
W	Weight			130		g
Top	Operating temperature		-20		+70	°C

Table 5. Sirius F9P Rover general performance

Parameter	Specifications	Value
Receiver type	Multi-band GNSS high precision	
Accuracy of Timepulse	RMS 99%	30 ns 60 ns
Frequency of Timepulse		0.25 Hz to 10 MHz
Operational limits	Dynamics Altitude Velocity	< 4g 50,000 m 500 m/s
Velocity accuracy		0.05 m/s

Table 6. Sirius F9P Rover performance in different GNSS mode

GNSS	Parameter	GPS+GLO+GAL +BDS	GPS+GLO	GPS+BDS	GPS
Acquisition	Cold start Hot start Aided start	24 s 2 s 2 s	26 s 2 s 2 s	28 s 2 s 2 s	29 s 2 s 2 s
Update rate	RTK PVT RAW	8 Hz 10 Hz 20 Hz	15 Hz 25 Hz 25 Hz	15 Hz 25 Hz 25 Hz	20 Hz 25 Hz 25 Hz
Convergence time	RTK	< 10 s	< 10 s	< 10 s	< 30 s
Horizontal pos. accuracy	PVT RTK	1.5 m CEP 0.01 m + 1ppm CEP	1.5 m CEP 0.01 m + 1ppm CEP	1.5 m CEP 0.01 m + 1ppm CEP	1.5 m CEP 0.01 m + 1ppm CEP
Vertical pos. accuracy	RTK	0.01 m + 1ppm CEP	0.01 m + 1ppm CEP	0.01 m + 1ppm CEP	0.01 m + 1ppm CEP
Sensitivity	Tracking & Nav. Reacquisition Cold start Hot start	-167 dBm -160 dBm -148 dBm -157 dBm			

Table 7. Sirius F9P Rover moving-base performance in different GNSS mode

GNSS	Parameter	GPS+GLO+GAL +BDS	GPS+GLO	GPS+BDS	GPS
Update rate		5 Hz	8 Hz	8 Hz	10 Hz
Heading accuracy		0.4 deg	0.4 deg	0.4 deg	0.4 deg

3. Absolute maximum ratings

Stresses above those listed as “absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 8. Sirius F9P Rover absolute maximum ratings

Symbol	Parameter	Maximum value	Unit
Vusb	USB supply voltage	-0.3 to +6	V
Vdd	Internal supply voltage	-0.5 to +3.6	V
Vdd_IO	I/O pins supply voltage	-0.5 to Vdd+0.5	V
Icc_RF	RF output current	100	mA
Prfin	Input power at RF_IN	10	dBm
TOP	Operating temperature	-20 to +70	°C
TSTG	Storage temperature	-40 to +80	°C

This device is sensitive to electrostatic discharge (ESD), improper handling can cause permanent damage to the part.

4. Applications

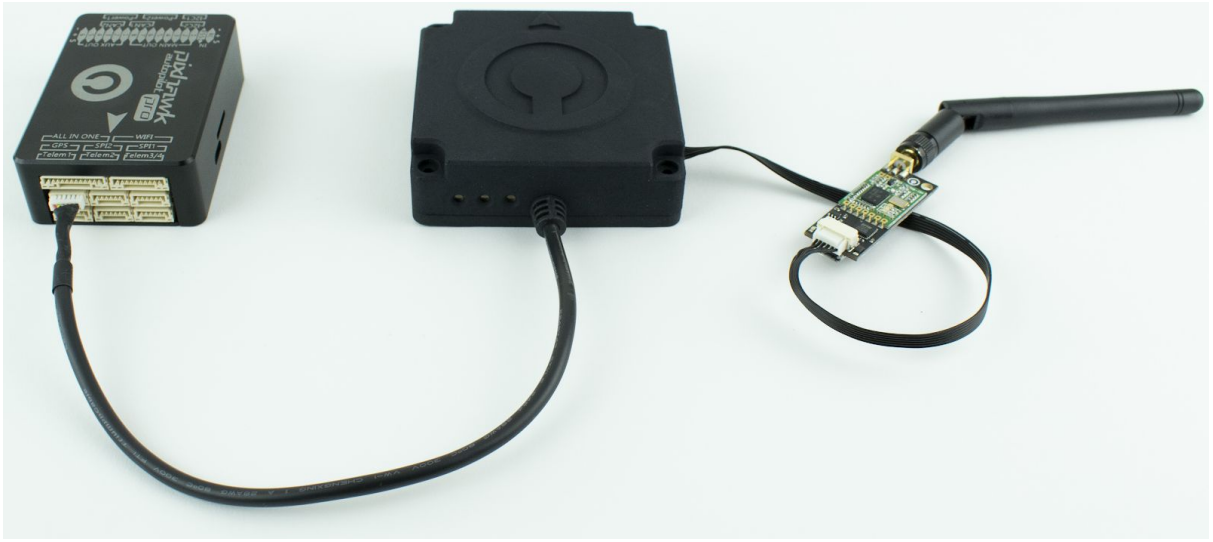
4.1 Standalone Rover configuration

Figure 3. Sirius F9P Rover connected to a 433MHz telemetry kit using UART2

Radio Telemetry Kit : https://store-drotek.com/795-radio-telemetry-kit-433-915-mhz.html

4.2 Autopilot Rover configuration

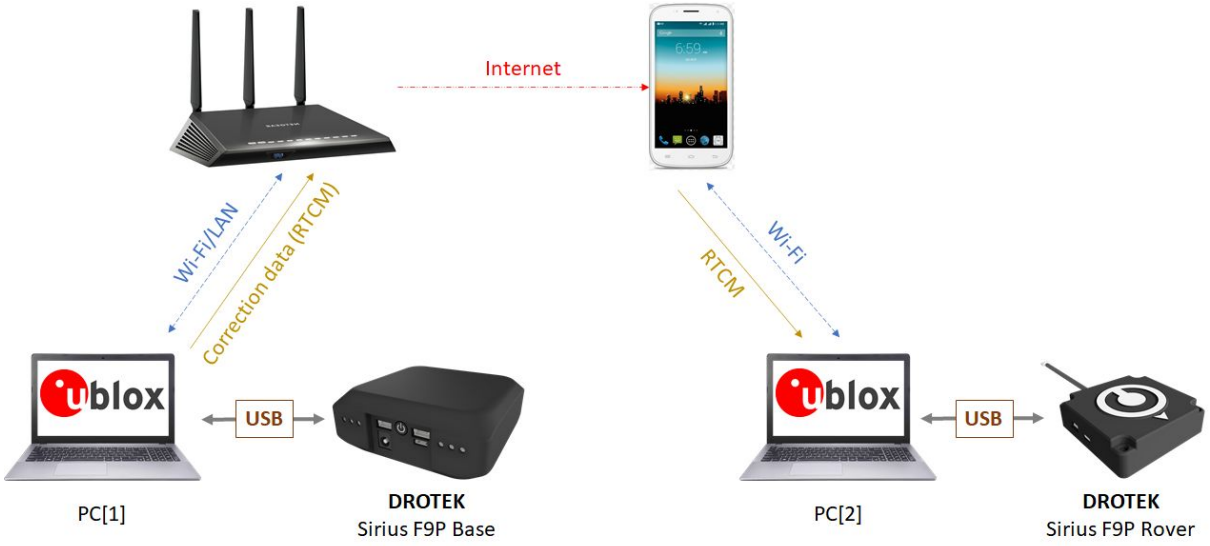
Figure 4. Sirius F9P Rover connected to a Drotek Pixhawk 3 Pro autopilot and a 433MHz telemetry kit



Drotek Pixhawk3Pro : https://store-drotek.com/821-pixhawk-pro-autopilot.html
Radio Telemetry Kit : https://store-drotek.com/795-radio-telemetry-kit-433-915-mhz.html

4.3 Standalone Base/Rover configuration

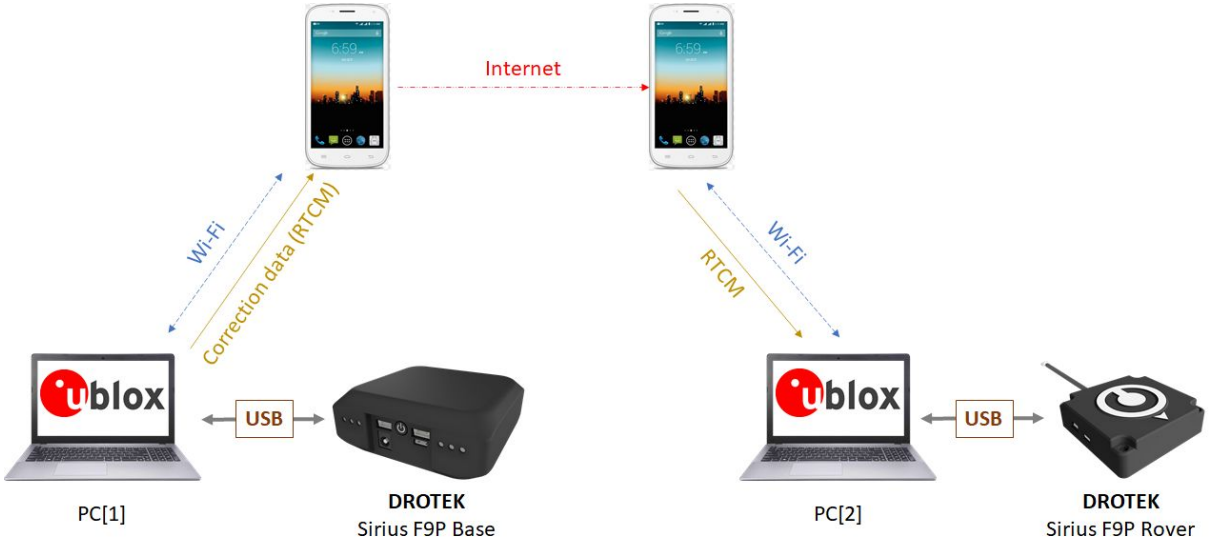
Figure 5. Sirius F9P Rover connected to USB and receiving the RTCM data from a Base via internet using a cell phone and u-center



Drotek Sirius F9P Base : https://store-drotek.com/912-sirius-rtk-gnss-base-f9p.html

4.4 Standalone Base/Rover configuration

Figure 6. Sirius F9P Rover connected to USB and receiving the RTCM data from a Base via internet using two cell phones and u-center



Drotek Sirius F9P Base : https://store-drotek.com/912-sirius-rtk-gnss-base-f9p.html

5. Communication interfaces

There are several communications interfaces including UART, I2C and USB. All the inputs have internal pull-up resistors in normal operation and can be left open if not used. All the PIOs are supplied by VCC, therefore all the voltage levels of the PIO pins are related to Vdd supply voltage.

5.1 UART Interface

There are two UART interfaces: UART1 and UART2. UART1 and UART2 operate up to and including a speed of 921600 baud. No hardware flow control on UART1 and UART2 is supported.

Figure 7. UART chronogram specifications

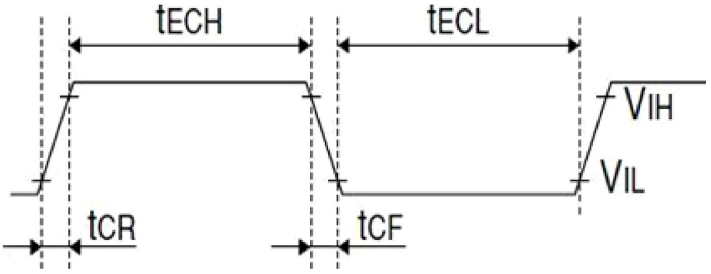


Table 9. Sirius F9P Rover serial UART timing specifications

Symbol	Parameter	Min.	Max.	Unit
Vil	LOW-LEVEL input voltage	0	0.2xVdd	V
Vih	HIGH-LEVEL input voltage	0.7xVdd	Vdd+0.3	V
tECH	HIGH period of external data input	0	0.4	µs
tECL	LOW period of external data input	TBA	TBA	µs
Ru	Baudrate	9600	921600	bps
tCR	Rise time of data		5	ns
tCF	Fall time of data		5	ns

5.2 Slave I2C interface

An I2C compliant interface is available for communication with an external host CPU. The interface can be operated in slave mode only. It is fully compatible with Fast-Mode of the I2C industry standard. Since the maximum SCL clock frequency is 400 kHz, the maximum bit rate is 400 kbit/s. The interface stretches the clock when slowed down while serving interrupts, therefore the real bit rates may be slightly lower.

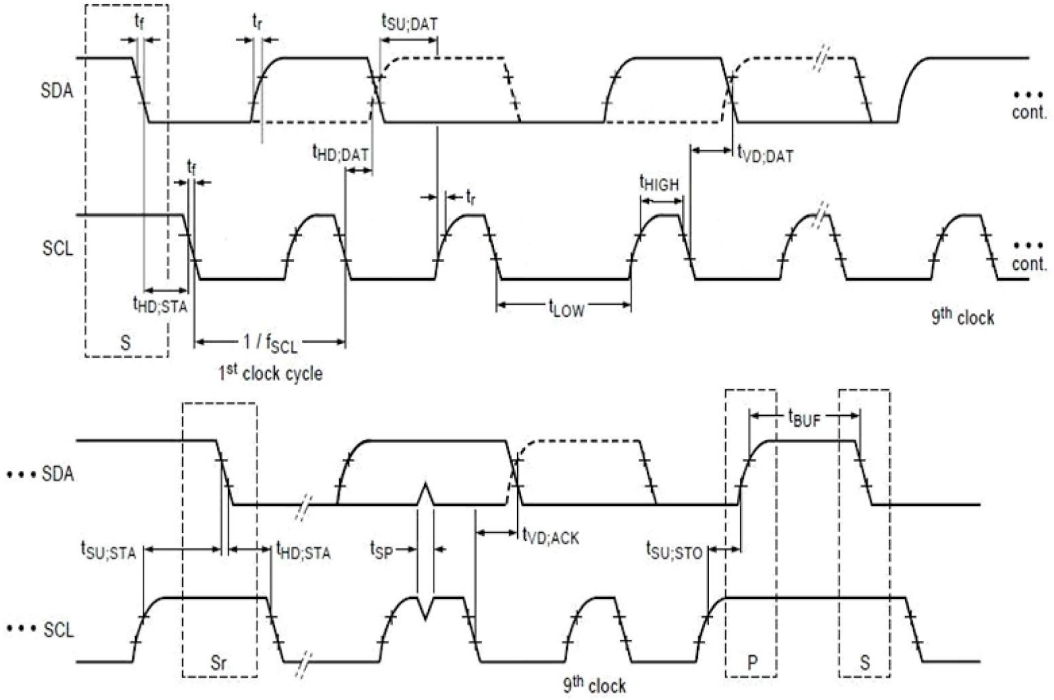


Table 10. Sirius F9P Rover I2C timing specifications

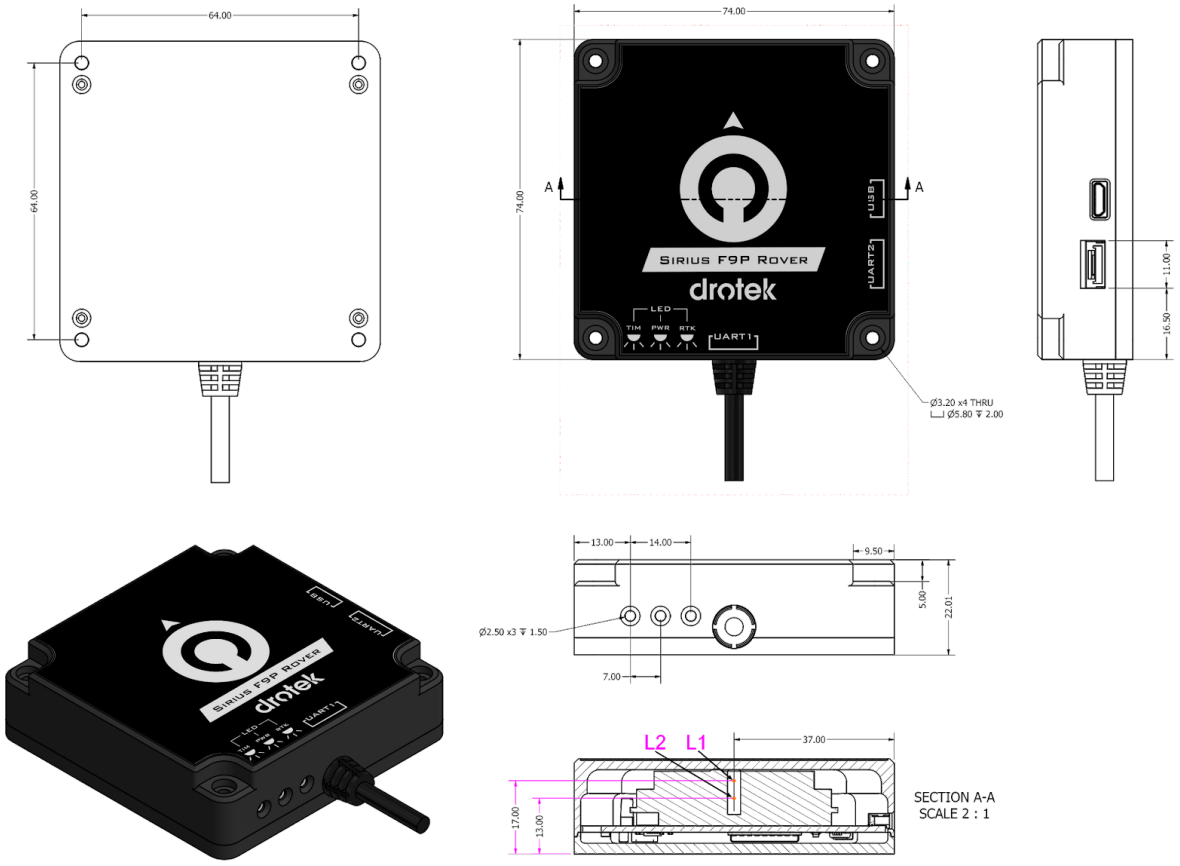
Symbol	Parameter	Min	Max	Unit
Vil	LOW-LEVEL input voltage	Vss-0.3	0.3xVdd	V
Vih	HIGH-LEVEL input voltage	0.7xVdd	Vdd+0.3	V
Vol	LOW-LEVEL output voltage		0.4	V
Voh	HIGH-LEVEL output voltage	Vdd-0.4		V
Fscl	SCL clock frequency	0	400	KHz

5.3 USB interface

A USB interface, which is compatible to USB version 2.0 FS (Full Speed, 12 Mbit/s), can be used for communication as an alternative to the UART.

6. Mechanical drawings

Figure 8. Sirius RTK GNSS Rover v1.2 mechanical drawings



7. Revision history

Table 11. Document revision history

Date	Revision	Changes
22-Oct-2019	1.0	DrotekDoc_0911A / Initial release
05-Mar-2020	2.0	L1 & L2 phase points added onto the mechanical drawing Weblinks redirecting towards Drotek products updated Height size has now changed to 22mm (23mm previously)

8. Appendix

U-blox ZED-F9P datasheet :
https://www.u-blox.com/sites/default/files/ZED-F9P_DataSheet_%28UBX-17051259%29.pdf

U-blox ZED-F9P integration manual :
https://www.u-blox.com/sites/default/files/ZED-F9P_IntegrationManual_%28UBX-18010802%29.pdf

U-blox ZED-F9P interface description :
https://www.u-blox.com/sites/default/files/u-blox_ZED-F9P_InterfaceDescription_%28UBX-18010854%29.pdf

Drotek user's guide : https://drotek.gitbook.io/rtk-f9p-positioning-solutions/how-to-get-started

Drotek tutorials : https://drotek.gitbook.io/rtk-f9p-positioning-solutions/tutorials

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