Datasheet

Linnet ZED-F9P

Features

- 5V-100mA power supply
- LEDs status: Timepulse / Power / **RTK**
- Timepulse and External Interrupt
- USB/I2C/SPI/UART
- Gold plated SMA connector
- ESD protection diodes

Applications

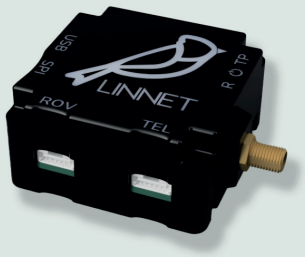
- Drones
- **RTK** bases
- Ground vehicles
- Precise navigation
- Automation of moving machinery

Description

Linnet is an affordable, compact and high precision multi bands multi frequencies **GNSS RTK** device.

It is based on the u-blox **ZED-F9P** module, and offers reliable and fast convergence to provide centimeter accuracy within seconds. **GPS**, **GLONASS**, **BEIDOU** and **GALILEO** signals are supported. The JSTGH connectors pinout is compatible with most of **px4** and **ardupilot** device.

Linnet is designed to work over a temperature range of -20 °C to +70 °C.



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1 : Diagram and pin description

1.1 : Diagram

The following figure represent the different LEDs and connector from Linnet.

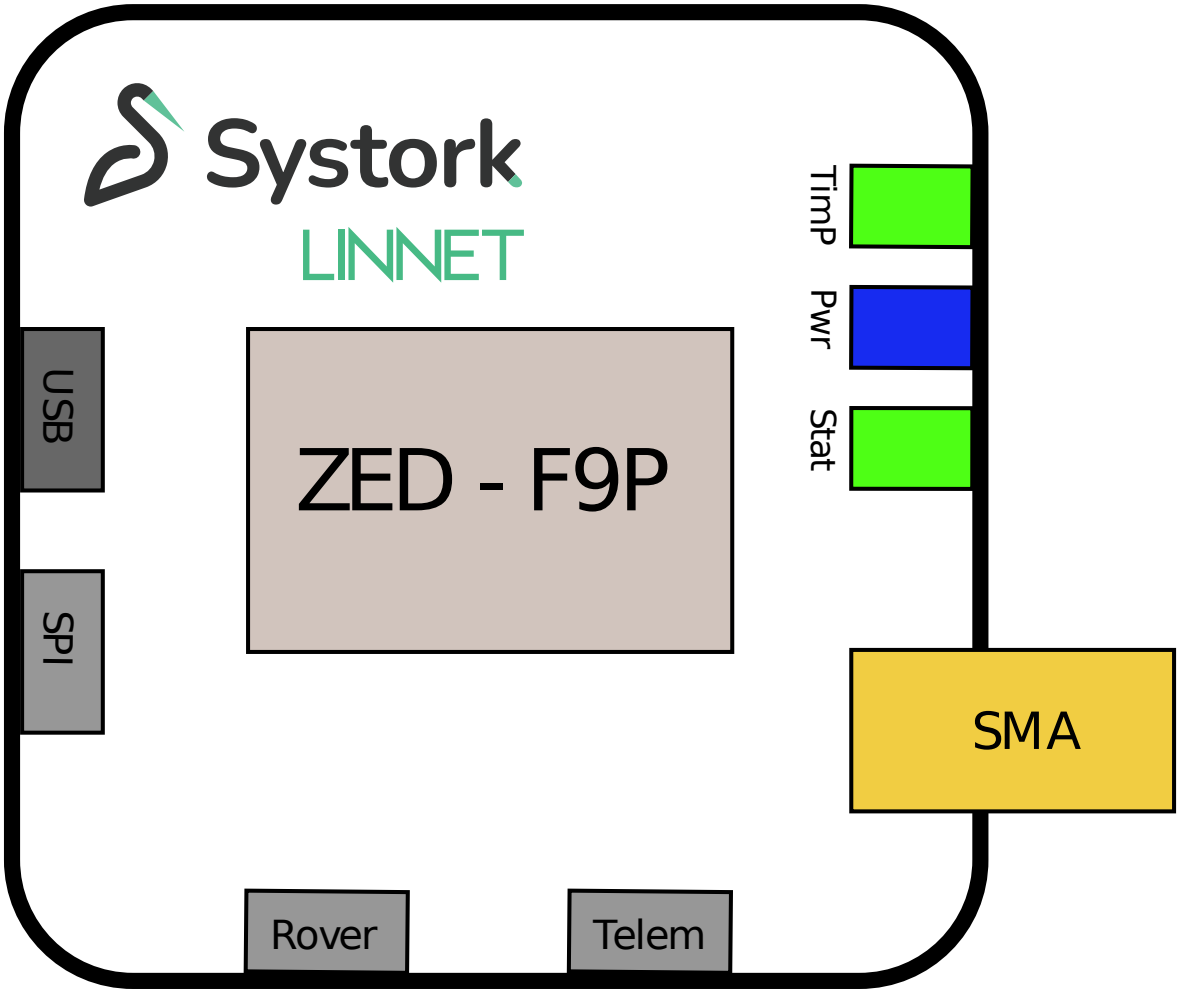


Figure 1: Linnet Diagram

1.2 : LED description

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 fixed but no fixed RTK fix
		● ● ● ●	FIXED RTK fix

Table 1: LED sequence status

1.3 : Pin description

Pinout follows the **JST-GH** standard.

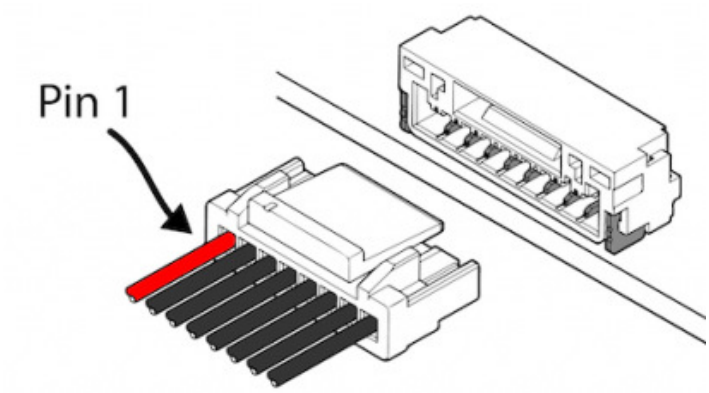


Figure 2: JST-GH, pin 1

Table 2: Pinout configuration

	Pin	Name	Type	Function
SPI	A1	VSPI	P	5V Input. If used, the UART1 interface is disabled
	A2	CLK	I	SPI clock input
	A3	MISO	O	SPI Master Input Slave Output
	A4	MOSI	I	SPI Master Output Slave Input
	A5	CS	I	SPI chip select input
	A6	GND	P	Ground interface
Rover	B1	5V	P	5V input
	B2	RX1/MOSI	I	UART1 receive **or** SPI MOSI
	B3	TX1/MISO	O	UART1 transmit **or** SPI MISO
	B4	I2C SCL/CLK	O	I2C clock or SPI clock
	B5	I2C SDA/CS	I	I2C data or SPI chip select input
	B6	GND	P	Ground interface
Telem	C1	5V	P	5V input
	C2	TX2	O	UART2 transmit
	C3	RX2	I	UART2 receive
	C4	EXT	O	External interrupt
	C5	TP	O	Timepulse
	C6	GND	P	Ground interface

2 : Specifications

The values for the following operating conditions have been specified at 25 °C ambient temperature.

Table 3: Mechanical and electrical specifications

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{USB}	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	w/o active antenna	-	50	-	mA
		w/ antenna	-	250	-	-
V_{il}	IO pin low level input voltage	-	0	-	0.8	V
V_{ih}	IO pin high level output voltage	-	2	-	Vdd + 0.3	V
V_{ol}	IO pin low level output voltage	I_{ol} = 2mA	-	-	0.4	V
V_{oh}	IO pin high level output voltage	I_{oh} = 2mA	Vdd - 0.4	-	-	V
T_{op}	Operating temperature	-	-20	-	+70	°C

3 : Absolute maximum rating

Stresses above those listed "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 operations for extended period may affect device reliability.

Table 4: Absolute maximum ratings

Symbol	Parameter	Maximum value	Unit
V_{USB}	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
$PwrRF_{IN}$	Input power at RF_{IN}	10	dBm
T_{op}	Operating temperature	-20 to +70	°C
T_{stg}	Storage Temperature	-40 to +80	°C

4 : GNSS

4.1 : Frequency band

A large panel of the standard GNSS frequency bands are supported

Table 5: Supported frequency band

GPS	L1C/A, L2C
Glonass	L1OF, L2OF
BeiDou	B1I, B2I
Galileo	E1, E5b

4.2 : GNSS performance

All values for proper antenna and open sky conditions.

Table 6: GNSS performance

	Parameter	Value	Unit
RTK performance	Horizontal accuracy	1 + 1 ppm CEP	cm
	Vertical accuracy	1 + 1 ppm CEP	cm
Maximum update rate	RTK (full constellation)	7	Hz
	RTK (GPS only)	20	Hz
Time to first fix	Cold start	<45	s

5 : Communication interfaces

There are several communications interfaces including UART, I2C, SPI and USB. All the inputs have internal pull-up resistors in normal operation and can be left open if unused. All the PIOs are supplied by Vdd, therefore all the voltage levels of the PIO are related to the Vdd supply voltage.

5.1 : UART interface

There are two UART interfaces: UART1 on the *rover* connector, and UART2 on the *telem* connector. UART1 and UART2 have configurable baud rates.

Hardware flow control is not supported

UART1 is enabled by default. A 5V input voltage on A1 pin (5V SPI) disable the UART interface and enable the SPI.

Table 7: serial UART specifications

Symbol	Parameter	Min.	Max.	Unit
V_{il}	Low-level input voltage	0	0.2 Vdd	V
V_{ih}	High-level input voltage	0.7 Vdd	Vdd + 0.3	V
R_u	Baudrate	9600	921600	bps
t_{CR}	Rise time of data	-	5	ns
t_{CF}	Fall time of data	-	5	ns

5.2 : SPI interface

Linnet has an SPI slave interface that can be selected by supplying a 5V voltage on A1 pin (5V SPI). The SPI slave interface is shared with UART1 on the *SPI* connector. The SPI interface is designed to allow communication to a host CPU. The interface can be operated in slave mode only. The maximum transfer rate using SPI is 125 kB/s and the maximum SPI clock frequency is 5.5 MHz.

Please note that while using SPI, UART1 and I2C interface are disabled, since the *rover* connector is used as a second SPI connector, allowing daisy chain structure.

The SPI timing parameters for slave operation are defined in figure 3. Default SPI configuration is CPOL = 0 and CPHA = 0.

Table 8: SPI slave timing parameters, 20 pF load capacitance

Parameter @ 20pf Load	Min.	Max.	Unit
MISO data valid time	16	55	ns
MISO data valid time, weak driver mode	15	40	ns
MISO data hold time	100	140	ns
MISO rise/fall time, weak driver mode	3	20	ns
MISO data disable lag time	15	35	ns

Figure 3: SPI specifications mode 1: CPHA = 0 SCK = 5.33 MHz

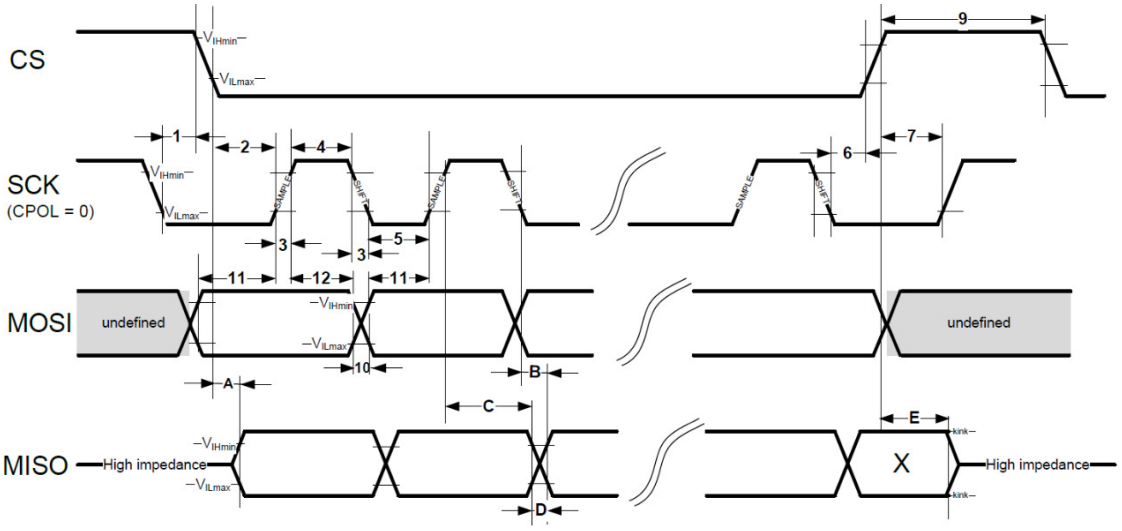


Table 9: Slave input timing parameters

Parameter	Min.	Max.	Unit
SCK rise/fall time	-	7	ns
SCK high time	24	-	ns
SCK low time	24	-	ns
Slave deselect time (SCK failing to CS)	30	-	ns
Slave deselect time (CS to SCK)	30	-	ns
CS high time	32	-	ns
MOSI transition time	-	7	ns
MOSI setup time	16	-	ns
MOSI hold time	24	-	ns

5.3 : I2C interface

An I2C compliant interface is available on the *SPI* connector 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 clock frequency maximum 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 bite rates may be slightly slower.

The I2C timing parameters for slave operation are defined in figure 4.

The I2C interface is only available with the UART default mode. If the SPI interface is used, the I2C interface is not available.

Figure 4: I2C slave specifications

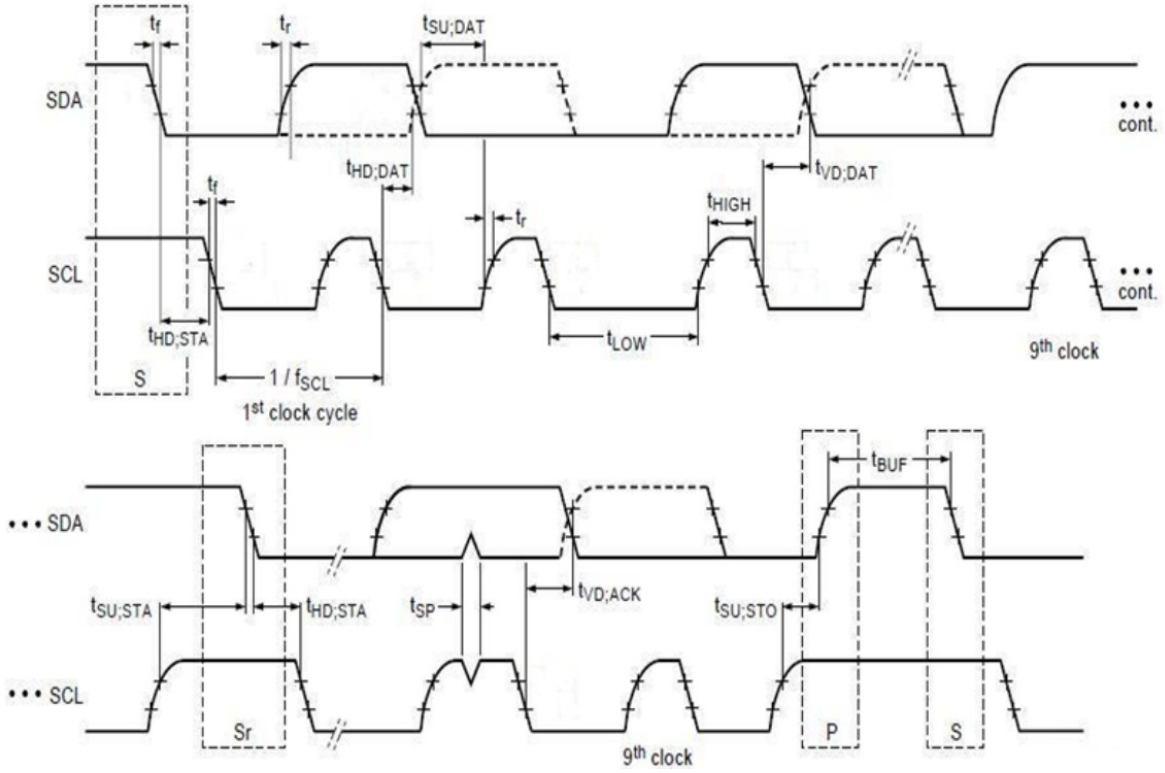
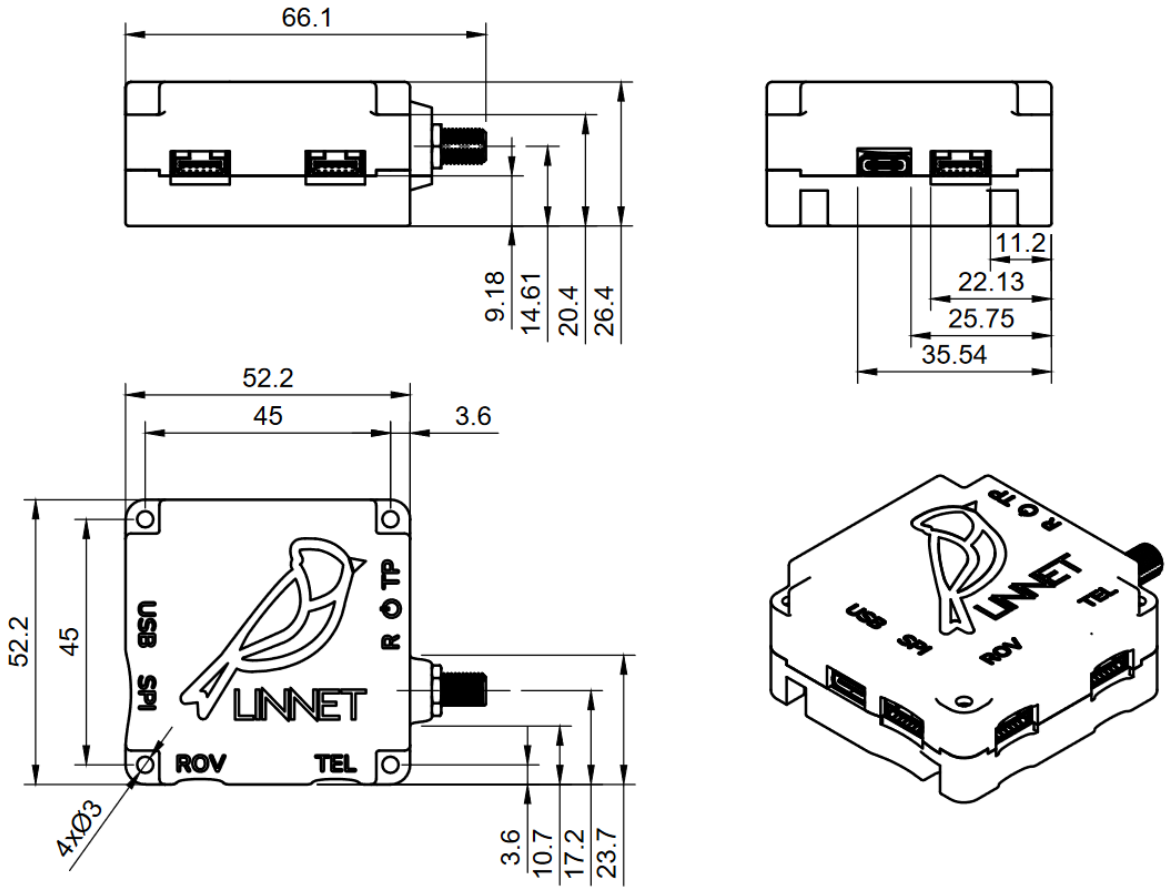


Table 10: I2C Slave timings and Specifications

		I2C Fast-Mode		
Symbol	**Parameter**	**Min.**	**Max.**	**Unit**
F_{SCL}	SCL clock frequency	0	400	kHz
$t_{HD, STA}$	Hold time (repeated) START condition	0.6	-	µs
t_{LOW}	Low period on SCL clock	1.3	-	µs
t_{HIGH}	High period on SCL clock	0.6	-	µs
$t_{SU, STA}$	Setup time for a repeated START condition	0.6	-	µs
t_r	Rise time of both SDA and SCL signals	-	300(for C = 400pf)	ns
t_f	Fall time of both SDA and SCL signals	-	300 (for C = 400pf)	ns
$t_{SU, STO}$	Setup time for STOP condition	0.6	-	µs
t_{BUF}	Buss-free time between a STOP and START condition	1.3	-	µs
$t_{VD, DAT}$	Data valid time	-	0.9	µs
$t_{VD, ACK}$	Data valid acknowledge time	-	0.9	µs
V_{nL}	Noise margin at the low level	0.1 Vdd	-	V
V_{nH}	Noise margin at the high level	0.2 Vdd	-	V

6 : Mechanical Drawing

Figure 5: Mechanical drawing



7 : Appendix

7.1 : Useful links

Ublox ZED-F9P datasheet

Ublox ZED-F9P integration manual

Systork Forum

7.2 : Glossary

BeiDou BeiDou Navigation Satellite System. Chinese satellite-based navigation system. . 1

Galileo Galileo. European satellite-based navigation system. . 1

Glonass Globalnaya Navigatsionnaya Sputnikovaya Sistema. Russian satellite-based navigation system. . 1

GNSS Global Navigation Satellite System. Satellite-based positioning system (GPS, Glonass, Beidou...). . 1

GPS Global Positioning System. American satellite-based navigation system. . 1

JST-GH Standard wire-to-board connector. There are used on most of PX4 and ArduPilot devices. . 3

RTK Real Time Kinematic. Allows achieving centimeter-level accuracy using a base sending correction data with a GNSS module. . 1

8 : Revision History

Table 11: Document revision history

Date	Revision	Changes
5 February 2024	1.0	Initial release