SkyTraQ Venus8 DR-INS Application Note

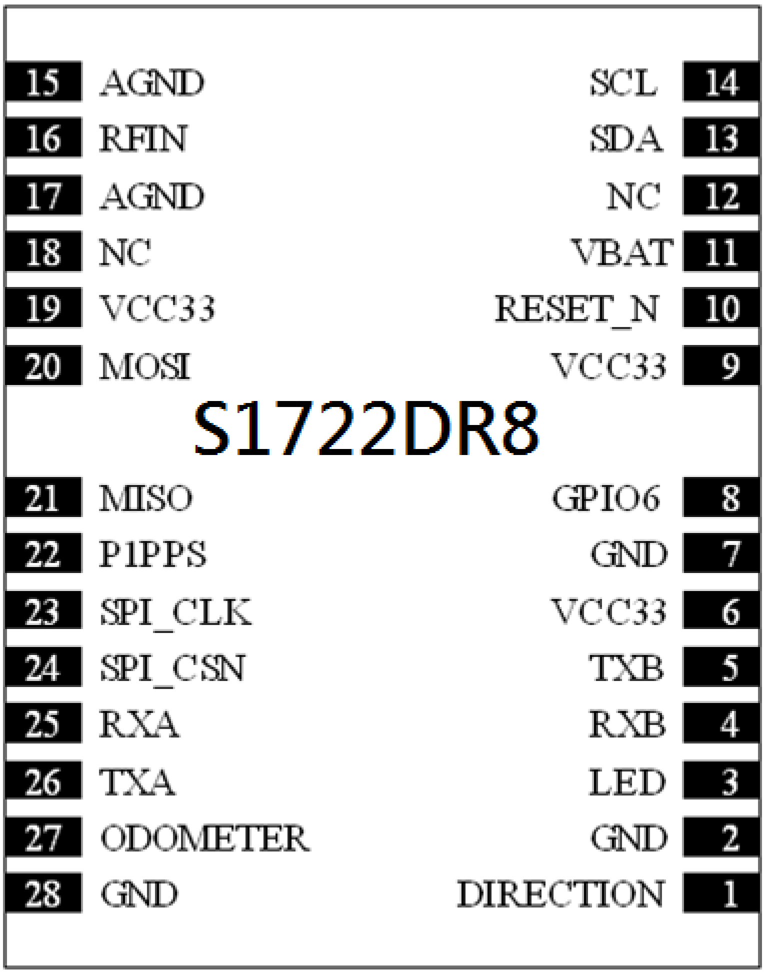
Preliminary Version

1. SCOPE:

The following products will be suitable for this document:
S1722DR8-xx V8 DR-INS series
S2525DR8P-xx V8 DR-INS series

2. PINS ASSIGNMENT:

S1722DR8-xx

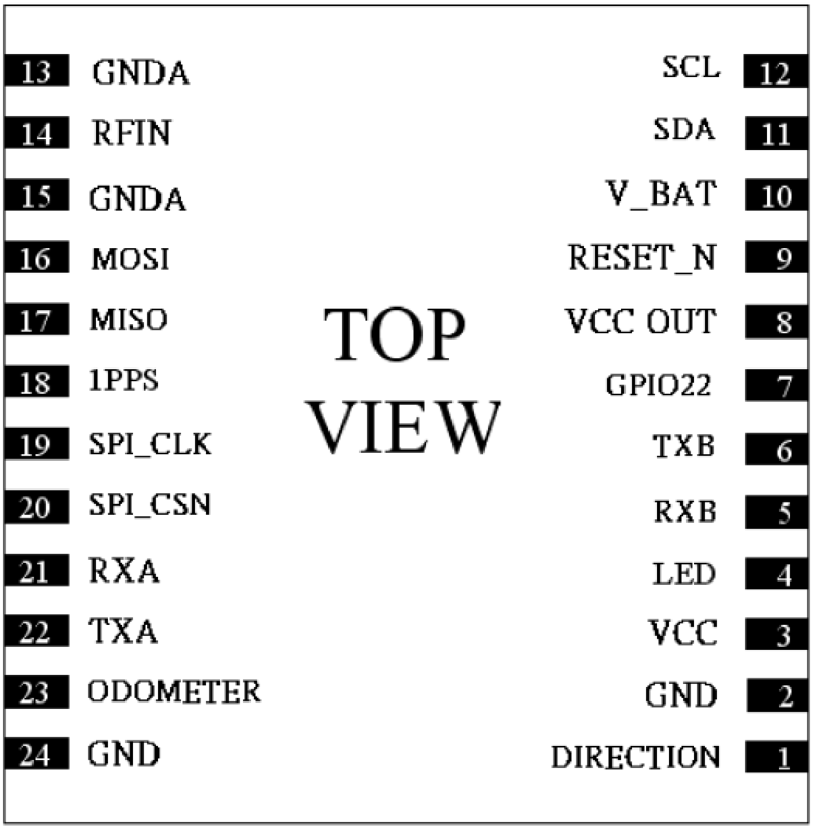


PINOUT DESCRIPTION

Pin No.	Name	Description
1	DIRECTION	Forward or reverse direction input from vehicle. Reverse (HIGH > 2.0V), Forward (LOW < 0.8V), Max 36V

2	GND	Ground
3	LED	GPS fix indicator. Output low at initial no fix, toggle each second after position fix.
4	RXB	UART2 serial data input, 3.3V LVTTL, V_{IH}>2.3V,V_{IL}<0.8V
5	TXB	UART2 serial data output, 3.3V LVTTL, V_{IH}>2.3V,V_{IL}<0.8V
6	VCC33	Main 3.3V DC supply input
7	GND	Ground
8	GPIO6	GPIO6(Reserved)
9	VCC33	Main 3.3V DC supply input
10	RESET_N	External reset (active low)
11	VBAT	Backup supply voltage for internal RTC and backup SRAM, 2.5V ~ 3.6V. V_BAT must be applied whenever VCC is applied. This pin should be powered continuously to minimize the startup time. If VCC and V_BAT are both removed, the receiver will be in factory default mode upon power up, all user configuration set is lost. For applications the does not care cold starting every time, this pin can be connect to VCC
12	NC	NC
13	SDA	2-wire interface data line (reserved)
14	SCL	2-wire interface clock line (reserved)
15	GNDA	RF Ground
16	RFIN	RF input, with 3.3V DC on pin
17	GNDA	RF Ground
18	NC	No connection
19	VCC33	Main 3.3V DC supply input
20	MOSI	SPI, MOSI(Reserved)
21	MISO	SPI,MISO(Reserved)
22	1PPS	One-pulse-per-second (1PPS) time mark output, 3V LVTTL. The rising edge synchronized to UTC second when getting 3D position fix. The pulse duration is about 4msec at rate of 1 Hz.
23	SPI_CLK	SPI, Clock(Reserved)
24	SPI_CSN	SPI, Chip Select(Reserved)
25	RXA	UART1 serial data input, 3.3V LVTTL. This UART input is normally for sending commands or information to the receiver in SkyTraq binary protocol. In the idle condition, this pin should be driven HIGH. If the driving circuitry is powered independently of S1722DR8, ensure that this pin is not driven to HIGH when primary power to S1722DR8 is removed.
26	TXA	UART1 serial data output, 3.3V LVTTL. This UART output is normally used for sending position, time and velocity information from the receiver in NMEA-0183 format. When idle, this pin output HIGH.
27	ODOMETER	Car Speed Pulse, Frequency<4KHz,V_{IH}>2.3V,V_{IL}<0.8V, Max 36V
28	GND	Ground

S2525DR8P-xx



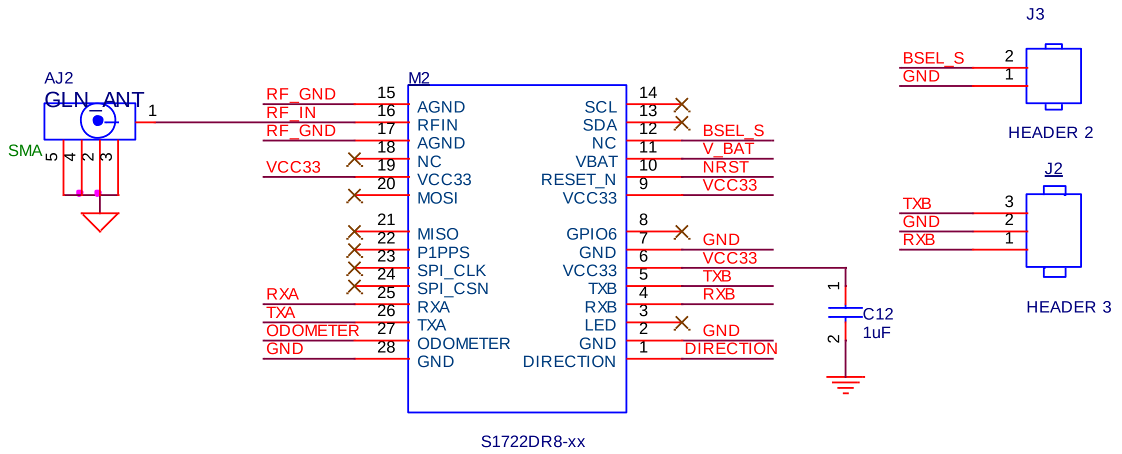
PINOUT DESCRIPTION

Pin No.	Name	Description
1	DIRECTION	Forward or reverse direction input from vehicle. Reverse (HIGH > 2.0V), Forward (LOW < 0.8V), Max 36V
2	GND	Ground
3	VCC	Main 5V DC supply input
4	LED	GPS fix indicator. Output low at initial no fix, toggle each second after position fix.
5	RXB	UART2 serial data input, 3.3V LVTTL
6	TXB	UART2 serial data output, 3.3V LVTTL
7	GPIO22	GPIO22 (reserved, gyro calibrated indicator).
8	VCCOUT	DC 3.3V output
9	RESET_N	External reset (active low). Can be left unconnected if unused.
10	V_BAT	Backup supply voltage for internal RTC and backup SRAM, 1.5V ~ 6V. V_BAT must be applied whenever VCC is applied. This pin should be powered continuously to minimize the startup time. If VCC and V_BAT are both removed, the receiver will be in factory default mode upon power up, all user configuration set is lost. For applications the does not care cold starting every time, this pin can be connect to VCC.
11	SDA	2-wire interface data line (reserved)

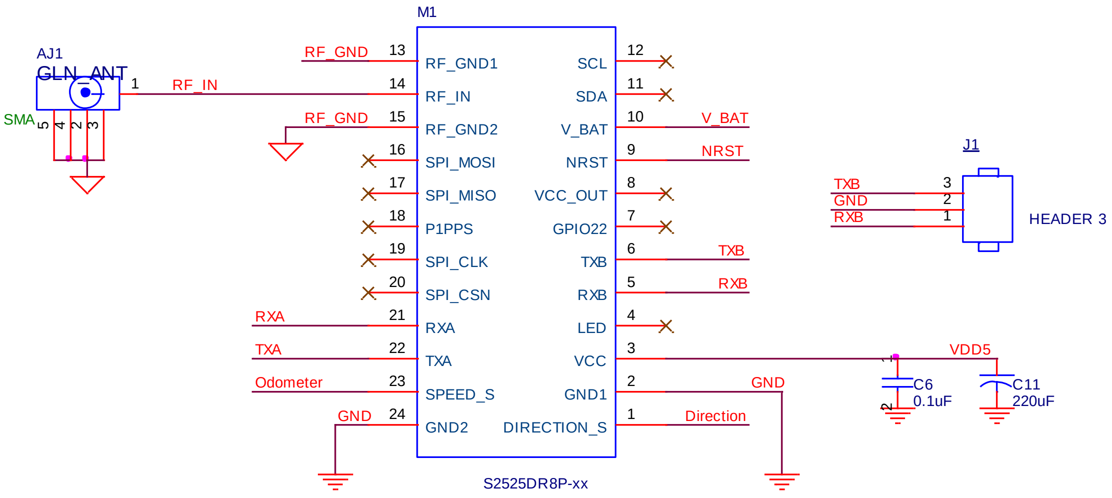
12	SCL	2-wire interface clock line (reserved)
13	GNDA	RF ground
14	RFIN	RF input with 3.3V active antenna bias voltage
15	GNDA	RF ground
16	MOSI	SPI master output slave input (reserved)
17	MISO	SPI master input slave output (reserved)
18	1PPS	One-pulse-per-second (1PPS) time mark output, 3V LVTTL. The rising edge synchronized to UTC second when getting 3D position fix. The pulse duration is about 4msec at rate of 1 Hz.
19	SPI_CLK	SPI clock (reserved)
20	SPI_CSN	SPI chip select (reserved)
21	RXA	UART1 serial data input, 3.3V LVTTL. This UART input is normally for sending commands or information to the receiver in SkyTraq binary protocol. In the idle condition, this pin should be driven HIGH. If the driving circuitry is powered independently of S2525DR8, ensure that this pin is not driven to HIGH when primary power to S2525DR8 is removed.
22	TXA	UART1 serial data output, 3.3V LVTTL. This UART output is normally used for sending position, time and velocity information from the receiver in NMEA-0183 format. When idle, this pin output HIGH.
23	ODOMETER	Car speed pulse, frequency < 4kHz, 3.3V LVTTL
24	GND	Ground

3. REFERENCE DESIGN

S1722DR8-xx REFERENCE DESIGN

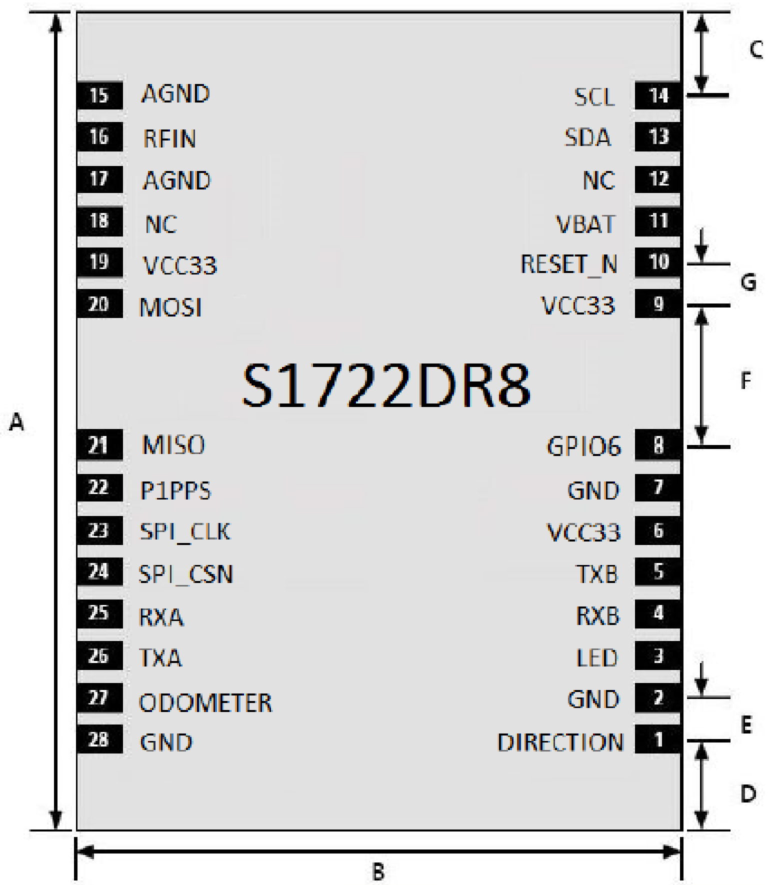


S2525DR8P-xx REFERENCE DESIGN

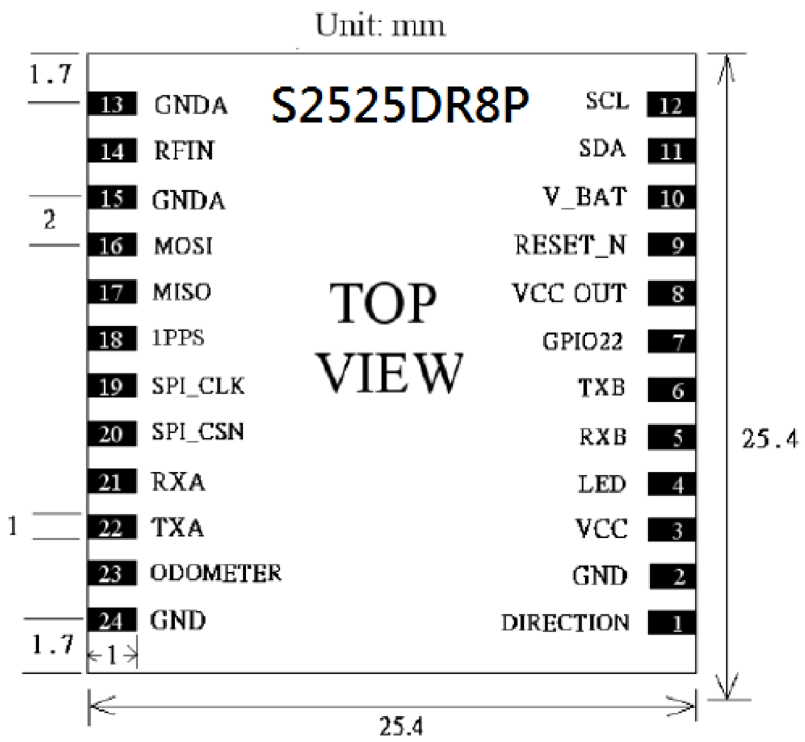


4. MECHANICAL DIMENSION & RECOMMEND LAYOUT PAD

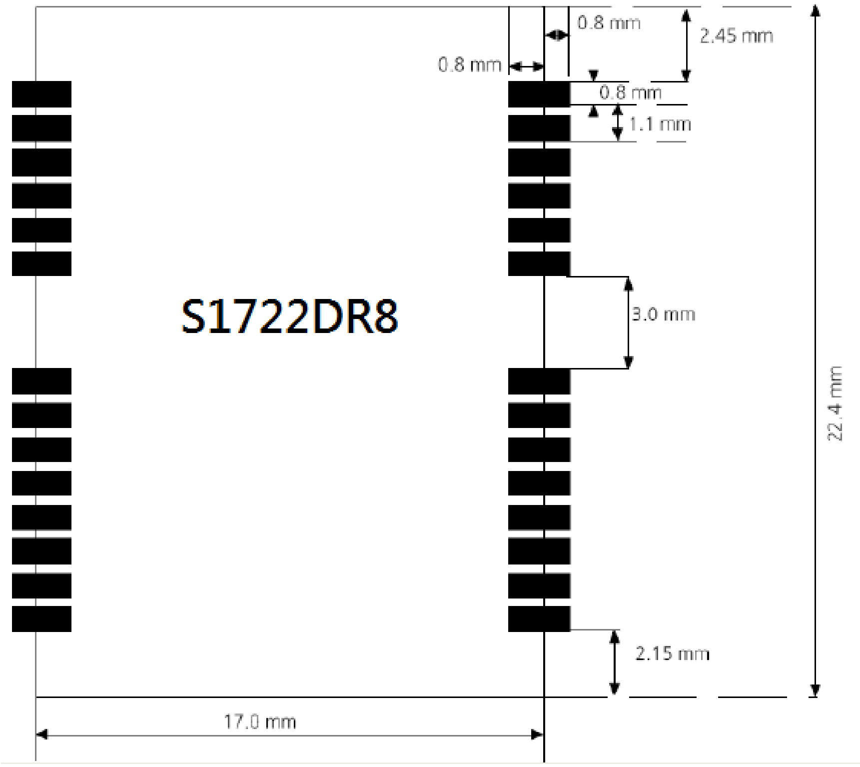
MECHANICAL DIMENSION

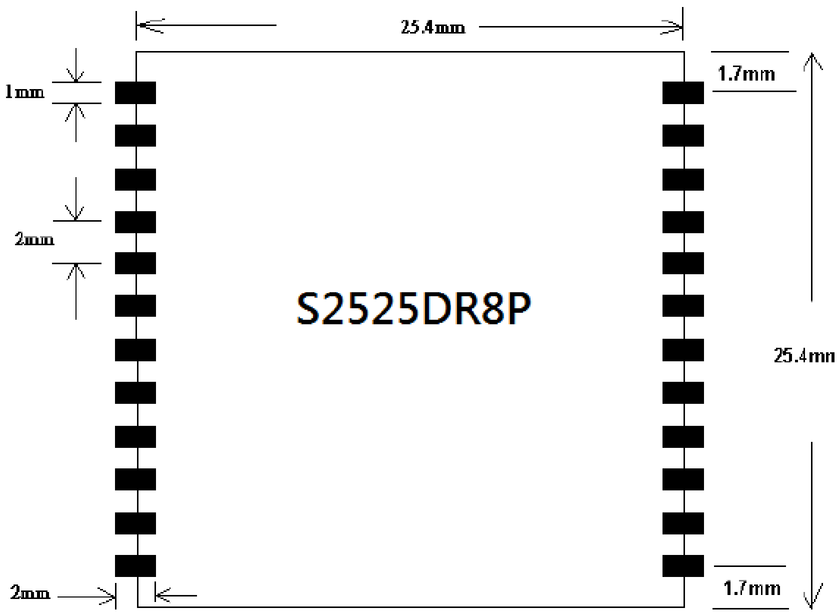


A	22.4mm
B	17.0mm
C	2.85mm
D	2.55mm
E	1.1mm
F	3.8mm
G	1.1mm



RECOMMEND LAYOUT PAD





5. INSTALLATION GUIDE

<u>Installation Angle(θ):</u>

Venus8 DR-INS board is a DR-INS product with 6 axis MEMS INS sensor, there is no need for the specified angle of the board for installation in the

vehicle.

Upon the board being installed, it must be fixed well in the vehicle and without any related movement to the vehicle. Otherwise, it might take very long or even be hard to finish the DR calibration for those multiple MEMS sensors.

GPS Active Antenna and Signal Level:

GNSS Active Antenna Specification:

- ◇ Gain: 25~28dB, 2 Stage LNA
- ◇ DC bias: 3.3V
- ◇ Noise Figure: < 2 dB

GNSS Signal Level Requirement: ***Important!***

In order to gain the better GNSS performance and the good DR calibration condition, GNSS signal **in open sky** environment is suggested to meet the following requirements:

- ◇ The maximum C/N ratio of the satellite exceed 43 or higher.
- ◇ The number of the satellite exceeding 40 C/N ratio is ≧ 3. More is better.
- ◇ The cold start TTFF should be less than 45 s.
- ◇ Speed must be ever over 30 km/hr.

DR Calibration Criteria:

To calibrate DR board (including the speed pulse and the multiple MEMS sensors), there are some criteria need to be satisfied:

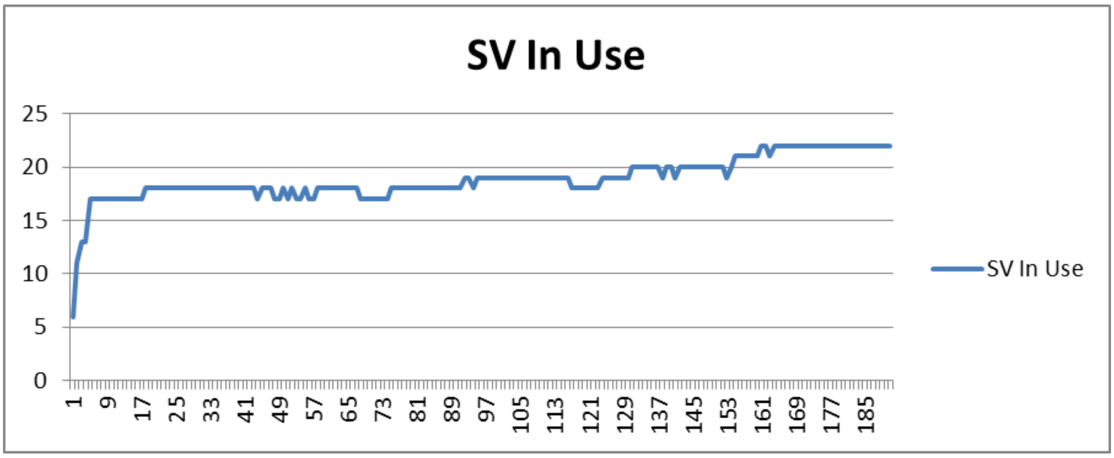
- ◇ With 3D GNSS position fixed and good GNSS receiving signal. Refer to "GNSS Signal Level Requirement".
- ◇ Correct and linear Odometer speed pulse. See "*Remark*".
- ◇ At least 3 times 90 degree turning (>270 degree) after 3 D position fixed.
- ◇ It normally takes 3~10 minutes after 3 D position fixed, depends the installation and signal condition.
- ◇ Moving forward. See "*Remark*".
- ◇ At least to stop the vehicle for more than 15 seconds after 3 D fix in first time calibration process.

Example:

Condition:

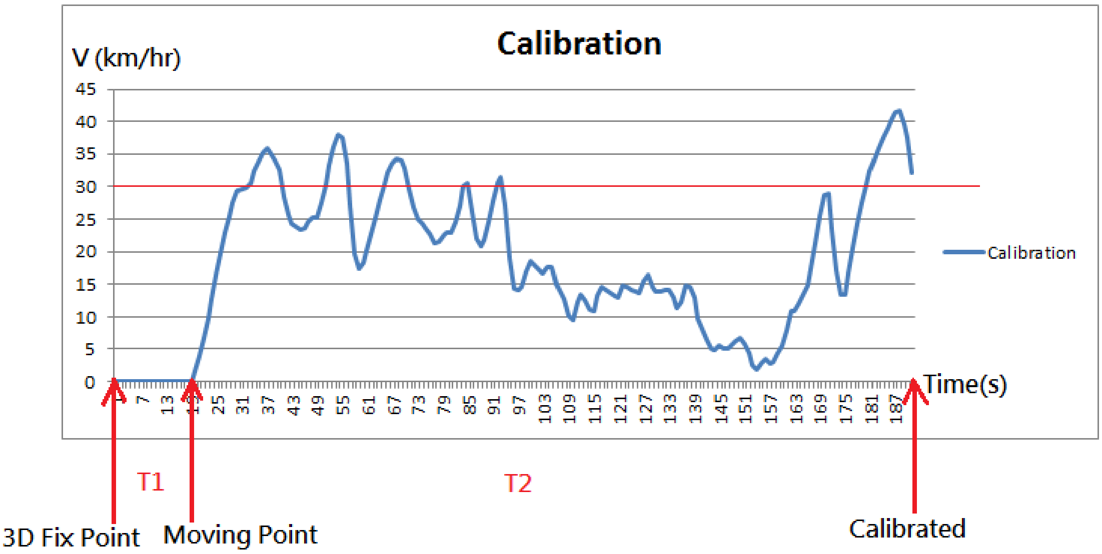
Under Open Sky, Dual mode GPS+BD active antenna and placed underneath frond window

Speed must be ever >30 m/s



Time To First Calibration(T)= T1+T2

Test No.	Static Time(s),T1	Dynamic Time(s),T2	Driving Distance(m)	Total Time(Time to First Calibration) (s),T
1	65	191	1402.17	256



Driving Distance(m): The distance between 3D fix point and first calibration

Driving Distance(m)= 1402.17 m

Remark

SPEEDPULSE: It needs to be the linear frequency related to the vehicle speed.

Moving Forward: The calibration of the DR is strongly recommend to be conducted during vehicle moving forward. DIRECTION Line shows “0” means moving forward and “1” means moving backward.

Attention!

1. DIRECTION LINE must be connected to avoid the unexpected error.
2. Do not move the board upon it is installed and during the operation procedure.　If need to move the board, the board needs to re-calibrated again by remove VBAT power for few seconds(>5 s) or place the cold start command(*****) to the board to remove the old data in the memory.

***:** Cold Start Command please refesr to SkyTraQ V8 Binary command List or contact SkyTraQ FAE.

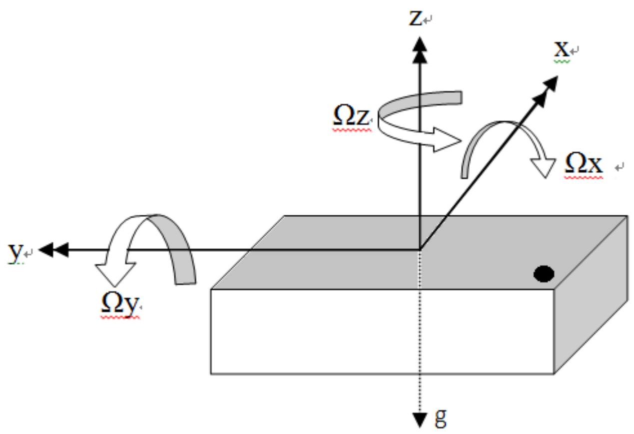
<u>Sensor Axis Orientation(Related to Module Pin1)</u>

x : Accelerometer X axis	Ωx: Gyro X axis
y : Accelerometer Y axis	Ωy: Gyro Y axis
z : Accelerometer Z axis	Ωz: Gyro Z axis

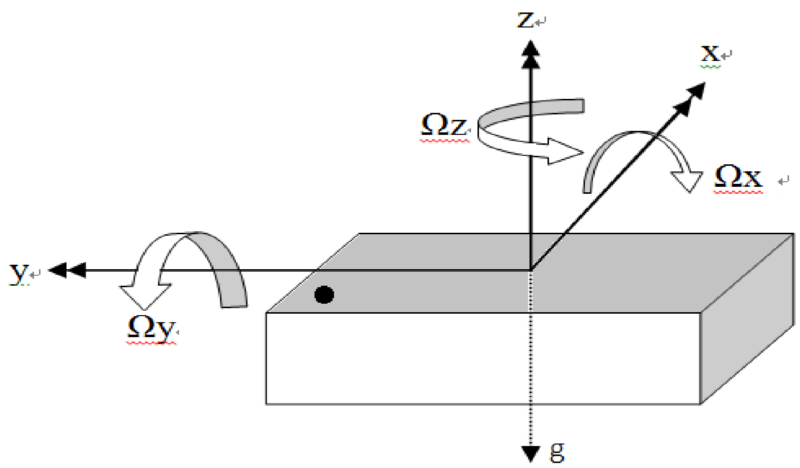
Example: For a S1722DR8-xx or S2525DR8P-xx module ,if it is at rest on a totally horizontal plane , the output signal ideally(zero bias) will be :

+/- 0 g for Accelerometer X axis	+/- 0 Degree/sec for Ωx Gyro X axis
+/- 0 g for Accelerometer Y axis	+/- 0 Degree/sec for Ωy Gyro Y axis
+1 g for Accelerometer Z axis	+/- 0 Degree/sec for Ωz Gyro Z axis

S1722DR8-xx



S2525DR8P-xx



6. OUTPUT MESSAGES

NMEA Output Description

The output protocol supports NMEA-0183 standard. The implemented messages include GGA, GLL, GSA, GSV, VTG, RMC, ZDA and GNS messages. The NMEA message output has the following sentence structure:

$aaccc,c–c*hh<CR><LF>

The detail of the sentence structure is explained in Table 1.

Table 1: The NMEA sentence structure

character	HEX	Description
"$"	24	Start of sentence.
Aaccc		Address field. "aa" is the talker identifier. "ccc" identifies the sentence type.
","	2C	Field delimiter.
C–c		Data sentence block.
"*"	2A	Checksum delimiter.
Hh		Checksum field.
<CR><LF>	0D0A	Ending of sentence. (carriage return, line feed)

Table 2: Overview of SkyTraq receiver's NMEA messages for S1216R8, S1216F8, S1216F8-BD12, S1216F8-GL12

$GPGGA	Time, position, and fix related data of the receiver.
$GPGLL	Position, time and fix status.
$GPGSA	Used to represent the ID's of satellites which are used for position fix.
$GPGSV	Satellite information about elevation, azimuth and CNR
$GPRMC	Time, date, position, course and speed data.
$GPVTG	Course and speed relative to the ground.
$GPZDA	UTC, day, month and year and time zone.

Table 3: Overview of SkyTraq receiver's NMEA messages for S1216F8-BD

$GNGGA	Time, position, and fix related data of the receiver.
$GNGLL	Position, time and fix status.
$GNGSA **$GPGSA** **$BDGSA**	Used to represent the ID's of satellites which are used for position fix. When both GPS and Beidou satellites are used in position solution, a $GNGSA sentence is used for GPS satellites and another $GNGSA sentence is used for Beidou satellites. When only GPS satellites are used for position fix, a single $GPGSA sentence is output. When only Beidou satellites are used, a single $BDGSA sentence is output.
$GPGSV **$BDGSV**	Satellite information about elevation, azimuth and CNR, $GPGSV is used for GPS satellites, while $BDGSV is used for Beidou satellites
$GNRMC	Time, date, position, course and speed data.
$GNVTG	Course and speed relative to the ground.
$GNZDA	UTC, day, month and year and time zone.

Table 4: Overview of SkyTraq receiver's NMEA messages for S1216F8-GL

$GNGGA	Time, position, and fix related data of the receiver.
$GNGLL	Position, time and fix status.
$GNGSA **$GPGSA** **$GLGSA**	Used to represent the ID's of satellites which are used for position fix. When both GPS and GLONASS satellites are used in position solution, a $GNGSA sentence is used for GPS satellites and another $GNGSA sentence is used for GLONASS satellites. When only GPS satellites are used for position fix, a single $GPGSA sentence is output. When only GLONASS satellites are used, a single $GLGSA sentence is output.
$GPGSV **$GLGSV**	Satellite information about elevation, azimuth and CNR, $GPGSV is used for GPS satellites, while $GLGSV is used for GLONASS satellites
$GNRMC	Time, date, position, course and speed data.
$GNVTG	Course and speed relative to the ground.
$GNZDA	UTC, day, month and year and time zone.

The full descriptions of supported NMEA messages are provided at the following paragraphs.

GGA - Global Positioning System Fix Data

Time, position and fix related data for a GPS receiver.

Structure:

$GPGGA,hhmmss.sss,ddmm.mmmm,a,dddmm.mmmm,a,x,xx,x.x,x.x,M,,,,xxxx*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11

Example:

$GPGGA,111636.932,2447.0949,N,12100.5223,E,1,11,0.8,118.2,M,,,,0000*02<CR><LF>

Field	Name	Example	Description
1	UTC Time	111636.932	UTC of position in hhmmss.sss format, (000000.000 ~ 235959.999)
2	Latitude	2447.0949	Latitude in ddmm.mmmm format Leading zeros transmitted
3	N/S Indicator	N	Latitude hemisphere indicator, ‘N’ = North, ‘S’ = South
4	Longitude	12100.5223	Longitude in dddmm.mmmm format Leading zeros transmitted
5	E/W Indicator	E	Longitude hemisphere indicator, 'E' = East, 'W' = West
6	GPS quality indicator	1	GPS quality indicator 0: position fix unavailable 1: valid position fix, SPS mode 2: valid position fix, differential GPS mode 3: GPS PPS Mode, fix valid 4: Real Time Kinematic. System used in RTK mode with fixed integers 5: Float RTK. Satellite system used in RTK mode. Floating integers 6: Estimated (dead reckoning) Mode 7: Manual Input Mode 8: Simulator Mode
7	Satellites Used	11	Number of satellites in use, (00 ~ 12)
8	HDOP	0.8	Horizontal dilution of precision, (00.0 ~ 99.9)
9	Altitude	108.2	mean sea level (geoid), (-9999.9 ~ 17999.9)
10	DGPS Station ID	0000	Differential reference station ID, 0000 ~ 1023 NULL when DGPS not used
11	Checksum	02	

GLL – Latitude/Longitude
Latitude and longitude of current position, time, and status.

Structure:
$GPGLL,ddmm.mmmm,a,dddmm.mmmm,a,hhmmss.sss,A,a*hh<CR><LF>
1 2 3 4 5 6 7 8

Example:
$GPGLL,2447.0944,N,12100.5213,E,112609.932,A,A*57<CR><LF>

Field	Name	Example	Description
1	Latitude	2447.0944	Latitude in ddmm.mmmm format Leading zeros transmitted
2	N/S Indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
3	Longitude	12100.5213	Longitude in dddmm.mmmm format Leading zeros transmitted
4	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
5	UTC Time	112609.932	UTC time in hhmmss.sss format (000000.000 ~ 235959.999)
6	Status	A	Status, 'A' = Data valid, 'V' = Data not valid
7	Mode Indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
8	Checksum	57	

GSA – GNSS DOP and Active Satellites
GPS receiver operating mode, satellites used in the navigation solution reported by the GGA or GNS sentence and DOP values.

Structure:
$GPGSA,A,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x*hh<CR><LF>
1 2 3 3 3 3 3 3 3 3 3 3 3 3 4 5 6 7

Example:
$GPGSA,A,3,05,12,21,22,30,09,18,06,14,01,31,,1.2,0.8,0.9*36<CR><LF>

Field	Name	Example	Description
1	Mode	A	Mode 'M' = Manual, forced to operate in 2D or 3D mode 'A' = Automatic, allowed to automatically switch 2D/3D
2	Mode	3	Fix type 1 = Fix not available 2 = 2D 3 = 3D
3	Satellite used 1~12	05,12,21,22,30,09,18,06,14,01,31,,	Satellite ID number, 01 to 32, of satellite used in solution, up to 12 transmitted
4	PDOP	1.2	Position dilution of precision (00.0 to 99.9)
5	HDOP	0.8	Horizontal dilution of precision (00.0 to 99.9)
6	VDOP	0.9	Vertical dilution of precision (00.0 to 99.9)
7	Checksum	36	

GSV – GNSS Satellites in View
Number of satellites (SV) in view, satellite ID numbers, elevation, azimuth, and SNR value. Four satellites maximum per transmission.

Structure:
$GPGSV,x,x,xx,xx,xx,xxx,xx,…,xx,xx,xxx,xx *hh<CR><LF>
1 2 3 4 5 6 7 4 5 6 7 8

Example:
$GPGSV,3,1,12,05,54,069,45,12,44,061,44,21,07,184,46,22,78,289,47*72<CR><LF>
$GPGSV,3,2,12,30,65,118,45,09,12,047,37,18,62,157,47,06,08,144,45*7C<CR><LF>
$GPGSV,3,3,12,14,39,330,42,01,06,299,38,31,30,256,44,32,36,320,47*7B<CR><LF>

Field	Name	Example	Description
1	Number of message	3	Total number of GSV messages to be transmitted (1-3)
2	Sequence number	1	Sequence number of current GSV message
3	Satellites in view	12	Total number of satellites in view (00 ~ 12)
4	Satellite ID	05	Satellite ID number, GPS: 01 ~ 32, SBAS: 33 ~ 64 (33 = PRN120)
5	Elevation	54	Satellite elevation in degrees, (00 ~ 90)
6	Azimuth	069	Satellite azimuth angle in degrees, (000 ~ 359)
7	SNR	45	C/No in dB (00 ~ 99) Null when not tracking
8	Checksum	72	

RMC – Recommended Minimum Specific GNSS Data
Time, date, position, course and speed data provided by a GNSS navigation receiver.

Structure:
$GPRMC,hhmmss.sss,A,dddmm.mmmm,a,dddmm.mmmm,a,x.x,x.x,ddmmyy,,,a*hh<CR><LF>
1 2 3 4 5 6 7 8 9 10 11
Example:
$GPRMC,111636.932,A,2447.0949,N,12100.5223,E,000.0,000.0,030407,,,A*61<CR><LF>

Field	Name	Example	Description
1	UTC time	0111636.932	UTC time in hhmmss.sss format (000000.000 ~ 235959.999)
2	Status	A	Status 'V' = Navigation receiver warning 'A' = Data Valid
3	Latitude	2447.0949	Latitude in dddmm.mmmm format Leading zeros transmitted
4	N/S indicator	N	Latitude hemisphere indicator 'N' = North 'S' = South
5	Longitude	12100.5223	Longitude in dddmm.mmmm format Leading zeros transmitted
6	E/W Indicator	E	Longitude hemisphere indicator 'E' = East 'W' = West
7	Speed over ground	000.0	Speed over ground in knots (000.0 ~ 999.9)
8	Course over ground	000.0	Course over ground in degrees (000.0 ~ 359.9)
9	UTC Date	030407	UTC date of position fix, ddmmyy format
10	Mode indicator	A	Mode indicator 'N' = Data not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
11	checksum	61	

VTG – Course Over Ground and Ground Speed
The Actual course and speed relative to the ground.

Structure:
GPVTG,x.x,T,,M,x.x,N,x.x,K,a*hh<CR><LF>
1 2 3 4 5

Example:
$GPVTG, 000.0,T,,M,000.0,N,0000.0,K,A*3D<CR><LF>

Field	Name	Example	Description
1	Course	000.0	True course over ground in degrees (000.0 ~ 359.9)
2	Speed	000.0	Speed over ground in knots (000.0 ~ 999.9)
3	Speed	0000.0	Speed over ground in kilometers per hour (0000.0 ~ 1800.0)
4	Mode	A	Mode indicator 'N' = not valid 'A' = Autonomous mode 'D' = Differential mode 'E' = Estimated (dead reckoning) mode 'M' = Manual input mode 'S' = Simulator mode
5	Checksum	3D	

PSTI,20 Dead Reckoning Status Message

Structure:
PSTI,xx,x,x,x,xx,x,x,x,xxx.xx,xx.xx,xx.xx,x.xx*xx<CR><LF>
1 2 34 5 67 8 9 10 11 12 13

Example:
$PSTI,20,1,1,1,32,A,0,1,821.95,20.73,-13.45,6.63*40<CR><LF>

Field No.	Example	Format	Unit	Description
1	20	numeric	-	Proprietary message identifier: 20
2	1	numeric	-	Odometer Calibrate Status 1: calibrated 0: not calibrated
3	1	numeric	-	Gyro Calibrate Status 1: calibrated 0: not calibrated
4	1	numeric	-	Sensor input available 1: available 0: not available
5	32	numeric	Pulse	Odometer pulse count
6	A	character	-	Position Mode indicator: A=GPS fix, N = Data not valid, E = Estimated(dead reckoning) mode
7	0	numeric	-	Backward Status 1: activated, moving backward 0: normal, moving forward
8	1	numeric	-	Antenna detecting(Reserved) 1: antenna available 0: antenna not available
9	821.95	numeric	-	Reserved
10	20.73	numeric	m/ pulse	Odometer Scaling Factor
11	-13.45	numeric	Deg/ sec	Rotation rate
12	6.63	numeric	m	Distance
13	40	hexadecimal	-	Checksum

PSTI,063 3 Axis Gyro Data and Bias(Optional)

Structure:
PSTI,xxx,x,xxx.xx,xxx.xx,xxx.xx,x,xxx.xx,xxx.xx,xxx.xx, *xx<CR><LF>
1 2 3 4 5 6 7 8 9 10

Example:
$PSTI,063,G,-0.84,0.05,1.93,C,-0.83,0.06,1.90*04<CR><LF>

Field No.	Example	Format	Unit	Description
1	063	numeric	-	Proprietary message identifier: 063
2	G	character	-	Sensor Type G: Gyro
3	-0.84	numeric	Deg/s	Average Gyro Data-X
4	0.05	numeric	Deg/s	Average Gyro Data-Y
5	1.93	numeric	Deg/s	Average Gyro Data-Z
6	C	character	-	Calibration indicator: N = Not Calibrated, C = Calibrated
7	-0.83	numeric	Deg/s	Gyro Bias-X
8	0.06	numeric	Deg/s	Gyro Bias-Y
9	1.90	numeric	Deg/s	Gyro Bias-Z
10	04	hexadecimal	-	Checksum

PSTI,065 3 Axis Accelerometer Data and Bias(Optional)

Structure:
PSTI,xxx,x,xxx.xx,xxx.xx,xxx.xx,x,xxx.xx,xxx.xx,xxx.xx, *xx<CR><LF>
1 2 3 4 5 6 7 8 9 10

Example:
$PSTI,065,A,-1.09,-1.02,10.22,C,-0.78,0.04,0.43*18 <CR><LF>

Field No.	Example	Format	Unit	Description
1	065	numeric	-	Proprietary message identifier:065
2	A	character	-	Sensor Type A: Accelerometer
3	-1.09	numeric	m/(s*s)	Average Accelerometer Data-X
4	-1.02	numeric	m/(s*s)	Average Accelerometer Data-Y
5	10.22	numeric	m/(s*s)	Average Accelerometer Data-Z
6	C	character	-	Calibration indicator: N = Not Calibrated, C = Calibrated
7	-0.78	numeric	m/(s*s)	Accelerometer Bias-X
8	0.04	numeric	m/(s*s)	Accelerometer Bias-Y
9	0.43	numeric	m/(s*s)	Accelerometer Bias-Z
10	18	hexadecimal	-	Checksum

PSTI,067　Odometer Sentence(Optional)

Structure:
PSTI,xxx,xxxx,x,x,xxx.xx,xxx.xx,x, *xx<CR><LF>
1 2 3 4 5 6 7 8

Example:
$PSTI,067,O,240,0,C,0.03,6.64*0E<CR><LF>

Field No.	Example	Format	Unit	Description
1	067	numeric	-	Proprietary message identifier: 067
2	O	character	-	Sensor Type O: Odometer
3	240	numeric	pulse	Odometer pulse count
4	0	character	-	Forward/Backward Status 1: activated, moving backward 0: normal, moving forward
5	C	character	-	Calibration indicator: N = Not Calibrated, C = Calibrated
6	0.03	numeric	m/pulse	Odometer Scaling Factor
7	6.64	numeric	m	Distance
8	0E	hexadecimal	-	Checksum

PSTI,068 Barometer States(Optional)

Structure:
PSTI,xxx,x,xxxx.xx,xxxx.xx, x,xxxxx.xx,xxxxx.xx, *xx<CR><LF>
1 2 3 4 5 6 7 8

Example:
$PSTI,068,B,1007.31,1013.25,C,49.56,-1.05*1A <CR><LF>

Field No.	Example	Format	Unit	Description
1	068	numeric	-	Proprietary message identifier: 068
2	B	character	-	Sensor Type B: Barometer
3	1007.31	numeric	hPa(mbar)	Pressure
4	1013.25	numeric	hPa(mbar)	Reference Pressure
5	C	character	-	Calibration indicator: N = Not Calibrated, C = Calibrated
6	49.56	character	m	Raw Altitude
7	-1.05	numeric	m	Altitude(Ellipsoid Height)
8	1A	hexadecimal	-	Checksum

PSTI,070 Temperature States(Optional)

Structure:
PSTI,xxx,x,x,xxx.x, *xx<CR><LF>
1 2 3 4 5

Example:
$PSTI,070,T,B,27.2*26 <CR><LF>

Field No.	Example	Format	Unit	Description
1	070	numeric	-	Proprietary message identifier: 070
2	T	character	-	Temperature
3	B	character	-	Sensor Type A:Accelerometer B: Barometer G: Gyroscope I: Inertial Sensor (Accelerometer+Gyroscope) T: Standalone Temperature Sensor
4	27.2	numeric	℃	Sensor Temperature
5	26	hexadecimal	-	Checksum

Example Message

$GNGGA,072050.000,2234.0730,N,11352.2470,E,2,20,0.6,1.2,M,-2.1,M,,0000*5E

$GNGLL,2234.0730,N,11352.2470,E,072050.000,A,D*44

$GNGSA,A,3,05,19,02,12,25,17,193,06,20,13,09,,1.1,0.6,0.9*1A

$GNGSA,A,3,206,208,203,215,209,201,202,204,205,,,,1.1,0.6,0.9*13

$GNRMC,072050.000,A,2234.0730,N,11352.2470,E,014.0,296.2,110916,,,D*77

$GNVTG,296.2,T,,M,014.0,N,026.0,K,D*18

$GNZDA,072050.000,11,09,2016,00,00*44

$PSTI,20,1,1,1,261,A,0,1,-191.10,0.03,-5.79,7.24*59

$PSTI,063,G,-0.74,-0.58,7.70,C,-0.86,0.03,1.91*24

$PSTI,065,A,-0.59,-0.36,10.20,C,-0.80,0.07,0.42*1D

$PSTI,067,O,261,0,C,0.03,7.24*08

$PSTI,068,B,1007.29,1013.25,C,49.72,-0.94*1C

$PSTI,070,T,B,27.2*26

$PSTI,070,T,I,28.0*20

7. Reversion History

Revision	Date	Description
Preliminary Version	Aug 01,2016	First Release Version