



HIGH PRECISION

COMMANDS AND LOGS

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UM981

GPS/BDS/GLONASS/Galileo/QZSS

All-constellation Multi-frequency

RTK/INS Integrated Positioning Module

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Revision History

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User Interface of Tilt Measurement

This protocol follows Unicore-defined format, as shown in *Unicore Reference Commands Manual For N4 High Precision Products*.

1 Configuration Commands

1.1 Lever Arm Configuration

Command Format:

```
CONFIG IMUTOANT OFFSET [x] [y] [z] [stdx] [stdy] [stdz]
```

Example:

```
CONFIG IMUTOANT OFFSET -0.025 0.031 0.040 0.010 0.010 0.010
```

(x, y, z) represents the vector from the center of the UM981 module to the phase center of the antenna. The coordinate system is marked on the front of the UM981 module, and the coordinates are measured in meters, which accurate to millimeters. (stdx, stdy, stdz) is the standard deviation of (x, y, z), which is in meters and accurate to millimeters.

The relative position between the module and the antenna should be fixed. Please keep the center of the UM981 module as close to the phase center of the antenna as possible.

After setting the parameters, send "SAVECONFIG" to save the configuration to the FLASH.

Users can input the CONFIG command to query the current configuration.

The lever arm parameters only need to be configured for the first use and can be obtained from FLASH for subsequent uses.

1.2 Enable/Disable Tilt Compensation

Command Format:

```
CONFIG INS [parameter]
```

Example:

```
CONFIG INS SLANTMEAS
```

Table 1-1 INS Configuration

Log Header	Configuration Item	Parameter	Description
CONFIG	INS	DISABLE	Disable all functions of INS, including the output of IMU data, GNSS/INS integrated solution, etc.
		RESET	Reset INS to the unaligned state
		SLANTMEAS	Enable tilt compensation

1.3 Antenna Height Configuration

This command is used to configure the length from the phase center of the antenna to the tip of the survey pole, in meters, accurate to millimeters.

Command format:

CONFIG ANTENNADELTAHEN LEN

Example:

CONFIG ANTENNADELTAHEN 2.192

1.4 Clear IMU Parameters

This command is used to clear the IMU parameters estimated by the algorithm in real time or the factory-calibrated IMU parameters. After this command is executed, the relevant parameters of IMU need to be recalibrated the next time the tilt compensation is enabled.

Command format:

ERASE IMUPARAM [parameter]

Example:

ERASE IMUPARAM

Table 1-2 Clear IMU Parameters

Log Header	Configuration Item	Parameter	Description
ERASE	IMUPARAM	null	Clear the saved IMU parameters
		TBD	To be determined
		TBD	To be determined

1.5 INS Reliability Configuration

This command is used to configure the reliability level of INS.

Command format:

CONFIG INSRELIABILITY [parameter]

Example:

CONFIG INSRELIABILITY 7

Table 1-3 INS Reliability Configuration

Log header	Configuration Item	Parameter	Description
CONFIG	INSRELIABILITY	1	Slightly lower reliability
		4	Normal reliability (default)
		7	High reliability

2 Output Logs

2.1 SLANTSTATUS

This log contains the status information when tilt compensation is initialized. Users can perform corresponding operations according to the status information.

- "WAITING" means waiting for the tilt compensation to be enabled.
- "STATIC" means to keep the survey pole static and as vertical to the ground as possible.
- "RTKNOFIX" means no RTK fix solution and waiting for RTK fix.
- "MOVING" means to move the survey pole left and right, back and forth, while keeping the pole tip on the ground.
- "INSBIGERR" means the accuracy of INS solution is low and the user needs to rock the survey pole.
- "CONVERGENCE" means the initialization is successfully finished and the pole tip can be put at the measurement point.

The initialization process should be carried out in an environment with good GNSS signals.

Message ID: 513

ASCII Syntax:

SLANTSTATUSA 1

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BINARY Syntax:

SLANTSTATUSB 1

Message Output:

```
#SLANTSTATUSA,40,GPS,FINE,2206,200969000,0,0,18,0;WAITING,0,0,0,0,0,0*c02862df
```

```
#SLANTSTATUSA,40,GPS,FINE,2206,200979000,0,0,18,0;STATIC,0,0,0,0,0,0*b02573df
```

```
#SLANTSTATUSA,40,GPS,FINE,2206,200986000,0,10,18,0;MOVING,0,0,0,0,0,0*94922df3
```

```
#SLANTSTATUSA,40,GPS,FINE,2206,201002000,0,15,18,0;CONVERGENCE,0,0,0,0,0,0*b86cd091
```

Table 2-1 SLANTSTATUS Data Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SLANTSTATUS header	Log header, see <i>Unicore Reference Commands Manual For N4 High Precision Products</i>		H	0
2	Status	Status information: 0: WAITING Tilt compensation disabled 5: STATC Keep the survey pole static and vertical to the ground 8: RTKNOFIX Wait for RTK fix 10: MOVING Move the survey pole back and forth, left and right 12: INSBIGERR Large error of INS solution, rock the survey pole 15: CONVERGENCE INS convergence finished	CHAR	1	H+0
3	Calibrate	0: normal initialization 6: IMU calibration	CHAR	1	H+1
4	Processing	0~100, percentage of the initialization/calibration progress	CHAR	1	H+2
5	cReserved	Reserved	CHAR	1	H+3
6	LeverHight	Height of the survey pole, configured by users, in millimeters	INT	4	H+4
7	iReserved[2]	Reserved	INT[2]	8	H+8
8	xxxx	32-bit CRC (ASCII or binary)	Hex	4	H+16
9	[CR][LF]	Sentence terminator (ASCII only)	-		

2.2 SLANTAP

After the initialization is finished, this log outputs the position of the measurement point and the tilt angle of the survey pole.

Message ID: 514

ASCII Syntax:

SLANTAPA ONCHANGED

BINARY Syntax:

SLANTAPB ONCHANGED

Message Output:

```
#SLANTAPA,39,GPS,FINE,2283,115797630,0,0,18,1;1,0,2283,115797600,40.0786368679
5,116.23635885107,34.229092,0.009176,0.008366,0.024702,24.016890,107.756493,0.0
00000,0*32d1306a
```

Table 2-2 SLANTAP Data Structure

ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	SLANTAP header	Log header, see <i>Unicore Reference Commands Manual For N4 High Precision Products</i>		H	0
2	ValidFlag	Validity flag, indicating whether the following values are valid: 1-valid; 0-invalid	CHAR	1	H+0
3	Reserved	Reserved	CHAR	1	H+1
4	Week	GPS week number	USHORT	2	H+2
5	TowMs	GPS milliseconds of week	UINT	4	H+4
6	Lat	Latitude (degree)	DOUBLE	8	H+8
7	Lon	Longitude (degree)	DOUBLE	8	H+16
8	Hgt	Height (meter)	DOUBLE	8	H+24
9	Lat std	Standard deviation of latitude (meter)	FLOAT	4	H+32
10	Lon std	Standard deviation of longitude (meter)	FLOAT	4	H+36
11	Htg std	Standard deviation of height (meter)	FLOAT	4	H+40
12	Slant angle	Tilt angle of the survey pole (degree)	FLOAT	4	H+44

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ID	Field Type	Data Description	Format	Binary Bytes	Binary Offset
13	Slant azimuth	Azimuth of the survey pole (degree)	FLOAT	4	H+48
14	Reserved1	Reserved	FLOAT	4	H+52
15	Reserved2	Reserved	INT	4	H+56
16	xxxx	32-bit CRC (ASCII or binary)	Hex	4	H+60
17	[CR][LF]	Sentence terminator (ASCII only)	-		

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