

RTK-M100/101

Real - Time Kinematic Module

Packet Format Document



Document history

Version	Date	Updates
1.0.0	Dec 24, 2019	First formal version

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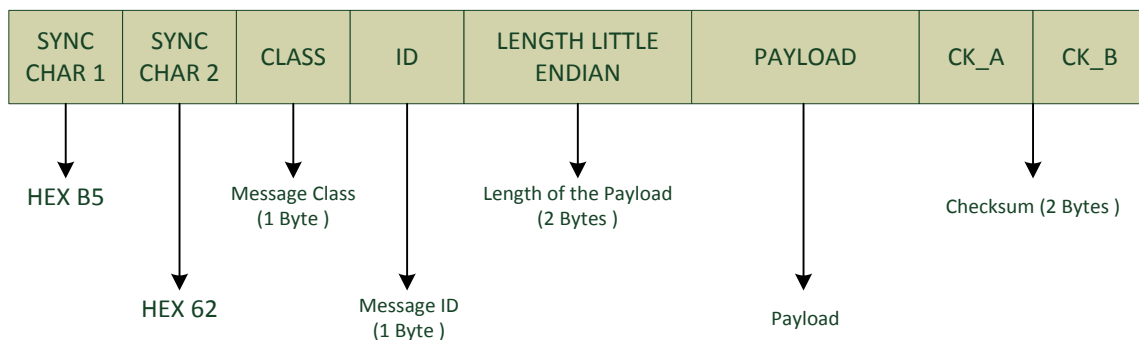
1. LCS (LoCoSys) Protocol

1.1 LCS Protocol Key Features

LOCOSYS receivers support a LOCOSYS proprietary protocol to communicate with a host computer.

1.2 LCS Frame Structure

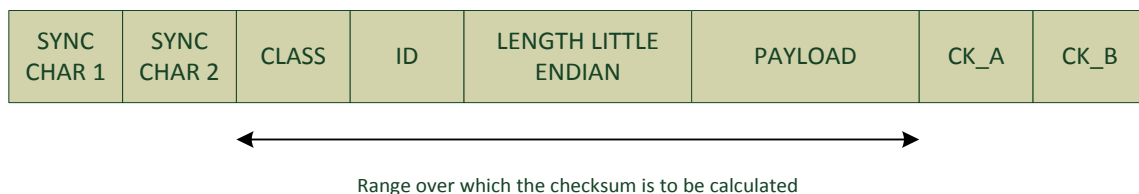
A basic LCS Frame looks as follows:



- Every Message starts with 2 Bytes: 0xB5 0x62
- A 1 Byte Class Field follows. The Class defines the basic subset of the message
- A 1 Byte ID Field defines the message that is to follow
- A 2 Byte Length Field is following. Length is defined as being the length of the payload, only. It does not include Sync Chars, Length Field, Class, ID or CRC fields. The number format of the length field is an unsigned 16-Bit integer in Little Endian Format.
- The Payload is a variable length field.
- CK_A and CK_B is a 16 Bit checksum whose calculation is defined below.

1.3 LCS Checksum

The checksum is calculated over the packet, starting and including the CLASS field, up until, but excluding, the Checksum Field:



The checksum algorithm used is the 8-Bit Fletcher Algorithm, which is used in the TCP standard (RFC 1145). This algorithm works as follows: Buffer[N] contains the data over which the checksum is to be calculated. The two CK_ values are 8-Bit unsigned integers, only! If implementing with larger-sized integer values, make sure to mask both CK_A and CK_B with 0xFF after both operations in the loop.

```

CK_A = 0, CK_B = 0
For(l=0;l<N;l++)
{
    CK_A = CK_A + Buffer[l]
    CK_B = CK_B + CK_A
}

```

After the loop, the two U1 values contain the checksum, transmitted at the end of the packet.

1.4 LCS Class ID

Syntax

Name	Class	Description
NAV	0x01	Navigation Results Messages: Position, Speed, Time, Acceleration, Heading, DOP, SVs used
ACK	0x05	Ack/Nak Messages: Acknowledge or Reject messages to CFG input messages
CFG	0x06	Configuration Input Messages: Set Dynamic Model, Set DOP Mask, Set Baud Rate, etc.
MON	0x0A	Monitoring Messages: Communication Status, CPU Load, Stack Usage, Task Status
MGA	0x13	Multiple GNSS Assistance Messages: Assistance data for various GNSS
SEC	0x27	Security Feature Messages
FIL	0x30	File Management
NET	0x31	Network Monitoring
UIO	0x32	User Define GPIO
LoRa	0x33	LoRa Configuration
SYS	0xFE	System information

1.5 LCS Message Overview

Syntax

Mnemonic	Cls/ID	Length	Type	Description
LCS Class ACK			ACK/NAK Messages	
ACK-ACK	0x05 0x01	2	Output	Message Acknowledged
ACK-NAK	0x05 0x00	2	Output	Message Not-Acknowledged
LCS Class CFG			Configuration Input Messages	
CFG-PWR	0x06 0x57	Get:0 / Set: 8	Get/Set	RTKLIB Engine defined power state

CFG-RST	0x06 0x04	4	Command	Reset RTK-22 module
CFG-RTKADV	0x06 0xC1	Get:0 / Set: 28	Get/Set	RTKLIB Engine Advanced Settings
CFG-RTKIO	0x06 0xC2	Get:0 / Set: 108	Get/Set	RTKLIB Engine I/O Settings
CFG-ROL	0x06 0xC3	Get:0 / Set: 4	Get/Set	RTKLIB Engine Role Settings
CFG-DFT	0x06 0xC4	4	Command	Reset configuration to default
CFG-RTKPOST	0x06 0xC5	Get:0 / Set: 104	Get/Set	RTKLIB Engine Post Message to NTRIP Caster Settings
CFG-CFGSVR	0x06 0xD1	Get:0 / Set: 8	Get/Set	User-Config. Server IP Address Settings
LCS Class MGA			Multiple GNSS Assistance Messages	
MGA-ACK	0x13 0x60	8	Output	Multiple GNSS Acknowledge message
MGA-INI-POS_LLH	0x13 0x40	Get:2 / Set:20	Get/Set	Initial Position Assistance
MGA-INI-POSHR_LLH	0x13 0x40	Get:2 / Set:32	Get/Set	Initial Position Assistance (High Resolution)
LCS Class MON			Monitoring Messages	
MON-IO	0x0A 0x02	0 + 48*N	Get	I/O Subsystem Status
MON-VER	0x0A 0x04	80 + 32*N	Get	System Software/Hardware Version
MON-SYSVER	0x0A 0x05	32*N	Get	System Firmware Version
LCS Class NAV			Navigation Results Messages	
NAV-POSLLH	0x01 0x02	28	Get	Geodetic Position Solution
NAV-PVT	0x01 0x07	100	Periodic	Navigation Position Velocity Time Solution
NAV-PVTHR	0x01 0x08	112	Periodic	Navigation Position Velocity Time Solution (High Resolution)
NAV-SOL	0x01 0x06	52	Periodic	Navigation Solution Information
NAV-STATUS	0x01 0x03	16	Periodic	Navigation Status Information
NAV-VELNED	0x01 0x12	36	Periodic	Velocity Solution Information
NAV-SATR	0x01 0x35	8+28*numSvs	Periodic	Rover Satellite Information
NAV-SATB	0x01 0x36	8+28*numSvs	Periodic	Base Satellite Information
NAV-BAS	0x01 0x61	20	Get	Base position information
NAV-BASHR	0x01 0x62	32	Get	Base position information (High Resolution)
LCS Class SEC			Security Feature Messages	
SEC-UNIQID	0x27 0x03	26	Get	Module Information
LCS Class FIL			File Management Messages	
FIL-LIST	0x30 0x02	8	Get	File List Information
FIL-DIRC	0x30 0x03	4	Get	User Storage Information
FIL-DELT	0x30 0x04	4 or 52	Command	Delete Single or All files
LCS Class NET			Network Center Messages	
NET-IO	0x31 0x01	4	Get	Network Information

NET-4GINF	0x31 0x02	4	Get	4G module Basic Information
NET-4GREG	0x31 0x03	Get:0 / Set: 36	Get/Set	4G module registering Information
NET-PWR	0x31 0x04	8	Command	network interface (4G or Ethernet) in a defined power state.
LCS Class UIO			User Define GPIO (I/O)	
UIO-GETSET	0x32 0x02	Get: 12 / Set: 12	Get/Set	Read/Write User GPIO
LCS Class LoRa			LoRa Configuration	
LoRa-GETSET	0x31 0x01	Get: 0 / Set: 4	Get/Set	Read/Write LoRa setting
LCS Class SYS			System Information	
MODEL-GET	0xFE 0x01	Get: 0	Get	Read model information

1.6 LCS-ACK (0x05)

LCS-ACK-ACK (0x05 0x01)

Message	ACK-ACK				
Description	Message Acknowledged				
Firmware					
Type	Output				
Comment	Output upon processing of an input message				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x05	0x01	2	see below	CK_A CK_B
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		clsID		Class ID of the Acknowledged Message
1	U1		msgID		Message ID of the Acknowledged Message

LCS-ACK-NAK (0x05 0x00)

Message	ACK-NAK				
Description	Message Not-Acknowledged				
Firmware					
Type	Output				
Comment	Output upon processing of an input message				

Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x05	0x00	2	see below	CK_A CK_B

Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		clsID		Class ID of the Not-Acknowledged Message
1	U1		msgID		Message ID of the Not-Acknowledged Message

1.7 LCS-CFG (0x06)

LCS-CFG-PWR (0x06 0x57)

Message	CFG-PWR				
Description	RTKLIB Engine defined power state.				
Firmware					
Type	Get/Set				
Comment					

Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x06	0x57	Get:0 / Set: 8	see below	CK_A CK_B

Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (1 for this version)
1	U1[3]		rsv		Reserved
4	U4		state		Get system state: 0x52554E20: RTK Engine running 0x53544F50: RTK Engine stopped Set system state: 0x52554E20: RTK Engine re-running

LCS-CFG-RST (0x06 0x04)

Message	CFG-RST
Description	Reset RTK-22 module
Firmware	

Type	Command								
Comment	Don't expect this message to be acknowledged by the receiver.								
Message Structure									
Header	Class	ID	Length (Bytes)	Payload	Checksum				
0xB5 0x62	0x06	0x04	4	see below	CK_A CK_B				
Payload Contents:									
Byte Offset	Number Format	Scaling	Name	Unit	Description				
0	X2		navBbr-Mask		Reserved				
2	U1		Reset-Mode		Reset Type <table><tr><td>Type</td><td>Description</td></tr><tr><td>0x00</td><td>Hardware reset immediately</td></tr></table>	Type	Description	0x00	Hardware reset immediately
Type	Description								
0x00	Hardware reset immediately								
3	U1		rsv		Reserved				

LCS-CFG-RTKADV (0x06 0xC1)

Message	CFG-RTKADV				
Description	RTKLIB Engine Advanced Settings				
Firmware					
Type	Get/Set				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x06	0xC1	Get:0 / Set: 28	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description																					
0	U1		version		Message version (1 for this version)																					
1	U1		update		Update rate definition <table><tr><td>Bitfield</td><td>value</td><td>Description</td></tr><tr><td rowspan="4">Bit[2:0]</td><td>0</td><td>1Hz</td></tr><tr><td>1</td><td>2Hz</td></tr><tr><td>2</td><td>4Hz</td></tr><tr><td>3</td><td>5Hz</td></tr><tr><td>Bit[7:3]</td><td colspan="2">reserved</td></tr></table>	Bitfield	value	Description	Bit[2:0]	0	1Hz	1	2Hz	2	4Hz	3	5Hz	Bit[7:3]	reserved							
Bitfield	value	Description																								
Bit[2:0]	0	1Hz																								
	1	2Hz																								
	2	4Hz																								
	3	5Hz																								
Bit[7:3]	reserved																									
2	X1		armode		Reserved																					
3	X1		maskrb		Rover/Base SNR mask <table><tr><td>Bitfield</td><td>Name</td><td>Description</td></tr><tr><td>Bit[0]</td><td>snrrover</td><td>1 = valid rover SNR mask</td></tr><tr><td>Bit[1]</td><td>snrbase</td><td>1 = valid base SNR mask</td></tr><tr><td>Bit[2]</td><td>mvbscs</td><td>1 = valid base constraint</td></tr><tr><td>Bit[3]</td><td>sendgga</td><td>1 = enable GGA transmission</td></tr></table>	Bitfield	Name	Description	Bit[0]	snrrover	1 = valid rover SNR mask	Bit[1]	snrbase	1 = valid base SNR mask	Bit[2]	mvbscs	1 = valid base constraint	Bit[3]	sendgga	1 = enable GGA transmission						
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4	U1		Inrfmt		Input Rover format <table><tr><td>format</td><td>Description</td></tr><tr><td>0</td><td>rtcm3</td></tr></table>	format	Description	0	rtcm3																	
format	Description																									
0	rtcm3																									
5	U1		Inbfmt		Input Base format <table><tr><td>format</td><td>Description</td></tr><tr><td>0</td><td>rtcm3</td></tr></table>	format	Description	0	rtcm3																	
format	Description																									
0	rtcm3																									
6	X2		navsys		A bit mask showing the current major GNSS selection enabled for this receiver <table><tr><td>Bitfield</td><td>Name</td><td>Description</td></tr><tr><td>Bit[0]</td><td>GPS</td><td>1 = GPS is enabled</td></tr><tr><td>Bit[1]</td><td>SBAS</td><td>1 = SBAS is enabled</td></tr><tr><td>Bit[2]</td><td>Glonass</td><td>1 = GLONASS is enabled</td></tr><tr><td>Bit[3]</td><td>Galileo</td><td>1 = Galileo is enabled</td></tr><tr><td>Bit[4]</td><td>QZSS</td><td>1 = QZSS is enabled</td></tr><tr><td>Bit[5]</td><td>Beidou</td><td>1 = BeiDou is enabled</td></tr></table>	Bitfield	Name	Description	Bit[0]	GPS	1 = GPS is enabled	Bit[1]	SBAS	1 = SBAS is enabled	Bit[2]	Glonass	1 = GLONASS is enabled	Bit[3]	Galileo	1 = Galileo is enabled	Bit[4]	QZSS	1 = QZSS is enabled	Bit[5]	Beidou	1 = BeiDou is enabled
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Bit[5]	Beidou	1 = BeiDou is enabled																								
8	U1		dgnssMode		Specifies differential mode: <table><tr><td>value</td><td>name</td></tr><tr><td>5</td><td>continuous</td></tr><tr><td>6</td><td>instantaneous</td></tr><tr><td>7</td><td>fix and hold</td></tr></table>	value	name	5	continuous	6	instantaneous	7	fix and hold													
value	name																									
5	continuous																									
6	instantaneous																									
7	fix and hold																									
9	U1		minCNO	dBHz	Minimum satellite signal level for navigation																					

10	U1		fixMode		<div>Position Fixing Mode:</div> <table><tr><td>mode</td><td>Description</td><td>Note</td></tr><tr><td>4</td><td>Single</td><td>Only for Sensor-Node Mode</td></tr><tr><td>6</td><td>kinematic</td><td>Only for Rover Mode</td></tr><tr><td>8</td><td>moving base</td><td>For Rover and Sensor-Node Mode</td></tr><tr><td>13</td><td>kinematic+ moving base</td><td>Only for Rover Mode</td></tr></table>	mode	Description	Note	4	Single	Only for Sensor-Node Mode	6	kinematic	Only for Rover Mode	8	moving base	For Rover and Sensor-Node Mode	13	kinematic+ moving base	Only for Rover Mode																								
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8	moving base	For Rover and Sensor-Node Mode																																										
13	kinematic+ moving base	Only for Rover Mode																																										
11	I1		minElev	deg	Minimum Elevation for a GNSS satellite to be used in NAV																																							
12	U4		baselen	cm	baseline length constraint (const)																																							
16	U4		basesig	cm	baseline length constraint (sigma)																																							
20	X4		autocmd		<div>A bit mask showing the current auto commands output selection enabled for this receiver</div> <table><tr><td>Bitfield</td><td>Name</td><td>Description</td></tr><tr><td>Bit[0]</td><td>NAV-SOL</td><td>1 = LCS-NAV-SOL is enabled</td></tr><tr><td>Bit[1]</td><td>NAV-STATUS</td><td>1 = LCS- NAV-STATUS is enabled</td></tr><tr><td>Bit[2]</td><td>NAV-VELNED</td><td>1 = LCS- NAV-VELNED is enabled</td></tr><tr><td>Bit[3]</td><td>NAV-PVT</td><td>1 = LCS-NAV-PVT is enabled</td></tr><tr><td>Bit[4]</td><td>NAV-SATR</td><td>1 = LCS-NAV-SATR is enabled</td></tr><tr><td>Bit[5]</td><td>NAV-SATB</td><td>1 = LCS-NAV-SATB is enabled</td></tr><tr><td>Bit[6]</td><td>NMEA-GGA</td><td>1 = NMEA GGA is enabled</td></tr><tr><td>Bit[7]</td><td>NMEA-RMC</td><td>1 = NMEA RMC is enabled</td></tr><tr><td>Bit[8]</td><td>NMEA-GSA</td><td>1 = NMEA GSA is enabled</td></tr><tr><td>Bit[9]</td><td>NMEA-GSV</td><td>1 = NMEA GSV is enabled</td></tr><tr><td>Bit[10]</td><td>NMEA-PMB</td><td>1 = NMEA PMB is enabled</td></tr><tr><td>Bit[11]</td><td>NAV-PVTHR</td><td>1 = LCS-NAV-PVTHR is enabled</td></tr></table>	Bitfield	Name	Description	Bit[0]	NAV-SOL	1 = LCS-NAV-SOL is enabled	Bit[1]	NAV-STATUS	1 = LCS- NAV-STATUS is enabled	Bit[2]	NAV-VELNED	1 = LCS- NAV-VELNED is enabled	Bit[3]	NAV-PVT	1 = LCS-NAV-PVT is enabled	Bit[4]	NAV-SATR	1 = LCS-NAV-SATR is enabled	Bit[5]	NAV-SATB	1 = LCS-NAV-SATB is enabled	Bit[6]	NMEA-GGA	1 = NMEA GGA is enabled	Bit[7]	NMEA-RMC	1 = NMEA RMC is enabled	Bit[8]	NMEA-GSA	1 = NMEA GSA is enabled	Bit[9]	NMEA-GSV	1 = NMEA GSV is enabled	Bit[10]	NMEA-PMB	1 = NMEA PMB is enabled	Bit[11]	NAV-PVTHR	1 = LCS-NAV-PVTHR is enabled
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Bit[11]	NAV-PVTHR	1 = LCS-NAV-PVTHR is enabled																																										
24	U4		autocycle		=0, Disable periodic message >0, Enable periodic message, The value is the multiple of GPS refresh period.																																							

LCS-CFG-RTKIO (0x06 0xC2)

Message	CFG-RTKIO
Description	RTKLIB Engine I/O Settings
Firmware	
Type	Get/Set
Comment	

Message Structure

Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x06	0xC2	Get:0 / Set: 108	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description															
0	X1		iotype		<div>Input Base type</div> <table><tr><th>Bitfield</th><th>Name</th><th>Description</th></tr><tr><td>Bit[0:2]</td><td>inbtype</td><td>Input Base Type (Only for Rover Mode) 1: serial, kinematic (rover): UART6 moving-base (rover): UART2 7: ethernet or 4G</td></tr><tr><td>Bit[3:5]</td><td>otbtype</td><td>Output Base Type (Only for Base Mode) 1: serial, 6: ethernet or 4G</td></tr></table>	Bitfield	Name	Description	Bit[0:2]	inbtype	Input Base Type (Only for Rover Mode) 1: serial, kinematic (rover): UART6 moving-base (rover): UART2 7: ethernet or 4G	Bit[3:5]	otbtype	Output Base Type (Only for Base Mode) 1: serial, 6: ethernet or 4G						
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Bit[3:5]	otbtype	Output Base Type (Only for Base Mode) 1: serial, 6: ethernet or 4G																		
1	X1		logpath		<div>RTK log Destination</div> <table><tr><th>Bitfield</th><th>Name</th><th>Description</th></tr><tr><td>Bit[0:1]</td><td>sollog</td><td>Solution result log file 0: Off, 1: SD-Card 2: Internal flash</td></tr><tr><td>Bit[2:3]</td><td>raw1log</td><td>GNSS1 raw data log file 0: Off, 1: SD-Card</td></tr><tr><td>Bit[4:5]</td><td>raw2log</td><td>GNSS2 raw data log file 0: Off, 1: SD-Card</td></tr><tr><td>Bit[6:7]</td><td>logfunc</td><td>Behavior of datalog function 0: Full-stop, 1: Recursive (FIFO)</td></tr></table>	Bitfield	Name	Description	Bit[0:1]	sollog	Solution result log file 0: Off, 1: SD-Card 2: Internal flash	Bit[2:3]	raw1log	GNSS1 raw data log file 0: Off, 1: SD-Card	Bit[4:5]	raw2log	GNSS2 raw data log file 0: Off, 1: SD-Card	Bit[6:7]	logfunc	Behavior of datalog function 0: Full-stop, 1: Recursive (FIFO)
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Bit[0:1]	sollog	Solution result log file 0: Off, 1: SD-Card 2: Internal flash																		
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Bit[4:5]	raw2log	GNSS2 raw data log file 0: Off, 1: SD-Card																		
Bit[6:7]	logfunc	Behavior of datalog function 0: Full-stop, 1: Recursive (FIFO)																		
2	X1		posopt		<div>Position option</div> <table><tr><th>option</th><th>Description</th></tr><tr><td>0</td><td>LLH</td></tr><tr><td>5</td><td>rtcm station pos</td></tr></table>	option	Description	0	LLH	5	rtcm station pos									
option	Description																			
0	LLH																			
5	rtcm station pos																			
3	U1		rsv1		Reserved															
4	U1[2]		rsv2		Reserved															
6	U2		port		Caster Port Number															
8	U4		addr		Caster IP Address															
12	CH [32]		user		Ntrip Caster user name															
44	CH [32]		pswd		Ntrip Caster password															
76	CH [32]		mptr		Ntrip Caster mount point															

LCS-CFG-ROL (0x06 0xC3)

Message	CFG-ROL								
Description	RTKLIB Engine Role Settings								
Firmware									
Type	Get/Set								
Comment									
Message Structure									
Header	Class	ID	Length (Bytes)	Payload	Checksum				
0xB5 0x62	0x06	0xC3	Get:0 / Set: 4	see below	CK_A CK_B				
Payload Contents:									
Byte Offset	Number Format	Scaling	Name	Unit	Description				
0	U1		version		Message version (1 for this version)				
1	U1[2]		rsv		Reserved				
3	U1		role		RTK log Destination <table><tr><td>Bitfield</td><td>Role Description</td></tr><tr><td>Bit[3:0]</td><td>0= Rover 1= Base 2=sensor-node</td></tr></table>	Bitfield	Role Description	Bit[3:0]	0= Rover 1= Base 2=sensor-node
Bitfield	Role Description								
Bit[3:0]	0= Rover 1= Base 2=sensor-node								

LCS-CFG-DFT (0x06 0xC4)

Message	CFG-DFT				
Description	Reset configuration to factory default				
Firmware					
Type	Command				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x06	0xC4	4	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description						
0	U1		version		Message version (1 for this version)						
1	U1		type		<table><tr><th>Type</th><th>Description</th></tr><tr><td>0</td><td>Reset RTK config. To Factory default (rover)</td></tr><tr><td>2</td><td>Reset RTK config. To Factory default (sensor)</td></tr></table>	Type	Description	0	Reset RTK config. To Factory default (rover)	2	Reset RTK config. To Factory default (sensor)
Type	Description										
0	Reset RTK config. To Factory default (rover)										
2	Reset RTK config. To Factory default (sensor)										
2	U2		magic		Message magic number (0xBEEF)						

LCS-CFG-RTKPOST (0x06 0xC5)

Message	CFG-RTKPOST
Description	RTKLIB Engine Post Message to NTRIP Caster Settings
Firmware	
Type	Get / Set
Comment	

Message Structure

Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x06	0xC5	Get:2 / Set: 104	see below	CK_A CK_B

Payload Contents: Get

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		rsv2		Reserved
1	U1		index		Indicate the Caster index (0 or 1)

Payload Contents: Set

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		rsv2		Reserved
1	U1		index		Indicate the Caster index (0 or 1)
2	U2		port		Caster Port Number
4	U4		addr		Caster IP Address
8	CH [32]		user		Ntrip Caster user name
40	CH [32]		pswd		Ntrip Caster password
72	CH [32]		mptr		Ntrip Caster mount point

LCS-CFG-CFGSVR (0x06 0xD1)

Message	CFG-CFGSVR				
Description	User-Config. Server IP Address Settings				
Firmware					
Type	Get / Set				
Comment	After RTK-22 accepts the configuration successfully, it will reboot automatically				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x06	0xD1	Get: 0 / Set: 8	see below	CK_A CK_B
Payload Contents: Set					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		rsv2		Reserved
2	U2		magic		Message magic number (0xBEEF)
4	U4		addr		User-defined Server IP Address

1.8 LCS-MGA (0x13)

LCS-MGA-ACK (0x13 0x60)

Message	MGA-ACK				
Description	Multiple GNSS Acknowledge message				
Firmware					
Type	Output				
Comment	This message is sent to acknowledge the receipt of an assistance message.				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x13	0x60	8	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		type		Type of acknowledgment: 0: The message was not used by the receiver (see infoCode field for an indication of why) 1: The message was accepted for use by the receiver (the infoCode field will be 0)
1	U1		version		Message version (0x00 for this version)
2	U1		infoCode		Provides greater information on what the receiver chose to do with the message contents: 0: The receiver accepted the data 2: The message version is not supported 3: The message size does not match the message version 4: The message data could not be stored to the database 5: The receiver is not ready to use the message data 6: The message type is unknown
3	U1		msgId		LCS message ID of the ack'ed message
4	U1[4]		msgPayloadStart		The first 4 bytes of the ack'ed message's payload

LCS-MGA-INIT-POS_LLH (0x13 0x40)

Message	MGA-INIT-POS_LLH				
Description	Initial Position Assistance				
Firmware					
Type	Get / Set				
Comment	Supplying position assistance that is inaccurate by more than the specified position accuracy, may lead to substantially degraded receiver performance. This message allows the delivery of initial position assistance to a receiver in WGS84 lat/long/alt coordinates.				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x13	0x40	Get:2 / Set:20	see below	CK_A CK_B

Payload Contents: Get

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		type		Message type (0x01 for this type)
1	U1		version		Message version (0x00 for this version)

Payload Contents: Set

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		type		Message type (0x01 for this type)
1	U1		version		Message version (0x00 for this version)
2	U1[2]		rsv		Reserved
4	I4	1e-7	lat	deg	WGS84 Latitude
8	I4	1e-7	lon	deg	WGS84 Longitude
12	I4		alt	cm	WGS84 Altitude
16	U4		posAcc	cm	Reserved

LCS-MGA-INI-POSHR_LLH (0x13 0x40)

Message	MGA-INIT-POSHR_LLH				
Description	Initial Position Assistance (High Resolution)				
Firmware					
Type	Get / Set				
Comment	Supplying position assistance that is inaccurate by more than the specified position accuracy, may lead to substantially degraded receiver performance. This message allows the delivery of initial position assistance to a receiver in WGS84 lat/long/alt coordinates.				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x13	0x40	Get:2 / Set:32	see below	CK_A CK_B

Payload Contents: Get

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		type		Message type (0xF1 for this type)
1	U1		version		Message version (0x00 for this version)

Payload Contents: Set

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		type		Message type (0x01 for this type)
1	U1		version		Message version (0x00 for this version)
2	U1[6]		rsv		Reserved
8	Double		lat	deg	WGS84 Latitude
16	Double		lon	deg	WGS84 Longitude
24	I4		alt	mm	WGS84 Altitude
28	U4		posAcc	cm	Reserved

1.9 LCS-MON (0x0A)

LCS-MON-IO (0x0A 0x02)

Message	MON-IO				
Description	I/O Subsystem Status				
Firmware					
Type	Get				
Comment	The size of the message is determined by the number of ports 'N' the module supports				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x0A	0x02	0 + 48*N	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description		
Start of repeated block (N times)							
0 + 48*N	U4		rxBytes	bytes	Number of bytes ever received		
4 + 48*N	U4		txBytes	bytes	Number of bytes ever sent		
8 + 48*N	U2		rxBps	bits	data rate (bps) of the receiving streams		
10 + 48*N	U2		txBps	bits	data rate (bps) of the sending streams		
12 + 48*N	U2		parityErrs		Reserved		
14 + 48*N	U2		framingErrs		Reserved		
16 + 48*N	U2		overrunErrs		Reserved		
18 + 48*N	U2		breakCond		Reserved		
20 + 48*N	U1		rxBusy		Flag is receiver is busy		
21 + 48*N	U1		txBusy		Flag is transmitter is busy		
22 + 48*N	X1		status		status of communication		
					Bitfield	Name	Description
					Bit[2:0]	net-status	0: close, 1: wait, 2: connect (only valid for network interface)
23 + 48*N	U1		rsv		Reserved		
24 + 48*N	CH[24]		strname		The name of physical interface		
End of repeated block							

LCS-MON-VER (0x0A 0x04)

Message	MON-VER				
Description	System Software/Hardware Version				
Firmware					
Type	Get				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x0A	0x04	80 + 32*N	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
Start of repeated block (N times)					
0	CH [64]		swVersion		Zero-terminated Software Version String.
64	CH [16]		hwVersion		Zero-terminated Hardware Version String
Start of repeated block (N times)					
80 + 32*N	CH [32]		extension		Extended software information strings. A series of zero-terminated strings. Each extension field is 32 characters long.
End of repeated block					

LCS-MON-SYSVER (0x0A 0x05)

Message	MON-SYSVER				
Description	System Firmware Version				
Firmware					
Type	Get				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x0A	0x05	0+32*N	see below	CK_A CK_B
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
Start of repeated block (N times)					
32*N	CH [32]		extension		System firmware information strings. A series of zero-terminated strings. Each field is 32 characters long.
End of repeated block					

1.10 LCS-NAV (0x01)
LCS-NAV-POSLLH (0x01 0x02)

Message	NAV-POSLLH
Description	Geodetic Position Solution

Firmware					
Type	Get				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x02	28	see below	CK_A CK_B
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4		iTOW	ms	GPS time of week of the navigation epoch.
4	I4	1e-7	lon	deg	Longitude
8	I4	1e-7	lat	deg	Latitude
12	I4		height	mm	Height above ellipsoid
16	I4		hMSL	mm	Height above mean sea level
20	U4		hAcc	mm	Horizontal accuracy estimate
24	U4		vAcc	mm	Vertical accuracy estimate

LCS-NAV-PVT (0x01 0x07)

Message	NAV-PVT				
Description	Navigation Position Velocity Time Solution				
Firmware					
Type	Periodic				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x07	100	see below	CK_A CK_B
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4		iTOW	ms	GPS time of week of the navigation epoch.
4	U2		year	y	Year (UTC)
6	U1		month	month	Month, range 1...12 (UTC)
7	U1		day	d	Day of month, range 1...31 (UTC)
8	U1		hour	h	Hour of day, range 0...23 (UTC)
9	U1		min	min	Minute of hour, range 0...59 (UTC)

10	U1		sec	s	Seconds of minute, range 0...60 (UTC)										
11	X1		valid		Reserved										
12	U4		tAcc	ns	Reserved										
16	I4		nano	ns	Fraction of second, range -1e9 ... 1e9 (UTC)										
20	U1		fixType		RTK Engine Fix Type for high precision position: <table><tr><td>Type</td><td>Description</td></tr><tr><td>6</td><td>Invalid</td></tr><tr><td>7</td><td>FIX</td></tr><tr><td>8</td><td>FLOAT</td></tr><tr><td>11</td><td>SINGLE</td></tr></table>	Type	Description	6	Invalid	7	FIX	8	FLOAT	11	SINGLE
Type	Description														
6	Invalid														
7	FIX														
8	FLOAT														
11	SINGLE														
21	X1		fixType2		RTK Engine Fix Type for high precision heading: <table><tr><td>Type</td><td>Description</td></tr><tr><td>6</td><td>Invalid</td></tr><tr><td>7</td><td>FIX</td></tr><tr><td>8</td><td>FLOAT</td></tr><tr><td>11</td><td>SINGLE</td></tr></table>	Type	Description	6	Invalid	7	FIX	8	FLOAT	11	SINGLE
Type	Description														
6	Invalid														
7	FIX														
8	FLOAT														
11	SINGLE														
22	X1		flags2		Reserved										
23	U1		numSV		Number of satellites used in Nav Solution										
24	I4	1e-7	lon	deg	Longitude										
28	I4	1e-7	lat	deg	Latitude										
32	I4		height	mm	Height above ellipsoid										
36	I4		hMSL	mm	Height above mean sea level										
40	U4		hAcc	mm	Horizontal accuracy estimate										
44	U4		vAcc	mm	Vertical accuracy estimate										
48	I4		velN	mm/s	NED north velocity										
52	I4		velE	mm/s	NED east velocity										
56	I4		velD	mm/s	NED down velocity										
60	I4		gSpeed	mm/s	Ground Speed (2-D)										
64	I4	1e-5	headMot	deg	Heading of motion (2-D)										
68	U4		sAcc	mm/s	Speed accuracy estimate										
72	U4	1e-5	headAcc	deg	Heading accuracy estimate (both motion and vehicle)										
76	U2	0.01	pDOP		Position DOP										
78	U1[6]		rsv1		Reserved										
84	I4	1e-5	headVeh	deg	Heading of vehicle (2-D)										
88	I4	1e-3	pitch	deg	A pitch is a counterclockwise rotation of β about the y -axis.										
92	I4	1e-3	yaw	deg	A yaw is a counterclockwise rotation of α about the z -axis.										
96	I4		baselen	mm	Length between base and rover										

LCS-NAV-PVTHR (0x01 0x08)

Message	NAV-PVTHR
Description	Navigation Position Velocity Time Solution (High Resolution)
Firmware	
Type	Periodic
Comment	

Message Structure

Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x08	112	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description										
0	U4		iTOW	ms	GPS time of week of the navigation epoch.										
4	U2		year	y	Year (UTC)										
6	U1		month	month	Month, range 1...12 (UTC)										
7	U1		day	d	Day of month, range 1...31 (UTC)										
8	U1		hour	h	Hour of day, range 0...23 (UTC)										
9	U1		min	min	Minute of hour, range 0...59 (UTC)										
10	U1		sec	s	Seconds of minute, range 0...60 (UTC)										
11	X1		valid		Reserved										
12	U4		tAcc	ns	Reserved										
16	I4		nano	ns	Fraction of second, range -1e9 ... 1e9 (UTC)										
20	U1		fixType		RTK Engine Fix Type for high precision position: <table><tr><th>Type</th><th>Description</th></tr><tr><td>6</td><td>Invalid</td></tr><tr><td>7</td><td>FIX</td></tr><tr><td>8</td><td>FLOAT</td></tr><tr><td>11</td><td>SINGLE</td></tr></table>	Type	Description	6	Invalid	7	FIX	8	FLOAT	11	SINGLE
Type	Description														
6	Invalid														
7	FIX														
8	FLOAT														
11	SINGLE														
21	X1		fixType2		RTK Engine Fix Type for high precision heading: <table><tr><th>Type</th><th>Description</th></tr><tr><td>6</td><td>Invalid</td></tr><tr><td>7</td><td>FIX</td></tr><tr><td>8</td><td>FLOAT</td></tr><tr><td>11</td><td>SINGLE</td></tr></table>	Type	Description	6	Invalid	7	FIX	8	FLOAT	11	SINGLE
Type	Description														
6	Invalid														
7	FIX														
8	FLOAT														
11	SINGLE														
22	X1		flags2		Reserved										
23	U1		numSV		Number of satellites used in Nav Solution										
24	Double		lon	deg	Longitude										
32	Double		lat	deg	Latitude										
40	I4		height	mm	Height above ellipsoid										

44	I4		hMSL	mm	Height above mean sea level
48	U4		hAcc	mm	Horizontal accuracy estimate
52	U4		vAcc	mm	Vertical accuracy estimate
56	I4		veIN	mm/s	NED north velocity
60	I4		veIE	mm/s	NED east velocity
64	I4		veID	mm/s	NED down velocity
68	I4		gSpeed	mm/s	Ground Speed (2-D)
72	I4	1e-5	headMot	deg	Heading of motion (2-D)
76	U4		sAcc	mm/s	Speed accuracy estimate
80	U4	1e-5	headAcc	deg	Heading accuracy estimate (both motion and vehicle)
84	U2	0.01	pDOP		Position DOP
86	U1[6]		rsv1		Reserved
92	I4	1e-5	headVeh	deg	Heading of vehicle (2-D)
96	I4	1e-3	pitch	deg	A pitch is a counterclockwise rotation of β about the y -axis.
100	I4	1e-3	yaw	deg	A yaw is a counterclockwise rotation of α about the z -axis.
104	I4		baselen	mm	Length between base and rover
108	U1[4]		rsv2		Reserved

LCS-NAV-SOL (0x01 0x06)

Message	NAV-SOL				
Description	Navigation Solution Information				
Firmware					
Type	Periodic				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x06	52	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description										
0	U4		iTOW	ms	GPS time of week of the navigation epoch.										
4	I4		fTOW	ns	Fractional part of iTOW (range: +/-500000). The precise GPS time of week in seconds is: (iTOW * 1e-3) + (fTOW * 1e-9)										
8	I2		week	weeks	GPS week number of the navigation epoch										
10	U1		gpsFix		RTK Engine Fix Type <table><tr><th>Type</th><th>Description</th></tr><tr><td>6</td><td>Invalid</td></tr><tr><td>7</td><td>FIX</td></tr><tr><td>8</td><td>FLOAT</td></tr><tr><td>11</td><td>SINGLE</td></tr></table>	Type	Description	6	Invalid	7	FIX	8	FLOAT	11	SINGLE
Type	Description														
6	Invalid														
7	FIX														
8	FLOAT														
11	SINGLE														
11	X1		flags		Reserved										
12	I4		ecefX	cm	ECEF X coordinate										
16	I4		ecefY	cm	ECEF Y coordinate										
20	I4		ecefZ	cm	ECEF Z coordinate										
24	U4		pAcc	cm	3D Position Accuracy Estimate										
28	I4		ecefVX	cm/s	ECEF X velocity										
32	I4		ecefVY	cm/s	ECEF Y velocity										
36	I4		ecefVZ	cm/s	ECEF Z velocity										
40	U4		sAcc	cm/s	Speed Accuracy Estimate										
44	U2	0.01	pDOP		Position DOP										
46	U1		rsv1		Reserved										
47	U1		numSV		Number of SVs used in Nav Solution										
48	U1[4]		rsv2		Reserved										

LCS-NAV-STATUS (0x01 0x03)

Message	NAV-STATUS				
Description	Navigation Status Information				
Firmware					
Type	Periodic				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x03	16	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description										
0	U4		iTOW	ms	GPS time of week of the navigation epoch.										
4	U1		gpsFix		RTK Engine Fix, this value does not qualify a fix as valid and within the limits. <table><tr><th>Type</th><th>Description</th></tr><tr><td>6</td><td>Invalid</td></tr><tr><td>7</td><td>FIX</td></tr><tr><td>8</td><td>FLOAT</td></tr><tr><td>11</td><td>SINGLE</td></tr></table>	Type	Description	6	Invalid	7	FIX	8	FLOAT	11	SINGLE
Type	Description														
6	Invalid														
7	FIX														
8	FLOAT														
11	SINGLE														
5	X1		flags		Reserved										
6	X1		fixStat		Reserved										
7	X1		flags2		Reserved										
8	U4		ttff	ms	Reserved										
12	U4		msss	ms	Reserved										

LCS-NAV-VELNED (0x01 0x12)

Message	NAV-VELNED				
Description	Velocity Solution information				
Firmware					
Type	Periodic				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x12	36	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4		iTOW	ms	GPS time of week of the navigation epoch.
4	I4		velN	cm/s	North velocity component
8	I4		velE	cm/s	East velocity component
12	I4		velD	cm/s	Down velocity component
16	U4		speed	cm/s	Speed (3-D)
20	U4		gSpeed	cm/s	Ground speed (2-D)
24	I4	1e-5	heading	deg	Heading of motion 2-D
28	U4		sAcc	cm/s	Speed accuracy Estimate
32	U4	1e-5	cAcc	deg	Course / Heading accuracy estimate

LCS-NAV-SATR (0x01 0x35) / LCS-NAV-SATB (0x01 0x36)

Message	NAV-SAT				
Description	Base/Rover Satellite Information				
Firmware					
Type	Periodic				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x35/0x36	8 + 28*numSvs	see below	CK_A CK_B

Payload Contents:

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4		iTOW	ms	GPS time of week of the navigation epoch.
4	U1		version		Message version (1, for this version)
5	U1		numSvs		Number of Satellites
6	U1[2]		rsv1		Reserved
Start of repeated block (numSv times)					

8+28*N	U1		gnssId		<div>GNSS ID<table><tr><td>gnssId</td><td>GNSS</td></tr><tr><td>0</td><td>GPS</td></tr><tr><td>1</td><td>SBAS</td></tr><tr><td>2</td><td>Galileo</td></tr><tr><td>3</td><td>BeiDou</td></tr><tr><td>5</td><td>QZSS</td></tr><tr><td>6</td><td>GLONASS</td></tr><tr><td>255</td><td>unknown</td></tr></table></div>	gnssId	GNSS	0	GPS	1	SBAS	2	Galileo	3	BeiDou	5	QZSS	6	GLONASS	255	unknown
gnssId	GNSS																				
0	GPS																				
1	SBAS																				
2	Galileo																				
3	BeiDou																				
5	QZSS																				
6	GLONASS																				
255	unknown																				
9+28*N	U1		svId		<div>Satellite ID</div> <div>Note: This value,255, represents an unknown Satellite ID.</div>																
10+28*N	U1		cno	dBHz	Carrier to noise ratio (signal strength)																
11+28*N	I1		elev	deg	Elevation (range: +/-90), unknown if out of range																
12+28*N	I2		azim	deg	Azimuth (range: 0-360), unknown if elevation is out of range																
14+28*N	I2	0.1	prRes	m	Pseudo range residual																
16+28*N	X4		flags		Reserved																
20+28*N	I4		lock		lock counter of phase																
24+28*N	U4		slipc		cycle-slip counter																
28+28*N	U4		rejc		reject counter																
32+28*N	X2		svFlag		<div>Bitmask<table><tr><td>Bitfield</td><td>Name</td><td>Description</td></tr><tr><td>Bit[0]</td><td>vs</td><td>valid satellite flag single: 0: unknown 1: OK</td></tr><tr><td>Bit[1]</td><td>vsat</td><td>valid satellite flag: 0: unknown 1: OK</td></tr><tr><td>Bit[2:3]</td><td>health</td><td>ambiguity fix flag 0: unknown 1: fix 2: float 3: hold</td></tr></table></div>	Bitfield	Name	Description	Bit[0]	vs	valid satellite flag single: 0: unknown 1: OK	Bit[1]	vsat	valid satellite flag: 0: unknown 1: OK	Bit[2:3]	health	ambiguity fix flag 0: unknown 1: fix 2: float 3: hold				
Bitfield	Name	Description																			
Bit[0]	vs	valid satellite flag single: 0: unknown 1: OK																			
Bit[1]	vsat	valid satellite flag: 0: unknown 1: OK																			
Bit[2:3]	health	ambiguity fix flag 0: unknown 1: fix 2: float 3: hold																			
34+28*N	U1		freqnum		carrier frequency number L1:0, L2:1, L5:2																
35+28*N	U1		rsv2		Reserved																
End of repeated block																					

LCS-NAV-BAS (0x01 0x61)

Message	NAV-BAS
Description	Base Position
Firmware	
Type	Periodic
Comment	

Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x61	20	see below	CK_A CK_B

Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4		iTOW	ms	GPS time of week of the navigation epoch.
4	I4	1e-7	lon	deg	Longitude
8	I4	1e-7	lat	deg	Latitude
12	I4		height	mm	Height above ellipsoid
16	I4		hMSL	mm	Height above mean sea level

LCS-NAV-BASHR (0x01 0x62)

Message	NAV-BASHR				
Description	Base Position (High Resolution)				
Firmware					
Type	Periodic				
Comment					

Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x01	0x62	32	see below	CK_A CK_B

Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U4		iTOW	ms	GPS time of week of the navigation epoch.
4	U1[4]		rsv		Reserved
8	Double		lon	deg	Longitude
16	Double		lat	deg	Latitude
24	I4		height	mm	Height above ellipsoid
28	I4		hMSL	mm	Height above mean sea level

1.11 LCS-SEC (0x27)

LCS-SEC-UNIQID (0x27 0x03)

Message	SEC-UNIQID
---------	------------

Description	Module Information				
Firmware					
Type	Get				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x27	0x03	26	see below	CK_A CK_B
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (0x01 for this version)
1	U1[3]		rsv1		Reserved
4	U1[6]		uniqueid		Unique chip ID
10	CH [16]		modelName		Model Name

1.12 LCS-FIL (0x30)

LCS-FIL-LIST (0x30 0x02)

Message	FIL-LIST				
Description	File List Information				
Firmware					
Type	Get				
Comment	This message is used to get log file list				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x30	0x02	REQ: 8, RESP: 8+num*96	see below	CK_A CK_B

Payload Contents: REQ

Byte Offset	Number Format	Scaling	Name	Unit	Description				
0	U1		version		Message version (=1 for this version)				
1	U1[3]		rsv		Reserved				
4	U4		idx		idx : Start Index of File List (request message) <table><tr><td>idx</td><td>range of file list</td></tr><tr><td>n</td><td>$((n*20)+1) \sim (n+1)*20$</td></tr></table>	idx	range of file list	n	$((n*20)+1) \sim (n+1)*20$
idx	range of file list								
n	$((n*20)+1) \sim (n+1)*20$								

Payload Contents: RESP

Byte Offset	Number Format	Scaling	Name	Unit	Description										
0	U1		version		Message version (=1 for this version)										
1	U1[3]		rsv		Reserved										
4	U4		num		num: Number of File (response message)										
Start of repeated block (num times)															
8+96*N	CH [48]		name		File Name										
56+96*N	CH [48]		info		File Information include [type, size, date]										
					Type definition:										
					<table><tr><td>f</td><td>File</td></tr><tr><td>d</td><td>Directory</td></tr><tr><td>c</td><td>Char device</td></tr><tr><td>b</td><td>Block device</td></tr><tr><td>l</td><td>Symbolic link</td></tr></table>	f	File	d	Directory	c	Char device	b	Block device	l	Symbolic link
					f	File									
					d	Directory									
					c	Char device									
b	Block device														
l	Symbolic link														
Size definition: bytes															
End of repeated block															

LCS-FIL-DIRC (0x30 0x03)

Message	FIL-DIRC				
Description	User Storage Information				
Firmware					
Type	Get				
Comment	This message is used to get storage information				
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x30	0x03	REQ: 4 RESP: 16	see below	CK_A CK_B

Payload Contents: REQ

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (=1 for this version)
1	U1[3]		rsv		Reserved

Payload Contents: RESP

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (=1 for this version)
1	U1[3]		rsv		Reserved
4	U4		dirspace	bytes	Available space
8	U4		filenum		Total files in the storage
12	U4		dirtotal	bytes	Total space

LCS-FIL-DELT (0x30 0x04)

Message	FIL-DELT
Description	Delete Single or All files
Firmware	
Type	Command
Comment	This message is used to delete file

Message Structure

Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x30	0x04	Delete all: 4 Delete single: 52	see below	CK_A CK_B

Payload Contents: Delete All

Byte Offset	Number Format	Scaling	Name	Unit	Description	
0	U1		version		Message version (=1 for this version)	
1	U1[2]		rsv		Reserved	
3	U1		num		Number of files	
					num	Description
					0	Delete all files
					1	Delete single file

Payload Contents: Delete Single

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (=1 for this version)

1	U1[2]		rsv		Reserved						
3	U1		num		Number of files						
					<table><tr><td>num</td><td>Description</td></tr><tr><td>0</td><td>Delete all files</td></tr><tr><td>1</td><td>Delete single file</td></tr></table>	num	Description	0	Delete all files	1	Delete single file
					num	Description					
					0	Delete all files					
1	Delete single file										
4	CH [48]		name		File name						

1.13 LCS-NET (0x31)

LCS-NET-IO (0x31 0x01)

Message	NET-IO				
Description	Network I/O Subsystem Status				
Firmware					
Type	Get				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x31	0x01	REQ: 4 RESP: 48	see below	CK_A CK_B

Payload Contents: REQ

Byte Offset	Number Format	Scaling	Name	Unit	Description						
0	U1		version		Message version (=1 for this version)						
1	U1[2]		rsv		Reserved						
3	X1		flag		<div>Bitmask<table><tr><th>Bitfield</th><th>Name</th><th>Description</th></tr><tr><td>Bit[0:1]</td><td>type</td><td>interface indicator: 0: ethernet 1: 4G</td></tr></table></div>	Bitfield	Name	Description	Bit[0:1]	type	interface indicator: 0: ethernet 1: 4G
Bitfield	Name	Description									
Bit[0:1]	type	interface indicator: 0: ethernet 1: 4G									

Payload Contents: RESP

Byte Offset	Number Format	Scaling	Name	Unit	Description									
0	U1		version		Message version (=1 for this version)									
1	U1[2]		rsv		Reserved									
3	X1		flag		Bitmask <table><tr><th>Bitfield</th><th>Name</th><th>Description</th></tr><tr><td>Bit[0:1]</td><td>type</td><td>interface indicator: 0: ethernet 1: 4G</td></tr><tr><td>Bit[2:4]</td><td>state</td><td>operation state: 0: invalid interface 1: link up 2: link down 3: unknow</td></tr></table>	Bitfield	Name	Description	Bit[0:1]	type	interface indicator: 0: ethernet 1: 4G	Bit[2:4]	state	operation state: 0: invalid interface 1: link up 2: link down 3: unknow
Bitfield	Name	Description												
Bit[0:1]	type	interface indicator: 0: ethernet 1: 4G												
Bit[2:4]	state	operation state: 0: invalid interface 1: link up 2: link down 3: unknow												
4	U4		ipaddr		IP address									
8	U4		netmask		Sub-Net Mask address									
12	U4		gwaddr		Reserved									
16	U8		rxBytes	bytes	Number of bytes ever received									
24	U8		txBytes	bytes	Number of bytes ever sent									
32	U8		rxPkts		Number of packets ever received									
40	U8		txPkts		Number of packets ever sent									

LCS-NET-4GINF (0x31 0x02)

Message	NET-4GINF
Description	Information of 4G network interface
Firmware	
Type	Get
Comment	

Message Structure

Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x31	0x02	REQ:4 RESP: 4+num*64	see below	CK_A CK_B

Payload Contents: REQ

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (=1 for this version)
1	U1[3]		rsv		Reserved

Payload Contents: RESP

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (=1 for this version)
1	U1[2]		rsv		Reserved
3	U1		num		num: Number of Message

Start of repeated block (num times)

4+32*N	CH [32]		key		<div>List of supported keys:</div> <table><tr><th>name</th><th>description</th></tr><tr><td>IMEI</td><td>International Mobile station Equipment Identity of the mobile terminal</td></tr><tr><td>MANU</td><td>Manufacturer Identification</td></tr><tr><td>MODEL</td><td>Model Identification</td></tr><tr><td>REVS</td><td>Revision Identification</td></tr><tr><td>FUNC</td><td>Current Functionality Level</td></tr><tr><td>NMODE</td><td>Network Operation Mode</td></tr><tr><td>SIM</td><td>Status of SIM presense</td></tr><tr><td>CSQ[rssi,ber]</td><td>Signal Strength <rssi> is the received signal strength indication and has value from 0 (-113 dBm and lower) to 31 (-51 dBm and higher), or 99 if the signal strength is not known or not detectable. The <ber> parameter is channel bit error rate.</td></tr><tr><td>NTYPE</td><td>Network Service Type</td></tr><tr><td>OPER[md,fm,op,st]</td><td>Currently Selected Operator <op> is the operator format</td></tr></table>	name	description	IMEI	International Mobile station Equipment Identity of the mobile terminal	MANU	Manufacturer Identification	MODEL	Model Identification	REVS	Revision Identification	FUNC	Current Functionality Level	NMODE	Network Operation Mode	SIM	Status of SIM presense	CSQ[rssi,ber]	Signal Strength <rssi> is the received signal strength indication and has value from 0 (-113 dBm and lower) to 31 (-51 dBm and higher), or 99 if the signal strength is not known or not detectable. The <ber> parameter is channel bit error rate.	NTYPE	Network Service Type	OPER[md,fm,op,st]	Currently Selected Operator <op> is the operator format
name	description																										
IMEI	International Mobile station Equipment Identity of the mobile terminal																										
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SIM	Status of SIM presense																										
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NTYPE	Network Service Type																										
OPER[md,fm,op,st]	Currently Selected Operator <op> is the operator format																										

36+32*N	CH [32]		val		<div><div>FUNC:</div><table><tr><td>val</td><td>description</td></tr><tr><td>1</td><td>Full functionality (Default)</td></tr><tr><td>4</td><td>Disable both transmit and receive RF circuits</td></tr><tr><td>5</td><td>Factory Test Mode</td></tr><tr><td>6</td><td>RESET</td></tr></table></div> <div><div>NMODE:</div><table><tr><td>val</td><td>description</td></tr><tr><td>1</td><td>UMTS ONLY</td></tr><tr><td>2</td><td>AUTO (LTE->CDMA->HDR->TDS->WCDMA->GSM)</td></tr><tr><td>3</td><td>GSM+CDMA ONLY</td></tr><tr><td>4</td><td>TDS first priority (TDS->GSM->LTE->WCDMA->HDR->CDMA)</td></tr><tr><td>5</td><td>LTE ONLY</td></tr><tr><td>6</td><td>TDSCDMA ONLY</td></tr><tr><td>7</td><td>TDSCDMA_AND_WCDMA</td></tr><tr><td>8</td><td>TDSCDMA,GSM,WCDMA</td></tr><tr><td>9</td><td>TDSCDMA,WCDMA,LTE</td></tr><tr><td>10</td><td>HDR ONLY</td></tr><tr><td>11</td><td>LTE first priority (LTE->HDR->CDMA->TDS->WCDMA->GSM)</td></tr><tr><td>12</td><td>HDR first priority (HDR->CDMA->LTE->TDS->WCDMA->GSM)</td></tr><tr><td>13</td><td>HDR AND LTE</td></tr><tr><td>14</td><td>CDMA AND HDR</td></tr></table></div> <div><div>SIM:</div><table><tr><td>val</td><td>description</td></tr><tr><td>READY</td><td>SIM card without PIN</td></tr><tr><td>SIM PIN</td><td>SIM card requiring a PIN</td></tr><tr><td>SIM PUK</td><td>SIM card requiring a PUK</td></tr><tr><td>NOT INSERTED</td><td>SIM or SIM holder not properly inserted</td></tr></table></div> <div><div>NTYPE:</div><table><tr><td>val</td></tr><tr><td>LTE TDD</td></tr><tr><td>LTE FDD</td></tr><tr><td>TDSCDMA</td></tr><tr><td>HSPA+</td></tr><tr><td>UMTS</td></tr><tr><td>HSUPA</td></tr><tr><td>HSDPA</td></tr><tr><td>WCDMA</td></tr><tr><td>GPRS</td></tr><tr><td>EDGE</td></tr><tr><td>GSM</td></tr><tr><td>NONE</td></tr><tr><td>CDMA</td></tr><tr><td>REVO</td></tr></table></div>	val	description	1	Full functionality (Default)	4	Disable both transmit and receive RF circuits	5	Factory Test Mode	6	RESET	val	description	1	UMTS ONLY	2	AUTO (LTE->CDMA->HDR->TDS->WCDMA->GSM)	3	GSM+CDMA ONLY	4	TDS first priority (TDS->GSM->LTE->WCDMA->HDR->CDMA)	5	LTE ONLY	6	TDSCDMA ONLY	7	TDSCDMA_AND_WCDMA	8	TDSCDMA,GSM,WCDMA	9	TDSCDMA,WCDMA,LTE	10	HDR ONLY	11	LTE first priority (LTE->HDR->CDMA->TDS->WCDMA->GSM)	12	HDR first priority (HDR->CDMA->LTE->TDS->WCDMA->GSM)	13	HDR AND LTE	14	CDMA AND HDR	val	description	READY	SIM card without PIN	SIM PIN	SIM card requiring a PIN	SIM PUK	SIM card requiring a PUK	NOT INSERTED	SIM or SIM holder not properly inserted	val	LTE TDD	LTE FDD	TDSCDMA	HSPA+	UMTS	HSUPA	HSDPA	WCDMA	GPRS	EDGE	GSM	NONE	CDMA	REVO
val	description																																																																					
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EDGE																																																																						
GSM																																																																						
NONE																																																																						
CDMA																																																																						
REVO																																																																						

					<table><tr><td colspan="2">HDR - EMPA EHRPD</td></tr><tr><td colspan="2">HDR - MMPA EHRPD</td></tr><tr><td colspan="2">HDR REVB</td></tr><tr><td colspan="2">EVDO</td></tr></table> <p>OPER (md element): Operation Mode</p> <table><tr><td>val</td><td></td></tr><tr><td>0</td><td>Automatic</td></tr><tr><td>1</td><td>Manual</td></tr><tr><td>2</td><td>Deregister from network</td></tr><tr><td>4</td><td>Manual/automatic; if manual selection fails, automatic mode (<mode>=0) is entered</td></tr></table> <p>OPER (fm element): Operator Format</p> <table><tr><td>val</td><td></td></tr><tr><td>0</td><td>Long format alphanumeric of op element</td></tr><tr><td>1</td><td>Short format alphanumeric of op element</td></tr><tr><td>2</td><td>Numeric of op element</td></tr></table> <p>OPER (st element): Access technology selected</p> <table><tr><td>val</td><td></td></tr><tr><td>0</td><td>GSM</td></tr><tr><td>1</td><td>GSM compact</td></tr><tr><td>2</td><td>UTRAN</td></tr><tr><td>7</td><td>EUTRAN</td></tr></table>	HDR - EMPA EHRPD		HDR - MMPA EHRPD		HDR REVB		EVDO		val		0	Automatic	1	Manual	2	Deregister from network	4	Manual/automatic; if manual selection fails, automatic mode (<mode>=0) is entered	val		0	Long format alphanumeric of op element	1	Short format alphanumeric of op element	2	Numeric of op element	val		0	GSM	1	GSM compact	2	UTRAN	7	EUTRAN
HDR - EMPA EHRPD																																									
HDR - MMPA EHRPD																																									
HDR REVB																																									
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val																																									
0	Automatic																																								
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val																																									
0	Long format alphanumeric of op element																																								
1	Short format alphanumeric of op element																																								
2	Numeric of op element																																								
val																																									
0	GSM																																								
1	GSM compact																																								
2	UTRAN																																								
7	EUTRAN																																								
End of repeated block																																									

LCS-NET-4GREG (0x31 0x03)

Message	NET-4GREG				
Description	Operator configuration of 4G network interface				
Firmware					
Type	Get / Set				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x31	0x03	Get:0 / Set: 36	see below	CK_A CK_B

Payload Contents: REQ

Byte Offset	Number Format	Scaling	Name	Unit	Description								
0	U1		pdptype		<div>PDP Type<table><tr><th>num</th><th>Description</th></tr><tr><td>0</td><td>IP</td></tr><tr><td>1</td><td>IPv6</td></tr><tr><td>2</td><td>IPv4v6</td></tr></table></div>	num	Description	0	IP	1	IPv6	2	IPv4v6
num	Description												
0	IP												
1	IPv6												
2	IPv4v6												
1	U1[3]		rsv		Reserved								
4	CH [32]		accname		Access Point Name								

LCS-NET-PWR (0x31 0x04)

Message	NET-PWR				
Description	Put network interface (4G or Ethernet) in a defined power state.				
Firmware					
Type	Command				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x31	0x04	Set: 8	see below	CK_A CK_B
Payload Contents:					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (1 for this version)
1	U1[3]		rsv		Reserved
4	U4		state		Enter system state 0x52554E20: 4G running 0x53544F50: 4G stopped (and try to run ethernet) 0x54534F80: Ethernet re-connecting

1.14 LCS-UIO (0x32)
LCS-UIO-GETSET (0x32 0x02)

Message	UIO-GETSET
Description	Read / Write User GPIO
Firmware	

Type	Get / Set																			
Comment																				
Message Structure																				
Header	Class	ID	Length (Bytes)	Payload	Checksum															
0xB5 0x62	0x32	0x02	Get: 12 / Set: 12	see below	CK_A CK_B															
Payload Contents: Get																				
Byte Offset	Number Format	Scaling	Name	Unit	Description															
0	X4		msk		Bitmask <table><tr><td>Bitfield</td><td>Name</td><td>Description</td></tr><tr><td>Bit[0]</td><td>IO_01</td><td>0: Out , 1: In</td></tr><tr><td>Bit[1]</td><td>IO_02</td><td>0: Out , 1: In</td></tr><tr><td>Bit[2]</td><td>IO_03</td><td>0: Out , 1: In</td></tr><tr><td>Bit[3]</td><td>IO_PWM</td><td>0: Out , 1: In</td></tr></table>	Bitfield	Name	Description	Bit[0]	IO_01	0: Out , 1: In	Bit[1]	IO_02	0: Out , 1: In	Bit[2]	IO_03	0: Out , 1: In	Bit[3]	IO_PWM	0: Out , 1: In
						Bitfield	Name	Description												
						Bit[0]	IO_01	0: Out , 1: In												
						Bit[1]	IO_02	0: Out , 1: In												
						Bit[2]	IO_03	0: Out , 1: In												
						Bit[3]	IO_PWM	0: Out , 1: In												
4	X4		dir		0: Out , 1: In															
8	X4		value		0: Low , 1: High															
Payload Contents: Set																				
Byte Offset	Number Format	Scaling	Name	Unit	Description															
0	U1[3]		rsv1		Reserved															
3	X1		value		Bitmask <table><tr><td>Bitfield</td><td>Name</td><td>Description</td></tr><tr><td rowspan="4">Bit[0~5]</td><td rowspan="4">Index</td><td>0: IO_01</td></tr><tr><td>1: IO_02</td></tr><tr><td>2: IO_03</td></tr><tr><td>3: IO_PWM</td></tr><tr><td>Bit[6]</td><td>Direction</td><td>0: Out , 1: In</td></tr></table>	Bitfield	Name	Description	Bit[0~5]	Index	0: IO_01	1: IO_02	2: IO_03	3: IO_PWM	Bit[6]	Direction	0: Out , 1: In			
						Bitfield	Name	Description												
						Bit[0~5]	Index	0: IO_01												
								1: IO_02												
2: IO_03																				
3: IO_PWM																				
Bit[6]	Direction	0: Out , 1: In																		
4	U4		rsv2		Reserved															
8	U4		rsv3		Reserved															

1.15 LCS-LORA (0x33)

LCS-LORA-GETSET (0x33 0x01)

Message	LORA-GETSET
Description	Read / Write LoRa settings
Firmware	
Type	Get / Set

Comment

Message Structure

Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0x33	0x01	Get: 0 / Set: 4	see below	CK_A CK_B

Response Contents: Get

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (0 for this version)
1	U1		addh		High byte of the module address
2	U1		addl		Low byte of the module address
3	U1		netID		Network address
4	U4		airrate		Air data rate (9600 for this default)
8	U4		serrate		Serial port rate (9600 for this default)
12	U1		serparity		Serial parity bit (8N1 for this default)
13	U1		txpower		Transmitting power (21 dbm for this default) Support value: 21dbm, 24dbm, 27dbm, 30dbm
14	U1		rssiamb		RSSI Ambient noise enable (disable for this default)
15	U1		subpkts		Sub packet size (240bytes for this default)
16	U4		channel		Channel control 0-80 represents a total of 81 channels Frequency= 850.125 + CH *1M
20	U1[5]		rsv		Reserved
25	U1[7]		pid		Product Information

Payload Contents: Set

Byte Offset	Number Format	Scaling	Name	Unit	Description
0	U1		version		Message version (0 for this version)
1	U1		netID		Network address
2	U1		txpower		Transmitting power (21 dbm for this default) Support value: 21dbm, 24dbm, 27dbm, 30dbm
3	U1		channel		Channel control 0-80 represents a total of 81 channels Frequency= 850.125 + CH *1M

1.16 LCS-SYS (0xFE)

LCS-MODEL-GET (0xFE 0x01)

Message	Model-GET				
Description	Read Device Model				
Firmware					
Type	Get				
Comment					
Message Structure					
Header	Class	ID	Length (Bytes)	Payload	Checksum
0xB5 0x62	0xFE	0x01	Get: 0	see below	CK_A CK_B
Response Contents: Get					
Byte Offset	Number Format	Scaling	Name	Unit	Description
0	CH[32]		model		Device model information RTK-M100R RTK-M101R RTK-M100 RTK-M101

2. NMEA Protocol

2.1 PLCS Messages Overview

Syntax

Mnemonic	Description
MBSOL	Moving Baseline Data

2.2 PLCS Messages

MBSOL

Message	MBSOL				
Description	Moving Baseline Data				
Firmware					
Type	Output				
Comment					
Message Structure					
\$PLCS,MBSOL,hhmmss.ss,y.yyy,p.ppp,b.bbb,x,uu*hh<CR><LF>					
Example:					
\$PLCS,MBSOL,042436.00,117.975,73.364,2.338,5,16*79					
Payload Contents:					
Field No.	Name	Unit	Format	Example	Description
0	\$PLCS	-	string	\$PLCS	Message ID, LCS protocol header, proprietary sentence
1	msgId	-	string	MBSOL	Proprietary message identifier: MBSOL
2	time	-	hhmmss.ss	042437.00	UTC time
3	yaw	deg	numeric	118.182	Vehicle heading.
4	pitch	deg	numeric	-14.546	Vehicle pitch
5	baselen	m	numeric	1.535	Baseline length between GNSS1 and GNSS2's antennas
6	quality	-	numeric	1	Quality indicator for position fix, 0: position fix unavailable 1: valid position fix, SPS mode 2: valid position fix, differential GPS mode

					4: RTK fixed solution 5: RTK float solution
7	numSV	-	numeric	08	Number of satellites used
8	cs	-	hexadecimal	*3C	Checksum
9	<CR><LF>	-	character	-	Carriage Return and Line Feed

