Mobile Knowledge

MKN5610
GPS Receiver
Reference Manual

2002-05.06

Mobile Knowledge Inc.
84 Hines Road, Kanata, Ontario, Canada, K2K 3G3
Tel: (613) 271-1601, Fax: (613) 271-9827
e-mail: info@Mobile-Knowledge.com, web: www.Mobile-Knowledge.com

REVISION HISTORY

Date	Revision	Description
April 25, 2002	01	Initial Draft of new format
May 09, 2002	02	Fixed syntax errors on command sets, added diagram
May 27, 2002	03	T. Gray review changes

For additional copies of this document, please contact:

Mobile Knowledge Inc.
84 Hines Road
Kanata, Ontario, Canada, K2K 3G3
Phone: 1-613-271-1601
Fax: 1-613-271-9827
e-mail: info@Mobile-Knowledge.com
web: www.Mobile-Knowledge.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. GENERAL INFORMATION

The MKN5610 is a satellite receiver for the GPS (Global Positioning System). It contains components to download satellite signals, compute positions from satellite ranges, and output data in a usable ASCII format according to the standard GPS sentence protocols defined by the National Marine Electronics Association (NMEA). This manual will provide all of the information necessary to operate the MKN5610.

1.1 Introduction

This manual contains information for the setup and operation of the following Mobile Knowledge products:

- MKN5610 GPS Module
- MKN5610 Evaluation Kit
- ADK VIEW GPS Evaluation Software for PCs

1.2 Hardware Specification

MECHANICAL	
Dimensions	80 mm x 40 mm x 9.4 mm
	3.15" x 1.57" x 0.37"
Weight	25 g, 0.9 oz

Table 1.1 Mechanical Dimensions

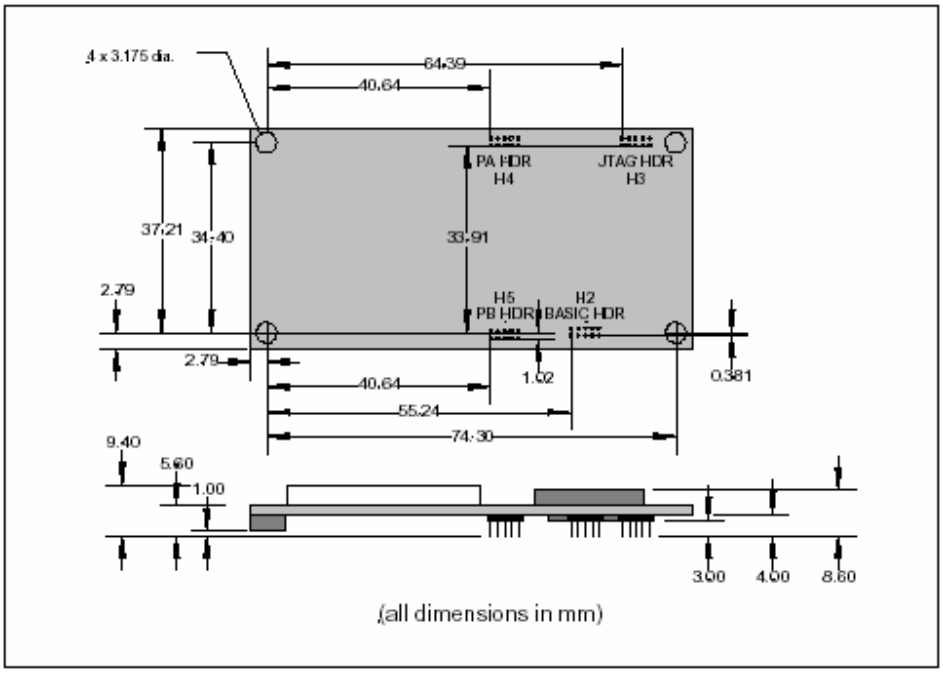


Figure 1.1 Physical Dimensions

1.3 Block Diagram & Header Information

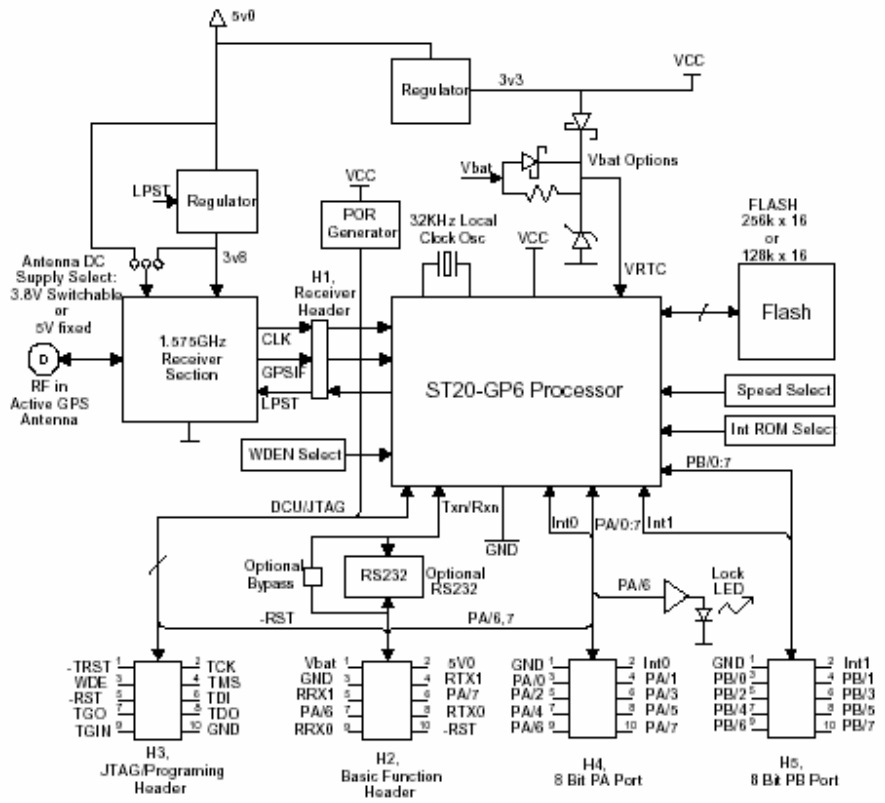


Figure 1.2 Block Diagram

Header	Specification	Function
H2	5 x 2 pin header, 1.27mm spacing, M503900522 HARWIN	Basic GPS interface: RS232 NMEA and RTCA, HCMOS 1PPS and LOCK indicator
H3	5 x 2 pin header, 1.27mm spacing, M503900522 HARWIN	Test and programming interface
H4	5 x 2 pin header, 1.27mm spacing, M503900522 HARWIN	Programmed IO interface – A Eight uncommitted TTL IO signals
H5	5 x 2 pin header, 1.27mm spacing, M503900522 HARWIN	Programmed IO interface – B Eight pre–allocated TTL IO signals

Table 1.2 Header Functions

Pin #	Signal	Description	Typical Usage*
1	VBAT	Backup battery power in, 3.3–5.0VDC	
2	5V	Power in, 5 VDC ± 5%	
3	GND	Digital ground	
4	RTx1	RS232 output	Test report output
5	RRx1	RS232 input	RTCM input
6	PA7	Uncommitted programmable IO	1PPS output pulse
7	PA6	Uncommitted programmable IO	LOCK output(satellite or DGPS), active high

8	RTx0	RS232 output	NMEA output
9	RRx0	RS232 input	NMEA input
10	-RST	External RESET (47K pull UP on 5610)	
* Usage depends on firmware			

Table 1.3 Header H2: Basic Functions

Pin #	Signal	In/Out	Description
1	–TRST	in	Test logic reset
2	TCK	in	Test clock
3	WDE	in	Watch dog enable. Ground to disable WDT in GP6
4	TMS	in	Test mode select
5	–RST	in	Reset. Ground to reset GP6
6	TDI	in	Test data input
7	TGO	out	Trigger output from DCU
8	TDO	out	Test data output
9	TGIN	in	Trigger input to DCU
10	GND		Digital Ground

Table 1.4 Header H3: Test and Programming

Pin #	Signal	Description	Usage
1	GND	Digital ground	
2	INT0	GP6 external interrupt 0	Uncommitted (Input)
3	PA0	GP6 programmed IO: PIO00	Short to PIO01 to force test mode on reset
4	PA1	GP6 programmed IO: PIO01	Short to PIO00 to force test mode on reset
5	PA2	GP6 programmed IO: PIO02	Uncommitted
6	PA3	GP6 programmed IO: PIO03	Uncommitted
7	PA4	GP6 programmed IO: PIO04	Uncommitted
8	PA5	GP6 programmed IO: PIO05	Uncommitted
9	PA6	GP6 programmed IO: PIO06	Satellite lock output, asserted high
10	PA7	GP6 programmed IO: PIO07	1PPS output pulse (not implemented)

Table 1.5 Header H4: PA Bus

Pin #	Signal	Description	Usage
1	GND	Digital ground	
2	INT1	GP6 external interrupt 1	Uncommitted (input)
3	PB0	GP6 programmed IO: PIO10	Uncommitted
4	PB1	GP6 programmed IO: PIO11	Uncommitted
5	PB2	GP6 programmed IO: PIO12	Uncommitted
6	PB3	GP6 programmed IO: PIO13	Uncommitted
7	PB4	GP6 programmed IO: PIO14	Uncommitted
8	PB5	GP6 programmed IO: PIO15	Uncommitted

9	PB6	GP6 programmed IO: PIO16	Uncommitted
10	PB7	GP6 programmed IO: PIO17	Uncommitted

Table 1.6 Header H5: PB Bus

1.4 Electrical Specification

Pin	Description	Min	Typ	Max
H2-2	Vcc	4.5 V	5 V	5.5 V
	Input current (without Antenna)		145mA	
H2-1	Vbat	1.4 V	3.3 V	3.6 V
	Operational power consumption		50µW	
H4, H5	PAx, PBx, output logic 1	2.4 V		3.3 V
	PAx, PBx, output logic 0	0 V		0.4 V
H4, H5	PAx, PBx, INTx Input logic 1	2.0 V		3.8 V
	Input logic 0	-0.5 V		0.8 V
	Input current	-10 µA		10 µA
Ext. Ant.	Vant (extern Antenna Power Supply)			6 V
	Input Current			50 mA
29	Not Reset	2.4 V		3.8 V
H2 – 5,9	RX0, RX1, RS232 option, Logic 0	-15 V		0.8 V
	RX0, RX1, RS232 option, Logic 1	2 V		15 V
H2 – 4,8	TX0, TX1, RS232 option, Logic 0		-5.8 V	-5 V
	TX0, TX1, RS232 option, Logic 1	5 V	5.8 V	

Table 1.7 Electrical Specifications

1.5 Performance Specifications

Feature	Specification
Channels	12 parallel tracking
Frequency	L1 - 1575 MHz
Position Accuracy	
Stand alone	15 m CEP
Differential	2-3 m CEP
Time To First Fix	
Cold	90s
Warm	< 30 s
Reacquisition	1 s

Table 1.8 Performance Specifications

1.6 Environmental Specifications

Characteristic	Specification
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
Humidity	95% max. (non-condensing)
Dynamics, Velocity	514 m/s

Table 1.9 Environmental Specifications

1.7 Default Configuration Settings

Parameter	Default
NMEA Message Strings	GGA, VTG, GSA, GSV
NMEA Message Period	1s
Baud Rate - Port 0	4,800
Baud Rate - Port 1	4,800
Elevation Mask	10
Satellite Mask	None
Fix Mode	Automatic
Differential Mode	Auto
Dilution of Precision	6
Debug	Off

Table 1.10 Default GPS Configuration Settings

1.8 Connector Part Numbers and Vendors

Purpose	Vendor	Part Number
Mating header	Harwin	M50–3110522
Nylon standoffs	3M	3C110–2001HB
Mating header on ribbon cable	Richco	MPSM–4–01 (0.250”)

Vendor	Phone Number	Web Site
Harwin	+1 (812) 285 – 0055	www.harwin.com
3M	+1 (800) 225 – 5373 *	www.3M.com/interconnects
Richco	+1 (773) – 539 4060	www.richcoplas.com
Samtec	+1 (812) 944 – 6733	www.samtec.com
* In North America Only		

Table 1.11 Part Numbers and Vendors

2. OPERATION

2.1 Getting Started

This section will help you get started quickly whether you wish to carry out differential GPS positioning, or simply output NMEA strings to a terminal program. Subsequent sections contain additional information related to output messages and configuration settings.

2.2 Evaluation Kit

If you have purchased the MKN5610 with the Evaluation Kit, your Evaluation Kit will include the following components:

- MKN7510 Evaluation Kit Interface Board
- MKN5610 GPS Module
- MKN3910 L1 GPS Antenna
- AC Power Adapter (120AC to 12VDC)
- RS-232 Data Cable
- Documentation and Software CD

2.3 Handling Precautions

The MKN5610 contains components that are sensitive to electrostatic discharge. Please handle with care. Use caution when using the device to not bend or displace the surface mount antenna cable.

2.4 System Setup

The MKN5610 is a self contained GPS receiver designed to fit into nylon standoffs for mounting into a hardware device, communicating with the primary (H2) header. See also the Evaluation kit section of this manual if your module is supplied with the kit.

The antenna connection on the MKN5610 is an SMA jack. The connection required for the antenna cable is an SMA plug. The antenna power supply is 5V, 50mA max. (supplied by the module).

2.5 Port Configuration

The default port settings for NMEA data output are PORT 0, communications 4800, 8, N, 1. The receiver is configured to output a version string at power up, and subsequent NMEA data at a 1 Hz data rate. PORT 1 is configured for RTCM SC-104 differential GPS input at communications 4800, 8, N, 1. Port settings are configurable – please see section 3: Communication for more information on configuring port settings.

2.6 Satellite Tracking

When the MKN5610 is powered up for the first time, it does not contain any satellite almanac or ephemeris data in onboard memory, nor time or previous position information. It will begin searching for satellites from this condition, called a cold start, by cycling through all 32 available satellite PRN numbers. Once satellites are tracked, the MKN5610 will automatically synchronize it's onboard clock with GPS time, and begin downloading satellite almanac and ephemeris information. Approximately 15 minutes of continuous data are required to download a full almanac set for all available satellites. After this time, the receiver will hold onto it's precise time and almanac information after power down, provided it is supplied with power from the battery backup. This condition is known as a warm start. Removing the backup battery will clear the memory and satellite acquisition will be from a "cold start" once power is returned. Time to first fix

(TTFF) for a cold start is approximately 1.5 minutes. For a warm start, TTFF is typically better than 30 seconds.

3. COMMUNICATIONS

All messages to and from the MKN5610 are configured in accordance with the recommended NMEA message protocol standard, Version 2.30.

3.1 NMEA Message Format

All messages conform to a general standard and are formatted similar to NMEA sentences. As a general rule messages sent from the host to the MKN5610 will have a standard response. All messages will be ASCII except where indicated.

3.1.1 General Format

The general format for NMEA messages is:

- $<Vendor><Message >{[Parameter],}[*Checksum] <CR> <LF>
- <>Angled brackets are compulsory parameters.
- [] Square brackets are optional parameters.
- {} Curly brackets signify a sequence.

<Vendor> Identifies the message format for NMEA standard messages. The Mobile Knowledge proprietary vendor tag is “PSGM”. ST proprietary vendor flag is “PSTM” and the NMEA standard is “GP”.

<Command/Query> Identifies the message format for proprietary request messages from the host to the GPS MKN5610.

<Parameters> Comma separated parameters specific to the request, response or data message. There are never any spaces between parameters.

<Response> Identify the message format for proprietary or NMEA standard messages from the MKN5610 to the host in response to a request.

<Data> Identifies unsolicited data messages from the GPS MKN5610.

<Result> Indicates the status of the response message. A value of 0 indicates success and all other values identify an error.

The proprietary Mobile Knowledge ADK NMEA sentences can be divided into

- Commands
- Queries
- Data messages

Requests are messages sent from a host computer or user to the GPS MKN5610. Responses are messages that are sent from the GPS MKN5610 to the host computer or user in response to a request message. Data messages are periodic messages automatically sent from the GPS MKN5610 to the host, for example the NMEA RMC message.

- $PSGM, <Command/Query>, {[Parameter],} [*Checksum]
- $PSGM, <Response>, <Result> {[Parameters],} [*Checksum]
- $GP<Data>, {[Parameters],} [*Checksum]

[*Checksum] A 1-byte checksum generated by XORing every byte of the sentence together (excluding the * immediately preceding the checksum). In request messages this parameter is optional.

3.2 Standard NMEA Data Messages

These standard NMEA messages comply with NMEA Revision V2.30. They are fully defined in this section. They are available through Port 0 of the MKN5610.

- GGA
- GSA
- GSV
- RMC
- VTG

3.2.1 GGA – GPS Fix Data

Message: $GPGGA, <UTC-Time>, <Latitude>, <Latitude-hemisphere>, <Longitude>, <Longitude-hemisphere>, <GPS-Quality>, <GPS-Quality>, <Satellites>, <Horizontal-dil>, <Height>, M, <Geoidal-height>, M, <DGPS-age>, <DGPS-station> [*Checksum]

<UTC-Time> UTC time of fix hhmmss.

<Latitude> ddmm.mmmm

<Latitude-hemisphere> N or S

<Longitude> dddmm.mmmm

<Longitude-hemisphere> E or W

<GPS-Quality> 0 = No fix, 1 = Non-differential fix, 2 = differential fix (DGPS)

<Satellites> Number of satellites in use, 00 to 12.

<Horizontal-dil> Horizontal dilution of precision, 0.5 to 99.9

<Height> -9999.9 to 99999.9 meters relative to mean sea level

<Geoidal-height> -000.9 to 9999.9 meters.

<DGPS-age> Seconds since last valid RTCM update, null field when DGPS not used.

<DGPS-station> Differential reference station ID, 0000 to 1023.

3.2.2 GSA – DOP and Active Satellites

Message: $GPGSA, <Fix-mode>, <Fix-type>, {<PRN>,} <Position-dil>, <Horizontal>, <Vertical -dil> [*Checksum]

<Fix-mode> Mode M = manual, A = automatic.

<Fix-type> 1 = fix not available, 2 = 2 dimensional fix, 3 = 3dimensional fix.

<PRN> A list of up to 12 satellite PRN numbers used in solution each with a value of 01 to 32.

<Position-dil> Position dilution of precision, 0.5 to 99.9

<Horizontal-dil> Horizontal dilution of precision, 0.5 to 99.9

<Vertical-dil> Vertical dilution of precision, 0.5 to 99.9

3.2.3 GSV – Satellites In View

Message: $GPGSV, <Total-sentences>, <Current-sentence>, <Satellites> {<PRN>, <Elevation>, <Azimuth>, <SNR>} [*Checksum]

<Total-sentences> Total number of GSV sentences to be transmitted.

<Current-sentence> Number of the current GSV sentence.

<Satellites> Total number of satellites in view.

<PRN> Satellite PRN number.

<Elevation> Satellite elevation, 00 to 90 degrees.

<Azimuth> Satellite azimuth, 000 to 359 degrees.

<SNR> Signal to noise ratio, 00 to 99 dB.

3.2.4 RMC – Recommended Minimum Specific GPS/Transit Data

Message: $GPRMC, <UTC-time>, <Status>, <Latitude>, <Latitude-hemisphere>, <Longitude>, <Longitude-hemisphere>, <Speed-knots>, <Course>, <UTC-date>, <Magnetic-variation>, <Magnetic-variation-sense>, <Mode> [*Checksum]

<UTC-time> UTC time of fix 'hhmmss'.

<Status> Status, A = Valid position, V = NAV receiver warning.

<Latitude> ddmm.mmmm

<Latitude-hemisphere> N or S

<Longitude> dddmm.mmmm

<Longitude-hemisphere> E or W

<Speed-knots> 000.0 to 999.9

<Course> 000.0 to 359.9

<UTC-date> ddmmyy

<Magnetic-variation> 000.0 to 180.0

<Magnetic-variation-sense> E or W

<Mode> A=Autonomous, D=Differential, E=Estimated, N=Data not valid

3.2.5 GLL – Geographic Position – Latitude/Longitude

Message: $GPGLL, <Latitude>, <Latitude-hemisphere>, <Longitude>, <Longitude-hemisphere>, <UTC-time>, <Status>, <Mode> [*Checksum]

<Latitude> ddmm.mmmm

<Latitude-hemisphere> N or S

<Longitude> dddmm.mmmm

<Longitude-hemisphere> E or W

<UTC-Time> UTC time of fix hhmmss

<Status> Status, A = Valid position, V = NAV receiver warning

<Mode> A=Autonomous, D=Differential, E=Estimated, N=Data not valid

3.2.6 VTG – Track Made Good and Ground Speed

Message: $GPVTG, <Course>, T, <Magnetic-course>, M, <Speed-knots>, N, <Speed-kph>, K, <Mode> [*Checksum]

<Course> True course over ground, 000 to 359 degrees.

<Magnetic-course> Magnetic course over ground, 000 to 359 degrees.

<Speed-knots> Speed over ground 000.0 to 999.9 knots.

<Speed-kph> Speed over ground, 000.0 to 1851.8 kilometres per hour.

<Mode> Mode indicator, A = Autonomous, D = Differential, E = Estimated, N = Data not valid.

3.2.7 ZDA – Time and Date

Message: $GPZDA, <UTC-time>, <UTC-day>, <UTC-month>, <UTC-year>, <Local Zone Hours>, <Local Zone Minutes>[*Checksum]

<UTC-Time> UTC time of fix hhmmss

<UTC-day> UTC day of fix 1 to 31

<UTC-month> UTC month of fix 1 to 12

<UTC-year> UTC year of fix

<Local Zone Hours> Local time zone hours (not used)

<Local Zone Minutes> Local time zone minutes (not used)

3.3 Non-Standard NMEA Data Messages

3.3.1 RAW – Unfiltered Position Data

Message: $GPRAW, <UTC-time>, <Latitude>, <Latitude-hemisphere>, <Longitude>, <Longitude-hemisphere>, <Height>, <Vel-north>, <Vel-east>, <Vel-vertical>[*Checksum]

<UTC-Time> UTC time of fix hhmmss.sss

<Latitude> ddmm.mmmmmm

<Latitude-hemisphere> N or S

<Longitude> dddmm.mmmmmm

<Longitude-hemisphere> E or W

<Height> -9999.9 to 99999.9 meters relative to mean sea level

<Vel-north> Velocity in north direction (m/s)

<Vel-east> Velocity in east direction (m/s)

<Vel-vertical> Velocity in vertical direction (m/s)

3.3.2 FIL – Filtered Position Data

Message: $GPFIL, <UTC-time>, <Latitude>, <Latitude-hemisphere>, <Longitude>, <Longitude-hemisphere>, <Height>, <Vel-north>, <Vel-east>, <Vel-vertical>[*Checksum]

<UTC-Time> UTC time of fix hhmmss.sss

<Latitude> ddmm.mmmm

<Latitude-hemisphere> N or S

<Longitude> dddmm.mmmm

<Longitude-hemisphere> E or W

<Height> -9999.9 to 99999.9 meters relative to mean sea level

<Vel-north> Velocity in north direction (m/s)

<Vel-east> Velocity in east direction (m/s)

<Vel-vertical> Velocity in vertical direction (m/s)

3.4 Command Messages

3.4.1 Activate NMEA Messages – Batch Format

To activate or deactivate all of these messages including baud rate in a single configuration message, the following NMEA formatted command must be issued to the MKN5610 from a PC Terminal utility:

$PSTMNMEA,<RMC>,<GGA>,<VTG>,<GSA>,<GSV>,<baud rate>

Where a 1 for each field sets the parameter to on/active, and 0 sets the parameter to off/deactive.

Example 1

To turn on only the GGA and VTG strings at 9600 baud, and to store the configuration for subsequent power-up:

$PSTMNMEA,0,1,1,0,0,9600, <store> <CR><LF>

Example 2

To turn on only the GSA and GSV strings on at 19,200 baud, and to not store the configuration for subsequent power-up:

$PSTMNMEA,0,0,0,1,1,19200,0<CR><LF>

3.4.2 Activate NMEA Messages - Individual Format

To toggle individual NMEA messages on or off, the following commands can be issued to the MKN5610 Evaluation Kit from a PC terminal utility:

- $PSTMRMC<CR><LF>
- $PSTMGGA<CR><LF>
- $PSTMVTG<CR><LF>
- $PSTMGSA<CR><LF>
- $PSTMGSV<CR><LF>

3.4.3 Set Baud Rates

By default the MKN5610 outputs its NMEA strings, and accepts NMEA formatted command messages from an external terminal at 4800bd-8-N-1. To switch to another baud rate between 0 and 38,400 bd, issue the following proprietary NMEA formatted command:

$PSTMBAUD,<baud rate><CR><LF>

Where the Baud rate = 1200, 2400, 4800, 9600, 19,200, 38,400 bd.

3.4.4 Initialize GPS Fix Parameters

To speed the time to first fix for the MKN5610 when starting the unit for the first time, you can upload a current time, date, and position to the receiver. If the MKN5610 has a current almanac, the TTFF should be within 30 seconds vs. 90 seconds for a cold start.

Command: $PSGM, INIT, <Latitude>, <Longitude>, <Height>, <Day>, <Month>, <Year>, <Hours>, <Minutes>, <Seconds> [*Checksum]

Response: $PSGM, INIT, <Result> [*Checksum]

3.4.5 Initialize Center Frequency

The MKN5610 utilizes a crystal oscillator as a frequency reference for the embedded DSP processor. This command allows you to specify a known frequency offset to the default crystal

value to ensure proper receiver operation. Center Frequency is a factory configurable parameter and should not be performed in the field.

Command: $PSTM, FREQ, <Center frequency> [*Checksum]

Response: $PSTM, FREQ, <Result> [*Checksum]

3.4.6 Set NMEA Message Output Period

You may specify the rate at which the MKN5610 outputs the active NMEA Data messages using this command.

Command: $PSGM, PERIOD, <Period> [*Checksum]

Response: $PSGM, PERIOD, <Result> [*Checksum]

Requests the GPS MKN5610 to output NMEA sentences every <time> seconds. Where time is between 1 and 600 seconds.

3.4.7 Configure One-Pulse Per Second

The MKN5610 provides an optional 1PPS timing signal for network synchronization and other applications. This command allows you to configure the pulse duration of this timing reference.

Command: $PSGM, PPS, <Enable>, <Length> [*Checksum]

Response: $PSGM, PPS, <Result> [*Checksum]

<Enable> Enable the one pulse per second timing feature. A value of 1 enables 1PPS, and a 0 disables 1PPS.

<Length> Sets the length of the pulse in milliseconds from 1 to 999ms.

3.4.8 Set Differential GPS Operating Mode

The MKN5610 will accept an external DGPS signal input to improve the accuracy of the GPS position computed by the receiver. This command allows you to specify whether the unit should output GPS messages only when a differential signal is available, only when no DGPS signal is available, or in either situation.

Command: $PSGM, DGPS, <Mode> [*Checksum]

Response: $PSGM, DGPS, <Result> [*Checksum]

<Mode> Sets the differential mode to differential fix only, automatic, or no

differential fix. DIFF_ONLY = 0, AUTO_DIFF = 1, NO_DIFF = 2.

3.4.9 Set Fix Mode

The MKN5610 can be configured to output a position message in either a 2D or a 3D format. When 2D is specified, the MKN5610 holds its elevation constant and uses all available satellites to compute a best estimate of the Latitude and Longitude. 2D Fix Mode is most typically used in marine applications though it can offer some advantages in urban centers where obstructions are frequent. Setting the MKN5610 to Auto Mode will allow a 2D position to be computed with only 3 satellites. When four or more satellites are available, a 3D position is computed.

Command: $PSGM, FIX, <Mode>, [*Checksum]

Response: $PSGM, FIX, <Result> [*Checksum]

<Mode> Sets the MKN5610s satellite-tracking mode to 2-dimensional, 3-dimensional or automatic. A value of 1 is for automatic, 2 for 2D and 3 for 3D.

3.4.10 Set Dilution of Precision

The MKN allows you to specify a maximum Dilution of Precision. In the event that the DOP is greater than these specified thresholds, the receiver will not output a position.

Command: $PSGM, DOP, <DIM>, <PDOP>, <HDOP>, <VDOP>[*Checksum]

Response: $PSGM, DOP, <Result> [*Checksum]

<DIM> Set dilution of precision for calculating 3-dimensional or 2-dimensional fixes. Valid values are, 2D = 2, 3D = 3.

<PDOP> Maximum PDOP, range is 1.0 to 6.0.

<HDOP> Maximum HDOP, range is 1.0 to 6.0.

<VDOP> Maximum VDOP, range is 1.0 to 6.0.

3.4.11 Set Elevation Mask Angle

The MKN5610 allows you to specify a minimum satellite elevation mask. Satellites below this mask angle will not be employed in the position computation.

Command: $PSGM, ELEV, <Angle> [*Checksum]

Response: $PSGM, ELEV, <Result> [*Checksum]

<Angle> The minimum angle in degrees at which the GPS MKN5610 will track a

satellite. This angle should be between 0 and 30 degrees.

3.4.12 Set Satellite Mask

The MKN5610 allows you to deactivate certain satellites that may be known to broadcast erroneous information. In the event that you chose to deactivate a satellite, that satellite will become active again on subsequent power-up.

Command: $PSGM, SAT, <Satellite-mask> [*Checksum]

Response: $PSGM, SAT, <Result> [*Checksum]

3.4.13 Set Debug

The MKN5610 offers a proprietary debug message used by Mobile Knowledge Engineers and Technical Support staff to diagnose problems in the field.

Command: $PSGM, DBG, <Enable> [*Checksum]

Response: $PSGM, DBG, <Result> [*Checksum]

<Enable> Enables or disables MKN5610 debugging. A value of 0 disables debugging

and a value of 1 enables debugging.

3.4.14 Set Serial Port

This command allows you to specify the baud rate with which you wish to communicate with the MKN5610.

Command: $PSGM, BAUD, <Port>, <Speed>, <Data-bits>, <Parity>, <Stop-bits>[*Checksum]

Response: $PSGM, BAUD, <Result> [*Checksum]

<Port> Is the port number (0 or 1).

<Speed> The speed in bits per second, which the port should be set between 300 and 38400 bps.

<Data bits> The number of data bits (normally 8)

<Parity> The parity (normally set to no parity), none, odd or even 0, 1 or 2

<Stop bits> The number of stop bits (normally set to 1), 1 or 2 stop bits.

3.4.15 Sleep

Instructs GPS MKN5610 to sleep for a period of time. This command is useful for users who wish to control the low-power behaviour of the device with an external controller via the serial port.

Command: $PSGM, SLEEP, <Duration> [*Checksum]

Response: None

<Duration> The time period in seconds that the MKN5610 should power down for from 1 to 9999 seconds.

3.4.16 Reboot

Instructs the GPS MKN5610 to perform a reboot immediately.

Command: $PSGM, REBOOT [,<Reason>] [*Checksum]

Response: None

<Reason> Optional reason for MKN5610 reboot, BOOT_NORMAL=0, BOOT_DOWNLOAD=1.

3.4.17 Clear Ephemeris

Clears the satellite ephemeris information stored in battery-backed memory. Subsequent reboots will result in longer TTFF as Ephemeris information is required to achieve the most rapid acquisition of satellites and subsequent position fixes.

Command: $PSGM, CLREPHS [*Checksum]

Response: $PSGM, CLREPHS, <Result> [*Checksum]

3.4.18 Clear Almanacs

Clears the satellite almanac information stored in battery-backed memory. Subsequent reboots will result in a Cold-start TTFF as Almanac information is required to acquire satellites in the GPS constellation. It can take up to 15 minutes to download an almanac once lock on the first satellite following a cold-start is achieved.

Command: $PSGM, CLRALMS [*Checksum]

Response: $PSGM, CLRALMS, <Result> [*Checksum]

3.4.19 Set Almanac

You may upload a current almanac for a specified satellite to the MKN5610 in order to accelerate time to first fix.

Command: $PSGM, ALMSET, <Satellite>, <Week>, <Toa>, <E>, <Delta_i>, <Omega_dot>, <Root_a>, <Omega_zero>, <Perigee>, <Mean anomaly>, <Af0>, <Af1>, <Health>, <Available>, <Save> [*Checksum]

Response: $PSGM, ALMSET, <Result>[*Checksum]

<Satellite> is the satellite's PRN (8-bit in decimal)

<Source> selects the current active almanac, or the almanac stored in flash. 0 indicates RAM, 1 indicates FLASH.

<Week> the week number for the epoch (16-bit in HEX)

<Toa> time of acquisition (8-bit in HEX)

<E> eccentricity (16-bit in HEX)

<Delta_i> rate of inclination angle (16-bit in HEX)

<Omega_dot> rate of right ascension (16-bit in HEX)

<Root_a> square-root of semi-major axis (24-bit in HEX)

<Omega_zero> longitude of ascending node of orbit plane at weekly epoch (24-bit in HEX)

<Perigee> argument of perigee (24-bit in HEX)

<Mean anomaly> mean anomaly at reference time (24-bit in HEX)

<Af0> constant clock correction (11-bit in HEX)

<Af1> first order clock correction (11-bit in HEX)

<Health> contains 1 if satellite is unhealthy, else 0 (1-bit in HEX)

<Available> contains 1 if available, else 0 (1-bit in HEX)

Write almanac data into RAM for a particular satellite.

3.4.20 Save Almanacs

Once an almanac has been uploaded/downloaded to the MKN5610 either through the serial port or over the satellite channel, may store this into Flash memory so that it is available for following subsequent power disruptions.

Command: $PSGM, ALMSAVE [*Checksum]

Response: $PSGM, ALMSAVE, <Result> [*Checksum]

Save the current almanacs stored in RAM to the flash.

3.4.21 Save Non-Volatile Configuration Information

You may store all configuration parameters associated with the MKN5610 into Flash memory so that the receiver's configuration is maintained through power disruptions.

Command: $PSGM, NVSAVE [*Checksum]

Response: $PSGM, NVSAVE, <Result> [*Checksum]

Saves the current NMEA configuration into Flash memory.

3.5 Queries

3.5.1 Get Initialization Information

Returns initialization parameters (if available)

Query: $PSGM, GETINIT [*Checksum]

Response: $PSGM, GETINIT, <Result> [, <Latitude>, <Longitude>, <Height>, <Day>, <Month>, <Year>, <Hours>, <Minutes>, <Seconds>, <Center frequency>[*Checksum]

3.5.2 Get Version Information

Returns receiver firmware version and date of update

Query: $PSGM, VERSION [*Checksum]

Response: $PSGM, VERSION, <Result> [, <Version String>] [*Checksum]

<Version-String> The version number of the GPS MKN5610.

3.5.3 Get Non-Volatile Configuration Information

Returns MKN5610 GPS configuration information

Query: $PSGM, GETCONF [*Checksum]

Response: $PSGM, GETCONF, <Result> [, <Sentences>, <Period> <PPS>, <DGPS-Mode>, <Debug>, <Baud-0>, <Baud-1>] [*Checksum]

<Period> The frequency in seconds to transmit the requested NMEA sentences.

<PPS> <PPS-State> <Pulse-Length>.

<DGPS-Mode> Differential GPS mode. DIFF_ONLY = 0, AUTO_DIFF = 1, NO_DIFF = 2

<GPS-Mode> Set to 1 for auto, 2 for 2D and 3 for 3D.

<Debug> A value of 1 indicates debugging is enabled, 0 indicates debugging is disabled.

<Baud-n> <baud>, <data-bits>, <stop-bits>,

3.5.4 Get Position Parameters

Returns satellite position parameters

Query: $PSGM, GETPP [*Checksum]

Response: $PSGM, GETPP, <Result> [, <2D-PDOP>, <2D-HDOP>, <2D-VDOP>, <3D-PDOP>, <3D-HDOP>, <3D-VDOP>, <Angle>, <Satellite-mask>] [*Checksum]

3.5.5 Get Almanac

Returns current available satellite almanac

Query: $PSGM, GETALM, <Satellite> [*Checksum]

Response: $PSGM, GETALM, <Result> [, <Satellite>, <Week>, <Toa>, <E>, <Delta_i>, <Omega_dot>, <Root_a>, <Omega_zero>, <Perigee>, <Mean anomaly>, <Af0>, <Af1>, <Health>, <Available>] [*Checksum]

<Satellite> is the satellite's PRN (8-bit in decimal)

<Week> the week number for the epoch (16-bit in HEX)

<Toa> time of acquisition (8-bit in HEX)

<E> eccentricity (16-bit in HEX)

<Delta_i> rate of inclination angle (16-bit in HEX)

<Omega_dot> rate of right ascension (16-bit in HEX)

<Root_a> square-root of semi-major axis (24-bit in HEX)

<Omega_zero> longitude of ascending node of orbit plane at weekly epoch (24-bit in HEX)

<Perigee> argument of perigee (24-bit in HEX)

<Mean anomaly> mean anomaly at reference time (24-bit in HEX)

<Af0> constant clock correction (11-bit in HEX)

<Af1> first order clock correction (11-bit in HEX)

<Health> contains 1 if satellite is unhealthy, else 0 (1-bit in HEX)

<Available> contains 1 if available, else 0 (1-bit in HEX)

4. EVALUATION KIT

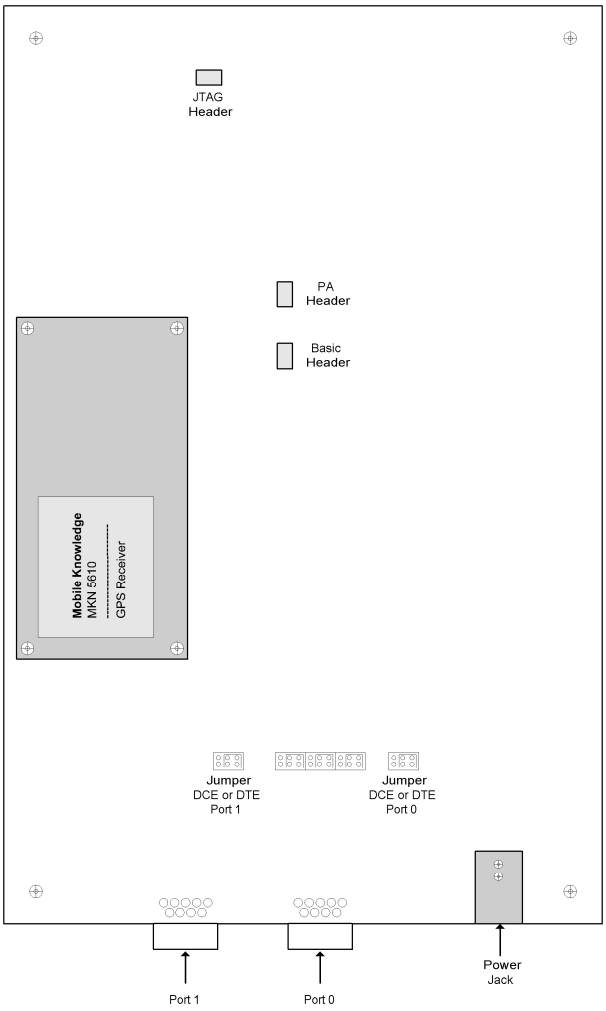


Figure 4.1 Evaluation Kit

4.1 Introduction

The Evaluation Unit is designed as a convenient, low cost means of demonstrating the capabilities of the MKN5610 OEM GPS receiver. The MKN5610 embeds the powerful ST Microelectronics ST20GP6CX33 microprocessor providing GPS processing capability.

The Evaluation Kit contains the following components:

- MKN5610 OEM GPS Receiver
- MKN3910 Antenna (3M, SMA)
- Carrier PCB w/ Power Supply and Interface Jumpers
- AC Power Adapter (110AC)
- DC Power Adapter (12VDC CLA)

4.2 Handling precautions

The Evaluation Kit contains components that are sensitive to electrostatic discharge. Please handle with appropriate care.

Do not apply excessive force to mount or disassemble the MKN5610 from the Evaluation kit.

4.3 Power supply

- External supply: 6 to 15 VDC, ⊕ at center contact. The system includes both a standard AC wall adapter, and a DC cigarette lighter adapter.
- SRAM backup: 3V lithium CR2032

4.4 JTAG Interface

Your MKN5610 Evaluation Kit may be equipped with a JTAG interface for connecting with the ST Connect programming box for reprogramming the GPS module. The Evaluation kit includes a 20 pin header for interfacing to this device on the end opposite of the connectors.

4.5 Basic Header H2

The MKN5610 communicates via the basic header H2 to the Evaluation unit. This is attached via jumper cable to the Evaluation unit and allows communication to the serial ports.

4.6 Serial ports

The MKN5610 Evaluation box communicates through two serial ports configurable by the following jumper settings :

4.6.1 Jumper DCE or DTE

Jumpers may be used to configure the DB9 data connectors for either DTE or DCE mode of operation. The default setting is DCE, which allows the Evaluation box to communicate with a PC using a standard serial cable.

5. SOFTWARE – ADK VIEW

Mobile Knowledge has developed a PC based configuration tool allowing you to communicate with the MKN5610. This software application is called ADKView.

5.1 Overview

The Application Design Kit (ADK) is a generic configuration and programming tool for Mobile Knowledge GPS modules. It provides fully featured GPS configuration enabling selection of NMEA strings, configuration of satellites and power management.

5.2 User Interface

There are six information display windows, as described in the following sub-sections:

5.2.1 NMEA Terminal Window

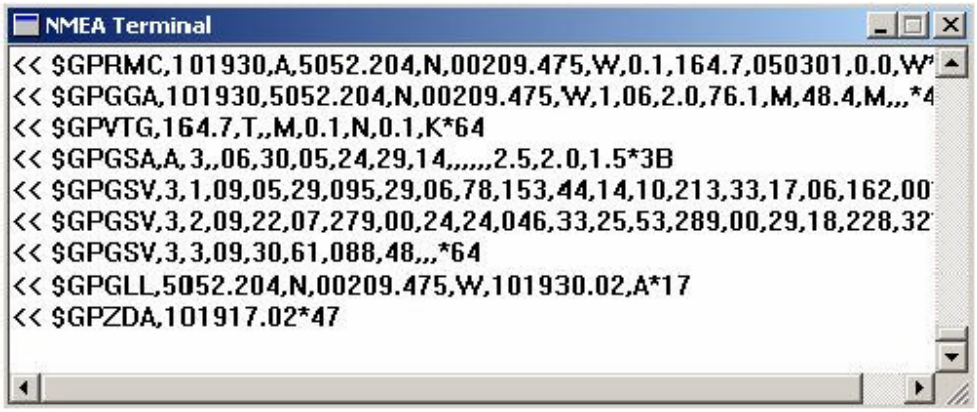


Figure 5.1 NMEA Terminal

Displays all messages output by the GPS device. The display is scrollable. To pause the display, double-click with a mouse. The window title will indicate the paused status. To re-activate a paused display double-click with a mouse. The paused status indication will be removed.

5.2.2 Satellite Signals Window

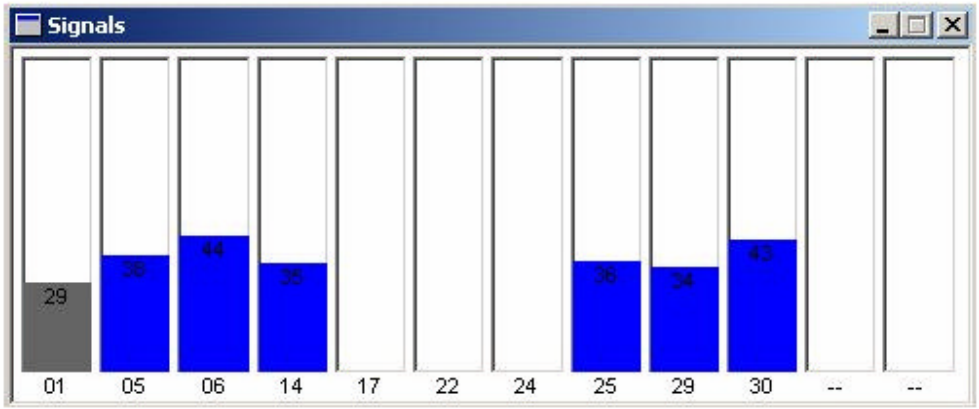


Figure 5.2 Signals

Presents a bar graph showing relative signal strength of all satellites the MKN5610 device can see. The PRN of each satellite is indicated at the foot of the bar.

A grey bar indicates a visible satellite for which there is no current ephemeris or from which the signal strength is inadequate for use in position calculations.

A blue bar indicates a visible satellite that has signal strength adequate for use in position calculations.

The height of the bar indicates the signal strength. A value is given at the top of the bar.

For each PRN the signal strength should be observed to be varying. When variation stops it is because the satellite ephemeris has been lost and is being re-acquired. Variation will re-start when the new ephemeris is successfully obtained, or the PRN will disappear from the display after failure to reacquire.

5.2.3 Satellite Tracking Window

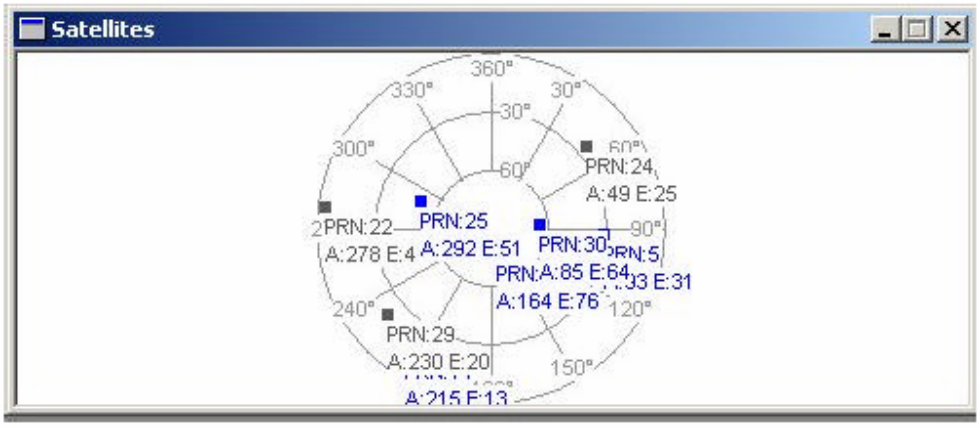


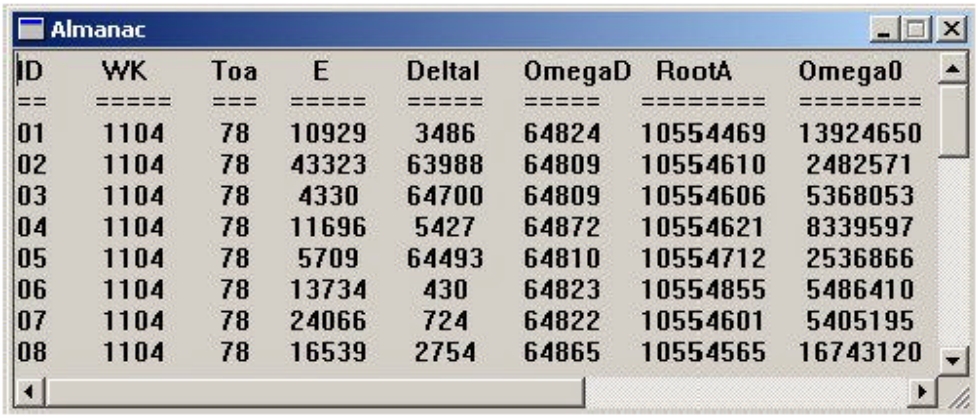
Figure 5.3 Satellites

Presents a graphical view of the azimuth and elevation of all visible satellites with reference to the zenith and the horizon. The zenith is at the centre of the display, the horizon near the edges.

For each satellite the PRN, azimuth and elevation are given. Azimuth and elevation are in degrees.

Satellites displayed in blue are being, or could be, used in position calculations.

5.2.4 Almanac Window



ID	WK	Toa	E	Deltai	OmegaD	RootA	Omega0
01	1104	78	10929	3486	64824	10554469	13924650
02	1104	78	43323	63988	64809	10554610	2482571
03	1104	78	4330	64700	64809	10554606	5368053
04	1104	78	11696	5427	64872	10554621	8339597
05	1104	78	5709	64493	64810	10554712	2536866
06	1104	78	13734	430	64823	10554855	5486410
07	1104	78	24066	724	64822	10554601	5405195
08	1104	78	16539	2754	64865	10554565	16743120

Figure 5.4 Almanac

Presents the parameters of the latest satellite almanac in memory.

Thirteen values are displayed for each satellite in the whole constellation, as follows:

1. ID - The PRN of the satellite.
2. WK
3. Toa
4. E
5. Deltal
6. OmegaD
7. RootA
8. Omega0
9. Perigee
10. MeanA
11. Af0
12. Af1
13. H

5.2.5 Configuration Window

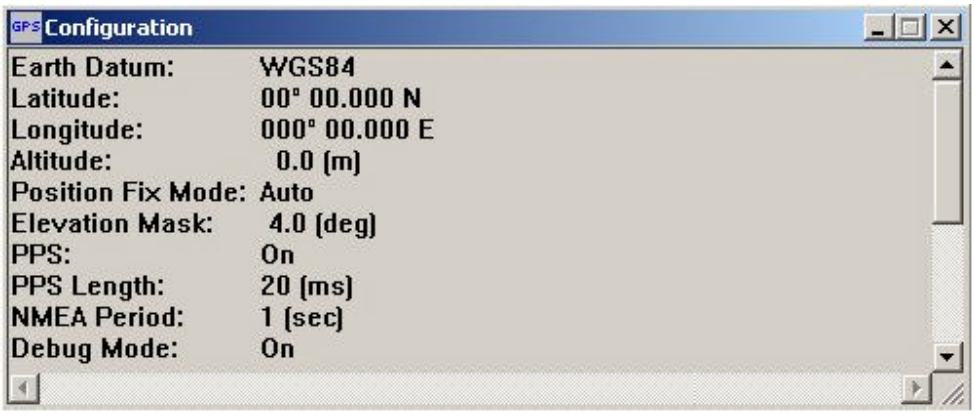


Figure 5.5 Configuration

Presents the details of the current configuration of the MKN5610 device.

5.2.6 Navigation Window

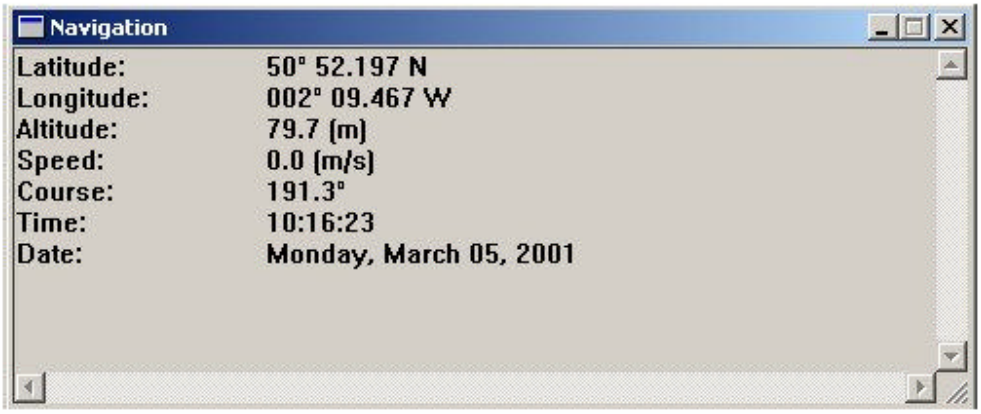


Figure 5.6 Navigation

Presents the details of the latest position calculation from the RMC message. This display will not update if the RMC message display is turned off in Config/NMEA.

The display is not interactive.

5.3 Pull Down Menus

The menu bar consists of seven items, descriptions of which follow.

5.3.1 File Menu

The first menu is the File menu. The File menu is intended for standard file operations, i.e. load, save, print etc.

The File menu contains nine entries as follows.

Load Config

Presents a standard Open dialog box defaulting to opening ADK configuration files of type *.cfg.

Save Config

Presents a standard Save as… dialog box defaulting to saving ADK configuration files of type *.cfg.

Save As

Presents a standard Save as… dialog box defaulting to saving ADK configuration files of type *.cfg.

Load Almanac

Presents a standard Open dialog box defaulting to opening almanac files of type *.alm.

Save Almanac

Presents a standard Save as… dialog box defaulting to saving almanac files of type *.alm.

Print

Gives access to standard printing functions.

Print Setup

Gives access to standard printing setup functions.

Exit

Closes the ADK program.

5.3.2 Comms Menu

The Comms menu contains entries involved in connecting and disconnecting from a GPS MKN5610 device. The Comms menu contains three entries as follows.

Setup

Presents the Comms Setup window to allow the setting of port and speed values. The Comms Setup window has two items :

- **Serial Port** – select a communications port, from the presented list, for connecting to the GPS MKN5610 device.
- **Baud** – select a baud rate, from the presented list, for communication with the GPS MKN5610 device. The default rate is 4800.

Connect

Will attempt to connect the ADK program to the GPS MKN5610 device using the port and baud values entered in Setup… above.

Disconnect

Will disconnect the ADK from the GPS MKN5610 device.

5.3.3 GPS Menu

The GPS menu contains entries involved in the setup and configuration of the GPS MKN5610 device.

The GPS menu has seven items as follows.

Download Almanac from GPS

Sends the commands '$PSGM,GETALM,1' to '$PSGM,GETALM,32' to the GPS MKN5610 device to obtain the almanac for every one of the 32 satellites.

Upload Almanac to GPS

Save Almanac to Flash

Clear Almanac

Sends the command '$PSGM,CLRALMS*6B' to the GPS MKN5610 device to clear the almanac.

Clear Ephemeris

Sends the command '$PSGM,CLREPHS*76' to the GPS MKN5610 device to clear the ephemeris.

Reboot GPS

Frequency Calibration…

5.3.4 Config

The Config menu contains entries involved in the configuration of the output data from the GPS MKN5610 device. The Config menu has five items as follows.

Download from GPS

Sends the command '$PSGM,GETCONF*77' to the GPS MKN5610 device to obtain the current configuration of the device.

Upload to GPS

Sends the command '$PSGM,NMEA,000000000*3E' to the GPS MKN5610 device to change the configuration of the device to that defined by the NMEA, General and Satellite Masking options that follow.

NMEA

Presents the NMEA selection window with nine checkboxes, one for each NMEA sentence produced by the GPS device. The sentences are GPGGA, GPGSA, GPGSV, GPRMC, GPVTG, GPGLL, GPZDA, PSGMRAW and PSGMFIL. Check a checkbox to make the MKN5610 produce the selected sentence. Uncheck a checkbox to suppress production of the selected sentence.

General

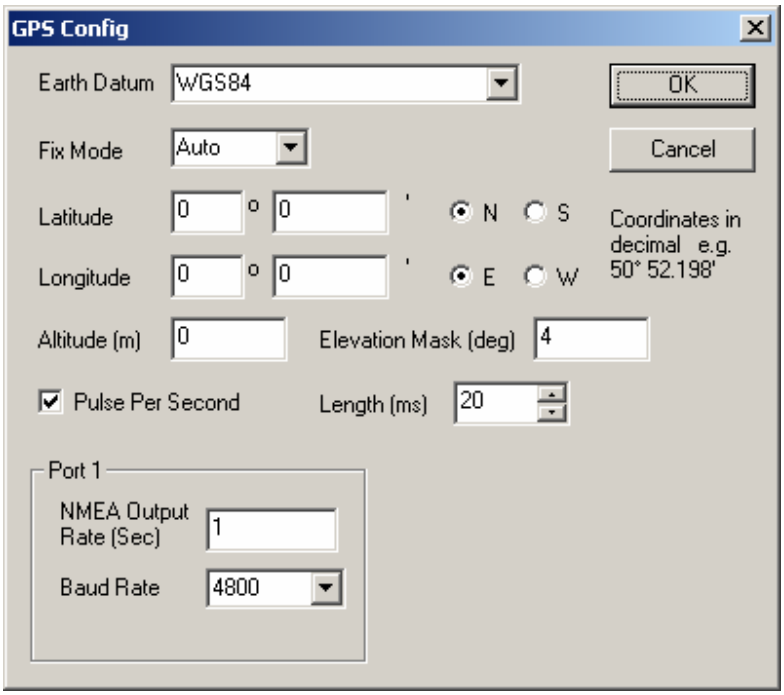


Figure 5.7 GPS Configuration Screen

Presents the GPS Config window for the entry of assorted configuration values. These values are:

- Earth Datum

Fix Mode

Select one from Auto, 2D or 3D

- Auto
- 2D
- 3D

Latitude

Entry of a latitude and longitude in this configuration window will give the GPS device an estimate of its current position. This will greatly speed up acquisition of initial fixes on visible satellites.

Longitude

See Latitude above.

Altitude

Will set an initial estimate of current altitude.

Elevation Mask

This value indicates the satellite elevation below which the satellite will not be used for position calculations even if they may be available and valid.

Pulse per Second

Check this checkbox to have the GPS MKN5610 device output an accurate timing pulse at the rate of one per second.

Length

Sets the length in milliseconds of the pulse output when the 'Pulse per second' checkbox above is checked.

Port 1

- NMEA Output Rate sets the number of seconds between output of NMEA sentences.
- Baud Rate

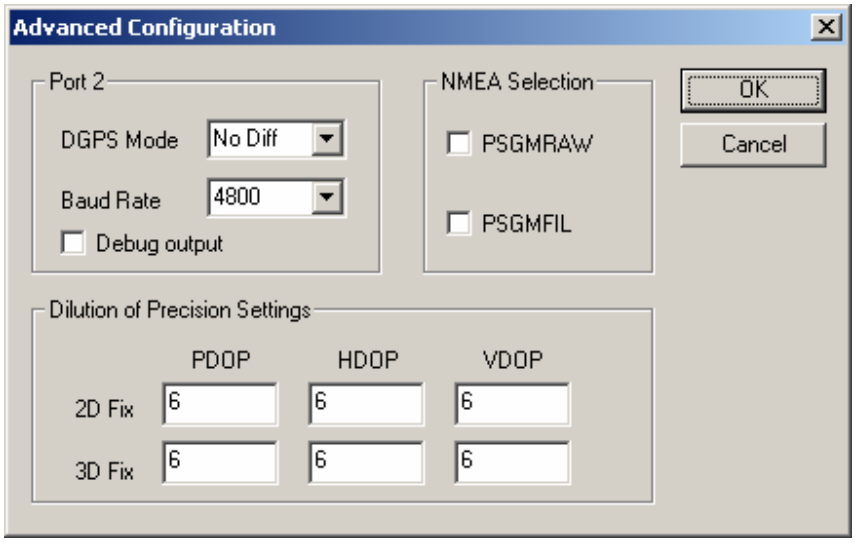


Figure 5.8 Advanced Configuration Screen

Dilution of Precision

Sets the Dilution of Precision (DOP) threshold above which the receiver will indicate a poor position fix.

- 2D PDOP
- 2D HDOP
- 2D VDOP
- 3D PDOP
- 3D HDOP
- 3D VDOP
-

Port 2

- DGPS Mode
- Baud Rate
- Debug Output - check this checkbox to cause debug information to be sent out from port 2.

Satellite Masking

Presents the Satellite Masking window. This window has a checkbox for each of the 32 satellites, which could potentially be visible.

- Check a checkbox to enable tracking of a particular satellite.
- Uncheck a checkbox to disable tracking of a particular satellite.

5.3.5 View Menu

The View menu contains standard functions for the user interface windows and tool bars.

5.3.6 Window Menu

The Window menu contains the standard windows layout functions. Tiling the windows will re-display the windows in the reverse order in which they last had focus, starting at top left, going down and ending at bottom right.

5.3.7 Help Menu

The Help menu contains the standard Help features.

5.4 Stored Parameters

The following parameters are stored in the MKN5610's flash:

5.4.1 Almanac

- Satellite's PRN
- Week number for the epoch
- Satellite PRM
- Shift-left test result
- Eccentricity
- Rate of inclination angle
- Rate of right ascension
- Square-root of semi-major axis
- Longitude of ascending node of orbit plane at weekly epoch
- Argument of perigee
- Mean anomaly at reference time
- Constant clock correction
- First order clock correction
- Satellite health
- Satellite availability

5.4.2 Position

- Longitude and Latitude
- Altitude

The almanac and position data stored in flash are used to acquire a fast satellite lock following a cold start, when the battery-backed almanac will have been lost.

APPENDIX A – SUPPORT

For ordering information, contact:

Mobile Knowledge Inc.
84 Hines Road
Kanata, Ontario, Canada, K2K 2M5
Phone: 1-613-271-1601
Fax: 1-613-271-9827
e-mail: info@Mobile-Knowledge.com
web: www.Mobile-Knowledge.com

If you encounter any difficulty in working with the MKN5610 Evaluation Kit, please contact Mobile Knowledge technical support between 08:30 to 17:00 Eastern time:

Tel: 1-613-271-1601
Fax: 1-613-271-9827
e-mail: info@Mobile-Knowledge.com
web: www.Mobile-Knowledge.com