

# **SDS**

## **Lodestar Command and Control Language**

**Version 101**

### **Document Revision History**

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# 1. Introduction

Lodestar supports a number of commands for detailed configuration of its functionality in support of a host of different applications. These commands are split into a set of logical groups related to the functionality they affect.

Commands can be sent to Lodestar via serial or Ethernet links. Once the system is set up as required it is possible to store the setup parameters to non-volatile memory.

Following power up, Lodestar runs a Bootloader which loads and initiates the application firmware. The commands listed in this document are for the application firmware (as opposed to Bootloader commands)

## 2. Command and Control

### 2.1. *Command Entry*

As it is unknown what the configuration of the system will be, in order to gain access to changing the Lodestar's settings it is configured to always allow command and control input on the following input ports UART 0 and Ethernet TCP port 4000.

To enter into the command line a specific sequence of characters must be sent to the Lodestar. Once in the command line system the text “\r\n% SAINTS Command Line\r\n” is output where “\r” is a carriage return and “\n” is a line feed. Upon leaving the command line system the text string “\r\n% Leaving SAINTS Command Mode\r\n” is output. If commanding on a port on which the serial settings are requested to be changed, the serial settings do not take effect until exiting the command line AND the exiting text above has been output.

#### 2.1.1. Non-multiplexed port

To enter the command line system “<Ctrl-P>CMD” must be entered. Due to the way the input on a non-multiplexed port is processed, it does not matter if the character sequence is appended with “\r\n”.

#### 2.1.2. Multiplexed port

For command line entry on a multiplexed port the sequence is slightly different. To prevent undesired entry to the command line caused by data in the multiplexed packets, the following sequence is required: “<not Ctrl-P><Ctrl-P>CMD”.

Due to the way the input on a multiplexed port is processed it matters that the above sequence is used exactly. This sequence can also be used on a non-multiplexed port.

To exit the command line system either <ESC> or ‘SYS EXIT\r\n’ must be entered. If the firmware is busy processing a command then no further commands are accepted (and no responses for those further commands are output). Further commands are accepted after the ‘ok’ or ‘not ok’ response to the earlier command has been output. It

is therefore important that any system sending commands to the Lodestar waits for the ok/not ok to know when the command has finished processing.

No file system commands are accepted while the SD card is initialising.

It is the intention that settings can be queried by typing the command stub without the values. At this time, it is not guaranteed that this is implemented in all cases.

## **2.2. Command Types**

The commands are split into a number of groups:

DVL	-	Control of the DVL
ENG	-	Engineering information
GC	-	Control of the Gyrocompass (AHRS)
GPS	-	Control of the GPS (GNSS)
IN	-	Control of the input messages
INS	-	Control of the Aided INS (AINS) functionality
LBL	-	Control of the LBL
LOG	-	Control of the logging
OP	-	Control of the output messages
PORT	-	Information of a port
PRESS-		Control of the Pressure sensor
SUSBL-		Control of the SUSBL position report
SVS	-	Control of the Sound Velocity Sensor (SVS)
SYS	-	Control of system modules
TRIG	-	Control of the triggers
TSYS	-	Control of the time system and the real time clock
ZMD	-	Control of Zero Mean Depth aiding of the AINS

In addition:

- All command groups have a LIST and HELP and in addition it is possible to enter LIST or HELP without a command group and useful information will be returned.
- ENG LIST returns the following:
  - Firmware version number and date and time of compilation
    - Format:  
FIRMWARE major.minor.interim.build yyymmddhhmmss  
eg FIRMWARE 2.07.00.857 20130408114558  
The version numbering contains 4 numbers each of variable length and separated by decimal points. The minor, interim and build numbers display at least 2 digits.  
The date/time contains the PC's date and time the build was compiled on the PC.
  - Commands version number
  - Datestamps or version numbers of two FPGAs
  - Serial number of the ISA block
  - Serial number of the IMU, datestamp and CRC for the IMU data
  - IP address
  - MAC address
  - SD card capacity

- Version number of the PIC
- Serial number of the PIC
- IMU data output allowed/disallowed by the PIC
- Application to run determined by the PIC
- User access level determined by the PIC

All commands must be appended with “\r\n”.

A command can be commented out from a list of commands by preceding the command with “// ”. (Note the space.)

Any changes to lever arms or mounting angles must be followed by a reset of the INS, otherwise the new values are not used in the INS computations.

## **2.1. Mounting angle and lever arm conventions**

Sensor mounting angles entered using the “<sensor> MA <alpha> <beta> <gamma>” command (eg DVL MA) express the Euler angle (Tate-Bryan) rotation sequence from vehicle frame into the frame of sensor. The vehicle and sensor frame convention used by Lodestar is:

- X – forward
- Y – right/starboard
- Z – down (in the vehicle/sensor sense).

The rotation sequence from the vessel frame to a sensor frame is:

1. Rotation by the gamma angle [fromAngleRange toAngleRange [ about  $Z_{\text{vessel}}$
2. Rotation by the beta angle about the resulting Y axis
3. Rotation by the alpha angle about the resulting X axis

The angles which are input are, pragmatically, allowed to be a larger range than is used internally and than is displayed. Inputs allowed are  $-360.0 \leq \alpha$  or  $\gamma \leq 360.0$  and  $-90.0 \leq \beta \leq 90.0$  while displayed values are  $-180.0 \leq \alpha$  or  $\gamma \leq 180.0$  and  $-90.0 \leq \beta \leq 90.0$ .

## 2.2. SYS Commands

Mnemonic	Purpose
LIST	Lists all parameters
CMDS LIST	Lists command parameters
NONDEFAULT LIST	Lists command parameters to be used to set up current functionality from Default Settings.
CMDS VERSION	Lists the commands version number
HELP	Helps with command syntax
RST	Reboot the system
EXIT	Exit the command line
SAVE	Saves the current configuration to non-volatile memory
LOAD	Loads a configuration file
NET	Sets or reads the IP address and mask
NET RST	Resets the Ethernet
NET PING	Pings an IP address
MAC	Reads the MAC address
MA	Sets or reads Mounting angles [2-7]
LA	Sets or reads Lever arms [2-7]
RP	Reads the lever arms, mounting angles and RPHV[0,2-7]
SHUTDOWN	Turns off the Lodestar
AUTOSHUTDOWN	Turns off the Lodestar if no external power for x secs.
BIST	Output the Lodestar BIST in ASCII format

### 2.2.1. Syntax help

#### **SYS CMDS LIST**

##### SYS CMDS LIST

While SYS LIST outputs every setting and some information, SYS CMDS LIST outputs only settings which can be used as input to set up a Lodestar eg it does not output the UART FPGA versions nor the MAC address. It also does not output the PIC MATCH setting because if this were then input on the system it would cause a reset.

It does also output some non-setup commands as information and these are pre-pended by comment characters as described in another section. One such item is the firmware version and its format must not change as it is to be used by Janus. This is supplied by the equivalent of an ENG LIST so please refer to that for the format (which for a SYS CMDS LIST is pre-pended by a comment).

#### **SYS NONDEFAULT LIST**

##### SYS NONDEFAULT LIST

This is similar to SYS CMDS LIST; however, the commands listed are only those required to set up the Lodestar from its default configuration. It assumes the IMU settings are available from the FACTORY area of the Flash.

It does not output the IMU or ISA settings specific to the calibration of the unit.

#### **SYS CMDS VERSION**

##### SYS CMDS VERSION

This outputs the version number of the commands for reference against the correct version of this document.

### **SYS SAVE**

**SYS SAVE FLASH | FACTORY**

The entered configuration of the Lodestar can be saved in on-board Flash. There are a number of areas in the Flash to which the configuration can be saved; 2 for FLASH and 2 for FACTORY. The FACTORY area contains the IMU calibration values to enable the AHRS to give a correct output.

It is not possible for the user to save to the FACTORY area.

If the user saves to FLASH then any Default Settings Alarm will be cancelled.

### **SYS LOAD**

**SYS LOAD FLASH | FACTORY**

This loads the configuration details from the particular area (see the SYS SAVE command). If SYS LOAD FACTORY, the IMU calibration values for the unit are read and the remaining settings are read from the firmware default settings.

At startup, normally the system reads the FLASH area. If this fails then it loads up the IMU calibrations settings from the FACTORY area in the Flash and uses the firmware default settings.

Note, in the situation where there are no saved FLASH or FACTORY settings, a SYS LOAD FLASH does not result in any change to the current settings but re-initialisation occurs; a SYS LOAD FACTORY results in a full set of defaults (including default IMU calibration settings) and re-initialisation.

After a SYS LOAD xxx whichever ports are in command mode will remain in command mode.

### **SYS NET**

**SYS NET a.b.c.d w.x.y.z**

Where a.b.c.d is the IP address and w.x.y.z is the mask.

This sets up the IP address and mask. The entry of the mask is optional while the IP address must always be entered. The default mask is 255.255.255.0.

e.g

**SYS NET 192.168.127.100**

**SYS NET 192.168.127.100 255.255.255.0**

**SYS NET** returns **SYS NET 192.168.127.100 255.255.255.0**

The address can be changed without requiring a restart. The software stores the current Ethernet setup (IN/OUT/LOG) and once the address has changed it configures that Ethernet setup.

Note, if the command was sent via a UART then the change takes place immediately. If it was sent while in command mode on an Ethernet port then the change takes place once the user exits the command line. Note that in this situation, if the IP address has been requested to be changed but this has not yet taken effect, then a SYS NET will return the current IP address, not the one to be changed to. If a SYS SAVE FLASH is done it will save the new IP address settings even if they have not yet taken effect. This behaviour is similar to that for a UART when the user requests changes to the UART's serial settings while commanding via that UART port.

*Default:       SYS NET 192.168.179.50 255.255.255.0*

**SYS NET RST**

SYS NET RST

This resets the Ethernet. The Ethernet can be reset by command or internally by the Lodestar having problems outputting on a connected socket. The command is not accepted if an Ethernet reset is in progress.

**SYS NET PING**

SYS NET PING a.b.c.d

e.g. SYS NET PING 192.168.179.100

This pings the requested IP address. It returns 'ok' if found else 'not ok'.

**SYS NET LIST**

SYS NET LIST

This outputs the IP address and mask and the OP, LOG and IN network ports.

e.g returns:

SYS NET 10.0.0.3 255.255.255.0

OP 4010 NET TCP MULTIPLEX 1

OP 4010 NET TCP MSG NAV 5.000 SRC 1

OP 4010 NET TCP MSG + INGGGA 1.000 SRC 1

OP 4010 NET TCP MSG + PSONTMS 1.000

OP 4010 NET TCP MSG + SON2 15.000

LOG 4010 NET TCP MSG ISA IMU NAVCAL NAVQUAL PMAT DXMAT

MUSBL TMS TRGP CMD USBLP GPSP PSONBCNP ALARMP ACKP DBGP

TXTP

IN 4010 NET TCP MSG USBL

IN 4010 NET TCP MSG + GPS

IN 4010 NET TCP MSG + PSONBCN

**SYS MAC**

SYS MAC dd:dd:dd:dd:dd:dd

This reads the MAC address, it is read only.

e.g. SYS MAC

**SYS SHUTDOWN**

SYS SHUTDOWN

This allows the user to turn the Lodestar off even if a battery is connected.

**SYS AUTOSHUTDOWN**

SYS AUTOSHUTDOWN <d> [DELAY <d>]

This allows the user to set up the Lodestar so that it shuts down after there has been no external power for DELAY seconds.

e.g. SYS AUTOSHUTDOWN <on|off> DELAY <60..7200 secs>

SYS AUTOSHUTDOWN 0

turn off autoshutdown

SYS AUTOSHUTDOWN 1

turn on autoshutdown. It will use whatever delay was previously set up.

SYS AUTOSHUTDOWN 1 DELAY 60

turn on autoshutdown and set delay to 60s



*Default: SYS AUTOSHUTDOWN 0 DELAY 1800*

**SYS LA**

SYS LA < rpIndex > <d.d> <d.d> <d.d>

SYS LA < rpIndex > <x> <y> <z>

SYS LA < rpIndex >

SYS LA

SYS LA RST

e.g. SYS LA 2 1.0 2.0 3.0

SYS LA 2 returns the lever arms for index 2

SYS LA returns all the lever arm indices and their values

SYS LA RST zeros all lever arms for all indices.

This allows various lever arms which can be applied to the output messages to be set up.

Distances are in metres. The Lever arms are all defined about the vehicle CRP (central reference point) of the vessel. The Lodestar may be used as the CRP in which case the INS or gyro-compass lever arm will be zero.

The range of “rpIndex” is [0-7]. Lever arms and mounting angles applied to the same rpIndex are paired. Changes are disallowed using this command to index 0 (CRP never changes from zero) and 1 (set using IMU LA cmd).

*Default: All SYS LA indices contain zeros*

**SYS MA**

SYS MA <rpIndex> <d.d> <d.d> <d.d>

SYS MA <rpIndex> <a> <b> <c>

SYS MA <rpIndex>

SYS MA

SYS MA RST

e.g. SYS MA 2 1.0 2.0 3.0

SYS MA 2 returns the mounting angles for index 2

SYS MA returns all the mounting angle indices and their values

SYS MA RST zeros all mounting angles for all indices.

This applies mounting angles an index.

Angles are in degrees. As the angles can be large (e.g. 90 degrees) these are defined as Euler angles.

The range of “rpIndex” is [0-7]. Lever arms and mounting angles applied to the same rpIndex are paired. Changes are disallowed using this command to index 0 (CRP never changes from zero) and 1 (set using IMU MA cmd).

*Default: All SYS MA indices contain zeros*

**SYS RP**

SYS RP <rpIndex>

SYS RP

e.g. SYS RP 2 returns the lever arms, mounting angles and remote heave settings for index 2

SYS RP returns all the lever arms, mounting angles and remote heave settings for all indices

This is a read-only command. The return values are in the format:

```
SYS RP <rpIndex> <d.d> <d.d> <d.d> <d.d> <d.d> <d.d> <FULL|ROT>  
<FILTER|NOFILTER>
```

```
SYS RP <rpIndex> <x> <y> <z> <a> <b> <c> <FULL|ROT>  
<FILTER|NOFILTER>
```

NOTE – RP 0 is the CRP and contains 0 for the LAs and MAs.

RP 1 is the IMU and reflects what has been set using IMU LA, IMU MA or the PSONLVR or PSONLBLVR msg input. Neither RP 0 nor RP 1 can be changed using SYS LA or SYS MA.

This is a read-only command and does not alter the LAs or MAs.

This reads lever arms, mounting angles, remote heave output type and remote heave filter setting respectively for an index.

Distances are in metres, angles are in degrees. As the angles can be large (e.g. 90 degrees) these are defined as Euler angles. The Lever arms are all defined about the CRP (common reference point) of the vessel. The Lodestar may be used as the CRP in which case the INS or gyro-compass lever arm will be zero.

The range of “rpIndex” is [0-7]. Lever arms and mounting angles applied to the same rpIndex are paired.

*Default: All SYS RP values contain zeros, the remote heave output type is FULL and the remote heave filter setting is on.*

#### **SYS BIST**

SYS BIST

This outputs the current BIST values of the Lodestar on the commanding port.

#### **SYS RST**

SYS RST

This restarts the Lodestar.

## 2.3. GC Commands

Mnemonic	Purpose
LIST	Lists all GC parameters
HELP	Helps with command syntax
LAT	Sets or reads the latitude
SETTLE	Sets or reads the AHRS settling time
RST	Resets the AHRS

### 2.3.1. Syntax help

#### GC LAT

GC LAT <d.ddd> (decimal degrees)

GC LAT <d.ddd> <d.ddd> (degrees & decimal minutes)

e.g. GC LAT 51.3309

returns GC LAT 51.3309,N,00000.00,E Deg, 5119.85,N,000.0000,E DegMins

e.g. GC LAT 51.0 19.852

returns GC LAT 51.3309,N,00000.00,E Deg, 5119.85,N,000.0000,E DegMins

(Note that in both above cases the longitude may vary to the above values.)

*Default:* GC LAT 51.3309

#### GC SETTLE

e.g. GC SETTLE 200

This sets the time in seconds between the start of the AHRS algorithm and it reporting 'settled'. The minimum is 50 seconds. The maximum is (0xffffffff = 4,294,967,295) seconds.

*Default:* GC SETTLE 200

NOTE: Should be set to a minimum of 300 sec for in vehicle operational use. Can be reduced for faster development and testing of system integration.

#### GC RST

e.g. GC RST

This resets the AHRS algorithm.

## 2.4. OP Commands

Mnemonic	Purpose
LIST	Lists all OP parameters
HELP	Helps with command syntax
SER	Sets the baud rate, number of data bits, the parity and the number of stop bits
BAUD	Sets the baud rate
DATA	Sets the number of data bits
PAR	Sets the parity
STOP	Sets the number of stop bits
TERM	Sets or reads the termination setting
POWER	Enable/Disable power to the port
PROT	Set signalling protocol (232, 485 ...)
MSG	Lists the messages and their numbers or sets the messages to be output
EN	Enables or disables output
ECHO	Enables or disables the echoing of user-entered characters
MULTIPLEX	Sets if port is to output in binary or ascii format
HOLDOFF	Used for a network port as a timeout for data output
NET	Sets up the protocol for a network port
CLOSE	Closes a network port

Note that any change to serial comms settings while in command mode (whether on a multiplexed port or not) does not take effect until exiting command mode. However, any change to the serial comms settings from outside command mode takes effect immediately.

### 2.4.1. Syntax help

Note: the system supports the following baud rates:

9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600

#### OP SER

OP <port> SER <baudrate> <databits> <parity> <stopbits>

E.g. OP 0 SER 9600 8 N 1

It also allows the selection of 7 or 8 data bits, the selection of even or odd parity or no parity and the selection of 1 or 2 stop bits.

In the case of this command, the text returned to screen after command input is the results the individual commands eg OP BAUD, OP DATA, OP PAR and OP STOP.

*Default:*

- OP 0 SER 9600 8 N 1*
- OP 1 SER 9600 8 N 1*
- OP 2 SER 9600 8 N 1*
- OP 3 SER 9600 8 N 1*
- OP 4 SER 9600 8 N 1*

#### OP BAUD

OP <port> BAUD <baudrate>

E.g. OP 0 BAUD 9600

A check is made on the speed of the comms compared to the throughput required. The baud rate is disallowed if it would result in too much data throughput for the new setting.

*Default: See OP SER cmd*

#### **OP DATA**

OP <port> DATA <databits>

E.g. OP 0 DATA 8

Selects between 7 or 8 data bits.

*Default: See OP SER cmd*

#### **OP PAR**

OP <port> PAR <parity>

E.g. OP 0 PAR N|O|E

Selects between even, odd or no parity.

*Default: See OP SER cmd*

#### **OP STOP**

OP <port> STOP <stopbits>

E.g. OP 0 STOP 1|2

Selection of 1 or 2 stop bits.

*Default: See OP SER cmd*

#### **OP TERM**

OP <port> TERM <0|1>

Turns the termination resistor for the UART on (1) or off (0). Applies to UARTS 1 – 4.

Note, it is only used for ports using 485F and 485H protocol; the setting has no effect on ports with RS232 protocol set.

*Default: OP 1 TERM 1  
OP 2 TERM 1  
OP 3 TERM 1  
OP 4 TERM 1*

#### **OP POWER**

OP <port> POWER <0|1>

Turns the power to the UART on or off. Applies to UARTS 1 – 4.

Sending this command (0 or 1) also clears the serial break bit. Note, this means that it is not possible to clear a serial break on UART 0 by means of a direct command.

*Default: OP 1 POWER 1  
OP 2 POWER 1  
OP 3 POWER 1  
OP 4 POWER 1*

**OP PROT**

OP <port> PROT <232|485F|485H>

Selects the signalling protocol for the port. Ignored for channel 0 as that's selected by the hardware. Applies to UARTS 1 – 4.

Valid options are:

232 – RS232

485F – Full duplex RS485/RS422

485H – Half duplex RS485

If OP <port> PROT is entered the response is the current setting. If the setting used by the firmware and the setting used by the FPGA are different then this is reported via a textual response.

*Default:*        *OP 1 PROT 232*  
                      *OP 2 PROT 232*  
                      *OP 3 PROT 232*  
                      *OP 4 PROT 232*

**OP NET**

OP <port> NET TCP

e.g. OP 4001 NET TCP

The TCP command creates a port on the IP address of the Lodestar that clients can connect to. Port numbers can be in the range 5-65535. Ports 0-4 are not allowed as they clash with UART ports. Port 4000 is always enabled. The protocol on the port is TCP/IP.

*Default:*        *OP 4000 NET TCP*

**OP NET MULTIPLEX**

OP <port> NET TCP MULTIPLEX <0|1>

e.g. OP 4006 NET TCP MULTIPLEX 1

This allows the output messages on a port to be output in their native form (0) or wrapped in the multiplex format (1) in the same way as for serial comms.

*Default:*        *OP 4000 NET TCP MULTIPLEX 0*

**OP NET HOLDOFF**

OP <port> NET TCP HOLDOFF <d>

e.g. OP 4006 NET TCP HOLDOFF 50

This is the timeout in ms for data to be output on a network port in the even there isn't enough data to be output within that time.

Minimum value 10ms, maximum 65535ms.

*Default:*        *OP 4000 NET TCP HOLDOFF 50*

**OP NET LIST**

OP NET LIST

This lists the sockets which are open.

## **OP CLOSE**

OP <port> NET TCP CLOSE

e.g. OP 4006 NET TCP CLOSE

This closes and removes a network port.

## **OP MSG**

The following commands can be entered to find out which message number corresponds to which output message. The message number is required when a message output is requested in a command.

OP MSG ?

OP MSG LIST

OP MSG on its own reports the setup of the output messages on the Lodestar's ports.

OP <port> MSG LIST or OP <port> MSG on its own reports the output messages set up for that port, where the port could be a serial port, network port or SD card.

There are a number of ways to set up output messages. A single or multiple messages can be selected or, if a message list is already set up, messages can be added or removed from this list. The ports could be a serial port (0 – 4), the SD card (SD) or a network port.

OP <port> MSG [+|-] <msgID> <msgFreq> [RP <rpIndex> SRC <dataSrc>]

The RP and SRC entries are optional. If omitted, the RP is assumed to be 0 and the SRC is assumed to be AHRS (0). In this case, the command echoed back does not contain those RP or SRC entries.

e.g. OP 1 MSG TSS1 10  
OP 1 MSG TSS1 10 RP 2 SRC 0  
OP 1 MSG TSS1 10 SON1 10  
OP sd MSG TSS1 10 RP 3 SRC 0 SON1 10 RP 3 SRC 0  
OP 4001 NET TCP MSG TSS1 10 RP 3 SRC 0 SON1 10 RP 3 SRC 0

The RP refers to the lever arm/mounting angle index number.

The SRC refers to if the data is generated from the AHRS algorithm (0) or the INS algorithm (1).

To add a single or multiple messages use a '+' as shown in the syntax above.

e.g. OP 1 MSG + SON110 RP 3 SRC 0 TSS1 3 RP 2 SRC 1

To remove a single or multiple messages use a '-' and provide the message number and the lever arm / mounting angle index and source number. The rate is not required.

OP <port> MSG - < msgID > [RP <rpIndex> SRC <dataSrc>]

OP 0 MSG - SON1 RP 1 SRC 0 EM1000 RP 4 SRC 1

OP 4001 NET TCP MSG - SON1 RP 1 SRC 0 EM1000 RP 4 SRC 1

This removes message SON1 with lever arm index 1 and AHRS source and also removes message EM1000 with lever arm index 4 and INS source from UART0.

A check is made on the speed of the comms compared to the throughput required. The message command is disallowed if it is judged to result in too much data throughput as compared to the link bandwidth. NOTE – if the command has not used a '+' after

OP port MSG then any previous message settings for that port will have been removed.

*Default:*        *OP 0 MSG 0*  
                  *OP 1 MSG 0*  
                  *OP 2 MSG 0*  
                  *OP 3 MSG 0*  
                  *OP 4 MSG 0*  
                  *OP 4000 NET TCP MSG 0*  
                  *OP SD MSG 0*

#### **OP EN**

OP <port> EN <0|1>

E.g. OP 0 EN 1

This allows output messages to be output on that port.

*Default:*        *OP 0 EN 1*  
                  *OP 1 EN 1*  
                  *OP 2 EN 1*  
                  *OP 3 EN 1*  
                  *OP 4 EN 1*  
                  *OP 4000 NET TCP EN 1*

#### **OP ECHO**

OP <port> ECHO <0|1>

E.g. OP 0 ECHO 1

This allows command line typing to be displayed on the command line.

*Default:*        *OP 0 ECHO 1*  
                  *OP 1 ECHO 1*  
                  *OP 2 ECHO 0*  
                  *OP 3 ECHO 0*  
                  *OP 4 ECHO 0*  
                  *OP 4000 NET TCP ECHO 1*

#### **OP MULTIPLEX**

OP <port> MULTIPLEX <0|1>

E.g. OP 0 MULTIPLEX 1

This allows the output messages on a port to be output in their native form (0) or wrapped in the multiplex format (1).

*Default:*        *OP 0 MULTIPLEX 0*  
                  *OP 1 MULTIPLEX 0*  
                  *OP 2 MULTIPLEX 0*  
                  *OP 3 MULTIPLEX 0*  
                  *OP 4 MULTIPLEX 0*  
                  *OP SD MULTIPLEX 1*  
                  *OP 4000 NET TCP MULTIPLEX 0*



## 2.5. IN Commands

Mnemonic	Purpose
LIST	Lists all IN parameters
HELP	Helps with command syntax
MSG	Lists the messages and their numbers or sets the messages to be output
NET	Sets up the protocol for a network port message

e. . See Appendix B for notes on MSG names

### 2.5.1. Syntax help

#### IN MSG

The following commands can be entered to find out which message IDs are available for aiding. The message ID is required when an aiding message is requested in a command.

IN MSG LIST

IN MSG or IN LIST on its own reports the setup of the input messages on the Lodestar's ports. IN <port> MSG LIST or IN <port> LIST on its own reports the aiding messages set up for that port, where the port could be a serial port or a network port.

There are a number of ways to set up aiding messages. Single or multiple aiding messages can be selected or, if a message list is already set up, messages can be added or removed from this list. The ports could be a serial port (0 – 4) or a network port – (ports 40000 – 65000 preferred).

IN <port> MSG [+|-] <msgID>

e.g. IN 0 MSG GPS  
IN 0 MSG GPS USBL  
IN 40006 NET TCP MSG USBL

To add a single aiding message use a '+' and provide the message name.

IN <port> MSG + <msgNo>

IN 0 MSG + USBL

To add multiple messages use a '+' and provide the message names.

IN 0 MSG + GPS USBL

To remove a single or multiple aiding messages use a '-' and provide the message names.

IN <port> MSG - <msgNo>

IN 1 MSG – GPS USBL

To remove all aiding messages from the port type eg

IN 1 MSG 0

Note that ports 0 and 4000 always accept COMMANDs; it is not possible to turn this off.

*Default: IN 0 MSG COMMAND*

*IN 1 MSG COMMAND*

*IN 1 MSG + GPS*

*IN 2 MSG 0*

*IN 3 MSG 0*

*IN 4 MSG 0*

**IN NET LIST**

IN NET LIST

This lists the sockets which are looking for input messages.

## 2.6. PORT Commands

Mnemonic	Purpose
LIST	Lists all ISA parameters
HELP	Helps with command syntax

### 2.6.1. Syntax help

#### PORT

PORT

The PORT command reports which serial port the command was typed on. This allows an easy check that the commands are working.

#### PORT LIST

PORT LIST

PORT <port> LIST

PORT <port> NET TCP LIST

The above commands allow the user to list the OP, IN and LOG settings for a port or for all ports. The named port can include the SD card and in that case no IN items are then shown.

## 2.7. INS Commands

Mnemonic	Purpose
LIST	Lists all INS parameters
HELP	Helps with command syntax
USE	Sets or reads the aiding messages for the AINS
KFHPOSrst	Sets or reads the INS Auto Reset value
KFHPOSBOOST	Sets or reads the value for boosting of horizontal position covariance
KFACOUQSCALE	Sets or reads the Kalman Filter Acoustic Horizontal Scale
KFREJFILT	Sets or reads the Kalman Filter Reject value for each sensor
ZMD KFBias	Sets or reads the MRms2 value and MTc2 value
ZMD NOISE	Sets or reads the MRms1 value
ZMD MINDEPTH SIG	Sets or reads the min depth sigma value
GPS KFHPOS	Sets or reads PH MRms2 value and PH MTc2 value
GPS KFQMAX	Sets or reads maximum acceptable HDOP value
GPS KfvPOS	Sets or reads if 2D/3D GPS INS and if quality used in calculation.
GPS USEVERTICAL	0=2D, 1=3D vertical aiding
GPS ENHANCED	Sets or reads the enhanced GNSS setting
LBL NOISE	Sets or reads PH MRms1 value
LBL SMPAREJEN	Sets or reads LBL Short Multipath rejection enable setting

LBL SMPAREJT	Sets or reads LBL Short Multipath max rejection time
LBL KFHPOS	Sets or reads LBL SLAM horizontal position
LBL KVVPOS	Sets or reads LBL depth error
LBL KFSS	Sets or reads LBL SS error
SUSBL KFHPOS	Sets or reads PH MRms2 value
SUSBL KFQMIN	Sets or reads minimum quality value and its enable
SUSBL KFQMAX	Sets or reads maximum quality value and its enable
SUSBL KVVPOS	Sets or reads PV MRms2 value
SUSBL USEVERTICAL	0=2D, 1=3D vertical aiding
PRESS NOISE	Sets or reads Bias/random noise, 1 <sup>st</sup> order Markov RMS value
DVL KVVXY	Sets or reads Bias/random noise, 1 <sup>st</sup> order Markov RMS value
DVL KVVZ	Sets or reads Bias/random noise, 1 <sup>st</sup> order Markov RMS value
DVL KFSF	Sets or reads Scale factor and time constant. Bias/random noise, 1 <sup>st</sup> order Markov RMS value.
DVL KFMA	Sets or reads RMS value and time constant. Boresight misalignment accuracy
XSAL	Sets or reads current salinity of sea water
XSV	Sets or reads current sound speed
RST	Resets the AINS

### 2.7.1. Syntax help

#### INS USE

INS USE [+|-] [GPS|ZMD|DVL|LBL|PRESS|SUSBL|XPOS|ZUPT]

Eg    INS USE GPS  
       INS USE + GPS SUSBL  
       INS USE – GPS SUSBL

This sets up what instrument data the INS will use in its Kalman filter.

Eg GPS, ZMD, DVL, PRESS, SUSBL, XPOS, LBL.

INS USE returns the current setting.

The message source names are shown when the user types INS HELP.

*Default:*        INS USE 0

#### INS RST

INS RST

This resets the AINS.

#### INS KFHPOSRST

INS KFHPOSRST <d.d>

Eg INS KFHPOSRST 1000

This command will set the 1DRMS limit at which the INS Auto Reset occurs. If the value is 0 then the INS Auto Reset is turned off.

*Default: INS KFHPOSRST 1000.0*

**INS KFHPOSBOOST**

INS KFHPOSBOOST <d.d>

Eg INS KFHPOSBOOST 8

This command boosts horizontal position covariance states when changing from one positioning sensor to another by adding the (non-zero) value in the command to them.

A value of 0.0 turns the boosting off otherwise the value is applied.

Suggested value if used: 8.0m

*Default: INS KFHPOSBOOST 0.0*

**INS KFACOUQSCALE**

INS KFACOUQSCALE <d.d>

Eg INS KFACOUQSCALE 1.0

This command will set the Kalman Filter Acoustic Horizontal Scale to scale the acoustic input noise on DPINS and Subsea INS use of USBL.

*Default: INS KFACOUQSCALE 1.0*

**INS GPS KFHPOS**

INS GPS KFHPOS <d.d> <d.d>

INS GPS KFHPOS <rms> <tc>

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value and Time Constant value for GPS Horizontal Position in the Kalman filter. The Time Constant is currently fixed to 0 (i.e. random time uncorrelated noise)

*Default: INS GPS KFHPOS 0.3 0.0*

**INS GPS KFQMAX**

INS GPS KFQMAX <d.d> <d>

INS GPS KFQMAX <value [m]> <1(enable)|0(disable)>

Eg INS GPS KFQMAX 20.0 1

Eg INS GPS KFQMAX 20.0 0

*This effect of this command is not influenced by the INS GPS KFHPOS command.*

If INS GPS KFQMAX is enabled then if the GGA *hdop* is above this value, the message contents are not used in the INS calculations and the required bit is set in the associated Observation Status message.

If INS GPS KFQMAX is disabled then the value of the GGA *hdop* is considered ok.

In either case, the *INS GPS KFHPOS* value is used as the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for GPS Horizontal Position in the Kalman filter

*Default: INS GPS KFQMAX 0.0 0*

**INS GPS KVVPOS**

INS GPS KVVPOS <d.d>

This sets the value or if no value specified it displays the value set.

If value > 0, the value is used in a 3D GPS position update.

If value = 0, the standard deviation of altitude error (m) is used in a 3D GPS position update.

The value is not allowed to be < 0

Note this setting is only used if a 3D GPS position update is selected.

*Default: INS GPS KVVPOS 0.6*

#### **INS GPS USEVERTICAL**

INS GPS USEVERTICAL <d>

This sets if the GPS position aiding is to be (0) 2D or (1) 3D.

*Default: INS GPS USEVERTICAL 0*

#### **INS GPS ENHANCED**

INS GPS ENHANCED <d.d>

This sets if the GPS position aiding is to use (non-zero) or not use (0) the enhanced GNSS algorithm. A non-zero value is used to boost the R matrix.

*Default: INS GPS ENHANCED 0*

#### **INS LBL NOISE**

INS LBL NOISE <d.d>

Random noise for LBL range measurement.

*Default: INS LBL NOISE 0.4*

#### **INS LBL SMPAREJEN**

INS LBL SMPAREJEN <d>

INS LBL SMPAREJEN <1|0>

This sets or reads the Short Multipath Rejection enable/disable (1 or 0 respectively) value.

*Default: INS LBL SMPAREJEN 0*

#### **INS LBL SMPAREJT**

INS LBL SMPAREJT <d.d>

This sets or reads the Short Multipath maximum rejection time in seconds.

*Default: INS LBL SMPAREJT 30.0*

#### **INS LBL KFHPOS**

INS LBL KFHPOS <d.d> <d.d>

INS LBL KFHPOS <rms> <tc>

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value and Time Constant value for LBL Horizontal Position in Kalman filter.

*Default: INS LBL KFHPOS 0.0 1e+20*

#### **INS LBL KFSS**

INS LBL KFSS <d.d> <d.d>

INS LBL KFSS <rms> <tc>

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value and Time Constant value for LBL SS in Kalman filter.

*Default: INS LBL KFSS 0.0 10800.0*

**INS SUSBL KFHPOS**

INS SUSBL KFHPOS <d.d [m]>

Not allowed to be negative.

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for SUSBL Horizontal Position in the Kalman filter.

If INS SUSBL KFHPOS is set to 0 then the (GGA) *hdop* or the (PSIMSSB) *Expected Accuracy* is used (subject to INS SUSBL KFQMIN and INS SUSBL KFQMAX); if non-zero then the INS SUSBL KFHPOS value is used.

*Default: INS SUSBL KFHPOS 0.0*

**INS SUSBL KFQMIN**

INS SUSBL KFQMIN <d.d> <d>

INS SUSBL KFQMIN <value [m]> <1(enable)|0(disable)>

Eg INS SUSBL KFQMIN 1.0 1

Eg INS SUSBL KFQMIN 1.0 0

*This command has no effect if INS SUSBL KFHPOS is non-zero.*

If INS SUSBL KFQMIN is enabled then if the (GGA) *hdop* or the (PSIMSSB) *Expected Accuracy* is below this value, the value in the commands is used as the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for SUSBL Horizontal Position in the Kalman filter.

If INS SUSBL KFQMIN is disabled then the (GGA) *hdop* or the (PSIMSSB) *Expected Accuracy* is used as the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for SUSBL Horizontal Position in the Kalman filter.

*Default: INS SUSBL KFQMIN 0.0 0*

**INS SUSBL KFQMAX**

INS SUSBL KFQMAX <d.d> <d>

INS SUSBL KFQMAX <value [m]> <1(enable)|0(disable)>

Eg INS SUSBL KFQMAX 20.0 1

Eg INS SUSBL KFQMAX 20.0 0

*This command has no effect if INS SUSBL KFHPOS is non-zero.*

If INS SUSBL KFQMAX is enabled then if the (GGA) *hdop* or the (PSIMSSB) *Expected Accuracy* is above this value, the message contents are not used in the INS calculations.

If INS SUSBL KFQMAX is disabled then the (GGA) *hdop* or the (PSIMSSB) *Expected Accuracy* is used as the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for SUSBL Horizontal Position in the Kalman filter.

*Default: INS SUSBL KFQMAX 0.0 0*

**INS SUSBL KVVPOS**

INS SUSBL KVVPOS <d.d [m]>

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for SUSBL Vertical Position in Kalman filter.

Note this setting only has effect if 3D use of USBL positions is enabled, see "INS SUSBL USEVERTICAL"

*Default: INS SUSBL KFVPOS 5.0*

#### **INS SUSBL USEVERTICAL**

INS SUSBL USEVERTICAL <d>

This sets if the SUSBL position aiding is to be (0) 2D or (1) 3D.

Note that 3D SUSBL position aiding is not fully implemented yet.

*Default: INS SUSBL USEVERTICAL 0*

#### **INS PRESS NOISE**

INS PRESS NOISE <d.d>

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value for Pressure MRms1 in Kalman filter

*Default: INS PRESS NOISE 1.0*

#### **INS DVL KFVXY**

INS DVL KFVXY <d.d>

This sets or reads Bias/random noise, 1<sup>st</sup> order Markov RMS, value for DVL Velocity in Horizontal direction in Kalman filter

*Default: INS DVL KFVXY 0.1*

#### **INS DVL KFVZ**

INS DVL KFVZ <d.d>

This sets or reads Bias/random noise, 1<sup>st</sup> order Markov RMS, value for DVL Velocity in Vertical direction in Kalman filter

*Default: INS DVL KFVZ 0.05*

#### **INS DVL KFSF**

INS DVL KFSF <d.d> <d.d>

INS DVL KFSF <sf> <tc>

This sets or reads the Bias/random noise, 1<sup>st</sup> order Markov RMS, value and the 1<sup>st</sup> order Markov time constant value for DVL Scale Factor in Kalman filter

If "INF" is entered for the time constant, the INF stands for infinity and this is set to 1e+20 in the firmware.

*Default: INS DVL KFSF 0.005 1e+20*

#### **INS DVL KFMA**

INS DVL KFMA <d.d> <d.d>

INS DVL KFMA <rms> <tc>

This sets or reads the 1<sup>st</sup> order Markov RMS boresight misalignment accuracy and the time constant for DVL in Kalman filter.



*Default: INS DVL KFMA 0.5 1e+20*

**INS XSAL**

INS XSAL <d.d>

Sets or reads current salinity of Sea-water. It is measured in parts per thousand (ppt) [‰]. Salinity is accepted in between 0‰ and 40‰.

e.g. INS XSAL 32

*Default: INS XSAL 35.0*

**INS XSV**

INS XSV <d.d>

e.g. INS XSV 1400.0

Sets or reads current sound speed. It is measured in metres/sec. Sound speed is accepted in between 1400m/sec and 1600m/sec.

The value is updated if there is an acceptable sound speed message input.

*Default: INS XSV 1500.0*

## 2.8. GPS Commands

Mnemonic	Purpose
LIST	Lists all GPS parameters
HELP	Helps with command syntax
LA	Sets or reads the GPS lever arms (m)
QUALITY	Sets or reads the min and max GPS quality accepted by the AINS.

### 2.8.1. Syntax help

#### GPS LA

GPS LA <d.d> <d.d> <d.d>

e.g. GPS LA 1.0 2.0 3.0

This sets the lever arms (m) of the GPS.

*Default: GPS LA 0.0 0.0 0.0*

#### GPS QUALITY

GPS QUALITY <d> <d>

e.g. GPS QUALITY 1 5

This sets the minimum acceptable GPS quality level for the AINS algorithm to be 1 and the maximum acceptable level to be 5. GPS QUALITY 4 4 would be 4 only.

Note, for AHRS use the GGA quality must be between 1 and 5 inclusive – this is hard-coded and unaffected by the GPS QUALITY setting.

*Default: GPS QUALITY 1 5*

## 2.9. SUSBL Commands

Mnemonic	Purpose
LIST	Lists all USBL parameters
HELP	Helps with command syntax
LA	Sets or reads the SUSBL lever arms (m)
TPDR	Sets or reads the transponder to be used from the PSIMSSB

### 2.9.1. Syntax help

#### SUSBL LA

SUSBL LA <d.d> <d.d> <d.d>

e.g. SUSBL LA 1.0 2.0 3.0

This sets the lever arms (m) of the SUSBL.

*Default: SUSBL LA 0.0 0.0 0.0*

#### SUSBL TPDR

SUSBL TPDR <d> [<d>]

e.g. SUSBL TPDR <on|off> [<tpdrNo>]

This command allows the Lodestar to either use (and log) all PSIMSSBs regardless of beacon number or to specify which beacon to look for in the PSIMSSB and use (and log) only that beacon.

SUSBL TPDR 1 – turns on single beacon use with default beacon number of 0.

SUSBL TPDR 1 2 – turns on single beacon use with a beacon number of 2.

SUSBL TPDR 0 – turns off single beacon use – all PSIMSSB beacons are used.

Introduced in v2.04.00.769, a USBL GGA can be restricted from passing through to the INS if the SUSBL TPDR command is used, where the GGA's Station ID is used as the bcn id for the SUSBL TPDR number. This may be a temporary change and if so, further change will be reflected here.

*Default: SUSBL TPDR 0*

## 2.10. LBL Commands

Mnemonic	Purpose
LIST	Lists all LBL parameters
HELP	Helps with command syntax
LA	Sets or reads the LBL lever arms (m)
SIGNAL	Sets or reads SNR/signal limits for outlier rejection
RANGE	Sets or reads range limits for outlier rejection
PASTOBSCNT	Sets or reads number of observations required
MAXTSINCEPASTTWT	Sets or reads time within which observations are expected

### 2.10.1. Syntax help

#### LBL LA

LBL LA <d.d> <d.d> <d.d>

e.g. LBL LA 1.0 2.0 3.0

This sets the lever arms (m) of the LBL.

*Default: LBL LA 0.0 0.0 0.0*

#### LBL SIGNAL

LBL SIGNAL <d.d> <d.d> <d.d> <d.d> <d.d>

The five numbers represent:

minimum SNR,

maximum reduced SNR relative low pass filter,

minimum SignalLevel,

maximum reduced SignalLevel relative low pass filter,

tau

respectively. These are the limits which the AINS uses to accept or reject LBL messages. Tau is a time constant used in the low pass filtering.

INS uses the LBL if all the following is true (in addition to other checks):

SNR in the PSONUOBS msg is > the minimum SNR

SignalLevel in the PSONUOBS msg is > the minimum SignalLevel

SNR – filtered SNR > -maximum reduced SNR relative LPF

SignalLevel – filtered SignalLevel > -maximum reduced SignalLevel relative

LPF

*Default: LBL SIGNAL -10.0000 2.00000 -10.0000 3.00000 30.0000*

#### LBL RANGE

LBL RANGE <d.d> <d.d> <d.d> <d.d>

The four numbers represent:

minimum range,

maximum range,

maximum range rate,

maximum range prediction error

respectively. These are the limits which the AINS uses to accept or reject LBL messages.

INS uses the LBL if all the following is true (in addition to other checks):

- Range in the PSONUOBS msg is > the minimum range
- Range in the PSONUOBS msg is < maximum range
- Range rate in the PSONUOBS msg is < maximum range rate
- Predicted range is < maximum range prediction

*Default: LBL RANGE 40.0 350.0 2.0 0.5*

**LBL PASTOBSCNT**

LBL PASTOBSCNT <d>

This is the number of observations for a beacon to be required within the previous time specified by LBL MAXTSINCEPASTTWT.

INS uses the LBL if this is true.

*Default: LBL PASTOBSCNT 2*

**LBL MAXTSINCEPASTTWT**

LBL MAXTSINCEPASTTWT <d>

This is the time in seconds prior to the current observation during which LBL PASTOBSCNT observations are required.

*Default: LBL MAXTSINCEPASTTWT 21.0*

## 2.11. ZMD Commands

Mnemonic	Purpose
LIST	Lists all ZMD parameters
HELP	Helps with command syntax
CRPDEPTH	Sets or reads the CRP Depth
CRPDEPTHUSE	Sets or reads indicator to use the CRP Depth

### 2.11.1. Syntax help

#### ZMD CRPDEPTH

ZMD CRPDEPTH <d.d>

This sets the CRP Depth. Its use depends on the CRPDEPTHUSE setting.

*Default:*        *ZMD CRPDEPTH 0.0*

#### ZMD CRPDEPTHUSE

ZMD CRPDEPTHUSE <d.d>

If set, the CRP depth comes only from the ZMD CRPDEPTH setting.

If not set, the CRP depth can be set by both the PSONLVR and the ZMD CRPDEPTH command. In this case the CRP depth used is the most recent of the two sources ie a new PSONLVR overrides the previously entered ZMD CRPDEPTH value.

Any change to the CRP depth, whether from the user or from the PSONLVR is reflected in the updated ZMD CRPDEPTH value.

The ZMD CRPDEPTH value can be changed if ZMD CRPDEPTHUSE 0 and a PSONLVR arrives (supercedes the last C&C value)

This value can be changed if ZMD CRPDEPTHUSE 0 and the user enters a value (supercedes the last PSONLVR value).

This value can be changed if ZMD CRPDEPTHUSE 1 and the user enters a value.

This value is not changed if ZMD CRPDEPTHUSE 1 and a PSONLVR arrives.

If change from ZMD CRPDEPTHUSE 1 to ZMD CRPDEPTHUSE 0 then ZMD CRPDEPTH remains at its current value (until C&C change or PSONLVR arrives).

If change from ZMD CRPDEPTHUSE 0 to ZMD CRPDEPTHUSE 1 then ZMD CRPDEPTH remains at its current value (until C&C change).

If the PSONLVR *changes* the ZMD CRPDEPTH (done if ZMD CRPDEPTHUSE 0), a SYS SAVE FLASH is done. This keeps it in line with PPR 13202: If any of the LA/MA in the PSONLVR change from the previous PSONLVR then a SYS SAVE FLASH is done.

Note, however, that if the user sets ZMD CRPDEPTHUSE 1 and ZMD CRPDEPTH <d.d> then a SYS SAVE FLASH is not done (this is as per normal operational procedures of not saving after every change).

*Default:*        *ZMD CRPDEPTHUSE 0*

## 2.12. SVS Commands

Mnemonic	Purpose
LIST	Lists all PRESS parameters
HELP	Helps with command syntax
TYPE	Sets or reads type of sound speed sensor

### 2.12.1. Syntax help

#### SVS TYPE

SVS TYPE <VALEPORT | PSONSS | MANUAL | AUTO | NONE>

This assigns and indicates LodeStar about the type of Sound Speed sensor.

e.g. SVS TYPE VALEPORT

Type AUTO computes the sound velocity using the Chen & Millero equation. It gets the temperature from the DVL, pressure from the pressure sensor and salinity from the INS XSAL command.

Type MANUAL allows the user to set the sound velocity using the INS XSV command.

*Default:* SVS TYPE NONE

## 2.13. PRESS Commands

Mnemonic	Purpose
LIST	Lists all PRESS parameters
HELP	Helps with command syntax
LA	Sets or reads the PRESS lever arms (m)
OFFSET	Sets or Reads Pressure Offset (m), applied to all pressure input types

The type of message input is determined by the message in the IN MSG command; it could be PRDDIGIQM, PRDDIGIQPSI, PRDDIGIQKPA, PRDKELLBAR, PRDSONDEPM, PRDDPT, WINSON or PRDSVX2DBAR. The message name defines the units.

It is possible to have a second pressure sensor input (use the above names with a '2' at their end). This second input does not aid the INS but can be logged.

Where a second input is set up, the below commands can be used but with a '2' appended to "PRESS" eg PRESS2 LA.

### 2.13.1. Syntax help

#### **PRESS LA**

PRESS LA <d.d> <d.d> <d.d>

e.g. PRESS LA 1.0 2.0 3.0

This sets the lever arms (m) of the PRESS.

*Default: PRESS LA 0.0 0.0 0.0*

#### **PRESS OFFSET**

PRESS OFFSET <d.d>

e.g. PRESS OFFSET 1

This sets the offset in metres. The offset is subtracted from the measured pressure for all types of pressure input.

*Default: PRESS OFFSET 0.0*



## 2.14. DVL Commands

Mnemonic	Purpose
LIST	Lists all DVL parameters
HELP	Helps with command syntax
LA	Sets or reads the DVL lever arms (m)
MA	Sets or reads the DVL mounting angles (degrees)
TRIG	Sets the DVL trigger port output
LATENCY	Sets the latency for the DVL
SFERROR	Sets the scale factor error
PREPMAXTLAST	Sets or reads the max time (s) allowed between measurements
PREPMAXACC	Sets or reads the max change in velocity allowed
KFEVEL	Sets or reads the error velocity
OPFORMAT	Sets or reads the DVL output format
MODE	Changes the mode of RDI DVL to either Command mode or Normal mode
CMD	Will send RDI Navigator Input commands to DVL, except 'CS'

### 2.14.1. Syntax help

#### DVL LA

DVL LA <d.d> <d.d> <d.d>

e.g. DVL LA 1.0 2.0 3.0

This sets the lever arms (m) of the DVL.

*Default: DVL LA 0.0 0.0 0.0*

#### DVL MA

DVL MA <d.d> <d.d> <d.d>

e.g. DVL MA 1.0 2.0 3.0

This sets the mounting angles (degrees) of the DVL.

*Default: DVL MA 0.0 0.0 0.0*

#### DVL TRIG

DVL TRIG <port> (This is the TRIG number [1-4])

This sets the trigger output port for the DVL. Its parameters are set up – they can be changed subsequently if required by using the TRIG commands. A 'NONE' indicates no port. "DVL TRIG –" is allowed.

e.g. DVL TRIG 3

If a DVL TRIG port command is sent the default TRIG port settings are:

TRIG <port> ACTIVE 1

TRIG <port> WIDTH 10.0000

TRIG <port> PERIOD 500.000

TRIG <port> START 20.0000

TRIG <port> INPUT 0

TRIG <port> FILTER 0  
TRIG <port> NRZ 1  
TRIG <port> LINK NONE

*Default: DVL TRIG NONE*

#### **DVL LATENCY**

DVL LATENCY <d.d>

e.g. DVL LATENCY 1.0

This sets the latency of the DVL in seconds. Values allowed are  $-0.1 \leq d \leq 2.0$ .

*Default: DVL LATENCY 0.0*

#### **DVL SFERROR**

DVL SFERROR <d.d>

e.g. DVL SFERROR 0.1

This sets the scale factor error of the DVL. (1-sferror) is multiplied with the data.

Values allowed are  $-0.1 \leq d \leq 0.1$ .

A value of 0.1 is equivalent to 10%.

*Default: DVL SFERROR 0.0*

#### **DVL PREPMAXTLAST**

DVL PREPMAXTLAST <d.d>

e.g. DVL PREPMAXTLAST 1.2

This sets the max time in seconds allowed between the current and previous measurement. The time is based on the time of arrival.

*Default: DVL PREPMAXTLAST 1.2*

#### **DVL PREPMAXACC**

DVL PREPMAXACC <d.d>

e.g. DVL PREPMAXACC 0.25

This sets the max change in velocity (m/s/s) allowed.

*Default: DVL PREPMAXACC 0.25*

#### **DVL KFEVEL**

DVL KFEVEL <d.d>

This sets or reads the error velocity (m/s).

*Default: DVL KFEVEL 0.01*

#### **DVL OPFORMAT**

DVL OPFORMAT <ASCII|BINARY>

e.g. DVL OPFORMAT ASCII

This sets the DVL output data format input to the Lodestar to be either HEXASCII or BINARY. Works for a direct connection into the Lodestar from the DVL.

*Default: DVL OPFORMAT BINARY*

The following are user settings to aid debug and will not necessarily be available in the final product!

#### **DVL MODE**

DVL MODE [CMD | NORMAL]

e.g. DVL MODE CMD

This command will change the mode of RDI DVL to with Command (CMD) mode or Interrogating mode (NORMAL). Under normal mode, 'CS' string is send to DVL to be ready for deployment, Lodestar sends differential trigger to DVL to receive PD4 message. Lodestar restricts DVL to be on any UART port. Under Command mode, differential trigger is stopped, UART break signal is send to DVL to change DVL state to command mode. Lodestar enables DVL CMD command and allows sending navigator commands to DVL.

*Default: DVL MODE NORMAL*

#### **DVL CMD**

DVL CMD [RDI Navigator Input Commands (except 'CS')]

e.g. DVL CMD deploy?

This command is enabled by changing DVL mode to Command mode. Any RDI Navigator input commands should be preceded by DVL CMD syntax. 'CS' navigator command is not accepted.

## 2.15. ZUPT Commands

<b>Mnemonic</b>	<b>Purpose</b>
LIST	Lists all DVL parameters
HELP	Helps with command syntax
MAXVEL	Sets or reads the maximum velocity

### 2.15.1. Syntax help

#### **ZUPT MAXVEL**

ZUPT MAXVEL <d.d>

e.g. ZUPT MAXVEL 0.001

This sets the maximum velocity (m/s).

*Default:* ZUPT MAXVEL 0.001

## 2.16. Tsys Commands

Mnemonic	Purpose
LIST	Lists all Tsys parameters
HELP	Helps with command syntax
SOURCE	Sets or reads the external UTC source to use
ZDA	Sets or reads the port number for GPZDA input
PPS	Sets or reads the port number for 1 PPS
PPSMODE	Sets or reads the mode of GPZDA and its corresponding 1 PPS
ZDALATENCY	Sets or reads GPZDA latency in seconds
UPDATE	Sets or reads the time in seconds to update the RTC
RST	Resets Time System Library
DATETIME	Sets or reads the RTC date and time
DATE	Sets or reads the RTC date
TIME	Sets or reads the RTC time

### TSYS SOURCE

TSYS SOURCE <ZDA|ZDA\_1PPS|NONE>

This sets the external UTC time source to use. To turn off time system library uses source as NONE, this will use offset calculated by RTC for system time to UTC time conversion and vice versa.

e.g. TSYS SOURCE ZDA\_1PPS

*Default:* TSYS SOURCE ZDA\_1PPS

### TSYS ZDA

TSYS ZDA <port>

This sets the port number for the ZDA input. (This is the UART number [0-4] or IP port [4000-65535])

e.g. TSYS ZDA 3

*Default:* TSYS ZDA 1

### TSYS PPS

TSYS PPS <port|NONE>

This sets the 1PPS trigger input port where port is trigger ports numbered 1-4.

e.g. TSYS PPS 1. "TSYS PPS -" is allowed.

*Default:* TSYS PPS 1

### TSYS PPSMODE

TSYS PPSMODE <BEFORE|TOA|AFTER >

Only applies when SOURCE is ZDA\_1PPS

This command defines how GPZDA UTC field relates to the 1PPS trigger.

The TSYS PPSMODE is BEFORE if the ZDA arrives *before* its 1PPS, it's AFTER if the ZDA arrives *after* its 1PPS and it's TOA if it is valid at the time of the 1PPS.

e.g. `TSYS PPSMODE AFTER`

Note, if the `TSYS SOURCE` is not `ZDA_1PPS` then the `TSYS PPSMODE` is '-'. This "TSYS PPSMODE -" cannot be commanded directly.

*Default:*        `TSYS PPSMODE AFTER`

#### **TSYS ZDALATENCY**

`TSYS ZDALATENCY <d.d>`

This sets the latency for `ZDA` time of arrival and only used when `TSYS SOURCE` is set to `GPZDA`. It is measured in seconds. Input should be less than or equal to +0.9 seconds and greater than or equal to -0.9seconds.

e.g. `TSYS ZDALATENCY 0.1`

*Default:*        `TSYS ZDALATENCY 0.0`

#### **TSYS UPDATE**

`TSYS UPDATE <d>`

e.g. `TSYS UPDATE 300`

The value is in seconds. This sets the period of time after which the RTC is to be updated with a *valid* UTC.

*Default:*        `TSYS UPDATE 5`

#### **TSYS RST**

This resets the Time System library of the Lodestar.

The following commands are to configure the persistent date/time clock.

#### **TSYS DATETIME**

`TSYS DATETIME <dd/mm/yyyy> <hh:mm:ss>`

e.g. `TSYS DATETIME 04/02/2009 10:25:46`

This sets up the RTC on the Lodestar.

#### **TSYS DATE**

`TSYS DATE <dd/mm/yyyy>`

e.g. `TSYS DATE 04/02/2009`

This sets up the RTC date on the Lodestar.

#### **TSYS TIME**

`TSYS TIME <hh:mm:ss>`

e.g. `TSYS TIME 10:25:46`

This sets up the RTC time on the Lodestar.

## 2.17. LOG Commands

Mnemonic	Purpose
LIST	Lists all LOG parameters
HELP	Helps with command syntax
MSG	Lists the messages and their numbers or sets the messages to be logged

\* See Appendix B for notes on MSG names

### LOG MSG

The following commands can be entered to find out the list of message IDs. The message ID is required when a message is requested to be logged.

LOG MSG ?

LOG MSG LIST

LOG MSG on its own reports the setup of the log messages on the Lodestar's ports.

LOG LIST on its own reports the setup of the log messages on the Lodestar's ports plus the rotation time.

LOG <port> MSG LIST or LOG <port> LIST on its own reports the log messages set up for that port, where the port could be a serial port, network port or SD card.

Some examples follow:

**LOG <uart number> MSG**

**LOG <port no> NET TCP MSG**

**LOG SD MSG**

The following commands will setup the logs associated with the given serial port, network port, or SD card.

**LOG <uart number> MSG <+/-> <log type>**

**LOG <port no> NET TCP MSG <+/-> <log type>**

**LOG SD MSG <+/-> <log type>**

These commands allows LOG types to be added or removed from the different log channels. For example "LOG 1 MSG + CMD" will add logging of the command line to serial port 1, and "LOG 23 NET TCP MSG + IMU" will add raw IMU data logging to TCP port 23.

If LOG <port> NET TCP MSG 0 is entered, if the port is not already open it will be opened. If it is already open, any LOG messages which are output on it will be removed and the port will remain open.

If the LOG MSG command is entered with no '+' or '-' before the log types then this list *replaces* what is currently set up. Note that if the command contains a log type which is already set up then that log type is not closed and re-opened but remains logging.

*Default:*

- LOG 4000 NET TCP MSG ALARM TXT*
- LOG SD MSG 0*
- LOG 0 MSG ALARM TXT*
- LOG 1 MSG 0*
- LOG 2 MSG 0*
- LOG 3 MSG 0*

## *LOG 4 MSG 0*

### **LOG NET LIST**

LOG NET LIST

Lists the sockets which are outputting LOG messages.

### **LOG ROTATE**

LOG ROTATE <d>

e.g. LOG ROTATE 30

Range is in minutes and is allowed to be 1 ..30.

This sets the time for writing to files before new files are created to take the next set of data. When a log msg change is done, if the file rotation is set to less than 5mins a warning text is output to the commanding port as a reminder in case the user might want to increase the rotate time.

*Default: LOG ROTATE 30*

<For debugging only>

### **LOG STAT**

LOG STAT

e.g. LOG STAT

Reports the max and current use of some buffers used for LOG and OP msgs.

### **LOG STAT2**

LOG STAT2

e.g. LOG STAT2

Reports the max and current use of some buffers used for matrices.

### **LOG PV**

LOG PV <d>

e.g. LOG PV 1

Reads or sets the protocol version the Lodestar uses on multiplexed ports.

Currently 0 or 1 allowed.

1 = pre-pended timestamp flag.

0 = no pre-pended timestamp flag, always a pre-pended timestamp compatible with Marksman v2.03

*Default: LOG PV 1*



## 2.18. TRIG Commands

These commands are to configure the bi-directional trigger ports.

Mnemonic	Purpose
LIST	Lists all TRIG parameters
HELP	Helps with command syntax
INPUT	Sets if the trigger is an input or output
GO	Sets or reads if the trigger is running
FILTER	Sets or reads if the bypass filter is turned ON or OFF

Any changes to the below trig parameters do not take effect until the TRIG <port> GO 1 command is issued. The exception to this is the TRIG LINK command. TRIG ports are from 1-4.

Note - if a port is set to output, the hw signal is fed back in so can be seen as an input. The firmware logs it as an output only but if a 1PPS is expected on that port it will see the output as the 1PPS input.

### 2.18.1. Syntax help

#### TRIG INPUT

TRIG <port> INPUT <d>

e.g. TRIG 1 INPUT 1

This sets up the trigger port 1 to be an input.

If set to 1 it is configured to be an input. If set to 0 it is configured to be an output.

TRIG 2 INPUT 0 sets up trigger port 2 as an output.

If the trigger is an input and is port 3 or 4 the NRZ must be set to 0.

If the user is changing the trigger to an input and the NRZ is 1 the NRZ is set to 0 and a warning is given on the command port that this has been done.

*Default:*        *TRIG 1 INPUT 1*  
                  *TRIG 2 INPUT 1*  
                  *TRIG 3 INPUT 1*  
                  *TRIG 4 INPUT 1*

#### TRIG GO

TRIG <port> GO <d>

e.g. TRIG 1 GO 1

Starts or stops a trigger in the Lodestar.

*Default:*        *TRIG 1 GO 1*  
                  *TRIG 2 GO 0*  
                  *TRIG 3 GO 0*  
                  *TRIG 4 GO 0*

**TRIG FILTER**

TRIG <port> FILTER <d>

When reset, Lodestar bypass's the input filter to reduce timing delays to a minimum but may cause random pulse's due to the noise on the input pin not being suppressed by the filter.

When set, Lodestar uses input filter but there will be 3µsec delay on the input event.

e.g. TRIG 1 FILTER 1

Uses input filter.

*Default:           TRIG 1 FILTER 0  
                      TRIG 2 FILTER 0  
                      TRIG 3 FILTER 0  
                      TRIG 4 FILTER 0*