

## Introduction

This newsletter describes the **Outside World Interface (OWI)** of System 500. This interface is required when a System 500 sensor has to be used as a “Black Box” in advanced third party application (e.g. machine guidance system) or if the sensor will be used together with applications, which are developed being executed on external devices (Husky, Pen Pad, PDA, PC).

System 500 supports two “Outside World” formats: an **ASCII** and a **Binary format**. The binary format is more compact and complex than the ASCII format and should be used for applications where large amounts of data with the smallest possible latency have to be transferred (e.g. code and phase measurements at 10Hz). The ASCII interface is easy to read and follows the well-defined NMEA standard. This newsletter describes the OWI ASCII format structure.

## The OWI ASCII Format Structure

This is how a Standard NMEA message looks:

**\$GPGLL,**  
*Header or Prefix*  
**3723.45,N,12202.26,W,151933,A**  
*Data block e.g. coordinates*  
**\*3E <CR><LF>**  
*Terminator or Suffix*

The Leica OWI (NMEA) message differs only in the Header or Prefix:

**\$PLEIX**

**P** = Propriety, **LEI** = Leica

**X** = “**Q**” for query command  
“**S**” for Set command  
“**R**” for Response from Sensor

## Working with the OWI ASCII Format

- **Getting information from the sensor with the OWI ASCII messages**

To request information from the sensor a query command is used. The following shows a **general query command**:

**\$PLEIQ,**  
**???,** Message Identifier  
**x,** Port<sup>1</sup>  
**x** Output rate  
**.** Get flag 1 (optional)

- .** Get flag n (optional)
- \*hh** Checksum
- <CR>** Carriage Return
- <LF>** Line Feed

<sup>1</sup>e.g. 200 = output immediately, 4 = 1sec

After sending a query message to the sensor, the sensor will respond with an acknowledgement message to indicate whether the message has been accepted or not.

This is how the **general structure** of the **Acknowledgement** message looks:

**\$PLEIR,**  
**ACK,** Acknowledgement Identifier  
**???,** Message Identifier  
**x** Accept/Reject flag<sup>2</sup>  
**\*hh** Checksum  
**<CR>** Carriage Return  
**<LF>** Line Feed

- <sup>2</sup>
- 0 = Message Accepted
  - 1 = Bad Checksum
  - 2 = Illegal Value
  - 3 = Unrecognized ID
  - 4 = Data not yet available
  - 5 = Invalid operation

### Example:

**Query the current geodetic position** at a 1Hz rate:

**\$PLEIQ,POS,0,4,0\*39<CR><LF>**

**Response** from the Sensor is first a **positive Acknowledgement** and then one **position message** every second:

**\$PLEIR,ACK,POS,0\*5B<CR><LF>**  
*Acknowledgement message*

**\$PLEIR,POS,101259.00,250497...\*hh<CR><LF>**  
*Position Messages*

- **Configuration of the sensor with OWI ASCII messages**

The configuration of the internal sensor setting is done using the “**Set**” command:

### Example:

To **set the antenna height** at 1.900m, the following message must be sent to the sensor:

**\$PLEIS,AHT,0,1.90,0\*34<CR><LF>**

To **query** the antenna height currently set the following message has to be used:

**\$PLEIQ,AHT,0,200,0\*2E<CR><LF>**

The **response** to this query will be:

**\$PLEIR,AHT,0,1.90,0\*4A<CR><LF>**

### The OWI Checksum

Every message contains a hexadecimal (0-9,A-F) **checksum** after the content of the message to increase data integrity. Like NMEA, the checksum is computed using an 8-bit **exclusive OR** of all characters in the message including the “,” but excluding the “\$” and the “\*” delimiter.

An **exclusive OR** is a comparison of corresponding bits in two values. The result has a 1 in each bit position where the binary digits of the two values differ and has a 0 where the digits are the same.

The following **example** shows how the checksum is computed for the message “\$PLEIQ,BAT,0,200”.

<pre> 128/64/32/16/8/ 4/ 2/ 1 P(80) &lt;&gt; 01010000 L(76) &lt;&gt; 01001100 XOR&lt;&gt; 00011100 E(69) &lt;&gt; 01000101 XOR&lt;&gt; 01011001 I(78) &lt;&gt; 01001001 XOR&lt;&gt; 00010000 Q(81) &lt;&gt; 01010001 XOR&lt;&gt; 01000001 ,(44) &lt;&gt; 00101100 XOR&lt;&gt; 01101101 B(66) &lt;&gt; 01000010 XOR&lt;&gt; 00101111 A(65) &lt;&gt; 01000001 XOR&lt;&gt; 01101110                 </pre>	<pre> 128/64/32/16/8/ 4/ 2/ 1 T(84) &lt;&gt; 01010100 XOR&lt;&gt; 00111010 ,(44) &lt;&gt; 00101100 XOR&lt;&gt; 00010110 O(48) &lt;&gt; 00110000 XOR&lt;&gt; 00100110 ,(44) &lt;&gt; 00101100 XOR&lt;&gt; 00001010 2(50) &lt;&gt; 00110010 XOR&lt;&gt; 00111000 0(48) &lt;&gt; 00110000 XOR&lt;&gt; 00001000 0(48) &lt;&gt; 00110000                 </pre>
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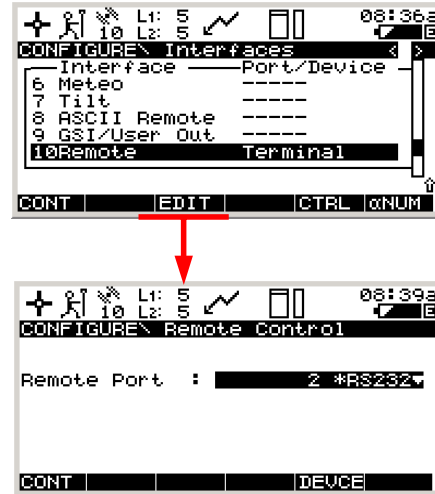
**Result:**                      **Decimal: 32 + 16 + 8 = 56**  
                                     **→ Hexadecimal: 38**

### The Configuration of the Sensor

The communication with the sensor via OWI works on every port of the sensor. But first it is necessary to choose the port and set the com-

munication parameters. This can be done in two ways:

1. Start the communication with the sensor by using the default settings (9600, none, 8, 1, none) and then change the communication parameters using OWI.
2. Configure the settings directly on the sensor by using the configuration panels as shown below:



### OWI Test Application

To give you an idea of how such an application could look, please refer to an example on the [Leica web page](#) where you can find a program to download jobs from sensor to PC via GSM. There, you can also find a simple tool where you can enter any OWI message to communicate with the sensor.

### Remember...

- OWI is a protocol to enable the sensor to communicate with external devices.
- The OWI protocol is available in two formats: the easy to use OWI ASCII message format and the more complex binary format for large amounts of data.
- It is possible to get data from the sensor to an external device and also to send information from an external device for sensor configuration.
- Communication is possible on every port of the receiver.
- Examples are available on the [Leica web page](#).