Hello Angles...



A First Use Guide to the HPS Product Series:

RS232 Interface with LD Standard Communication Protocol.



Who Is This Guide For?

The purpose of this guide is to show the correct procedure for connecting and using the HPS inclinometer with a Windows PC for the first time.

This document can be followed by users of all skill levels including absolute beginners.

What products can I apply these instructions to?

This guide can be used for any HPS products that feature the **RS232** interface option. All applicable part numbers will start with "**HPS**" and end with "**232**" e.g. "HPS-XX-X-**232**"



Note: If you are using a "**HPS...485**" or a "**HPS**...**MOD**" product please search for your full part number on our website and download the document that specifically applies to your device as shown below:

| Other Documentation | Software | CAD Files |
|------------------------|--------------------------------|-----------------------------|
| Liser Guide (PDF 3 MB) | Windows PC Software For | 3D Models (ZIP 762 kB) |
| | Inclinometer Data (ZIP 380 kB) | Select Your Inclinometer |
| | | Inclinometer Selection Tool |
| | | Inclinometer Selection Tool |

Additional Information:

Take care while making all connections. To avoid damaging your product do not allow any wires to make contact with anything you do not intend (especially a source of power).

Once your connections have been made and the unit is responding correctly, please refer to the product datasheet for the full command list(s) and more information about the communication protocol.

Step 1: Ensure You Have a Working COM Port (Hardware).

Many PCs and Laptops have a **built-In**¹ COM (communication) port which looks like this:



The above connector is known as a DB-9 Male & shouldn't be confused with "VGA" which looks like this:



If your PC or laptop doesn't have this connection you can buy a **separate**² USB to COM adapter. For this guide we have used the "StarTech ICUSB232DB25" which is inexpensively available online:



Step 2: Ensure You Have a Working COM Port (Software):

On your computer go to "Device Manager" which can be accessed via the control panel:



¹ For **Built-In** COM ports:

In most cases the driver will be installed and working already. Typically this will be called "Communications Port (COM1)" meaning that "COM1" is the port we would use to communicate with the inclinometer.

| 🚔 Device Manager | |
|--|--|
| <u>File Action View H</u> elp | |
| | |
| A 🚔 ELECTRONICS7 | |
| ⊳ nter Computer | |
| Disk drives | |
| 🔉 📲 Display adapters | |
| DVD/CD-ROM drives | |
| 🔈 🕼 Human Interface Devices | |
| IDE ATA/ATAPI controllers | |
| Imaging devices | |
| 🔉 🔮 Jungo Connectivity | |
| Keyboards | |
| Mice and other pointing devices | |
| Monitors | |
| Network adapters | |
| D - D Other devices | |
| Ports (COM & LPT) | |
| - Transmission Port (COM1) | |
| Intel(R) Active Management Technology - SOL (COM3) | |
| Processors | |

² If you have bought a **separate** USB to COM Port:

Follow the manufacturer's instructions to install your driver and check that it has installed properly.



The name & port number that's automatically allocated to this device can vary. Make a note of the port number that the device has been allocated. Our example USB to COM device is using "COM9" so this is the port number we would use to communicate with the inclinometer.

^{1 & 2} For both **Built-in** or **Separate** types:

If the COM device symbol looks like this: In the you will need to troubleshoot the device driver problem. (A good place to start is the website for the manufacturer of the hardware).

Step 3: Connect the Inclinometer wires to the COM Port:

Full RS232 connections for the HPS inclinometer are as follows, note that the wire colours may vary depending on the cable you are using:

| Front View of HPS Connector | HPS Pin Number | Example Cable's wire colour | HPS Wire Function | Connects to (Function) | On DB-9 Pin Number |
|--------------------------------|-------------------|--------------------------------|-------------------------------|---------------------------|-----------------------|
| (| 1 | Brown | +ve Power Input | +ve Supply (9 to 30V) | Not connected to DB-9 |
| | 2 | White | 0V Power input & RS232 GND | 0V Supply & COM GND. | 5 |
| | 3 | Blue | RS232 Transmit | RS232 Receive | 2 |
| \checkmark | 4 | Black | RS232 Receive | RS232 Transmit | 3 |

As the built-in COM port / USB to COM device is fitted with a male type connector you will need a female type connector to make the necessary solder connections:



Back side of the female DB-9 connector & the required connections. Note the 2 wires connected to pin 5 of the DB-9 to allow HPS Pin-2 to connect to –Ve power.

Step 4: Connecting the Inclinometer to the Power Supply / Power Source:

The power source should provide between 9V & 30V maximum, ensure it is switched off & connect HPS Pin 1 (brown in our example) to the +Ve node.

If you are using a battery or have no on/off option available then leave Pin 1 disconnected for now.

Connect Pin 2 (which is white & green in our example) to the -Ve node of the power source whilst it's still connected to pin 5 of the DB-9 connector as shown in the illustration below.



Once you've made all of the necessary connections you can switch on the power source or connect Pin 1 (brown) wire to "+" if using a battery.



Step 5: Connecting an Inclinometer to the Level Developments Inclinometer App:

We recommend using the inclinometer app before attempting to create your own more advanced commands, this ensures that you have the correct connections and your hardware is working as it should.

Download and install the application from our website:

| Other Documentation | Software | CAD Files |
|-----------------------|---|-----------------------------|
| User Guide (PDF 3 MB) | Windows PC Software For | 3D Models (ZIP 762 kB) |
| | Viewing and Logging Inclinometer Data (ZIP 380 kB) | Select Your Inclinometer |
| | | Inclinometer Selection Tool |
| | | Inclinometer Selection Tool |

| Port Dill Baud rate 3840 Connect South Connect South Connect settings Connect set | el Developments Inclinometer v2.3 | |
|--|--|------------------|
| X Y Decimals Image: Constraint of the second secon | Pot SOMI Baud rate 38400 COM10 COM10 Xsplay (COM3 COM3 COM3 COM3 COM3 COM3 COM3 COM3 | Connect |
| Decimals | X | Y |
| Decimals 0 0 1 | 8888888 | |
| Data Logging | | |
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| Hours Mins Secs Start 00:00:00 Folder Name SSESERVER RedirectedFoldershashleyfloyd My Documents Browse. Text 1 cev Etail 1 cev | _ Interval | |
| Folder Name (\\SBERTVER\PredrectedFolders\\ashleyfloyd\My Documents File Name Feet 1.csv www.leveldevelopments.com Ievel development nected | Hours Mins Secs Start | 00:00:00 |
| INSESERVER/RedirectedFolders/sahleyloyd/My Documents Re Name Test 1.csv Ievel developments.com Ievel development nected | Folder Name | |
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| Test 1.csv www.leveldevelopments.com level development nected | File Name | |
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| | nected | |

Run the Inclinometer App and select the port number that was determined earlier in Step 2.

By default the inclinometers baud rate setting is 38400(bps), ensure this is selected and click on "Connect".

You should now see angles being displayed on the screen.

| Leve | l Developments Inclinometer v2.3 | | |
|-------|---|------------------|------------|
| | Port COM1 Baud rate | 38400 👻 | Disconnect |
| Di | splay & Logging Inclinometer settings | | |
| | Х | | Y |
| | Decimals | 3,8.8.9 | 8888 |
| | Data Logging Interval Hours Mins Secs 0 10 10 10 | Start | 00:00:00 |
| | Folder Name | | |
| | \\pdc\RedirectedFolders\ashleylloyd | My Documents | Browse |
| | File Name | | |
| | Test1.csv | | |
| | www.leveldevelopments.com | level dev | velopments |
| Conne | ted, COM1, 38400, Dual Axis | | |
| | | | |

Step 6: Sending Your Own Commands Using an RS232 Terminal / Serial Monitor Program:

To create your own commands you will need a serial monitoring application. For the purpose of this demonstration we are using Docklight but there are many to choose from. *The layout and terminology used in your terminal program may vary*.

A free trial version of Docklight can be downloaded from *https://docklight.*de with some minor limitations. Please see their website for more information.

Open your application and locate the project settings window. In Docklight this can be accessed by doubleclicking the highlighted area below or going to tools, project settings.

| Edit Run | Tools Help | h | | |
|----------------|---------------------|----------|-------------------------------|---|
| 🖙 🖬 😅 11— | ication port closed | | Colors&Fonts Mode COM10 38400 | I. None. 8 |
| d Sequences | | | Communication | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| Send | Name | Sequence | ASCII HEX Decimal Binary | |
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You can then change the COM channel (port number) to match the value determined in step 2.

| Project Settings | | | | X |
|------------------------------------|-------------------------------------|------------------------------|------------|------|
| Communication Flow | Control Commun | nication Filter | | |
| Communication Mo | e 1 2 | C Monitoring (receive on) | y) | |
| Send/Receive or COM10 | n Comm. Channel | | | |
| Choose a COM p port from COM1 b | ort from the list of a o COM256. | vailable devices, o | r type a (| сом |
| COM Port Settings | | | | |
| Baud Rate | 38400 💌 | Data Bits | 8 | • |
| Parity | None 💌 | Stop Bits | 1 | - |
| Parity Error Char. | (ignore) 💌 | | | |
| | OK | Cancel | | Help |

The default baud setting for all HPS sensors is 38400, with 8 data bits, 1 stop bit and no parity.

Click OK then open the port by clicking on the ▶ button:

Once the port is open, the \blacksquare button should be visible as shown below:

| Ocklight V1.9 | - Projec | t: LD_Exam |
|-----------------------|------------|------------|
| <u>File Edit R</u> un | Tools | Help St |
| 🗅 📽 🖬 🚳 | ▶ ■ | P 9 |
| Commu | nication p | oort open |

The \blacksquare button can then be used to close the port if required. (Note: the port can only be open in 1 application at a time). You can now begin to create the commands to send to the Inclinometer. To do this go to Edit, Edit Send Sequence List...

| File | Edit | Run Tools Help | | |
|------|------|---------------------------------------|--------|--|
| D 🛛 | | Edit Send Sequence List | | |
| u-JJ | | Edit Receive Sequence List | | |
| Send | | Swap Send and Receive Sequence List | | |
| | | Find Sequence in Communication Window | Ctrl+F | |
| | | Clear Communication Window | Ctrl+W | |

This will open the window shown below. You can see that we've given our first command a description (highlighted) and created our first command in the sequence window.

By default all HPS inclinometers are set to respond in 32bit signed integer mode which can't be read by eye, so the first command we will send to the device is "setoasc". This will change the output (response) mode to ASCII format.

Note that all send sequences in the LD command set must be 7 bytes long and in lower case.

| ciot Edit Send Sec | uence | × |
|----------------------------|--|------------------------------|
| Index | 0 < > | Control Characters Shortcuts |
| Sequence Defin | ition | |
| 1 - Name | Set the device transmission mode to ASCII format. | |
| 2 - Sequence | Edit Mode ASCII CHEX C Decimal C Bina | ary Pos. 8 / 7 |
| seto | asc | |
| 3 - Additional Settings | Repeat Send periodically (if not sent as an automatic answer to a received Repeat sequence every 5 | ve sequence) |
| Delete Sec | uence DK Cance | al Apply Help |

Once you have filled in the send sequence press OK.

This will save the new command into the sequence list as shown below. You can now send the command to the Inclinometer by clicking on the "->" button. This will print the command "setoasc" (Tx) into the monitor window & and the inclinometer should respond (Rx) with "OK" to indicate success.



You can now create a 2nd command to request the angles from the Inclinometer.

Open the "Edit Sequence List..." as shown before and click on the ">" button to go to a new blank command.

| 11810 Edit Send S | equence |
|-------------------|----------------------------------|
| Index | 0 < > |
| Sequence De | finition |
| 1 - Name | Set the device transmission mode |
| | |

Create the new command "get---x" as shown below then click on OK.



Send the new command to Inclinometer by clicking on the "->" button.

The inclinometer should now respond with a 9 byte string in the following format:

| 🔄 Docklight V1.9 | | | | | | | | |
|---|----------------|--------------|--|-----------------------|--------------------------|--|---|--|
| E | ile | <u>E</u> dit | <u>R</u> un <u>T</u> ools <u>H</u> elp | | | | | |
| C |) | ê 🛛 | | 🗛 🔀 🕱 🕸 🖮 | | | | |
| Colors&Fonts Mode COM10 38400, None, 8, 1 | | | | | | | | |
| Se | Jend Sequences | | | | | Communication | | |
| | | Send Name | | Sequence | ASCII HEX Decimal Binary | | | |
| | | (Σ) | Set the device transmission | mode to ASCII format. | setoasc | | | |
| | | > | Request X angle from the in | nclinometer | getx | 21:44:26.750 [TX] - setoasc | | |
| | | | | | | 21:44:26.779 [RX] - OK 21:44:27.685 [TX] - getx | | |
| | | | | | | 21:44:27.707 [RX] - +000.638 <cr:< td=""><td>2</td></cr:<> | 2 | |
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±xxx.xxx<CR>

& That's It!

You can now use the "get-x&y" command to read angles from your Inclinometer and these techniques to build on your collection of send sequences using the full list of commands as described on the product datasheet.

If you need more information or have a query relating to the use of your HPS inclinometer, please get in touch with tech@leveldevelopments.com & will be happy to assist you.