Web Enabled

Geo-Pointing Module

Model PTU-DGPM

USER'S MANUAL

Version 1.0

DirectedPerception

www.DPerception.com

PTU-DGPM User's Manual, Version 1.0,

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1 INTRODUCTION

The Geo-Pointing Module allows Directed Perception pan-tilt units to be commanded with latitude/longitude/altitude positions in addition to pan/tilt angles. The unit provides three separate functions: (1) Implements a new set of commands for controlling a pan-tilt unit using geo-coordinates instead of pointing angles or presets, (2) Allows control of a pan-tilt unit over Ethernet/IP, and (3) Provides a built-in web page-based graphical interface to configure and control the pan-tilt unit and geo-pointing functions. Some general features include:

- Modular design
- Built-in Web/Ethernet Interface for geo-pointing and pan-tilt commands
- Supports DPoIP command format for sending pan-tilt commands over IP networks
- Compatible with all Directed Perception Pan-Tilt Units
- Simple setup and operation
- Geo-pointing and geo-tracking functions
- Supports standard pan-tilt and geo-pointing commands
- Single DC power input.

Applications of the Geo-Pointing Module include:

- Long-range surveillance
- Force protection
- Perimeter security
- Radar-based port monitoring systems
- Antenna positioning systems
- Satellite communications systems
- Laser ranging systems
- Automated video detection & tracking systems
- Vehicle & shipboard surveillance systems.

PLEASE REFER TO TECHNICAL SPECIFICATIONS FOR DETAILS ON TECHNICAL OPERATING LIMITS AND CAPABILITIES.

This User's Manual provides information needed to set up and operate the Geo-Pointing Module. The next section provides a brief overview to allow you to get started as quickly as possible. More detailed technical information is provided in the remaining sections.

1.1 IMPORTANT SAFEGUARDS AND WARNINGS

IMPORTANT SAFEGUARDS AND WARNINGS

1. Please read these instructions.
2. Please keep these instructions accessible.
3. Please heed all warnings.
4. Please follow all instructions.
5. Install in accordance with Directed Perception's instructions.
6. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
7. Only use attachments/accessories specified by Directed Perception.
8. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture when improperly sealed, does not operate normally, or has been dropped.
9. Installation should be done only by qualified personnel and conform to all local codes.
10. The unit should not be installed in environments that present conditions beyond the environmental specification limits of the apparatus.
11. **CAUTION:** These servicing instructions are for use by qualified service personnel only. To reduce the risk of electric shock do not perform any servicing other that contained in the operating instructions unless you are qualified to do so.
12. Only use replacement parts recommended by Directed Perception.
13. After replacement/repair of this unit's electrical components, conduct a resistance measurement between the line and exposed parts to verify the exposed parts have not been connected to the line circuitry.

1.2 Models

| PTU-DGPM	Standard Geo-Pointing Module

2 QUICK START

2.1 Overview

As shown in Figure 1 the Geo-Pointing Module (GPM) accepts commands over the built-in Ethernet/IP interface. The Geo-Pointing Module connects to the Pan-tilt unit (PTU) Host Interface (RS-232). Both standard pan-tilt pointing and configuration commands, as well as geo-pointing commands can be sent to the Geo-Pointing Module. Standard pan and tilt commands are passed directly to the PTU. Geo-pointing commands are processed by the Geo-Pointing Module to compute pan-tilt angle commands which it then issues to the attached PTU.

The Geo-Pointing Module must be configured with the position of the pan-tilt unit in geo-coordinates (latitude, longitude, altitude, and 3D orientation). The latitude, longitude and altitude of the pan-tilt unit are entered manually using the Geo-Pointing Module's web interface (*e.g.*, using a hand-held GPS unit to measure the installed pan-tilt unit position).

The built-in calibration function computes the orientation of the pan-tilt in real-world coordinates using a set of user-provided landmarks. Landmark locations (latitude, longitude, altitude) are entered through the web interface. The pan-tilt is then aimed at four or more landmarks and the system automatically computers the pan-tilt's orientation estimate.

Once calibrated, the Geo-Pointing Module can accept geo-pointing commands and queries.

A set of web pages built into the Geo-Pointing Module allow configuration and control of the pan-tilt.
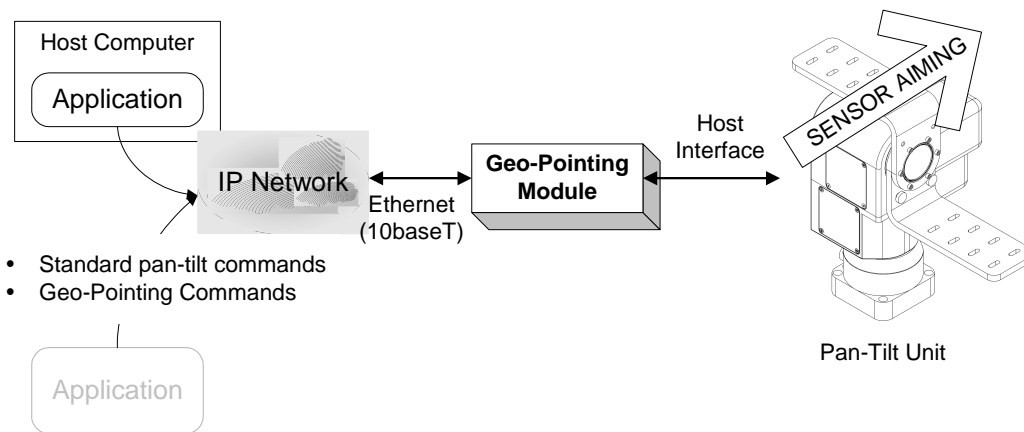
Figure 1: Geo-Pointing Module System Overview
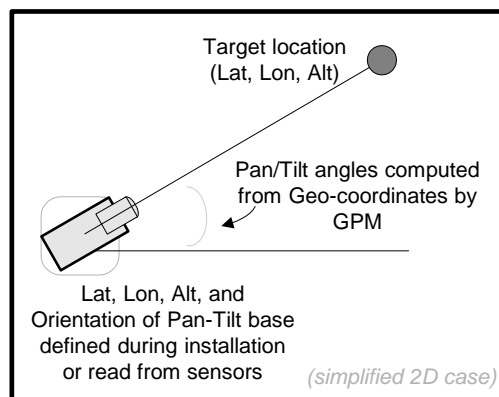
Figure 2: Geo-Pointing Module Operation

2.2 Installation Components

Components supplied with this manual are:

- Geo-Pointing Module (GPM)
- Ethernet Patch Cable (crossover type)
- AC/DC Power Supply

2.3 Required Components

- Directed Perception Pan-Tilt Unit (PTU-D46-17, PTU-D46-70, or PTU-D300)
- Camera or other payload that allows "aiming" the Pan-Tilt Unit at a known landmark
- Pan-Tilt Host Serial Cable (to connect GPM to Pan-Tilt unit; supplied with pan-tilt unit)
- Host computer with Ethernet connection
- Hand-held GPS unit or other means to survey geo-position of installed pan-tilt unit and landmarks for calibration

2.4 Basic Setup Steps

The following outlines the basic set-up and installation steps. Section 3 on page 5 and subsequent sections detail each of these steps.

1. Install Pan-Tilt Unit including payload. For calibration, payload must allow visibly identifying what the pan-tilt is pointing at (e.g., camera with a display that allows centering the FOV on a specific point).
2. Connect Geo-Pointing Module to Pan-Tilt Host Interface.
3. Connect Geo-Pointing Module Ethernet connection to Host Computer and configure Geo-Pointing Module IP network address.
4. Set the pan-tilt's position by entering its latitude, longitude, and altitude (e.g., by surveying with a handheld GPS unit).
5. Calibrate the pan-tilt's orientation by alternately pointing at, and entering coordinates for, a minimum of 4 and up to 10 landmarks.
6. Unit is ready to accept geo-pointing commands through the "Geo Control" web page and/or using the DPoIP command format.

3 INSTALLATION & INITIAL SETUP

This section describes the basic installation and setup steps required to get your Geo-Pointing Module operational as quickly as possible. Unpack the Geo-Pointing Module. Figure 3 on page 5 shows an overview of the wiring and connections which are detailed in the following sections.
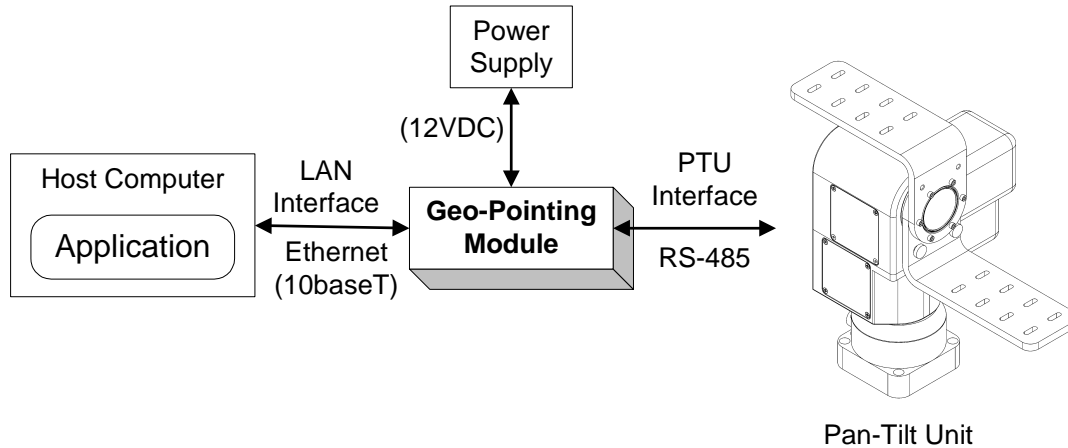
Figure 3: Wiring Overview

3.1 Physical Mounting

The Pan-Tilt Unit being used with the Geo-Pointing Module should be mounted at the user site prior to final calibration of the system. Mounting of the Pan-Tilt Unit should follow all instructions for mounting provided with the Pan-Tilt Unit. The Geo-Pointing Module may be mounted near the pan-tilt, or separately (up to the maximum allowed distance for the RS-485 Host Interface cabling). The Geo-Pointing Module is not designed for outdoor use and should be housed in a weatherized enclosure or mounted indoors.

3.2 Power Sources

Connect the Geo-Pointing Module power connections to power supply as shown in Figure 3 on page 5.

> **CAUTION!** **When wiring your own power source, failure to comply with wiring and power source requirements described in this manual can result in decreased unit performance or damage not covered under the limited warranty**.

3.3 Pan-Tilt Unit Interface Connection and Settings (RS-485)

The Geo-Pointing Module PTU Interface connects to the RS-485 Host Interface on the Pan-Tilt Unit. The Pan-Tilt RS-485 settings must be set to match that of the Geo-Pointing Module: **9600 baud, 1 start bit, 8 data bits, 1 stop bit, and no parity**. Hardware handshaking and XON/XOFF are not used.

The RS-485 connections to the Geo-Pointing Module are: R+ (pin 2), R- (pin 3), T- (pin 4), T+ (pin 5) and Sheild (pins 1 and 6). Figure 4 on page 6 shows the connector pinout for the RS-485 interface on the Geo-Pointing Module.

1	Shield
2	R+
3	R-
4	T-
5	T+
6	Shield

View looking into RJ12 (6P6C) receptacle
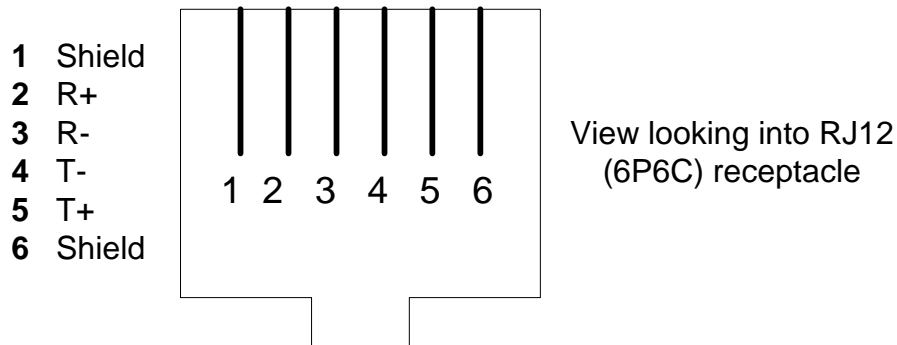
Figure 4: Geo-Pointing Module RS-485 Interface

3.4 Ethernet Interface

The Ethernet Interface on the Geo-Pointing Module is an industry-standard RJ-45 connector and connects to a LAN that is reachable from the Host Computer. For initial configuration this may be a direct connection between the Host Computer and the Geo-Pointing Module with the use of an appropriate "cross-over" cable.

3.5 Initial Installation and Operation

Before you can use the Geo-Pointing Module you must configure its IP address so that it can communicate with the Host Computer and other applications over Ethernet/IP. The Geo-Pointing Module ships with a default IP address of **192.168.1.110**. The computer that is used to initially configure the IP address of the Geo-Pointing Module must be accessible from the LAN where the Geo-Pointing Module is installed. Following are the basic steps to install and test operation of the Geo-Pointing Module.

1. Mount and power Pan-Tilt Unit according to User Manual instructions. Mount payload or temporary camera and an output device to allow viewing where the Pan-Tilt Unit is pointing (required for calibration step). [*IMPORTANT: sensor should be mounted carefully so that line-of-sight angle is pointing exactly "forward" with respect to pan-tilt unit. Misalignment of sensor to pan-tilt will affect system accuracy*].

2. Connect an RS-485 cable between the Pan-Tilt Unit RS-485 Host Interface and the Geo-Pointing Module PTU Interface. Ensure that the PTU Host Interface communications settings are configured as defined in Section 3.3 on page 6.

3. Connect an Ethernet cable between the Geo-Pointing Module LAN Interface and the LAN where the Host Computer resides. [*IMPORTANT: ensure that there are no other devices on the LAN at the Geo-Pointing Module Default IP Address, or use a direct connection with "crossover" cable.*]

4. Apply power to the Geo-Pointing Module.

5. On the Host Computer open a web browser and point to "**HTTP://192.168.1.110/**". The Network Configuration web page should appear. If the Geo-Pointing Module cannot be reached check ethernet connections and reconfigure LAN as required. See Section 5.2 on page 17 for additional information on configuring the Network address.

6. Click the "PTU Control" web page from the upper navigation bar. Make sure the Pan-Tilt Unit is powered. Test communication with the Pan-Tilt Unit by clicking on the pan or tilt arrows or entering a position command. See Section 5.4 on page 19 and Section 5.3 on page 18 for additional information on web configuration control of the Pan-Tilt Unit.

7. Point your browser at the "Geo Config" page (from the upper navigation bar). Enter the surveyed Pan-Tilt Unit location (latitude, longitude, altitude) using the fields on the "Geo Config" web page. See Section 5.4 on page 19 for details on Geo Config.

8. Point your browser at the "Geo Calibration" page (accessible from the Geo Config page). Point the pan-tilt (e.g., using the PTU Control web page) at the first landmark, enter the geo-coordinates of the first landmark, and "Save". Repeat for a minimum of 3 additional landmarks. Up to 10 landmarks may be entered. See Section 5.5 on page 20 for further details on calibration. Click "Calibrate". This operation may take up to several minutes.

9. Point your browser at the "Geo Control" page (from the upper navigation bar). Enter geo-coordinates of desired target locations and command the Pan-Tilt Unit to point. See Section 5.6 on page 22 for further details on Geo-Pointing commands.

10. (Optional) Use the DPoIP interface to send calibration and/or pointing commands from a web browser or custom application. See Section 4 on page 9 for further details on the DPoIP command interface.

3.6 Resetting to Factory Defaults

The Geo-Pointing Module can be reset to factory defaults (network address parameters) with the following procedure:

*   Depress service pin (see Figure 5 on page 7) and hold for 5 seconds.

This will set IP address, Subnet, Gateway, DNS, Name, Username, Password parameters to factory default values. It will also erase user values in memory including landmarks and calibration data.

[Insert photo of service pin]

Figure 5: Geo-Pointing Module Service Pin

4 COMMAND REFERENCE

This section describes the Geo-Pointing Module command set. Each command has a section that provides a brief functional description, a format (syntax) description, examples, and related topics. Only commands specific to the Geo-Pointing Module are described here. Standard pan-tilt commands that may be passed through the Geo-Pointing Module to the Pan-Tilt Unit are described in the relevant Pan-Tilt Unit User Manual.

When describing the format (syntax) of pan-tilt Geo-pointing commands, the following conventions are adopted:

- Input characters may be in upper or lower case (we show them in upper case for presentational consistency)
- A delimiter (`<delim>`) can be either a space (" ") or a carriage return (`<CR>`).

4.1 DPoIP Command Format

The Geo-Pointing Module accepts both Geo-pointing commands and standard pan-tilt commands over TCP/IP using HTTP get commands ("DPoIP command format").

4.1.1 General Forms

The general form of the DPoIP command format is:

Description:

> The Geo-Pointing Module accepts both Geo-pointing commands and standard pan-tilt commands over TCP/IP using HTTP get commands ("DPoIP command format").
> The "raw" form returns the raw result from the pan-tilt or Geo-Pointing Module command. The "non" command executes the command but returns no data.

Syntax

> **http://**<ipaddr>/**<verb>**?<cmd>=<params><delim> **|**
> **http://**<ipaddr>/**<verb>**?**cmd**=<command><delim>
>
> where
>   **`<ipaddr>`** `is the IP Address of the GPM`
>   `<`**`verb`**`>` $\in$ `{ "non" , "raw" }`
>   **`<cmd>`** `is a Geo-Pointing or Pan-Tilt command`
>   **`<command> = <cmd><params>`**
>   **`<params> =`** `""`
> | **`<param1>`**
> | **`<param1>,<param2>`**
> | **`<param1>,<param2>,<param3>`**

Examples

> The following commands the pan-tilt to pan to location 42 and tilt to location 99 using the "PP" and "TP" commands, and then resets the pan-tilt. The Geo-Pointing Module is at IP address 192.168.1.110.
>
> http://192.168.1.110/non?PP=42
> http://192.168.1.110/non?TP=99
> http://192.168.1.110/non?R
>
> The following commands use alternate forms of the commands to execute the same "PP" pan-tilt command. The second form is generally more convenient

for sending requests from a web page while the first is more convenient for programs.
http://192.168.1.110/raw?cmd=PP1200
http://192.168.1.110/raw?PP=1200
http://192.168.1.110/raw?R

4.1.2 Authentication of IP Commands

All DPoIP commands are authenticated using the HTTP "Basic Authentication Scheme". The basic authentication scheme provides for filtering unauthorized access to resources on an HTTP server. It is based on the assumption that the connection between the client and the server can be regarded as a trusted carrier. As this is not generally true on an open network, the basic authentication scheme should be used accordingly.

When issuing DPoIP commands to the Geo-Pointing Module from a browser, the user will be prompted for a user-name and password. A valid user-name and password will allow the command to be sent to the GPM. User-name/password must be entered once per session (or user-name/password may be stored by your browser depending on settings).

Non-browser applications must set the credentials (user-name, password) on the Geo-Pointing Module server prior to issuing each DPoIP command.

The factory-set default username is **"admin"** and the factory-set default password is **"default"** User-name and password are managed from the Network Configuration web page (See Section 5.2 on page 17).

4.2 Calibration Commands

4.2.1 Calibration & Relevant Terms

Geo-pointing commands operate by translating target geo-coordinates to relative pan-tilt pointing angles using the known position and orientation of the pan-tilt unit. The pan-tilt unit position and orientation are defined during a calibration step after the pan-tilt is physically installed at the site of use.

Figure 6 on page 11 shows the orientation coordinate system for the pan-tilt. Pan-tilt orientation is measured with respect to the "0" positions of pan and tilt positions of the unit.

Pitch offset accounts for any error in mounting the sensor with respect to 0 pitch angle.

The pan-tilt position (latitude, longitude, altitude) of the installed pan-tilt is defined using the relevant commands below. Pan-tilt position may be measured, for example, using a handheld GPS at the installed pan-tilt site. The pan-tilt orientation can be defined either by directly entering the values (determined through some external means of measuring the pan-tilt orientation in real-world coordinates), or, more commonly, by using the calibration function described below.

Automated determination of the pan-tilt orientation angles is achieved by entering, and pointing the pan-tilt at, 4 or more landmark geo-locations and then issuing a calibration command. The calibration algorithm then uses the defined landmark locations and the associated recorded pan-tilt pointing angles to compute an estimate of the pan-tilt orientation angles (Roll, Pitch, Heading and Pitch Offset). A calibration quality measure is also computed by the algorithm and can be queried after the calibration function is invoked to determine if additional or different landmarks produce a more accurate orientation estimate. Calibration quality is computed as a

"typical maximum error" in degrees as shown in Figure 7 on page 12. Once pan-tilt position and orientation are defined, geo-pointing commands may be issued.
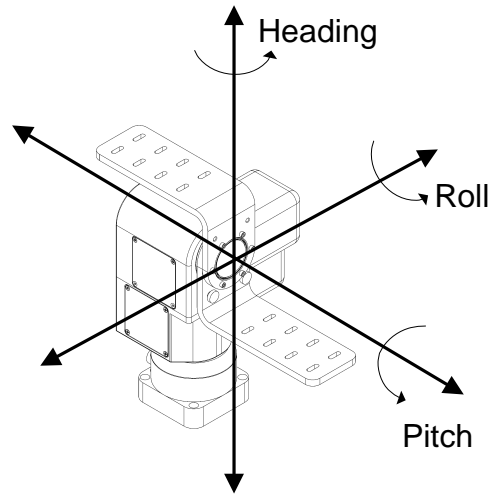
Figure 6: Pan-Tilt Orientation Coordinate System

Overall accuracy of the geo-pointing commands is determined by pointing resolution of the PTU and accuracy of the initially provided geo-position *and orientation* of the PTU. For target standoff distances of greater than ~1000m, angular error of the geo-pointing will approximately equal error in the calibrated pan-tilt orientation. Careful aiming during calibration, and use of accurately surveyed and well-spaced landmarks allows overall resolution to approach the angular resolution of the PTU being used.

Accuracy can also be affected by the alignment of the sensor to the pan-tilt frame of reference. Up to approximately 5 degrees of misalignment between sensor line-of-sight and pan-tilt coordinates will result in error similar to that of pan-tilt angular error. Misalignment above 5 degrees should be avoided.

Landmarks for calibration should be selected so as to cover a wide span of angles (up to 180 degrees preferred) and distances. A minimum of 4 landmarks are required to compute PTU orientation. Additional landmarks can improve system pointing accuracy. Landmarks should also be selected to have a visually distinct point that can be seen by and aligned to the camera/sensor (e.g., center of field-of-view) during landmark definition. The survey location of the landmark should match the landmark's visual alignment point used during the calibration process.

A "landmark quality" value is output by the calibration algorithm. This value can be used to identify poorly surveyed or aimed landmarks and provides a good estimate of overall system accuracy.

4.2.2 Tips on Selecting Landmarks

Accurate survey and entry of landmarks is critical to overall system geo-pointing accuracy. The following guidelines can help ensure the best calibration:

- Select a set of landmarks that cover the widest possible range of angles, distances and altitudes. Even if the field of interest for operation is narrow, a wider range of landmarks will help ensure better pointing accuracy. Having some of the landmarks quite far away (> 1 mile) will also help system accuracy.
- Select landmarks which have a visually distinct survey point. When aligning the pan-tilt to the landmark (e.g., viewing through a zoomed-in camera), it is important to aim at the surveyed location. Objects like the base of a flagpole or telephone pole, or corner of a building are usually good. Make sure the landmark will be visible from the mounted pan-tilt location.

- Survey carefully. Most hand-held GPS units include an "averaging" function which will improve measured coordinates if the unit is left in position for a period of time. Using this function can improve landmark location quality.
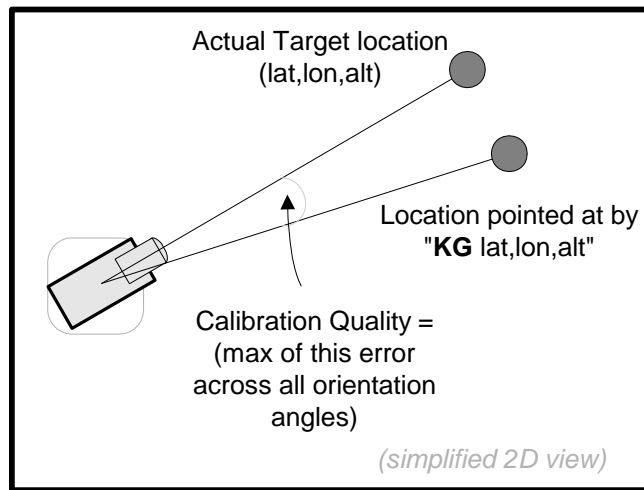
Figure 7: Calibration Quality Measure

4.2.3 Calibration (geo-reference)

Description:

Specify or query the calibrated position and orientation of the PTU. Current position can be changed on the fly and will be written to flash each time it is changed. A maximum of 10 landmarks may be defined for the calibration algorithm. All heading, roll, and pitch information is in radians.

Syntax

Query calibrated latitude position:	**KL\<delim\>**
Set calibrated latitude position	**KL\<position\>\<delim\>**
Query calibrated longitude position:	**KO\<delim\>**
Set calibrated longitude position	**KO\<position\>\<delim\>**
Query calibrated altitude position:	**KA\<delim\>**
Set calibrated altitude position	**KA\<position\>\<delim\>**
Query calibrated heading position:	**KH\<delim\>**
Set calibrated heading position	**KH\<position\>\<delim\>**
Query calibrated roll position:	**KR\<delim\>**
Set calibrated roll position	**KR\<position\>\<delim\>**
Query calibrated pitch position:	**KP\<delim\>**
Set calibrated pitch position	**KP\<position\>\<delim\>**
Query calibrated pitch-offset position:	**KN\<delim\>**
Set calibrated pitch-offset position :	**KN\<position\>\<delim\>**
Query landmark locations:	**KM\<delim\>**
Set calibrated landmark:	**KM\<name\>,\<lat\>,\<lon\>,\<alt\>\<delim\>**
Issue calibration command:	**KC\<delim\>**
Clear last landmark:	**KD\<delim\>**

Clear all landmarks: `KJ<delim>`
Query calibration quality: `KQ<delim>`

Example

The following defines the PTU position, defines and points at 4 landmark locations, computes the calibrated orientation, and queries the resulting calibration quality.

```
KL36.67939 *
KO-121.43923 *
KA335 *
A *
KM lm-1, 37.67939, -122.43923, 345 *
<point PTU at landmark using commands such as PO
and TO>
KM lm-2, 35.67939, -123.43923, 355 *
<point PTU at landmark using commands such as PO
and TO>
KM lm-3, 36.67939, -124.43923, 315 *
<point PTU at landmark using commands such as PO
and TO>
KM lm-4, 38.67939, -125.43923, 305 *
<point PTU at landmark using commands such as PO
and TO>

KC *
KQ * Current calibration quality is 0.125 deg.
```

4.3 Geo-Pointing Commands

The Geo-Pointing Commands allow commanding the Pan-Tilt unit to aim at a given geo-coordinate (latitude, longitude, altitude) and to read the geo-coordinate at which the Pan-Tilt Unit is pointing. These commands are valid only after a calibration has been completed (see Section 4.2 on page 10).

4.3.1 Geo-Coordinate Data Formats

Geo-coordinates used in the pointing and query commands utilize a latitude, longitude, and altitude coordinate system. Multiple data formats are accepted as input parameters. Geo-coordinates returned by the Query functions are in format 1. ASCII data representations for Latitude (<lat>) and Longitude(<lon>) data for pointing commands are as follows:

1. **DDD.ddddd** : "DDD" is degrees and "ddddd" is decimal degrees
2. **DDD:MM.mmmm** : "DDD"=degrees; "MM" = minutes; "mmmm" = decimal minutes
3. **DDD:MM:SS.sss** : "DDD" = degrees;"MM" =minutes;"SS"=seconds;"sss"=decimal seconds

The format is flexible with respect to significant digits. So for example, "012.45678" is interpreted the same as "12.45678". Negative values must include "-" prefix. Positive values need not include "+".

The return format for query functions is always format 1.

Altitude data (<alt>) format is:

aaaaa : "aaaaa" = altitude in Feet. [IMPORTANT: make sure to convert surveyed altitude data

to feet for use in calibration or geo-pointing functions]

IMPORTANT: By convention, latitude and longitude numeric representations are signed numbers indicating hemisphere. "West" and "South" coordinates are signed negative "-", while "East" and "North" coordinates are signed positive "+".

4.3.2 Position (geo-reference)

Description:

Specify or query the geo-pointing position. Desired positions can be changed on-the-fly without waiting for previous position commands to complete. Pan-Tilt can be moved using standard pan-tilt commands (e.g., "PP") and then geo-pointing position queried.

There are three forms of the "KG" command. One that requires lat, lon, alt which points the unit at the given coordinates. There are two "query" forms. The first, "KG<delim>" returns that last geo-coordinate given via a KG command. The "KG<alt><delim>" form computes the geo-coordinate being currently pointed at. The results of these two forms will differ, since the altitude of the "position being pointed at" cannot be computed from geometry alone due to terrain effects.

The "KG<alt><delim>" command will return the lat/lon position computed as where the current pointing vector intercepts the earth sphere. If the "alt" given in the query command is 0, this would be the sea level intercept point. If the altitude provided is non-zero, then the command returns the lat/lon intercept of "column" normal to the earth sphere and at that given altitude.

Syntax

Set desired pointing position: `KG<lat>,<lon>,<alt><delim>`
Query desired pointing position:`KG<delim>`
Query actual pointing position: `KG<alt><delim>`

Examples

The following sends the pan-tilt unit to point at 36.67939, -121.43923, 335, then pans the unit 100 steps, and reads the resulting geo-coordinate being pointed at:

`KG36.67939,-121.43923,335 *`
`A *`
`KG * Current desired pointing position is 36.67939,`
-121.43923, 335
`PO100 *`
`A *`
`KG * Current desired pointing position is 36.67002,`
-121.43123, 350

The following sends the pan-tilt unit to position 1000, 500 then queries the geolocation being pointed at (at sea level):

`PP1000 *`
`TP500 *`
`A *`
`KG0 * Current actual pointing position is 36.67939,`
-121.43923, 0

Related Topics

• Calibration: See Section 4.2 on page 10

4.4 Unit Commands

4.4.1 Default Settings

Description:
> View current settings and restore default settings for geo-pointing functions.

Syntax
> Load default settings to Flash: **KF\<delim\>**
> View Current Settings: **KV\<delim\>**

Example
> The following displays the current settings, loads the default settings to Flash, and then displays those:
> ```
> KV * Current settings are:......
> KF * Default settings restored
> KV * Current settings are:......
> ```

Related Topics

4.4.2 Restore Network Defaults

Description:
> Restore unit network address settings to factory defaults. Use to reconfigure IP network identity of unit to a known state.

Syntax
> Restore Defaults: **KR\<delim\>**

Example
> The following restores unit network address parameters to factory defaults:
> ```
> KR *
> ```


4.4.3 Reboot Module

Description:
> Reboot the Geo-Pointing Module.

Syntax
> Reboot Module: **KK\<delim\>**

Example
> The following reboots the module:
> ```
> KK *
> ```

5 WEB CONTROL INTERFACE

The Geo-Pointing Module has a built-in web server and set of password-protected web pages that allow the user to:

- Configure the Geo-Pointing Module network addresses
- Configure and Control the Pan-Tilt Unit
- Configure and Calibrate Geo-Pointing Module
- Manually Enter Geo-Pointing Commands
- Update Geo-Pointing Module firmware

The following sections provide details on use of these web pages.

Once the Geo-Pointing Module is connected to the LAN, an accessible host computer can be used to access these web pages by pointing a browser at: "http://<gpm-ip>/". This will bring up the default "home" page of the unit ("Network Configuration"). The other pages can be accessed from the top navigation bars accessible from all pages.

5.1 Authentication and Access Control

All web pages are secured via password protection. The HTTP "Basic Authentication Scheme" is used. The basic authentication scheme provides for filtering unauthorized access to resources on an HTTP server. It is based on the assumption that the connection between the client and the server can be regarded as a trusted carrier. As this is not generally true on an open network, the basic authentication scheme should be used accordingly.

When accessing Geo-Pointing Module web pages, the user will be prompted for a user-name and password. A valid user-name and password will allow access to the web page. User-name/password must be entered once per session (or user-name/password may be stored by your browser depending on settings).

The factory-set default username is ["admin"] and the factory-set default password is ["default"] User-name and password are managed from the Network Configuration web page (See Section 5.2 on page 17).

5.2 Network Configuration

This page allows setting of the Geo-Pointing Module's IP network address and related parameters. This is the default "home" page of the Geo-Pointing Module.

5.2.1 Accessing the Geo-Pointing Module from the Internet

Once installed, your Geo-Pointing Module is accessible on your local network (LAN). To access the Unit from the Internet, network routers and firewalls must be configured to allow incoming traffic over **port 80, HTTP**. Please refer to the documentation for your router for further instructions.

5.2.2 Reset Geo-Unit Defaults

The "Reset Geo-Unit Defaults" button on this page will set IP address, Subnet, Gateway, DNS, Name, Username, Password parameters to factory default values. It will also erase user values in memory including landmarks and calibration data.
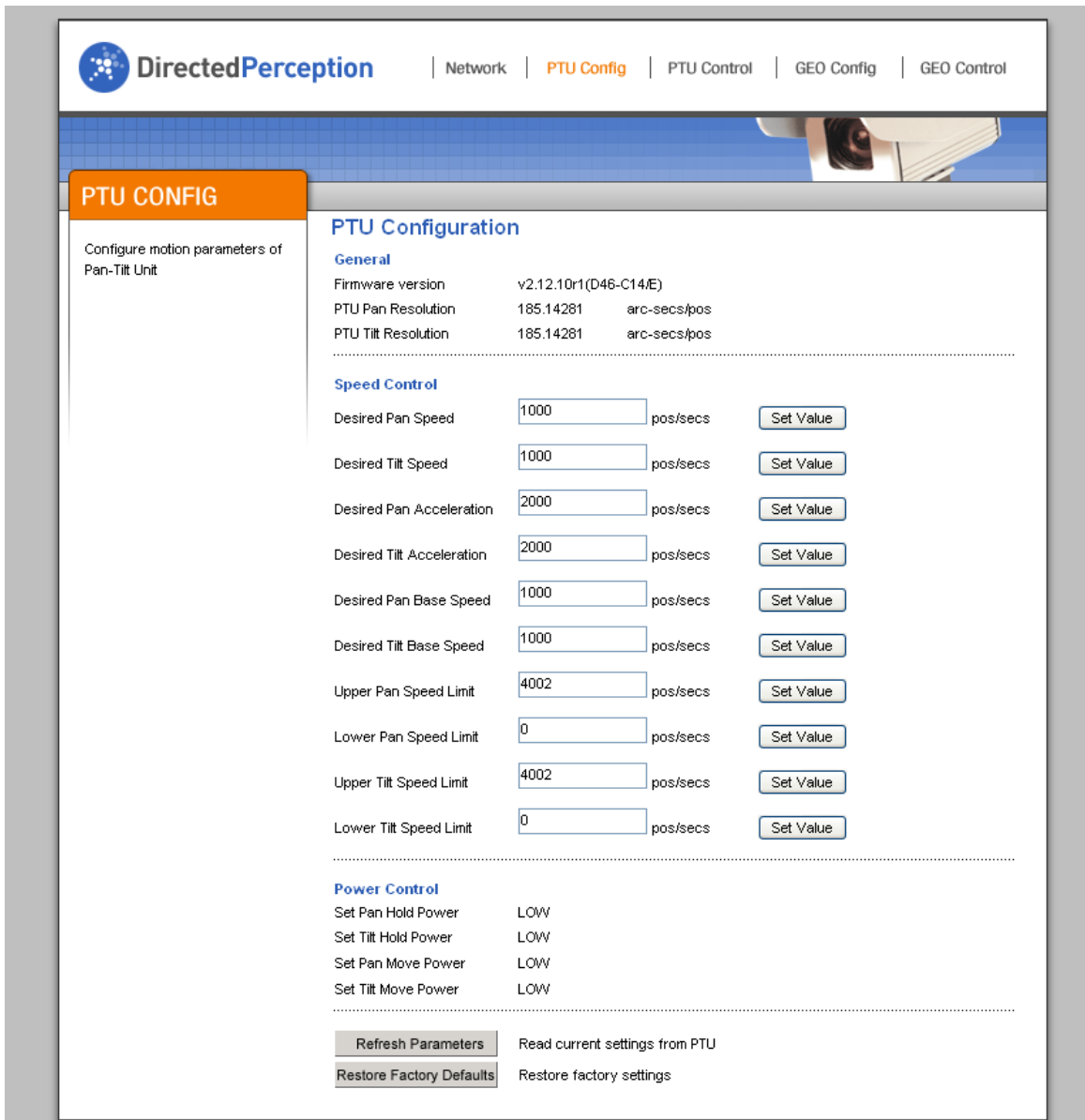
Figure 8: Network Configuration Web Page

5.3 PTU Configuration

This page allows configuration of many pan-tilt parameters on the Pan-Tilt unit attached to the Geo-Pointing Module. Refer to the Users Manual for your pan-tilt unit for details on the semantics and function of these parameters.

The "Restore Factory Defaults" button issues a "DF" command to the pan-tilt unit and resets all the parameters on the PTU Config page to values queried from the pan-tilt unit.

Figure 9: PTU Configuration Web Page

5.4 PTU Control

The Pan-Tilt Unit attached to the Geo-Pointing Module can be controlled manually using the PTU Control web page. Clicking on the "arrows" graphic allows panning or tilting the unit incrementally (large or small increments from the large and small arrows respectively). The "Low Resolution"/"High Resolution" toggle is used to set the increments of the small and large arrows for incremental pan/tilt movement. "High Resolution" setting will move the pan/tilt smaller increments per mouse click. The "Low Resolution" will move in relatively larger steps.

The form fields allow entering specific go-to positions. Upon "apply" the pan-tilt will move to the given position using the "PP" and "TP" commands and the currently set motion parameters.

The "Raw Command" field of the PTU Control web page can be used to send any pan-tilt command directly to the unit. Whatever text is entered here will be sent directly to the attached pan-tilt unit. See your pan-tilt Users Manual for a complete list of commands.
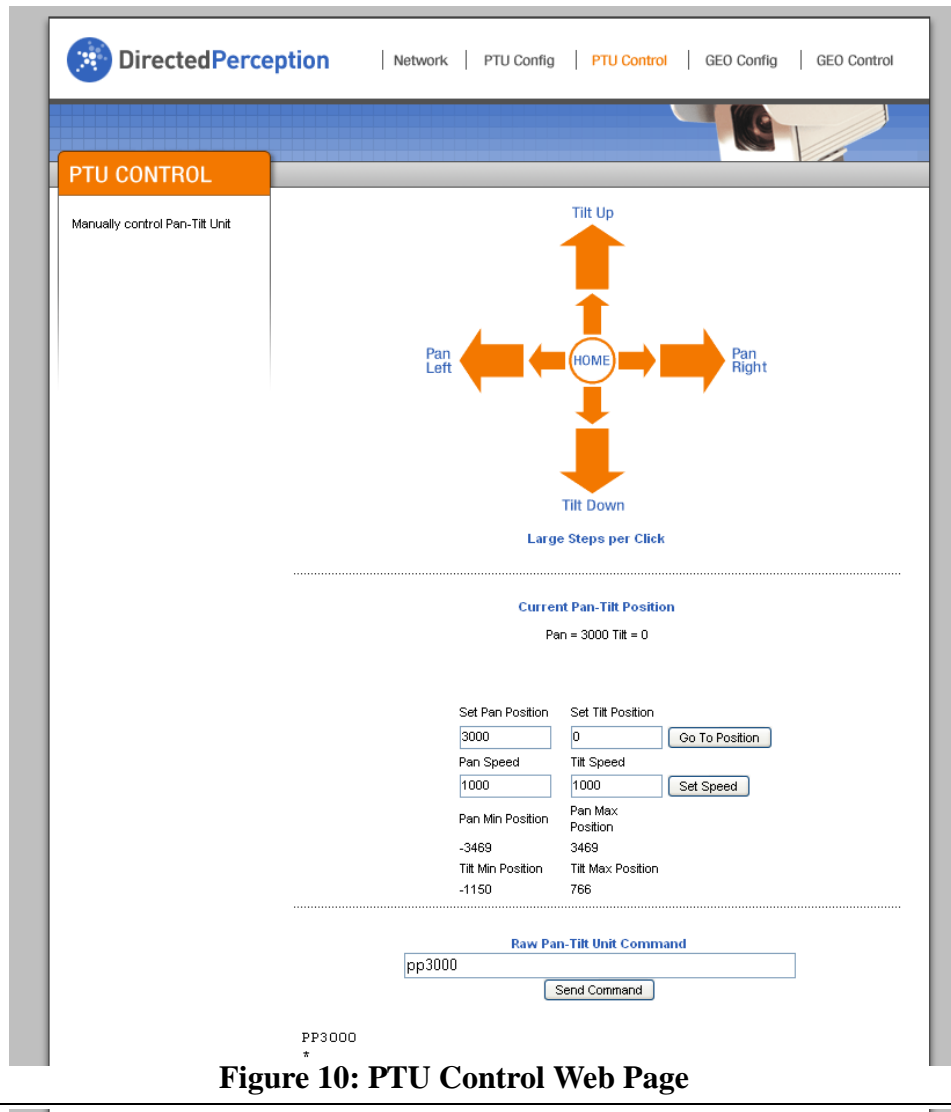
Figure 10: PTU Control Web Page

5.5 Geo Config

This page is used to calibrate the Geo-Pointing Module. It allows entering the surveyed Pan-Tilt Unit position, and entering a series of landmarks to allow the system to compute the pan-tilt unit orientation angles. During calibration, as each landmark is entered, the pan-tilt must be aimed at the corresponding landmark. This aiming can be done using the PTU Control page or other means. The Geo Calibration page also includes an output of current "quality" of the calibration to help determine if more or different landmarks may be required.

A mnemonic label can be associated with each landmark to facilitate identifying it during calibration.

The Geo-Pointing Module accepts altitude data in Feet only. A Meters/Feet converter is included on the Geo Config page for convenience in entering surveyed or other geo-coordinates.

Figure 11: Geo Config Web Page

5.6 Geo Control

This page allows the user to issue a geo-pointing command by entering the geo-coordinate and sending the command. The currently pointed-at geo-location is also displayed on this page. The page should be refreshed to display the currently pointed-at geo-location if the pan-tilt is moved using external means.

The "Pan-Tilt Last Targeted At" field refers to the last geo-position commanded ("KG" command). The "Pan-Tilt Currently Pointing At" field refers to the calculated earth-intercept point ("KG<alt>" command). See Section 4.3.2 on page 14 for further details.

Figure 12: GEO Control Web Page

5.7 Flash Update

This page is invoked from a link on the Network page and allows updating the firmware of the Geo-Pointing Module. A firmware update file should be obtained only from Directed Perception and selected from the "browse" button.

IMPORTANT: Removing power or resetting the module during firmware update may corrupt memory and require factory repair.
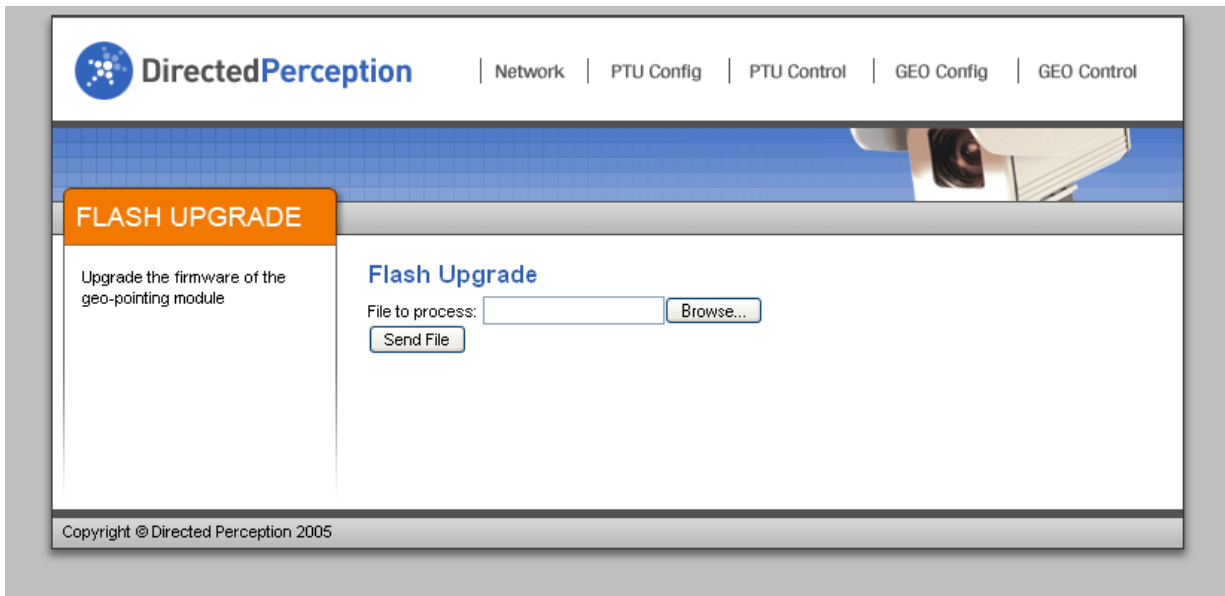
Figure 13: Firmware Update Web Page

6 CUSTOM CONFIGURATIONS

The Geo-Pointing Module is specially designed for flexibility and includes a number of features and options to allow customization and enhancement of the unit for specific applications. Some of the potential custom configurations and features of the Geo-Pointing Module include:

- Customized web pages
- Gyro/GPS sensor inputs for mobile applications
- Outputs for web control of cameras and other sensors

Contact the Directed Perception Sales Team for details: sales@dperception.com

A. SPECIFICATIONS
A.1 Mechanical Dimensions

A.2　Troubleshooting Guide.

A.2.1　Calibrated unit is not pointing to correct locations

Likely Cause: If the position and orientation have not been properly calibrated, the unit will not point accurately at entered targets.

Remedies: Check the "landmark quality" output for each landmark on the Geo Calibration web page. This value will often indicate a landmark that is "off" (inconsistent with other landmarks). This often indicates poor survey data, incorrectly entered coordinates or other error in the land-mark data (e.g., was not visually aligned properly during calibration process). Confirm landmark coordinates, re-align pan-tilt, and re-enter landmark and recalibrate.

A.2.2　"Waiting for Pan-Tilt unit to power up..." will not go away

Likely Cause: The GPM is not able to communicate with the pan-tilt unit.

Remedies: Confirm physical connection between the GPM and the pan-tilt unit. A null-modem may be required. Confirm that pan-tilt unit baud rate and communications are set at the default (9600/8/N/1). Make sure Pan-Tilt unit is powered on. If problem persists, power cycle the GPM after pan-tilt unit is powered on.

A.2.3　Pan-Tilt stopped responding / web page hangs

Likely Cause: The GPM is not able to communicate with the pan-tilt unit.

Remedies: If the pan-tilt had been responding to web commands, and then web commands/web page queries hang or give http errors, this is likely due to GPM not being able to communicate with the pan-tilt unit. Try resetting the pan-tilt and GPM units, and reopening browser to the GPM site.

REGULATORY INFORMATION

Electromagnetic Interference (EMI) is any signal or emission, radiated in free space or conducted along power or signal leads that endangers the function of a radio navigation or other safety service or seriously degrades, obstructs, or repeatedly interrupts a licensed radio communications service.

Class A

Class A equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

The Geo-Pointing Module is pending certification for FCC Class A requirements.

Class B

Class B equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The Geo-Pointing Module is pending certification for FCC Class B requirements.

Caution: Changes or modifications of this equipment not expressly approved by manufacturer could result in violation of Part 15 of the Federal Communications Commission's rules. The FCC has prepared the following booklet: "How to Identify and Resolve Radio-TV Interference Problems." It is available from the US Government Printing Office, Washington DC, 20402. Stock Number 004-00-00345-4.

FCC Notice

According to 47CFR, Parts 2 and 15, Class B Computer Peripherals:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, (2) This device must accept any interference received including interference that may cause undesired operations.

LIMITED WARRANTY

Directed Perception, Inc. warrants this product against defects in material or workmanship, as follows:

For a period of one year from date of purchase, Directed Perception, Inc. will repair the defective product and provide new or rebuilt replacements at no charge. Warranty repairs require the issuance of a repair authorization number from Directed Perception prior to the return of merchandise, and buyer assumes responsibility for freight charges.

After the one year period, buyer must pay for all parts, labor and freight.

This warranty does not cover any damage due to accident, misuse, abuse or negligence. Buyer should retain original bill of sale as evidence of the date of purchase.

REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. DIRECTED PERCEPTION SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT, EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied warranty lasts, so the above limitations or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.