



Data Transmission Protocol Specification for Magellan Products



Revision 2.11

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GENERAL

Purpose

This document describes the protocol used by Thales Navigation's Magellan line of consumer GPS units to transfer waypoint data to and from an external device (presumably a PC). This protocol is an extension of the *National Marine Electronics Association NMEA 0183 Standard for Interfacing Marine Electronic Devices* Version 2.10 dated October 15, 1995.

Revision 2.0 Note

Messages that were only used in Magellan Skystar products or the GSC-100 satellite communicator have been removed from revision 2.0 of this document. For information on these messages please see revision 1.0 or 1.1.

Intended Audience

This document does not deal with the hardware issues necessary to implement this protocol. Electrical issues involved in connecting a GPS unit to a PC, or other device, are not covered. If necessary which pins are used for data transmission to and from a Magellan GPS unit can be obtained from Thales Navigation technical support.

The intended user of this document is assumed to have some level of familiarity with serial data transfer as used by PCs and other devices. The user is assumed to be familiar with the concepts of bytes, bit order, general messaging concepts, acknowledgement based protocols and the purpose of checksums.

The intended use of this document is to provide sufficient information to a developer so that data can be properly formatted for communications between Magellan products and an external Personal Computer or similar device. While not specified in this document, it is assumed that a user interface will be provided on the Personal Computer to handle all necessary control functions to accomplish the task at hand.

Legal Disclaimer

The protocols described in this document and used by Thales Navigation equipment are subject to change without notice. Thales Navigation does not assume any liability or responsibility for any use made of the information in this document.

Data Transmission

Format

All data formats in this document are assumed to be based on an 8 bit byte as the fundamental unit of transfer. All byte (0 to 255) may be used in a transmitted message, unless otherwise indicated all bytes are encoded as per ASCII standards. Although any arbitrary byte value could be used in a message that is part of this protocol, an effort has been made to stick to the limitations described in the NMEA standards. The primary affect of this is to limit most characters to ASCII characters with values of 20 (hex) to 60 (hex). This comprises numbers, uppercase letters and most of the punctuation characters.

Some early Magellan units supported the use of an “Icon” within a text string. These graphics characters are defined as binary values above the NMEA limit of decimal 125. These characters were transmitted through an *escape character* mechanism. This consisted of using three bytes to represent the icon’s code, an ASCII ESC character followed by two characters that represented the icon’s code. For example, an icon whose code is 03 would be represented by the three character string <ESC>03.

Baud Rates

This protocol can be implemented at any baud rate.

For reasons dealing with the internal priority structure of the software inside most Magellan consumer GPS units, in normal mode this protocol will work best at 4800 baud. If the unit is put into transfer mode with the TON command (see below) higher baud rates are possible.

Message Sequences

The data communications messages as described in the following sections may be sent in any order. The Magellan unit will process each command as it is received, even if it means interrupting the command that is currently in process. Since a user may cause the Magellan unit to start data transmission at any time, the PC to which it is connected must expect any message to be received at any time.

In normal mode there is no acknowledgement returned by the unit when it processes a message. This means that the PC cannot determine whether a message has been received and/or understood. In order to receive acknowledgement based handshaking a *hand shaking* mode has been implemented as part of this protocol. It is recommended that this mode be used when implementing this protocol. Otherwise, processor load and limited buffer size in the GPS unit could cause commands and data to be lost.

In order to activate this mode the first message that should be sent to the Magellan unit is the command **HANDON** (see below). After the next message is sent, the sending program should wait until either the Checksum response or the Unable response is received from the Magellan unit before transmitting again.

NMEA Messages

Some of the messages in this protocol are duplicates of those described in the NMEA 0183 specification. Whatever the origin of their format all the messages described in this document are treated the same and operate as described.

Thales Navigation’s Magellan line of consumer GPS units also have the capability of outputting streams of standard NMEA 0183 messages. These are used to convey information regarding position, velocity, time, navigation data, GPS satellite status, etc. Under certain conditions (for example, the user has activated these commands, the GPS unit is receiving GPS signals, the unit is not in *transfer mode*) these messages will be interspersed with the messages described in this document. In such cases, responsibility for handling these interruptions of the protocol reside with the external software.

MESSAGES SUPPORTED

Format

In general, the Messages defined by this specification follow the NMEA Message structure in that they consist of a header, one or more fields, followed by a hex checksum, and ended by a Carriage Return Line Feed delimiter as follows:

\$PMGNxxx, <fields>*hh<CR><LF>

The Header portion of the message, in conformance with NMEA standards, consists of the dollar sign and the letter “P” indicating that this is a private message. Magellan’s registered private message identifier of MGN is next, followed by the command name. In the example above, the lower case “xxx” is replaced with the command identifier in upper case. A comma terminates the Header field.

The data part of the message consists of one or more fields as described in this document. Commas separate each field in the data. Each field, and the data values that they can contain, are described under the various commands as shown in this document.

The tail of the message consists of a two character checksum (hexadecimal notation) followed by a carriage return then a line feed. The checksum consists of the byte-wise exclusive OR of all bytes in the message. This includes all characters between the leading dollar sign and the asterisk immediately before the checksum(the dollar sign and asterisk are not included in the checksum).

General Rules for Position and Time

Unless otherwise indicated all position information is referenced to the WGS-84 datum. All altitude information is referenced to the geoid (e.g. it is height above mean sea level). All date and time information is in UTC.

Message List

The messages that are contained in this protocol are listed in the following table..

Message	To Unit	From Unit	Description
PMGNCMD ¹	X		Command Messages.
PMGNCSM	X	X	Checksum of message that was just received.
PMGNRTE	X	X	Route Information.
PMGNTRK		X	Track information
PMGNVER		X	Hardware and software version numbers.
PMGNWPL	X	X	Description of a single waypoint
PMGNALM		X	Almanac information
PMGNMPH		X	Map header
PMGNPIH		X	POI header
PMGNDRT	X		Delete a single route
PMGNDWP	X		Delete a single waypoint

Protocol Messages

Due to different information needs in different GPS units it is possible that not all empty fields at the end of the message will be transmitted. Missing, or empty, fields are to be set to the default state for each field. When receiving additional data beyond that which is defined in this document, the extra data is to be ignored.

Fields described in this document as <reserved> must be transmitted empty as shown, as they are reserved for implementation of features that have not yet been released by Thales Navigation. When they are released, Thales Navigation will revise this document to reflect those fields. Persons implementing this protocol that decide to use these fields without the concurrence of Thales Navigation risk having their implementation break when Thales Navigation begins to utilize these fields.

¹The only command sent from the unit is the “END” or “UNABLE” command that is used to indicate that the last of an indeterminate number of messages have been sent

PMGNALM

This message is the same as the NMEA 0183 message and uses the same fields and syntax. This Private Message has been defined to enable the Check Sum Handshake to be utilized during data transmission.

\$PMGNALM,<Fields per NMEA 0183 ALM Message>*hh<CR><LF>

PMGNCMD

This message is used to command the GPS unit to do something. This could result in data messages being sent from the unit, the unit going into a certain mode, etc. The commands are sent as ASCII text, in upper case. Where the Command requires more than one field, the command and its fields will be sent consecutively within the same message. In no case may a command be given in one message, with the second field sent in a different message. Fields that are not needed need not be sent.

\$PMGNCMD, c---c , p-p*hh<CR><LF>

Note that the PC program can send all of these commands. The unit, however, will only send the **END** and **UNABLE** commands.

The following commands are supported. The REPLY column indicates the message that is expected to be returned by the unit (if any).

COMMAND	REPLY	DESCRIPTION
ALMANAC	PMGNALM	Send Almanac Data
DELETE		Empties the data buffer specified in the next field: WAYPOINTS – deletes all user waypoints ROUTES – deletes all user routes TRACK – deletes all points in the track buffer FIX – deletes all saved fixes ALL – deletes all of the above
END		End of data when multiple NMEA records have been sent that does not include a record count identifier.
FIX	GGA	Begin sending fix information until a STOP command is received
HANDOFF		Turns off <i>handshaking</i> mode
HANDON		Turns on <i>handshaking</i> mode
ROUTE	PMGNRTE	Send Route messages
TRACK	PMGNTRK	Send Track messages
UNABLE		Sent by the unit when a previous command cannot be complied with.
VERSION	PMGNVER	Send a string giving product and software version information.
WAYPOINT	WPL or PMGNWPL ²	Send NMEA Way Point Messages
TON		Turn on <i>transfer</i> mode (for support of higher baud rates)
TOFF		Turn off <i>transfer</i> mode
NMEAON		Set the unit to output NMEA 2.1
NMEAOFF		Set the unit to NMEA OFF (no regular NMEA output)
BAUD,xxxxx		Set the unit's baud rate to xxxxx (1200, 4800, 9600, 19200, 57600 or 115200 only)

Commands

²NMEA WPL message is sent for the marine units that do not support Altitude or Message information. For those products that support altitude, Icons, or additional information, then the Magellan Proprietary PMGNWPL message is sent by the Magellan unit. See the description of the PMGNWPL message for details.

PMGNCMD,VERSION

There are two different version request commands. The first has no other arguments or an argument of 1:

```
$PMGNCMD,VERSION*hh<CR><LF>  
$PMGNCMD,VERSION,1*hh<CR><LF>
```

which results in a PMGNVER message containing no serial number information. The second format has an argument of 2:

```
$PMGNCMD,VERSION,2*hh<CR><LF>
```

which results in a PMGNVER message containing serial number information.

PMGNCMD,TRACK

There are two different track download commands. The first has no other arguments or an argument of 1:

```
$PMGNCMD,TRACK*hh<CR><LF>  
$PMGNCMD,TRACK,1*hh<CR><LF>
```

which results in PMGNTRK messages containing no date information. The second format has an argument of 2:

```
$PMGNCMD,TRACK,2*hh<CR><LF>
```

which results in PMGNTRK messages containing date information.

PMGNCSM

In *handshake* mode this message is used to acknowledge successful data transmission in response to a data message. In handshake mode it is expected that both the GPS unit and the PC will acknowledge a successful message receipt with the PMGNCSM message. For example, if the GPS unit has been commanded to send its waypoints (and it is in *handshake* mode) it will wait for receipt of a PMGNCSM message after it sends each waypoint message. When the PMGNCSM message is received the included checksum will be compared to the checksum of the last message sent. If they are the same the next waypoint message will be sent. If they are different the unit will re-send the previous waypoint message.

```
$PMGNCSM, hh*hh<CR><LF>
```

Where the first “hh” field is the Hex Check Sum of the last message received, and the second “hh” field is the hex check sum of this message. It is important to recognize that the hex checksum of the received message must be calculated, not copied from the transmitted message. If the hex checksum data is copied, errors in transmission will not be detected and the unit will not then resend the message.

PMGNDRT

This message commands the receiver to delete a specific route from its memory. The route to be deleted is given by the route number in the message.

```
$PMGNDRT, xx*hh<CR><LF>
```

Route numbers are zero based. Thus, the first route is number 00.

PMGNDWP

This message commands the receiver to delete a specific waypoint from its memory. The waypoint to be deleted is given by the name and icon specified. If no icon is associated with the name that field will be null.

```
$PMGNDWP , c---c , xx*hh<CR><LF>
```

The first field is the name of the Waypoint, and the last is an Icon identifier. Currently, a blank Icon field indicates a default icon. A non default icon is indicated with a lowercase letter. See the icon appendix for details.

PMGNRTE

This message will be used to transmit route information to or from a Magellan unit. The message structure shown below is similar to the NMEA 0183 “RTE” message. The message consists of two groups of fields. The first set of fields consists of header information and includes the Magellan Proprietary Message Identifier, followed by the number of messages that make up this route, the individual Id number for this message, the letter “c”, the route number, and the Route Name. If the Magellan unit does not support route names that field will be ignored. If a route is sent to a unit without a route number the first free slot will be used. For those Magellan Units that accept a message attached to the route, a lower case “m” is used to indicate that this is a message. The remaining fields are the names, in order, of the waypoints that make up the route.

```
$PMGNRTE , xx , xx , c , n , c----c , c , c---c , c , c---c , c , . . . . . *hh<CR><LF>
```

The character fields consist of a waypoint name followed by Icon information in lower case. The Icon information applies to the waypoint name immediately to its left. If no waypoint Icon information is being transmitted, then the icon field should be left empty. The character fields are a list of waypoint names, and icons, in route order up to the maximum message length.

```
$PMGNRTE , 2 , 1 , c , 1 , FOO , POINT1 , b , POINT2 , c , POINT3 , d*6C<CR><LF>
```

```
$PMGNRTE , 2 , 2 , m , 1 , FOO , THIS IS A ROUTE MESSAGE*1F<CR><CLF>
```

Sample Magellan Private Route Message

The above two example messages are decoded as follows: “\$PMGNRTE” identifies these as a route message, the next two fields, “2,1” indicate that this is the first message for this route, which is described in two messages. The next field, “c” indicates that this is a complete route description. “FOO” is the name of this route. The first waypoint that makes up this route is “POINT1” and has a special Icon identified as “b” attached to it. The middle point of this three waypoint route is “POINT2”. The route ends at waypoint “POINT3”. “*62” is the hexadecimal check sum for this message, which is terminated by a Carriage Return and a Line Feed.

The second message describes the message that is part of the route. The message is decoded as follows: “\$PMGNRTE” indicates that this is a Magellan Private Message. The next two fields indicate that this is the second message of two that make up this route. The lower case ‘m’ indicates that this is a message record. The next field, “FOO” is the name of the route. This field must be the same for all records that make up a route. The next field contains the message that is to be attached to the route. This message may be in mixed case, however, only certain Thales Navigation products that support lower case letters may be able to use a mixed case message. The message is terminated by the usual checksum field followed by carriage return/line feed pair..

To ensure forward compatibility, a test should be made for the presence of one of the two valid characters in field 4. Other letters are reserved for future expansion. Messages containing an unrecognized character in this field should be ignored.

Messages must be sent in increasing numerical order. A reception of message 1 of 'x' indicates the start of a route description, while reception of message 'x' of 'x' indicates that the route is complete. Missing sequence numbers indicate that some data is missing, and the route should not be processed.

NOTE: Some early Magellan units, due to internal limitations, must send and receive waypoint names in pairs. When the Route consists of an odd number of waypoints, the last waypoint name field of the last Route "c" message may contain the special value "<<>>". This indicates that the field is not used and should be ignored. This special value does not need to be stored, nor should it be sent to a unit.

PMGNTRK

This message is to be used to transmit Track information (basically a list of previous position fixes) which is often displayed on the plotter or map screen of the unit. The first field in this message is the Latitude, followed by N or S. The next field is the Longitude followed by E or W. The next field is the altitude followed by "F" for feet or "M" for meters. The next field is the UTC time of the fix. The next field consists of a status letter of "A" to indicate that the data is valid, or "V" to indicate that the data is not valid. The last character field is the name of the track, for those units that support named tracks. The last field contains the UTC date of the fix. Note that this field is (and its preceding comma) is only produced by the unit when the command PMGNCMD,TRACK,2 is given. It is not present when a simple command of PMGNCMD,TRACK is issued.

NOTE: The Latitude and Longitude Fields are shown as having two decimal places. As many additional decimal places may be added as long as the total length of the message does not exceed 82 bytes.

```
$PMGNTRK,1111.11,a,yyyy.yy,a,xxxxx,a,hmmss.ss,A,c---c,ddmmyy*hh<CR><LF>
```

PMGNVER

This message has two forms, one with a unit serial number, one without. It is used to send the model number of the GPS unit and its software version number. The field denoted by c---c represents the unit name or model in text format.

```
$PMGNVER,PID,SID,c---c,DBID*hh<CR><LF>
```

or

```
$PMGNVER,PID,SID,c---c,ssssssssss*hh<CR><LF>
```

PID is a unique numerical product ID specifying the unit's model. SID is the software version number. The character field contains a text representation of the unit's model name. DBID is a set of three strings used to identify the database in certain aviation units. Ssssssssss is a 12 digit serial number.

NOTE: A unit without a serial number will always respond with the first version of this message.

PMGNWPL

This message is used to transmit waypoint information. It is based upon the NMEA 0183 WPL message with the addition of altitude, message and icon information fields. An example of this message is given below:

```
$PMGNWPL,1111.111,N,11111.111,W,aaaa,F,c---c,c---c,c-c,xx*hh<CR><LF>
```

The first field consists of two digits representing the degrees of Latitude, with a leading zero if necessary, followed by two digits representing the minutes of Latitude, with a leading zero if necessary, followed by fractional minutes. For example, a latitude of 38° 15' 30" would be encoded as 3815.5. The next field consists of either the letter "N" or "S" to indicate North or South Latitude. The next field consists of the Longitude formatted like the Latitude, but with 3 digits to represent the degrees of Longitude. For example, a Longitude of 118° 5' 15" would be encoded as 11805.25. This field is followed by an "E" or "W" to indicate East or West Longitude. The next field is the Altitude, followed by its units ("F" for feet, "M" for meters). Three text fields follow the position, the first is the name of the waypoint, the next is a message or comment for this way point, and the last is an Icon identifier. Some GPS receivers do not support messages or icons. In this case these fields are not sent by the unit and ignored if received by the unit. Currently, a blank icon field indicates a default icon. Magellan Products use lower case to indicate which icon is associated with the waypoint. See the icon appendix for details. The final data field is a waypoint type indicator (a numerical value particular to a given model of GPS units) which is used in some GPS units. Trailing fields need not be transmitted if they are empty.

EXAMPLES

GENERAL

This section has examples of the message exchange in a number of different scenarios. The purpose of these is to illustrate one possible sequence of messages between a PC and a Magellan unit

INITIAL SEQUENCE

The following exchange will verify that a GPS unit is attached to the PC, place it in *handshaking* and *transfer* modes. The first phase of this exchange should be a repeated transmission of the request for a PMGNVER message from the unit. Once this message is received the PC will know what unit is attached and that the connection is operating correctly.

The following assumes that the GPS unit starts in its default state, which has *handshaking* mode turned off.

<u>Transmit To GPS Unit</u>	<u>Received From GPS Unit</u>
\$PMGNCMD,VERSION*28	\$PMGNVER,015,4.01,GPS3000XL*05
\$PMGNCMD,HANDON*70	
\$PMGNCMD,TON*27	\$PMGNCSM,27*60

Sample Initial Handshake Sequence

WAYPOINTS

Retrieving All Waypoints From the GPS Unit

One of the most common tasks is to retrieve all of the waypoints stored in the unit for display, and/or editing on a PC. This task is accomplished by sending and receiving a sequence of messages. The PC starts the sequence by sending a command message to the unit. The unit then responds with one or more PMGNWPL messages. After all messages have been sent, the unit will send the END command to indicate that all data has been sent. This sequence is shown below which assumes that there are only two waypoints stored in the unit.

<u>Sent To GPS Unit</u>	<u>Received From GPS Unit</u>
\$PMGNCMD,WAYPOINT*71	\$PMGNCSM,71*63
	\$PMGNWPL,llll.ll,a,yyyyy.yy,a,c—c*hh
\$PMGNCSM,hh*hh	\$PMGNWPL,llll.ll,a,yyyyy.yy,a,c—c*hh
\$PMGNCSM,hh*hh	
\$PMGNCSM,3D*12	\$PMGNCMD,END*3D

Retrieving All Way Points

IMPLEMENTATION MATRIX

PID Definitions

The following table indicates what the PID field in the PMGNVER message indicates:

PID string	Model
001	SkyBlazer
002	Skyblazer XL
003	Skyblazer LT MAP
004	Skystar – 2 channel
005	Meridian XL
006	GSC-100
007	Trailblazer XL
008	Trailblazer XL – Arabic
009	Patriot
010	NAV 1200
011	GPS 2000
012	GPS 2000 – OSGB
013	GPS 3000
014	GPS 4000
015	GPS 3000XL
016	GPS 2000XL
017	DLX 10
018	NAV 6000
019	Colortrak
020	Skystar – 2 channel
021	GPS 2000XL – with data
022	Skystar – 12 channel
023	Tracker
024	GPS 315/320
025	MAP 410
030	MAP 330
031	GPS 310
033	Meridian (new)
035	ProMark 2
036	Sportrak Map/Pro
037	Sportrak
038	FX 324
039	Meridian Color
040	FX 324 Color
041	Sportrak Color
042	Sportrak Marine
043	Meridian Marine (2003 edition)

Message Implementation

Not all of the Magellan GPS receivers support all of the messages listed above. The following is a table of products and, if applicable, software versions indicating which messages are supported.

	P M G N D W P	P M G N D R T	P M G N C S M	P M G N R T E	P M G N T R K	P M G N V E R	P M G N W P L	P M G N C M D
Meridian XL			X	X	X	X	X	X
Trailblazer XL			X	X	X	X	X	X
GPS 2000XL			X	X	X	X	X	X
GPS 3000XL			X	X	X	X	X	X
NAV 6000			X	X	X	X	X	X
MAP 410	X	X	X	X	X	X	X	X
GPS 315/320	X	X	X	X	X	X	X	X
ColorTrak	X	X	X	X	X	X	X	X
Tracker	X	X	X	X	X	X	X	X
MAP 330	X	X	X	X	X	X	X	X
ProMark 2	X	X	X	X	X	X	X	X
Meridian (new)	X	X	X	X	X	X	X	X
Sportrak	X	X	X	X	X	X	X	X
Sportrak Map/Pro	X	X	X	X	X	X	X	X
FX 324	X	X	X	X	X	X	X	X
Meridian Color	X	X	X	X	X	X	X	X

Route messages in PMGNRTE messages are only supported in the NAV 6000.

Waypoint icons in PMGNRTE and PMGNWPL messages are not supported in the Meridian XL or Trailblazer XL.

Waypoint types in PMGNWPL messages are only supported in the NAV 6000.

PMGNCMD implementation

The following table indicates which commands of the PMGNCMD message are supported by which products.

	A L M A N A C	D E L E T E W A Y P O I N T S	D E L E T E R O U T E S	D E L E T E T R A C K	D E L E T E F I X	D E L E T E A L L	H A N D O F F & H A N D O N	R O U T E	T R A C K	V E R S I O N	W A Y P O I N T	T O N & T O F F	N M E A O N & N M E A O F F	B A U D
Meridian XL		X	X	X		X	X	X	X	X	X			
Trailblazer XL		X	X	X		X	X	X	X	X	X			
GPS 2000XL		X	X	X		X	X	X	X	X	X			
GPS 3000XL		X	X	X		X	X	X	X	X	X			
NAV 6000		X	X	X		X	X	X	X	X	X			
MAP 410	X	X	X	X	X	X	X	X	X	X	X	X		
GPS 315/320	X	X	X	X	X	X	X	X	X ³	X	X	X		
ColorTrak	X	X	X	X	X	X	X	X	X	X	X			
Tracker	X	X	X	X	X	X	X	X	X	X	X			
MAP 330	X	X	X	X	X	X	X	X	X ⁴	X	X		X ¹	X ²
ProMark 2	X	X	X	X	X	X	X	X	X	X	X		X	X
Meridian (new)	X	X	X	X	X	X	X	X	X	X	X		X	X
Sportrak	X	X	X	X	X	X	X	X	X	X	X		X	X
Sportrak Map/Pro	X	X	X	X	X	X	X	X	X	X	X		X	X
FX 324	X	X	X	X	X	X	X	X	X	X	X		X	X
Meridian Color	X	X	X	X	X	X	X	X	X	X	X		X	X

¹ Software version 1.06 and later

² Software version 1.09 and later

³ Time and altitude included with version 3.14 and later

⁴ Date included with version 2.01 and later

UNIT ICON DEFINITIONS

ICON Characters.

This section contains tables of what lowercase icon identifiers translate to in the given units:

Colortrak, Tracker, GPS 315/320, MAP 410 and Sportrak:

Lowercase character	ICON
a	filled circle
b	box
c	red buoy
d	green buoy
e	anchor
f	rocks
g	Green daymark
h	red daymark
i	Bell
j	danger
k	diver down
l	fish
m	house
n	mark
o	car
p	tent
q	boat
r	food
s	fuel
t	tree

NAV 6000:

Lowercase character	ICON
a	filled circle
b	fish
c	buoy
d	light
e	anchor
f	flag
g	red daymark
h	green daymark
i	wreck
j	house
k	boat
l	fuel
m	danger
n	diver down
o	food
p	w
q	l
r	r

Meridian XL:

Lowercase character	ICON
a	filled circle
b	flag right
c	flag left
d	diamond
e	square
f	filled square
g	anchor
h	banner
i	fish
j	crosshair

Trailblazer XL:

Lowercase character	ICON
a	filled circle
b	flag right
c	flag left
d	diamond
e	square
f	filled square
g	anchor
h	banner
i	fish
j	crosshair
k	car
l	house
m	wine glass
n	mountain
o	sign
p	tree
q	water
r	airplane
s	deer's head

MAP 330, ProMark 2, Meridian (new), Sportrak Map and Sportrak Pro:

Lowercase character	ICON
a	crossed square
b	box
c	house
d	aerial
e	airport
f	amusement park
g	ATM
h	auto repair
I	boating
j	camping
k	exit ramp
l	first aid
m	nav aid
n	buoy
o	fuel
p	garden
q	golf
r	hotel
s	hunting/fishing
t	large city
u	lighthouse
v	major city
w	marina
x	medium city
y	museum
z	obstruction
aa	park
ab	resort
ac	restaurant
ad	rock
ae	scuba
af	RV service
ag	shooting
ah	sight seeing
ai	small city
aj	sounding
ak	sports arena
al	tourist info
am	truck service
an	winery
ao	wreck
ap	zoo

ICON Bitmaps

TBD