PB100 WeatherStation
Technical Manual

also covers model LB100

Revision 1.007

AIRMAR Technology Corporation
35 Meadowbrook Drive
Milford, NH 03055-4613
(603) 673-9570

Table of Contents

1.   Introduction

This document is a supplement to the Airmar PB100 WeatherStation Owner's Guide. This document provides a detailed description of the communications protocol for both transmitted and received NMEA 0183 sentences used by the PB100 WeatherStation.

At this writing there are two models of the WeatherStation: the PB100 and the LB100. These are identical, except that the LB100 does not include the integrated GPS, compass, and tilt sensor circuitry. This document covers both models. Some of the transmitted NMEA sentences described in this document are not available on the LB100.

For further information about the NMEA 0183 protocol, refer to the document, *NMEA 0183 Standard for Interfacing Marine Electronic Devices, v3.01*, available from the National Marine Electronics Association (www.nmea.org).

2.   NMEA 0183 Interfaces

The Airmar WeatherStation has a single standard NMEA 0183-compliant output channel, and a single standard NMEA 0183-compliant input channel. The unit transmits standard NMEA 0183 sentences on its output channel. It also recognizes standard and proprietary NMEA 0183 sentences received on its input channel. The standard baud rate for both input and output channels is 4800 baud, though if desired this may be increased to 38400 baud via a proprietary command.[1]

The transmitted NMEA 0183 sentences are described in section 2.1. Received NMEA 0183 sentences and proprietary commands are described in section 2.2.

2.1.   Transmitted NMEA 0183 Sentences

By default, only certain NMEA sentences are enabled for transmission. Other sentences may be enabled individually for transmission via commands sent to the input channel.[2]

The standard transmission interval for most of the transmitted sentences is once per second. However, in models that include an integrated GPS, if every sentence were enabled for transmission, there would not be enough bandwidth in the output channel at

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[1] See the `$PAMTC,BAUD` command.
[2] See the `$PAMTC,EN` command.

4800 baud to output all sentences within a one second timeframe. Therefore, one or more of the following remedies should be employed:

- To conserve bandwidth, only enable for transmission those sentences required for the given application, and disable all others.

- Reduce the frequency of transmission for less critical sentences.

- Increase the overall bandwidth eightfold by increasing the baud rate from the standard 4800 baud to 38400 baud (though keep in mind that most NMEA 0183 instruments are not capable of operating at 38400 baud)

All NMEA sentences transmitted by the WeatherStation include a checksum at the end of the sentence, consisting of an asterisk (*) followed by two ASCII hexadecimal characters. In the detailed specifications to follow, these hexadecimal characters are designated by "hh".

The standard NMEA 0183 sentences provided by the WeatherStation are summarized in Table 1. Each of the transmitted sentences in Table 1 is described in detail on the subsequent pages.

The Maximum Length (chars) column in the table indicates an expected worst-case scenario that can be used for bandwidth budgeting. The total time in seconds required to transmit all enabled sentences in a single interval is

$$Total\_transmission\_time = \frac{Total\_number\_of\_characters \times 10}{baud\_rate}$$

Table 1: NMEA 0183 Regularly Transmitted Sentences[1]

Sentence	Description	PB100	LB100	Enabled by Default	Maximum Length (chars)
$GP**GGA**	GPS Fix Data	✓	No	✓ (PB100)	82
$GP**GLL**	Geographic Position – Latitude/Longitude	✓	No	No	48
$GP**GSA**	GNSS DOP and Active Satellites	✓	No	No	66
$GP**GSV**	GNSS Satellites in View	✓	No	No	70
$HC**HDG**	Heading, Deviation and Variation	✓	No	No	33
$WI**MDA**	Meteorological Composite. Barometric pressure, air temperature, relative humidity, dew point, wind direction, wind speed	✓	✓	✓	81
$WI**MWD**	Wind Direction and Speed, with respect to north	✓[2]	✓[2]	✓	41
$WI**MWV** (relative)	Wind Speed and Angle, in relation to the vessel's bow/centerline (relative)	✓	✓	✓	28
$WI**MWV** (theoretical)	Wind Speed and Angle, in relation to the vessel's bow/centerline (theoretical)	✓[2]	✓[2]	✓	28
$GP**RMC**	Recommended Minimum Specific GNSS Data	✓	No	No	74
$GP**VTG**	Course Over Ground and Ground Speed	✓	No	✓ (PB100)	42
$WI**VWR**	Relative Wind Speed and Angle	✓	✓	No	41
$WI**VWT**	True Wind Speed and Angle	✓	✓	✓[3]	41
$WI**XDR**	Transducer Measurements: wind chill and vessel attitude	✓	✓	No	73
$YX**XDR** (type A)	Transducer Measurements: wind chill, heat index, and station pressure	✓	✓	No	74
$YX**XDR** (type B)	Transducer Measurements: vessel attitude (pitch and roll)	✓	No	No	43
$GP**ZDA**	Time and Date	✓	No	✓ (PB100)	38

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[1] As of firmware version 1.011/1.003.

[2] True wind data is provided in the $WIMWD and $WIMWV (theoretical) sentences if SOG/COG, heading, and magnetic variation data are available from an internal or external GPS and compass.

[3] $WIVWT True Wind Speed and Angle referenced to water is provided only if water referenced speed is available via the NMEA 0183 input from an Airmar® Smart™ speed sensor.

$GP**GGA**

Summary

NMEA 0183 standard GPS Fix Data.

Syntax

```
$GPGGA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,
<9>,<10>,<11>,<12>,<13>,<14>*hh<CR><LF>
```

Fields

<1>   UTC of position, in the form hhmmss

<2>   Latitude, to the nearest .0001 minute

<3>   N if field <2> is North Latitude
            S if field <2> is South Latitude

<4>   Longitude, to the nearest .0001 minute

<5>   E if field <4> is East Longitude
            W if field <4> is West Longitude

<6>   GPS quality indicator:

            0 = Fix not available or invalid
            1 = GPS SPS Mode, fix valid
            2 = Differential GPS, SPS Mode, fix valid
            3 = GPS PPS Mode, fix valid
            4 = Real Time Kinematic (RTK)
            5 = Float RTK
            6 = Estimated (dead reckoning) Mode
            7 = Manual Input Mode
            8 = Simulator Mode

            When providing data from the WeatherStation's internal GPS, the only valid values for the GPS quality indicator are 0 and 1.

<7>   Number of satellites in use, 0-12

<8>   Horizontal dilution of precision (HDOP)

<9>   Altitude relative to mean-sea-level (geoid), meters (to the nearest whole meter)

<10>   M

<11>   Geoidal separation, meters (to the nearest whole meter). This field is not provided by the WeatherStation, and appears as a null field.

`<12>`   M. This field is not provided by the WeatherStation, and appears as a null field.

`<13>`   Age of Differential GPS data, seconds. This field is not provided by the WeatherStation, and appears as a null field.

`<14>`   Differential reference station ID, 0000-1023. This field is not provided by the WeatherStation, and appears as a null field.

Default State

Enabled. Transmitted once per second.

Notes

This sentence is not available in the LB100.

This sentence may be enabled or disabled via the $PAMTC,EN,GGA command. However, if the WeatherStation receives a VTG or RMC sentence from an external GPS, then this sentence shall not be transmitted.

$GP**GLL**

Summary

NMEA 0183 standard Geographic Position – Latitude/Longitude.

Syntax

$GPGLL,<1>,<2>,<3>,<4>,<5>,<6>,<7>*hh<CR><LF>

Fields

<1>   Latitude, to the nearest .0001 minute

<2>   N if field <1> is North Latitude
          S if field <1> is South Latitude

<3>   Longitude, to the nearest .0001 minute

<4>   E if field <3> is East Longitude
          W if field <3> is West Longitude

<5>   UTC of position, in the form hhmmss

<6>   Status:
                  A = data valid; V = data invalid

<7>   Mode indicator:

          A = Autonomous mode
          D = Differential mode
          E = Estimated (dead reckoning) mode
          M = Manual input mode
          S = Simulator mode
          N = Data not valid

          The only values transmitted by the WeatherStation for the Mode
          indicator are A and N.

Default State

Disabled. Once per second when enabled.

Notes

This sentence is not available in the LB100.

This sentence may be enabled via the $PAMTC,EN,GLL command. However, if
the WeatherStation receives a VTG or RMC sentence from an external GPS, then
this sentence shall not be transmitted.

$GP**GSA**

Summary

NMEA 0183 standard GNSS DOP and Active Satellites.

Syntax

```
$GPGSA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,
<12>,<13>,<14>,<15>,<16>,<17>*hh<CR><LF>
```

Fields

`<1>`	M = Manual, forced to operate in 2D or 3D mode A = Automatic, allowed to automatically switch 2D/3D
`<2>`	1 = Fix not available 2 = 2D fix 3 = 3D fix
`<3>-<14>`	ID numbers of satellites used in solution
`<15>`	Positional Dilution of Precision (PDOP). This field is null unless the GPS has a 3D fix.
`<16>`	Horizontal Dilution of Precision (HDOP). This field is null unless the GPS has either a 2D fix or a 3D fix.
`<17>`	Vertical Dilution of Precision (VDOP). This field is null unless the GPS has a 3D fix.

Default State

Disabled. Once per second when enabled.

Notes

This sentence is not available in the LB100.

This sentence may be enabled via the $PAMTC,EN,GSA command. However, if the WeatherStation receives a VTG or RMC sentence from an external GPS, then this sentence shall not be transmitted.

$GP**GSV**

Summary

NMEA 0183 standard GNSS Satellites in View.

Syntax

```
$GPGSV,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,
<12>,<13>,<14>,<15>,<16>,<17>,<18>,<19>*hh<CR><LF>
```

Fields

<1>   Total number of GSV sentences (1 to 3 for internal GPS in WeatherStation)

<2>   Sentence number (1, 2, or 3)

<3>   Total number of satellites in view

<4>   Satellite ID number, 1st SV

<5>   Elevation degrees, 0 to 90, to the nearest degree, 1st SV

<6>   Azimuth, degrees True, to the nearest degree, 1st SV

<7>   SNR (C/No) 00-99 dB-Hz, 1st SV (null field if satellite not tracked)

<8>   Satellite ID number, 2nd SV

<9>   Elevation degrees, 0 to 90, to the nearest degree, 2nd SV

<10>   Azimuth, degrees True, to the nearest degree, 2nd SV

<11>   SNR (C/No) 00-99 dB-Hz, 2nd SV (null field if satellite not tracked)

<12>   Satellite ID number, 3rd SV

<13>   Elevation degrees, 0 to 90, to the nearest degree, 3rd SV

<14>   Azimuth, degrees True, to the nearest degree, 3rd SV

<15>   SNR (C/No) 00-99 dB-Hz, 3rd SV (null field if satellite not tracked)

<16>   Satellite ID number, 4th SV

<17>   Elevation degrees, 0 to 90, to the nearest degree, 4th SV

<18>   Azimuth, degrees True, to the nearest degree, 4th SV

<19>   SNR (C/No) 00-99 dB-Hz, 4th SV (null field if satellite not tracked)

Default State

Disabled. Once per second when enabled. This sentence is transmitted in groups of up to three instances, containing data for up to 4 satellites with each instance, for a total of up to 12 satellites. Fields <1> and <3> only contain data in the first instance; they are null fields in the second and third instances.

Notes

This sentence is not available in the LB100.

This sentence may be enabled via the $PAMTC,EN,GSV command. However, if the WeatherStation receives a VTG or RMC sentence from an external GPS, then this sentence shall not be transmitted.

$HC**HDG**

Summary

NMEA 0183 standard Heading, Deviation and Variation.

Syntax

```
$HCHDG,<1>,<2>,<3>,<4>,<5>*hh<CR><LF>
```

Fields

`<1>`   Magnetic sensor heading, degrees, to the nearest 0.1 degree.

`<2>`   Magnetic deviation, degrees east or west, to the nearest 0.1 degree.

`<3>`   E if field <2> is degrees East
W if field <2> is degrees West

`<4>`   Magnetic variation, degrees east or west, to the nearest 0.1 degree.

`<5>`   E if field <4> is degrees East
W if field <4> is degrees West

Default State

Disabled. Twice per second when enabled.

Notes

This sentence is not available in the LB100.

This sentence may be enabled or disabled via the $PAMTC,EN,HDG command.
However, if the WeatherStation receives heading data in a HDG sentence from an
external compass, then this sentence shall not be transmitted.

$WI**MDA**

Summary

NMEA 0183 standard Meteorological Composite.

Syntax

```
$WIMDA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,
<12>,<13>,<14>,<15>,<16>,<17>,<18>,<19>,<20>*hh
<CR><LF>
```

Fields

`<1>`	Barometric pressure, inches of mercury, to the nearest 0.01 inch
`<2>`	I = inches of mercury
`<3>`	Barometric pressure, bars, to the nearest .001 bar
`<4>`	B = bars
`<5>`	Air temperature, degrees C, to the nearest 0.1 degree C
`<6>`	C = degrees C
`<7>`	Water temperature, degrees C (this field left blank by WeatherStation)
`<8>`	C = degrees C (this field left blank by WeatherStation)
`<9>`	Relative humidity, percent, to the nearest 0.1 percent
`<10>`	Absolute humidity, percent (this field left blank by WeatherStation)
`<11>`	Dew point, degrees C, to the nearest 0.1 degree C
`<12>`	C = degrees C
`<13>`	Wind direction, degrees True, to the nearest 0.1 degree
`<14>`	T = true
`<15>`	Wind direction, degrees Magnetic, to the nearest 0.1 degree
`<16>`	M = magnetic
`<17>`	Wind speed, knots, to the nearest 0.1 knot
`<18>`	N = knots
`<19>`	Wind speed, meters per second, to the nearest 0.1 m/s
`<20>`	M = meters per second

Default State

Enabled. Transmitted once per second.

Notes

This sentence may be enabled or disabled via the $PAMTC,EN,MDA command.

The barometric pressure provided in this sentence is the *altimeter setting*, which is the barometric pressure corrected for altitude above sea level. See the transmitted $YXXDR(A) sentence, and the received $PAMTC,ALT command, for further information.

$WIMWD

Summary

NMEA 0183 standard Wind Direction and Speed, with respect to north.

Syntax

`$WIMWD,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>*hh<CR><LF>`

Fields

<1>	Wind direction, 0.0 to 359.9 degrees True, to the nearest 0.1 degree
<2>	T = True
<3>	Wind direction, 0.0 to 359.9 degrees Magnetic, to the nearest 0.1 degree
<4>	M = Magnetic
<5>	Wind speed, knots, to the nearest 0.1 knot.
<6>	N = Knots
<7>	Wind speed, meters/second, to the nearest 0.1 m/s.
<8>	M = Meters/second

Default State

Enabled. Transmitted once per second.

Notes

The wind speed and direction data provided in this sentence are calculated using vector math based on the measured apparent wind speed and direction, SOG and COG from a GPS, compass heading, and magnetic variation. If any of these data are not available, this sentence shall be transmitted with null fields.

The SOG, COG, and compass heading data used in the calculation may be provided by the internal GPS (if installed), internal compass (if installed), and/or from an external compass and GPS. The decision as to which data will be used is determined by the precedence rules defined in section 2.2.1.

This sentence may be enabled or disabled via the $PAMTC,EN,MWD command.

$WI**MWV**

Summary

NMEA 0183 standard Wind Speed and Angle, in relation to the vessel's bow/centerline.

Syntax

```
$WIMWV,<1>,<2>,<3>,<4>,<5>*hh<CR><LF>
```

Fields

<1>   Wind angle, 0.0 to 359.9 degrees, in relation to the vessel's bow/centerline, to the nearest 0.1 degree. If the data for this field is not valid, the field will be blank.

<2>   Reference:
R = Relative (apparent wind, as felt when standing on the moving ship)
T = Theoretical (calculated actual wind, as though the vessel were stationary)

<3>   Wind speed, to the nearest tenth of a unit. If the data for this field is not valid, the field will be blank.

<4>   Wind speed units:
K = km/hr
M = m/s
N = knots
S = statute miles/hr

In the WeatherStation, this field always contains "N" (knots).

<5>   Status:
A = data valid; V = data invalid

Default State

MWV(R): Enabled. Transmitted twice per second.
MWV(T): Enabled. Transmitted once per second.

Notes

Depending on the contents of the Reference field (field <2>), this sentence provides either relative (apparent) wind or theoretical (true) wind data, both in relation to the bow of the vessel. As it is conceivable that both of these forms could be useful simultaneously, the WeatherStation by default outputs this sentence twice, once in each form.

To enable/disable the theoretical (true) form of this sentence, use the $PAMTC,EN,MWVT command. To enable/disable the relative (apparent) form, use the $PAMTC,EN,MWVR command.

$GP**RMC**

Summary

    NMEA 0183 standard Recommended Minimum Specific GNSS Data.

Syntax

    `$GPRMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,`
    `<9>,<10>,<11>,<12>*hh<CR><LF>`

Fields

`<1>`	UTC of position, in the form hhmmss
`<2>`	Status: A = Data Valid; V = Navigation Receiver Warning
`<3>`	Latitude, to the nearest .0001 minute
`<4>`	N if field <2> is North Latitude S if field <2> is South Latitude
`<5>`	Longitude, to the nearest .0001 minute
`<6>`	E if field <4> is East Longitude W if field <4> is West Longitude
`<7>`	Speed Over Ground, knots, to the nearest 0.1 knot
`<8>`	Course Over Ground, degrees True, to the nearest 0.1 degree
`<9>`	Date: ddmmyy
`<10>`	Magnetic Variation, degrees E/W, to the nearest 0.1 degree
`<11>`	E if field <10> is degrees East W if field <10> is degrees West
`<12>`	Mode indicator:

        A = Autonomous mode
        D = Differential mode
        E = Estimated (dead reckoning) mode
        M = Manual input mode
        S = Simulator mode
        N = Data not valid

        The only values transmitted by the WeatherStation for the Mode indicator are A and N.

Default State

    Disabled. Once per second when enabled.

Notes

This sentence is not available in the LB100.

This sentence may be enabled or disabled via the $PAMTC,EN,RMC command. However, if the WeatherStation receives a VTG or RMC sentence from an external GPS, then this sentence shall not be transmitted.

$GP**VTG**

Summary

NMEA 0183 standard Course Over Ground and Ground Speed.

Syntax

```
$GPVTG,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>
```

Fields

<1> Course Over Ground, degrees True, to the nearest 0.1 degree

<2> T = True

<3> Course Over Ground, degrees Magnetic, to the nearest 0.1 degree

<4> M = Magnetic

<5> Speed Over Ground, knots, to the nearest 0.1 knot

<6> N = Knots

<7> Speed Over Ground, km/hr, to the nearest 0.1 km/hr

<8> K = km/hr

<9> Mode indicator:

A = Autonomous mode
D = Differential mode
E = Estimated (dead reckoning) mode
M = Manual input mode
S = Simulator mode
N = Data not valid

The only values transmitted by the WeatherStation for the Mode indicator are A and N.

Default State

Enabled. Transmitted once per second.

Notes

This sentence is not available in the LB100.

This sentence may be enabled or disabled via the $PAMTC,EN,VTG command. However, if the WeatherStation receives a VTG or RMC sentence from an external GPS, then this sentence shall not be transmitted.

$WI**VWR**

Summary

NMEA 0183 Relative (Apparent) Wind Speed and Angle. Wind angle in relation to the vessel's heading, and wind speed measured relative to the moving vessel.

Syntax

$WIVWR,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>*hh<CR><LF>

Fields

<1>   Measured wind angle relative to the vessel, 0 to 180°, left/right of vessel heading, to the nearest 0.1 degree

<2>   L = left, or R = right

<3>   Measured wind speed, knots, to the nearest 0.1 knot

<4>   N = knots

<5>   Wind speed, meters per second, to the nearest 0.1 m/s

<6>   M = meters per second

<7>   Wind speed, km/h, to the nearest km/h

<8>   K = km/h

Default State

Disabled. Transmitted once per second if enabled.

Notes

This sentence may be enabled or disabled via the $PAMTC,EN,VWR command.

$WIVWT

Summary

NMEA 0183 True wind angle in relation to the vessel's heading, and true wind speed referenced to the water. True wind is the vector sum of the Relative (apparent) wind vector and the vessel's velocity vector relative to the water along the heading line of the vessel. It represents the wind at the vessel if it were stationary relative to the water and heading in the same direction.

Syntax

```
$WIVWT,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>*hh<CR><LF>
```

Fields

<1>   Calculated wind angle relative to the vessel, 0 to 180°, left/right of vessel heading, to the nearest 0.1 degree

<2>   L = left, or R = right

<3>   Calculated wind speed, knots, to the nearest 0.1 knot

<4>   N = knots

<5>   Wind speed, meters per second, to the nearest 0.1 m/s

<6>   M = meters per second

<7>   Wind speed, km/h, to the nearest km/h

<8>   K = km/h

Default State

Disabled, but automatically enabled if water speed is provided via the NMEA 0183 input. Transmitted once per second when enabled.

Notes

This sentence can be manually enabled or disabled via the $PAMTC,EN,VWT command.

$WIXDR

Summary

NMEA 0183 Transducer Measurements. Used in the WeatherStation to provide wind chill data, and vessel attitude (pitch and roll) data.

Syntax

```
$WIXDR,<1>, <2>, <3>, <4>,
       <5>, <6>, <7>, <8>,
       <9>, <10>,<11>,<12>,
       <13>,<14>,<15>,<16>
       *hh<CR><LF>
```

Fields

<1>   C = temperature

<2>   Calculated "relative" wind chill temperature, degrees Celsius, to the nearest 0.1 degree

<3>   C = degrees C

<4>   WCHR (ID indicating relative wind chill)

<5>   C = temperature

<6>   Calculated "theoretical" wind chill temperature, degrees Celsius, to the nearest 0.1 degree

<7>   C = degrees C

<8>   WCHT (ID indicating theoretical wind chill)

<9>   A = angular displacement

<10> Pitch: oscillation of vessel about its latitudinal axis. Bow moving up is positive. Value reported to the nearest 0.1 degree.

<11> D = degrees

<12> PTCH (ID indicating pitch of vessel)

<13> A = angular displacement

<14> Roll: oscillation of vessel about its longitudinal axis. Roll to the starboard is positive. Value reported to the nearest 0.1 degree.

<15> D = degrees

<16> ROLL (ID indicating roll of vessel)

Default State

      Disabled. Transmitted once per second when enabled.

Notes

      The $WIXDR sentence is provided for backward compatibility. It is recommended to use the newer $YXXDR(A) and $YXXDR(B) sentences, instead, which provide more information.

      The fields in the $WIXDR sentence are grouped in sets of four. There may be up to four sets, with four fields per set, in a single transmitted $WIXDR sentence. Each set contains, in order, the four fields <Type>, <Data>, <Units>, and <ID>. If for some reason the contents of a given set are not available, then the entire set (including commas) may be omitted. It is necessary when parsing any XDR sentence to examine the <ID> field in each set of four fields in order to identify the meaning of the data in that set.

      The $WIXDR sentence may be enabled via the $PAMTC,EN,XDR command.

      The wind chill temperature is the perceived temperature on a person's face at the current wind speed. The calculation assumes that the wind speed measured by the sensor is the same as the wind speed at the face of an observer. The "relative" wind chill uses the measured apparent wind speed for this calculation, and the "theoretical" wind chill uses the calculated true wind speed.

      The reported pitch and roll values are adjusted by the azimuth, pitch, and roll offsets established with the $PAMTC,ATTOFF command.

      At this writing, the pitch and roll features are only provided in PB100 units with hardware version 3. Model LB100 does not provide pitch and roll. The $PAMTC,QV query can be used to determine the hardware version for a given unit.

$YX**XDR**

Summary

NMEA 0183 Transducer Measurements. Used in the PB100 WeatherStation to provide wind chill, heat index, barometric station pressure, and vessel attitude (pitch and roll) data.

IMPORTANT NOTE: See the discussion in the Notes section below regarding the behavior of the XDR sentence with regard to null fields and commas.

Syntax

```
$YXXDR,<1>, <2>, <3>, <4>,
       <5>, <6>, <7>, <8>,
       <9>, <10>,<11>,<12>,
       <13>,<14>,<15>,<16>
       *hh<CR><LF>
```

Fields

There are two versions of this sentence, the "A" version, and the "B" version.

The fields in the A version of the XDR sentence are as follows:

<1>   C = temperature

<2>   Calculated "relative" wind chill temperature, degrees Celsius, to the nearest 0.1 degree

<3>   C = degrees C

<4>   WCHR (ID indicating relative wind chill)

<5>   C = temperature

<6>   Calculated "theoretical" wind chill temperature, degrees Celsius, to the nearest 0.1 degree

<7>   C = degrees C

<8>   WCHT (ID indicating theoretical wind chill)

<9>   C = temperature

<10>   Calculated heat index, degrees Celsius, to the nearest 0.1 degree

<11>   C = degrees C

<12>   HINX (ID indicating heat index)

<13>   P = pressure

<14>   Actual measured barometric pressure, or "station pressure", bars, to the nearest 0.001 bar

<15>   B = bars

<16>   STNP (ID indicating station pressure)

The fields in the B version of the XDR sentence are as follows:

<1>   A = angular displacement

<2>   Pitch: oscillation of vessel about its latitudinal axis. Bow moving up is positive. Value reported to the nearest 0.1 degree.

<3>   D = degrees

<4>   PTCH (ID indicating pitch of vessel)

<5>   A = angular displacement

<6>   Roll: oscillation of vessel about its longitudinal axis. Roll to the starboard is positive. Value reported to the nearest 0.1 degree.

<7>   D = degrees

<8>   ROLL (ID indicating roll of vessel)

<9>   Not used

<10>   Not used

<11>   Not used

<12>   Not used

<13>   Not used

<14>   Not used

<15>   Not used

<16>   Not used

Default State

$YXXDR(A): Disabled. Transmitted once per second when enabled.
$YXXDR(B): Disabled. Transmitted twice per second when enabled.

Notes

The fields in an XDR sentence are grouped in sets of four. There may be up to four sets, with four fields per set, in a single transmitted XDR sentence. Each set contains, in order, the four fields <Type>, <Data>, <Units>, and <ID>. If for some reason the contents of a given set are not available, then the entire set (including commas) may be omitted.

Because there are two versions of the XDR sentence, and because a group of four fields can be omitted entirely, it is necessary when parsing any XDR sentence to examine the <ID> field in each set of four fields in order to identify the meaning of the data in that set.

The XDR(A) sentence may be enabled via the $PAMTC,EN,XDRA command. The XDR(B) sentence may be enabled via the $PAMTC,EN,XDRB command.

The **wind chill temperature** is the perceived temperature on a person's face at the current wind speed. The calculation assumes that the wind speed measured by the sensor is the same as the wind speed at the face of an observer. The "relative" wind chill uses the measured apparent wind speed for this calculation, and the "theoretical" wind chill uses the calculated true wind speed. The wind chill temperature is only defined when the air temperature is below 50°F (10°C) and the wind speed is above 3 mph.

The **heat index** is the apparent temperature felt by a person's skin when exposed to air with a high moisture content. Dry air allows evaporative cooling of the skin's surface. The higher the humidity, the less the skin can cool itself with evaporative cooling. The heat index is only defined when air temperature is above 80°F (27°C) and relative humidity is above 40%.

The barometric **station pressure** is the raw, uncorrected barometric pressure reading. This is provided here in the XDRA sentence, and is distinct from the *altimeter setting*, which is the barometric pressure corrected for altitude, provided in the MDA sentence.

The reported **pitch and roll** values are adjusted by the azimuth, pitch, and roll offsets established with the $PAMTC,ATTOFF command.

The B version of the XDR sentence is not available in the model LB100.

$GP**ZDA**

Summary

NMEA 0183 standard Time and Date

Syntax

    $GPZDA,<1>,<2>,<3>,<4>,<5>,<6>*hh<CR><LF>

Fields

    `<1>`   UTC of position, in the form hhmmss

    `<2>`   Day, 01 to 31

    `<3>`   Month, 01 to 12

    `<4>`   Year, four digits (e.g. 2006)

    `<5>`   Local zone hours, always set to 00 in PB100

    `<6>`   Local zone minutes, always set to 00 in PB100

Default State

Enabled. Transmitted once per second.

Notes

This sentence is not available in the LB100.

This sentence may be enabled or disabled via the $PAMTC,EN,ZDA command. However, if the WeatherStation receives a VTG or RMC sentence from an external GPS, then this sentence shall not be transmitted.

2.2. Received NMEA 0183 Sentences and Commands

The WeatherStation has an NMEA 0183-compliant input channel that is capable of receiving standard NMEA sentences as well as proprietary commands for initialization, calibration, or to modify the behavior of the unit.

All received sentences and commands can include or omit the NMEA checksum. If a checksum is included, the sentence will be checked against its checksum, and the sentence will be accepted only if there is a checksum match. If the NMEA checksum is excluded, it is required that the preceding asterisk (*) also be excluded. If no checksum is provided, the WeatherStation will accept the sentence without error checking. It is recommended that all sentences and commands provided to the WeatherStation include a checksum to help ensure integrity of the transmitted data.

The sentences recognized by the WeatherStation on the serial input channel are summarized in Table 2 on the next page.

Note that the prefix "$--" appearing in the descriptions for several of the listed sentences should be replaced by a "$" followed by the two-character talker ID of the transmitting device.

Each of the sentences in Table 2 is described in detail on the subsequent pages.

Table 2: NMEA 0183 Received Sentences and Commands

Sentence or Command	Description
$--HDG	Standard NMEA Heading, Deviation, and Variation
$--RMC	Standard NMEA Recommended Minimum Specific GNSS Data (for magnetic variation, SOG, COG)
$--VHW	Standard NMEA Water Speed and Heading (for water speed)
$--VTG	Standard NMEA COG and SOG
$PAMTC,ALT	Program the PB100 WeatherStation with altitude settings
$PAMTC,ATTOFF	Program the WeatherStation with angular attitude offsets: azimuth, pitch, and roll
$PAMTC,BAUD	Change the baud rate from the nominal 4800 baud to 38400 baud
$PAMTC,EN	Enable/disable transmission of specific sentences, and change their rate of transmission
$PAMTC,ERST	Reset the user portion of nonvolatile EEPROM to factory defaults
$PAMTC,OPTION	Enable/disable certain WeatherStation features
$PAMTC,QV	Query WeatherStation hardware and firmware versions
$PAMTC,RESET	Reset the WeatherStation
$PAMTX	Pause or resume all automatic transmission of messages

2.2.1. Precedence of Data

In a given installation, certain data items might be available from more than one source. In this circumstance, the following precedence rules apply. The calculation of true wind, in particular, depends on these precedence rules.

SOG/COG:
$--VTG supersedes $--RMC, which supersedes the WeatherStation's internal GPS. Note that to be valid, SOG and COG must both be available from the same source.

Magnetic Variation:

$--HDG supersedes $--VTG, which supersedes $--RMC, which supersedes the WeatherStation internal calculation. The internal calculation determines magnetic variation using the present position and the date: these data provided from an external GPS will supersede the data from the internal GPS.

Heading and Deviation:

$--HDG supersedes the internal compass. (Note: if heading is supplied in a received $--VHW sentence, it is ignored.)

NMEA 0183 RECEIVED SENTENCE

$--**HDG**

Summary

NMEA 0183 standard Heading, Deviation and Variation.

Syntax

```
$--HDG,<1>,<2>,<3>,<4>,<5>*hh<CR><LF>
```

Fields

`<1>`	Magnetic sensor heading, degrees.
`<2>`	Magnetic deviation, degrees east or west.
`<3>`	E if field <2> is degrees East W if field <2> is degrees West
`<4>`	Magnetic variation, degrees east or west.
`<5>`	E if field <4> is degrees East W if field <4> is degrees West

Notes

See section 2.2.1. for precedence rules regarding data received via this sentence.

$--**RMC**

Summary

NMEA 0183 standard Recommended Minimum Specific GNSS Data.

Syntax

```
$--RMC,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,
<9>,<10>,<11>,<12>*hh<CR><LF>
```

Fields

<1>   UTC of position

<2>   Status: A = Data Valid; V = Navigation Receiver Warning

<3>   Latitude

<4>   N if field <2> is North Latitude
        S if field <2> is South Latitude

<5>   Longitude

<6>   E if field <4> is East Longitude
        W if field <4> is West Longitude

<7>   Speed Over Ground, knots

<8>   Course Over Ground, degrees True

<9>   Date: ddmmyy

<10>   Magnetic Variation, degrees E/W

<11>   E if field <10> is degrees East
        W if field <10> is degrees West

<12>   Mode indicator:

        A = Autonomous mode
        D = Differential mode
        E = Estimated (dead reckoning) mode
        M = Manual input mode
        S = Simulator mode
        N = Data not valid

Notes

See section 2.2.1. for precedence rules regarding data received via this sentence.

$--**VHW**

Summary

NMEA 0183 standard Water Speed and Heading.

Syntax

`$--VHW,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>*hh<CR><LF>`

Fields

<1>   Compass Heading, degrees True

<2>   T = true

<3>   Compass Heading, degrees Magnetic

<4>   M = magnetic

<5>   Water speed, knots

<6>   N = knots

<7>   Water speed, km/h

<8>   K = km/h

Notes

This sentence is used to obtain water speed from an Airmar® Smart™ speed sensor. The water speed data is used to calculate true wind relative to the water.

The compass heading fields in this sentence are ignored by the WeatherStation.

$--**VTG**

Summary

NMEA 0183 standard Course Over Ground and Ground Speed.

Syntax

```
$--VTG,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>
```

Fields

<1>   Course Over Ground, degrees True

<2>   T = True

<3>   Course Over Ground, degrees Magnetic

<4>   M = Magnetic

<5>   Speed Over Ground, knots

<6>   N = Knots

<7>   Speed Over Ground, km/hr

<8>   K = km/hr

<9>   Mode indicator:

      A = Autonomous mode
      D = Differential mode
      E = Estimated (dead reckoning) mode
      M = Manual input mode
      S = Simulator mode
      N = Data not valid

Notes

See section 2.2.1. for precedence rules regarding data received via this sentence.

$PAMTC

Summary

Prefix for recognized proprietary commands.

Syntax

`$PAMTC,<1>…*hh<CR><LF>`

Fields

`<1>`   Command mnemonic. This may be any of the following:

```
ALT
ATTOFF
BAUD
EN
ERST
OPTION
QV
RESET
```

The number and meaning of any subsequent fields is dependent on the command mnemonic. Each of the command mnemonics defines a separate proprietary command (or set of commands) recognized by the WeatherStation. These commands are each described in their own section on the following pages.

$PAMTC,**ALT**

Summary

Settings related to the altitude of the PB100.

Syntax

One of the following forms:

`$PAMTC,ALT,SET,<2>,<3>,<4>*hh<CR><LF>`

`$PAMTC,ALT,Q*hh<CR><LF>`

Fields

`<2>` Fixed altitude, -999.99 meters to +40,000.00 meters, to the nearest 0.01 meter.

Default value = 0 meters

`<3>` 0 = Do not use fixed altitude for GPS 2D mode
1 = Use fixed altitude for GPS 2D mode

Default value = 1

`<4>` 0 = Do not use altitude for barometric pressure altimeter setting ($WIMDA, fields 1 and 3)

1 = Barometric pressure altimeter setting uses fixed altitude (field <2>).

2 = Barometric pressure altimeter setting uses GPS altitude when GPS has a 3D fix, or fixed altitude (field <2>) when GPS does not have a 3D fix.

Default value = 2.

Notes

The $PAMTC,ALT,SET,<2>,<3>,<4> command is used to program the PB100 WeatherStation with a fixed altitude setting to be used in calculating a more accurate GPS position when the GPS is operating in 2D mode, and in calculating the barometric pressure altimeter setting provided in fields 1 and 3 of the transmitted $WIMDA sentence.

Fields <3> and<4> of the $PAMTC,ALT,SET command define how to use the altitude setting provided in field <2>.

All of the parameters of the $PAMTC,ALT,SET command are stored in nonvolatile EEPROM memory within the PB100, and so remain programmed even after cycling power. If any of the fields <2>, <3>, or <4> are null fields, the corresponding stored value will remain unchanged.

The $PAMTC,ALT,Q command is used to query the values of the parameters currently programmed into the PB100. The unit will reply with

> $PAMTR,ALT,*a,b,c*

where *a, b,* and c correspond to fields <2>, <3>, and <4>, respectively, in the $PAMTC,ALT,SET command.

See also:

> NMEA 0183 received proprietary sentence $PAMTC,OPTION, option 2.
>
> NMEA 0183 transmitted sentence $WIMDA (barometric pressure altimeter setting)
>
> NMEA 0183 transmitted sentence $YXXDR (barometric pressure station pressure).

$PAMTC,**ATTOFF**

Summary

A set of proprietary commands to set and query the angular attitude offsets for the WeatherStation.

Syntax

One of the following forms:

$PAMTC,ATTOFF,SET,<3>,<4>,<5>*hh<CR><LF>

$PAMTC,ATTOFF,Q*hh<CR><LF>

Fields

<3>   Signed azimuth offset (yaw, or bow offset), degrees, to the nearest tenth of a degree. The value must be between -180.0 and +180.0 degrees. Negative values indicate the forward mark on the sensor housing is oriented toward the starboard side of the vessel; positive values toward the port side.

<4>   Signed pitch offset, degrees, to the nearest tenth of a degree. The value must be between -45.0 and +45.0 degrees. Positive values indicate the sensor is tilted forward toward the bow; negative values indicate the sensor is tilted aftward.

<5>   Signed roll offset, degrees, to the nearest tenth of a degree. The value must be between -45.0 and +45.0 degrees. Positive values indicate the sensor is tilted toward the port side; negative values toward the starboard side.

Notes

The $PAMTC,ATTOFF,SET,<3>,<4>,<5> command is used to program the WeatherStation with the attitude offset angles when the sensor is not oriented parallel to the centerline, and perpendicular to the deck of the vessel. The programmed values are stored in nonvolatile EEPROM memory within the WeatherStation, and so remain programmed even after cycling power. If any of the fields <3>, <4>, or <5> are null fields, the corresponding stored value will remain unchanged.

The $PAMTC,ATTOFF,Q command is used to query the values of the attitude offset angles currently programmed into the WeatherStation. The unit will reply with

$PAMTR,ATTOFF,*a,b,c*

where a is the current signed azimuth offset value, b is the current signed pitch offset value, and c is the current signed roll offset value. All values are reported to the nearest tenth of a degree.

The factory default value for all three parameters is 0.0 degrees.

The azimuth offset angle is used to adjust the apparent wind angle relative to the bow of the vessel, and the vessel's heading when using the internal compass. These values are further used in calculating the true wind speed and angle.

The azimuth offset angle, along with the pitch and roll offset angles are also used to adjust the reported pitch and roll values in the transmitted $WIXDR sentence. A properly set azimuth offset angle will allow the unit to accurately report pitch and roll of the vessel, even though the orientation mark on the sensor housing may not be facing precisely toward the bow. The recommended procedure to set these offsets is as follows:

1. If the unit is mounted on a vessel, this procedure should be performed with calm water and no wind, and with the vessel at rest.

2. First, zero out all offsets by sending the command $PAMTC,ATTOFF,SET,0,0,0.

3. Determine the desired azimuth offset angle, and program this into the sensor using the command $PAMTC,ATTOFF,SET,$a$ where a is the azimuth offset of the sensor relative to the bow, in degrees. The pitch and roll offset fields should be omitted for this step (or set to zeroes).

4. Allow the vessel to stabilize to its "level" state, and then read the values of pitch and roll that are reported by the XDR sentence. If the vessel is rocking back and forth, then take a number of readings and calculate an average for both pitch and roll.

5. Program the *negated* versions of these measured pitch and roll values back into the unit with the $PAMTC,ATTOFF,SET,,$b,c$ sentence. For example, if the XDR sentence reports an average pitch angle of 6.2 degrees, and an average roll angle of -4.3 degrees, then you would send the sentence $PAMTC,ATTOFF,SET,,-6.2,4.3 to the WeatherStation. Note that the azimuth offset field in this sentence is a null field, indicating we are not changing its value at this time.

6. At this point the transmitted XDR sentences should be producing values that are centered around 0.0 degrees for both pitch and roll.

7. The programmed attitude offset values may be checked at any time by sending the command $PAMTC,ATTOFF,Q to the unit; it will reply with $PAMTR,ATTOFF,$a,b,c$.

$PAMTC,**BAUD**

Summary

Change the baud rate for both the transmitting and receiving NMEA 0183 channels.

Syntax

One of the following forms:

```
$PAMTC,BAUD,4800*hh<CR><LF>
```

```
$PAMTC,BAUD,38400*hh<CR><LF>
```

Notes

The $PAMTC,BAUD command may be used to increase the baud rate from the standard 4800 baud to 38400 baud. This will provide an eightfold increase in the bandwidth of the NMEA 0183 interface, allowing more data to be transmitted in a given period of time.

On power up, the NMEA input and output interfaces always default to 4800 baud.

It is recommended to employ the following sequence when changing the baud rate for the WeatherStation from 4800 baud to 38400 baud. The following assumes there is a single host device communicating with the WeatherStation:

1. Send the $PAMTX command to the WeatherStation (at 4800 baud) to temporarily disable transmission of periodic sentences.

2. Send the $PAMTC,BAUD,38400 command (at 4800 baud) to instruct the WeatherStation to change its baud rate to 38400. The unit will finish transmitting any periodic sentences in progress at 4800 baud, and will then change its interface to use 38400 baud.

3. Delay a short interval within the host to allow reception of any remaining queued sentences from the WeatherStation at 4800 baud.

4. Change the baud rate on the host's serial port to 38400 baud.

5. Send the $PAMTX,1 command to the WeatherStation (at 38400 baud) to resume transmission of periodic sentences.

6. All subsequent communication with the WeatherStation will be at 38400 baud, until the unit is powered down or reset, or the $PAMTC,BAUD,4800 command is sent to the unit.

Note that a baud rate of 38400 does not comply with the NMEA 0183 standard.

$PAMTC,**EN**

Summary

    Enable or disable the periodic transmission of individual standard NMEA 0183 sentences, and specify their rate of transmission.

Syntax

    One of the following forms:

    `$PAMTC,EN,<2>,<3>,<4>*hh<CR><LF>`

    `$PAMTC,EN,S*hh<CR><LF>`

    `$PAMTC,EN,L*hh<CR><LF>`

    `$PAMTC,EN,LD*hh<CR><LF>`

    `$PAMTC,EN,Q*hh<CR><LF>`

Fields

    `<2>`   The identifier `ALL`, or one of the following sentence ID's:

        Model PB100:
            `GGA, GLL, GSA, GSV, HDG, MDA, MWD, MWVR, MWVT, RMC, VTG, VWR, VWT, XDR, XDRA, XDRB, ZDA`

        Model LB100:
            `MDA, MWD, MWVR, MWVT, VWR, VWT, XDR, XDRA`

    `<3>`   If field <2> is the `ALL` identifier, then

            0 = disable transmission of all sentences
            1 = enable transmission of all sentences.

        Otherwise,

            0 = disable transmission of the specified sentence
            1 = enable transmission of the specified sentence

    `<4>`   The amount of time between successive transmissions of the specified sentence, in tenths of a second. For example, if field <4> contains the value 5, this specifies an interval of 0.5 seconds between successive transmissions of the specified sentence.

        If field <2> is the `ALL` identifier, then field <4> specifies the transmission interval for all sentences.

Notes

The factory default settings are as follows:

Sentence ID	Enabled by default?	Default Transmission Interval
GGA	✓[1]	10
GLL	–	10
GSA	–	10
GSV	–	10
HDG	–	5
MDA	✓	10
MWD	✓	10
MWV (R)	✓	5
MWV (T)	✓	10
RMC	–	10
VTG	✓[1]	10
VWR	–	10
VWT	✓	10
XDR	–	10
XDRA	–	10
XDRB	–	5
ZDA	✓[1]	10

[1] PB100 only

Note that the MWV sentence appears in two forms: relative (R) and theoretical (T). These two forms are enabled separately.

Also note that the XDR sentence appears in three forms: $WIXDR, $YXXDR(A), and $YXXDR(B). These three forms are enabled separately.

If either of fields <3> or <4> is a null field, then that field will remain unchanged from its previous value.

The selections as to which sentences are enabled for transmission, and the rate at which each sentence is transmitted, are stored in nonvolatile EEPROM memory within the WeatherStation unit. On power up, these settings are copied from EEPROM into a working copy in RAM memory. It is the working copy in RAM that determines the behavior of the WeatherStation, with regard to the transmission of sentences.

Any changes to these settings using the $PAMTC,EN,<2>,<3>,<4> command only affect the working copy in RAM. When power is lost, the changes to the working copy in RAM will be lost.

The **$PAMTC,EN,S** command causes the contents of the current working copy in RAM to be saved to EEPROM. The saved settings will then be restored to RAM each time power is applied to the unit.

The **$PAMTC,EN,L** command allows the settings to be reloaded from EEPROM to RAM without cycling power to the unit. This can be used to discard any changes made to the working copy in RAM, and restore the saved settings as though the unit had been turned off and then back on again.

The **$PAMTC,EN,LD** command loads the factory default settings from ROM memory into RAM memory.

Note that the $PAMTC,ERST command (see separate description) differs from the $PAMTC,EN,LD command in that $PAMTC,ERST will initialize *all* of user EEPROM memory to its factory default settings. This includes settings unrelated to the selection of transmitted sentences.

The above paragraphs are summarized in the below figure.
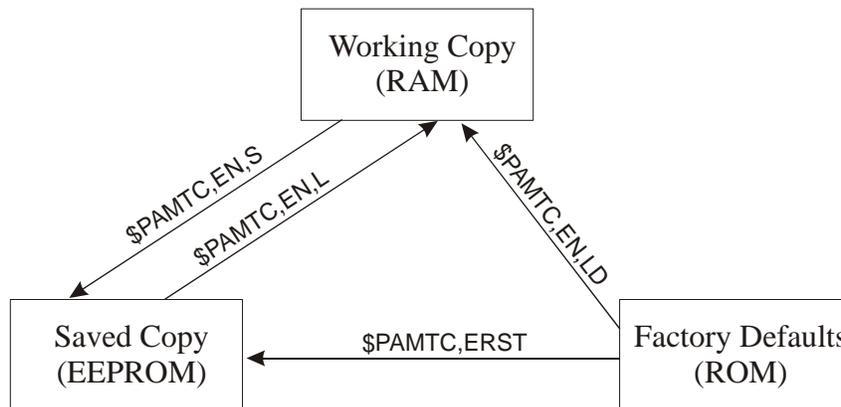
The **$PAMTC,EN,Q** command provides a query function to allow reading the current settings from the working copy in RAM. The reply to the $PAMTC,EN,Q command is a series of sentences with the following format:

```
$PAMTR,EN,<1>,<2>,<3>,<4>,<5>*hh<CR><LF>
```

where

      $<1> =$ Total number of $PAMTR,EN sentences in the reply
      $<2> =$ Sentence number
      $<3> =$ Sentence ID (GGA, GLL, GSA, GSV, HDG, MDA, MWD, MWVR,
             MWVT, RMC, VTG, VWR, VWT, or XDR)

      $<4> =$ 0 or 1 (0=disabled, 1=enabled)

          <5> = Transmission interval (tenths of a second)

For example, a unit programmed with only the factory default settings would provide the
following as a reply to the $PAMTC,EN,Q command:

```
$PAMTR,EN,17,1,GGA,1,10*17
$PAMTR,EN,17,2,GLL,0,10*13
$PAMTR,EN,17,3,GSA,0,10*00
$PAMTR,EN,17,4,GSV,0,10*10
$PAMTR,EN,17,5,HDG,0,5*2C
$PAMTR,EN,17,6,MDA,1,10*19
$PAMTR,EN,17,7,MWD,1,10*0E
$PAMTR,EN,17,8,MWVR,1,5*75
$PAMTR,EN,17,9,MWVT,1,10*46
$PAMTR,EN,17,10,RMC,0,10*3B
$PAMTR,EN,17,11,VTG,1,10*22
$PAMTR,EN,17,12,VWR,0,10*36
$PAMTR,EN,17,13,VWT,1,10*30
$PAMTR,EN,17,14,XDR,0,10*2D
$PAMTR,EN,17,15,XDRA,0,10*6D
$PAMTR,EN,17,16,XDRB,0,5*59
$PAMTR,EN,17,17,ZDA,1,10*3E
```

Keep in mind when enabling sentences that the overall bandwidth of the interface should
not be exceeded. At 4800 baud, only 480 characters can be transmitted in a one second
period of time. If every one of the above sentences were enabled for transmission, their
total number of characters could exceed 800. It is possible to use the $PAMTC,EN
command to overspecify the amount of data transmitted, beyond the bandwidth capacity
of the NMEA output channel. See section 2.1. for further information regarding bus
bandwidth.

Examples

    <u>Example 1:</u>

    To disable all sentences for transmission, except transmit compass heading 5
    times per second, and save the settings in EEPROM, send the following sequence
    of commands to the unit:

        $PAMTC,EN,ALL,0
        $PAMTC,EN,HDG,1,2
        $PAMTC,EN,S

    <u>Example 2:</u>

    To reload the factory defaults for the $PAMTC,EN settings into EEPROM
    without affecting other EEPROM settings (such as attitude offsets set with the

$PAMTC,ATTOFF command), send the following sequence of commands to the unit:

$PAMTC,EN,LD
$PAMTC,EN,S

Example 3:

To enable transmission of the XDR sentence and set it to transmit at the slow rate of once every 10 seconds *for the current session only*, send the following command to the unit:

$PAMTC,EN,XDR,1,100

Example 4:

To disable transmission of the MWV(T) sentence permanently:

$PAMTC,EN,MWVT,0
$PAMTC,EN,S

Example 5:

To enable transmission of all of the GPS-related sentences, and disable all others, for the current session only:

$PAMTC,EN,ALL,0
$PAMTC,EN,GGA,1
$PAMTC,EN,GLL,1
$PAMTC,EN,GSA,1
$PAMTC,EN,GSV,1
$PAMTC,EN,RMC,1
$PAMTC,EN,VTG,1
$PAMTC,EN,ZDA,1

$PAMTC,**ERST**

Summary

Reset the user portion of nonvolatile EEPROM to its factory default state.

Syntax

```
$PAMTC,ERST*hh<CR><LF>
```

Notes

The following data items are saved in nonvolatile EEPROM within the WeatherStation. For each item, the default value, and the command used to change the value is shown.

Item	Default value	Changed via command
Azimuth offset	0.0°	$PAMTC,ATTOFF
Pitch offset	0.0°	$PAMTC,ATTOFF
Roll offset	0.0°	$PAMTC,ATTOFF
List of sentences enabled for transmission	See the description for the $PAMTC,EN command	$PAMTC,EN
Rates of transmission of sentences	See the description for the $PAMTC,EN command	$PAMTC,EN
Allow COG to be used instead of internal compass heading in true wind calculations	Disabled	$PAMTC,OPTION
GPS fix 2D, 3D, or Auto	Auto	$PAMTC,OPTION
Altitude settings	0,1,2	$PAMTC,ALT

Other items related to factory calibration of the sensor are also saved in EEPROM, but these items are not affected by the $PAMTC,ERST command.

$PAMTC,**OPTION**

Summary

Enable or disable certain WeatherStation features, or query their state.

Syntax

One of the following forms:

`$PAMTC,OPTION,SET,<3>,<4>*hh<CR><LF>`

`$PAMTC,OPTION,Q,<3>*hh<CR><LF>`

Fields

Option 1:

`<3>`   1 = Allow COG to be used instead of internal compass heading in true wind calculations

`<4>`   1 = Feature enabled
0 = Feature disabled (default)

Option 2:

`<3>`   2 = Set GPS fix mode

`<4>`   1 = 2D fix only
2 = 3D fix only
3 = Automatic selection of 2D or 3D mode (default)

Notes

Option 1:

If the local magnetic inclination (dip) is severe, this can produce errors in the compass heading when the vessel is not level. Since the compass heading is used in the calculations for true wind, this can also result in errors in the reported true wind speed and direction. (Apparent wind is not affected.)

The WeatherStation can be instructed to use Course Over Ground (COG) provided by the internal GPS in place of the internal compass heading in the calculations for true wind. The command to enable this feature is $PAMTC,OPTION,SET,1,1. If this feature is enabled, then the COG will be used instead of internal compass heading *for calculation of true wind only* if the GPS

has achieved a fix, and if the Speed Over Ground (SOG) is greater than 3 knots. If there is no GPS fix, or if the SOG is 3 knots or less, then the internal compass heading will be used.

Do be aware when using this feature that Heading and COG are not the same. Heading refers to the direction the bow of the vessel is *pointing*. COG refers to the direction the vessel is *traveling*. While in an automobile these values are likely to be nearly identical, in a boat they can differ because of the effects of wind and current on the vessel. The rationale for using COG instead of heading in the calculations for true wind is that the difference between COG and actual heading might be less than the error in the reported compass heading due to dip.

The setting is saved in nonvolatile EEPROM within the WeatherStation.

To disable this feature, use the command $PAMTC,OPTION,SET,1,0. When disabled, the COG will not be used in place of internal compass heading under any circumstances.

The WeatherStation may be queried to determine the state of this feature. If the command $PAMTC,OPTION,Q,1 is received, the unit will transmit the reply $PAMTR,OPTION,1,0 if the feature is disabled, or $PAMTR,OPTION,1,1 if enabled.

Option 2:

The GPS receiver in the PB100 can calculate a position fix when it has achieved a lock on at least three GPS satellites. If it has achieved a lock on four or more satellites, the unit may be able to calculate a *3D position fix*, meaning it can determine latitude, longitude, and altitude. But if it has achieved a lock on only three satellites, it may only be able to calculate a *2D position fix*, meaning it can determine latitude and longitude, but not altitude.

By default, the unit will automatically calculate a 3D position fix if it is able to, but will fall back to 2D position fixing if there are not enough satellites being tracked.

It is possible to restrict the operation of the GPS to only allow 3D position fixes by sending the unit the command $PAMTC,OPTION,SET,2,2. If this is done, then the unit will not calculate a position fix until it has achieved a lock on at least four satellites.

Note that sometimes the GPS may be tracking at least four satellites, but is still unable to calculate a position fix. This is because the positions of the satellites in the sky must be satisfactory in order to achieve good geometry in the fix calculation, as determined by the HDOP, VDOP, and PDOP values.

It is also possible to restrict the operation of the GPS to only allow 2D position fixes by sending the unit the command $PAMTC,OPTION,SET,2,1.

To re-enable the automatic selection of 2D versus 3D fix calculations, send the unit the command $PAMTC,OPTION,SET,2,3.

This setting is stored in EEPROM within the unit, and retrieved on power up.

The current setting may be queried by issuing the $PAMTC,OPTION,Q,2 command. The unit will respond with the sentence $PAMTR,OPTION,Q,2,<4>, where the value of <4> is 1, 2, or 3, corresponding to 2D, 3D, or Automatic mode, respectively.

When calculating a 2D position fix, the latitude/longitude values may have a relatively large error if the altitude of the GPS receiver is not set appropriately. This can be corrected by programming a fixed altitude offset into the unit. See the $PAMTC,ALT command on page 35.

Note that sometimes the GPS may be tracking at least four satellites, but is still unable to calculate a position fix. This is because the positions of the satellites in the sky must be satisfactory in order to achieve good geometry in the fix calculation, as determined by the HDOP, VDOP, and PDOP values.

$PAMTC,**POST**

Summary

      Perform the Power-On Self Test.

Syntax

      `$PAMTC,POST*hh<CR><LF>`

The WeatherStation will reply with a sentence in the following form:

      `$PAMTR,POST,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,`
      `<9>,<10>,<11>*hh<CR><LF>`

Each of the fields <1> through <11> contains an integer value that represents the status of a simple test performed on a given submodule within the WeatherStation. For each field, a value of 0 (zero) indicates the unit passed the respective test; a nonzero value indicates a possible problem was discovered with the given submodule. Therefore, a properly operating unit would reply with $PAMTR,POST,0,0,0,0,0,0,0,0,0,0,0.

The fields and their corresponding submodules are listed below.

where

      `<1>` = Internal communication between microprocessors
      `<2>` = Factory EEPROM
      `<3>` = User EEPROM
      `<4>` = Air temperature sensor
      `<5>` = Plate temperature sensor
      `<6>` = Relative humidity sensor
      `<7>` = Barometric pressure sensor
      `<8>` = Wind sensor
      `<9>` = Compass sensor
      `<10>` = GPS receiver
      `<11>` = Attitude sensor

Notes

      The various tests performed for the POST function are simple tests to determine if the hardware is minimally responding to software stimuli. The POST function should not be regarded as a comprehensive indicator that a given unit is healthy. In other words, it is possible that a defective unit might still pass the POST operation. However, the POST can be useful to identify certain types of problems with the WeatherStation.

Certain models of the WeatherStation may omit some features in the hardware. For example, model LB100 omits the internal GPS receiver, compass sensor, and attitude sensor. In this case, the corresponding fields in the POST sentence will be null (blank) fields.

The Power-On Self Test is performed automatically a few seconds after applying power to the unit.

$PAMTC,**QV**

Summary

      Query version information.

Syntax

      `$PAMTC,QV*hh<CR><LF>`

The WeatherStation will reply with a sentence in the following form:

`$PAMTR,QV,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>`

    where

        `<1>` = Part number
        `<2>` = Hardware version
        `<3>` = OEM option
        `<4>` = Serial number of unit
        `<5>` = Bootloader 1 firmware version
        `<6>` = Application 1 firmware version
        `<7>` = Bootloader 2 firmware version
        `<8>` = Application 2 firmware version
        `<9>` = GPS module version

$PAMTC,**RESET**

Summary

Reset the WeatherStation.

Syntax

```
$PAMTC,RESET*hh<CR><LF>
```

The WeatherStation will reset as though power had been removed and reapplied. All settings will revert to their power-on defaults.

$PAMTX

Summary

Suspend and resume transmission of NMEA sentences.

Syntax

`$PAMTX,<1>*hh<CR><LF>`

Fields

`<1>`   0 = temporarily suspend transmission of all NMEA sentences. (default)

1 = resume transmission

Notes

Upon receiving this sentence, the WeatherStation will suspend transmission of all future NMEA sentences after the currently transmitting sentence has completed.

If the $PAMTX command is received with no fields present (i.e. $PAMTX*50<CR><LF> or $PAMTX<CR><LF>, the default case shall prevail, i.e. transmission of sentences will be suspended.

Transmission of NMEA sentences will resume when one of the following has occurred:

- A `$PAMTX,1` command has been received.

- The power to the WeatherStation has been cycled.

- A `$PAMTC,RESET` command has been received.

3. Revision History

Revision 1.000
Date: 12/14/05
Description: Initial release.

Revision 1.001
Date: 1/17/06
Description: Added pitch and roll, and POST sections.

Revision 1.002
Date: 2/22/06
Description: Expanded $PAMTC,EN description, and explanation of XDR sentences. This revision corresponds to the release of firmware version 1.005/1.001.

Revision 1.003
Date: 6/1/06
Description: Added details specific to model LB100, and new $PAMTC,OPTION command. This revision corresponds to the release of firmware version 1.006/1.002.

Revision 1.004
Date: 12/1/06
Description: Modified default enabled sentences to now enable GGA and VTG, and disable RMC. This revision corresponds to the release of firmware version 1.007/1.002.

Revision 1.005
Date: 12/12/06
Description: Added transmitted ZDA sentence. Updated description of $PAMTC,EN. This revision corresponds to the release of firmware version 1.011/1.003.

Revision 1.006
Date: 2/15/07
Description: Added transmitted $YXXDR sentences. Added received $PAMCT,ALT command. Added received $PAMTC,OPTION,,2 command. Removed $PAMTC,LAMP. Updated descriptions of $PAMTC,EN and $WIMDA. This revision corresponds to the release of firmware version 1.015/1.005.

Revision 1.007
Date: 3/22/07
Description: Added station pressure fields to transmitted $YXXDR(A) sentence, which was inadvertently omitted from previous revision.