

WX Series WeatherStation Technical Manual

**(Derivative Products Include 300WXR, 300WX, 150WX, 100WX w/CAN,
100WX)**

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- DRAFT -

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

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2. Revision History

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1. Introduction

The WX Series of WeatherStation Sensors are a family of multifunctional devices that integrates several sensors into a single compact housing. These sensors include some of the following depending on the configuration:

- Ultrasonic anemometer, providing apparent wind speed and direction
- Thermistor, providing air temperature
- Piezoresistive pressure sensor, providing barometric pressure
- Capacitive humidity sensor, providing relative humidity
- Magnetoinductive XYZ sensors, providing tilt-compensated magnetic compass heading (3D compass)
- 3-axis MEMS¹ accelerometer, providing pitch and roll angles
- MEMS rate gyro, providing rate-of-turn , pitch rate, and roll rate of the vessel
- Global Positioning System (GPS) receiver with 10 Hz update rate, providing position, and speed and course over ground
- Polyvinylidene fluoride (**PVDF**) rain sensor, providing rain rate and accumulated rain measurements
- Thermistor providing the operating temperature of the main processor board
- Voltage sensor providing the board/network voltage

In addition to the above directly measured parameters, the WX Series WeatherStation Sensor is able to calculate the following values as well, if the necessary data are available:

- True wind speed and direction
- Heading relative to true north
- Apparent wind chill temperature
- True wind chill temperature
- True wind speed relative to water (with optional Airmar[®] Smart[™] speed sensor, not included)

¹ MEMS is an acronym for Micro Electro-Mechanical Systems

The WX Series WeatherStation Sensor has one communication interfaces with the NMEA 0183 protocol.

This document provides detailed descriptions of the communications protocols for the NMEA 0183 interface used by the WX Series WeatherStation Sensor.

For further information about the NMEA 0183 protocol, refer to the document, *NMEA 0183 Standard for Interfacing Marine Electronic Devices, v4.00*. This document is available from the National Marine Electronics Association (www.nmea.org).

1. NMEA 0183 Interfaces

The Airmar WX Series WeatherStation Sensor may have a single standard NMEA 0183-compliant output channel, and a single standard NMEA 0183-compliant input channel. If so, 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 1.1. Received NMEA 0183 sentences and proprietary commands are described in section

1.1. 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 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 WX Series WeatherStation Sensor include a checksum at the end of the sentence, consisting of an asterisk (*) followed by two ASCII

¹ See the \$PAMTC, BAUD command.

² See the \$PAMTC, EN command.

hexadecimal characters. In the detailed specifications to follow, these hexadecimal characters are designated by “hh”.

The standard NMEA 0183 sentences provided by the WX Series WeatherStation Sensor 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

<u>Sentence</u>	<u>Description</u>	<u>Enabled by Default</u>	<u>Maximum Length (chars)</u>	<u>WXR300</u>
\$GPD TM	Datum Reference	No	47	✓
\$GPGGA	GPS Fix Data	✓	82	✓
\$GPGLL	Geographic Position – Latitude/Longitude	No	48	✓
\$GPGSA	GNSS DOP and Active Satellites	No	66	✓
\$GPGSV	GNSS Satellites in View	No	70	✓
\$HCHDG	Heading, Deviation and Variation	No	33	✓
\$HCHDT	Heading relative to True North	No	19	✓
\$WIMDA	Meteorological Composite. Barometric pressure, air temperature, relative humidity, dew point, wind direction, wind speed	✓	81	✓
\$WIMWD	Wind Direction and Speed, with respect to north ¹	✓	41	✓
\$WIMWV (relative)	Wind Speed and Angle, in relation to the vessel's bow/centerline (relative)	✓	28	✓
\$WIMWV (theoretical)	Wind Speed and Angle, in relation to the vessel's bow/centerline (theoretical) ¹	✓	28	✓
\$GPRMC	Recommended Minimum Specific GNSS Data	No	74	✓
\$TIROT	Rate of Turn	✓	22	✓
\$HCTHS	True Heading and Status	No	19	✓
\$GPVTG	Course Over Ground and Ground Speed	✓	42	✓
\$WIVWR	Relative Wind Speed and Angle	No	41	✓
\$WIVWT	True Wind Speed and Angle	✓ ²	41	✓

¹ True wind data is provided in the \$WIMWD and \$WIMWV (theoretical) sentences if SOG/COG, heading, and magnetic variation data are available from the internal GPS and compass.

² \$WIVWT True Wind Speed and Angle referenced to water is provided only if water referenced speed is available via the NMEA 0183 input or from the NMEA 2000[®] bus from an Airmar[®] Smart[™] speed sensor.

<u>Sentence</u>	<u>Description</u>	<u>Enabled by Default</u>	<u>Maximum Length (chars)</u>	<u>WXR300</u>
\$YXXDR (type A)	Transducer Measurements: wind chill, heat index, and station pressure	No	74	✓
\$YXXDR (type B)	Transducer Measurements: vessel attitude (pitch and roll)	No	43	✓
\$YXXDR (type C)	Transducer Measurements: Accelerometers	No	?	✓
\$YXXDR (type D)	Transducer Measurements: Rate gyros: Pitch, Roll, Yaw	No	?	✓
\$YXXDR (type E)	Transducer Measurements: Rate gyros: Pitch, Roll, Yaw (Raw)	No	?	✓
\$YXXDR (type H)	Transducer Measurements: Heater temperatures and voltages	No	?	✓
\$WIXDR (type R)	Transducer Measurements: rain	No	?	✓
\$YXXDR (type T)	Transducer Measurements: Internal temperatures and voltages	No	?	✓
\$WIXDR (type W)	Transducer Measurements: Raw wind phase values	No	?	✓
\$GPZDA	Time and Date	✓	38	✓

\$GPD^TM

\$PAMTC,EN: DTM	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
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Summary

NMEA 0183 standard Datum Reference.

Syntax

\$GPD^TM, <1>, <2>, <3>, <4>, <5>, <6>, <7>, <8>*hh<CR><LF>

Fields

- <1> Three character alphabetical code for local datum:
W84 (WGS84)
W72 (WGS72)
S85 (SGS85)
P90 (PE90)
or IHO datum code from the International Hydrographic Organization Publication S-60 Appendices B and C.
- <2> One character subdivision datum code when available, as defined in IHO Publication S-60 Appendices B and C.
- <3> Latitude offset, to the nearest .0001 minute
- <4> N if field <3> is North Latitude
S if field <3> is South Latitude
- <5> Longitude offset, to the nearest .0001 minute
- <6> E if field <5> is East Longitude
W if field <5> is West Longitude
- <7> Signed altitude offset, to the nearest meter
- <8> 3-character reference datum code:
W84 = WGS-84

Notes

Latitude and longitude offsets are positive numbers; the altitude offset may be negative. Offsets change with position; position in the local datum is offset from the position in the reference datum in the directions indicated:

$$P_{\text{local datum}} = P_{\text{ref datum}} + \text{offset}$$

KGS, OHI-A, OHI-B, OHI-C, OHI-D, OHI-M, SIR, P90, and S85 are not currently supported by the GPS Engine used in the the WX Series WeatherStation Sensor, and therefore are not available for use as Local Datum.

See also the proprietary NMEA 0183 command \$PAMTC,DATUM.

\$GPGGA

\$PAMTC,EN: GGA	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes
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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 WX Series WeatherStation Sensor's internal GPS, the only valid values for the GPS quality indicator are 0, 1, and 2.

- <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). In the WX Series WeatherStation Sensor, this field contains the separation data, if available, otherwise, it is not provided, and appears as a null field.
- <12> M. In the WX Series WeatherStation Sensor, this field contains M, if separation data is available, otherwise, it is not provided, and appears as a null field.
- <13> Age of Differential GPS data, seconds. This field is not provided by the WX Series WeatherStation Sensor, and appears as a null field.
- <14> Differential reference station ID, 0000-1023. This field is not provided by the WX Series WeatherStation Sensor, and appears as a null field.

Notes

\$GPGLL

\$PAMTC,EN: GLL	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
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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 WX Series WeatherStation Sensor for the Mode indicator are A, D, and N.

Notes

\$GPGSA

\$PAMTC,EN: GSA	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
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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 may be enabled via the \$PAMTC,EN,GSA command.

\$GPGSV

\$PAMTC,EN: GSV	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
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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 WX Series WeatherStation Sensor)
- <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)

Notes

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. Field <3> only contain data in the first instance; it is a null field in the second and third instances.

\$HCHDG

\$PAMTC,EN: HDG	Default Interval (m:ss.00) 0:0.50	Enabled By Default: No
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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

Notes

\$HCHDT

\$PAMTC,EN: HDT	Default Interval (m:ss.00) 0:0.50	Enabled By Default: No
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Summary

NMEA 0183 standard Heading relative to True North

Syntax

\$HCHDT, <1>, <2>*hh<CR><LF>

Fields

- <1> Heading relative to True North
- <2> T = True

Notes

The data in field <1> is only provided if both magnetic compass heading and magnetic variation values are available.

\$WIMDA

\$PAMTC,EN: MDA	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes
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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 the WX Series WeatherStation Sensor)
- <8> C = degrees C (this field left blank by the WX Series WeatherStation Sensor)
- <9> Relative humidity, percent, to the nearest 0.1 percent (this field left blank if the relative humidity sensor is not available in the WX Series WeatherStation Sensor, see Notes)
- <10> Absolute humidity, percent (this field left blank by the WX Series WeatherStation Sensor)
- <11> Dew point, degrees C, to the nearest 0.1 degree C (this field left blank if the relative humidity sensor is not available in the WX Series WeatherStation Sensor, see Notes)
- <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

Notes

This WX Series WeatherStation Sensor has a relative humidity sensor.

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

\$PAMTC,EN: MWD	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes
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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

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 the GPS, compass heading, and magnetic variation. If any of these data are not available, this sentence shall be transmitted with null fields.

\$WIMWV

\$PAMTC,EN: MWVR	Default Interval (m:ss.00) 0:0.50	Enabled By Default: Yes
\$PAMTC,EN: MWVT	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes

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 WX Series WeatherStation Sensor, this field always contains "N" (knots).
- <5> Status:
 - A = data valid; V = data invalid

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 WX Series WeatherStation Sensor may output this sentence twice, once in each form.

\$GPRMC

\$PAMTC,EN: RMC	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
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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 WX Series WeatherStation Sensor for the Mode indicator are A, D, and N.

Notes

\$TIROT

\$PAMTC,EN: ROT	Default Interval (m:ss.00) 0:0.50	Enabled By Default: Yes
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Summary

NMEA 0183 standard Rate of Turn.

Syntax

\$TIROT, <1>, <2>*hh<CR><LF>

Fields

- <1> Signed rate of turn, degrees per minute, to the nearest 0.1 degree.
Negative values indicate the bow is turning to port.
- <2> Status: A = Data Valid; V = Data Invalid.

Notes

NMEA 0183 TRANSMITTED SENTENCE

\$HC**THS**

\$PAMTC,EN: THS	Default Interval (m:ss.00) 0:0.50	Enabled By Default: No
-----------------	-----------------------------------	------------------------

Summary

NMEA 0183 standard True Heading and Status.

Syntax

\$HCTHS, <1>, <2>*hh<CR><LF>

Fields

- <1> Heading relative to True North
- <2> Mode indicator :
 - A = Autonomous
 - E = Estimated (dead reckoning)
 - M = Manual input
 - S = Simulator
 - V = Data not valid (including standby)

This field shall not be null.

Notes

The data in field <1> is only provided if both magnetic compass heading and magnetic variation values are available, otherwise field <1> is null and field <2> is 'V'. When heading is provided, field <2> will be 'A'.

\$GPVTG

\$PAMTC,EN: VTG	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes
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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 WX Series WeatherStation Sensor for the Mode indicator are A, D, and N.

Notes

\$WIVWR

\$PAMTC,EN: VWR	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
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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

Notes

\$WIVWT

\$PAMTC,EN: VWT	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes
-----------------	-----------------------------------	-------------------------

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

Notes

When enabled, automatically prohibited until water speed is provided via the NMEA 0183 input. Transmitted only when enabled and not prohibited.

\$--XDR

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide measurements not provided in the standard NMEA 0183 sentences. There are multiple versions of this sentence, for example, A, B, C, D, E, H, R, T, and W. Each version will be described in its own section, such as \$YX XDR-A.

Important 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 multiple 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.

\$YXXDR-A

\$PAMTC,EN: XDRA	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide wind chill, heat index, and barometric station pressure.

Syntax

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

Fields

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 (this field left blank if the relative humidity sensor is not available in the WX Series WeatherStation Sensor, see Notes)
- <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)

Notes

This WX Series WeatherStation Sensor has a relative humidity sensor.

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.

\$YXXDR-B

\$PAMTC,EN: XDRB

Default Interval (m:ss.00) 0:1.00

Enabled By Default: No

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide vessel attitude (pitch and roll) data.

Syntax

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

Fields

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)

Notes

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

\$YXXDR-C

\$PAMTC,EN: XDRC	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide x, y, z accelerometer readings.

Syntax

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

Fields

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

- <1> A = angular displacement
- <2> Acceleration of vessel along its latitudinal axis. Moving to starboard is positive. Value reported to the nearest 0.001g.
- <3> G = none defined (gravitational force)
- <4> XACC (ID indicating acceleration in x direction)
- <5> A = angular displacement
- <6> Acceleration of vessel along its longitudinal axis. Forward motion is positive. Value reported to the nearest 0.001g.
- <7> G = none defined (gravitational force)
- <8> YACC (ID indicating acceleration in y direction)
- <9> A = angular displacement
- <10> Acceleration of vessel along its vertical axis. Upward motion is positive. Value reported to the nearest 0.001g.
- <11> G = none defined (gravitational force)
- <12> ZACC (ID indicating acceleration in z direction)

Notes

\$YXXDR-D

\$PAMTC,EN: XDRD	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide compensated Roll, Pitch, and Yaw Rate readings, relative to the longitudinal axis of the locally level (“horizontal”) reference frame.

Syntax

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

Fields

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

- <1> A = angular displacement
- <2> Rate of turn about the vessel longitudinal axis. Vessel rolling to starboard is positive. Value reported to the nearest 0.001 degrees per second.
- <3> D = degrees (degrees per second)
- <4> RRAT (ID indicating roll rate)
- <5> A = angular displacement
- <6> Rate of turn about the locally level latitudinal axis. Bow moving up is positive. Value reported to the nearest 0.001 degrees per second.
- <7> D = degrees (degrees per second)
- <8> PRAT (ID indicating pitch rate)
- <9> A = angular displacement
- <10> Rate of turn about the locally vertical axis. Rotation of bow to starboard (clockwise) is positive. Value reported to the nearest 0.001 degrees per second.
- <11> D = degrees (degrees per second)
- <12> YRAT (ID indicating yaw rate)

Notes

\$YXXDR-E

\$PAMTC,EN: XDRE

Default Interval (m:ss.00) 0:1.00

Enabled By Default: No

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide raw Roll, Pitch, and Yaw Rate readings, relative to the vessel's frame of reference.

Syntax

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

Fields

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

- <1> A = angular displacement
- <2> Rate of turn about the vessel longitudinal axis. Vessel rolling to starboard is positive. Value reported to the nearest 0.001 degrees per second.
- <3> D = degrees (degrees per second)
- <4> RRTR (ID indicating roll rate)
- <5> A = angular displacement
- <6> Rate of turn about the vessel latitudinal axis. Bow moving up is positive. Value reported to the nearest 0.001 degrees per second.
- <7> D = degrees (degrees per second)
- <8> PRTR (ID indicating pitch rate)
- <9> A = angular displacement
- <10> Rate of turn about the vessel vertical axis. Rotation of bow to starboard (clockwise) is positive. Value reported to the nearest 0.001 degrees per second.
- <11> D = degrees (degrees per second)
- <12> YRTR (ID indicating raw yaw rate)

Notes

\$YXXDR-H

\$PAMTC,EN: XDRH	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide heater temperature and voltage readings.

Syntax

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

Fields

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

- <1> C = temperature
- <2> Plate temperature (lower heater), degrees Celsius, to the nearest 0.1 degree
- <3> C = degrees C
- <4> PLAT (ID indicating plate temperature)
- <5> C = temperature
- <6> Cap temperature (upper heater), degrees Celsius, to the nearest 0.1 degree.
- <7> C = degrees C
- <8> CAPT (ID indicating cap temperature)
- <9> U = voltage
- <10> Plate heater voltage.
- <11> V = Volts
- <12> PLAV (ID indicating plate heater voltage)
- <13> U = voltage
- <14> Cap heater voltage.
- <15> V = Volts
- <16> CAPV (ID indicating cap heater voltage)

Notes

\$WIXDR-R

\$PAMTC,EN: XDRR	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide rain measurements (WXR only).

Syntax

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

Fields

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

- <1> D = linear displacement
- <2> Accumulation of rain since last reset.
- <3> m = undefined (millimeters)
- <4> RAIN (ID indicating accumulated rain)
- <5> t = time
- <6> Duration of rain since last reset in seconds.
- <7> s = undefined (seconds)
- <8> DURA (ID indicating rain duration)
- <9> R = Rate
- <10> Rate or intensity of rainfall measured in mm / hour.
- <11> h = undefined (millimeters per hour)
- <12> RATE (ID indicating rain intensity / rate)
- <13> R = Rate
- <14> Peak rate or intensity of rainfall since last reset, measured in mm / hour.
- <15> h = undefined (millimeters per hour)
- <16> PEAK (ID indicating peak rain intensity / rate)

Notes

\$YXXDR-T

\$PAMTC,EN: XDRT	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide internal temperature and voltage readings.

Syntax

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

Fields

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

- <1> C = temperature
- <2> Air temperature reported by humidity sensor.
- <3> C = degrees C
- <4> HUMT (ID indicating temperature from humidity sensor)
- <5> C = temperature
- <6> Main board temperature (in WX Series WeatherStation Sensors, this comes from the barometric pressure sensor), degrees Celsius, to the nearest 0.1 degree
- <7> C = degrees C
- <8> BRDT (ID indicating main board temperature)
- <9> C = temperature
- <10> Upper / auxiliary board temperature, degrees Celsius, to the nearest 0.1 degree.
- <11> C = degrees C
- <12> UPPT (ID indicating auxiliary board temperature)
- <13> U = voltage
- <14> Main board / network voltage.
- <15> V = Volts
- <16> BRDV (ID indicating main board / network voltage)

Notes

\$WIXDR-W

\$PAMTC,EN: XDRW	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
------------------	-----------------------------------	------------------------

Summary

NMEA 0183 Transducer Measurements. Used in the WX Series WeatherStation Sensor to provide unfiltered wind measurements.

Syntax

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

Fields

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

- <1> A = angular displacement
- <2> Unfiltered apparent wind angle relative to sensor.
- <3> D = Degrees
- <4> WNDA (ID indicating unfiltered wind angle)
- <5> w = undefined (Wind Speed)
- <6> Unfiltered apparent wind speed relative to sensor.
- <7> N = Knots
- <8> WNDS (ID indicating unfiltered wind speed)

Notes

NMEA 0183 TRANSMITTED SENTENCE

\$GPZDA

\$PAMTC,EN: ZDA	Default Interval (m:ss.00) 0:1.00	Enabled By Default: Yes
-----------------	-----------------------------------	-------------------------

Summary

NMEA 0183 standard Time and Date.

Syntax

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

Fields

- <1> UTC time of day, in the form hhmmss
- <2> UTC day, 01 to 31
- <3> UTC month, 01 to 12
- <4> UTC year (four digits, e.g. 2006)
- <5> Local time zone hours, 00 to +/-13 hrs
- <6> Local time zone minutes, 00 to +59

Notes

Local time zone is the magnitude of hours plus the magnitude of minutes added, with the sign of local zone hours, to local time to obtain UTC. Local zone is generally negative for East longitudes with local exceptions near the International Date Line.

Examples:

At Chatham Is. (New Zealand) at 1230 (noon) local time on June 10, 1995:

```
$GPZDA,234500,09,06,1995,-12,45*6C<CR><LF>
```

In the Cook Islands at 1500 local time on June 10, 1995:

```
$GPZDA,013000,11,06,1995,10,30*4A<CR><LF>
```

The local time zone is not changeable via the NMEA 0183 interface.

NMEA 0183 TRANSMITTED SENTENCE

\$PAMTO

\$PAMTC,EN: PAMTO	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
-------------------	-----------------------------------	------------------------

Summary

Airmar proprietary sentence. Used in the WX Series WeatherStation Sensor to provide uncalibrated magnetometer data.

Syntax

```
$PAMTO, R, <1>, <2>, <3>  
*hh<CR><LF>
```

Fields

- R Indicates raw/uncalibrated magnetometer data.
- <1> X – magnetometer data.
- <2> Y – magnetometer data.
- <3> Z – magnetometer data.

Notes

\$PAMTOC

\$PAMTC,EN: PAMTOC	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
--------------------	-----------------------------------	------------------------

Summary

Airmar proprietary sentence. Used in the WX Series WeatherStation Sensor to provide calibrated magnetometer data.

Syntax

```
$PAMTO,C,<1>,<2>,<3>  
*hh<CR><LF>
```

Fields

C	Indicates calibrated magnetometer data.
<1>	X – magnetometer data.
<2>	Y – magnetometer data.
<3>	Z – magnetometer data.

Notes

\$PAMTRW

\$PAMTC,EN: PAMTRW	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
--------------------	-----------------------------------	------------------------

Summary

Airmar proprietary sentence. Used in the WX Series WeatherStation Sensor to provide raw wind phase data.

Syntax

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

Fields

- <1> Raw apparent wind phase data – north.
- <2> Raw apparent wind phase data – south.
- <3> Raw apparent wind phase data – east.
- <4> Raw apparent wind phase data – west.
- <5> Wind Valid Flags.

Notes

NMEA 0183 TRANSMITTED SENTENCE

\$PAMTW

\$PAMTC,EN: PAMTW	Default Interval (m:ss.00) 0:1.00	Enabled By Default: No
-------------------	-----------------------------------	------------------------

Summary

Airmar proprietary sentence. Used in the WX Series WeatherStation Sensor to provide filtered wind phase data.

Syntax

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

Fields

- <1> Filtered apparent wind phase data – north.
- <2> Filtered apparent wind phase data – south.
- <3> Filtered apparent wind phase data – east.
- <4> Filtered apparent wind phase data – west.
- <5> Wind Valid Flags.
- <6> Toffset.
- <7> Error_count.
- <8> Sum_threshold.
- <9> Settle_count.
- <10> Period_north.
- <11> Period_south.
- <12> Period_east,
- <13> Period_west.

Notes

1.2. Received NMEA 0183 Sentences and Commands

The WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor will accept the sentence without error checking. It is recommended that all sentences and commands provided to the WX Series WeatherStation Sensor include a checksum to help ensure integrity of the transmitted data.

The sentences recognized by the WX Series WeatherStation Sensor 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

<u>Sentence or Command</u>	<u>Description</u>
\$--VHW	Standard NMEA Water Speed and Heading (for water speed)
\$PAMTC,ALT	Program the WX Series WeatherStation Sensor with altitude settings
\$PAMTC,ATTOFF	Program the WX Series WeatherStation Sensor with angular attitude offsets: azimuth, pitch, and roll.
\$PAMTC,BAUD	Change the baud rate from the nominal 4800 baud to 38400 baud.
\$PAMTC,COMP	Control user compass calibration.
\$PAMTC,DATUM	Define the local datum to which GPS position locations are referenced.
\$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,HEATER	Control the WX Series WeatherStation Sensor internal heater.
\$PAMTC,LAMP	Control the WX Series WeatherStation Sensor windex lamp.
\$PAMTC,OPTION	Enable/disable certain WX Series WeatherStation Sensor features.
\$PAMTC,POST	Query Power On Self Test results.
\$PAMTC,QPS	Query part number and serial number strings.
\$PAMTC,QV	Query WX Series WeatherStation Sensor hardware and firmware versions.
\$PAMTC,RESET	Reset the WX Series WeatherStation Sensor.
\$PAMTC,SIM	Enable/disable Simulate Mode.
\$PAMTC,WIND	Control setting of user wind parameters.
\$PAMTX	Pause or resume all automatic transmission of messages.

\$--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 WX Series WeatherStation Sensor.

See section **Error! Reference source not found.** 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
COMP
DATUM
EN
ERST
HEATER
LAMP
OPTION
POST
QPS
QV
RESET
SIM
WIND
PAMTX

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 WX Series WeatherStation Sensor. These commands are each described in their own section on the following pages.

\$PAMTC,ALT

Summary

Settings related to the altitude of the WX Series WeatherStation Sensor.

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, -999.9 meters to +40,000.0 meters, to the nearest 0.1 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 = 0
- <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 WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor, 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 WX Series WeatherStation Sensor. 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 \$YXXDR (barometric pressure).

\$PAMTC,ATTOFF

Summary

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

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

Note that in the NMEA 0183 command, the arguments are in degrees. The values stored in the WX Series WeatherStation Sensor are in radians. Therefore, when using the \$PAMTC,ATTOFF command, there may be a slight rounding error causing the values read back from the WX Series WeatherStation Sensor to be different than the commanded values by one least significant digit.

The \$PAMTC,ATTOFF,SET,<3>,<4>,<5> command is used to program the WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor, 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 WX Series WeatherStation Sensor. 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 WX Series WeatherStation Sensor. 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 WX Series WeatherStation Sensor from 4800 baud to 38400 baud. The following assumes there is a single host device communicating with the WX Series WeatherStation Sensor:

1. Send the \$PAMTX command to the WX Series WeatherStation Sensor (at 4800 baud) to temporarily disable transmission of periodic sentences.
2. Send the \$PAMTC,BAUD,38400 command (at 4800 baud) to instruct the WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor (at 38400 baud) to resume transmission of periodic sentences.
6. All subsequent communication with the WX Series WeatherStation Sensor 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,COMP

Summary

User calibration commands for the internal compass sensor.

Syntax

One of the following forms:

\$PAMTC,COMP,GO*hh<CR><LF>

\$PAMTC,COMP,RESETALL*hh<CR><LF>

\$PAMTC,COMP,RESETCAL*hh<CR><LF>

\$PAMTC,COMP,RESETDAMP*hh<CR><LF>

\$PAMTC,COMP,SET,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

\$PAMTC,COMP,Q*hh<CR><LF>

\$PAMTC,COMP,X*hh<CR><LF>

\$PAMTC,COMP,VERIFY*hh<CR><LF>

\$PAMTC,COMP,GO

Summary

Manually initiate a user calibration sequence for the internal compass sensor. There is an alternative to issuing the “GO” command to start user compass calibration, called AutoCal. AutoCal is intended for users who do not have access to a user interface which allows them to manually start user compass calibration.

Syntax

`$PAMTC,COMP,GO*hh<CR><LF>`

Calibration needs to be done in calm seas, away from other boats or ferrous objects (structures or aids to navigation). Trying to turn a 2-3 minute circle in strong currents or congested areas will be difficult, if not hazardous.

The user calibration sequence for the WX Series WeatherStation Sensor is as follows:

1. The weather station instrument is installed on the vessel. The unit under test is powered up.
2. Manual Start: The `$PAMTC,COMP,GO*hh<CR><LF>` command is sent to the weather station instrument’s NMEA 0183 input channel to initiate user calibration mode.
AutoCal Start: Within 2 minutes of applying power to the weather station instrument being calibrated, the vessel must start a slow circular turn. If it completes a full circle within 2-3 minutes, AutoCal will enter the user compass calibration procedure (See steps 3-5).
3. During the user calibration process, the vessel is rotated slowly (driven at 2-4 knots, completing a circle within 2-3 minutes), while the sensor collects data. Once the weather station instrument has determined that enough data has been collected for the purpose of calculating the coefficients, it transmits the following sentence: `$PAMTR,COMP,XXXX,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>`. Where XXXX is “PASS” or “FAIL”.
4. If PASS was transmitted, then the offsets that are now in use and saved in EEPROM are the newly calculated ones.
5. Note: During user compass calibration, heading is not valid and will be output as NULL fields. Also, air temperature is set to 0 degrees Celsius. After calibration is complete, heading will again be valid, and if successful, air temperature will also return to the current temperature, but if calibration fails, air temperature will be output as -10.0 degrees Celsius for 30 seconds.

Reply

The weather station instrument will reply immediately with:

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

Where fields <1> through <9> contain the data from the weather station instrument's nonvolatile EEPROM, as defined in the "Q", Query Command.

Upon successful completion the weather station instrument will reply with:

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

Or, upon failure it will reply with:

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

Where x indicates the type of failure, 1 = Timeout, 2 = Tilt Error, or 3 = Other Error. Timeout errors: 5 minute timeout occurred before successful completion or more than 30 seconds was taken to turn thru 45 degrees. Other Errors: reversing the direction of the turn for more than 45 degrees, for example. The user compass calibration procedure can be aborted by purposely causing one of the above errors. For example, stopping the turn will cause an error within 30 seconds, or reversing the direction of the turn will cause an error even faster.

\$PAMTC,COMP,RESETALL

Summary

Reset the user calibration coefficients and damping control to the default values.

Syntax

\$PAMTC,COMP,RESETALL*hh<CR><LF>

Reply

The weather station instrument will reset the user calibration coefficients and damping control (fields 1-9) and reply with:

\$PAMTR,COMP,RESETALL,
<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

where fields <1> through <9> contain the data from the weather station instrument's nonvolatile EEPROM, as defined in the "Q", Query Command.

\$PAMTC,COMP,RESETCAL

Summary

Reset the user calibration coefficients to the default values.

Syntax

\$PAMTC,COMP,RESETCAL*hh<CR><LF>

Reply

The weather station instrument will reset the user calibration coefficients (fields 1 – 6) and reply with:

\$PAMTR,COMP,RESETCAL,
<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

where fields <1> through <9> contain the data from the weather station instrument's nonvolatile EEPROM, as defined in the "Q", Query Command.

\$PAMTC,COMP,RESETDAMP

Summary

Reset the user damping control to the default values.

Syntax

\$PAMTC,COMP,RESETDAMP*hh<CR><LF>

Reply

The weather station instrument will reset the user damping control (fields 7-9) and reply with:

\$PAMTR,COMP,RESETDAMP,
<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

where fields <1> through <9> contain the data from the weather station instrument's nonvolatile EEPROM, as defined in the "Q", Query Command.

\$PAMTC,COMP,SET

Summary

Set one or more user compass calibration coefficients.

Syntax

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

where fields <1> through <9> contain the data to be set into the weather station instrument's nonvolatile EEPROM corresponding to the fields as follows.

All fields are 16-bit signed fixed point decimal integers.

- <1> X axis Gain value, hundredths used as multiplier.
- <2> Y axis Gain value, hundredths used as multiplier.
- <3> Z axis Gain value, hundredths used as multiplier.
- <4> X axis linear offset, hundredths of micro-Teslas.
- <5> Y axis linear offset, hundredths of micro-Teslas.
- <6> Z axis linear offset, hundredths of micro-Teslas.
- <7> X axis angular offset, tenths of degrees.
- <8> Pitch and Roll Damping, twentieths of a second.
- <9> Compass/RateGyro Damping, twentieths of a second, negative numbers indicate that the rate gyro is to be used in compass computations.

Notes

Currently only Linear Offsets and Damping values are supported.

Valid ranges for data:

Gain: 50 to 500

Linear Offset: -32000 to +32000

X-Angular Offset: 0 to 3600

Pitch and Roll Damping: 0 to 200

Compass/RateGyro Damping: -2400 to 2400

\$PAMTC,COMP,Q

Summary

Query the weather station instrument for the stored user compass calibration coefficients.

Syntax

\$PAMTC,COMP,Q*hh<CR><LF>

Reply

The weather station instrument will reply with:

\$PAMTR,COMP,Q,
<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

where fields <1> through <9> contain the data from the weather station instrument's nonvolatile EEPROM corresponding to the fields as follows.

All fields are 16-bit signed fixed point decimal integers.

- | | |
|-----|---|
| <1> | X axis Gain value, hundredths used as multiplier. |
| <2> | Y axis Gain value, hundredths used as multiplier. |
| <3> | Z axis Gain value, hundredths used as multiplier. |
| <4> | X axis linear offset, hundredths of micro-Teslas. |
| <5> | Y axis linear offset, hundredths of micro-Teslas. |
| <6> | Z axis linear offset, hundredths of micro-Teslas. |
| <7> | X axis angular offset, tenths of degrees. |
| <8> | Pitch and Roll Damping, twentieths of a second. |
| <9> | Compass/RateGyro Damping, twentieths of a second, negative numbers indicate that the rate gyro is to be used in compass computations. |

Notes

Currently only Linear Offsets and Damping values are supported.
If in user calibration mode, the "Q" will be replaced by "INPROGRESS".
If a user calibration pass has been completed, the "Q" will be replaced by "PASS" or "FAIL".

\$PAMTC,COMP,X

Summary

Terminate the user compass calibration mode.

Syntax

\$PAMTC,COMP,X*hh<CR><LF>

Reply

\$PAMTR,COMP,X,
<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*hh<CR><LF>

Notes

Upon receiving \$PAMTC,COMP,X user calibration mode will be terminated, if it had been previously entered by a \$PAMTC,COMP,GO. The reply will always be issued.

If not in user calibration mode, the “X” will be replaced by “Q”.

\$PAMTC,COMP,VERIFY

Summary

Verify the user compass calibration mode.

Syntax

`$PAMTC,COMP,VERIFY*hh<CR><LF>`

The verify user calibration sequence for the WX Series WeatherStation Sensor is as follows:

1. The weather station instrument is installed on the vessel. The unit under test is powered up. User calibration has been completed successfully.
2. The `$PAMTC,COMP,VERIFY*hh<CR><LF>` command is sent to the weather station instrument's NMEA 0183 input channel to initiate user calibration mode.
3. During the verify user calibration process, the vessel is rotated slowly (driven in a circle) and the sensor calculates the resulting score. Once the weather station instrument has determined that enough data has been collected, it transmits the following sentence: `$PAMTR,COMP,SCORE,XXX*hh<CR><LF>`

Reply

The weather station instrument will reply immediately with:

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

Where fields <1> through <9> contain the data from the weather station instrument's nonvolatile EEPROM, as defined in the "Q", Query Command.

Upon successful completion the weather station instrument will reply with:

`$PAMTR,COMP,SCORE,XXX*hh<CR><LF>`

Where XXX is a score from 0 – 255, meaning TBD.

Or, upon failure it will reply with:

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

Where x indicates the type of failure, 1 = Timeout, 2 = Tilt Error, or 3 = Other Error.

\$PAMTC, DATUM

Summary

Define the local datum to which GPS position locations are referenced.

Syntax

One of the following forms:

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

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

Fields

- <3> Three character alphabetical code for local datum:
W84 (WGS84)
W72 (WGS72)
S85 (SGS85)
P90 (PE90)
or IHO datum code from the International Hydrographic
Organization Publication S-60 Appendices B and C.
- <4> One character subdivision datum code when available, as defined in
IHO Publication S-60 Appendices B and C.

Notes

The \$PAMTC,DATUM,SET,<3>,<4> command is used to establish the local datum used by the GPS receiver for calculating position. These values are stored in EEPROM memory within the unit. The default value for field <3> is W84 (WGS84). The default value for field <4> is a null field (no subdivision datum code).

Unlike other NMEA 0183 proprietary commands, if in the command \$PAMTC,DATUM,SET,<3>,<4> field <4> is a null field, the value will be actually set to null (no subdivision datum code).

The \$PAMTC,DATUM,Q command may be used to determine the current datum setting within the unit. Upon receiving this command, the unit will reply with \$PAMTR,DATUM,<3>,<4>, where fields <3> and <4> are as described above.

The value established by this command will be used by the transmitted \$GPDTM sentence.

KGS, OHI-A, OHI-B, OHI-C, OHI-D, OHI-M, SIR, P90, and S85 are not currently supported by the GPS Engine used in the WX Series WeatherStation Sensor, and therefore are not available for use as Local Datum.

Important Note: Chart transformations based on IHO S60 parameters may result in significant positional errors when applied to chart data.

\$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>[,<5>]*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:
DTM, GGA, GLL, GSA, GSV, HDG, HDT, MDA,
MWD, MWVR, MWVT, RMC, ROT, VTG, VWR, VWT,
XDRA, XDRB, ZDA
- <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. Value is 0-250, 0 to 25 seconds by tenths.
If field <2> is the ALL identifier, then field <4> specifies the transmission interval for all sentences.
- [<5>] Optional field used to specify the amount of time between successive

transmissions of the specified sentence in a new high precision format. This field is only used when field <4> is Null. The format is “m:ss.hh”. Where ‘m’ is minutes (0-174), ‘s’ is seconds (0-10440), and ‘hh’ is decimal seconds (0-99). The maximum number of hundredths of seconds is 1044013. Once the number of seconds is >= 60, the decimal seconds are ignored.

The query outputs 2 numbers, the interval in tenths of seconds and the interval in the m:ss.hh format. Some truncation will occur in the former, if the interval is not a multiple of tenths of seconds.

If the interval is less than 26 seconds and a multiple of tenths of seconds, the last field of the query (m:ss.hh) is dropped.

For example,

if field <5> contains this value	The interval is	Output of Query, tenths,m:ss.hh
5	5 seconds	50
5.50	5.5 seconds	55
59.50	59.5 seconds	595,000:59.50
1:30	1 minute, 30 seconds	900,001:30.00
6000	6000 seconds	60000,100:00.00
0:30.25	30.25 seconds	302,000:30.25
25	25 seconds	250
25.55	25.55 seconds	255,000:25.55
26	26 seconds	260,000:26.00

If field <2> is the ALL identifier, then field <5> specifies the transmission interval for all sentences.

Notes

While hundredths of seconds can be specified, the WX Series of WeatherStation Sensors is limited to .05 second granularity.

The factory default settings are as follows:

<u>Sentence ID</u>	<u>Enabled by default?</u>	<u>Default Transmission Interval</u>
DTM	No	0:1.00
GGA	Yes	0:1.00
GLL	No	0:1.00
GSA	No	0:1.00
GSV	No	0:1.00
HDG	Yes	0:1.00
HDT	No	0:1.00

MDA	Yes	0:1.00
MWD	No	0:1.00
MWV (R)	Yes	0:1.00
MWV (T)	No	0:1.00
RMC	Yes	0:1.00
ROT	No	0:1.00
VTG	No	0:1.00
VWR	No	0:1.00
VWT	No	0:1.00
XDR (A)	Yes	0:1.00
XDR (B)	Yes	0:1.00
XDR (C)	No	0:1.00
XDR (D)	Yes	0:1.00
XDR (E)	No	0:1.00
XDR (H)	No	0:1.00
XDR (T)	No	0:1.00
XDR (W)	No	0:1.00
ZDA	No	0:1.00

Build the above table from the control file.

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 multiple. These forms are also enabled separately.

If field <3> is a null field, then that field will remain unchanged from its previous value.

If both field <4> and <5> are null fields, then the interval 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 WX Series WeatherStation Sensor. 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 WX Series WeatherStation Sensor, 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.

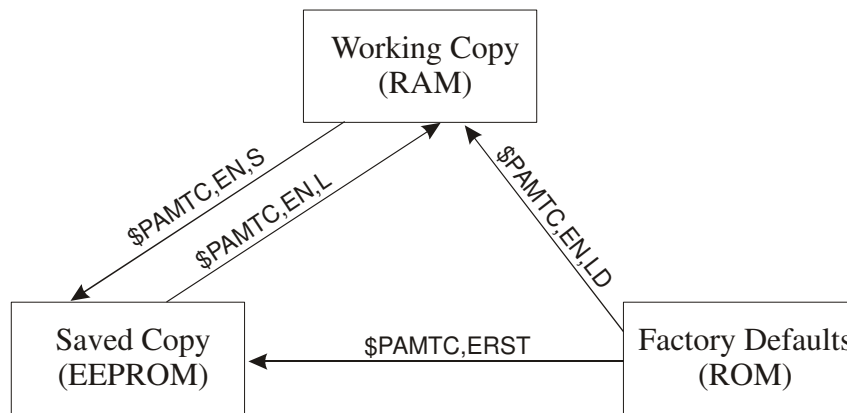
The \$PAMTC,EN,L command allows the settings to be reloaded from EEPROM to RAM without cycling power to the unit. This can be used to discard any changes made

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> [, <6>] *hh<CR><LF>
```

where

- <1> = Total number of \$PAMTR,EN sentences in the reply
- <2> = Sentence number
- <3> = Sentence ID (for example, 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)
- [<6>] = Optional format of Transmission interval (m:ss.hh)

For example, a unit could provide the following as a reply to the **\$PAMTC,EN,Q** command (the output may be different depending on the configuration):

```
$PAMTR,EN,9,5,DTM,1,600,001:00.00*18  
$PAMTR,EN,9,1,GGA,0,10*29  
$PAMTR,EN,9,2,GLL,0,10*1C  
$PAMTR,EN,9,3,GSA,0,10*0F  
$PAMTR,EN,9,4,GSV,0,10*2F  
$PAMTR,EN,9,5,HDG,1,2,000:00.25*18  
$PAMTR,EN,9,6,RMC,0,10*33  
$PAMTR,EN,9,7,VTG,0,10*1B  
$PAMTR,EN,9,8,XDRA,0,10*4B  
$PAMTR,EN,9,9,ZDA,0,10*3F
```

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 over specify the amount of data transmitted, beyond the bandwidth capacity of the NMEA output channel. See section 1.1. for further information regarding bus bandwidth.

Examples

Example 1:

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
```

Example 2:

To disable all sentences for transmission, except transmit compass heading 4 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,,0:0.25  
$PAMTC,EN,S
```

Example 3:

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 4:

To enable transmission of the XDR (A) 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,XDRA,1,100  
or  
$PAMTC,EN,XDRA,,10
```

Example 5:

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

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

Example 6:

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,DTM,1  
$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 WX Series WeatherStation Sensor. For each item, the default value, and the command used to change the value is shown.

<u>Item</u>	<u>Default value</u>	<u>Changed via command</u>
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.

This command performs the same function as the received proprietary NMEA 2000[®] PGN 126720-130.

\$PAMTC, HEATER

Summary

Control the internal heater within the weather station instrument.

Syntax

One of the following forms:

\$PAMTC, HEATER, 0*hh<CR><LF>	Turn heater off (default state).
\$PAMTC, HEATER, A*hh<CR><LF>	Control heater automatically.
\$PAMTC, HEATER, Q*hh<CR><LF>	Query heater status, and start reporting subsequent changes in status
\$PAMTC, HEATER, X*hh<CR><LF>	Stop reporting heater status change

Notes

The heater may be used in the weather station instrument to prevent the formation of dew or ice on the aluminum plate in the wind channel. If the heater control is set to "A" (automatic control), then the weather station instrument will automatically cycle the heater on and off over time to keep the plate temperature within appropriate limits based on the air temperature (and dew point temperature, if product has relative humidity sensor).

If a \$PAMTC, HEATER, Q (Query) command is received, then every time the heater status changes, the sensor will transmit the following message:

```
$PAMTR, HEATER, <1>, <2>, <3>*hh<CR><LF>
```

where

<1> = Heater mode (M = manual, A = automatic)

<2> = Heater state (0 = heater Off, 1 = heater On)

<3> = Heater control (V = Valid, if Factory enabled, else NULL)

Heater status change reporting may be disabled with the \$PAMTC, HEATER, X command.

Note that when the heater is on, the air temperature sensor within the unit will be heated by the heater and will not provide an accurate indication of outside ambient air temperature.

This is a factory enabled option that is not present by default.

See also the proprietary NMEA 2000[®] PGN 130881, Heater Control.

\$PAMTC, LAMP

Summary

Control the windex lamp on top of the weather station instrument.

Syntax

One of the following forms:

\$PAMTC, LAMP, 0 [, S] *hh<CR><LF> Turn lamp off(default state).
\$PAMTC, LAMP, 1 [, S] *hh<CR><LF> Turn lamp.
\$PAMTC, LAMP, A [, S] *hh<CR><LF> Control lamp based on GPS data
\$PAMTC, LAMP, Q *hh<CR><LF> Query lamp status

Notes

The [,S] indicates an optional parameter that can be used to save this setting as the default to be stored in non-volatile memory and used after a Reset or Power Cycle.

The lamp may be used to light the windex on weatherstation instruments so equipped. If the lamp control is set to "A" (automatic control), then the weatherstation instrument will automatically turn the lamp on if it determines it is needed based on GPS Time, Date, and Location information.

If a \$PAMTC, LAMP, Q (Query) command is received, the lamp status will be transmitted using the following message:

```
$PAMTR, LAMP, <1>, <2>, <3> *hh<CR><LF>
```

where

<1> = Current Lamp Command Setting (0 = Off, 1 = On, A = Automatic)

<2> = Saved Lamp Command Setting (0 = Off, 1 = On, A = Automatic)

<3> = Current Lamp Status (0 = Off, 1 = On)

See also the proprietary NMEA 2000[®] PGN XXXXXX, Lamp Control.

\$PAMTC,OPTION

Summary

Enable or disable certain WX Series WeatherStation Sensor 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)

Option 3:

- <3> 3 = Set WAAS mode
- <4> 0 = WAAS Disabled
1 = WAAS Enabled, but report fixes as GPS, Autonomous
2 = WAAS Enabled, report fixes as Differential

Option 4:

- <3> 4 = Set WAAS Satellite
- <4> 0 = Auto Mode (default)
120-138 = WAAS Satellite ID

Option 5:

- <3> 5 = Enable Type 0 Messages
- <4> 0 = Ignore Type 0 messages for 60 seconds
1-27 = Enable Type 0 messages as data
255 = Ignore Type 0 messages (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 WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor.

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 WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor 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.

This setting is mirrored in the NMEA 2000[®] transmitted GNSS Control Status PGN 129538, field 5.

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 49.

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.

See page **Error! Bookmark not defined.** for more information on the NMEA 2000[®] PGN 129538.

Option 3:

The Wide Area Augmentation System (WAAS) uses a system of land based reference stations and geostationary satellites to augment the Global Positioning System (GPS) in order to provide additional accuracy, integrity, and availability. Several GPS Sentences are able to differentiate between WAAS (Differential) fixes and those fixes that do not use WAAS corrections.

The available WAAS modes are:

0 – Disable WAAS

1 – Enable WAAS, but report WAAS fixes as GPS (Autonomous, non-differential). This is provided for backward compatibility for systems that might not recognize WAAS (Differential) fixes.

2 – Enable WAAS, and report WAAS fixes as Differential.

The default mode is 2.

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

Option 4:

This option can be used to direct the GPS to use a specific WAAS satellite. This value is NOT stored in EEPROM.

Option 5:

This option can be used to direct the GPS how to handle type 0 messages. This value is NOT stored in EEPROM.

- <15> = Internal temperature Sensor
- <16> = Battery voltage Sensor
- <17> = TBD Sensor
- <18> = TBD Sensor
- <19> = TBD Sensor
- <20> = TBD Sensor
- <21> = “WX” string that indicates POST results are for the family of products described in this specification.

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 WX Series WeatherStation Sensor.

Certain models of the WX Series WeatherStation Sensor may omit some features in the hardware. 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, QPS

Summary

Query part number and serial number information.

Syntax

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

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

```
$PAMTR, QPS, <1>, <2>, <3>*hh<CR><LF>
```

where

- <1> = Part number string (up to 32 ASCII characters)
- <2> = Serial number string (up to 32 ASCII characters)
- <3> = Model number (0-255)

Notes

The part number and serial number strings may not contain the following characters:

- "\$" (dollar sign)
- "," (comma)
- "*" (asterisk)
- " " (space)

Current definitions for Model number:

300 WXR = 1,

\$PAMTC, QV

Summary

Query version information.

Syntax

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

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

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

where

- <1> = Null field
- <2> = Hardware version
- <3> = OEM option
- <4> = Null field
- <5> = Bootloader 1 firmware version
- <6> = Application 1 firmware version
- <7> = Bootloader 2 firmware version
- <8> = Application 2 firmware version
- <9> = GPS module version
- <10> = Compass module version

Notes

In the earlier model WeatherStation sensor, the PB100, fields <1> and <4> in the reply to this command contained the 12-character part number and serial number fields, respectively. In the model PB200 and the WX Series WeatherStation Sensor, the part number and serial number fields have been expanded to 32 characters to harmonize them with their NMEA 2000[®] equivalents. Because this would have caused this sentence to exceed the 82-character NMEA 0183 limit, these fields in the WX Series WeatherStation Sensor must be read using the \$PAMTC,QPS command.

NMEA 0183 RECEIVED SENTENCE

\$PAMTC, **RESET**

Summary

Reset the WX Series WeatherStation Sensor.

Syntax

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

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

\$PAMTC, **RESET, GPS**

Summary

Reset the GPS on a WX Series WeatherStation Sensor.

Syntax

\$PAMTC, RESET, GPS*hh<CR><LF>

Reset the GPS sensor on a GPS equipped WX Series WeatherStation Sensor.

NMEA 0183 RECEIVED SENTENCE

\$PAMTC, **RESET, RAIN, RAIN**

Summary

Reset the Accumulated Rain and Rain Duration values of a rain sensor equipped WX Series WeatherStation Sensor.

Syntax

\$PAMTC, RESET, RAIN, RAIN*hh<CR><LF>

Reset the Accumulated Rain and Rain Duration values of a rain sensor equipped WX Series WeatherStation Sensor.

NMEA 0183 RECEIVED SENTENCE

\$PAMTC, **RESET, RAIN, RATE**

Summary

Reset the Rain Rate calculation and the Peak Rain Rate value of a rain sensor equipped WX Series WeatherStation Sensor.

Syntax

\$PAMTC, RESET, RAIN, RATE*hh<CR><LF>

Reset the Rain Rate calculation and the Peak Rain Rate value of a rain sensor equipped WX Series WeatherStation Sensor.

\$PAMTC, **SIM**

Summary

Turn Simulate Mode On or Off.

Syntax

One of the following forms:

\$PAMTC, SIM, 0*hh<CR><LF>	Turn Simulate Mode Off (default state).
\$PAMTC, SIM, 1*hh<CR><LF>	Turn Simulate Mode On.
\$PAMTC, SIM, Q*hh<CR><LF>	Query Simulate state.

The **\$PAMTC, SIM, Q** command provides a query function to allow reading the current Simulate state. The reply to the **\$PAMTC, SIM, Q** command is one of the following:

\$PAMTR, SIM, 0*hh<CR><LF>	Simulate Mode is Off
\$PAMTR, SIM, 1*hh<CR><LF>	Simulate Mode is On

Notes

The Simulate Mode is *not* stored in EEPROM. On power up, the Simulate Mode returns to the Off state.

\$PAMTC, WIND

Summary

Set or report user settings for wind filtering and wind gust parameters.

Syntax

One of the following forms:

```
$PAMTC, WIND, FILTER, SET, <1>, <2>*hh<CR><LF>
```

```
$PAMTC, WIND, FILTER, Q*hh<CR><LF>
```

```
$PAMTC, WIND, GUST, SET, <1>, <2>, TBD, *hh<CR><LF>
```

```
$PAMTC, WIND, GUST, Q*hh<CR><LF>
```

\$PAMTC, WIND, FILTER, SET

Summary

Change user settings for wind filtering.

Syntax

```
$PAMTC, WIND, FILTER, SET, <1>, <2>*hh<CR><LF>
```

Field one is an 8-bit unsigned fixed point decimal integer and field two is a 16-bit unsigned fixed point decimal integer.

<1> Filter Type, where 0 = None, 1 = IIR Filter..

<2> When Filter Type = IIR Filter, this is the Filter Time Constant, in tenths of seconds to reach 95% of a steady state change in value.

Reply

None.

\$PAMTC, WIND, FILTER, Q

Summary

Query the weather station instrument for the stored user wind filtering parameters.

Syntax

```
$PAMTC, WIND, FILTER, Q*hh<CR><LF>
```

Reply

The weather station instrument will reply with:

```
$PAMTR, WIND, FILTER, <1>, <2>*hh<CR><LF>
```

where fields <1> through <2> contain the data from the weather station instrument's nonvolatile EEPROM corresponding to the fields as follows.

Field one is an 8-bit unsigned fixed point decimal integer and field two is a 16-bit unsigned fixed point decimal integer.

- <1> Filter Type, where 0 = None, 1 = IIR Filter..
- <2> When Filter Type = IIR Filter, this is the Filter Time Constant, in tenths of seconds to reach 95% of a steady state change in value.

Notes

\$PAMTC,WIND,GUST,SET

Summary

Change user settings for gust parameters.

Syntax

\$PAMTC,WIND,GUST,SET,<1>,<2>*hh<CR><LF>

TBD

Reply

None.

\$PAMTC,WIND,GUST,Q

Summary

Query the weather station instrument for the stored user wind gust parameters.

Syntax

\$PAMTC,WIND,GUST,Q*hh<CR><LF>

Reply

The weather station instrument will reply with:

\$PAMTR,WIND,GUST,<1>,<2>*hh<CR><LF>

TBD

Notes

\$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 WX Series WeatherStation Sensor 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 WX Series WeatherStation Sensor has been cycled.
- A \$PAMTC, RESET command has been received.

2. Revision History

Revision 1.000

Date: 05112011

Description: Made into an 0183 User Technical Manual.