

PB200 WeatherStation User Manual

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This document is Subject to Change.

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1. Introduction

This document is a supplement to the Airmar PB200 WeatherStation Owner's Guide.

The PB200 WeatherStation is a multifunctional device that integrates several sensors into a single compact housing. These sensors include:

- Ultrasonic anemometer, providing apparent wind speed and direction
- Thermistor, providing air temperature
- Piezoresistive pressure sensor, providing barometric pressure
- Magnetoinductive XYZ sensors, providing tilt-compensated magnetic compass heading
- 3-axis MEMS¹ accelerometer, providing pitch and roll angles
- MEMS rate gyro, providing rate-of-turn of the vessel
- Global Positioning System (GPS) receiver, providing position, and speed and course over ground

In addition to the above directly measured parameters, the PB200 WeatherStation 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)

The PB200 WeatherStation has two separate communication interfaces: one compliant with the NMEA 2000®² protocol, and the other with the NMEA 0183 protocol. Both interfaces are able to operate simultaneously and independently from one another.

This document provides detailed descriptions of the communications protocols for the NMEA 2000® and NMEA 0183 interfaces used by the PB200 WeatherStation.

For further information about the NMEA 2000® protocol, refer to the document, *NMEA 2000® Standard for Serial-Data Networking of Marine Electronic Devices, version 1.200*. For further information about the NMEA 0183 protocol, refer to the document, *NMEA 0183 Standard for Interfacing Marine Electronic Devices, v3.01*. Both of these documents are available from the National Marine Electronics Association (www.nmea.org).

¹ MEMS is an acronym for Micro Electro-Mechanical Systems

² NMEA 2000® is a Registered Trademark of the National Marine Electronics Association, Inc.

2. NMEA 2000[®] Interface

The Airmar PB200 WeatherStation has a single NMEA 2000[®]-compliant network interface, and is expected to be certified as a Class 1 Level B device. The PB200 transmits and receives standard and proprietary NMEA 2000[®] Parameter Groups via this interface. Transmitted PGNs (Parameter Group Numbers) are described in section 2.4. Received PGNs are described in section 2.5.

2.1. Terminology

The following terms related to the NMEA 2000[®] protocol appear on the detailed PGN pages to follow.

PGN: Parameter Group Number. NMEA 2000[®] messages are organized into logical collections of data called Parameter Groups. The NMEA assigns each Parameter Group a unique Parameter Group Number, or PGN.

Single Frame: Yes = the Parameter Group has been designed to fit within the 8 bytes of a single CAN frame. No = the Parameter Group is larger than 8 bytes, so must be transmitted in multiple CAN frames using either NMEA 2000[®] Fast Packets, or (TBD) ISO 11783 multi-packets, using the Data Transfer Transport Protocol (PGNs 60160 and 60416).

Priority: NMEA 2000[®] parameter groups are each assigned a priority value between 0 and 7, which is used to arbitrate between two devices attempting to transmit simultaneously. 0 is the highest priority, and 7 is the lowest. The Priority field at the top of each of the detailed specification pages shows three values separated by slashes (e.g. 6/Y/Y). The first value is the default priority, between 0 and 7, of the parameter group as defined in the NMEA 2000[®] Standard. The second value is "Y" if the priority for this parameter group may be changed using the Command Group Function PGN 126208, or "N" if the priority may not be changed. The third value is "Y" if the priority is saved in nonvolatile EEPROM memory within the PB200 and maintained upon cycling power, or "N" if the priority reverts to the default value upon cycling power.

Update Rate: Some NMEA 2000[®] parameter groups are transmitted periodically by the PB200. The Update Rate field at the top of each of the detailed specification pages shows three values separated by slashes (e.g. 100 ms/Y/Y). The first value is the default update rate for the parameter group, as defined in the NMEA 2000[®] Standard. If the default behavior for the parameter group is not to transmit periodically, then this first value will be 0 (zero). The second value is "Y" if the update rate for this parameter group may be changed using the Transmission Interval field in the Request Group Function PGN 126208, or "N" if the update rate may not be changed. The third value is "Y" if the update rate is saved in nonvolatile EEPROM memory within the PB200 and maintained upon cycling power, or "N" if the update rate reverts to the default value upon cycling power.

Destination: Global or Address. A Global Destination means that the parameter group was designed to be broadcast for use by all receiving devices on the bus. If Destination = Address, this means the parameter group was designed to be transmitted to a specific device on the bus. In this case, the address of the destination device must be provided within the PGN.

Query Support: If the parameter group supports queries, then the PB200 will transmit the parameter group if requested by another device on the bus. The request must be made using either the ISO Request PGN 59904, or the Complex Request Group PGN 126208.

Access Level: The PB200 contains a security mechanism whereby certain PGNs require an access sequence to be performed in order to enable the functionality in the PGN. If the indicated Access Level is 0, then the PGN is fully functional without requiring an access sequence to be performed. If the indicated Access Level is nonzero, then it is necessary to perform an access sequence using the proprietary transmitted PGN 065287, Access Level, before the functionality of the PGN will be enabled.

Request Parameter: A "Yes" value specifies that the given field may be used by the Request Group Function PGN 126208 as a qualifier to request specific data according to the contents of the field.

DD: Data Dictionary. The Data Dictionary number defines the contents of the parameter group field. The designators in this column are described in detail in the NMEA 2000[®] Standard, Appendix B.2.

DF: Data Format. The Data Format number defines the format of the data in the parameter group field. The designators in this column are described in detail in the NMEA 2000[®] Standard, Appendix B.3.

Type: The Type designators are described in detail in the NMEA 2000[®] Standard, Appendix B.4.

Resolution: The resolution indicates the smallest increment of the value in the given field, in the units specified by the data format.

Value: This indicates the range of allowable values the field may contain.

2.2. Sequence ID (SID)

Some transmitted Parameter Groups contain a SID (Sequence Identification Number) field. This field contains an 8-bit upward counting number that is used to tie related information together between different Parameter Groups. The SID provides a method to indicate that the data in a given set of Parameter Groups are synchronized to the same sample interval.

In the PB200, the following PGNs will contain identical SID values, indicating that the data from each of these PGNs was taken at the same time, even though the PGNs may be transmitted at different times:

- 126992 System Time
- 129026 COG and SOG, Rapid Update
- 129029 GNSS Position Data
- 129539 GNSS DOPs
- 129540 GNSS Satellites in View

2.3. Precedence of Data

In a given installation, certain data items received by the PB200 might be available from more than one source. In this circumstance, the following precedence rules apply for the PB200.

Speed Through Water:

NMEA 2000[®] PGN 128259 supersedes NMEA 0183 \$--VHW.

2.4. Transmitted NMEA 2000[®] PGNs

The NMEA 2000[®] PGNs transmitted by the PB200 WeatherStation are summarized in Table 1. Each of the transmitted PGNs in Table 1 is described in detail on the subsequent pages.

Table 1: NMEA 2000® Transmitted PGNs

<u>PGN</u>	<u>Description</u>
59392	ISO Acknowledgement
60928	ISO Address Claim
65285	Proprietary: Boot State Acknowledgment
65287	Proprietary: Access Level
65410	Proprietary: Internal Device Temperature and Supply Voltage
126208	Acknowledge Group Function
126464	PGN List – Transmit and Received PGNs Group Function
126720	Proprietary: -32: Attitude Offsets -33: Calibrate Compass -34: True Wind Options -35: Simulate Mode -46: NMEA 2000® Options -47: Received PGN Source -48: Altitude Settings -49: Set WAAS Satellite -50: Enable GPS Type 0 Messages
126992	System Time
126996	Product Information
126998	Configuration Information
127250	Vessel Heading
127251	Rate of Turn
127257	Attitude
127258	Magnetic Variation
129025	Position, Rapid Update
129026	COG & SOG, Rapid Update
129029	GNSS Position Data
129033	Time & Date
129044	Datum
129538	GNSS Control Status
129539	GNSS DOPs
129540	GNSS Sats in View
130306	Wind Data
130310	Environmental Parameters
130311	Environmental Parameters
130323	Meteorological Station Data
130880	Proprietary: Additional Weather Data
130881	Proprietary: Heater Control

<u>PGN</u>	<u>Description</u>
130944	Proprietary: POST

PGN **059392** (0x0E800)

ISO Acknowledgment

Single Frame: Yes

Priority: 6/N/N

Update Rate: 0/N/N

Destination: Address

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This PGN is transmitted as a handshake mechanism in response to an ISO Request PGN 59904.

PGN **060928** (0x0EE00)

ISO Address Claim

Single Frame: Yes

Priority: 6/N/N

Update Rate: 0/N/N

Destination: Address

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

PGN 60928 is a network management message used to claim a network address, reply to devices requesting the claimed address, and to respond to requests for device information (NAME). The 64 bits comprised by the ten fields in this parameter group constitute the ISO 11783-5 NAME entity.

The contents of fields 3, 4, and 8 are stored in EEPROM memory and may be changed using PGN 126208, Command Group Function.

PGN 065285 (0x0FF05)

Proprietary: Boot State Acknowledgment

Single Frame: Yes	Priority: 7/N/N	Update Rate: 0/N/N	Destination: Global	Query Support: No	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	No	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	No	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Boot State	No	N/A	DF52	3 bits	1	000 = in Startup Monitor 001 = running Bootloader 010 = running Application 011 to 110 = reserved 111 = Data Not Available	
5	Reserved bits	No	DD001	DF52	45 bits	1	0x1FFFFFFFFFFFF	All bits set to logic "1"

Notes

The Boot State Acknowledgment proprietary PGN is transmitted in response to the received proprietary PGN 65286, Global Boot State Request. This PGN is transmitted from any of the following contexts: Startup Monitor, CAN Bootloader, or Application.

PGN 065287 (0x0FF07)

Proprietary: Access Level

Single Frame: Yes	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Global	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Format Code	Yes	DD005	DF53	uint8	1 bit	1	1 = Format Code 1
5	Access Level	No	N/A	DF52	3 bits	1	0x0 = locked 0x1 = unlocked, level 1 0x2 = unlocked, level 2 0x3 to 0x7 = reserved	When this PGN is transmitted, this field indicates the current Access Level of the PB200. This field may be changed using the Command Group Function PGN 126208 (see text below).
6	Reserved bits	No	DD001	DF52	5 bits	1	0x1F	All bits set to logic "1"
7	Access Seed/Key	No	N/A	DF55	uint32	1 bit	0 to 4,294,967,292	When this PGN is transmitted, this field contains a Seed that may be used in a subsequent Unlock operation. This field is also used to provide a Key to the PB200 when performing an Unlock operation, using the Command Group Function PGN 126208 (see text below).

Notes

The Access Level proprietary PGN is a security mechanism that provides the PB200 with a method to limit access to certain functions to devices that understand the proper unlock sequence. Certain operations will not be possible unless the Access Level is first increased to the required value. A nonzero Access Level remains in effect until the unit powers down, or 15 minutes has elapsed, whichever comes first, after which the Access Level returns to zero. The Access Level is not stored in EEPROM.

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1 and 3 must both be fully specified in the request in order for this PGN to be transmitted.

Note that the value in field 4 (Format Code) may correspond to a specific set of algorithms for calculating the key from a given seed.

If field 4 is specified in a Request Group PGN 126208, but does not agree with the format code known by the device, then the request will be NAK'ed. If field 4 is *not* specified in a request, then the PGN will be transmitted with the format code known to the device.

This PGN does not respond to ISO Requests (PGN 59904).

When this PGN is transmitted, field 5 contains the current Access Level of the PB200, and field 7 contains a randomly-generated Seed that may be used in a subsequent Unlock operation.

To change the Access Level, use the Command Group Function PGN 126208, specifying the individual fields in PGN 65287 as follows:

To change the Access Level to 0 (i.e. to lock the device after having been previously unlocked):

Use the Command Group Function PGN 126208, specifying the individual fields in PGN 65287 as follows. (Note that it is not required to specify field 7.)

PGN 65287	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	1
5	0

The PB200 will respond with the Acknowledge Group Function PGN 126208, indicating success or failure according to the error codes provided in the parameter fields.

To change the Access Level to 1:

Use the Command Group Function PGN 126208, specifying the individual fields in PGN 65287 as follows.

Field 7 serves as a simple password to allow setting the Access Level to 1. For this Access Level, it is not necessary to obtain a Seed or calculate a Key.

PGN 65287	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	1
5	1
7	0x12345678

The PB200 will respond with the Acknowledge Group Function PGN 126208, indicating success or failure according to the error codes provided in the parameter fields.

To change the Access Level to 2 or higher:

1. Use the Request Group Function PGN 126208, specifying PGN 65287, to obtain a Seed.
2. The PB200 will respond with PGN 65287, with the current Access Level in field 5, and with a random Seed in field 7.
3. Using the Seed provided in step 2, calculate a Key according to the algorithm corresponding to the desired Access Level.

4. Use the Command Group Function PGN 126208, specifying the individual fields in PGN 65287 as follows:

PGN 65287	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	1
5	The desired Access Level
7	The calculated Key

5. The PB200 will respond with the Acknowledge Group Function PGN 126208, indicating success or failure according to the error codes provided in the parameter fields.

After executing the above sequence to change the Access Level, you may optionally request this PGN using the Request Group Function PGN 126208 to confirm that the Access Level was in fact changed.

Note that increasing the Access Level does not in and of itself allow global access to the secure functions of the PB200. The Access Level is changed only for subsequent commands and requests originating from the device with the source address originally used to specify the Access Level.

PGN 65410 (0xFF82)

Proprietary: Device Temp. and Supply Voltage

Single Frame: Yes	Priority: 7/Y/Y	Update Rate: 0/Y/Y	Destination: Global	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	SID (Sequence ID)	No	DD056	DF53	uint8	1 bit	0 to 252	Unit-less number. Refer to section 2.2. for an explanation of this field.
5	Internal Device Temperature	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Measured temperature of the PB200 upper module circuit board.
6	Supply Voltage	No	DD136	DF42	int16	0.01 V	+/-327.64 V	Supply voltage, as measured by the PB200
7	Reserved bits	No	DD001	DF52	8 bits	1	0xFF	All bits set to logic "1"

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1 and 3 must both be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

PGN 126208 (0x1ED00)

Acknowledge Group Function

Single Frame: No

Priority: 6/N/N

Update Rate: 0/N/N

Destination: Address

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The Acknowledgment Reply is transmitted in response to a PGN 126208 Request or Command Group Function message. In response to the Request message, the Acknowledge is only transmitted for a request that cannot be complied with.

See also related PGNs:

- the received Request Group Function PGN 126208
- the received Command Group Function PGN 126208

PGN 126464 (0x1EE00)

PGN List - Transmit/Received PGNs Group

Single Frame: No	Priority: 6/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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For further information about the NMEA 2000® protocol, including field descriptions refer to the document, *NMEA 2000® Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This message provides a list of the transmitted or received PGNs that are supported by the PB200. It is transmitted only upon request. If it is requested using the ISO Request PGN 59904, or with the Request Group Function PGN 126208 without specifying the Group Function Code in field 1, then this PGN will be transmitted twice, once each for the transmitted and received lists.

Note that proprietary PGNs are excluded from these lists.

The list of Transmitted PGNs is as follows:

<u>PGN</u>	<u>Description</u>
59392	ISO Acknowledgment
60928	ISO Address Claim
126208	Acknowledge Group Function
126464	PGN List – Transmit and Received PGNs Group Function
126992	System Time
126996	Product Information
126998	Configuration Information
127250	Vessel Heading
127251	Rate of Turn
127257	Attitude
127258	Magnetic Variation
129025	Position, Rapid Update
129026	COG & SOG, Rapid Update
129029	GNSS Position Data
129033	Time & Date
129044	Datum

<u>PGN</u>	<u>Description</u>
129538	GNSS Control Status
129539	GNSS DOPs
129540	GNSS Sats in View
130306	Wind Data
130310	Environmental Parameters
130311	Environmental Parameters
130323	Meteorological Station Data

The list of Received PGNs is as follows.

<u>PGN</u>	<u>Description</u>
59904	ISO Request
60928	ISO Address Claim
126208	Request Group Function
126208	Command Group Function
128259	Speed

PGN 126720 (0x1EF00)

Addressable Multi-Frame Proprietary

Single Frame: No **Priority:** 7/Y/N **Update Rate:** 0/N/N **Destination:** Address **Query Support:** Yes **Access Level:** See PID variants

Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	0 to 252	Identifier specifying how to interpret the remaining fields in this parameter group.
5+	(PID-dependent)	No	DD000	DF00	undef.	undefined	undefined	The use of the remaining bytes and the number of CAN frames required varies according to the PID (field 4).

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

The use of this PGN with the following Proprietary ID's (field 4) is described on the subsequent pages:

- 32: Attitude Offsets
- 33: Compass Calibration
- 34: True Wind Options
- 35: Simulate Mode
- 46: NMEA 2000® Options
- 47: Received PGN Source
- 48: Altitude Settings
- 49: Set WAAS Satellite
- 50: Enable GPS Type 0 Messages

PGN 126720-32 (0x1EF00)

Proprietary: Attitude Offsets

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	32 (decimal)	32 = Attitude Offsets
5	Azimuth offset	No	N/A	DF04	int16	0.0001 rad	- π to + π rad Default value = 0 rad.	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. Value stored in EEPROM.
6	Pitch offset	No	N/A	DF04	int16	0.0001 rad	- $\pi/4$ to + $\pi/4$ rad Default value = 0 rad.	Positive values indicate the sensor is tilted forward toward the bow; negative values indicate the sensor is tilted aftward. Value stored in EEPROM.
7	Roll offset	No	N/A	DF04	int16	0.0001 rad	- $\pi/4$ to + $\pi/4$ rad Default value = 0 rad.	Positive values indicate the sensor is tilted toward the port side; negative values toward the starboard side. Value stored in EEPROM.

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

This PGN performs the same function in the PB200 as the NMEA 0183 proprietary command, \$PAMTC,ATTOFF. Note that in the NMEA 0183 command, the arguments are in degrees, while in the NMEA 2000® PGN, the arguments are in radians. The values are stored in the PB200 in radians.

This PGN is used to program the PB200 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.

The azimuth offset angle is used by the PB200 to adjust the apparent wind angle relative to the bow of the vessel, and the vessel's heading measured by 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 PGN 127257, and in the transmitted NMEA 0183 \$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 using the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-32 as follows.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	32 (decimal)
5	0
6	0
7	0

3. Determine the desired azimuth offset angle, and program this into the sensor using the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-32 as follows. The pitch and roll offset fields should be omitted for this step (or set to zeroes).

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	32 (decimal)
5	Azimuth offset angle of sensor, relative to bow

4. Allow the vessel to stabilize to its "level" state, and then read the values of pitch and roll that are reported by PGN 127257. 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 as offsets using the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-32 as follows. Note that field 5, azimuth offset angle, is not programmed during this step.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	32 (decimal)
6	Pitch offset angle
7	Roll offset angle

6. At this point the transmitted PGN 127257 should be producing values that are centered around 0.0 degrees for both pitch and roll.

PGN 126720-33 (0x1EF00)

Proprietary: Calibrate Compass

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0/1
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	33 (decimal)	33 = Calibrate Compass
5	Calibrate Function	Yes	DD005	DF53	uint8	1 bit	0 = X = Normal, cancel calibration mode 1 = GO, enter calibration mode 2 = RESET All User Calibration Values to Defaults 3 = Verify 4 = Reset Compass Cal Values to defaults 5. Reset Damping Values to defaults	See Notes
6	Calibration Status	No	DD005	DF53	uint8	1 bit	0 = QUERIED 1 = PASSED 2 = FAILED, Timeout 3 = FAILED, Tilt Error 4 = FAILED, Other Error 5 = IN-PROGRESS	See Notes
7	Verify Score	No	N/A	DF53	uint8	1 bit	Score	TBD
8	X-axis Gain Value	No	N/A	DF58	int16	.01	Multiplier	Default 100, range 50 to 500
9	Y-axis Gain Value	No	N/A	DF58	int16	.01	Multiplier	Default 100, range 50 to 500
10	Z-axis Gain Value	No	N/A	DF58	int16	.01	Multiplier	Default 100, range 50 to 500
11	X-axis Linear Offset	No	N/A	DF58	int16	.01	Teslas	Default 0, range -32000 to +32000

Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
12	Y-axis Linear Offset	No	N/A	DF58	int16	.01	Teslas	Default 0, range -32000 to +32000
13	Z-axis Linear Offset	No	N/A	DF58	int16	.01	Teslas	Default 0, range -32000 to +32000
14	X-axis Angular Offset (Unused)	No	N/A	DF58	int16	.1	Degrees	Default 0, range 0 to 3600
15	Pitch and Roll Damping	No	N/A	DF58	int16	.05	Seconds	Default 30, range 0 to200
16	Compass/RateGyro Damping	No	N/A	DF58	int16	.05	Seconds	Default -30, range -2400 to 2400, negative numbers indicate that the rate gyro is to be used in compass computations.

Notes

This PGN can be used to manually initiate a user calibration sequence for the internal compass sensor. There is an alternative to issuing this PGN 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.

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

Queries work with access level 0, all other functions require at least access level 1.

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 PB200 is as follows:

1. The weather station instrument is installed on the vessel. The unit under test is powered up.
2. Manual Start: The access level is set to 1.
AutoCal Start: Access level not required.
3. Manual Start: PGN 126208 Command Group Function message is sent. Fields 1, 3, 4 and 5 must each be fully specified, field 5 is set to 1 (GO) 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 (2-4 knots) circular turn. If it completes a full circle within 2-3 minutes, AutoCal will enter the user compass calibration procedure (See steps 4-7).
4. 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, it calculates the coefficients, and sets the status to 1 for PASS or 2 - 4 for FAIL.
5. During the user calibration process, PGN 126208 can be used to request PGN 126720-33 to obtain status at any time. While calibration is running, the status will be 5 for INPROGRESS. Once it has completed, the status will be 1 for Passed or 2-4 for Failed.
6. If PASS was transmitted, then the offsets that are now in use and saved in EEPROM are the newly calculated ones.

7. Note: During user compass calibration, heading is not valid and will be output as DataNotAvailable. 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.

To exit user calibration mode before it passes or fails, PGN 126208 Command Group Function message is sent. Fields 1, 3, 4 and 5 must each be fully specified, field 5 is set to 0 (X, Normal, Cancel).

To reset user calibration coefficients and damping control, PGN 126208 Command Group Function message is sent. Fields 1, 3, 4 and 5 must each be fully specified, field 5 is set to 2 (Reset All).

To reset just user calibration coefficients, PGN 126208 Command Group Function message is sent. Fields 1, 3, 4 and 5 must each be fully specified, field 5 is set to 4 (Reset Calibration).

To reset just user damping control, PGN 126208 Command Group Function message is sent. Fields 1, 3, 4 and 5 must each be fully specified, field 5 is set to 5 (Reset Damping).

To request status or current user calibration coefficients, PGN 126208 Request Group Function message is sent. Fields 1, 3, and 4 must each be fully specified. PGN 126720-33, will be transmitted with status set to 0 for QUERIED, 1 for PASSED, 2-4 for FAILED, or 5 for IN-PROGRESS.

Fields 8-16 can be used to set User Calibration Coefficients. PGN 126208 Command Group Function message is sent. Fields 1, 3, 4 and the field or fields to be set must each be fully specified. Currently only Linear Offsets and Damping values are supported.

Failure modes: 2 = FAILED: 5 minute timeout occurred before successful completion or more than 30 seconds was taken to turn thru 45 degrees, 3 = FAILED: Tilt Error, or 4 = FAILED: Other Error, such as, reversing the direction of the turn for more than 45 degrees.

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.

User compass calibration procedure does not affect Pitch and Roll Damping or Compass/RateGyro Damping, but this PGN can be used to change the damping control values.

PGN 126720-34 (0x1EF00)

Proprietary: True Wind Options

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	34 (decimal)	34 = True Wind Options
5	Allow COG Instead of Heading for True Wind Calculations	No	N/A	DF52	2 bits	1	MSB/LSB: 00 = Use heading only 01 = Allow COG to replace heading 10 = Error 11 = Data not available	This field defines whether COG may be substituted for compass heading in true wind calculations. This field is stored in EEPROM and may be changed with the Command Group Function PGN 126208. The default value is 00 (use heading only).
6	Reserved bits	No	DD001	DF52	22 bits	1	0x3FFFFFF	All bits set to logic "1"

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

This PGN performs the same function as the received proprietary NMEA 0183 command, \$PAMTC,OPTION. See the description of that command for a full description of the use of this feature.

Although this is a fast-packet message, the version with this PID fits into a single CAN frame.

To change the state of the Allow COG Instead of Heading for True Wind Calculations option (field 5), use the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-34 as follows.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	34 (decimal)
5	One of the following: MSB/LSB: 00 = Use heading only 01 = Allow COG to replace heading

PGN 126720-35 (0x1EF00)

Proprietary: Simulate Mode

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 1
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	35 (decimal)	35 = Simulate Mode
5	Simulate Mode	No	DD003	DF52	2 bits	1	MSB/LSB: 00 = Simulate Mode Off 01 = Simulate Mode On 10 = Reserved 11 = No action/Data Not Available	This field defines whether the PB200 is in Simulate Mode. This field may be changed with the Command Group Function PGN 126208. It is <i>not</i> saved in EEPROM. The default value on power up is 00 (Simulate Mode Off).
6	Reserved bits	No	DD001	DF52	22 bits	1	0x3FFFFFF	All bits set to logic "1"

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

Although this is a fast-packet message, the version with this PID fits into a single CAN frame.

(continued on next page)

To change the state of the Simulate Mode option (field 5), use the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-35 as follows.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	35 (decimal)
5	One of the following: MSB/LSB: 00 = Turn Simulate Mode Off 01 = Turn Simulate Mode On

This PGN performs the same function as the received proprietary NMEA 0183 command \$PAMTC,SIM.

PGN 126720-46 (0x1EF00)

Proprietary: NMEA 2000® Options

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	46 (decimal)	46 = NMEA 2000® Options
5	Transmission Interval Supersedes Measurement Interval	No	DD003	DF52	2 bits	1	MSB/LSB: 00 = Feature Disabled 01 = Feature Enabled 10 = Reserved 11 = No action/Data Not Available	See the text below for a description of this feature. This field may be changed with the Command Group Function PGN 126208. It is saved in EEPROM. The default value is 00 (Feature Disabled).
6	Reserved bits	No	DD001	DF52	22 bits	1	0x3FFFFFF	All bits set to logic "1"

Notes

The various types of data provided by the PB200 are sampled, or measured, at different rates, depending on the nature of the data being measured. For example, the GPS receiver in the PB200 provides new position fix data once per second, while the wind sensor provides new data twice per second. The rate at which a given source of data is measured is unrelated to the rate at which its corresponding PGN is transmitted. It is possible, using the Request Group Function PGN 126208, to specify a PGN transmission interval that is faster than the corresponding measurement interval for data within the PGN.

Field 5 of this PGN allows the user to specify the behavior of the unit when PGNs are requested to be transmitted faster than the measurement intervals for data within the PGNs. If the feature is disabled (the default case), then the measurement interval supersedes the requested transmission interval. If the feature is enabled, then the requested transmission interval supersedes the measurement interval.

Some examples are shown below:

<u>Measurement Interval</u>	<u>Transmission Interval</u>	<u>Field 5</u>	<u>Actual Rate of Transmission</u>	<u>Comment</u>
500 mS	100 mS	00 = disabled	500 mS	In the default case, the device will not transmit data any faster than it is sampled, or measured, even if requested to do so.
500 ms	100 mS	01 = enabled	100 mS	If the feature is enabled, then PGNs will be transmitted at the rate specified by the transmission interval, regardless of the measurement interval. If the transmission interval is shorter than the measurement interval, then data will be repeated on successive PGNs until it is measured again.
500 mS	1000 mS	00 = disabled	1000 mS	If the transmission interval is greater than the measurement interval, then it will supersede regardless of the setting in field 5.
500 mS	1000 mS	01 = enabled	1000 mS	If the transmission interval is greater than the measurement interval, then it will supersede regardless of the setting in field 5.

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

Although this is a fast-packet message, the version with this PID fits into a single CAN frame.

To change the state of field 5, use the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-46 as follows.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	46 (decimal)
5	One of the following: MSB/LSB: 00 = Disable Feature 01 = Enable Feature

PGN 126720-47 (0x1EF00)

Proprietary: Received PGN Source

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	47 (decimal)	47 = Received PGN Source
5	Received PGN number	Yes	DD009	DF52	24 bits	1	128259 only (for PB200)	24-bit Parameter Group Number (PGN) expressed in binary, LSB is transmitted first.
6	Rule	No	DD003	DF52	3 bits	1	0 = Reserved 1 = Highest priority Airmar device 2 = Highest priority device, any mfr. 3 = Specific device 4 = Specific device, or highest priority 5-6 = Reserved 7 = No action/Data Not Available	The default value for this field is 1. This field is saved in EEPROM. See the text below for an explanation of this field.
7	Reserved bits	No	DD001	DF52	5 bits	1	0x1F	All bits set to logic "1"
8	CAN name	No	N/A	DF52	64 bits	1	Variable	CAN name for the specific transmitting device intended to provide the PGN specified in field 5. The CAN name is supplied by the address claim PGN 60928 of the transmitting device. This field is saved in EEPROM.

Notes

This PGN is used to specify the rules by which the PB200 decides which device on the NMEA 2000[®] bus is used to provide a given PGN received by the PB200.

For the PB200, this PGN is used only in relation to received PGN 128259 (speed through water).

The Rule field, field 6, is interpreted as follows:

Rule value 1: for the received PGN specified in field 5, use the device on the bus transmitting the given PGN, and having the highest priority CAN name (lowest value) with a manufacturer code of 135, corresponding to AIRMAR Technology Corporation. If there are no Airmar devices on the bus transmitting the given PGN, then use the device having the highest priority CAN name, regardless of its manufacturer code. This is the default behavior for all of the listed PGNs.

Rule value 2: for the received PGN specified in field 5, use the device on the bus transmitting the given PGN, and having the highest priority CAN name (lowest value) irrespective of manufacturer code.

Rule value 3: for the received PGN specified in field 5, use the device on the bus corresponding to the CAN name specified in field 8.

Rule value 4: for the received PGN specified in field 5, use the device on the bus corresponding to the CAN name specified in field 8. If that device is not present on the bus, or is not transmitting the given PGN, then use the device having the highest priority CAN name, regardless of its manufacturer code.

Fields 6 and 8 are stored in nonvolatile EEPROM within the PB200.

To change the Rule (field 6) to a value of 1 or 2 for PGN 128259, use the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-47 as follows.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	47 (decimal)
5	128259
6	1 or 2, as desired

Note that when changing the Rule (field 6) to 1 or 2, it is not necessary to specify field 8.

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To specify a certain transmitting device to be used to supply PGN 128259, set the Rule field (field 6) to a value of 3 or 4, and specify the CAN name of the transmitting device using the Command Group Function PGN 126208, specifying the individual fields in PGN 126720-47 as follows.

PGN 126720	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	47 (decimal)
5	128259
6	3 or 4, as desired
8	The CAN name of the device transmitting the PGN of interest.

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted. If field 5 (received PGN number) is also supplied, PGN 126720-47 will be transmitted once only, for the given received PGN. If field 5 is omitted, then this PGN will be transmitted once for each received PGN supported by the PB200.

This PGN does not respond to ISO Requests (PGN 59904).

PGN 126720-48 (0x1EF00)

Proprietary: Altitude Settings

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	48 (decimal)	48 = Altitude Settings
5	Altitude	No	DD024	DF15	int32	0.01 m	Legal range of values is -999.99 to +40,000 meters	Altitude of sensor. The contents of this field are mirrored in field 9 of transmitted PGN 129538. Default value = 0 meters. This value is stored in EEPROM memory in the PB200, and is changeable with the Command Group Function PGN 126208.
6	Use Antenna Altitude for GPS 2D Mode	No	DD002	DF52	2 bits	1	MSb/LSb: 00 = [No, Off, Disabled, Reset, "0"] 01 = [Yes, On, Enabled, Set, "1"] 10 = Error 11 = [Unavailable, Unknown]	The contents of this field are mirrored in field 10 of transmitted PGN 129538. Default value = 00 (disabled). This value is stored in EEPROM memory in the PB200, and is changeable with the Command Group Function PGN 126208.

Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
7	Altitude Option for Barometric Pressure	No	N/A	DF52	3 bits	1	0 = Do not use altitude for barometric pressure altimeter setting 1 = Barometric pressure altimeter setting uses fixed altitude (field 5) 2 = Barometric pressure altimeter setting uses GPS altitude when GPS has a 3D fix, or fixed altitude (field 5) when GPS does not have a 3D fix 3-6 = reserved 7 = Data not available./Do not change	Default value = 2. This value is stored in EEPROM memory in the PB200, and is changeable with the Command Group Function PGN 126208.
8	Reserved bits	No	DD001	DF52	3 bits	1	0x7	All bits set to logic "1"

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

This PGN performs the same function as the received NMEA 0183 sentence \$PAMTC,ALT.

PGN 126720-49 (0x1EF00)

Proprietary: Set WAAS Satellite

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	49 (decimal)	49 = Set WAAS Satellite
5	WAAS Satellite Number	No	DD074	DF53	uint8	1 bit	0=Auto Mode (default) 120-138=WAAS satellite ID 255=Data Not Available / Do Not Change	This command can be used to direct the GPS to use a specific WAAS satellite. This value is NOT stored in Eeprom, but is changeable with the Command Group Function PGN 126208.

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

This PGN performs the same function as the received NMEA 0183 sentence \$PAMTC,OPTION,4,XXX.

PGN 126720-50 (0x1EF00)

Proprietary: Enable GPS Type 0 Messages

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/N/N	Destination: Address	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	Yes	DD005	DF53	uint8	1 bit	50 (decimal)	50 = Enable GPS Type 0 Messages
5	Enable GPS Type 0 Messages Parameter	No	N/A	N/A	uint16	1 bit	0=Ignore type 0 message for 60 seconds 1-39=Enable type 0 messages as data 255=Ignore type 0 messages (default) 65535=Data Not Available / Do Not Change	This command can be used to direct the GPS how to handle type 0 messages. This value is NOT stored in Eeprom, but is changeable with the Command Group Function PGN 126208.

Notes

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

This PGN performs the same function as the received NMEA 0183 sentence \$PAMTC,OPTION,5,XXX.

PGN 126992 (0x1F010)

System Time

Single Frame: Yes	Priority: 3/Y/Y	Update Rate: 1000 ms/Y/Y	Destination: Global	Query Support: Yes	Access Level: 0
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For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The Date and Time fields will only contain valid data once the GPS receiver within the PB200 has achieved a position fix.

The latency of this parameter group will be governed by overall bus traffic.

The following transmitted PGNs are linked by their SID fields: 126992, 129026, 129029, 129539, and 129540.

PGN 126996 (0x1F014)

Product Information

Single Frame: No	Priority: 6/Y/N	Update Rate: 0/N/N	Destination: Global	Query Support: Yes	Access Level: 0
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For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

PGN 126998 (0x1F016)

Configuration Information

Single Frame: No	Priority: 6/Y/N	Update Rate: 0/N/N	Destination: Global	Query Support: Yes	Access Level: 0
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For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The contents of fields 1 and 2 are stored in nonvolatile memory, and may be programmed using the NMEA Command Group Function, PGN 126208.

To change the state of the Installation Description (fields 1 and 2), use the Command Group Function PGN 126208, specifying the individual fields in PGN 126998 as follows.

PGN 126998	
Field	Value
1	Desired variable length ASCII string, up to 70 characters
2	Desired variable length ASCII string, up to 70 characters

PGN 127250 (0x1F112)

Vessel Heading

Single Frame: Yes

Priority: 2/Y/Y

Update Rate: 100 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The value in field 2 provides ship heading relative to magnetic north. This value includes corrections for deviation and attitude offsets. Use PGN 126720-33 to calibrate the compass (produce a deviation table). Use PGN 126720-32 to establish sensor attitude offsets.

To obtain ship heading relative to true north, add the variation value in field 4 to the heading sensor reading in field 2.

See also Magnetic Variation PGN 127258.

PGN 127251 (0x1F113)

Rate of Turn

Single Frame: Yes

Priority: 2/Y/Y

Update Rate: 100 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

PGN 127257 (0x1F119)

Attitude

Single Frame: Yes

Priority: 3/Y/Y

Update Rate: 1000 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

Use PGN 126720-32 to establish sensor attitude offsets.

PGN 127258 (0x1F11A)

Magnetic Variation

Single Frame: Yes

Priority: 7/Y/Y

Update Rate: 1000 mS/Y/Y

Destination: Global

Query Support: No

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The magnetic variation provided in field 5 is calculated based on the current date and position provided by the PB200 internal GPS, using the World Magnetic Model for 2005. Prior to the internal GPS achieving a position fix, the last known Variation and Age of Service (fields 5 and 4, respectively) are retrieved from EEPROM memory and supplied in these fields.

See also field 4 of PGN 127250.

PGN 129025 (0x1F801)

Position, Rapid Update

Single Frame: Yes

Priority: 2/Y/Y

Update Rate: 100 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The data in this PGN is derived from the PB200 internal GPS. If the GPS has not achieved a fix, then both fields will contain the value +2,147,483,647, indicating Data Not Available.

The latitude and longitude values are referenced to the WGS-84 datum.

See also PGN 129029.

PGN 129026 (0x1F802)

COG & SOG, Rapid Update

Single Frame: Yes

Priority: 2/Y/Y

Update Rate: 250 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The following transmitted PGNs are linked by their SID fields: 126992, 129026, 129029, 129539, and 129540.

PGN 129029 (0x1F805)

GNSS Position Data

Single Frame: No

Priority: 3/Y/Y

Update Rate: 1000 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

Some of the data in this parameter group will only be available once the GPS has achieved a position fix. Other data will be available once satellites are being tracked.

Fields 16, 17, 18 are repeated for each station indicated by field 15, and therefore are not present when field 15 is 0, which is the case for the PB200.

The following transmitted PGNs are linked by their SID fields: 126992, 129026, 129029, 129539, and 129540.

PGN 129033 (0x1F809)

Time & Date

Single Frame: Yes

Priority: 3/Y/Y

Update Rate: 1000 ms/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

Fields 1 and 2 will only contain valid data once the GPS receiver within the PB200 has achieved a position fix.

The contents of field 3 are stored in EEPROM memory within the PB200, and may be changed using PGN 126208, Command Group Function.

To change the Local Offset value (field 3), use the Command Group Function PGN 126208, specifying the individual fields in PGN 129033 as follows.

PGN 129033	
Field	Value
3	Desired local offset, minutes

PGN 129044 (0x1F814)

Datum

Single Frame: No	Priority: 6/Y/Y	Update Rate: 10,000 ms/Y/Y	Destination: Global	Query Support: No	Access Level: 0
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For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

(continued on next page)

To change to a different Local Datum (field 1), use the Command Group Function PGN 126208, specifying the individual fields in PGN 129044 as follows.

PGN 129044	
Field	Value
1	4-character Local Datum code

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 PB200, and therefore are not available for use as Local Datum (field 1).

See also the NMEA 0183 transmitted sentence \$GPDTM, and the received NMEA 0183 proprietary command \$PAMTC,DATUM.

PGN 129538 (0x1FA02)

GNSS Control Status

Single Frame: No	Priority: 6/Y/Y	Update Rate: 0/N/N	Destination: Global	Query Support: Yes	Access Level: 0
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For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

Each field in this PGN contains a setting stored in nonvolatile EEPROM within the PB200. The default values are shown in the Remarks column. The value in each field may be changed using PGN 126208, Command Group Function.

See also the NMEA 0183 received proprietary sentence \$PAMTC,OPTION regarding allowing the calculation of 2D position fixes (page 132).

PGN 129539 (0x1FA03)

GNSS DOPs

Single Frame: Yes

Priority: 6/Y/Y

Update Rate: 1000 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The following transmitted PGNs are linked by their SID fields: 126992, 129026, 129029, 129539, and 129540.

PGN 129540 (0x1FA04)

GNSS Sats in View

Single Frame: No

Priority: 6/Y/Y

Update Rate: 1000 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This parameter group contains a variable number of fields, depending on the number of Satellites in View (field 4). Fields 5 through 11 are repeated for each satellite in view.

The following transmitted PGNs are linked by their SID fields: 126992, 129026, 129029, 129539, and 129540.

PGN 130306 (0x1FD02)

Wind Data

Single Frame: Yes

Priority: 2/Y/Y

Update Rate: 100 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

Different instances of this parameter group may be simultaneously enabled to transmit with different selections for the Wind Reference field. This may be done using the Request Group Function PGN 126208, specifying the Wind Reference field as one of the requested parameters. If the Wind Reference field is not specified in the Request Group Function PGN 126208, the default wind reference (0x02, Apparent) is assumed. In addition, the update rate (transmission interval) may be individually specified for the different wind references using the Request Group Function PGN 126208.

The Priority field of this parameter group may also be individually specified by Wind Reference using PGN 126208, Command Group Function.

Wind data using reference values 0x00, 0x01, and 0x03 will only be available once a GPS fix has been achieved. Wind data using reference value 0x04 will only be available if Speed Water Referenced is available on the NMEA 2000[®] bus from a device transmitting PGN 128259, or from a water speed sensor providing the VHW sentence on the PB200 NMEA 0183 input.

By default, two different instances of this parameter group are transmitted: the first with field 4, Wind Reference, set to 0x02 (Apparent), and the second with field 4 set to 0x00 (True referenced to North).

PGN **130310** (0x1FD06)

Environmental Parameters

Single Frame: Yes

Priority: 5/Y/Y

Update Rate: 0/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This PGN has been superseded by PGN 130311, but is included for backward compatibility.

PGN **130311** (0x1FD07)

Single Frame: Yes

Priority: 5/Y/Y

Update Rate: 500 mS/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This PGN is currently under review by the NMEA 2000[®] Working Group.

PGN **130323** (0x1FD13)

Meteorological Station Data

Single Frame: No

Priority: 6/Y/Y

Update Rate: 1000 ms/Y/Y

Destination: Global

Query Support: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

The contents of fields 13 and 14 are stored in EEPROM memory within the PB200, and may be changed using PGN 126208, Command Group Function.

To change the Station ID String (field 13) and Station Name String (field 14), use the Command Group Function PGN 126208, specifying the individual fields in PGN 130323 as follows.

PGN 130323	
Field	Value
13	The desired variable length ASCII string, up to 15 characters.
14	The desired variable length ASCII string, up to 50 characters.

PGN 130880 (0x1FF40)

Proprietary: Additional Weather Data

Single Frame: No	Priority: 7/Y/Y	Update Rate: 0/Y/Y	Destination: Global	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Format Code	Yes	DD005	DF53	uint8	1 bit	1	1 = Format Code 1
5	Wind chill temperature, relative	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Wind chill temperature, calculated from the ambient air temperature and apparent wind speed, both determined from internal PB200 sensors.
6	Wind chill temperature, theoretical	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Wind chill temperature, calculated from the ambient air temperature and true wind speed, both determined from internal PB200 sensors.
7	Heat index	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Heat index, calculated from the ambient air temperature and relative humidity, both determined from internal PB200 sensors. The PB200 always contains the value 0xFFFF (Data Not Available) in this field.
8	Dew point	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Dew point, calculated from the ambient air temperature and relative humidity, both determined from internal PB200 sensors. . The PB200 always contains the value 0xFFFF (Data Not Available) in this field.

Notes

This proprietary PGN provides data for which no standard NMEA 2000® PGN exists at the time of PB200 product development.

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1, 3, and 4 must all be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

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 **dew point** is the temperature at which the water vapor in the air begins to condense into a liquid. If the air were gradually cooled while maintaining constant moisture content, the relative humidity would rise until it reaches 100%. The air temperature at this point of saturation is called the dew point. If the air is dry enough, it is possible to have a dew point that is below freezing. The dew point is then sometimes referred to as the frost point. The PB200 calculates dew point from the measured air temperature and relative humidity sensor readings.

PGN 130881 (0x1FF41)

Proprietary: Heater Control

Single Frame: No	Priority: 7/Y/Y	Update Rate: 0/Y/Y	Destination: Global	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	PG Transmit Option	No	N/A	DF52	2 bits	1	MSB/LSB: 00 = Do not transmit on status change 01 = Transmit on status change 10 = Error 11 = Data not available	This field defines whether this PGN is transmitted automatically when there is a change in the heater status (field 6) while the heater mode (field 5) is in Automatic. This field is stored in EEPROM and may be changed with the Command Group Function PGN 126208. The default value is 00 (do not transmit on status change).
5	Heater Mode	No	N/A	DF52	2 bits	1	MSB/LSB: 00 = Manual, Turn Off 01 = Manual, Turn On 10 = Automatic 11 = No action	This field is stored in EEPROM and may be changed with the Command Group Function PGN 126208. If the Heater Mode is 01 upon power up, the heater will <i>not</i> be turned On, i.e. the unit will behave as though the Heater Mode is 00. If the Heater Mode is 10 (Automatic) upon power up, the heater will cycle on and off automatically over time as required to maintain the proper plate temperature. The default value is 00 (Manual, Turn Off).
6	Heater Status	No	DD002	DF52	2 bits	1	MSB/LSB: 00 = Off 01 = On 10 = Error 11 = Data not available	This field indicates the actual state of the heater. The power up default value is 00 (Off). The PB200 will return DataNotAvailable unless the Heater Control option is enabled at the factory.
7	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
8	Plate Temperature	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Temperature of the aluminum plate at the base of the PB200 wind channel.

Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
9	Air Temperature	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Ambient air temperature as measured by the air temperature sensor within the PB200.
10	Dew Point	No	DD043	DF39	uint16	0.01 deg K	0 to 655.32 deg K	Dew point temperature, calculated from the measured air temperature and the relative humidity. . The PB200 always contains the value 0xFFFF (Data Not Available) in this field.

Notes

Heater Control is a factory enabled option that is not present by default.

The heater may be used in the weather station to prevent the formation of dew or ice on the aluminum plate in the wind channel. If the Heater Mode is set to Automatic, then the weather station 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 a humidity sensor, PBxxx products do not, LBxxx products do).

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.

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

This PGN is transmitted in response to a PGN 126208 Request Group Function message. Fields 1 and 3 must each be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

To change the PG Transmit Option (field 4), use the Command Group Function PGN 126208, specifying the individual fields in PGN 130881 as follows.

PGN 130881	
Field	Value
1	135 (decimal)
3	4 (decimal)
4	One of the following: 0 = Do not transmit on status change 1 = Transmit on status change

To change the Heater Mode (field 5), use the Command Group Function PGN 126208, specifying the individual fields in PGN 130881 as follows.

PGN 130881	
Field	Value
1	135 (decimal)
3	4 (decimal)

PGN 130881	
Field	Value
5	One of the following: 0 = Manual, Turn Off 1 = Manual, Turn On 2 = Automatic 3 = No action

PGN 130944 (0x1FF80)

Proprietary: POST

Single Frame: No	Priority: 7/Y/N	Update Rate: 0/Y/N	Destination: Global	Query Support: Yes	Access Level: 0
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Field #	Name	Request Param.	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	Yes	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	No	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	Yes	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Control	Yes	N/A	DF52	1 bit	1	0 = report previous values 1 = generate new values	Default value = 0 This field only applies when this PGN is transmitted in response to a query. Periodic transmissions of this PGN will always generate new values.
5	Reserved bits	No	DD001	DF52	7 bits	1	0x7F	All bits set to logic "1"
6	Number of ID/test result pairs to follow	No	DD006	DF53	uint8	1 bit	0 to 252 This field contains 4 for this product.	
7	Test ID #1	No	DD005	DF53	uint8	1 bit	0 to 252	Refer to the Table of IDs and Failure Codes.
8	Test result #1	No	N/A	DF53	uint8	1 bit	0x00 = Pass 0x01-0xEF = Fail 0xF0-0xFE = reserved 0xFF = Data Not Available	Refer to the Table of IDs and Failure Codes.
9	Variable number of fields, field 7 repeated	No	DD005	DF53	uint8	1 bit	0 to 252	Refer to the Table of IDs and Failure Codes.
10	Variable number of fields, field 8 repeated	No	N/A	DF53	uint8	1 bit	0x00 = Pass 0x01-0xEF = Fail 0xF0-0xFE = reserved 0xFF = Data Not Available	Refer to the Table of IDs and Failure Codes.

Notes

This PGN is transmitted once automatically upon power up of the PB200. Thereafter, it may be transmitted in response to a PGN 126208 Request Group Function message. Fields 1 and 3 must both be fully specified in the request in order for this PGN to be transmitted.

This PGN does not respond to ISO Requests (PGN 59904).

This PGN provides a method of reporting the results of the Power On Self Test performed by the PB200. The various tests performed by the POST 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 PB200.

Field 4, Control, specifies whether this PGN will report the results of the last test, or whether the PB200 will conduct a new self test prior to reporting the results. This field should be specified when requesting a single transmission of this PGN.

This PGN may be configured to transmit periodically by specifying an Update Rate using the Request Group Function PGN 126208. By default, this PGN is not transmitted periodically.

If Field 4, Control, is not specified, then Field 4 will be regarded as 0 (report previous values) for single requests, and 1 (generate new values) for periodic transmissions.

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

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

Table of IDs and Failure Codes:

<u>ID</u>	<u>Description</u>	<u>Failure Codes</u>
0	Inter-CPU communication	0x01 = Communication failure 0x02-0xEF = reserved
1	Format Code	0x01 = Format Code mismatch 0x02-0xEF = reserved
2	Factory EEPROM	0x01-0xEE = count of checksum errors 0xEF = one or more illegal values detected
3	User EEPROM	0x01-0xEE = count of checksum errors 0xEF = one or more illegal values detected
7	Internal temperature sensor	0x01 = Thermistor shorted 0x02 = Thermistor open 0x03-0xEF = reserved
8	Battery voltage sensor	0x01 = Sensor not functional 0x02-0xEF = reserved
9	Air temperature sensor	0x01 = Thermistor shorted 0x02 = Thermistor open 0x03=0xEF = reserved
10	Plate temperature sensor	0x01 = Thermistor shorted 0x02 = Thermistor open 0x03=0xEF = reserved

<u>ID</u>	<u>Description</u>	<u>Failure Codes</u>
11	Standard relative humidity sensor	0x01 = Humidity sensor fault: no frequency 0x02 = Humidity sensor fault: frequency too high 0x03 = Humidity sensor fault: frequency too low 0x04=0xEF = reserved
12	Barometric pressure sensor	0x01 = Sensor fault 0x02-0xEF = reserved
13	Wind sensor	0x01 = Sensor fault 0x02-0xEF = reserved
14	Compass sensor	0x01 = Sensor fault 0x02-0xEF = reserved
15	GPS receiver	0x01 = Fault 0x02-0xEE = reserved 0xEF = Test results not yet available
16	Attitude sensor	0x01 = Sensor fault 0x02-0xEF = reserved
17	Rate gyro	0x01 = Sensor fault 0x02-0xEF = reserved
18	Optional Galltec relative humidity sensor	0x01 = Sensor fault 0x02-0xEE = reserved 0xEF = Sensor not present

2.5. Received NMEA 2000® PGNs

The NMEA 2000® PGNs recognized by the PB200 WeatherStation are summarized in Table 2. Each of the PGNs in Table 2 is described in detail on the subsequent pages.

Table 2: NMEA 2000® Received PGNs

<u>PGN</u>	<u>Description</u>
59904	ISO Request

<u>PGN</u>	<u>Description</u>
60928	ISO Address Claim
65286	Proprietary: Boot State Request
126208	Request Group Function
126208	Command Group Function
126720	Proprietary -1: Master Reset -130: Restore EEPROM -132: Reset GPS
128259	Speed

PGN **059904** (0x0EA00)

ISO Request

Single Frame: Yes

Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

When this PGN is received by the PB200, the unit will respond by transmitting either the PGN being requested, or the ISO Acknowledge PGN 59392.

See also the received Request Group Function PGN 126208.

PGN **060928** (0x0EE00)

ISO Address Claim

Single Frame: Yes **Access Level:** 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

PGN 60928 is a network management message used to claim a network address, reply to devices requesting the claimed address, and to respond to requests for device information (NAME). The 64 bits comprised by the ten fields in this parameter group constitute the ISO 11783-5 NAME entity.

PGN **065286** (0x0FF06)

Proprietary: Boot State Request

Single Frame: Yes Access Level: 0

Field #	Name	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Reserved bits	DD001	DF52	48 bits	1	0xFFFFFFFFFFFF	All bits set to logic "1"

Notes

When this destination global PGN is received by the PB200, the unit will respond by transmitting PGN 65285 (see). It is intended that all Airmar devices connected to the NMEA 2000® bus will likewise also reply accordingly when receiving this PGN.

PGN 126208 (0x1ED00)

Request Group Function

Single Frame: No Access Level: 0

For further information about the NMEA 2000® protocol, including field descriptions refer to the document, *NMEA 2000® Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

When this PGN is received by the PB200, the unit will compare the specified Request Parameters in fields 6, 7 (and any following fields) against the contents of the actual fields in the requested PGN. The only fields that may be used as Request Parameters are those which indicate a "Yes" in the "Request Param." column in the detailed description for the specific transmitted PGN. If all specified parameters match the values in the corresponding fields, then the requested PGN will be transmitted. If any of the parameters do not match, then the unit will respond by transmitting the Acknowledge Group Function PGN 126208 with the appropriate error code(s) provided.

This PGN may also be used to specify the Transmission Interval (Update Rate) between successive transmissions of a periodically transmitted PGN. (Note: certain PGNs do not permit changing the transmission interval.) For all single-frame PGNs that permit changing the transmission interval, the allowable range of interval values is 50 ms to 60 seconds. For all fast-packet PGNs that permit changing the transmission interval, the allowable range of interval values is 100 ms to 60 seconds. Note that it may be possible to specify an update rate that is faster than the unit's ability to generate new data. In this case, the PGN will be transmitted only as new data becomes available.

Use the proprietary received PGN 126720-130 to reset all Transmission Intervals for all PGNs to their factory defaults.

Refer to the detailed descriptions of the specific transmitted PGNs in this document for any exceptions or special cases with regard to using the Request Group Function PGN 126208 with each PGN.

All parameter value fields must be padded (with 1's) if necessary to ensure byte boundaries are adhered to.

When the Requested PGN field 2 (of PGN 126208) refers to a proprietary PGN, fields 1 and 3 (manufacturer code and industry group) of the proprietary PGN must be specified *first* in the list of field number and parameter value pairs in PGN 126208. All other field number and parameter value pairs may appear in any order in this message.

For proprietary PGNs described in this document, fields 1, 2, and 3 (manufacturer code, reserved bits, and industry group) of the proprietary PGN may optionally be combined into a single 16-bit field when specifying fields in PGN 126208. For Airmar proprietary PGNs, the 16-bit field is constructed as follows:

- bits 15-13 = binary 100 = decimal 4 (industry group for "Marine Industry")
- bits 12-11 = binary 11 = reserved bits
- bits 10-0 = binary 000 1000 0111 = decimal 135 (manufacturer code for Airmar Technology)

The concatenation of these 16 bits produces the binary value 1001 1000 1000 0111 = hexadecimal 0x9887. Therefore, instead of specifying the two fields, 11-bit field 1 and 3-bit field 3 for a proprietary PGN, it is permissible to specify a single 16 bit field 1, containing the value 0x9887, for the proprietary PGNs described in this document.

When doing so, field 3 may *not* also be specified, or the PGN will not be accepted. The 16-bit field 1 must be specified first in the list of field number and parameter value pairs in PGN 126208.

See also related PGNs:

- the received ISO Request PGN 59904
- the received Command Group Function PGN 126208
- the transmitted Acknowledge Group Function PGN 126208

NMEA 2000® RECEIVED PARAMETER GROUP
Command Group Function

PGN 126208 (0x1ED00)

Single Frame: No Access Level: 0

For further information about the NMEA 2000® protocol, including field descriptions refer to the document, *NMEA 2000® Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This received PGN is used by the PB200 to set the value of one or more parameters in a Parameter Group. The individual parameters of the Commanded PGN are specified in the Field Number/Value pairs (fields 6 and 7 of this PGN). Refer to the detailed description for each transmitted PGN for specific instructions regarding which fields to specify when using the Command Group Function PGN 126208. (Note that some required fields are not changeable, but are used as qualifiers when changing other fields.)

This PGN may also be used to specify the Priority field of a given transmitted PGN. (Note: certain PGNs do not permit changing the Priority field.)

Upon receiving this PGN, the PB200 will respond by transmitting the Acknowledge Group Function PGN 126208.

Use the proprietary received PGN 126720-130 to reset all Priority fields for all PGNs to their factory defaults.

All parameter value fields must be padded (with 1's) if necessary to ensure byte boundaries are adhered to.

When the Commanded PGN field 2 (of PGN 126208) refers to a proprietary PGN, fields 1 and 3 (manufacturer code and industry group) of the proprietary PGN must be specified *first* in the list of field number and parameter value pairs in PGN 126208. All other field number and parameter value pairs may appear in any order in this message.

For proprietary PGNs described in this document, fields 1, 2, and 3 (manufacturer code, reserved bits, and industry group) of the proprietary PGN may optionally be combined into a single 16-bit field when specifying fields in PGN 126208. For Airmar proprietary PGNs, the 16-bit field is constructed as follows:

- bits 15-13 = binary 100 = decimal 4 (industry group for "Marine Industry")
- bits 12-11 = binary 11 = reserved bits
- bits 10-0 = binary 000 1000 0111 = decimal 135 (manufacturer code for Airmar Technology)

The concatenation of these 16 bits produces the binary value 1001 1000 1000 0111 = hexadecimal 0x9887. Therefore, instead of specifying the two fields, 11-bit field 1 and 3-bit field 3 for a proprietary PGN, it is permissible to specify a single 16 bit field 1, containing the value 0x9887, for the proprietary PGNs described in this document.

When doing so, field 3 may *not* also be specified, or the PGN will not be accepted. The 16-bit field 1 must be specified first in the list of field number and parameter value pairs in PGN 126208.

See also related PGNs:

- the received Request Group Function PGN 126208
- the transmitted Acknowledge Group Function PGN 126208

PGN 126720 (0x1EF00)

Addressable Multi-Frame Proprietary

Single Frame: No Access Level: See PID variants

Field #	Name	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	DD005	DF53	uint8	1 bit	0 to 252	Identifier specifying how to interpret the remaining fields in this parameter group.
5+	(PID-dependent)	DD000	DF00	undef.	undefined	undefined	The use of the remaining bytes and the number of CAN frames required varies according to the PID (field 4).

Notes

In order for this received PGN to be recognized by the PB200, the Manufacturer Code and Industry Group (fields 1 and 3) must match the values shown.

The use of this PGN with the following Proprietary ID's (field 4) is described on the subsequent pages:

- 1: Master Reset
- 130: Restore user EEPROM memory to factory defaults
- 132: Reset GPS

PGN 126720-1 (0x1EF00)

Single Frame: No Access Level: 1

Field #	Name	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	DD005	DF53	uint8	1 bit	1 = Master Reset	Identifier specifying how to interpret this PGN.
5	Reserved bits	DD001	DF52	24 bits	1	0xFFFFFFFF	All bits set to logic "1"

Notes

Upon receiving this PGN, the PB200 will perform a master CPU reset, as though the power had been turned off and back on again. This PGN performs the same function as the NMEA 0183 proprietary command, \$PAMTC,RESET.

In order for this received PGN to be recognized by the PB200, the Manufacturer Code, Industry Group, and Proprietary ID (fields 1, 3, and 4) must match the values shown.

Although this is a fast-packet message, the version with this PID fits into a single CAN frame.

PGN 126720-130 (0x1EF00)

Proprietary: Reset EEPROM

Single Frame: No Access Level: 1

Field #	Name	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	DD005	DF53	uint8	1 bit	130 (decimal) = Reset EEPROM	Identifier specifying how to interpret this PGN.
5	Options	N/A	DF52	4 bits	1	0x0 = Restore entire user EEPROM except Unique Number 0x1 = Restore all message Priorities 0x2 = Restore all message Update Rates 0x3 = Restore all message Priorities <i>and</i> Update Rates 0x4 = Restore user Unique Number 0x4 to 0xE = reserved 0xF = reserved	
6	Reserved bits	DD001	DF52	20 bits	1	0xFFFF	All bits set to logic "1"

Notes

Upon receiving this PGN, the PB200 will restore part of user EEPROM memory to its factory default state.

The Options field (field 5) specifies whether all of user EEPROM memory (except the user Unique Number) is to be restored (value 0x0), or only a subset of EEPROM memory is to be restored.

Note that this PGN requires Access Level 1, even when resetting the Unique Number to its factory default value (option 0x4). The proprietary PGN to change the Unique Number to a value other than the factory default value, which is described in another document, requires Access Level 2.

In order for this received PGN to be recognized by the PB200, the Manufacturer Code, Industry Group, and Proprietary ID (fields 1, 3, and 4) must match the values shown.

Although this is a fast-packet message, the version with this PID fits into a single CAN frame.

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

PGN 126720-132 (0x1EF00)

Single Frame: No Access Level: 0

Field #	Name	DD	DF	Type	Resolution	Value	Remark
1	Manufacturer Code	DD172	DF52	11 bits	1	135 (decimal)	Manufacturer Code for Airmar Technology.
2	Reserved bits	DD001	DF52	2 bits	1	0x3	All bits set to logic "1"
3	Industry Group	DD168	DF52	3 bits	1	4 (decimal)	Industry Group for "Marine Industry".
4	Proprietary ID (PID)	DD005	DF53	uint8	1 bit	132 (decimal) = Reset GPS	Identifier specifying how to interpret this PGN.
5	(Remaining fields TBD)						

Notes

Upon receiving this PGN, the PB200 will reset its internal GPS module.

In order for this received PGN to be recognized by the PB200, the Manufacturer Code, Industry Group, and Proprietary ID (fields 1, 3, and 4) must match the values shown.

Although this is a fast-packet message, the version with this PID fits into a single CAN frame.

PGN 128259 (0x1F503)

Speed

Single Frame: Yes Access Level: 0

For further information about the NMEA 2000[®] protocol, including field descriptions refer to the document, *NMEA 2000[®] Standard for Serial-Data Networking of Marine Electronic Devices* available from NMEA.

Notes

This received PGN is recognized by the PB200 in order to receive Speed Water Referenced from an external water speed sensor, such as an Airmar Smart[™] Speed sensor. The Speed Water Referenced data is used by the PB200 to calculate True Wind Relative to the Water, for transmission in PGN 130306 and the NMEA 0183 VWT sentence.

See section 2.3. for precedence rules regarding data received in this PGN.

3. NMEA 0183 Interfaces

The Airmar PB200 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.³

The transmitted NMEA 0183 sentences are described in section 3.1. Received NMEA 0183 sentences and proprietary commands are described in section 3.2.

3.1. 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.⁴

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 PB200 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 PB200 WeatherStation are summarized in Table 3. Each of the transmitted sentences in Table 3 is described in detail on the subsequent pages.

³ See the \$PAMTC, BAUD command.

⁴ See the \$PAMTC, EN command.

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 3: NMEA 0183 Regularly Transmitted Sentences

<u>Sentence</u>	<u>Description</u>	<u>Enabled by Default</u>	<u>Maximum Length (chars)</u>
\$GPDTM	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 ⁵	✓	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) ⁵	✓	28
\$GPRMC	Recommended Minimum Specific GNSS Data	No	74
\$TIROT	Rate of Turn	✓	22
\$GPVTG	Course Over Ground and Ground Speed	✓	42
\$WIVWR	Relative Wind Speed and Angle	No	41
\$WIVWT	True Wind Speed and Angle	✓ ⁶	41
\$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
\$GPZDA	Time and Date	✓	38

⁵ 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.

⁶ \$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.

\$GPDTM

Summary

NMEA 0183 standard Datum Reference.

Syntax

\$GPDTM, <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

Default State

Disabled. Transmitted once per second when enabled.

Notes

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

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 PB200, and therefore are not available for use as Local Datum.

See also the proprietary NMEA 0183 command \$PAMTC,DATUM, and the transmitted NMEA 2000[®] Datum PGN 129044.

\$GPGGA

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 PB200 WeatherStation'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). This field is not provided by the PB200 WeatherStation, and appears as a null field.

- <12> M. This field is not provided by the PB200 WeatherStation, and appears as a null field.
- <13> Age of Differential GPS data, seconds. This field is not provided by the PB200 WeatherStation, and appears as a null field.
- <14> Differential reference station ID, 0000-1023. This field is not provided by the PB200 WeatherStation, and appears as a null field.

Default State

Enabled. Transmitted once per second.

Notes

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

\$GPGLL

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 PB200 WeatherStation for the Mode indicator are A, D, and N.

Default State

Disabled. Once per second when enabled.

Notes

This sentence may be enabled via the \$PAMTC,EN,GLL command.

\$GPGSA

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

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 PB200 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 may be enabled via the \$PAMTC,EN,GSV command.

\$HCHDG

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 may be enabled or disabled via the \$PAMTC,EN,HDG command.

\$HCHDT

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

Default State

Disabled. Twice per second when enabled.

Notes

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

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

\$WIMDA

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 (this field left blank by WeatherStation)
- <10> Absolute humidity, percent (this field left blank by WeatherStation)
- <11> Dew point, degrees C, to the nearest 0.1 degree C (this field left blank by WeatherStation)
- <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 the GPS, compass heading, and magnetic variation. If any of these data are not available, this sentence shall be transmitted with null fields.

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

\$WIMWV

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 PB200 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 PB200 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.

\$GPRMC

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 PB200 WeatherStation for the Mode indicator are A, D, and N.

Default State

Disabled. Transmitted once per second when enabled.

Notes

This sentence may be enabled via the \$PAMTC,EN,RMC command.

\$TIROT

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.

Default State

Enabled. Transmitted twice per second.

Notes

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

\$GPVTG

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 PB200 WeatherStation for the Mode indicator are A, D, and N.

Default State

Enabled. Transmitted once per second.

Notes

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

\$WIVWR

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 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

Enabled, but automatically prohibited until water speed is provided via the NMEA 0183 input. Transmitted once per second when enabled and not prohibited.

Notes

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

\$YXXDR

Summary

NMEA 0183 Transducer Measurements. Used in the PB200 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 (this field left blank by WeatherStation)
- <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 once 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.

\$GPZDA

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

Default State

Enabled. Transmitted once per second.

Notes

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

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>
```

In the PB200, the local time zone fields in the NMEA 0183 \$GPZDA sentence may only be changed by receiving an NMEA 2000[®] Command Group Function PGN 126208 to change the Local Offset field 3 of the Time and Date PGN 129033. (See page 46.) The local time zone is not changeable via the NMEA 0183 interface.

3.2. Received NMEA 0183 Sentences and Commands

The PB200 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 PB200 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 PB200 WeatherStation on the serial input channel are summarized in Table 4 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 4 is described in detail on the subsequent pages.

Table 4: 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 PB200 WeatherStation with altitude settings
\$PAMTC,ATTOFF	Program the PB200 WeatherStation with angular attitude offsets: azimuth, pitch, and roll
\$PAMTC,BAUD	Change the baud rate from the nominal 4800 baud to 38400 baud
\$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 WeatherStation internal heater.
\$PAMTC,OPTION	Enable/disable certain WeatherStation features
\$PAMTC,POST	Query Power On Self Test results
\$PAMTC,QPS	Query part number and serial number strings
\$PAMTC,QV	Query WeatherStation hardware and firmware versions
\$PAMTC,RESET	Reset the PB200 WeatherStation
\$PAMTC,SIM	Enable/disable Simulate Mode.
\$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 PB200 WeatherStation.

See section 2.3. 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
DATUM
EN
ERST
HEATER
OPTION
POST
QPS
QV
RESET
SIM

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 PB200 WeatherStation. These commands are each described in their own section on the following pages.

\$PAMTC,ALT

Summary

Settings related to the altitude of the PB200.

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 PB200 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 PB200, 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 PB200. 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.

This sentence performs the same function as the transmitted proprietary NMEA 2000[®] PGN 126720-48.

Field <2> corresponds to the NMEA 2000[®] transmitted PGN 129538, field 9, and proprietary PGN 126720-48, field 5.

Field <3> corresponds to the NMEA 2000[®] transmitted PGN 129538, field 10, and proprietary PGN 126720-48, field 6.

Field <4> corresponds to the NMEA 2000[®] transmitted proprietary PGN 126720-48, field 7.

See also:

NMEA 0183 received proprietary sentence \$PAMTC,OPTION, option 2.

NMEA 0183 transmitted sentence \$YXXDR (barometric pressure).

NMEA 2000[®] transmitted GNSS Position Data PGN 129029 (field 6, altitude).

NMEA 2000[®] transmitted GNSS Control Status PGN 129538 (fields 5, 9 and 10).

NMEA 2000[®] transmitted proprietary PGN 126720-48.

\$PAMTC,ATTOFF

Summary

A set of proprietary commands to set and query the angular attitude offsets for the PB200 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 of commands perform the same function in the PB200 as the transmitted proprietary NMEA 2000[®] PGN 126720-32. Note that in the NMEA 0183 command, the arguments are in degrees, while in the NMEA 2000[®] PGN, the arguments are in radians. The values stored in the PB200 are in radians. Therefore, when using the \$PAMTC,ATTOFF command, there may be a slight rounding error causing the values read back from the PB200 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 PB200 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,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 PB200 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 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'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 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'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 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'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'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 for the stored user compass calibration coefficients.

Syntax

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

Reply

The weather station 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'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 PB200 is as follows:

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

Reply

The weather station 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's nonvolatile EEPROM, as defined in the "Q", Query Command.

Upon successful completion the weather station 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 PB200, 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.

Also refer to the transmitted NMEA 2000[®] PGN 129044, Datum.

\$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:
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.

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:

<u>Sentence ID</u>	<u>Enabled by default?</u>	<u>Default Transmission Interval</u>
DTM	–	10
GGA	✓	10
GLL	–	10
GSA	–	10
GSV	–	10
HDG	–	5
HDT	–	5
MDA	✓	10
MWD	✓	10
MWV (R)	✓	5
MWV (T)	✓	10
RMC	–	10
ROT	✓	5
VTG	✓	10
VWR	–	10
VWT	✓	10
XDR (A)	–	10
XDR (B)	–	10
ZDA	✓	10

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 two forms: A and B. These two forms are also 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 PB200 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.

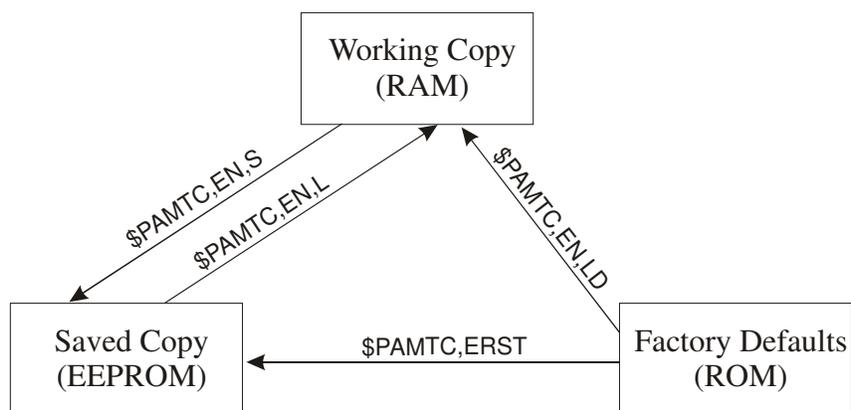
The \$PAMTC,EN,S command causes the contents of the current working copy in RAM to be saved to EEPROM. The saved settings will then be restored to RAM each time power is applied to the unit.

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,19,1,DTM,1,10*17  
$PAMTR,EN,19,2,GGA,1,10*17  
$PAMTR,EN,19,3,GLL,0,10*13  
$PAMTR,EN,19,4,GSA,0,10*00  
$PAMTR,EN,19,5,GSV,0,10*10  
$PAMTR,EN,19,6,HDG,0,5*2C  
$PAMTR,EN,19,7,HDT,0,5*22  
$PAMTR,EN,19,8,MDA,1,10*19  
$PAMTR,EN,19,9,MWD,1,10*0E  
$PAMTR,EN,19,10,MWVR,1,5*75  
$PAMTR,EN,19,11,MWVT,1,10*46  
$PAMTR,EN,19,12,RMC,0,10*3B  
$PAMTR,EN,19,13,ROT,1,5*1A  
$PAMTR,EN,19,14,VTG,1,10*21  
$PAMTR,EN,19,15,VWR,0,10*37  
$PAMTR,EN,19,16,VWT,1,10*37  
$PAMTR,EN,19,17,XDRA,0,10*6D  
$PAMTR,EN,19,18,XDRB,0,5*59  
$PAMTR,EN,19,19,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 3.1. 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 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 (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

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,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 PB200 WeatherStation. 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.

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 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 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 humidity sensor, PBxxx products do not, LBxxx products do).

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,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)

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
1-39 = 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 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 PB200 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 108.

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 48 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.

\$PAMTC,POST

Summary

Perform the Power-On Self Test.

Syntax

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

The PB200 WeatherStation will reply with a sentence in the following form:

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

Each of the fields <1> through <14> contains an integer value that represents the status of a simple test performed on a given submodule within the PB200 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 (with all connected options) would reply with \$PAMTR,POST,0,0,0,0,0,0,0,0,0,0,0,0,0,0,PB200. A standard PB200 would output \$PAMTR,POST,0,0,0,0,0,0,,0,0,0,0,0,,0,PB200, where a Null field indicates sensor not present.

The fields and their corresponding submodules are listed below.

where

- <1> = Internal communication between microprocessors
- <2> = Format code
- <3> = Factory EEPROM
- <4> = User EEPROM
- <5> = Air temperature sensor
- <6> = Plate temperature sensor
- <7> = Standard relative humidity sensor
- <8> = Barometric pressure sensor
- <9> = Wind sensor
- <10> = Compass sensor
- <11> = GPS receiver
- <12> = Attitude sensor
- <13> = Rate gyro
- <14> = Optional Galltec relative humidity sensor
- <15> = Internal temperature Sensor
- <16> = Battery voltage Sensor

<17> = “PB200” string that indicates POST results are for the product 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 WeatherStation.

Certain models of the WeatherStation 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.

See also the transmitted proprietary NMEA 2000® PGN 130944.

\$PAMTC, QPS

Summary

Query part number and serial number information.

Syntax

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

The PB200 WeatherStation will reply with a sentence in the following form:

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

where

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

Notes

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

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

\$PAMTC, QV

Summary

Query version information.

Syntax

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

The PB200 WeatherStation 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, 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, 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 PB200 must be read using the \$PAMTC,QPS command.

\$PAMTC, **RESET**

Summary

Reset the PB200 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.

This command performs the same function as the received proprietary NMEA 2000[®] PGN 126720-1.

\$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.

This command performs the same function as the transmitted proprietary NMEA 2000[®] PGN 126720-35.

\$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 PB200 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.

4. Revision History

Revision 0.001

Date: 7/6/06
Description: Draft.

Revision 0.002

Date: 7/24/06
Description: Draft.

Revision 0.003

Date: 7/31/06
Description: Draft for Airmar internal review and comment.

Revision 0.004

Date: 9/16/06
Description: Draft.

Revision 0.005

Date: 10/12/06
Description: Draft.

Revision 0.006

Date: 3/7/07
Description: Draft.

Revision 0.007

Date: 3/28/07
Description: Draft.

Revision 0.008

Date: 11/26/07
Description: Draft. Added new proprietary PGNs 126720-49 and 126720-50 and \$PAMTC,OPTIONS 4 and 5 for controlling WAAS Satellite selection and Enable GPS Type 0 Messages parameter selection. Added OPTION 3, enable WAAS. Added Device Temp/Voltage to POST results and PB200 to end of POST Sentence. Changed Device Temp/Voltage PGN to 65410. Made \$PAMTC,ALT altitude units 0.1 meters. Added note about unsupported local datum codes.

Revision 0.009

Date: 03/04/08
Description: Draft. Added note to PGN 129029, that fields 16-18 are not present if field 15 is 0. Changed Heater PGN to Global. Changed Introduction to say 3d MEMS Accelerometer.

Revision 0.010

Date: 03/05/08
Description: Draft. Added Compass User Calibration Sentence and PGN details.

Revision 0.011

Date: 03/24/08

Description: Draft. Fixed version numbering and revised Compass User Calibration Sentence and PGN details. Added “damping” fields and resets. Compass User Cal INPROCESS changed to INPROGRESS.

Revision 0.012

Date: 04/10/08

Description: Draft. Made Heater a Factory enabled option. Updated Wind References in Meteorological Data PGN. User Compass Cal updates relating to Damping values. Made minor changes (added differential settings, clarified VWT)

Revision 0.013

Date: 08/01/08

Description: Draft. AutoCal and SelfCal additions/changes. Version to 0.013.

Revision 1.000

Date: 12/01/09

Description: Converted from internal Technical Manual to User Manual.