

MiniPlex-3 NMEA and Proprietary Sentences

Firmware V3.40.0 and up

Revision History

Version	Date	Modification
3.32.0	27-02-25	Option 19 added to \$PSMDOP sentence. Maximum sentence length specified for \$PSMDSR text fields.
3.33.0	15-04-25	Operation of Switch contact added to Option 18. Changed \$PSMDCNV conversion 10. Changed \$PSMDNO options 30 and 31.
3.35.0	16-07-25	Sentence HDT added to the description of Option 6.
3.36.0	24-07-25	Talker ID fields added to \$PSMDID and \$PSMDRTE sentences. Hardware ID field added to \$PSMDVER sentence. Option 19 added to \$PSMDNO sentence.
3.38.0	02-04-26	Modifier character '<' added to \$PSMDSR sentence. Number of entries increased to 5.
3.40.0	27-08-26	Added Conversion ID's 6 to 9 to the \$PSMDXDR command . Added \$PSMDCNV conversion 32. Added \$PSMDNO option 20. Added definition of the \$PSMDACK sentence

Introduction

The MiniPlex-3 is configured using proprietary NMEA 0183 sentences received through its host interface. These will be called commands. These commands always result in a response from the MiniPlex-3. All commands and responses begin with \$PSMD and have the following format:

\$PSMDxxx,a,b,c,...*hh<CR><LF>

\$P: Start of a proprietary sentence as dictated by the NMEA standard

SMD: ShipModul manufacturer mnemonic

xxx: Proprietary sentence formatter

a: Sentence Status flag:

C: sentence is a command to change settings

R: sentence is a status report of current settings

b,c,...: Optional fields

*hh: Optional checksum field

<CR><LF>: Carriage Return (0x0D, \r) and Line Feed (0x0A, \n) characters that terminate the sentence

Unless specified otherwise, fields are optional and may be skipped if no change is required. For instance, a \$PSMDCF,C,,2 command only changes the priority time-out. The preceding field is skipped. Any trailing field may be omitted. Some commands require multiple or even all fields to be present because they are related to each other like in the \$PSMDRTE command, which defines a route for an NMEA sentence.

Configuration commands and status reports

Sentences used to both set and report a configuration setting have a Sentence Status field. This field is the first field of the sentence and contains one of the following characters:

C: the sentence is a configuration command to change settings

R: the sentence is a status report of current settings

A configuration command (C) is sent to the MiniPlex-3 to change a setting. A status report (R) is sent by the MiniPlex-3 to report a setting.

When the MiniPlex-3 receives a configuration command, it will always respond with a status report sentence with the new settings. Exceptions are commands which transfer tables, like routing or Modbus tables. A command to retrieve a table from the MiniPlex-3 results in a series of table definitions, followed by a \$PSMDRDY sentence.

When a table is transferred to the MiniPlex-3, a 200 ms timer guards this transfer. Each time the MiniPlex-3 receives a table command, this timer is restarted. When no more sentences are received, the timer expires, the MiniPlex-3 will program the received table in non-volatile memory and respond with a \$PSMDRDY sentence.

Unless specified otherwise, all command sentences return a report sentence with their settings when the command is received without parameters. Commands which transfer tables, will transmit the contents of the table when received without parameters.

A sentence with its Sentence Status field set to 'R' is ignored by the MiniPlex-3.

Example

The \$PSMDID sentence controls the Talker ID settings of the MiniPlex-3. When \$PSMDID is sent to the MiniPlex-3, it will report with the current Talker ID settings with:

\$PSMDID,R,aa,bb,cc,dd,ee*hh

To set the change the Talker ID settings, send the following sentence:

\$PSMDID,C,aa,bb,cc,dd,ee*hh

The MiniPlex-3 will then respond with:

\$PSMDID,R,aa,bb,cc,dd,ee*hh

This response will contain the new Talker ID's.

Standard NMEA 0183 Sentences

\$MXPGN – NMEA 2000 PGN Data

This sentence transports NMEA 2000/CAN frames in NMEA 0183 format. The MiniPlex-3 will transmit this sentence with Talker ID "MX". When the MiniPlex-3 receives this sentence, the Talker ID is ignored unless a routing entry exists for this sentence.

Format: \$--PGN,pppppp,aaaa,d--d*hh<CR><LF>

pppppp: PGN of the NMEA 2000/CAN frame, 3-byte hexadecimal number. If the PGN is non-global, the lowest byte contains the destination address.

aaaa: Attribute Word, a 16-bit hexadecimal number. This word contains the priority, the DLC code and then source/destination address of the frame, formatted as shown below:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
S	Priority			DLC			Address								

S: Send bit. When an NMEA 2000/CAN frame is received, this bit is 0.
To use the \$MXPGN sentence to send an NMEA 2000/CAN frame, this bit must be 1.

Priority: Frame priority. A value between 0 and 7, a lower value means higher priority.

DLC: Data Length Code field, contains the size of the frame in bytes (1..8) or a Class 2 Transmission ID (9..15).

Address: Depending on the Send bit, this field contains the Source Address (S=0) or the Destination Address (S=1) of the frame.

d--d: Data field of the NMEA 2000/CAN frame, organised as one large number in hexadecimal notation from MSB to LSB. This is in accordance with "NMEA 2000 Appendix D", chapter D.1, "Data Placement within the CAN Frame".

The size of this field depends on the DLC value and can be 1 to 8 bytes (2 to 16 hexadecimal characters).

NMEA 2000 Reception

When the MiniPlex-3 converts an NMEA 2000/CAN frame into an \$MXPGN sentence, the S bit in the Attribute field will be 0 and the Address field contains the source address of the frame. The destination address of the frame is either global or contained in the lower byte of the PGN field pppppp, in accordance with the NMEA 2000/ISO specification.

NMEA 2000 Transmission

If the MiniPlex-3 receives a \$--PGN sentence, it will be converted to an NMEA 2000/CAN frame if the S bit in the Attribute field is 1.

The Address field is used as the Destination Address of the NMEA 2000/CAN frame. The Source Address of the frame will be the Source Address of the MiniPlex-3 input that receives this sentence. If a global PGN is used, the contents of the Address field will be ignored. A non-global PGN can be sent globally by setting the Address field to 0xFF.

The Destination Address of a non-global PGN can also be specified by loading it into the lower byte of the PGN field pppppp. The Address field of the Attribute word must be set to 0x00 for this.

The DLC field must be set to the size of the Data field (1 to 8 bytes) and the actual size of the Data field must match with the DLC. If the DLC field is used as a Class 2 Transmission ID (9..15), the size of the Data field must be 8 bytes/16 characters. If any of these conditions is not met, the frame will not be transmitted.

For quick transmission of an NMEA 2000/CAN frame, the Attribute field of the \$--PGN sentence may be omitted. In this case, the following values for the Attribute will be assumed:

S: 1

Priority: 7

DLC: Set automatically from the size of the Data field (d--d) field.

Address: 0. The Destination Address of the message will be contained in the PGN field (pppppp).

Examples

A received PGN 127250 (hex: 1F112, Vessel Heading) will be converted into the following \$MXPGN sentence:

```
$MXPGN,01F112,2807,FC7FFF7FFF168012*11
```

The Attribute word shows a received frame (S = 0), with priority 2, it is 8 bytes and the Source Address is 0x07.

To transmit PGN127250, the following \$--PGN sentence must be sent to the MiniPlex-3:

```
$MXPGN,01F112,A800,FC7FFF7FFF168012*65
```

In this example, the Address field of the Attribute field is ignored and set to 0x00 because PGN 127250 is a Global PGN.

An ISO Request (PGN 059904) can be transmitted in the following ways:

```
$MXPGN,00EA00,F309,01F016*68
```

```
$MXPGN,00EA09,,01F016*1D
```

In both cases, this message is sent to Destination Address 0x09. In the first sentence, the Destination Address is specified in the Attribute word, the second sentence in the example has it embedded in the PGN field.

\$--XDR – Sensor Data

The data received from certain NMEA 2000 sensors or Modbus slaves will be converted into standard NMEA 0183 \$--XDR sentences. The Talker ID of this sentence depends on the source of the data. For instance: "ER" for engine related data, "WI" for weather data and "YX" for generic sensor data.

Format: \$MXXDR,t,x.x,u,i[,t,x.x,u,i][,t,x.x,u,i][...]*hh<CR><LF>

t: Transducer Type

x.x: Sensor value

u: Units

i: Transducer ID

For engine sensor and weather data, the contents of t, u and i fields are compliant with NMEA 0183 V4.11. For sensor data received from Modbus slaves, the t, u and i fields contain the parameters specified in the Modbus Slave table.

Multiple groups of t,x,u,i parameters are collated into one XDR sentence as long as the sentence length permits. The exact number of t,x,u,i groups depends on the length of the value and Transducer ID and may vary.

TAG Blocks

When TAG blocks are enabled, the MiniPlex-3 prepends each NMEA sentence transmitted on the host interface with a TAG Block. This TAG block has a source parameter containing the UI (Unique Identifier) of the MiniPlex-3 and the input number or Source Address of the received sentence.

This TAG block It has the following format:

`\s:UI-x*hh\` or `\s:UI#xx*hh\`

UI is the Unique Identifier of the MiniPlex-3. The separator character ('-' or '#') indicates whether the TAG Block identifies an NMEA 0183 input ('-') or an NMEA 2000 Source Address ('#') as a hexadecimal number.

If an NMEA 0183 input is identified, x can have the following values:

- 0: Internally generated responses (\$PSMD sentences)
- 1: NMEA 0183 In1/SeaTalk
- 2: NMEA 0183 In2
- 3: NMEA 0183 In3
- 4: NMEA 0183 In4
- 5: Conversion results

If no UI is specified with the \$PSMDUI sentence, "MXnn" is used, where "nn" are the last two digits of the serial number of the MiniPlex-3.

A heading sentence received on input 1 will thus be transmitted as

`\s:MX01-1*1E\ $HEHDT,23.5*37<CR><LF>`

A similar sentence generated from an NMEA 2000 source will be transmitted as

`\s:MX01#4D*A2\ $HEHDT,23.5*37<CR><LF>`

Proprietary NMEA 0183 Sentences - General

\$PSMDCF – Set Configuration

This sentence sets various configuration settings of the MiniPlex-3.

Format: \$PSMDCF,a,b,t*hh<CR><LF>

a: Sentence Status flag:

- C: sentence is a command to change settings
- R: sentence is a status report of current settings
- A: sentence is a flag indicating MPX-Config3 is connected*)

b: Baud rate selector for the RS-232 interface (ignored when no RS-232 port present):

- 0 = 4800 Baud
- 1 = 9600 Baud
- 2 = 19200 Baud
- 3 = 38400 Baud
- 4 = 57600 Baud
- 5 = 115200 Baud

t: Priority Timeout (in seconds):

- 0 = 1
- 1 = 2
- 2 = 3
- 3 = 5
- 4 = 10
- 5 = 30

*) This flag enables TAG blocks for 5 seconds. When MPX-Config3 is connected, it sends a \$PSMDCF,A sentence to the MiniPlex every 4 seconds. This temporarily enables TAG blocks to tell MPXConfig3 from which NMEA 0183 input or NMEA 2000 Source Address an NMEA sentence is received/generated. These TAG blocks also contain a relative time parameter, containing the time of day in milliseconds.

\$PSMDCFQ – Get Configuration

This sentence requests the configuration of the MiniPlex-3. The MiniPlex-3 will respond with all known configuration sentences, followed by a \$PSMDRDY sentence.

\$PSMDCNV – Set Conversions

This sentence enables, disables or sets NMEA conversions. Two types of conversions exist: conversions that are switched on or off and conversions that can have multiple numerical values.

All conversions are numbered, starting at 0. Conversions 0 to 31 are conversions that can be switched on/enabled or switched off/disabled only. Conversions starting at 32 are multiple value conversions.

Conversions 0 to 31 can be set individually or all at once by collating them in one 32-bit hexadecimal data field.

Format: \$PSMDCNV,C,c,v*hh<CR><LF> (command single conversion)
or: \$PSMDCNV,C,xxxxxxxx*hh<CR><LF> (command conversions 0 - 31 at once)
or: \$PSMDCNV,R,xxxxxxxx,c,...*hh<CR><LF> (report)

a: Sentence Status flag:

- C: sentence is a command to change settings
- R: sentence is a status report of current settings

c: Conversion number

v: For conversions 0 to 31: 1/0: enable/disable conversion
For conversions 32 and up: value or character for that conversion

xxxxxxxx: Enable/disable multiple conversions at once using a 32-bit hexadecimal number. Each bit represents a conversion where bit 0 is conversions 0, bit 1 is conversions 1, etc.

Example: \$PSMDCNV,C,6,1<CR><LF> (enables conversion 6)
\$PSMDCNV,C,00000021<CR><LF> (enables conversions 5 and 0)
\$PSMDCNV,C,32,2<CR><LF> (set conversion 32 to 2)
\$PSMDCNV,C,33,6<CR><LF> (set conversion 33 to 6)
\$PSMDCNV,R,00000021,2,6<CR><LF> (reports conversions)

The following conversions are implemented:

0: Heading Conversion Magnetic/True

Convert HDM and HDG sentences (magnetic heading) into HDT sentences (true heading) and HDT sentences into HDG sentences. The heading is corrected from magnetic to true and vice versa if a magnetic variation is available in the originating HDG sentence or from another source (RMC sentence, SeaTalk Datagram 99, PGN 127250 or 127258). If Option 16 is enabled and a GNSS position is received, the magnetic variation from the internal table is used to calculate magnetic or true heading.

1: Reverse Heading

Convert a heading sentence (HDG, HDM or HDT) into a sentence with the heading reversed by 180 degrees.

2: Enable COG to HDT Conversion

Convert VTG sentences (course over ground) into HDT sentences (true heading).

3: Wind Conversion VWR/MWV

Convert VWR sentences (relative wind, deprecated) into MWV,R sentences (relative wind) and convert MWV sentences into either VWR or VWT sentences, depending on the R or T flag in the MWV sentence.

4: Theoretical Wind Conversion – AWA/AWS to TWA/TWS

Convert MWV,R sentences (relative or apparent wind) into MWV,T sentences (theoretical or true wind). The required STW for this calculation is taken from any source of water speed, or ground speed if Option 15 is enabled.

This conversion can be used in conjunction with conversion 3, to first convert VWR to MWV,R and then to MWV,T.

5: Calculate wind direction TWD

Convert a theoretical/true wind angle sentence (MWV,T) into true wind direction sentence (MWD) using a true heading source.

6: Reverse wind angle

Converts a wind sentence (VWR, MWV) into a new MWV sentence with a reversed wind angle.

7: Velocity Conversion – VTG to VHW

Convert VTG sentences (GPS) into VHW sentences (speed log). If the MiniPlex-3 receives heading from any source, the heading fields of the resulting VHW sentence will be filled. Otherwise, they will be left empty. The COG fields of the originating VTG sentence are not used for this conversion.

8: Velocity Conversion – VHW to VTG

Convert VHW sentences (speed log) into VTG sentences (GPS). All fields of the VHW sentence are copied into the resulting VTG sentence.

9: Reverse Speed

Convert VBW sentences into new VBW sentences with all speed values reversed.

10: Add Heading to VHW

Convert a VHW sentence into a new VHW sentence with its heading fields filled from any heading source.

11: Heading conversion HDT <-> THS

This option converts an HDT sentence into a THS sentence and vice versa. The Talker ID in HDT and THS sentences is preserved to ensure compatibility with GPS compasses, which generally output a Talker ID "GP".

12: Convert TLL to WPL

Convert a TLL (Target lat/lon) into a WPL (Waypoint) sentence.

13 - 31: undefined.

32: Force units of an MWV sentence

This option generates a new MWV sentence with specified speed unit. If the source is an NMEA 0183, a new MWV sentence is generated from input 'C'. If the source is NMEA 2000, the specified unit is used in the generated MWV sentence. This conversion accepts the following values:

- 0: Conversion is disabled
- 1: Speed in knots (N)
- 2: Speed in m/s (M)
- 3: Speed in km/h (K)
- 4: Speed in statute mile/h (S)

The character in parentheses is the speed unit used in the generated MWV sentence.

\$PSMDDR – Set Default Route

This sentence specifies the default route from the NMEA 0183 inputs or the NMEA 2000 network to the NMEA outputs and from the host interface(s) to the NMEA 0183 outputs. Any route set by the \$PSMDRTE sentence overrides the default route.

Format: \$PSMDDR,a,xx,b,yy,c*hh<CR><LF>

a: Sentence Status flag:

- C: sentence is a command to change settings
- R: sentence is a status report of current settings

xx: Input field for NMEA Out1. This is a hexadecimal number where each bit represents an NMEA input. The following bits are defined:

- 0: NMEA In1
- 1: NMEA In2
- 2: NMEA In3
- 3: NMEA In4
- 4: NMEA Conversions
- 7: NMEA 2000

When a bit is 1, the input is routed to output 1, otherwise the input is not routed.

b: Host data to NMEA Out1:

- 0: Host data is not routed
- 1: Host data is routed
- 2: Host data is routed and overrides data from the inputs. A time out mechanism will route data from the inputs when no data from the host is received.

yy: Input field for NMEA Out2. This is a hexadecimal number where each bit represents an NMEA input. The following bits are defined:

- 0: NMEA In1
- 1: NMEA In2
- 2: NMEA In3
- 3: NMEA In4
- 4: NMEA Conversions
- 7: NMEA 2000

When a bit is 1, the input is routed to output 1, otherwise the input is not routed.

c: Host data to NMEA Out2:

- 0: Host data is not routed
- 1: Host data is routed
- 2: Host data is routed and overrides data from the inputs. A time out mechanism will route data from the inputs when no data from the host is received.

\$PSMDDS – Set Data Source

This sentence selects a Data Source used for a specific conversion.

Format: \$PSMDDS,a,i,s,n--n,z*hh<CR><LF>

a: Sentence Status flag:

- C: sentence is a command to change settings
- R: sentence is a status report of current settings

i: Data Source ID. The following ID's are defined for correcting wind angle on a rotating mast:

- 0: Primary heading source
- 1: Rotating mast-mounted heading source
- 2: Rotating mast-mounted wind source

s: Data Source:

- 1..4: NMEA 0183 input 1 to 4
- N: NMEA 2000 source

n--n: NAME, (16 hexadecimal digits) identifying an NMEA 2000 source. Only valid when field s contains 'N'. For an NMEA 0183 input this field can be omitted.

z: Optional attribute field, only used for Modbus Slave operation, no user interface defined yet.

\$PSMDID – Set Talker ID

This sentence sets a Talker ID for a specific input or output. If a Talker ID is set for an input, the original Talker ID of the sentences received on that input is replaced with the Talker ID set with this command. If a Talker ID is set for an output, the Talker ID of that sentence is replaced with the Talker ID set with this command, but only for that output. A set Talker ID for an output overrides the Talker ID set for an input or in the Routing Table.

Format: \$PSMDID,a,aa,bb,cc,dd,ee,ff,gg*hh<CR><LF>

- a: Sentence Status flag:
- C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- aa: Talker ID for In1
- bb: Talker ID for In2
- cc: Talker ID for In3
- dd: Talker ID for In4
- ee: Talker ID for conversion results
- ff: Talker ID for Out1
- gg: Talker ID for Out2
- hh: optional checksum

An empty field clears the Talker ID for that input or output.

\$PSMDIN – Input modes

Set the operating mode of each NMEA input.

Format: \$PSMDIN,a,x,x,x,x*hh<CR><LF>

- a: Sentence Status flag:
- C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- x: Operating mode field for inputs 1 to 4:
- 0: Normal NMEA processing. This is the default processing mode in which sentences are checked for correct formatting according to the NMEA 0183 standard. Any sentence that is incorrectly formatted or has a checksum error is rejected. This behaviour meets the IEC/EN60945 requirements.
 - 1: Forward NMEA sentences with a checksum error unmodified, bypassing all further NMEA processing, routing and conversions. Only the default route is applied. This allows other devices or software to detect the checksum error.
 - 2: Relaxed NMEA format checking. This mode will accept incorrectly terminated sentences. Using this mode, a sentence is considered terminated if it ends on a CR, a LF or a combination of both in arbitrary order. A sentence with a checksum error is blocked. The MiniPlex-3 will terminate the forwarded sentence correctly with a CR/LF pair.
 - 3: Receive plain text strings and forward them as \$MXTXT sentences. Any character with an ASCII value greater than 32 (a space) is regarded as the start of a string. The string must end on a CR or LF and its length may not exceed 61 characters. A longer string will result in a new \$MXTXT sentence containing the remainder of the string. Only valid NMEA characters are read. Invalid characters are stripped from the received string. The Total number and Sentence number fields of the \$MXTXT sentence are always set to "01". The Text Identifier field of the \$MXTXT sentence contains the input number on which the string was received. When for instance "Hello World" is received on input 3, the resulting sentence will be: \$MXTXT,01,01,03,Hello World*6E.
 - 4: Receive plain text strings and forward them in \$PTXT sentences. Any character with an ASCII value greater than 32 (a space) is regarded as the start of a string. The string must end on a CR or LF and its length may not exceed 71 characters. A longer string will result in a new \$PTXT sentence containing the remainder of the string. The MiniPlex-3 will always terminate a forwarded string with a CR/LF pair. All characters with an ASCII value from 32 to 127 are forwarded.

5: Receive plain text strings and forward them unmodified. Any character with an ASCII value greater than 32 (a space) is regarded as the start of a string. The string must end on a CR or LF and its length may not exceed 77 characters. A longer string will result in a new string containing the remainder of the original string. The MiniPlex-3 will always terminate a forwarded string with a CR/LF pair.
All characters between from ASCII 32 to 127 are forwarded.

6: Available on In1 only. This mode switches In1 to SeaTalk mode and fixes its speed to 4800 Baud. When this mode is selected, In1 becomes a fully bi-directional SeaTalk port, which can receive and transmit SeaTalk data.

When this mode is selected, the \$PSMDOP response will show option 1 enabled. Any other mode (0..5) will clear both SeaTalk option bits in the \$PSMDOP response.

7: Available on In1 of NMEA 2000 models only. This mode switches In1 to SeaTalk mode with RayMarine SeaTalk-STNG converter emulation and fixes its speed to 4800 Baud. When this mode is selected, In1 becomes a fully bi-directional SeaTalk port, which can receive and transmit SeaTalk data. Conversion of SeaTalk control datagrams is also supported, just like Raymarine's own SeaTalk-STNG converter does. This allows for instance a Raymarine ST100 remote control to be used to control a SeaTalkNG autopilot. This mode should not be used when a RayMarine SeaTalk-STNG converter is already present on the SeaTalkNG/NMEA 2000 network, because this would result in a data-loop, flooding the SeaTalk bus with control messages.

When this mode is selected, the \$PSMDOP response will show option 1 enabled. Any other mode (0..5) will clear both SeaTalk option bits in the \$PSMDOP response.

\$PSMDLDR – Loader message

This sentence is transmitted by the boot-loader through the host interface. After transmission, the loader will wait for a special loader key to initiate a firmware update. If this key is not received, either the current firmware will be started. If no firmware is found, this sentence will be transmitted continuously with an interval of 1 s.

The window for the loader key depends on the reset source: after a power-on reset, this window is 200 ms. After receiving a \$PSMDRESET command, the window is 1 s.

Format: \$PSMDLDR,xx,v.v,c--c,rr<CR><LF>

xx: Hardware ID of the MiniPlex-3 (a hexadecimal number)
v.v: Boot-loader version number
c--c: Hardware name of the MiniPlex-3
rr: Reset source (hexadecimal bit-field)

The following hardware ID's and names are defined:

11:	MPX-3U	1 st generation board (AVR) with USB interface
12:	MPX-3E	1 st generation board (AVR) with Ethernet interface
13:	MPX-3UW	1 st generation board (AVR) with USB and WiFi interface
21:	MPX-3U	2 nd generation board (ARM) with USB interface
22:	MPX-3E	2 nd generation board (ARM) with Ethernet interface
23:	MPX-3UW	2 nd generation board (ARM) with USB and WiFi interface

Bit 7 of the hardware ID indicates the presence of an NMEA 2000 interface.

This sentence has no checksum.

The Reset source indicates what caused the MiniPlex-3 to restart or reset. For the 1st generation boards, the following bits are defined:

- 0: Power-on reset
- 1: External reset via Reset pin
- 2: Brownout reset
- 3: Watchdog reset
- 4: Program and Debug interface reset
- 5: Software reset

For the 2nd generation boards, the following bits are defined:

- 2: External reset via Reset pin
- 3: Power-on reset
- 4: Software reset
- 5: Watchdog reset

A few reset causes are of interest when troubleshooting a MiniPlex-3 which transmits \$PSMDLDR sentences continuously:

- Power-on reset: A bad power connection (loose contact), causing the MiniPlex-3 to restart.
- Brownout reset: This reset occurs when the supply voltage is too low. When the MiniPlex-3 is powered from a pulsing DC source (e.g. a battery charger at home), it will almost continuously transmit \$PSMDLDR sentences. This is because a battery charger does not provide a smooth DC voltage but a pulsating (100 or 120Hz) DC voltage, causing the MiniPlex-3 to reset continuously.
- Watchdog reset: This reset indicates a watchdog time out. The watchdog timer is a safety measure using a timer which must be reset periodically by the running firmware. When this no longer happens because the firmware is "stuck" somewhere or not loaded, the watchdog timer eventually will time out and reset the MiniPlex-3. A continuous stream of \$PSMDLDR sentences with this reset cause is transmitted when a firmware update failed.
- Software reset: This value can be seen when issuing a \$PSMDRESET command, which effectively results in a software reset.

Example: \$PSMDLDR,91,2.2,MPX-3U,01

This MiniPlex-3 has an MPX-U board with a USB interface and has an NMEA 2000 interface; the boot-loader is version 2.2; the reset source was a power-on event.

\$PSMDB – Modbus

This sentence sets various Modbus related parameters. The format of the \$PSMDB sentence depends on the character in the first and second field of the sentence.

Command Sentences

\$PSMDB,C,M	Command to set the Modbus mode.
\$PSMDB,C,R	Command to set the XDR sentence and Modbus polling intervals.
\$PSMDB,C,S	Command to set the Modbus slave address.
\$PSMDB,C,X	Command to add a slave/register definition to be transmitted as XDR sentence.
\$PSMDB,C,DELETE	Command to delete all slave/register definitions. The MiniPlex-3 will respond with a \$PSMDRDY sentence.

Report Sentences

\$PSMDB,D	Raw Modbus frame data report*).
\$PSMDB,E	Error report*).
\$PSMDB,R,M	Mode and slave address report.
\$PSMDB,R,X	Slave/register definition report.

*) These sentences are enabled with Option 14 (\$PSMDOP).

When Modbus is enabled, NMEA Out2 becomes a Modbus RTU (RS485) port. Its baud rate is still controlled by the speed setting of NMEA Out2 on the NMEA Inputs & Outputs tab of MPXConfig3. All routing of NMEA 0183 data to Out2 is inhibited when Modbus is enabled. The communication parameters are fixed to 8 data bits, 2 stop bits and no parity. Only the communication speed can be changed.

\$PSMDB,C,M – Set Modbus Mode

This sentence sets the Modbus mode of the MiniPlex-3.

Format: \$PSMDB,C,M,x*hh<CR><LF>

x: Modbus mode:
0: Modbus disabled
1: Modbus Master enabled
2: Modbus Slave enabled

Response: \$PSMDB,R,M,x,y*hh<CR><LF>

x: Modbus mode (see above)
y: Modbus slave address, 1..247

\$PSMDB,C,R – Set XDR and Poll Rates

This sentence sets the interval of transmitted XDR sentences and the interval at which slaves are polled. The intervals are set in 10 ms increments. So a number of 10 equals an interval of 100 ms.

Format: \$PSMDB,a,R,x,p*hh<CR><LF>

a: Sentence Status flag:
C: sentence is a command to change settings
R: sentence is a status report of current settings
x: XDR interval, 1..65535, default: 100 (1000 ms)
p: Poll interval, 1..255, default: 10 (100 ms)

The default values are 100 (1000ms) for the XDR interval and 10 (100ms) for the polling interval.

\$PSMDB,C,S – Set Modbus Slave Address

This sentence sets the slave address of the MiniPlex-3 if it is configured as a Modbus Slave.

Format: \$PSMDB,C,S,s*hh<CR><LF>

s: Slave address, 1..247

Response: \$PSMDB,R,M,x,y*hh<CR><LF>

x: Modbus mode (see above)
y: Modbus slave address

\$PSMDB,C,X – Define Modbus Slave/Register

This sentence adds an entry into the Modbus slave table, defining a Modbus slave/register pair as well as the data format and the contents of the generated NMEA 0183 XDR sentences.

Format: \$PSMDB,C,X,s,r,t,d,r,p,t,u,i*hh<CR><LF> (command)

or: \$PSMDB,R,X,s,r,t,d,r,p,t,u,i,x*hh<CR><LF> (report)

s: Modbus slave address, 1..247

r: Modbus register number, 0..65535 (0-based protocol address)

t: Modbus register type:

H: Holding register (function code 03)

I: Input register (function code 04)

d: Data type:

I: Signed integer (16-bit/1 register)

U: Unsigned integer (16-bit/1 register)

L: Signed long integer (32-bit/2 registers)

F: Floating point (32-bit/2 registers)

r: Optional 'R' to reverse the Modbus register order in case of a multi-register read operation (Data types "L" and "F"). Ignored if not required.

p: Precision or number of decimals for value in Modbus register (0 to 7)

t: Transducer Type in the XDR sentence, one character

u: Units in the XDR sentence, one character

i: Transducer ID in the XDR sentence, 15 characters max.

x: Slave status (report only):

00: Communication is successful.

01-0B: Modbus Exception Code. This is an error code returned by a Modbus slave. These are defined in "Modbus Application Protocol V1.1" which can be downloaded from www.modbus.org.

F0: No status known yet

FA: The slave response contains the wrong register count.

FB: The received response originates from the wrong slave.

FC: Communication error (parity, framing or overrun).

FD: The slave response has an incorrect frame size.

FE: The slave response has an incorrect CRC.

FF: No response received/slave timed out.

Modbus,C,DELETE – Delete Table

This sentence deletes the entire Modbus slave table.

Format: \$PSMDB,C,DELETE*hh<CR><LF>

The MiniPlex-3 will respond with a \$PSMDRDY sentence. This also indicates the start of a time window of 200 ms during which new \$PSMDB,C,X,... sentences are accepted to set new slave/register entries. Each received \$PSMDB,C,X,... sentence restarts this window. When the last \$PSMDB,C,X,... sentence is received, the window will eventually time out and the MiniPlex-3 will store the received slave/register definitions in non-volatile memory and respond with a \$PSMDRDY sentence.

The MiniPlex-3 will ignore any further \$PSMDB,C,X,... sentences when the window has timed out or when the maximum number of 30 entries is reached.

\$PSMDB

This sentence returns the current modbus mode and slave address, and all entries in the Modbus table. The returned sentences containing Modbus table entries have the same format as the \$PSMDB,C,X,... command, with an additional slave-status field at the end. The Sentence Status flag field contains an 'R', indicating this is a report. A \$PSMDRDY sentence marks the end of the list.

Example:

```
$PSMDB, R, M, 1, 23*2A<CR><LF>
$PSMDB, R, R, 100, 10*35<CR><LF>
$PSMDB, R, X, 1, 1, H, I, , 2, C, C, Temp, 00*10<CR><LF>
$PSMDB, R, X, 1, 0, H, I, , 2, P, P, Hum, 00*6D<CR><LF>
$PSMDRDY, R*45<CR><LF>
```

The sentences may not be transmitted as one contiguous block. In case of much NMEA data, they may be interspersed with other NMEA sentences.

\$PSMDB,D

This report sentence contains raw Modbus frame data and is transmitted when error reports are enabled with Option 14. This can be used to diagnose a communication problem or to detect a faulty Modbus slave.

Format: \$PSMDB,D,x,h--h*hh<CR><LF>

x: Direction indicator:

T: Transmitted frame

R: Received frame

h--h: Raw Modbus frame data (variable length)

The frame data contains every single byte of a Modbus frame, including the 2-byte CRC at the end.

Example:

```
$PSMDB,D,T,010300000001583F*42<CR><LF>
$PSMDB,D,R,0103020000B844*45<CR><LF>
```

These two sentences show one transmitted request to and a received response from slave 1 with function code 3.

\$PSMDB,E

Modbus Error report. If error reports are enabled with Option 14, this sentence is transmitted on reception of an erroneous Modbus response.

Format: \$PSMDB,E,a,r,s,c*hh<CR><LF>

a: Slave address

r: Register number

s: Status code or Modbus exception code:

01-0B: Modbus Exception Code

F0: No status known yet

FA: The slave response contains the wrong register count

FB: The received response originates from the wrong slave

FC: Communication error (parity, framing or overrun)

FD: The slave response has an incorrect frame size

FE: The slave response has an incorrect CRC

FF: No response received/slave timed out

c: Calculated CRC

If the received Modbus response message is shorter than 5 bytes, the CRC field is empty.

The Modbus Exception Codes are defined in "Modbus Application Protocol V1.1" which can be downloaded www.modbus.org.

This sentence is transmitted only if an error or exception occurs and always prior to the \$PSMDB,D,R sentence.

Example:

```
$PSMDB,D,T,010300000001583F*42<CR><LF>
$PSMDB,E,1,0,FE,44B8*14<CR><LF>
$PSMDB,D,R,0103020000D48D*33<CR><LF>
```

This example shows a CRC error (code FE). The received frame has a CRC of 8DD4 (last two bytes placed in correct order) while the \$PSMDB,E sentence shows a calculated CRC of 44B8.

\$PSMDMOB – Set MOB MMSI

This sentence adds the MMSI of an AIS based MOB device to the MOB table.

Format: \$PSMDMOB,a,mmsi,v*hh<CR><LF>

a: Sentence Status flag:

C: sentence is a command to change settings

R: sentence is a status report of current settings

mmsi: MMSI number, 9 digits

v: MOB Status:

A: MOB has been activated

V: MOB not activated

The v is only present in a \$PSMDMOB response.

A \$PSMDMOB sentence with the word DELETE in the mmsi field deletes all MOB's. The MiniPlex-3 will respond with a \$PSMDRDY sentence. This also indicates the start of a time window of 200 ms during which new \$PSMDMOB sentences are accepted to define new MOB's. Each received \$PSMDMOB sentence restarts this window. When the last \$PSMDMOB sentence is received, the window will eventually time out. When this happens, the MiniPlex-3 will store the received MOB's in non-volatile memory and respond with a second \$PSMDRDY sentence.

The MiniPlex-3 will ignore new MOB's when the window has timed out or when then maximum number of 8 MOB's is reached.

When the MOB table is requested, the MiniPlex-3 responds by sending \$PSMDMOB sentences, one for each entry. A \$PSMDRDY sentence marks the end of the list.

Example response:

```
$PSMDMOB,R,972123456,V*4A<CR><LF>
```

```
$PSMDMOB,R,972882974,A*56<CR><LF>
```

```
$PSMDMOB,R,972834749,V*50<CR><LF>
```

```
$PSMDRDY*45<CR><LF>
```

The sentences may not be transmitted as one contiguous block. In case of much NMEA data, they may be interspersed with other NMEA sentences.

The AIS MOB feature must be enabled with Option 9.

\$PSMDOP – Set Options

This sentence enables, disables or sets options which control the operation of the MiniPlex-3. Two types of options exist: options that are switched on or off and options that can have multiple numerical values.

All options are numbered, starting at 0. Options 0 to 31 are options that can be switched on/enabled or switched off/disabled only. Options starting at 32 are multiple value options.

Options 0 to 31 can be set individually or all at once by collating them in one 32-bit hexadecimal data field.

Format: \$PSMDOP,C,o,v*hh<CR><LF> (command single option)

or: \$PSMDOP,C,xxxxxxxx*hh<CR><LF> (command options 0 - 31 at once)

or: \$PSMDOP,R,xxxxxxxx,v,...*hh<CR><LF> (report)

a: Sentence Status flag:

C: sentence is a command to change settings

R: sentence is a status report of current settings

o: Option number

v: For options 0 to 31: 1/0:enable/disable option

For options 32 an up: value or character for that option

xxxxxxxx: Enable/disable multiple options at once using a 32-bit hexadecimal number. Each bit represents an option where bit 0 is option 0, bit 1 is option 1, etc.

Example: \$PSMDOP,C,6,1<CR><LF> (enables option 6)

\$PSMDOP,C,00000021<CR><LF> (enables options 5 and 0)

\$PSMDOP,C,32,2<CR><LF> (set option 32 to 2)

\$PSMDOP,C,33,6<CR><LF> (set option 33 to 6)

\$PSMDOP,R,00000021,2,6<CR><LF> (reports options)

The following options are implemented:

0: Routing Block

Block sentences which are not found in the routing table. The default operation is to apply the default route to those sentences.

1: SeaTalk to NMEA Conversion

SeaTalk data is converted to NMEA 0183 sentences and to NMEA 2000 PGN's (-N2K models only). This option will also be reflected in the \$PSMDIN response: NMEA In1 will report SeaTalk mode.

2: SeaTalk to \$PSMDST Conversion

SeaTalk datagrams are converted into \$PSMDST sentences, which contain the "raw" bytes of a SeaTalk datagram as hexadecimal numbers.

If option 1 is enabled, only datagrams are which could not be converted to NMEA 0183 and/or NMEA 2000 are converted to a \$PSMDST sentence.

If option 1 is disabled, all datagrams are converted to \$PSMDST sentences. This option will also be reflected in the \$PSMDIN response: NMEA In1 will report SeaTalk mode.

3: Test GPS Status Field

If this option is enabled, a GPS related NMEA 0183 sentence will be discarded if its status field indicates invalid data ('V'). This forces the Priority mechanism to pass GPS sentences from a lower priority source with a valid status. This option also blocks HDT sentences with empty heading fields from a GPS compass without fix.

4: Suppress GPS Pinning

GPS receivers sometimes leave the COG and SOG fields of an RMC or VTG sentence empty when the position is stationary. Some devices receiving such sentences consider this as an error. When this option is enabled, the MiniPlex-3 will detect these empty fields and fill them with "0.0".

5: Transmit TAG Blocks

Prepend each NMEA sentence transmitted from the host interface with a source TAG block. This TAG block identifies the NMEA 0183 input number or the NMEA 2000 Source Address of the sentence.

6: NMEA 0183 V1.5 Output

Enables conversion from NMEA 0183 V2.0 and up, to V1.5 sentences for NMEA Out2. The following sentences are converted: APB, BWC, BWR, GGA, GLL, HDG, RMA, RMB, RMC, VBW, VLW, VTG, XTE and ZDA.

HDG sentences are converted into HDM sentences. The heading and COG fields of HDM and VTG sentences respectively are truncated to remove any decimals. The heading field of HDT sentences is truncated to one decimal.

7, 8: Undefined.

9: Enable AIS MOB Alarm

Enables the AIS MOB Alarm feature. Switch A/B serves as an alarm switch contact while NMEA In4 serves as a Mute/Acknowledge input. When enabled, no NMEA 0183 data is received through NMEA In4.

10: Enable Metric SeaTalk Depth

This option will instruct any SeaTalk (repeater) display to show depth in meters instead of feet.

11: No Divisor on NMEA Out2

Disables the sentence divisor for sentences routed to NMEA Out2. The sentence divisor is still applied to sentences routed to NMEA Out1.

12: Generate GNSS Data from AIS Own Ship Information

This option generates GGA, GLL, RMC and VTG sentences as well as GNSS PGN's when AIS Own Ship information is received from NMEA 0183 or NMEA 2000.

Note: AIS Own Ship information does not contain time and data. Thus, the corresponding fields in the generated NMEA 0183 sentences and NMEA 2000 PGN's will be left empty or marked as "not available".

13: Generate NMEA 0183 GNSS sentences from NMEA 0183 sources

This option generates NMEA 0183 GNSS sentences from all sources, including NMEA 0183. This can be used for instance to generate GGA, GLL, VTG and ZDA if only RMC is received, or an RMC sentence if only GGA/GLL, VTG and ZDA are received.

14: Enable Modbus Error reports

Enables transmission of \$PSMDB,D,... and \$PSMDB,E,... sentences in case of errors on the Modbus RS485 network.

15: Use SOG for Theoretical Wind conversion

When this option is enabled, COG instead of STW is used to calculate theoretical wind.

16: Use Internal Variation Table

This option replaces a magnetic variation in NMEA 0183 sentences, NMEA 2000 PGN's and SeaTalk datagrams with magnetic variation from an internal table, provided that a latitude and longitude are received from a GNSS source.

17: Hi-Speed

This option repeats HDT and VBW sentences received on any of the NMEA 0183 inputs at a higher frequency.

HDT sentences are repeated at 10 Hz. If any of the NMEA 0183 outputs is set to 38400 Baud or higher, HDT is repeated at 50 Hz.

VBW sentences are repeated at 2 Hz.

18: Auto Reverse

This option automatically reverses heading when conversion 1 (Reverse Heading) is enabled and a reverse motion is detected. This also closes the Switch contact. COG and SOG from a GNSS source are required for this option.

19: Force Numbered Target Name for TLL to WPL Conversion

This option disregards the target name in the originating TLL sentence and always generates waypoint name 'TGT-xxxxx' where 'xxxxx' is an increasing number from 0 to 65535. The counter rolls over to 0 and resets on a power cycle.

\$PSMDOV – Overflow

This sentence is transmitted when more NMEA sentences are routed to an output (Out1 and Out2) than its queue can hold. In MPXConfig3, this will be indicated by two blinking red indicators, one for each output. The red LED on the MiniPlex-3 will blink too.

Format: \$PSMDOV,xx*hh<CR><LF>

xx: Hexadecimal field. This is a hexadecimal number where each bit represents an NMEA output.

The following bits are defined:

0: NMEA Out1

1: NMEA Out2

\$PSMDPR – Priority

Set the priority of the NMEA inputs.

Format: \$PSMDPR,a,x,x,x,x,x*hh<CR><LF>

a: Sentence Status flag:

C: sentence is a command to change settings

R: sentence is a status report of current settings

x: Priority index for input 1 to 4 and NMEA 2000.

When similar sentences are received on multiple inputs, the priority of an input is evaluated to determine if a sentence should be forwarded or blocked.

The table below shows the relation between priority index x and the priority level. A lower number means higher priority. The highest index for NMEA 2000 is 10. At this setting a source's Device Instance value other than 0 determines its priority.

X	Priority
0 - 9	0 - 9
10	10/DI
11	20
12	50
13	100
14	200

Any data source with a Device Instance value of 0 is not evaluated for priority and is thus always passed.

The higher priorities for the NMEA 0183 inputs (eg. 20, 50, etc.) can be used to set a priority against an NMEA 2000 source with a fixed high Device Instance.

\$PSMDRESET – Reset the MiniPlex-3

This sentence resets the MiniPlex-3 and starts the boot-loader. When a '1' is given as parameter, the factory settings of the MiniPlex-3 are restored.

Format: \$PSMDRESET,x*hh<CR><LF>

x: Optional parameter to specify an action while resetting:

1: restore the MiniPlex-3 to its factory settings

After a reset, the MiniPlex-3 transmits a \$PSMDLDR sentence and after one second, a \$PSMDVER sentence on the host interface. During the time between both sentences, a loader-key is accepted to start the boot-loader.

\$PSMDRTE – Set Route

This sentence adds an entry to the routing table. Routes are specified using the address field of an NMEA sentence. For each route, the input(s) or NMEA 2000 device from which the sentence may be received must be specified. Optionally, a divisor and a routing field can be added. NMEA 2000 devices are identified by their NAME, which is the contents of their Address Claim Message (PGN 60928).

Format: \$PSMDRTE,C,aaaaa,ii,dd,rr,n--n,tt*hh<CR><LF> (command)

\$PSMDRTE,R,aaaaa,ii,dd,rr,n--n,tt,s*hh<CR><LF> (report)

aaaaa: Address field for the route (e.g. "GPRMC", "IIMTW", etc.). This field may contain wildcard characters ('-'). For instance, "--MWV" will apply to all sentences ending on "MWV", regardless of their Talker ID.

ii: Input field. This is a hexadecimal number where each bit represents an NMEA input. The following bits are defined:

- 0: NMEA In1
- 1: NMEA In2
- 2: NMEA In3
- 3: NMEA In4
- 4: NMEA Conversions
- 5: Host input
- 7: NMEA 2000

When a bit is 1, the sentence is forwarded, otherwise the sentence is blocked from that input.

dd: Optional divisor factor (0..99). The rate or frequency of a sentence is divided by this number to reduce the number of sentences over time. If for instance a divisor of 5 is specified, only every 5th occurrence of this sentence is forwarded. The divisor is only applied to sentences which are routed to NMEA Out1 and NMEA Out2. The host interface will always transmit sentences at their original rate.

rr: Optional routing field, setting the destination of the sentence. This is a hexadecimal number where each bit represents an output. The following bits are defined:

- 0: NMEA Out1
- 1: NMEA Out2
- 2: SeaTalk bus
- 4: Wireless output
- 5: Host output

When a bit is 1, the sentence is routed to that output.

n--n: Optional NAME, (16 hexadecimal digits) identifying an NMEA 2000 source. Only processed and stored if the NMEA 2000-bit is set in the input (xx) field.

tt: Optional Talker ID. This replaces the original Talker ID of the sentence.

s: Optional Source Address from an NMEA 2000 source. This field only exists in a report sentence.

hh: Optional checksum

A \$PSMDRTE sentence with the word DELETE in the "ccccc" field deletes all routes. The MiniPlex-3 will respond with a \$PSMDRDY sentence. This also indicates the start of a time window of 200 ms during which new \$PSMDRTE sentences are accepted to define new routes. Each received \$PSMDRTE sentence restarts this window. When the last \$PSMDRTE sentence is received, the window will eventually time out and the MiniPlex-3 will store the received routes in non-volatile memory. When the routes are stored, the MiniPlex-3 will respond again with a \$PSMDRDY sentence.

The MiniPlex-3 will ignore new routes when the window has timed out or when the maximum number of 50 routes is reached.

Example:

```
$PSMDRTE,C,GPHDT,0C,5,21,,HE<CR><LF>
```

This sentence specifies a route for all sentences that have "GPHDT" in the address field. It only passes GPHDT sentences from inputs 3 and 4, the rate/frequency is reduced by 5 and the sentence is routed to NMEA Out1 and the host only and changed into "HEHDT".

When the routing table is requested, the MiniPlex-3 responds by sending \$PSMDRTE sentences, one for each entry. A \$PSMDRDY sentence marks the end of the list.

Example response:

```
$PSMDRTE,R,GPRMC,09,,20,,*3E<CR><LF>
$PSMDRTE,R,GPGBA,80,,21,C632820022220839,213*6F<CR><LF>
$PSMDRTE,R,WIMWV,80,,20,C03287004A600A23,5*6D<CR><LF>
$PSMDRTE,R,GPGSV,01,,20,,*28<CR><LF>
$PSMDRDY*45<CR><LF>
```

The sentences may not be transmitted as one contiguous block. In case of much NMEA data, they may be interspersed with other NMEA sentences.

\$PSMDSP – Set Speed

This sentence sets the baud rate of the NMEA inputs and outputs.

Format: \$PSMDSP,a,b,c,d,e,f[*hh]<CR><LF>

The following fields are defined for setting the various inputs and outputs:

- a: Sentence Status flag:
 - C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- b: NMEA In1
- c: NMEA In2
- d: NMEA In3
- e: NMEA In4/Out1
- f: NMEA Out2/Modbus

Valid field values are:

- 0: 4800 Baud
- 1: 9600 Baud
- 2: 19200 Baud
- 3: 38400 Baud
- 4: 57600 Baud
- 5: 115200 Baud

If NMEA In1 is set to SeaTalk, field b is ignored in a command and will be 0 in a report sentence.

\$PSMDSR – Sentence Rebuilding

This sentence sets a Sentence Rebuilding definition. Up to three rebuilding definitions can be stored. To clear an entry, send this command with only fields a and b.

Format: \$PSMDSR,a,b,c,d,e,text,...,text*hh<CR><LF>

- a: Sentence Status flag:
 - C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- b: Definition number (1..3)
- c: Address field of originating sentence. Wildcard characters ('-') are accepted, matching on every character. This field must contain 4 or 5 characters.
- d: Optional contents of first parameter field of originating sentence.
- e: Address field of new sentence
- text: Text that defines the new sentence. The text in this field is copied verbatim into the new sentence. A formatter character '%' in this text followed by a number inserts the contents of that field from the originating sentence at that position. So, if the text field contains "%3" at some point, the contents of field 3 of the originating sentence is inserted here.

Two modifier characters are defined that can be placed between the '%' and the number:

- '-': Change the sign of the numerical value of that field.
Example: "%-4" takes the value of field 4 and changes the sign of the value; a negative number becomes positive and vice-versa,
- '<': Modify an angle in the specified field from -180° to 180° into 0° to 360°.
Example: "%<5" converts field 5 from being a value between -180° to 180° into a value ranging between 0° to 360°.

These modifiers cannot be combined. The total length of all text fields including the separating commas may not exceed 90 characters.

When a command is successfully processed, the MiniPlex-3 responds with a \$PSMDSR,R,... sentence.

Up to five Sentence Rebuilding definitions can be stored in the MiniPlex-3. Each of them is addressed by the definition number in field b.

When the Sentence Rebuilding table is requested, the MiniPlex-3 responds by sending \$PSMDSR sentences, one for each entry. A \$PSMDRDY sentence marks the end of the list.

Example response:

```
$PSMDSR,R,1,GPRMC,,GPVTG,%8,T,%8,M,%7,N,,K,%12*3E<CR><LF>
$PSMDSR,R,2,PSAT-,HPR,PFEC,GPatt,%3,%4,%5*47<CR><LF>
$PSMDRDY*45<CR><LF>
```

\$PSMDST – SeaTalk Data

This sentence transports raw SeaTalk data. It is transmitted by the MiniPlex-3 when options 1 and 2, or option 2 are enabled.

Format: \$PSMDST,a,xx,xx,xx,...,xx*hh<CR><LF>

a: Sentence Status flag:

- C: sentence is a command to transmit SeaTalk data
- R: sentence contains received SeaTalk data

xx: hexadecimal value of a SeaTalk datagram byte, 3 to 18 bytes.

When the MiniPlex-3 receives this sentence while SeaTalk is enabled, a SeaTalk datagram containing this data will be transmitted on the SeaTalk network.

\$PSMDUI – Set Unique Identifier

Sets the Unique Identifier (UI) of the MiniPlex-3. This UI is sent as source parameter in TAG blocks sent by the MiniPlex-3.

Format: \$PSMDUI,a,c--c*hh<CR><LF>

a: Sentence Status flag:

- C: sentence is a command to change settings
- R: sentence is a status report of current settings

c--c: Unique Identifier, 12 characters max. If this field exceeds the maximum character count, is not present or empty, the UI is reset to "MXnn" where "nn" are the last two digits of the serial number of the MiniPlex-3.

\$PSMDVER – Get Version

This sentence retrieves version information from the MiniPlex-3.

Format: \$PSMDVER

The MiniPlex-3 responds with the following version sentence:

\$PSMDVER,v.v.v,n--n,ssssssss,cccc,xx*hh<CR><LF>

v.v.v: firmware version number

n--n: MiniPlex-3 model name

ssssssss: serial number

cccc: MiniPlex-3 capabilities. This is a 4 digit, 16-bit field represented as a hexadecimal number. Each bit identifies a capability of the MiniPlex-3. The following bits are defined:

2-0: Host interface type, 0: serial, 1: USB, 2: Ethernet, 3: USB +
WiFi
3: SeaTalk transmission supported
4: NMEA 2000 supported
5: MiniPlex-3PRO
15-13: MiniPlex-3 generation: 5 = 4th generation
xx: Hardware ID of the MiniPlex-3 (a hexadecimal number; see the description of the \$PSMDLDR
sentence for an overview of Hardware ID's).
hh: checksum

\$PSMDWI – WiFi Control

This sentence controls the WiFi module of a MiniPlex-3Wi(-N2K). This sentence always results in a response sentence from the MiniPlex-3. This response reflects the response of the wireless module or the result of the operation.

These sentences should only be issued through the USB interface of the MiniPlex-3Wi(-N2K) because they disable the WiFi module shortly, resulting in a loss of the WiFi connection.

Format: \$PSMDWI,x,a,b..*hh<CR><LF>

x: Sub-command. See below

a,b...: Optional parameters required by a subcommand

Response: \$PSMDWI,<message>

The following sub-commands are defined:

A: Initialise the WiFi module with the default access point settings:

SSID: MiniPlex-xxxxxxx
Channel: 6
IP address: 10.0.0.1
Network mask: 255.255.255.0
TCP/UDP port: 10110

xxxxxxx is the serial number of the MiniPlex-3.

B: Boot WiFi module in Command Line mode (for diagnostics only). The red Overflow LED will blink continuously in this mode. When command mode is enabled, all NMEA data is blocked. A ctrl-Q exits Command Mode.

C: Enter Command Mode of the WiFi module (for diagnostics only). The red Overflow LED will blink continuously in this mode. When command mode is enabled, all NMEA data is blocked. A ctrl-Q exits Command Mode.

D: Disable the WiFi interface. The yellow LED will go off to indicate this. When WiFi is disabled, the WiFi module is switched off completely and all WiFi related commands will fail. Only a \$PSMDWI,E command will be accepted to switch the WiFi module on again.

E: Enable the WiFi interface. The yellow LED will light up solid once the WiFi module has started again. This will take appr. 7 seconds.

F: Format the internal file system on the WiFi module.

M: Read the MAC address of the wireless module. Returns a \$PSMDWI,MAC,<mac address> sentence

Q: Read the WiFi parameters. Returns a \$PSMDWI,AP,<ssid>,<password>,<channel> sentence.

R: Reset the WiFi module to its factory settings. Following this command, a \$PSMDWI,A must be executed to restore our factory settings.

V: Read the version number of the WiFi firmware. Returns a \$PSMDWI,VER,xxx sentence.

W: Set the parameters of the WiFi access point:

\$PSMDWI,W,ssid,password,chan*hh<CR><LF>

ssid: SSID of the access point, 32 characters max.
password: password of the access point, 8 characters min., 31 characters max.
chan: WiFi channel

Example:

\$PSMDWI,W,Blue Lagoon,h48skhr5,4

\$PSMDXDR – Specify Transducer ID

This sentence specifies the Transducer ID for a conversion from an XDR sentence to NMEA 2000.

Format: \$PSMDXDR,a,x,c--c*hh<CR><LF>

a: Sentence Status flag:

C: sentence is a command to change settings

R: sentence is a status report of current settings

x: Conversion ID:

0: Mast angle to PGN 65330

1: Sailing performance to PGN 127488, field 2 (Engine Speed)

2: Air temperature to PGN 130316

3: Sea temperature to PGN 130316

4: Atmospheric/barometric pressure to PGN 130314

5: Relative outside humidity to PGN 130313

6: Heave to PGN 127252

7: Yaw to PGN 127257

8: Pitch to PGN 127257

9: Roll to PGN 127257

c--c: Transducer ID, 15 characters max.

Example:

```
$PSMDXDR,C,0,mastangle
```

This command will enable the conversion for mast angle. The MiniPlex-3 will search for Transducer ID "mastangle" in every XDR sentence it receives and convert this angle to PGN 65330. The received XDR sentence may also contain other sensor data.

To disable a conversion, send a \$PSMDXDR command without c--c field:

```
$PSMDXDR,C,0
```

This will disable reception and conversion of a mast angle.

Proprietary NMEA 0183 Sentences – NMEA 2000

\$PSMDACK – Acknowledge

This sentence reports the error codes received in a PGN 126208 Acknowledge message in response to commanded Device and System Instances using command \$PSMDNI.

Format: \$PSMDACK,e[e...]*hh<CR><LF>

e: One or more digits with an error code. The number of digits equals the number of commanded fields using a PGN 126208 Command message, in that order.

The following error codes can be returned, as defined in the NMEA 2000 standard V3.000:

- 0: No Error/Acknowledge;
- 1: Invalid request or command parameter field;
- 2: Temporarily unable to comply;
- 3: Request or command parameter out-of-range;
- 4: Access denied;
- 5: Request or Command is not supported;
- 6: Read or Write is not supported;

\$PSMDNA – Set NMEA 2000 Source Address

This sentence sets the NMEA 2000 Source Address of each virtual NMEA 2000 device of the MiniPlex-3.

Format: \$PSMDNA,a,b,c,d,e,f,g*hh<CR><LF>

- a: Sentence Status flag:
 - C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- b: Source Address of Main (System and Host interfaces)
- c: Source Address of NMEA 0183 In1/SeaTalk
- d: Source Address of NMEA 0183 In2
- e: Source Address of NMEA 0183 In3
- f: Source Address of NMEA 0183 In4
- g: Source Address of NMEA 0183 conversions

Note that when this command is executed, the specified addresses will be requested using the NMEA 2000 Address Claim Procedure. If other devices on the NMEA 2000 network have already claimed one of these addresses, the Address Claim Procedure determines who “wins” the specified address. So, the addresses claimed by the MiniPlex may eventually be different than specified.

\$PSMDNC – ISO Address Claim Message/ISO Command Address

This sentence is transmitted from the host interface when the MiniPlex receives an NMEA 2000/ISO Address Claim Message (PGN 60928) from another device on the NMEA 2000 network. This sentence is also used to set the Source Address of another device on the NMEA 2000 network.

Format: \$PSMDNC,a,n--n,s*hh<CR><LF>

- a: Sentence Status flag:
 - C: sentence is a command to set the Source Address of another device on the NMEA 2000 network.
 - R: sentence contains the Address Claim Message of a device on the NMEA 2000 network.
- n--n: The NAME of the device receiving or claiming the Source Address, a 16-digit hexadecimal number.
- s: Source Address of the device receiving or claiming the Source Address.

\$PSMDND – Set NMEA 2000 Device Instance

This sentence sets the NMEA 2000 Device Instance of each virtual NMEA 2000 device of the MiniPlex-3.

Format: \$PSMDND,a,b,c,d,e,f,g*hh<CR><LF>

- a: Sentence Status flag:
C: sentence is a command to change settings
R: sentence is a status report of current settings
- b: Device Instance of Main (System and Host interfaces)
c: Device Instance of NMEA 0183 In1/SeaTalk
d: Device Instance of NMEA 0183 In2
e: Device Instance of NMEA 0183 In3
f: Device Instance of NMEA 0183 In4
g: Device Instance of NMEA 0183 conversions

\$PSMDNF – Set NMEA 2000 Device Class and Function Code

This sentence sets the NMEA 2000 Device Class and Function Code of each virtual NMEA 2000 device of the MiniPlex-3.

Format: \$PSMDNF,a,b,c,d,e,f,g*hh<CR><LF>

- a: Sentence Status flag:
C: sentence is a command to change settings
R: sentence is a status report of current settings
- b: Device Class and Function Code of Main (System and Host interfaces)
c: Device Class and Function Code of NMEA 0183 In1/SeaTalk
d: Device Class and Function Code of NMEA 0183 In2
e: Device Class and Function Code of NMEA 0183 In3
f: Device Class and Function Code of NMEA 0183 In4
g: Device Class and Function Code of NMEA 0183 conversions

The Device Class and Device Function is set by a single number. Each number defines a combination of Device Class and Device Function as shown in the table below:

Num	Class	Function	Name
0	25	135	NMEA 0183 Gateway
1	25	130	PC Gateway
2	60	195	AIS
3	70	140	AIS (< V2)
4	40	150	Autopilot
5	60	130	Depth
6	60	135	Depth & Speed
7	120	130	Display/User Interface/Plotter
8	70	150	DSC (< V2)
9	60	205	ECDIS (< V2)
10	60	210	ECS (< V2)
11	20	130	EPIRB
12	70	130	EPIRB (< V2)
13	80	160	General Purpose Display (< V2)
14	40	160	Heading (< V2)
15	60	140	Ownship Attitude
16	80	150	Integrated Instruments (< V2)
17	60	170	Integrated Navigation (< V2)
18	60	175	Integrated Navigation System
19	20	135	Man Overboard
20	70	180	MF/HF Radio (< V2)
21	60	145	Ownship Position (GNSS)
22	60	150	Ownship Position (Loran C)
23	60	200	Radar

Num	Class	Function	Name
24	40	155	Rudder
25	70	170	Satellite Communications
26	60	155	Speed
27	60	160	Turn Rate (< V2)
28	70	190	VHF Radio with DSC
29	20	140	Voyage Data Recorder
30	80	140	Voyage Data Recorder (< V2)
31	85	160	Water Temperature
32	80	180	Weather Instrument (< V2)
33	85	130	Wind/Pressure/Humidity

If an NMEA input of the MiniPlex-3 is set to a "< V2)" device, the Product Information PGN transmitted for this input will report an "NMEA Message Database Version" of 1.300.

If an NMEA input of the MiniPlex-3 is set to an "AIS (< V2)" or a "Weather Instrument (< V2)" device, it will transmit the corresponding NMEA 2000 V1.300 PGN's.

\$PSMDNI – Command Device and System Instance

This sentence sets the Device and/or System Instance of another device on the NMEA 2000 network.

Format: \$PSMDNI,a,b,c*hh<CR><LF>

- a: Source Address of device on the NMEA 2000 network
- b: Device Instance to be commanded to the remote device
- c: System Instance to be commanded to the remote device

When the remote device acknowledges the commanded parameters, the MiniPlex-3 will transmit a \$PSMDACK sentence containing the acknowledgement status values for each parameter that is modified on the remote device.

\$PSMDNM – Set Manufacturer Code

This sentence sets the NMEA 2000 Manufacturer Code of each virtual NMEA 2000 device of the MiniPlex-3.

This command should be used with care because it violates the NMEA 2000 certification of the MiniPlex-3.

Some older NMEA 2000 devices only accept data from other devices from the same manufacturer. These devices will not list a MiniPlex-3 NMEA 0183 input as a Data Source. By setting the Manufacturer Code of an NMEA 0183 input of the MiniPlex-3 to the Manufacturer Code of this receiving device, it will then list and accept this input as a Data Source. A good example of such a device is the Lowrance LMF-200, a gauge for engine data which is also capable of showing NMEA parameters such as Water Speed, Depth or GNSS Position. The MF-200 however, will only show other Lowrance devices in its Device List and accept data from Lowrance devices.

Format: \$PSMDNM,a,b,c,d,e,f,g*hh<CR><LF>

- a: Sentence Status flag:
 - C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- b: Manufacturer Code of Main (System and Host interfaces)
- c: Manufacturer Code of NMEA 0183 In1
- d: Manufacturer Code of NMEA 0183 In2
- e: Manufacturer Code of NMEA 0183 In3
- f: Manufacturer Code of NMEA 0183 In4
- g: Manufacturer Code of NMEA 0183 conversions

The ShipModul manufacturer code is 595.

\$PSMDNO – Set NMEA 2000 Options

This sentence enables or disables NMEA 2000 options.

Format: \$PSMDNO,C,o,e*hh<CR><LF> *(command only)*
Or: \$PSMDNO,a,xxxxxxx*hh<CR><LF> *(command and report)*

a: Sentence Status flag:

 C: sentence is a command to change settings

 R: sentence is a status report of current settings

o: Option number

e: 0: off/disable

 1: on/enable

xxxxxxx: Enable/disable multiple options at once using a 32-bit hexadecimal number. Each bit represents an option where bit 0 is option 0, bit 1 is option 1, etc.

Example: \$PSMDNO,C,6,1<CR><LF> *(enables option 6)*
 \$PSMDNO,C,00000021<CR><LF> *(enables options 5 and 0)*

The following options are implemented:

- 0: Enable RMC sentence from a GPS source (enabled by default)
- 1: Enable GGA sentence from a GPS source
- 2: Enable GLL sentence from a GPS source
- 3: Enable VTG sentence from a GPS source
- 4: Enable GSA and GSV sentences from a GPS source
- 5: Enable RMB sentence from a navigation source (enabled by default)
- 6: Enable APB sentence from a navigation source
- 7: Enable XTE sentence from a navigation source
- 8: Enable BWC or BWR sentences from a navigation source
- 9: Transmit system time using a ZDA sentence and PGN 126992
- 10: Transmit a DBT sentence instead of DPT from a water depth source
- 11: Transmit GNSS sentences (GGA, GLL, RMC and VTG) at 10 Hz
- 12: Transmit \$PFEC,Att,... and \$PFEC,Hve,... sentences instead of \$YXXDR from attitude and heave sources
- 13: Enable ZTG sentence from a navigation source
- 14: Transmit speed sentences (VBW, VHW) at 10 Hz
- 15: Transmit MDA sentence
- 16: Transmit THS sentence instead of HDT from a true heading source
- 17: Transmit PGN 130074 (Waypoint) on reception of a TLL sentence
- 18: Host navigation override: Navigation data received from a host interface overrides that of any other interface. Normally, NMEA 2000 has highest priority.
- 19: Enable Raymarine Alarms. When enabled, the MiniPlex controls the Switch contact upon reception of Raymarine Alarm PGN 65288.
- 20: Load PGN 129284, field *Bearing, Origin to Destination Waypoint* (field 9) and *Bearing, Position to Destination Waypoint* (field 10) with a magnetic bearing and set *Course/Bearing Ref.* (field 3) to Magnetic.
- 28: Transmit \$PSMDEL,xxx sentences when battery and DC related NMEA 2000 data is received
- 29: Disable transmission of the Main device (Host interface) on the NMEA 2000 network
- 30: \$MXPGN sentence bit 0

31: \$MXPGN sentence bit 1

The \$MXPGN sentence bits define one of four modes:

- 0: No \$MXPGN sentences generated.
- 1: Unknown PGN's will be converted into \$MXPGN sentences.
- 2: All received PGN's will be converted into \$MXPGN sentences.
- 3: All received PGN's and NMEA 0183 sentences will be converted into \$MXPGN sentences.

Regardless of these bits, PGN's 60928 (Address Claim) and 126996 (Product Information) will always be converted to \$PSMDNC and \$PSMDNP sentences respectively to ensure that MPXConfig3 can still fill the NMEA 2000 Device List in MPXConfig3.

\$PSMDNP – NMEA 2000 Product Information

This sentence is transmitted from the host interface when the MiniPlex receives an NMEA 2000 Product Information PGN (126996) in response to command \$PSMDNR. Each request results in three \$PSMDNP sentences, each with a different format. Each of these sentences is identified with an identifier character in the first field.

Format: \$PSMDNP,A,s,v,p,c,l*hh<CR><LF>

- s: Source Address of the Product Information
- v: NMEA 2000 Message Version (field 1 of PGN 126996)
- p: Manufacturer's Product Code (field 2 of PGN 126996)
- c: NMEA 2000 Certification Level (field 7 of PGN 126996)
- l: Load Equivalency of the device (field 8 of PGN 126996)

Format: \$PSMDNP,B,m,s*hh<CR><LF>

- m: Manufacturer's Model ID (field 3 of PGN 126996)
- s: Manufacturer's Serial Code(field 6 of PGN 126996)

Format: \$PSMDNP,C,v,m*hh<CR><LF>

- v: Manufacturer's Software Version Code (field 4 of PGN 126996)
- m: Manufacturer's Model Version (field 5 of PGN 126996)

\$PSMDNR – NMEA 2000 PGN Request

This sentence requests a PGN from an NMEA 2000 device.

Format: \$PSMDNR,p,s*hh<CR><LF>

- p: PGN to request.
- s: Optional Source Address to send the request to. If omitted or set to 255, the request is sent as a global request.

The MiniPlex-3 will listen for a response to this request for 1.25s (standard ISO response timeout). This sentence can be used to request an Address Claim Message or a Product Information PGN from another device, for instance.

\$PSMDNS – Set NMEA 2000 System Instance

This sentence sets the NMEA 2000 System Instance of each virtual NMEA 2000 device of the MiniPlex-3.

Format: \$PSMDND,a,b,c,d,e,f,g*hh<CR><LF>

- a: Sentence Status flag:
 - C: sentence is a command to change settings
 - R: sentence is a status report of current settings
- b: System Instance of Main (System and Host interfaces)
- c: System Instance of NMEA 0183 In1
- d: System Instance of NMEA 0183 In2
- e: System Instance of NMEA 0183 In3
- f: System Instance of NMEA 0183 In4
- g: System Instance of NMEA 0183 conversions

Configuration Data Example

Below is an example of the output of a MiniPlex-3 in response to a PSMDCFQ command:

```
$PSMDCFQ
$PSMDCF,R,0,3*72
$PSMDID,R,,HE,,,*58
$PSMDSP,R,0,3,0,0,2*6A
$PSMDDR,R,00,0,00,0*62
$PSMDOP,R,00000202*47
$PSMDCNV,R,00000010*02
$PSMDIN,R,7,0,0,0*74
$PSMDPR,R,0,2,0,0,1*69
$PSMDUI,R,MX00*51
$PSMDNA,R,1,7,11,10,9,8*7D
$PSMDND,R,0,0,0,0,0,0*7E
$PSMDNS,R,0,0,0,0,0,0*69
$PSMDNF,R,1,0,0,0,0,0*7D
$PSMDNO,R,00000021*5A
$PSMDDS,R,0,1,,0*52
$PSMDDS,R,1,N,C032820022220839,0*56
$PSMDDS,R,2,1,,0*50
$PSMDRTE,R,GPRMC,82,,20,C0789100118273BA,31*0F
$PSMDRTE,R,HEHDT,02,10,21,,*62
$PSMDRTE,R,WIMWV,01,,20,,*66
$PSMDRTE,R,HCHDG,01,,20,,*74
$PSMDRTE,R,HCHDG,80,,00,C032820022220839,213*35
$PSMDB,R,M,1,1*1A
$PSMDB,R,R,100,10*35
$PSMDB,R,X,3,100,H,L,,0,C,C,Temp,FC*10
$PSMDB,R,X,3,102,H,I,,0,P,B,Pressure,FC*0C
$PSMDB,R,X,27,10,H,I,,0,H,P,Humidity,FC*1E
$PSMDMOB,R,979879997,V*54
$PSMDMOB,R,970002388,V*5D
$PSMDMOB,R,970699847,V*51
$PSMDRDY*45
```