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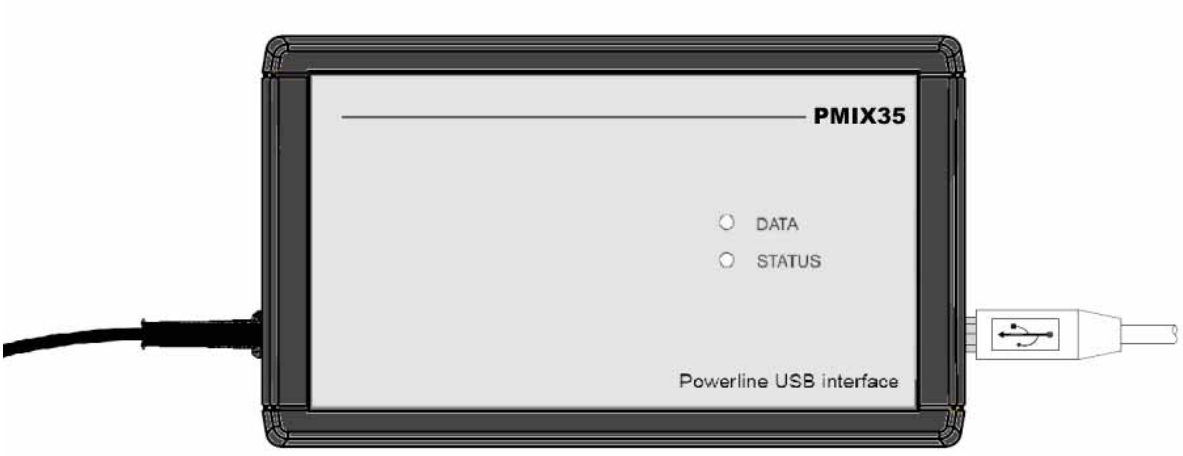
Haibrain X-10
Programming and Measuring Interface
Type PMIX35



CE

Introduction

The Programming and Measuring Interface (PMIX35) is a power line communication interface suitable for Haibrain X-10 and other compatible systems (such as X-10). In addition to supporting the standard and extended protocols of Haibrain X-10, this interface also measures the quality of various signals. With the supplied PMIX35 software, technical problems in installations can be quickly localised and resolved, a new installation can be tested for reliability and modules can be quickly and easily programmed.

Functions

- Sending and receiving commands.
- Measuring the signal level and noise level of incoming messages.
- Measuring network impedance.
- Sending messages with quick-selection buttons.
- Sending messages with two preset macros.
- Running macros automatically.
- Sending messages with adjustable transmission levels.
- Logging of received and sent messages with error analysis.
- Easily accessible network diagnostic information.
- Automatic programming of modules at the touch of a button.
- Network validation measuring method with reporting for the reliable delivery of new installations (available starting from software version 1.1).
- Support for the PMIX35 ASCII protocol similar to the CTX15/35 protocol.
- Support for the CTX15/35 protocol.

Contents

In the PMIX35 box, you should find the following:

- 1x PMIX35
- 1x USB cable
- 1x CD-ROM with:
  - PMIX35 software
  - PDF operating instructions for the PMIX35
  - Quick reference guide

Figure 1: PMIX35

Software installation

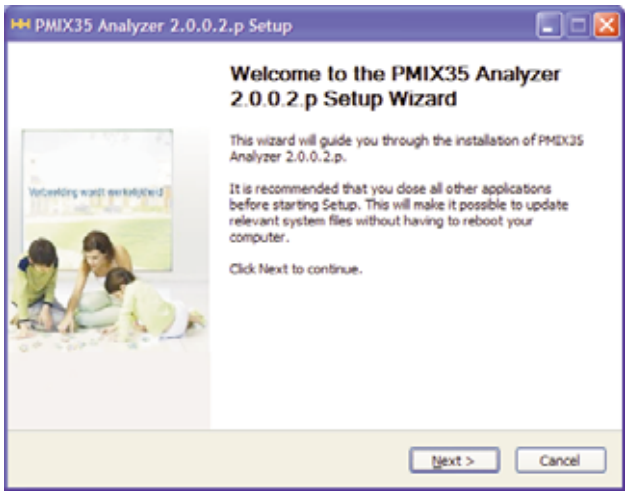
Follow the steps below to install the PMIX35 software.

⚠ Please note:

Follow the installation procedure below before connecting the PMIX35 to the PC!

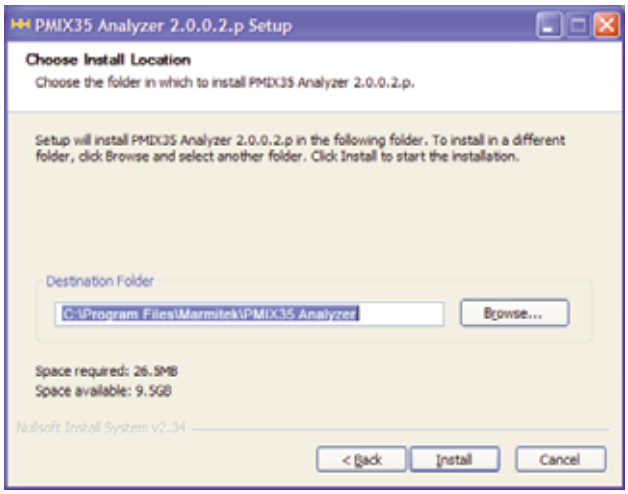
1. Place the PMIX35 CD in the CD-ROM drive of the PC.
If the installation does not start automatically, then follow the steps below:
a. Open Windows Explorer and go to the CD-ROM drive in which the PMIX35 CD is located.
b. Click the SETUP.EXE file to start it.
c. Click Run to start the installation.

2. Click "Next" in the following screen:

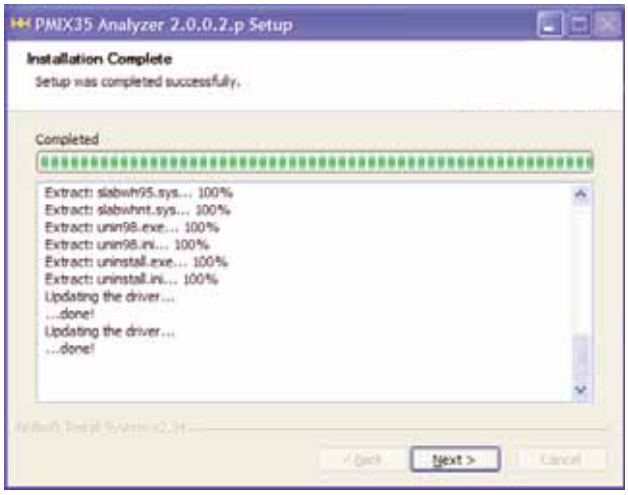


3. Read the terms and conditions and accept them to continue with the installation process.

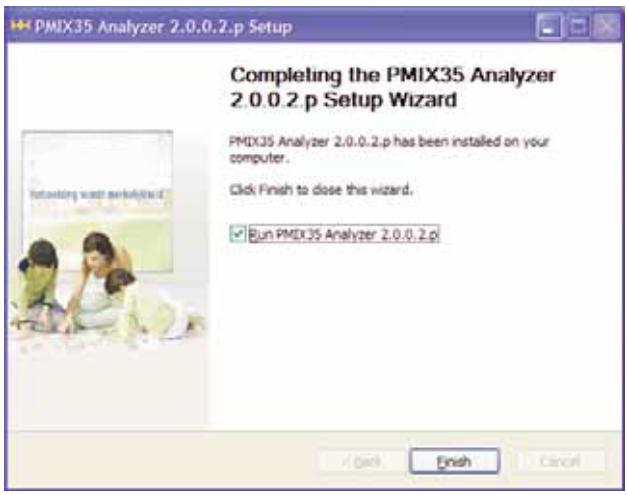
4. Chose a different folder or location, if desired, and click "Install" in the following screen:



5. Wait until the installation is complete.



6. Click "Finish" in the following screen:



7. Now connect the USB cable of the PMIX35 to the PC.

8. The PMIX35 is now ready for use.

After starting up, the PMIX35 software will automatically search for the presence of a connected PMIX35 and attempt to establish a connection. The software verifies whether the correct firmware version is in use. If this is not the case, the software will load the correct firmware version into the PMIX35. The status of the connection is indicated in the lower right part of the screen by the following two indicators (see figure 2):

- Yellow: Signals sent to the PMIX35.
- Green: Signals received by the PMIX35.

Figure 2: Connection with PMIX35 indicator

Check **http://www.haibrain.com.** regularly for new software versions for the PMIX35

1 Programming and measuring functions

The PMIX35 software can be used for:
- Programming Haibrain X-10 modules.
- Measuring and testing an installation.

For this purpose the PMIX35 software is divided into three tab pages, namely:
1. Programmer
2. Analyzer
3. Network Validation (available via a software update from mid-2008)

The table below gives an overview of these functions and their applications:

Tab page name	Purpose	Application
Programmer	Programming modules	All Haibrain X-10 modules can be easily programmed using this function.
Analyzer	Problem analysis	Highly specific measurements for analysis can be carried out in a Haibrain X-10 installation using this function.
Network Validation	Validation of an installation	This function validates the reliability of a new, yet to be delivered Haibrain X-10 installation with a validation report and a final assessment.

Table 1 1: Overview of software functions.

In the following chapters each individual tab page with its specific functions will discussed in detail.

1.1 Programmer

The purpose of the Programmer tab page is to allow the simple programming of Haibrain X-10 modules.
The required settings are preset and programmed in the module at the touch of a button.

The latest Haibrain X-10 modules can be automatically placed in program mode (PRG function) without having to remove the module to press the program button. The module types that support this PRG function can be found in the table below:

Type	Description	PRG function
IMX10 / TWM4	Programmable interface potential-free inputs	Yes
SAIX12 / AWM2P	Switch actuator/switch interface 230 V AC inputs	Yes
DAIX12 / LWM1P	Dimming actuator/dimmer interface 230 V AC inputs	Yes
PIOX15 v2	Potential-free input/output interface	Yes
SAX15 v2	Switch actuator/switch interface potential-free	Yes
SVX10 v2	Signal amplifier	Yes
SAIX / AWM2	Switch actuator/witch interface potential-free inputs	No
SAX1	Switch actuator	No
DAIX10 / LWM1	Dimming actuator/dimmer interface potential-free inputs	No
DAX10	Dimming actuator	No
AIX / TMA4	Switch interface potential-free inputs	No
AIX12	Switch interface 230 V AC inputs	No
DIX1	Dimmer interface single-face potential-free inputs	No
DIX2	Dimmer interface two-face potential-free inputs	No
GIX	Group interface potential-free inputs	No
SVX10 v1	Signal amplifier	No
PIOX15 v1	Potential-free input/output interface	No
SAX15 v1	Switch actuator/switch interface potential-free	No
SAX35	witch actuator/switch interface potential-free	No
VIX10	Fan interface	No
ZAX12 / SWM1P	Sunscreen interface potential-free	No

Table 1 2: Module types.

The following paragraphs describe the programming method for both types of modules.

1 Programming and measuring functions

1.1.1 Programming standard modules

Standard modules (without PRG function, see table 1-2) can be easily programmed by selecting the required module settings. After that, these settings can be programmed in the module at the touch of a button.
In order to program a module, a number of steps must be followed. These steps are described on the next page.

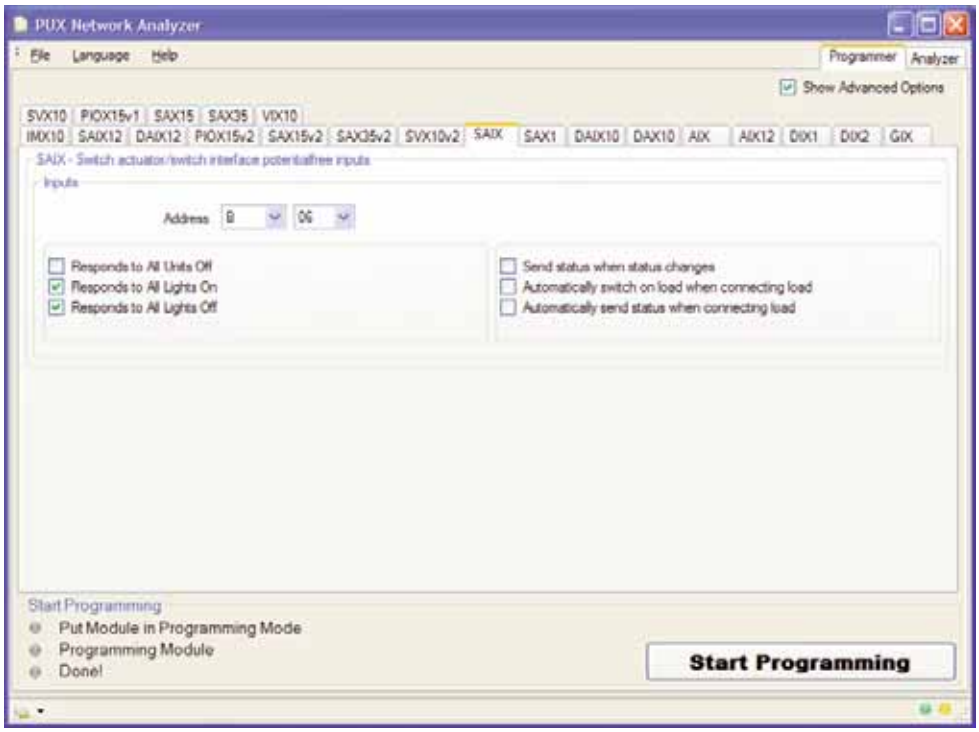


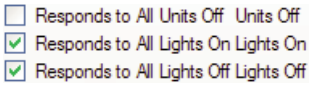
Figure 3: Example of programming an SAIX.

Programming steps:

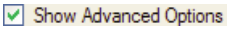
1. Select the module to be programmed at the top of the tab page:

2. Select the required address:

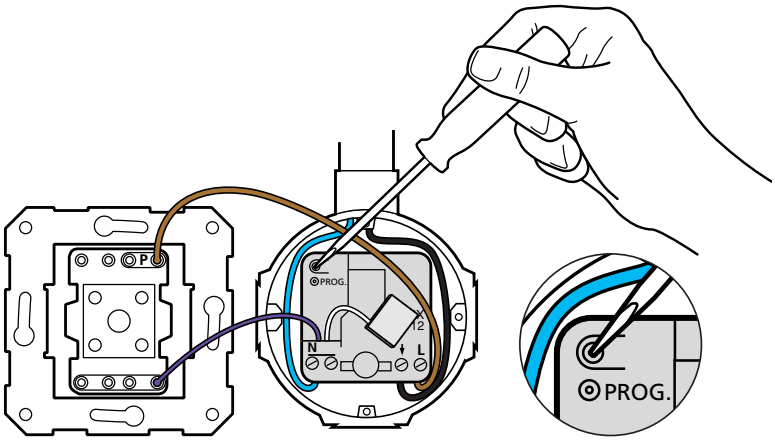
3. Select the required options:



4. Select any extra options using:



5. Switch the module to programming mode by pressing the programming button for 3 seconds.



The module LED switches on.

6. Click: **Start Programming**

The module LED will start to flash.

7. Wait for the green indicator: Done!

8. Exit programming mode by pressing the programming button again briefly.
The module LED switches off.

1.1.2 Programming using automatic programming mode

The latest generation of Haibrain X-10 modules can be (re)programmed by means of a special procedure without having to remove the module. This procedure, which must be followed precisely, is based on interaction between the PMIX35 and the module. The module can be programmed by operating a switch or pushbutton, or by switching the connected load on and off (in electrical wall sockets), in combination with the software. The module will not enter the programming mode if any of the conditions have not been met.
Read through the instructions below carefully and follow them precisely.

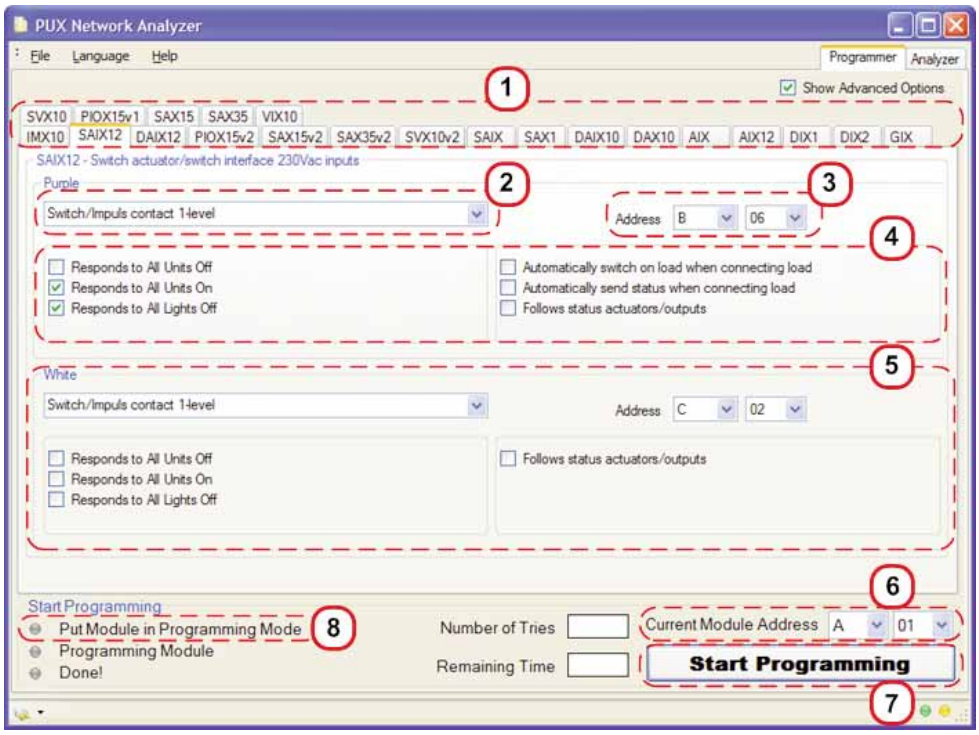


Figure 4: Programming steps

The steps for automatic programming mode are as follows:

1. Select the module type by pressing the tab page.
2. Select the function required for the first input wire.
3. Select the address required for the first input wire.
4. If necessary, select the options for the first input wire.
5. If necessary, select the function, the address and options for the other input wires.
6. Verify whether the current address of the module is selected here. All new modules have the default address A01. This is necessary to activate the PRG function in this module.

1. Click: **Start Programming**

2. Wait until the green indicator light is illuminated: Put Module in Programming Mode

3. Within 5 seconds, activate the programming mode of the module according to the table below:

Type	Activation of programming mode
IMX10	Switch one of the inputs 4 times within 5 seconds using the switch or pushbutton.
SAIX12 DAIX12	Switch one of the inputs 4 times within 5 seconds using a switch or pushbutton or switch the connected load (wall socket) on and off 4 times within 5 seconds.

The programming starts: Programming Module

4. Wait for the indicator: Done!

If programming does not start automatically:

- Press: **Stop Programming** and repeat the instructions above or
- Press the programming button of the module within the time indicated by: Remaining Time 60s

The PMIX35 makes three attempts Number of Tries 1 / 3, before stopping the procedure.

1.2 Analyzer

The purpose of the Analyzer tab page is to measure and analyse the quality of the data transfer over the power line. For a good analysis, various settings can be made, in many cases requiring specific knowledge. Where in the installation the measurement is carried out is also important.
All measurements take place via the power cord of the PMIX35.

The explanation of the application of the Analyzer function is divided into a number of practical components. The table below gives an overview of these components and their possibilities:

Component	Possibilities
Measuring signal levels	The signal levels of all messages transmitted and received are displayed in the log screen. In this way, unreliable signal levels are immediately noticeable. By varying the transmission level of the transmitted messages, the sensitivity of the receiving side of a module can be measured.
Network diagnostics	The network diagnostic indicators offer direct insight into possible areas of interest.
Sending and receiving messages	Messages can be sent directly or be placed in a macro before they are sent. The macros can be sent automatically at certain intervals. Messages that are transmitted and received can be found in the log screen.
Logging and viewing message communication	The status of the received messages is indicated in the log screen by means of colour shading. In this way, communication faults are immediately noticeable. The saved log file can be imported into Excel, for example, for further analysis.

Table 1 3: Analyzer components.

1.2.1 Measuring signal levels

The measuring of signal levels in Haibrain X-10 installations allows the rapid detection and resolution of problems. A few examples of this are:

- One or more modules appear to be inaccessible after switching on one module.
- Switching this module On has an affect on various signal levels. The load connected to this module is causing the problem.
- Some of the modules do not work at certain times. The signal levels of some of the modules lie below the required level.

At the times when these modules do not respond, the noise level is shown to be much higher.

The automatic measuring of the signal quality can be performed most simply via the network validation tab page.
See chapter 1.3.

The measuring of signal levels can also be performed for individual modules. This procedure is described below.

1.2.1.1 Signal levels of modules

The signal level and noise level of each message received is measured. These values can be found in the log screen as well as in the log file next to the received message. These values are reported in mV.
The readings from the two most recently received messages can also be found on the large display fields in order to quickly gain insight into current events. An important factor in power line communication is network impedance. The value of the power line impedance is reported in Ohm (see figure 5).

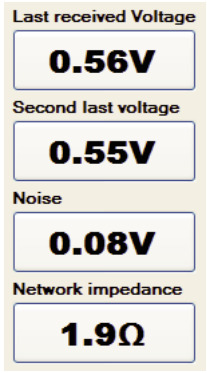


Figure 5:
Display of latest readings.

During measuring, always take the following points into account to be able to properly assess the signal level of a module:

- Before the measuring starts, switch all appliances in the home on. By doing so, the effect of the switched on appliances is included in the measurement.
- Perform the same measurement at more than one socket in the home.
- Always look at the noise level. The higher the noise level, the more signal is necessary to be able to function properly. It can happen that an appliance has a negative effect on the noise level and, therefore, communication. Provide this appliance with a filter.
- Always look at the network impedance. It can happen that an appliance has a negative effect on the network impedance and, therefore, communication. Provide this appliance with a filter.
- The network impedance should not be lower than 2 Ω.

For maximum reliability, the signal levels must comply with the threshold values as indicated in figure 6. If the signal level falls into the yellow area, it is important to check whether the module continues to function properly in all cases. If the signal level falls in the red area, action must always be taken to improve the signal quality.

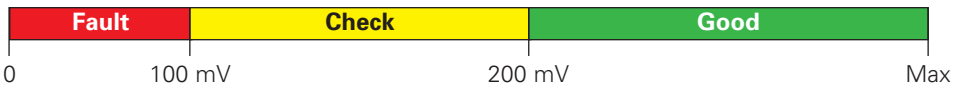


Figure 6: Signal level thresholds for modules.

1.2.1.2 Sensitivity of modules

The sensitivity of modules can be measured by varying the transmission level of the messages. By doing so, it is possible to determine at which level the module no longer reacts. To do this, slide the selector from left to right (see figure 7).

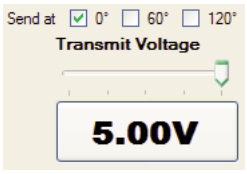


Figure 7:
Setting the transmission level.

Follow the steps below to measure the sensitivity of a module starting from the measurement site:

1. Enter ON/OFF or Status Request commands in the command lines for controlling the relevant module (see paragraph 1.2.3.2 Sending several messages simultaneously). For interface modules, make use of following the status.
2. Slide the "Transmit Voltage" selector all the way to the right (maximum) and send several ON/OFF commands to check the operation of the module. The signal level sent is then displayed in the large display field underneath.
3. With the selector, find the lowest point at which the module still responds properly. Take the value of the transmission signal from the display field below.
4. Check where this value falls within the thresholds depicted in the figure below:

Figure 8: Sensitivity thresholds of modules.

5. If the signal level falls into the yellow area, it is important to check whether the module continues to function properly in all cases.

1.2.2 Network diagnostics

The Network Diagnostics indicators and the Counters (see figure 9) offer quick insight into specific events.

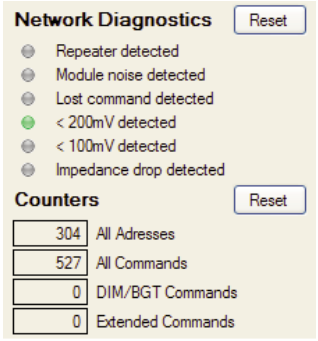


Figure 9: Network diagnostics data.

The table on the below gives an overview of the diagnostic indicators and their functions. The indicators are displayed until all indicators are reset with the Reset button.

Indicator name	Diagnostics
Repeater detected	Indication that the signal level measured from the 2nd address/command received is higher than the 1st over the course of several measurements.
Module noise detected	Indication that the PMIX35 detects signal interference that disrupts communication.
Lost command detected	Indication that a suspect message has been detected in the log screen, indicated by red shading. Lines shown in this colour require extra attention.
<200 mV detected	Indication that a signal lower than 200 mV has been measured.
<100 mV detected	Indication that a signal lower than 100 mV has been measured.
Impedance drop detected	Indication that the impedance measured changes a specified delta X.

Table 1 4: Network diagnostics indicators.

The table below gives an overview of the various counters and their functions.
All counters can be set to 0 with the [Reset] button.

Indicator name	Diagnostics
All Addresses	Counter value of all addresses received.
All Commands	Counter value of all commands received.
DIM/BGT Commands	Counter value of all DIM and BRIGHT commands received.
Extended commands	Counter value of all extended data received.

Table 1 5: Counters.

1.2.3 Sending and receiving messages

1.2.3.1 Sending messages directly

When sending messages, the required addresses and commands can be sent directly with the buttons available for this purpose (see figure 10). In this case "Add to command line" must not be selected.

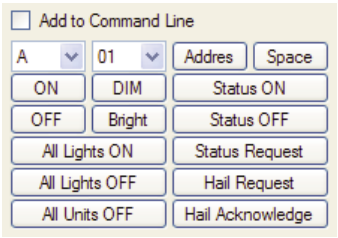


Figure 10: Sending messages directly.

Make use of the address selection buttons [A] [01] to choose another address. The [Space] button is only used for the selection of "Add to command line" when using macros.

1.2.3.2 Sending several messages simultaneously

When sending several messages simultaneously, the two available command lines can be used (see figure 11).

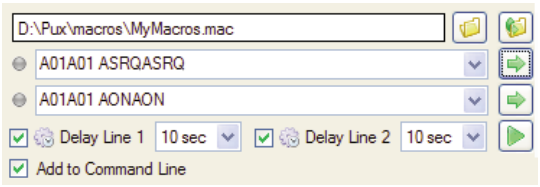


Figure 11: Sending messages indirectly.

Example:

Follow the steps below for sending a Status Request to the address "A01".

1. Select the option: [Add to Command Line]
2. Select the address: [A] [01]
3. Click the top command line with the mouse.
4. Click twice [Addres] , in this example A01A01.
5. Click [Space] (there must always be a space between addresses and commands).
6. Click twice on [Status Request]
7. Send the command line using the button next to the entry field. [A01A01 ASRQASRQ]

1.2.3.3 Sending messages automatically

With the two command lines available, two series of messages can be sent automatically in a specified pattern.

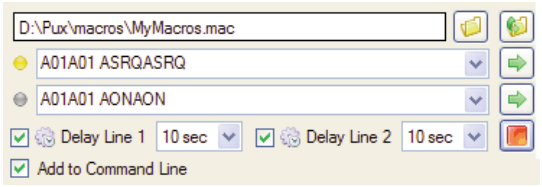


Figure 12: Sending messages automatically.

The command lines can be saved in a macro file with the button. To do this, choose the file name required and save. All command lines entered and sent can be selected with the arrow keys. An existing macro can be opened with the button.

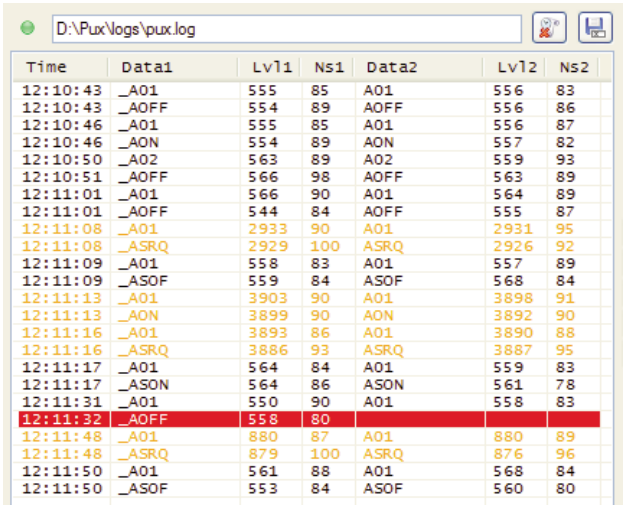
Example:

Follow the steps below to automatically send two command lines to the address "A01".

1. Follow the steps in paragraph 1.2.3.12 to provide both command lines with the required messages.
2. Select the option and the required delay time for the first command line: Delay Line 1 10 sec
3. Select the option and the required delay time for the second command line.
4. Start automatic sending by clicking: (this symbol then becomes:).
5. The indicator for the command lines indicates in yellow which line is waiting to be sent.
6. Sending can be cancelled by clicking: (this symbol then becomes:).

1.2.3.4 Receiving messages

As well as messages that are transmitted, messages that are received are also displayed, with their arrival times, in the `Data1` and `Data2` columns in the log window (see figure 13).



Time	Data1	Lvl1	Ns1	Data2	Lvl2	Ns2
12:10:43	_A01	555	85	A01	556	83
12:10:43	_AOFF	554	89	AOFF	556	86
12:10:46	_A01	555	85	A01	556	87
12:10:46	_AON	554	89	AON	557	82
12:10:50	_A02	563	89	A02	559	93
12:10:51	_AOFF	566	98	AOFF	563	89
12:11:01	_A01	566	90	A01	564	89
12:11:01	_AOFF	544	84	AOFF	555	87
12:11:08	_A01	2933	90	A01	2931	95
12:11:08	_ASRQ	2929	100	ASRQ	2926	92
12:11:09	_A01	558	83	A01	557	89
12:11:09	_ASOF	559	84	ASOF	568	84
12:11:13	_A01	3903	90	A01	3898	91
12:11:13	_AON	3899	90	AON	3892	90
12:11:16	_A01	3893	86	A01	3890	88
12:11:16	_ASRQ	3886	93	ASRQ	3887	95
12:11:17	_A01	564	84	A01	559	83
12:11:17	_ASON	564	86	ASON	561	78
12:11:31	_A01	550	90	A01	558	83
12:11:32	_AOFF	558	80			
12:11:48	_A01	880	87	A01	880	89
12:11:48	_ASRQ	879	100	ASRQ	876	96
12:11:50	_A01	561	88	A01	568	84
12:11:50	_ASOF	553	84	ASOF	560	80

Figure 13: Received messages log screen.

According to the X-10 protocol, messages are always sent twice consecutively. The first message always appears in the `Data1` column and the second message always appears in the `Data2` column. If the second message is not received, the second column will be empty. Single messages occur normally with Phase Couplers and Repeaters.

See the table below for an explanation of the different data colours in the log screen.

Log line	Meaning
12:11:50 _A01	Received message.
12:11:48 _A01	Transmitted message.
12:11:32 _AOFF	Suspect message. Lines shown in this colour require extra attention.

Table 1 6: Log line colour meanings.

Errors in the log screen are indicated with red shading.
The table below gives several examples of suspect messages:

Suspect messages	Description
" "A01" "AONAON	
" "A01A01" "AON	If one of the double addresses or commands is missing. This does not apply to repeated messages for which the address and the command consist of only one message.
A01AON	If there is no space between two different messages.
A01BDIM	
A01B03	
AONAOFF	
AONBON	
A01A[1]031531	
AONA[1]031531	
A01" "BON	If an address is followed by a command with a different letter code.
A01" "B02	If an address is followed by an address with a different letter code.

Table 1 7: Examples of faulty message patterns.

The example of sending a Status Request to the address "A01" from chapter 1.2.3.2 Sending several messages simultaneously can be found in the log screen as shown below:

```
12:11:08  _A01    A01
12:11:08  _ASRQ   ASRQ
12:11:09  _A01    A01
12:11:09  _ASOF   ASOF
```

Go to the next chapter for more information about the interpretation of log information.

1.2.4 Logging and reading data communication

Information if the log screen can be saved in a log file with the  button. To do this, choose the file name required and save. The log screen can be cleared with the  button.
A log file looks like this:

Sample log file: pmix35.log

Date / Time	Space	Data1	Level1	Noise1	Data2	Level2	Noise2	Status	Echo
11/30/2007 12:10:43 PM	S	A01	555	85	A01	556	83		No Echo
11/30/2007 12:10:43 PM	S	AOFF	554	89	AOFF	556	86		No Echo
11/30/2007 12:10:46 PM	S	A01	555	85	A01	556	87		No Echo
11/30/2007 12:10:46 PM	S	AON	554	89	AON	557	82		No Echo
11/30/2007 12:10:50 PM	S	A02	563	89	A02	559	93		No Echo
11/30/2007 12:10:51 PM	S	AOFF	566	98	AOFF	563	89		No Echo
11/30/2007 12:11:01 PM	S	A01	566	90	A01	564	89		No Echo
11/30/2007 12:11:01 PM	S	AOFF	544	84	AOFF	555	87		No Echo
11/30/2007 12:11:08 PM	S	A01	2933	90	A01	2931	95		Echo
11/30/2007 12:11:08 PM	S	ASRQ	2929	100	ASRQ	2926	92		Echo
11/30/2007 12:11:09 PM	S	A01	558	83	A01	557	89		No Echo
11/30/2007 12:11:09 PM	S	ASOF	559	84	ASOF	568	84		No Echo
11/30/2007 12:11:13 PM	S	A01	3903	90	A01	3898	91		Echo
11/30/2007 12:11:13 PM	S	AON	3899	90	AON	3892	90		Echo
11/30/2007 12:11:16 PM	S	A01	3893	86	A01	3890	88		Echo
11/30/2007 12:11:16 PM	S	ASRQ	3886	93	ASRQ	3887	95		Echo
11/30/2007 12:11:17 PM	S	A01	564	84	A01	559	83		No Echo
11/30/2007 12:11:17 PM	S	ASON	564	86	ASON	561	78		No Echo
11/30/2007 12:11:31 PM	S	A01	550	90	A01	558	83		No Echo
11/30/2007 12:11:48 PM	S	A01	880	87				Suspicious	Echo
11/30/2007 12:11:48 PM	S	A01	880	87	A01	880	89		Echo
11/30/2007 12:11:48 PM	S	ASRQ	879	100	ASRQ	876	96		Echo
11/30/2007 12:11:50 PM	S	A01	561	88	A01	568	84		No Echo
11/30/2007 12:11:50 PM	S	ASOF	553	84	ASOF	560	80		No Echo

Table 1 8: Log file.

Errors that appear in the log screen with red shading (see table 1-6) are indicated in the log file with the message "Suspicious".

1.3 Network validation

In this tab page, a quick and simple network analysis can be performed before the delivery of a Haibrain X-10 installation. By making a selection of the addresses used, the PMIX35 will perform a number of measurements and present a report which includes the areas of interest of the Haibrain X-10 installation.

1.3.1 Performing network validation

When performing network validation, the tab page "Network validation" must first be selected. Select the letter codes used in the Haibrain X-10 installation by clicking the relevant boxes, thereby selecting the letter code(s).

In the fields on the top right corner, the name and address details of the customer where the measurement is taking place can be entered. Any comments can be entered in the remarks field. Once the measurement is complete, this data can be saved and compared with the data from any subsequent measurements.

⚠ Please note:

Before validation can be started, it is important to switch on **all** of the appliances in the home that are connected to the power line. Switching on means bringing the appliance to working voltage, as opposed to leaving them in stand-by mode. Appliances such as dishwashers, washing machines, dryers, computer monitors, TVs etc. must be switched on. In this way, the measurement will be made under the most adverse conditions, so the result gives a good picture of the points that require attention to guarantee reliable data transfer.

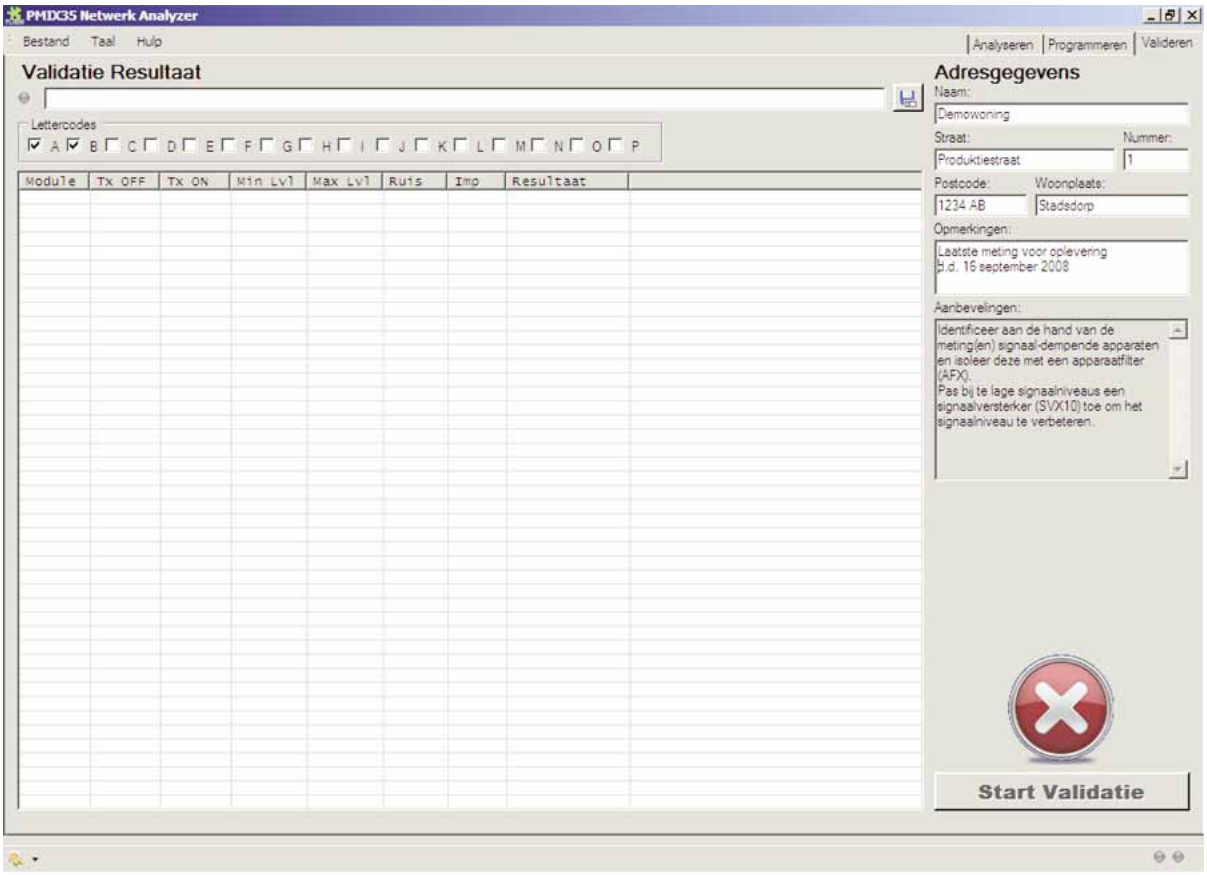


Figure 14: Network validation tab page.

Press **"Start Validation"** as soon as all appliances in the home have been switched on. The PMIX35 will now begin transmitting data to and receiving data from the modules that are present in an installation. This process can take up to 10 minutes or so depending on the number of letter codes.

⚠ Please note: Make sure that no switches are operated during this process and that any motion detectors are not activated while the measurement is being made. Do not interrupt the test; allow the PMIX35 to run through the entire process.

1.3.2 Interpreting the network validation data

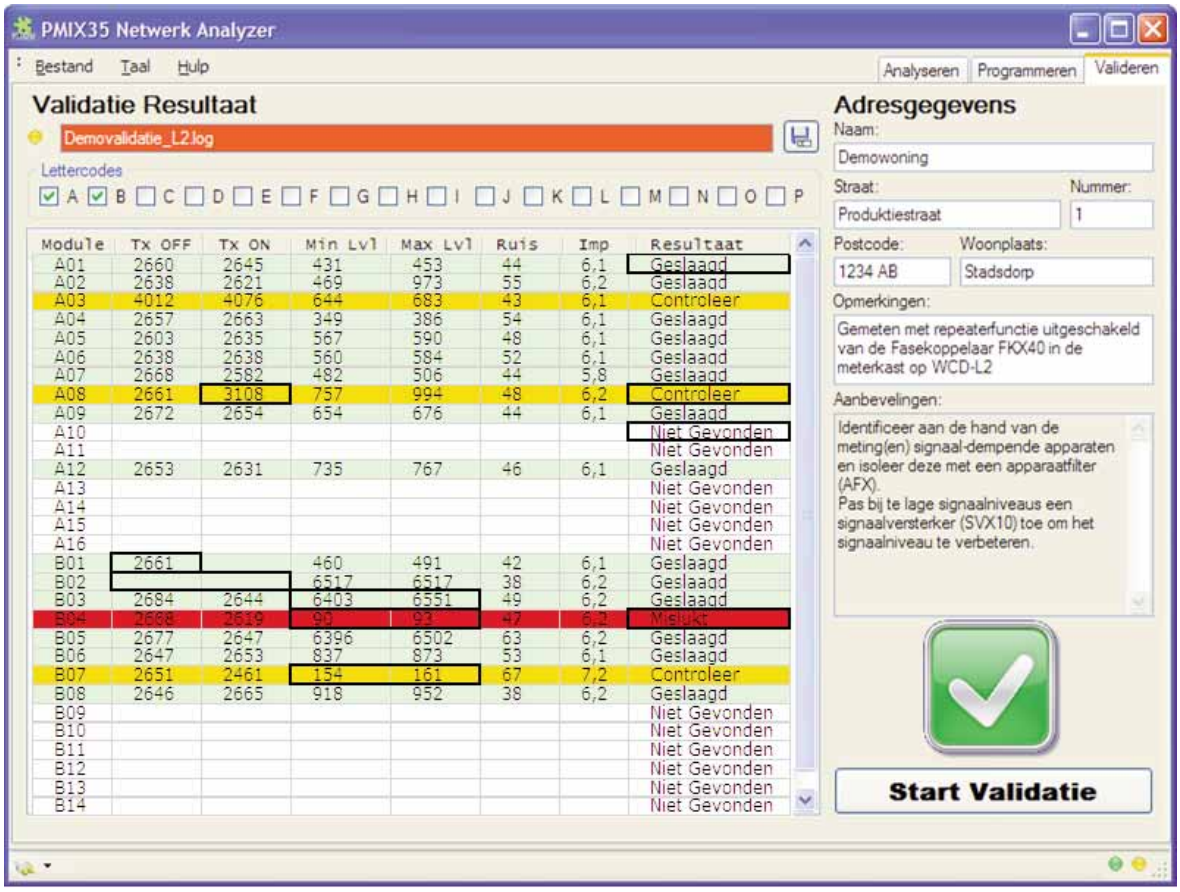
The PMIX35 software will display the transmission, reception, noise and impedance levels per address.
In the "Result" column, the software displays the result of the measuring process for the relevant address.

There are four possible results, namely:

- Not Found: the address was not found in the installation. The line is coloured white.
- Passed: the results are good. No further action is necessary. The line is coloured green.
- Check: the results give cause to re-examine the situation around the module at this address. The line is coloured orange.
- Failed: the results indicate that under the current circumstances no reliable communication is possible to and/or from this module. The line is coloured red.

The result is established by an analysis of the software on the basis of the signal level and noise level. As soon as there are low signal levels, the result is clear. However, it can also occur that the signal levels are good (above the minimal values) but that there is a very large difference between the signal levels of an ON and an OFF command in a module. The PMIX35 software will also indicate this address as "check".

It is advisable to repeat the validation test for the modules that receive a "check" or a "fail" result. Before repeating the test, switch off one or more appliances in the vicinity of the module you wish to check. If the repeat validation gives a better result, this means that the appliances in question have a damping effect on the signal quality. Isolate the appliances with one or more filters. If the signal levels do not change after switching off the appliances, this can mean that there are other factors causing the signal strengths to be inadequate. In this situation, a signal amplifier (SVX10) can offer a solution to improve the signal levels.



The measurement data can be saved by clicking the button. Another possibility is to select the data and copy and paste it into a spreadsheet program.

2 The PMIX35 as data interface

The PMIX35 supports the CTX15/35 protocol as standards and, in addition, has a number of extra functions. This means that the PMIX35 can directly replace the CTX15/35 without having to adapt the software.

2.1 PMIX35 communication driver

The PMIX35 is equipped with a USB connection based on a CP210x virtual COM port. The installation software automatically installs the CP210x USB to UART Bridge Virtual COM Port (VCP) drivers, so that the PMIX35 can communicate via the USB port of a PC.

The drivers are available for the following operating systems:

- Windows 2000/XP/Server 2003/Vista
- Macintosh
- Linux

During the installation, the software also checks whether the firmware version which belongs with the installed software is loaded in the PMIX35. If this is not the case, the software will load the correct firmware version.

2.1.1 Example using Windows 2000/XP driver

After the installation of the USB drivers on the Windows XP operating system, the name of this COM port can be found under "Device Manager" in the hardware overview in the configuration screen in XP (see figure 15).

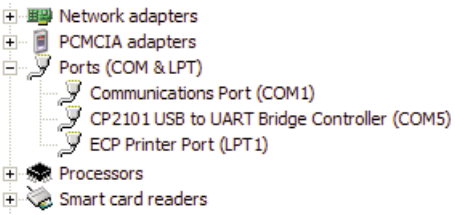


Figure 15: Windows XP Device Manager USB Driver.

The COM port number assigned to the PMIX35, COM5 in this case, follows the driver name "CP2101 USB to UART Bridge Controller". Now, communication with the PMIX35 can occur via this COM port.

2.2 Protocol description

2.2.1 COM port settings

See the figure below for the required COM port settings:

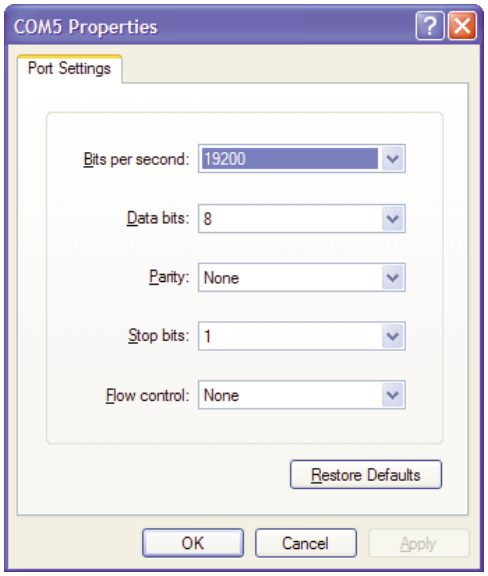


Figure 16: Port settings.

2.2.2 COM port detection

The COM port to which the PMIX35 is connected can be detected by sending the "PX" command. As the PMIX35 will answer this command, the correct COM port can be automatically selected.

2.2.3 Communication format

All communication is ASCII format. The messages between the PC application and the PMIX35 are equipped with headers. The PC application always takes the initiative and the PMIX35 answers it. See the table below for the format.

$>9000{message}cs#	Communication direction: PC -> PMIX35
$	Start character.
>	Communication direction from PC to PMIX35.
9000	PMIX35 address.
{message}	Message for PMIX35.
cs	Checksum: sum of all characters except the end character.
#	End character.

$<9000{bericht}cs#	Communication direction: PMIX35 -> PC
$	Start character.
<	Communication direction from PMIX35 to PC.
9000	PMIX35 address.
{message}	Message for PC.
cs	Checksum: sum of all characters except the end character.
#	End character.

Table 2 1: Format headers.

There are various types of messages, including messages which contain X-10 traffic. These messages contain not only the X-10 format but also the accompanying signal levels. The table below shows the X-10 format:

<L><AA>	Address
L	16 letter codes, A to P.
AA	16 addresses, 01 to 16.

<L><CC[C]>	Command
L	16 letter codes, A to P.
CC[C]	commands: ON, OFF, DIM, BGT, AUF, ALN, ALF, HRQ, HAK, PRG, SON, SOF, SRQ.

<L>[1]<AA><EEEE>	Extended
L	16 letter codes, A to P.
AA	16 addresses, 01 to 16.
EEEE	Extended code hexadecimal.

" "	Space
" "	The space character. This corresponds to a specific time between the different messages. Messages which are different from each other are always separated by a space.

Table 2 2: Format X-10.

2.2.4 Types of messages

The tables below describe the different types of messages. See the next section for an example of a checksum "cs" calculation.

Transmitter	Format	Description
PC	**PX**	PMIX35: "Are you PMIX35" message to ask COM ports whether a PMIX35 is connected to the COM port. The PMIX35 reacts to this message within 1000 ms with VP.
PMIX35	**VP{MMmm}**	Version PMIX35: This message is sent to the PC application as a response to PX. This also contains the version number of the PMIX35. Parameters: **MM** - Major Version Number in two-byte decimal ASCII notation. **mm** - Minor Number in two-byte decimal ASCII notation. Example: **$<9000VP0131cs#** Corresponds to version 1.31.

Table 2 3: Message: PX (Are you PMIX35).

Transmitter	Format	Description
PC	**TV{VVVV}**	Transmit Voltage: The transmit voltage of the PMIX35 is set with this message. Parameters: **VVVV** - Voltage in two-byte decimal ASCII notation; valid range between 0-5000 mV. Example: **$>9000TV2500cs#** Corresponds to a transmit voltage of 2500 mV.
PMIX35	**{s}**	This message gives an ACK or NACK indicator for the received message. Parameters: **s** - "!" ACK. "?" NACK transmit again (maximum three times). Example: **$<9000!cs#** Message has been received.

Table 2 4: Message: TV (Transmit Voltage).

Transmitter	Format	Description
PC	**SP{D}**	Send Position: The position of the transmitted data on the mains voltage with respect to the zero crossing is set with this message. Parameter: **D** - "1" Transmit at: 0 degrees. "2" Transmit at 30 degrees. "3" Transmit at 0 and 30 degrees. "4" Transmit at 60 degrees. "5" Transmit at 0 and 30 degrees. "6" Transmit at 0 and 60 degrees. "7" Transmit at 0, 30 and 60 degrees. Example: **$>9000SP1cs#** Transmit data at 0 degrees.
PMIX35	**{s}**	This message gives an ACK or NACK indicator for the received message. Parameters: **s** - "!" ACK. "?" NACK transmit again (maximum three times). Example: **$<9000!cs#** Message has been received.

Table 2 5: Message: SP (Send Position).

Transmitter	Format	Description
PC	**RQ**	Data Request: After the connection has been established, a Data Request is made to the PMIX35 with a period of 500 ms. The PMIX35 can answer with the following message types: **ND** - Noise detected. **NI** - Network Impedance. **LR/LE** - Line Read/Line Echo. **?** - Message not properly received. These messages can appear in the answer together or separately. Example: **$>9000RQcs#**
PMIX35	**ND{SS}**	Module Noise Detected: When changing state, this message is sent along with the other messages. Parameters: **SS** - State in one-byte decimal ASCII notation; 00 = No Noise Detected, 01 = Noise Detected. Example: **$<9000ND01cs#** Corresponds to: There is Module Noise Detected.
PMIX35	**NI{OOOO}**	Network Impedance: Every 5 seconds, this message is sent along with the other messages. Parameters: **OOOO** - Impedance in two-byte decimal ASCII Notation; valid range between 0-9999 10th of an Ohm. Example: **$<9000NI0047cs#** Corresponds to a Network Impedance of 4.7 Ohm.
PMIX35	**LR{VVVV}{NNNN}{LL…L}** **LE{VVVV}{NNNN}{LL…L}**	LR/LE - Line Read/Line Echo: Data packet read by the PMIX35 on the circuit, transferred transparently to the PC application. The voltage and noise that the message was received with are also provided. The "LE" indicates that the data packet received had been sent by the PMIX35 itself. Parameters: **VVVV** - Voltage in two-byte decimal ASCII notation; valid range between 0-6000 mV. **NNNN** - Noise Level in two-byte decimal ASCII notation; valid range between 0-6000 mV. **LL..L** - Line in variable length ASCII notation. Description: Example 1: **$<9000LR35000300A01cs#** Received: A01 with 3500 mV and 300 mV noise. Example 2: **$<9000LE35000300AOFFcs#** Received echo: AOFF with 3500 mV and 300 mV noise. Example 3: **$<9000LR35000300 A01cs#** Received: A01 preceded by a space with 3500 mV and 300 mV noise.
PMIX35	**{s}**	This message gives a NACK indicator for the received message. Parameters: **s** - "?" NACK transmit again (maximum three times). Example: **$<9000?cs#** Message not properly received.
PC	**?**	Nack: After the connection has been established, a Data Request is made to the PMIX35 with a period of 500 ms. The PMIX35 can answer with the following message types: **ND** - Noise detected. **NI** - Network Impedance. **LR/LE** - Line Read/Line Echo. These messages can appear in the answer together or separately. Example: **$>9000?cs#**
		Examples of combined messages. Only one of each type can appear in these messages. The LR/LE messages are always at the end of the line. **$<9000NI0047LR35000300A01cs#** **$<9000ND01NI0047LE35000300 AOFFcs#** **$<9000ND01LR35000300 A01cs#**

Table 2 6: Message: RQ (Data Request).

Transmitter	Format	Description
PC	**LW{LLL..L}**	Line Write: With this message, the PC application commands the PMIX35 to transfer data transparently on the circuit. Parameters: **LL..L** - Line in variable length ASCII notation. Corresponds to the data entered in the "Macro entry fields". See item 4 **Fout! Verwijzingsbron niet gevonden.** Example: **$>9000LW A01A01 AONAONcs#** Corresponds to switching on everything on A01.
PMIX35	**{s}**	This message gives an ACK or NACK indicator for the received message. Parameters: **s** - "!" ACK. "?" NACK transmit again (maximum three times). Example: **$<9000!cs#** Message has been received.

Table 2 7: Message: LW (Line Write).

2.2.4.1 Sample checksum calculation

To receive data from the PMIX35, a request must be sent to the PMIX35.
This request is described in **Table 2 6: Message: RQ (Data Request)** and looks like this:

$>9000RQcs#

To calculate the checksum "cs", the hexadecimal values of all of the previous characters must be added together hexadecimally. These values can be found in the ASCII table below:

Hex	Code	Hex	Code	Hex	Code	Hex	Code	Hex	Code	Hex	Code
20	(Space)	30	0	40	@	50	P	60	`	70	p
21	!	31	1	41	A	51	Q	61	a	71	q
22	"	32	2	42	B	52	R	62	b	72	r
23	#	33	3	43	C	53	S	63	c	73	s
24	$	34	4	44	D	54	T	64	d	74	t
25	%	35	5	45	E	55	U	65	e	75	u
26	&	36	6	46	F	56	V	66	f	76	v
27	'	37	7	47	G	57	W	67	g	77	w
28	(	38	8	48	H	58	X	68	h	78	x
29	)	39	9	49	I	59	Y	69	i	79	y
2A	*	3A	:	4A	J	5A	Z	6A	j	7A	z
2B	+	3B	;	4B	K	5B	[	6B	k	7B	{
2C	,	3C	<	4C	L	5C	\	6C	l	7C	|
2D	-	3D	=	4D	M	5D	]	6D	m	7D	}
2E	.	3E	>	4E	N	5E	^	6E	n	7E	~
2F	/	3F	?	4F	O	5F	_	6F	o		

Table 2 8: ASCII table.

With the values from the table, the calculation is made as follows:

Character:	$		>		9	0	0	0	R	Q		
Hex value:	24	+	3E	+	39	+ 30	+ 30	+ 30	+ 52	+ 51	=	1CE
cs:											=	CE

Use only the last two hexadecimal numbers for the checksum.
A Data Request looks like this:

$>9000RQCE#

Examples of answers which can be expected from the PMIX35:
$<900029#
$<9000ND001B# (No Module Noise Detected)
$<9000NI001687# (Network Impedance is: 1.6 Ohm)

The LR and LE data types are also included in the data received.

2.3 Technical data

Haibrain X-10 home automation	
Rated voltage	230 Vac, 50 Hz
Total power consumption	Max. 2.5 W
Signal transmission	Adjustable from 0 to 5 Vpp (per 25 mV) in 5 Ω at 120 kHz according to EN 50065-1, EN 50065-2-1, EN 50065-4-1
Transmission regulation:	Transmission level adjusts itself automatically to the power line impedance. The maximum adjustable level is 5 Vpp.
Transmission synchronisation	1 pulse burst at 0°/ 30°/ 60°/ 90°/ 120°/ 150° selectable
Signal sensitivity	25 mVpp-6 Vpp at 120 kHz ± 4 kHz
Signal/noise ratio	1.35 : 1
Minimum ambient temperature	0°C
Maximum ambient temperature	40°C (*)
Atmospheric pressure	86 pkA - 106 pkA
Relative humidity (non condensing)	30 to 90%
Standards	NEN-EN-IEC 60669-2-1, NEN-EN-IEC 60669-2-2
Marking	CE

Subject to technical changes without prior notice.

(*) Haibrain X-10 modules are suitable for use in homes where the ambient temperature in the living area is not higher that 35°C under normal circumstances, or may (exceptionally) reach a maximum of 40°C.

Undisturbed functioning of Haibrain X-10 automation

Electrical equipment and systems can be sensitive to signals from other equipment, which causes electro magnetic disturbance. In the European Union, countries agreed upon laws for the immunity (sensitivity) of signals of other equipment as well as equipment emission (disturbance). When equipment or applications in a certain surrounding comply with the valid standards, they will not disturb each other's operations (they are called "Electro Magnetic Compatible").
For residential surroundings, where the home automation system Haibrain X-10 is being applied, the European standard for immunity is standardised in EN 61000-6-1. Equipment that complies with this standard is resistant to electro magnetic emission of other equipment, which complies with the European standard EN 61000-6-3 for residential surroundings.
Experience has shown that in domestic surroundings, equipment is being used which has an EMC-emission level that is above the levels stated in EN 61000-6-3. This equipment can disturb the correct functioning of the Haibrain X-10 modules.
The immunity of the Haibrain X-10 built-in modules is therefore revaluated and equivalent to EN 61000-6-2 (the more severe European standard for immunity in industrial surroundings).

Nevertheless, the application area for Haibrain X-10 will remain restricted to residential areas.

Haibrain X-10 is therefore not responsible for the disfunctioning of the Haibrain X-10 system as a consequence of equipment in the building with emission levels that exceed the maximum allowed levels set as standard for residential, commercial and semi-industrial surroundings stated in EN 61000-6-3.

Application area	Valid European Standard		Haibrain X-10-home automation*
	Immunity of equipment	Emission of equipment	Immunity and emission standards
Residential Commercial Semi-industrial	61000-6-1	61000-6-3	Compatible/meets the requirements

*Condition is that the total Haibrain X-10-system is installed in accordance with valid instructions supplied by a certified and trained Haibrain X-10 dealer.

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