

UNIVERSAL POWER-LINE CARRIER SYSTEM TYPE OPU-1



WHOLE BAND QAM MODEM MBPU

Rev. 0 - July 2011

DIMAT
Antonio Machado,78-80
08840 Viladecans,
Barcelona-Spain

Tel.: +34 933 490 700
Fax: +34 933 492 258
Mail to: info@dimat.com

www.dimat.com

SAFETY SYMBOLS

**WARNING OR CAUTION:**

This symbol denotes a hazard. Do not follow the indicated procedure, operation or such like, it could mean a total or partial breakdown of the equipment or even injury to the personnel handling it.

**NOTE:**

Information or important aspects to take into account in a procedure, operation or such like.

TABLE OF CONTENTS

	Page
1 INTRODUCTION	4
1.1 GENERAL	4
1.2 CONSTITUTION OF THE MODEM	4
1.3 TECHNICAL CHARACTERISTICS	5
2 OPERATING PRINCIPLE	7
2.1 MODULATION STANDARD AND SPEED	7
2.2 DATA TRANSMISSION IN ASYNCHRONOUS MODE	7
2.3 EQUALIZATION AND RECONDITIONING (RETRAIN)	8
2.4 MODEM RESET	8
3 INSTALLATION	9
3.1 MODULE ARRANGEMENT	9
3.2 TERMINAL BLOCK	9
4 COMMISSIONING	12
4.1 FRONT-PLATE ELEMENTS	12
4.1.1 Optical indicators	12
4.1.2 Button PI1	14
4.2 INTERNAL ELEMENTS	14
4.2.1 MI1 microswitch	15
4.2.2 Switch	15
4.2.3 Jumpers	15
4.3 LEVELS	16
4.4 CONFIGURATION STORAGE	16
5 PROGRAMMING	17
5.1 AT COMMAND	17
5.1.1 Format of the AT commands	17
5.1.2 Group of AT commands	18
5.2 S REGISTERS	22

1 INTRODUCTION

1.1 GENERAL

The MBPU is a modem with a programmable modulation scheme, especially designed to work in point to point Power-Line Carrier (PLC) links for the transmission of synchronous or asynchronous data at a speed of up to 28800 bit/s in line.

The MBPU modem is capable of operating with frequency-shift keying (FSK) modulation according to Recommendations V.23 and V.21 of ITU-T, as well as with multi-level modulations (DPSK, QAM and TCM) according to Recommendations V.34, V.32bis, V.32, V.22bis and V.22 of ITU-T.

The MBPU modem is made up of a single module, which can be totally incorporated in an OPU-1 Universal Power-Line Carrier terminal, from which it receives the power supply. It has two types of interface: V.24/V.28 of the ITU-T (with one clock for emission and another for reception) and V.11 in accordance with standard ISO 4903 (a single clock).

It is possible to execute AT commands in order to modify the modem programming and request the state of specific parameters, from a compatible Personal Computer (PC) that has a communications emulator program, such as for example *HyperTerminal*. It is also possible to configure certain parameters of the MBPU by means of the internal microswitches and jumpers in the module.

1.2 CONSTITUTION OF THE MODEM

The MBPU modem is made up of a single-printed circuit board containing the circuitry of the modem, all the adaptive circuits necessary for the connection of the transmission and reception signals of the modem to the corresponding buses associated to the analog channel of the OPU-1 terminal, the connection circuits associated to the elements on the front plate, a programmable logic, the voltage stabilizers, as well as the jumpers and microswitches to be configured by the user.

There is a button on the front plate for carrying out a terminal reset as well as for entering in programming mode by means of AT commands.

Data format	<p>Synchronous: bit to bit.</p> <p>Asynchronous:</p> <p style="padding-left: 40px;">Direct mode: V.14 conversion. Character length of 8, 9, 10 or 11 bits.</p> <p style="padding-left: 40px;">With buffer</p>
Data interface	
Standard	V.24/V.28 of the ITU-T (RS-232) and V.11 according to ISO 4903
Type of connector	25-pin SUB-D (J1 of ZQBT) for V.24/V.28 and 15-pin SUB-D (J2 of ZQBT) for V.11
Speed with the DTE	<p>Asynchronous: 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400, 1200 and 300 bit/s.</p> <p>Synchronous: 28800, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400, 1200 and 300 bit/s</p>
Speed with the programming PC	Asynchronous: 38400, 28800, 19200, 14400, 9600, 7200, 4800, 2400, 1200, 600, 300 and 75 bit/s
Optical indications	<ul style="list-style-type: none"> - State of the logic signals of the interface (TD, RD, RTS, CTS, DSR, DTR and DCD). - Modem connected to the line (OH). - Type of interface (V.24 or V.11). - Hardware reset of module (AUX lights up in red) or module in programming mode by means of AT commands (AUX blinks in green)
Connections	ZQBT terminal block
Dimensions	Height: 262 mm; Width: 30 mm; Depth: 256 mm (with handles)
Weight	350 g

2 OPERATING PRINCIPLE

2.1 MODULATION STANDARD AND SPEED

The MBPU modem has 7 modulation standards: V.34, V.32bis, V.32, V.22bis, V.22, V.23 and V.21, at different line speeds.

It can be programmed by means of commands AT, in order to operate at a predetermined speed and modulation standard.

Table 1 shows the possible standards, their transmission speeds associated, and the AT Hayes commands that configure the modem in order for it to operate according to the said standards and speeds.

The automatic modulation scheme detection mode, that is programmed by means of command ATF0 or ATN1, must always operate with modulations that comply with the ITU-T standards (except V.22 at 600 bit/s QAM).

2.2 DATA TRANSMISSION IN ASYNCHRONOUS MODE

There are two asynchronous operating modes: direct or with intermediate storage (buffering). The modem has a memory storage area (buffer), both in transmission and reception, so that it can transmit at its own speed without having to depend on that of the data terminal equipment.

It is possible to disable the intermediate storage mode (buffering), functioning therefore in direct mode, by means of command ATN1 or AT&Q0. In direct mode, the speed selected in the communications program must be the same as that of the line speed.

The character format used by the series interface is selected according to the result of the automatic speed negotiation or autobauding or, in the opposite case, to the S23 register.

The asynchronous formats permitted are those that include 1 start bit, 7 or 8 data bits, even parity, odd parity or none, and 1 or 2 stop bits.

2.3 EQUALIZATION AND RECONDITIONING (RETRAIN)

The modem has an automatic adaptive equalizer that operates according to standards V.22bis and higher (V.32, V.32bis and V.34). This equalizer continually supervises line conditions, adapting it to them in order to guarantee optimum reception. If the equalizer detects a marked decrease in the line quality, the modem is capable of generating a retrain request according to the standard that is active. It will also answer a request from the remote modem if necessary. The terminal will attempt a retraining up to three times before disconnecting from the line.

2.4 MODEM RESET

Two types of reset, hardware and software, can take place in the MBPU modem.

The hardware reset occurs in the modem when the PI1 button on the front plate is pressed for more than 2 seconds (long pressing) or when the activation of the *Unavailable link*⁽²⁾ signal is received, by means of the programming and control bus of the OPU-1 terminal. The LED AUX on the front plate lights up in red to indicate this type of reset.

The software reset is produced internally in the modem when a training sequence should begin or when the period of time determined by the S35 register has elapsed.

⁽²⁾ The conditions that activate the *Unavailable link* signal are specified in the OPU-1 terminal by means of programming. *Pilot loss, Low S/N ratio, Loss of synchronism and Boosting* must at least be programmed.

3 INSTALLATION

This chapter describes the installation of the MBPU modem in the 6 s.u. shelf of the Universal Power-Line carrier terminal type OPU-1, together with the cabinet-mounted terminal block associated to the modem module.

3.1 MODULE ARRANGEMENT

The MBPU module can be installed in the last five positions of the 6 s.u. shelf, provided the said positions are not already occupied by other options. It must be kept in mind that the first shelf position corresponds, seen from the front, to module POWER SUPPLY (FAPU).

The module must only be inserted when the power supply of the OPU-1 is not connected.

The MBPU module has two fixing screws, one at the top and one at the bottom of the front plate.

To extract the module, turn the two fixing screws anti-clockwise as far as allowed. Then by means of the handles pull the module out of the shelf.

Inserting the module in the shelf is achieved by carrying out the extraction process in reverse. Once the module has been inserted, the fixing screws must then be turned clockwise.

3.2 TERMINAL BLOCK

The terminal block associated to the MBPU module is called ZQBT.

The block is fastened to the OPU-1 cabinet-mounted terminal block by means of screws. The connection between the block and the equipment is carried out by means of a cable.

The ZQBT terminal block is made up of:

- Four terminals that will allow a filter or an external equalizer to be inserted, provided jumpers J10 and J11 are in position B.

- A 25-pin female SUB-D type connector for connection to a RS-232C interface, provided microswitch MI1-4 is configured in ON.
- A 15-pin female SUB-D type connector for connection to a V.11 interface according to Recommendation ISO 4903, provided microswitch MI1-4 is configured in OFF.

Table 2, Table 3 and Table 4 show the use of the BB1 block and the J1 and J2 connectors. Figure 1 shows the front view of the block. The terminals have disconnect devices and are suitable for 2.5 mm² flexible conductors and 4 mm² rigid conductors.

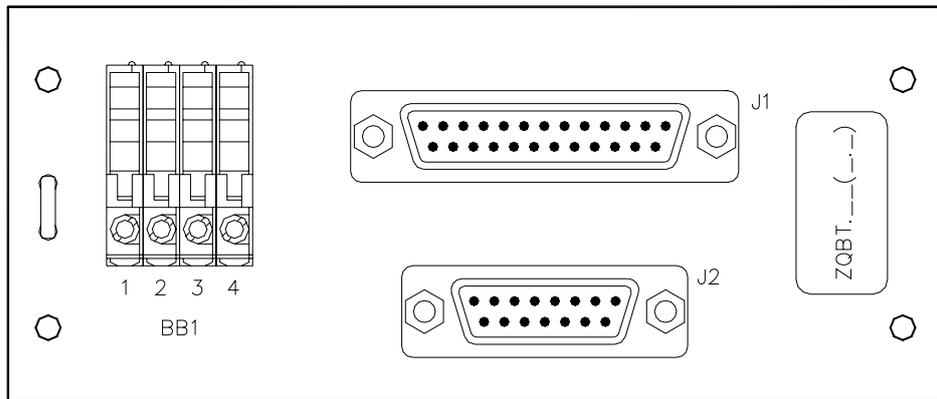


Figure 1 Terminal block of the MBPU module

ZQBT-BB1 block	Use
1 2	AF XMT signal
3 4	AF RCV signal

Table 2 Signals of ZQBT-BB1

SUB-D 25 pin	Circuit no.	DTE/DCE*	V.24/V.28 signal
1	101	-	Protective ground
2	103A	⇒	TXD
3	104A	⇐	RXD
4	105A	⇒	RTS
5	106A	⇐	CTS
6	107A	⇐	DSR
7	102	-	GND
8	109A	⇐	DCD
15	114A	⇐	TXCLK
17	115A	⇐	RXCLK
20	108A	⇒	DTR
24	113A	⇒	EXT CLOCK

* The DTE/DCE column shows the direction of each of the signals involved, the MBPU modem corresponding to the Data Circuit Equipment (DCE).

Table 3 Signals V.24/V.28 of connector J1 of terminal block ZQBT

SUB-D 15 pin	Signal	DTE - DCE*	ISO 4903 designation
1	Protective ground	-	-
2	Transmission (A)	⇒	T (A)
3	Control (A)	-	C (A)
4	Reception (A)	⇐	R (A)
5	Indication (A)	-	I (A)
6	Signal timing (A)	⇐	S (A)
7	External clock (A)	⇒	X (A)
8	Signal ground	-	G
9	Transmission (B)	⇒	T (B)
10	Control (B)	-	C (B)
11	Reception (B)	⇐	R (B)
12	Indication (B)	-	I (B)
13	Signal timing (B)	⇐	S (B)
14	External clock (B)	⇒	X (B)
15	Not used	-	-

* The DTE/DCE column shows the direction of each of the signals involved, the MBPU modem corresponding to the Data Circuit Equipment (DCE).

Table 4 Signals V.11 of connector J2 of terminal block ZQBT

4 COMMISSIONING

This chapter deals with the functions of the elements accessible from the front plate as well as the internal microswitches, switch and jumpers.

4.1 FRONT-PLATE ELEMENTS

The front view of the module is shown in Figure 2. All the accessible elements are described below, in a downward order and from left to right.

4.1.1 Optical indicators

TD/103 LED	Green. Indicates data input and lights up when a logical level "0" is applied.
RD/104 LED	Green. Indicates data output. This LED lights up when a logical level "0" is received.
RTS/105 LED	Green. Indicates request to transmit and lights up when the signal is in active state.
CTS/106 LED	Green. Indicates the modem is ready to transmit and lights up when the signal is in active state.
DSR/107 LED	Green. Indicates the modem is working correctly.
DTR/108 LED	Green. Lights up when the state of the signal is active in the data terminal.
DCD/109 LED	Green. Indicates the detection of line signals and lights up when the level of the carrier is above a pre-set level. It goes out in the opposite case.
OH LED	Green. When lit indicates line has been taken by the modem.
V.11 LED	Amber. This LED lights up when the modem has been configured with interface V.11.
V.24 LED	Amber. This LED lights up when the modem has been configured with interface V.24.

AUX LED

The LED lights up in red when a hardware reset is taking place in the modem (see section 2.4, *MODEM RESET*) and blinks in green when the module is in programming mode by means of AT commands.



Figure 2 Front view of the MBPU module

4.1.2 Button PI1

When the button is pressed for more than 2 seconds (long pressing), a hardware reset is carried out in the modem. The LED AUX remains lit in red during the reset.

When the button is pressed for less than 2 seconds (short pressing), the module enters in programming mode by means of AT commands. The LED AUX continues to blink in green whilst the module is in this programming mode. It is necessary to carry out a hardware reset in order to leave the programming mode by means of AT commands.

4.2 INTERNAL ELEMENTS

This section describes the function of the internal measurement and configuration elements of the MBPU module, see Figure 3.

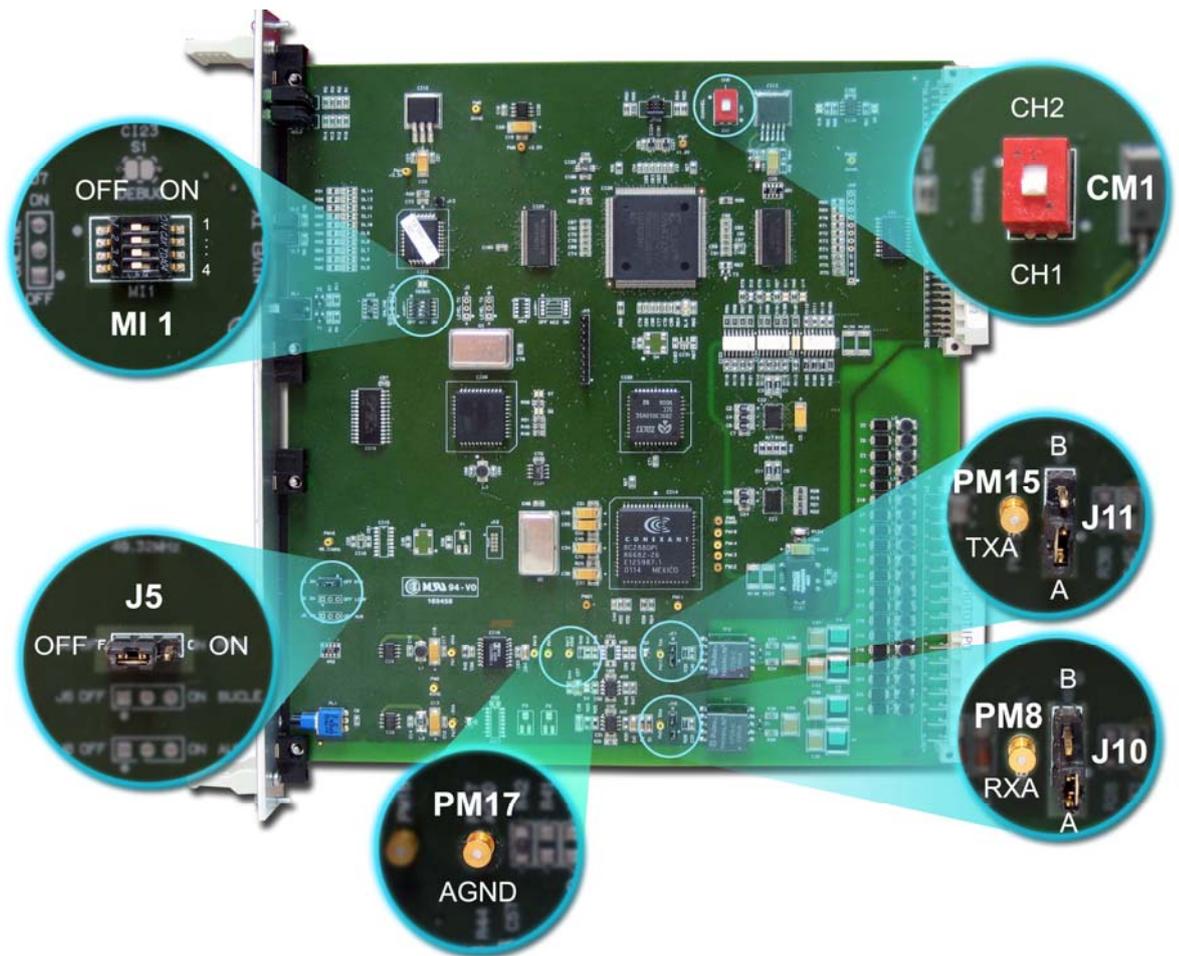


Figure 3 Position of the configuration and measurement elements of the MBPU module

4.2.1 MI1 microswitch

Microswitch 1: Selection of Master/Slave.
 ON Slave (Responder).
 OFF Master (Originator).

Microswitches 2 and 3: Selection of synchronism mode.

Microswitch		Description
2	3	
ON	ON	Asynchronous
ON	OFF	Synchronous internal clock
OFF	ON	Synchronous external clock
OFF	OFF	Synchronous slave clock

Table 5 Selection of synchronism mode

Microswitch 4: Selection of data interface.
 OFF V.11 interface.
 ON V.24 interface.

4.2.2 Switch

CM1 Selection of the Power-line Carrier terminal analog channel.
 CH1: Channel 1.
 CH2: Channel 2.

4.2.3 Jumpers

J10 and J11 Routing of AF signals.
 A: Direct channel (OPU-1 buses associated to analog channel).
 B: ZQBT terminal block
 (4-wire input and output terminals).

J5 Activation of the RTS signal.
 OFF: According to interface.
 ON: Permanent.

4.3 LEVELS

The transmit and receive levels must be programmed when the AF signals are routed by means of the ZQBT terminal block (jumpers J10 and J11 in position B).

The programming of the input and output levels associated to the corresponding option, for example Digital Transit Filter, is carried out from the OPU-1 Management System, by means of the *Input levels* and *Output levels* options of the basic equipment, by establishing a level of -7 dBm.

4.4 CONFIGURATION STORAGE

The modem configuration includes the operation options selected for a particular application. This configuration can be modified locally by means of the AT commands or by the internal microswitches and jumpers in the module.

The modem has a configuration storage area, known as the user profile, that is situated in the E2ROM non-volatile memory. The moment it is started up, or after a software reset (command ATZ), the modem loads the contents of the user profile, using it from then on as active configuration. In order to modify the user profile it is only necessary to:

- Change the necessary operative parameters of the modem by means of the corresponding commands, and
- store the resulting active configuration in the user profile available, by means of the command AT&W.

The modem also has a fixed configuration, known as factory profile, that is stored in the read-only memory. The user can retrieve this profile (by means of AT&F) and convert it into the active configuration of the modem, and store it as the user profile by defect (by means of AT&W).

A factory profile is re-established as an active configuration by means of AT&F command.

The active configuration can be displayed by means of the AT\S command, whilst the AT&V command shows the factory and user profile.

5 PROGRAMMING

The modem configuration includes the operation options selected for a particular application. When working with the V.24 interface, connector J1 of the ZQBT block, this configuration can be modified by means of the AT commands, from a compatible Personal Computer (PC) that has a communications emulator program, such as for example *HyperTerminal*.

When working with the AT commands, the modem interface allows the speed, parity and character length used by the programming PC, according to on the AT header of each command user, to be automatically adapted. The automatic length and parity adaptive procedure is capable of detecting characters of 7 and 8 bits and even parity, odd parity, or none and speeds of between 75 and 38400 bit/s. If this procedure is not carried out the modem remains configured at the speed and parity specified in the S23 register, or at those in which the profile recording command AT&W has been introduced.

5.1 AT COMMAND

5.1.1 Format of the AT commands

When working with the AT commands, with the exception of command A/, each command transmitted by the PC must start with the AT sequence of characters and must end with a return. The commands can be transmitted in either capital letters or small letters. A command can be aborted at any time by introducing <CTRL X>.

The AT sequence can be followed by a list of commands in sequence, separated or not by a space, except for the Z commands, as the commands that follow these last ones will be ignored. The maximum number of characters in any line of commands is 75, including A and T. If a syntax error is detected in any command, the rest of the line is ignored and an ERROR message is sent to the PC. The blank spaces in a command will be ignored.

Before sending another command wait for the result of the previous one.

5.1.2 Group of AT commands

The modem accepts the group of AT commands detailed below. The possible values of their parameters as well as their significance are indicated for each of the commands. If you do not enter any value, it will be equivalent to 0.

Parameters:

[X] digit

A/ Repetition of the last command

The modem will act as if it has received the last line of commands from the PC again. This command should not be preceded by the AT sequence, and is carried out without the transmission of the return.

C[X] Carrier control

C0 Continuous carrier. (by default)

C1 Controlled carrier.

&C[X] RLSD circuit control (CD or 109)

The 109 circuit of the V.24 interface, connector J1, and the corresponding LED on the front plate will act according to the parameter of this command.

&C0 109 circuit (CD) always ON.

&C1 109 circuit (CD) adapts to the line carrier. (by default)

&D[X] DTR option

This command indicates the modem how it has to treat a fall in the DTR signal (circuit 108) according to the parameter:

&D0 The DTR signal is ignored. (by default)

&D1 The modem will respond to an ON/OFF transition of the DTR signal as if it had received an escape sequence in asynchronous format, and will disconnect from the line in synchronous format.

&D2 The modem will respond to an ON/OFF transition of the DTR signal by disconnecting from the line.

&D3 The modem will respond to an ON/OFF transition of the DTR signal as if it had carried out a software reset in asynchronous format, and disconnecting from the line in synchronous format.

%D[X] Autobauding option

- %D0 Disables autobauding.
- %D1 Enables autobauding. (by default)

E[X] Echo command

The modem will enable or disable the echo of the characters transmitted by the DTE according to the parameter provided.

- E0 No echo.
- E1 Echo enabled. (by default)

F[X] Modulation selection

This command selects the modulation scheme in line according to the parameter provided. The modulation is fixed, except when automatic mode is selected.

- F0 Selects the automatic mode.
- F1 V.21 at 300 bit/s FSK.
- F2 Ignored.
- F3 V.23 75TX/1200RX in call mode or 1200TX/75RX in answering mode.
- F4 V.22 at 1200 bit/s QAM.
- F5 V.22bis at 2400 bit/s QAM.
- F6 V.32 at 4800 bit/s.
- F7 V.32bis at 7200 bit/s.
- F8 V.32 at 9600 bit/s.
- F9 V.32bis at 12000 bit/s.
- F10 V.32bis at 14400 bit/s.
- F11 V.34 at 16800 bit/s.
- F12 V.34 at 19200 bit/s.
- F13 V.34 at 21600 bit/s.
- F14 V.34 at 24000 bit/s.
- F15 V.34 at 26400 bit/s (only for use in asynchronous mode).
- F16 V.34 at 28800 bit/s. (by default).

&F Re-establish factory configuration

Re-establish all the configurations by default.

&G[X] Guard tone selection (only DPSK modulations)

- &G0 Disable guard tone.
- &G1 Select guard tone of 1800 Hz. (by default)

\G[X] Modem-modem flow control (XON/XOFF)

- \G0 Disable modem-modem flow control. (by default)
- \G1 Enable modem-modem flow control.

%G[X] Fallback/Fallforward

- %G0 Disabled. (by default)
- %G1 Enabled.

&K[X] Selection of the DTE-modem flow control

- &K0 Disable flow control.
- &K3 Enable RTS/CTS flow control. (by default)
- &K4 Enable XON/XOFF flow control.
- &K5 Enable XON/XOFF transparent flow control.
- &K6 Enable RTS/CTS and XON/XOFF together.

%L Received signal level

Sends back the value of the input signal (in negative dBm).

N[X] Enable automatic modulation detection

- N0 Disabled. (by default)
- N1 Enabled (equivalent to ATF0).

\N[X] Asynchronous transmission mode

- \N0 Bufferized mode (equal to AT&Q5). (by default)
- \N1 Direct mode (equal to AT&Q0).

%O[X] Overspeed option

The overspeed allows a higher speed tolerance in the V.24 interface in asynchronous mode.

- %O0 Disables overspeed ($\pm 1\%$).
- %O1 Enables overspeed ($\pm 2.5\%$). (by default)

&Q Transmission mode

- &Q0 Direct asynchronous mode.
- &Q1 Selects synchronous on-line operating mode and asynchronous in commands. (by default)
- &Q2 Selects synchronous on-line operating mode and asynchronous in commands.

- &Q3 Selects synchronous operating mode.
- &Q4 Same as AT&Q1.
- &Q5 Asynchronous buffered operating mode.
- &Q6 Same as AT&Q5.

If the autobauding is activated, %D1 (by default), configure the emulator communication program, such as for example *Hyper Terminal*, with the same speed as or higher than that of operation, for asynchronous mode.

S Reading or writing in the S registers

Using this command, the PC can read or write in the S registers. The possible commands are:

- ATS*n*=*v* The *n* register takes the *v* value.
- ATS*n*? The value (in decimal) of the *n* register is returned.

&S[X] DSR circuit control (107)

The 107 circuit of the V.24 interface, connector J1, and the corresponding LED on the front plate will act according to the parameter of this command.

- &S0 107 circuit (DSR) always ON.
- &S1 107 circuit (DSR) passes to ON after detecting answer tone and passes to OFF when the carrier is lost. (by default)

Update the S21 register, bit 6.

\S Display active configuration

This command displays the active configuration with the following format.

```
CURRENT PROFILE:
DTE 19200 8N1
B0 C0 E1 F16 L0 M1 N0 P Q0 V1 W1 X4 Y0 &C1
&D0 &G0 &K3 &L0 &M1 &Q1 &R1 &S1 &X0 %E1 \G0 \N0 \P0 \R0
S00=002 S06=004 S07=050 S08=002 S09=006 S10=040
S12=050 S23=019 S30=003
```

&V Display of configuration profiles

The modem will answer by showing the user and factory profiles that are not selected as active configuration. An example is shown below:

```
FACTORY PROFILE:
B0 C0 E1 F16 L1 M1 N0 P Q0 V1 W0 X4 Y0 &C1
&D0 &G0 &K3 &L0 &M0 &Q0 &R1 &S1 &X0 %E1 \G0 \N1 \P0 \R0
```

S00=002 S06=004 S07=050 S08=002 S09=006 S10=040
 S12=050 S23=175 S30=003

USER PROFILE:

B0 C0 E1 F16 L0 M1 N0 P Q0 V1 W1 X4 Y0 &C1

&D0 &G0 &K3 &L0 &M1 &Q1 &R1 &S1 &X0 %E1 \G0 \N0 \P0 \R0

S00=002 S06=004 S07=050 S08=002 S09=006 S10=040
 S12=050 S23=019 S30=003

&W Save active configuration in user profile

The modem will save the active configuration in the user profile.

&X[X] Synchronous transmission clock

Selects the transmission clock for synchronous connections.

&X0 Internal clock. (by default)

&X1 External clock.

&X2 Slave clock.

Z Reset

It is a software reset.

5.2 S REGISTERS

The modem uses the S registers to control operation. Their contents are determined by the configuration profile selected, although they can be modified by means of the AT commands in two ways:

- By means of the commands that control different configuration parameters and that modify the corresponding bits of the adequate S registers.

The S registers are listed and briefly described below. The mentioned AT command is the one that affects the S register in question. The values by default indicated are those of the three factory profiles. If these values are all the same, only one value is shown.

S3 Return character

Range: 0 - 127

Units: ASCII decimal

By default: 13

- S4 Line jump character**
 Range: 0 - 127
 Units: ASCII decimal
 By default: 10
- S5 Delete character**
 Range: 0 - 32
 Units: ASCII decimal
 By default: 8
- S7 Maximum waiting time for carrier detection**
 Range: 1 - 255
 Units: s
 By default: 50
- S9 Answering time for carrier detection**
 Range: 1-255
 Units: 1/10 s
 By default: 6
- S10 Disconnection time after carrier loss**
 Range: 1 - 255
 Units: 1/10 s
 By default: 40
- S14 General options**
 Bit 0 Carrier control (ATC).
 0 Continuous carrier.
 1 Controlled carrier.
 Bit 1 Enable echo command (ATE).
 0 Disabled.
 1 Enabled.
 Bits 2...7 Reserved.
- S15 Received signal level (in -dBm) (AT%L) (Read only)**
- S21 General options**
 Bit 1, 0 Reserved.

Bit 2	CTS control (AT&R).
	0 CTS controlled by DTE.
	1 CTS always ON.
Bit 4,3	DTR behaviour (AT&D).
	00 AT&D0.
	01 AT&D1.
	10 AT&D2.
	11 AT&D3.
Bit 5	CD behaviour (AT&C).
	0 CD follows the on-line carrier.
	1 CD always ON.
Bit 6	DSR behaviour (AT&S).
	0 DSR by DCE.
	1 DSR always ON.
Bit 7	Reserved.

S22 General options

Bits 0...6	Reserved.
Bit 7	Guard tone (AT&G).
	0 Disabled.
	1 Enabled.

S23 General options

Bit 0	Reserved.
Bit 1...4	Speed of programming PC.
	0 75 bit/s
	1 300 bit/s
	2 600 bit/s
	3 1200 bit/s
	4 2400 bit/s
	5 4800 bit/s
	6 7200 bit/s
	7 9600 bit/s.
	8 14400 bit/s
	9 19200 bit/s
	10 28800 bit/s
	11 38400 bit/s

Bit 7, 6, 5 Asynchronous format.
 0 8N1.
 1 7E1
 2 7O1
 3 8O1
 4 7N1
 5 8E1.

S25 Delay between the fall of the DTR signal and disconnection (only bufferized mode). (See AT&D)

Range: 1 - 255
 Units: s (synchronous), 1/100 s (asynchronous)
 By default: 5

S26 Delay between the RTS and CTS signals. (See AT&R)

Range: 1 - 255
 Units: ms
 By default: 10

S27 General options

Bit 3, 1, 0 Transmission mode (AT&Qn).
 000 Direct asynchronous mode. (defect in 0 profile)
 001 Selects the on-line synchronous operation mode and asynchronous in commands.
 011 Synchronous mode.
 100 Selects the on-line synchronous operation mode and asynchronous in commands.
 101 Bufferized asynchronous mode.
 110 Bufferized asynchronous mode.
 111 Reserved.

Bit 2 Reserved.

Bit 5, 4 Synchronous transmission clock (AT&X).
 00 Internal.
 01 External.
 10 Slave.

Bit 6 Reserved.

S31 General options

Bit 0 Reserved.
Bit 1 Automatic detection of the on-line speed (ATN).
 0 As ATN0.
 1 As ATN1.
Bit 2...7 Reserved.

S32 XON character

Range: 0 - 255
Units: ASCII decimal
By default: 17

S33 XOFF character

Range: 0 - 255
Units: ASCII decimal
By default: 19

S35 Periodic reset

Range: 0 – 24
Units: hours
By default: 0 (disabled)

S37 On-line speed selection

0 Automatic mode (ATF0).
1 V.21 (ATF1)
3 V.23 (ATF3)
4 V.22 (ATF4)
5 V.22bis (ATF5)
6 V.32 (ATF6)
7 V.32bis (ATF7)
8 V.32 (ATF8)
9 V.32bis (ATF9)
10 V.32bis (ATF10)
11 V.34 (ATF11)
12 V.34 (ATF12)
13 V.34 (ATF13)
14 V.34 (ATF14)
15 V.34 (ATF15)
16 V.34 (ATF16)

S39 General options

- Bit 2...0 Flow control options.
 - 000 Disable flow control (AT&K0).
 - 011 Flow control RTS/CTS (AT&K3).
 - 100 Flow control XON/XOFF (AT&K4).
 - 101 Transparent mode XON/XOFF (AT&K5).
 - 110 Flow control RTS/CTS and XON/XOFF (AT&K6).
- Bit 3...7 Reserved.

S41 General options

- Bits 0...2 Reserved.
- Bit 3 Modem/modem flow control.
 - 0 Disabled (AT\G0).
 - 1 Enabled (AT\G1)
- Bit 4 Overspeed.
 - 0 Disabled (AT%O).
 - 1 Enabled (AT%O)
- Bit 5 Fallback/fallforward (AT%G).
 - 0 Disabled.
 - 1 Enabled.
- Bit 6, 7 Reserved.

S91 Point-to-point transmission level

- Range: 0 - 15
- Units: -dBm
- By default: 7

In some cases, for example when the speed is modified, the changes made are not immediate. Therefore it is advisable to save them in the user profile (AT&W) and carry out a software or hardware reset to make them effective.

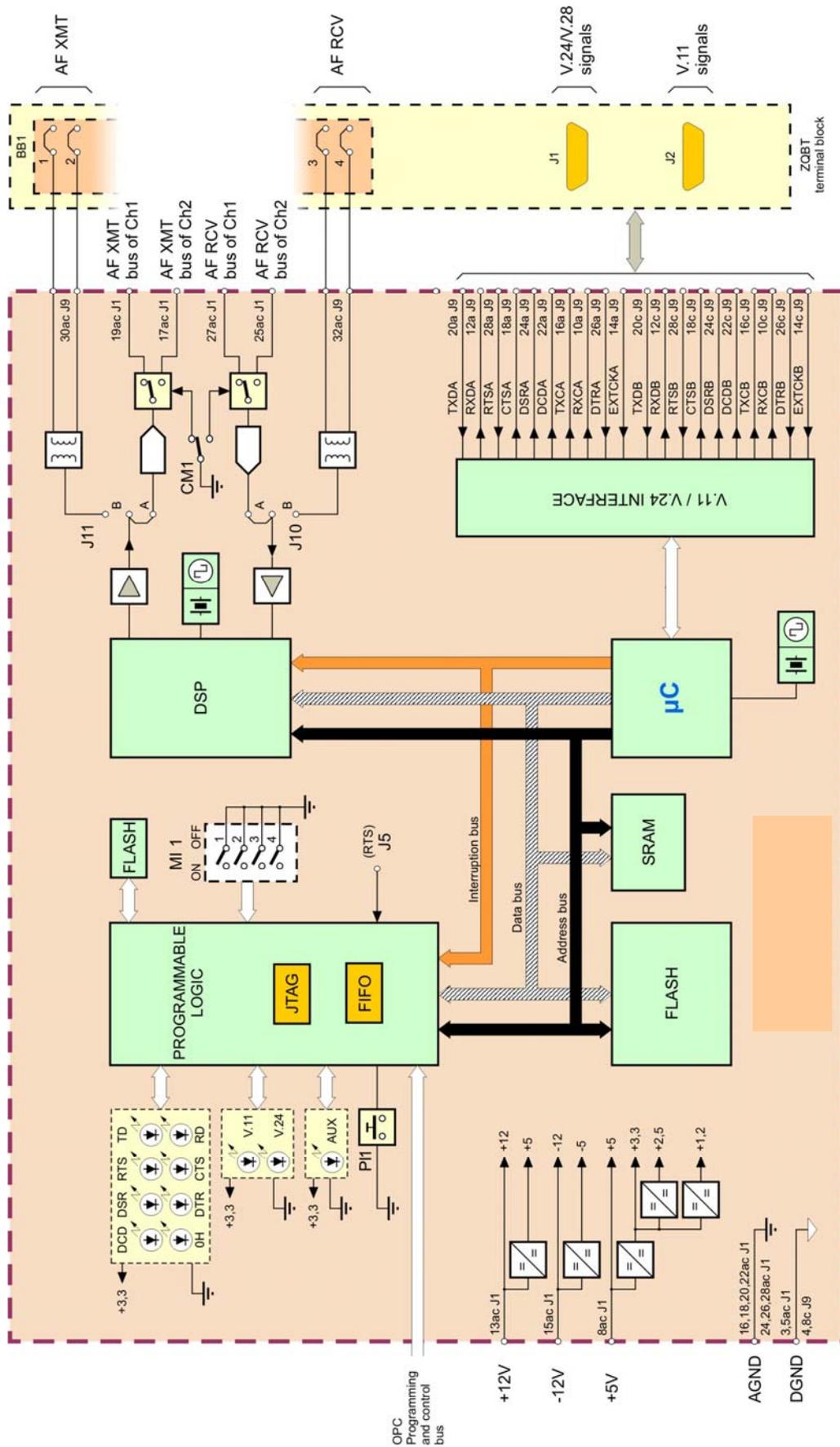


Figure 4 Simplified block diagram of the MBPU module