

BLACK BOX Catalogue Ltd
The Source for Connectivity



MDU903
MDU904
RMU903
MDU903C

Data-Link Modem



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Foreword

This document describes how to set up the *BLACK BOX MDU903/4 modem*.

- **Chapter 1** is to familiarize the user with the operation of a modem.
- **Chapter 2** describes the installation.
- **Chapter 3** describes the most common uses of a modem.
- **Chapter 4** explains the operation of the modem security features and memories.
- **Chapter 5** provides technical characteristics.
- **Chapter 6** indicates how to solve operation problems.

Note to the reader

Users who are not familiar with the **MDU903/4** modem operation, should read the first three chapters. Advanced users can refer directly to **chapter 4** to use the advanced functions of the modem. Whenever a problem arises, refer to **chapter 6**.

Product range

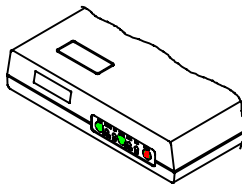
The **MDU903/4** modem has various options:

- Dial-up
- Leased line
- Group III fax
- Stand alone or rack
- LCD front panel

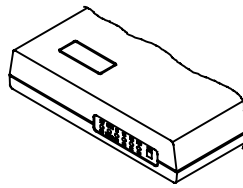
These different versions are summed up in the following table. The names in the first column will be used throughout the manual to indicate when these options apply.



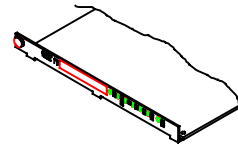
Data-Link Modem



LCD version



Stand alone version



Rackmount version

Options :	Versions :	Data-Link	Industrial Data-Link	Rack mount
LCD		●	●	
Leased Line		●	●	●
230VAc		MDU903	MDU904	MDU903C
48Vdc		Optional	Optional	Optional
(*) 5Vdc		Optional	Optional	Optional
RACK		-	-	RMU903

(*) Power supply 5V adaptor 230VAc

MDU903/4 features

The **MDU903/4** is a modem for the professional user. It encompasses a number of features that place it above the rest. It includes features such as:

- Configuration through front panel LCD and key pad: for synchronous application, the MDU903/904 can be fully set up from its user friendly front panel.
- Busy-Out: Whenever modems are pooled, a faulty modem will lock-up the rest. The busy-out, standard in the BLACK BOX modems lets the PBX pass onto the next modem without upsetting the system.
- Line Quality Testing: The modem can test a line at every call. If it finds it below standard, it will hang-up and retry up to 5 times transparently to the user. This guarantees that you have the most reliable connection every time on any type of infrastructure.
- BERT: The modem can perform simple Bit Error Rate Tests between two BLACK BOX modems to qualify the digital transmission of data.
- ITU V.13: Half duplex operation.
- 10 User Configurations
- UnAttended Automatic Dial Backup: If ever your Leased Line fails, the **MDU903/4** will back-up onto the dial-up network. Not only that, it will continue to monitor the Leased Line until it is operational and switch back automatically. This is called Intelligent LookBack.
- Password Security: To change configuration of the modem, 2 levels of password security are provided - User & Supervisor.
- Connection Security: 4 levels of security are provided:
 - + Answerback, i.e. where the far modem asks the calling modem for a password, transparently to the user.
 - + Pass Through Access, i.e. where the far modem asks the user for a password.
 - + Automatic Modem Password Access, i.e. same as before but for synchronous operation.
 - + Call back, i.e. the far modem asks for a password from the calling modem and hangs up. The far modem associates a telephone number with the password and calls back the original calling modem.
- 5 different Statuses:
 - + Modem Configuration.
 - + Line, e.g. Xmit/Rcve levels, signal quality etc.
 - + Line Error Statistics, e.g. for MNP or V42, the number of bad characters, bytes frames etc.
 - + Leased Line Statistics, e.g. connection & idle time etc.
 - + Dial-Up Statistics, e.g. same as leased line with directory information etc.

This is but a short list. For full details, consult the Command Set Manual.



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1. Introduction

This chapter is to familiarize the user with the operation of a modem. Note: <CR> indicates that the user must press the return key after a command sequence.

1.1 The modem

A modem is a device that allows two terminals (DTE, PC...) to communicate via a telecommunication line (phone line).

The data is converted by the modem into electrical signals adapted to the telecommunication network. This conversion is called modulation and demodulation.

Various conversion techniques have been developed to speed-up the data flow. The different speeds are particular to each type of modulation: 300 bps in V21, 2400 bps in V22bis, 14400 bps in V32bis, 19200 bps in V32terbo and 33600 bps in V34.

1.2 The modem-fax

A fax device transmits scanned images via the telephone network.

In addition to traditional fax machines, the fax modem also allows transfer of computer data such as:

- ASCII files from a text processor,
- PCX or TIF files from a graphic editor, etc.

The Fax mode operation is controlled by a fax software which:

- Converts files to T4 format (fax graphic format),
- Transmits and receives faxes,
- Supervises fax modem operation.

Supervision of the fax modem is carried out by a standard protocol: "Asynchronous Facsimile DCE Control Standard", Class 1 Service - TR 29.2188 or Class 2 Service - TR 29.2388.

The computer equipped with a fax modem will be able to transmit and receive fax in Group III mode:

- At about one A4 page per minute,
- In fine or standard resolution.

See chapter 5 for the list of modem class 1 and 2 commands.

1.3 Calling modes dialing

The modem can be in 2 modes:

- + Send or calling,
- + Receive or answer.

1.3.1 Calling Mode

The modem switches to originate mode when the dial command: **ATD 37487126** is sent (example number).

The calling modem then waits for the remote modem to respond.

1.3.2 Answering Mode

The modem switches to answer mode when it detects ringing on the phone line.

The answer is carried out automatically if the command **ATS0 = 2** was sent to the modem by the local PC. A training sequence is then initiated. A training sequence is the hand-shake sequence between modems to establish a communication link. It establishes speed, modes...

1.4 Leased line

A leased line is a permanent communication link dedicated between two modems. This kind of link is used for:

- High usage,
- Secure communications,
- Privately managed networks.

The leased line, can be a:

- 4-Wire type where there is:
 - + 1 transmit pair,
 - + 1 receive pair.
- 2-Wire type where:



- + the same pair of wires is used for transmit & receive.

For a leased line, a modem is designated:

- Originating modem (ORIGINATE or MASTER),
- The other as the answering modem (ANSWER or SLAVE).

Modems in leased line mode always try to connect when power is on, in order to provide permanent a link.

The **MDU903/4** modem can establish leased line connections in the following speeds:

+ V22	1200 bps
+ V22bis	2400 bps
+ V32	9600 bps/4800 bps
+ V32bis	14400 bps/12000 bps
+ V32terbo	19200 bps/16800 bps
+ V34	33600 bps down to 2400 per steps of 2400 bps

In case of failure on the leased line, the **MDU903/4** modem performs automatic switch-over to the dial-up PSTN. It then monitors the leased line until it finds a connection has been re-established.

1.5 Protocols

Two types of protocols can be used to improve communication performance between two modems:

- Error correction:
 - + MNP4 or V42 detect errors which occurred during data transmission, and either correct them or re-transmit the data.
- Data compression:
 - + MNP5 or V42bis compress the data and thus transmit at a higher effective speed.

These two types of protocols improve efficiency and reliability of a connection.

1.5 Memory

Beyond these basic principles, the modem offers other functions, aimed at improving performance and ease of use.

These functions are controlled via the memory (S-Registers) of the modem, and are available via the extended AT command set.

These functions are described in chapter 4 of this manual.

Some of the extra functions are:

- Storage of phone numbers,
- Forced V24 signals,
- Exchange of a password between two modems ("Answer Back"),
- Pre-qualification of the telephone line,



2. Installation

2.1 Stand alone version

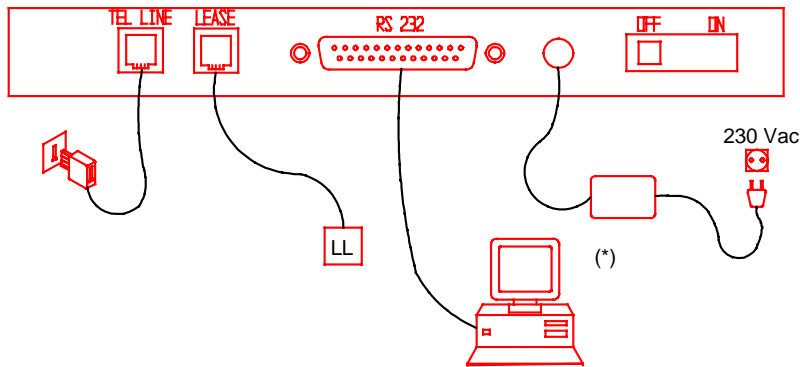
Package Contents:

Before installing your modem, check all these items are present:

- One **MDU903/4** modem
- One RJ11 phone cable
- Power supply or 48V cable for SPC version
- Leased line RJ-11 cable, except for STV and FTV versions
- AT and V25bis command reference manual
- User manual
- Software (as an option)

Connections:

Connect your modem as shown on the following diagram:



Power On:

When the modem is connected, switch the power switch to the "On" position.

(*) Power supply DC adaptor or Power supply cable.

2.2 Rackmount version

Package Contents:

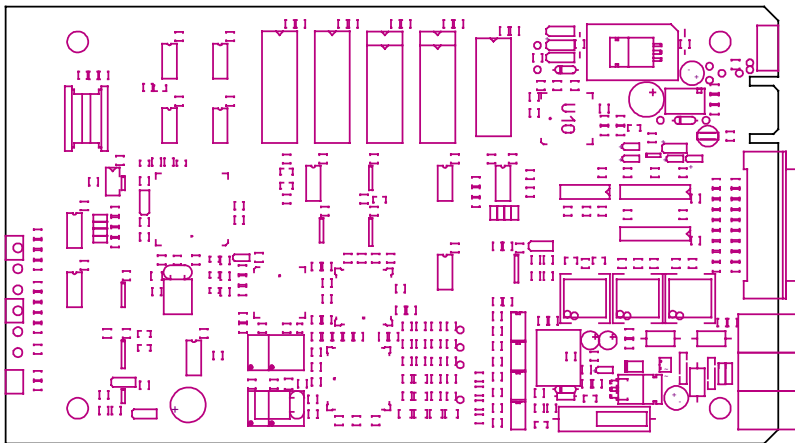
Before installing your modem, check all these items are present:

- One **MDU903C Card**
- One RJ11 phone cable
- A leased line RJ-11 cable
- AT command set reference manual
- User manual
- Software (as an option)

Rack - Controller Option:

If your rack is equipped with a controller card for modem supervision, the control card interface is located at the U10 position of the MDU903C Card (see following diagram).





If the U10 position is empty, your MDU903C Card will not be recognized by the rack controller.

If you ordered the busy out function, check that the K3 option is available. This function forces the line to be active when there is:

- A faulty power supply,
- No answer to a call after N rings (N is set by the S20 register). This maybe due to a non-connected data terminal (DTR/108 absent).
- N successive ineffective connection sequences (N is set by the S20 register). This maybe due to a bad connection to the telephone line.

This option is particularly useful for line pooling applications, and in case of fault, incoming calls are switched to another modem in the pool.

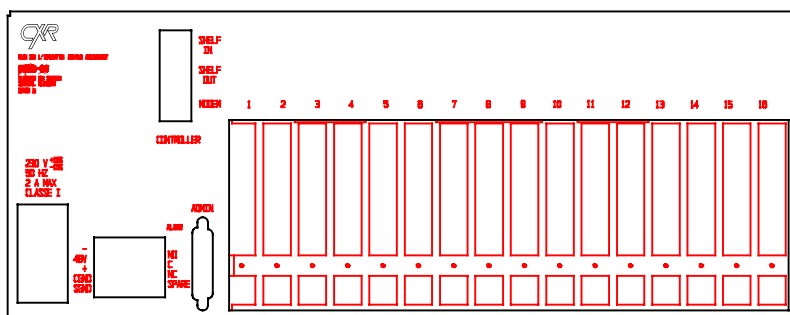
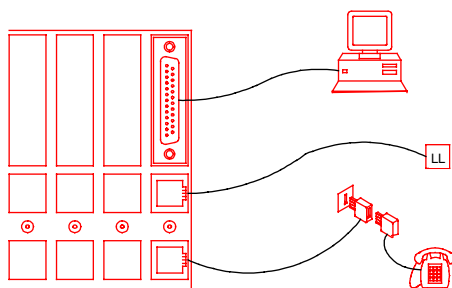
Installation:

See rack operation manual to install your modem.

Find an empty location in the rack and insert the **MDU903C Card** into its card guide.

Connection:

Connect your modem from the rear of the rack, according to the following diagram:



Power On:

Inserting the modem card connects it to the power supply of the rack. Power-on is carried out by the power switch located at the rear of the rack.



2.3 Power-up self-test

When the modem is turned on, an automatic self-test is performed, which tests:

- Its program memory
- Its data memory
- Its stored memory
- Its data processing unit

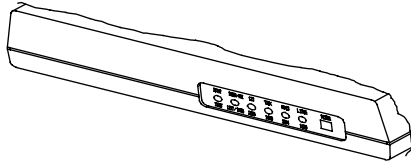
The test lasts a few seconds and ends with a series of:

- Different tones if the test is ok,
- The same tone if a failure is detected. This failure is stored in the S19 register or detailed by the ATi7 command. See chapter 6 "Troubleshooting".

The self test result is displayed on the front panel LCD of the modem.

2.4 Operating modes

This chapter describes the operation of the Data-Link modem.



The modem can operate in one of the four following modes:

1. IDLE MODE:

- The modem enters the idle mode after powering up if it passes its power-up self test. Beeps announcing the end of the test can be heard unless the speaker is turned off (see corresponding command).
- From this mode, the modem will enter in command mode by receiving a command from the DTE, or in ONLINE mode if an automatic call is initiated from the front panel, or if a call is received when the modem is configured to answer calls.

2. COMMAND MODE:

- The modem enters the command mode when it receives a recognized command. In this mode, commands are interpreted and executed. (Configuration set up - automatic call request...). The modem also enters in command mode when it recognizes an escape sequence in the data when in an on-line mode.

3. ONLINE MODE:

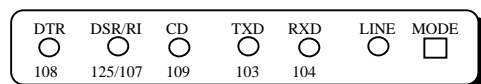
- The on-line mode starts, when detecting a carrier signal from a remote modem.

4. TEST:

- The test mode is selected when in a command mode using appropriate test commands.

The front panel of the modem has six red LEDs and one push button.

The different LEDs indicate the state of the modem and the status of the self test sequence.



The following table list these functions:

LED	Circuit	Function
DTR (Data Terminal Ready)	108	Indicates that the data terminal equipment connected to the modem is ready for data communication (also bad Ram during power up test).
DSR/RI (Data Set Ready/Ring Indicator)	107/125	Flashes when an incoming ring is received (125/RI). Remains lighted permanently when connecting. Also bad RAM causes flashing of light during power up test.
CD (Carrier Detect)	109	Indicates that the remote modem's carrier signal has been received by the modem. In test mode, this light will flash if the test is negative. Also flashes if bad ram during power up test.
TXD (Transmit Data)	103	Flashes as data is transmitted by the modem.
RXD (Receive Data)	104	Flashes as data is received by the modem.
LINE	-	Indicates the mode of connection: Permanent: Leased Line Flashing: PSTN Off: Command Mode Equally a sign of bad non volatile RAM during power up test. PSTN Off: 300 bps Flash 1 Time = 1200 bps Flash 2 Times = 2400 bps Flash 3 Times = 4800 bps Flash 4 Times = 7200 bps Flash 5 Times = 9600 bps Flash 6 Times = 12200 bps Flash 7 Times = 14400 bps Flash 8 Times = 16800 bps Flash 9 Times = 19200 bps Flash 10 Times = 21600 bps Flash 11 Times = 2400 bps Flash 12 Times = 26400 bps Flash 13 Times = 28800 bps Flash 14 Times = 31200 bps Lighted permanent = 33600 bps

The MODE push button programs different functions depending on the current mode.

IN COMMAND MODE:

- Performs automatic dialing of the number stored in memory or holds the line in originate mode if no number was stored, or starts answering if rings were detected on the line. The length of the press is signaled by a single flash of the DSR LED.
- A two-second push holds the line in answer mode. The length of this push is signaled by two flashes of the DSR LED.
- If the button is pressed for more than 10 seconds (three flashes of the DSR LED), the modem resets.

IN ON-LINE MODE:

- Pressing the button once disconnects the modem and selects idle mode again.

Holding MODE for more than 10 seconds will initiate a hardware reset.

If the switch is still pressed after some beeps are heard, the modem will enter configuration mode.

The front panel LEDs DTR, DSR, CD and LINE indicate which configuration the user can select. There are listed in the following table:

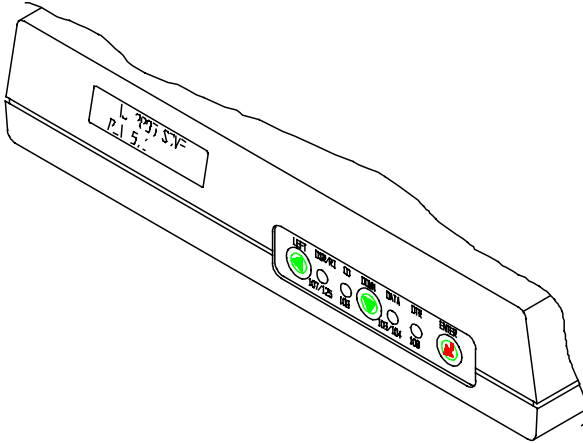
DTR	DSR	CD	LINE	Configuration
0	0	1	1	User configuration "0" (AT%M0)
0	1	0	1	User configuration "1" (AT%M1)
0	1	1	1	User configuration "2" (AT%M2)
1	0	0	1	User configuration "3" (AT%M3)
1	0	1	1	User configuration "4" (AT%M4)
0	0	1	0	Factory configuration "0" async dial configuration (AT&F0)
0	1	0	0	Factory configuration "1" sync 2WLL configuration originate (AT&F1)
0	1	1	0	Factory configuration "2" sync 2WLL configuration answer (AT&F2)
1	0	0	0	Factory configuration "3" V25bis HDLC dialer (AT&F3)
1	0	1	0	Factory configuration "4" V25bis BSC dialer (AT&F4)



Each of the configuration will stay on for 2 seconds while the MODE button is pressed. Releasing the button will select the new configuration, and this configuration will be loaded after power up. Immediately after the power up test (after the beeps), the LEDs will indicate which configuration is loaded for 2 seconds.

2.5 Configuration through front panel LCD and keypad

This chapter describes states of the front panel lights and operation of the LCD and keypad.



LED	Circuit	Function
DSR/Ri	107/125	Flashes when an incoming ring is receiving (125-Ri). Flashes during training on leased line. ON when DSR is activated, when the modem is off hook and when connected.
CD	109	Indicates that the modem is connected to the remote one, i.e. remote carrier is detected.
DATA	103/104	Flashes as data are received and transmitted by the modem.
DTR	108	Indicates that the data terminal equipment connected to the modem is ready for data communication.

The LCD displays two lines of 16 characters:

- + It displays results of the self test after power on.
- + The main menu displays successively states of the modem (connection, speed, DTE interface statuses) and branches to configuration and dialing sub-menus.
- + These menus are described on the next double page diagram.
- + Three keys are used to pass between menus: down ↓ key accesses next item in a list, enter ↵ key validates a choice or branches to a sub-menu, and left ← key comes back one step to the main menu with no effect on last choice.



↵ ENTER : This key validates the displayed choice or option, according to the following examples:

Case 1	PRESS ENTER FOR CONFIG CHANGE	Enter branches to the configuration sub-menus.
Case 2	CHANGE ? VISUAL DISPLAY	Enter branches to the AT display parameter sub-menus.
Case 3	COMMAND ECHO ON > OFF	Enter selects the new value of the parameter located on the right of the <> symbol.

↓ DOWN : This key displays next item of the menu, i.e. next menu, or parameter or value, according to the following examples:

Case 1	SELECT CONFIGURATIO N?	↓	STORE CONFIGURATION ?	Displays next menu.
Case 2	COMMAND ECHO ON CHANGE?	↓	QUIET OFF CHANGE ?	Displays next parameter.
Case 3	COMMAND ECHO ON > ON	↓	COMMAND ECHO ON > OFF	Displays next value of the parameter.

← LEFT : This key comes back one step to the previous menu, according to the following examples:

Case 1	CHANGE ? MODEM OPTION	←	MDU903/4 REV 5.01	Comes back to main menu.
Case 2	COMMAND ECHO ON CHANGE ?	←	CHANGE ? VISUAL DISPLAY	Comes back to configuration menu.
Case 3	COMMAND ECHO ON > OFF	←	COMMAND ECHO ON CHANGE ?	Leaves the parameter unchanged.

From the main menu, LEFT ← key is a multiple action key depending on the modem configuration and connection status:

- During training, left key aborts the connection and restores command mode,
- In on line mode, left key disconnects,
- In idle mode, if the modem is configured in leased line mode, left key initiates a leased line training,
- In idle mode when incoming rings are detected, left key initiates answer mode (acts as an 'ATA' command),
- In idle mode when the modem is configured in dial up mode (i.e. not in leased line mode), left key initiates a calling mode connection. The modem dials the first automatic number found in the phone book, or just hangs up in calling mode if any (acts as an 'ATDS' or 'ATD'),
- In leased line mode with dial backup option set, during training on lease line, left key initiates dial backup,
- During dial backup with alarm beep, left key stops beeping,
- During dial backup without alarm beep, left key aborts the dial line connection and starts training on leased line.



Example

How to store a phone number in the phone book as would this AT command:

AT&Z3:BLACKBOX:FOX:33237:::A

- Number 3 in the phone book (range 0 to 99),
- « BLACKBOX » is the name field,
- « FOX » is the password field,
- LINK and CONGURATION fields are both left blank,
- « A », attributes means this number is dialed from the front panel or from the DTE interface (DTR, 108-1).

NOTA : Please refer to the AT command reference manual for more details on the phone book fields and usage (see AT commands: &N, &Z, DS).

While editing the number, the modem keeps modification in its memory:

- You may stop editing, and restart later,
- This memory is not saved: modification will be lost in case of reset by ATZ command or power lost,
- To save memory and make modification permanent, you must validate the last menu of the number editing: « PRESS ENTER TO SAVE NUMBER MEMORY ».

#	On display	Press the key	Comments
1	PRESS ENTER FOR CONFIG CHANGE	↵ to access configuration menus, then ↓ to display :	
2	CHANGE? PHONE NUMBERS	↵ to access phone number editing sub-menus	
3	CHANGE? P00:O 123456	↓ to access number 3	00 already exists in this example. Look at the name on line 1 an the number on the second line,
4	CHANGE? PO3 :	↵ to start editing number 3	03 is empty in this example
5	PO3:--NAME--?	↵ to edit the NAME field	↓ would access to the PASSWORD next field
6	PO3:--NAME-- _	↓ three times to displays « C » character. Then leave ↓ pressed until you get a « C » again	Note that the ? symbol is gone. Note the cursor position
7	PO3:--NAME-- <u>C</u>	↵ to validate this first character, the cursor moves on the right. Press ↓ to get the « X », then ↵, then ↓ to get the « R », then ↵	
8	PO3:--NAME-- _	↵ no character is displayed on the cursor: ENTER key validates this field and initiate next field editing	↵ validate a field on a blank cursor
9	PO3:--PASSWORD--?	Just like steps 5 to 8, press : ↵ once to start editing, ↓ to get « F », then ↵ (« F- ») ↓ to get « O », then ↵ (« FO- ») ↓ to get « X », then ↵ (« FOX- ») ↵ to validate « FOX », as the	



#	On display	Press the key	Comments
		password and access to the next field of this number	
10	PO3:--NUMBER-- ?	Again like previous steps, press: ↵ once to start editing, ↓ to get « 3 », then ↵ (« 3- ») ↓ to get « 3 », then ↵ (« 33- ») ↓ to get « 2 », then ↵ (« 332- ») ↓ to get « 3 », then ↵ (« 3323- ») ↓ to get « 7 », then ↵ (« 33237- ») ↵ to validate « 33237 »,	Note that dialable digits are available as well as control character. Refer to the dial command ATD in the reference manual
11	PO3:--LINK--? NONE	↓ to get next field	
12	PO3:--CONFIG--? NONE	↓ to get next field	
13	PO3:-- ATTRIBUTE-- NONE	↵ to edit attribute field	
14	PO3: NONE AUTO CALL > ON ?	↵ to validate this choice	Note the attribute on the first line
15	PO3: A DIAL OUT > ON ?	↓ to display next attribute	
16	PO3 A PASSWD ACCS>ON ?	↓ 4 times to pass other attributes and display next menu	
17	SAVE MEMORY	↵ to save these changes in permanent memory, or ← to ignore and return to configuration menu (step 2) without saving memory	

2.6 Dialogue

For your first dialogue with your modem, install communication software on your micro-computer.

Your **MDU903/4** modem will recognize automatically the communication speed and format of your computer, up to 115200 bps, as soon as you enter the following characters:

☞ **AT <CR> (Carriage return)**

☞ **Answer: OK**

☞ **AT&S <CR>**

☞ **Answer: *Displays configuration pages.***

* Identification model.

Once this first dialogue is established, the reference manual will help you to perform complete operation of your modem.



3. Configurations

This chapter describes commonly used configurations through the AT command set: These commands may be used as part of software drivers for example. The same configuration can be achieved through the LCD and keypad front panel. Refer to the LCD menu diagram provided in chapter 2.5.

3.1 Factory configuration

This configuration applies when the modem is first powered on, or after complete reset by the following commands:

```
AT&W255 <CR>
Answer : OK
ATZ <CR>
Answer : OK
```

This configuration is designed for most common applications and has the following characteristics:

DTE - V24:
+ Normal CD, DTR,
+ DSR activated on handshake,
+ CTS controlled by DTR in command mode and RTS in on line mode.
Automatic answer S0 = 2
Automatic hunt: V34, V32bis, V32, V22bis, V21 and V23 modes
Error correction and data compression: V42bis and MNP automatic mode (S0?)
Flow control: RTS/CTS

This configuration can be modified for a specific application. The following examples describe the most common applications.

3.2 Flow control

Flow control can either be performed physically using the RTS/CTS signals or via software using the Xon/Xoff protocol. The following table shows how to activate each form of flow control.

Xon - Xoff:

```
AT*LG1 <CR>
AT*LR1 <CR>
or AT&K4 <CR>
```

Or RTS - CTS:

```
AT%C1 <CR>
AT&R1 <CR>
AT*LG2 <CR>
AT*LR2 <CR>
or AT&K3 <CR>
```

3.3 Synchronous mode

Synchronous mode is when the DTE provides a clock to which the data being transmitted or received must be synchronized. It provides a more efficient means of data transmissions as longer packets of data can be strung together.

The following table shows how to enable this feature.

```
AT*M0 <CR>
AT&M1 <CR>
AT&X1 <CR>
AT@V0 <CR>
```

If the synchronization clock is provided by the DTE, send the command: **AT&X1 <CR>**

If the DTE transmits a continuous flow of data it is recommended to disable the COMMAND mode of the modem, to prevent escape characters from appearing in the course of data transmission or constant polling. To do this, send the command: **AT@V0 <CR>**




3.4 Automatic dialing directory

The MDU903/4 has a non volatile memory that allows the user to store frequently used numbers. Each phone number can have a name and control sequence associated. So instead of remembering every number, the user can type in the recipient name, thus greatly easing the task of making a connection.

The following example shows how to store a number, name and control sequence at location 3 of the directory memory.

Dialing a direct line, send the command:

 **ATDT36062424 <CR>**


Dialing via a PABX, send the command:

 **ATDP0W36062424 <CR>**

Storing a number in the directory (number 3), send the command:

 **AT&Z3:NAME:CONTROL:P0W36062424:::A <CR>**

Show directory contents, send the command:

 **AT&N <CR>**

Dialing from the directory:

- The ATDSn command dials the stored telephone number specified by n where n is 0 to 99.
- By CCITT 108/1 operation. The modem autodial a stored number when an off-to-on transition of the DTR occurs. The modem disconnects when an on to off transition of the DTR occurs. AT&D1 command select the dialing mode of the DTR signal.

3.5 Leased line

As mentioned before, a leased line is a permanent analogue telephone connection between 2 sites. Therefore there is no dialing necessary.

Depending on the selected configuration, the following commands are sent to the modem.

(See reference manual for a description of these commands).

Configuration	Originating modem	Answering modem
2-wire line	AT&L1%O1&W <CR>	AT&L1%O0&W <CR>
4-wire line	AT&L2%O1&W <CR>	AT&L2%O0&W <CR>
Dial back up	AT%U1	AT%U1
1234 back up dial number	AT&Z:::1234:::A <CR>	
Recovery lookback	AT%L1&W <CR>	AT%L1&W <CR>

after this leased line configuration is saved by the AT&W command, the modem will start training on leased line if :

- it is reset by ATZ or by a power restart,
- the front panel button is pressed.

3.6 Saving user configurations

The MDU903/4 modem can store up to 5 user configurations.

The AT&Wn command saves the current configuration in non-volatile memory (n = 0 to 4). This configuration is saved even when the modem is turned off. The modem will load the last saved user configuration at power-up.



4. Security and memory

4.2 Principles

The modem contains three types of memory:

The **PROM**, where factory configuration is stored permanently,

The **RAM**, where the modem configurations are stored temporary,

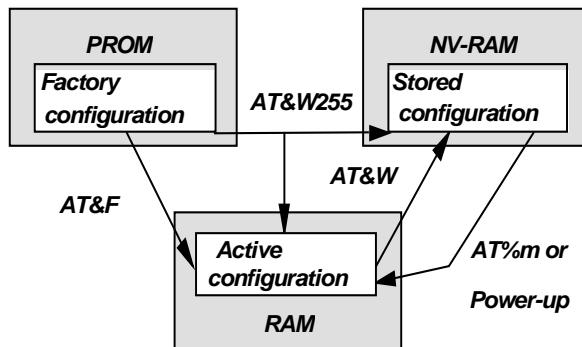
The **NVRAM** where semi-permanent data is stored even when the modem is turned off.

The first time your modem is turned on, or after a complete reset, these three memories are identical and set to the default factory configuration.

The **AT&Wn** command saves the current configuration in the non-volatile memory, (n = 0 to 4).

The last stored user configuration will be loaded automatically on next power-up.

These memory operations are shown on the following diagram:



Memory reset	AT&W255
Memory store	AT&W0 to AT&W4
Loading of a factory configuration without losing the stored memory	AT&F0 to AT&F4
Loading the user configuration	AT% m0 to AT% m4

4.2 The phone directory

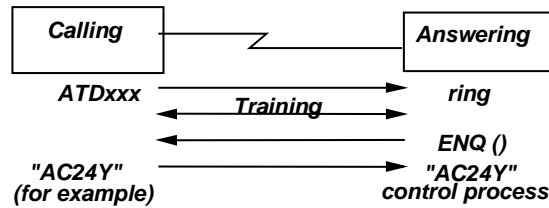
Up to 100 phone numbers can be stored in the modem's non-volatile memory, to be used by the automatic dialer.

Save a number	AT&Z0:Directory::11:::A
This command saves automatically the directory in non-volatile memory	
Dial a number	ATDS0 <CR>
Display the directory	AT&N <CR>



4.3 Answerback security

This security mode is controlled by the answering modem, and depends on a password exchange which authorizes a modem connection, i.e.:



If the answerback matches the one stored in memory within two seconds after an ENQ code was sent by the answering modem, access is granted.

Otherwise the modem disconnects automatically.

To store the answerback code, see the following example. The password can be up to 12 characters long.

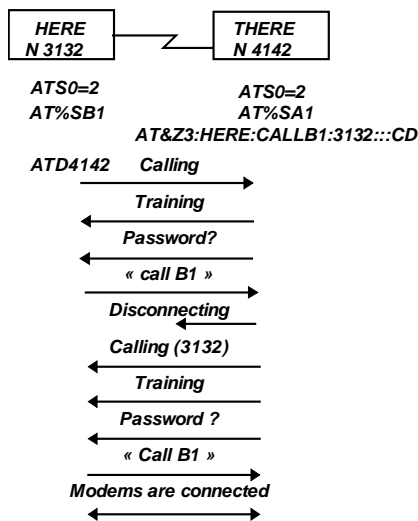
Store answerback (for example: AC24Y)	AT&A:AC24Y:AC24Y <CR>
To disable answerback security	AT&A:: <CR>

4.4 Callback security

This security mode is controlled by the answering modem.

It sends a password and then calls back the telephone number associated with that password.

See %SA and %SB commands in the reference manual.



The double security guarantees password and localization of the calling modem.



4.5 Inactivity password

The modem asks for a password when no data passes through it for a presented delay. If this password matches the operator or supervisor password stored in memory then the modem will reconnect otherwise it will drop the line.

S32: number of minutes of inactivity that will start the password request.

S96: number of seconds that the modem will wait for the password.

AT%ST 0/1: number of password trials (0: one trial / 1: three trials).

AT%In: inactivity is detected if:

n=0: no detection, i.e. feature is disabled.

n=1: detects transmitted data inactivity.

n=2: detects received data inactivity.

n=3: detects both received and transmitted data inactivities.

AT%PS: SUPER:SUPER: stores the supervisor password, (SUPER as an example).

AT%PO: OPE:OPE: stores the operator password (OPE as an example).



5. Specifications

5.1 Line side characteristics

Mode	Switched network	2-wire leased line	4-wire leased line
Receiver sensitivity	- 43 dBm	- 33 dBm	- 26 dBm
Carrier detection:			
Open threshold	< - 48 dBm	< - 38 dBm	< - 31 dBm
Close threshold	> - 43 dBm	> - 33 dBm	> -26 dBm
Transmission level:			
Nominal	- 10 dBm	- 14 dBm	- 14 dBm
Maximum	- 8 dBm	- 6 dBm	- 6 dBm
Minimum	- 16 dBm	- 16 dBm	- 16 dBm

Recom- mendations	Call/Answer	Speed Bps	Xmit 0	Xmit 1	Received 0	Received 1
V22 bis	Call	2400	1200	1200	2400	2400
	Answer	2400	2400	2400	1200	1200
V22	Call	1200	1200	1200	2400	2400
	Answer	1200	2400	2400	1200	1200
V21	Call	300	1180	980	1850	1650
	Answer	300	1850	1650	1180	980
V23	Call	75	450	390	2100	1300
	Answer	1200	2100	1300	450	390
V32		9600	1800 Hz			
V32 bis		14400	1800 Hz			
V32 terbo		19200	1800 Hz			
V34		33600	Adaptive			

5.2 Automatic call & answer

Automatic dialing or calling by the originating modem is initiated by:

- "AT" or V25bis commands
- Push button on front panel
- DTR 108/1 being enabled
- Pulse or tone dialing.

Tone recognition occurs when there is:

- A dial request (public network or private exchange).
- A busy line.

When the modem is set in answer mode, it will go off hook after 2 rings (if the command ATSO=2 is sent). This is in conformity with CCITT V25bis recommendation.

In calling mode, the modem will automatically recognize the remote modem modulation type and adapt correspondingly.

It will disconnect only if:

- The carrier is lost,
- No carrier tone is detected within 35 to 90 seconds,
- No data activity has occurred for the selected period of time dictated by the Inactivity Timer.



5.3 Serial interface

The V24 serial interface of the modem conforms to the DCE specifications. A straight ribbon cable is all that is needed to connect to the DTE port of your computer or terminal. The serial port will automatically recognize DTE speeds up to 115200 bps. This is called auto-bauding.

Both asynchronous and synchronous modes with internal or external clock are supported.

5.4 Fax-mode

See 5-2

The modem provides the ability to send and receive faxes at speeds up to 9600 bps. The following modulations are supported:

ITU-T	Speed Bps	Carrier (Hz)
V21	300	1650 - 1850
V27 ter	2400 / 4800	1800
V29	7200 / 9600	1700

In fax mode, the modem support the following standards:

- Group III Fax, EIA 578 class 1 and class 2 compatible,
- CCITT T4 - T30 recommendations.

The following AT commands control the operation of a class 1 modem/fax:

+FCLASS Service class identification and control
+FTS Stop transmission and wait
+FRS Receive silence
+FTM Transmit mode
+FRM Receive mode
+FTH Transmit T30 command mode
+FRH Receive T30 command mode
+FCERROR Error code

The following AT commands control the operation of a class 2 modem/fax:

+FCLASS Service class identification and control
+FMDL Fax-modem model
+FMFR Fax-modem manufacturer
+FREV Fax-modem checkup
+FBUG Frame report
+FAA Automatic answer
+FBOR Data bit order
+FDCC Fax-modem capability selection
+FDIS Capability initialization for transmission
+FLID Identification selection of the fax-modem
+FCON Remote fax detection
+FCIG Identification of called subscriber by CIG
+FCSI Identification of called subscriber by CSI
+FTSI Identification of calling subscriber by TSI
+FDTC Called fax return capability - DCS frame
+FDCS Discussed capability for process - DCS frame
+FHR Content of received frame
+FHT Content of transmitted frame
+FBUF? Buffer state
+FDT Fax message transmission



+FPTS	Page transmission result
+FDR	Fax message reception
+FCFR	Reception mode confirmation
+FPTS	Remote reception status
+FET	End of page status
+FHNG	End of procedure status
+FAXERR	Error code

5.5 General characteristics

Dimensions : Length: 260 mm,
 Width: 170 mm,
 Height: 35 mm.

Weight: 0,7kg.

External power supply module: 230V/50Hz.

Power consumption: 25mA.

Operating temperature: 0 to 50°C.

Relative humidity: 0 -> 90% non-condensing.

Conforms to European security standards: EN41003, EN60950,

Conforms to European Electromagnetic Standards: EN50082, EN55022.



6. Troubleshooting

Problem:

This chapter lists most modem operating problems.

Problem	Check
No tone when modem is turned on	Connection to the mains On/Off switch in On position Power supply of the rack and fuse of the card (rack version), DTR indicator on or flashing
Single and continuous tone when modem is turned on	Send commands: AT&W255 <CR> ATZ <CR> Then restart the modem to see if the same continuous tone is heard. See S19 section below.
Modem does not obey commands	Flashing of the TXD indicator when sending characters. No flash: check V24 cable. Flashes: <CR> command: AT&S4 <CR> and check for a long flash of TXD indicator. Long flash: check V24 cable.
Modem answers "NO DIAL TONE"	Try to dial an outside line using the ADT command. Make sure that you select a valid telephone number and dialing mode (P-Pulse, T-Tone). Listen to the internal speaker to see if the normal dial tone is heard. If not then it is a problem with the line connection.
Modem refuses to dial	Check for any blacklisting: AT&NB <CR> (see reference manual) Turning the modem off and on resets the blacklist.

ATI7 command:

Check the answer to the ATI7 command. It provides a clear message in case of self detected problem.

ATI7 Response	
BAD ROM	Code EPROM checksum bad
BAD RAM	Write and read failure in RAM
BAD NOW VOLATILE MEMORY	No volatile memory checksum bad
BAD DSP ROM	DSP checksum bad
BAD DSP	DSP bad
ALB FAILED	Analog loopback test bad

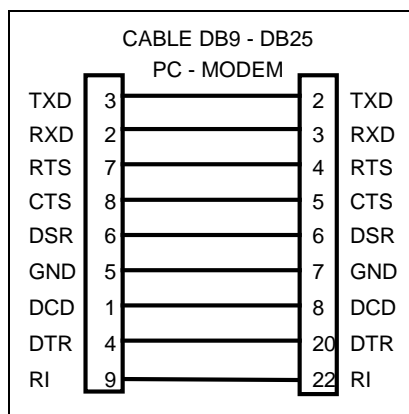
If a problem persists after these verifications, contact the BLACK BOX "Hot Line" service:

HOTLINE: +44 118 931 2233



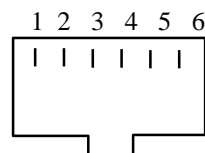
7. Appendix A – V24 Signals

Pin number	Name	CCITT number	
1		101	Earth protection
2	TXD	103	Data transmission
3	RXD	104	Data reception
4	RTS	105	Request to send
5	CTS	106	Clear to send
6	DSR	107	Data terminal ready
7	GND	102	Signaling earth
8	CD	109	Carrier detect
9-19	SS	116	Dial backup command
10-16	Si	117	Dial backup indicator
15	SCT	114	Time basis for signal elements at transmission. Source: ETCD
17	SCR	115	Time basis for signal elements at reception
18	TB3	141	Test command. Local loop 3.
20	DTR	108/2	Data terminal ready
21	DB2	140	Test command: remote control of loop 2
22	RI	125	Ring indicator
24	SX	113	Time basis for signal elements transmission. Source: ETTD.
25	TEST	142	Test indicator.



Dial line connector:

Pin	Signal
1	Not used
2	Telset Tip
3	Tip PSTN
4	Ring PSTN
5	Telset Ring
6	Not used

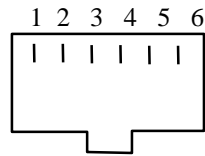


CBL903-UK (Dialup cable for use in the UK)

Pin (Modem) RJ-11 6 wire	Signal	Pin (Line) BT631A
1	Not used	N/C
2	Telset Tip	N/C
3	Tip PSTN	2
4	Ring PSTN	5
5	Telset Ring	N/C
6	Not used	N/C

Leased line connector :

Pin	Signal 2W	Signal 4W
1	Not used	Not used
2	Not used	Receive Tip
3	Tip	XMIT Tip
4	Ring	XMIT Tip
5	Not used	Receive ring
6	Not used	Not used



8. *Appendix B - Country specific informations*

UK	Although this equipment can use either loop disconnect or DTMF signalling, only the performance of the DTMF signalling is subject to regulatory requirements for correct operation. It is therefore strongly recommended that the equipment is set to use DTMF signalling for access to public or private emergency services. DTMF signalling also provides faster call set up.
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