

AP-WM USER GUIDE

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Chapter 1: System Overview

The AP-WM is a field telemetry unit for automated remote meter reading (AMR), based on the general purpose AP-TX Remote Unit. The unit is designed to operate in a “fixed network” configuration, which proves highly economical, owing to the large reception range achieved while maintaining high reliability of the communication link.

The network operates in the ISM (Industrial, Scientific, Medical) frequency range of 903.6 - 926.2 MHz, utilizing Direct Sequence Spread Spectrum communication technology. The combination of special frequency band and innovative technology provides important benefits. Among these are:

- Reduced infrastructure costs
- Fast data rates
- Interference immunity
- Extended range
- Secure communication
- Unlicensed operation in many countries

The network’s three main components are its regional Control Center, Base Stations and Remote Units.

The Control Center

The Control Center is the nucleus of the network, serving as the system’s command and control site. It receives messages from the Remote Units via the Base Stations on the Uplink network. The Center performs the following functions:

- Controlling and monitoring of Base Station receivers and Remote Unit transmitters.
- Managing communication with the client application.

The Control Center software enables the operator to monitor system operation, change operating parameters and to control the various components by means of a series of user friendly screens, menus and graphs.

The Base Stations

The system of Base Stations provides the link between the Remote Units and the Control Center. The Base Stations receive Uplink transmissions from the Remote Units. They perform the digital signal processing necessary to despread the signal, which is then conveyed to a host PC and on to the Control Center via a dedicated line.

The Remote Units

The Remote Units transmit RF signals to the Base Stations. Their operation is controlled by a microcontroller. In order to maximize battery life, the unit remains in “power down” mode whenever it is not receiving or transmitting data.

About This Manual

This manual guides the user with information about the transmitter unit, its installation and configuration procedure both for personnel engaged in operating the network and for installation and maintenance technicians.

The information presented in this manual is organized as follows:

- **Chapter 2, Remote Unit Description**, describes the Remote Unit and its sub-components and functions.
- **Chapter 3, Installing the Remote Unit**, details the installation procedures for the Remote Unit.
- **Chapter 4, Operating the System**, sets out detailed operating procedures together with an explanation of the software.

Conventions

To help you interpret information correctly, this manual uses consistent text formats for different information. These conventions are explained as follows:

Bold Courier Font	Text that must be typed exactly as it appears, e.g. AptelPc.exe
ALL CAPITALS	Acronyms and abbreviations, e.g. ACK, AGC.
First Letter Capitals	Technical terms related to the APnet system, e.g. Base Station, Frequency Sweep.

FCC Requirements

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on. The user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Chapter 2: Remote Unit Description

The AP-WM

The unit includes a support board (spacer), batteries, a shielded Direct Sequence Spread Spectrum (“DS SPSP”) transmitter and CPU circuit, an I/O circuit and a printed antenna, fitted in a plastic spray-proof (IP-64) box. The I/O circuit translates pulses of dry contact, to digital signals stored by the unit. The dry contact pulses are generated by a magnetic interface to a water meter, or any other pulse generating interface.

The AP-WM is a fully programmable unit. Programming is performed via an RS232 serial port, using an RJ-45 connector on the unit’s board. The unit can also be programmed through a magnetic loop interface, provided as an option. The units are supplied with simple operator software, to enable initialization and service checks on the field. The unit transmits periodically, at intervals programmed prior to operation. The data transmitted by the unit includes:

- Unit identification
- Meter identification (a separate message is initiated for each meter connected to the unit)
- Current reading of the meter
- Factor used by the meter (e.g. a reading of 1234 with a factor of 10 represents actual consumption of 123.4 volume units - m³ or ft³)
- Tampering information - magnetic tamper and cut-wire tamper are alerted by the unit immediately

Components

The Unit consists of two modules:

- I/O (input/output) module, which may include a paging receiver.
- Transmitter module, which includes the following components:
 - Microcontroller
 - ASIC (Application Specific Integrated Circuit)

- Transmitter
- External memory

The I/O (Input/Output) Module

The I/O module conveys logical, digital and power inputs to the unit's transceiver, and carries signals and messages from the microprocessor to the application. It thus provides the physical interface with the application and the connection with the power supply. The application interface includes a terminal block with 12 inputs, that can be connected to up to four pairs of "dry contact" switches and their ground connection.

The Microcontroller

The 8051 family microcontroller controls the transmitter's operation, and monitors the message receive process. It also performs sampling of the application's inputs through the application interface and controls the application's operating state.

In order to save battery power, a specialized circuit in the I/O module automatically turns the microcontroller circuit's power down. In this mode current consumption is reduced to a minimum, enabling long battery life. The circuit is activated only by an "event," which is identified when one of the following happens:

- Input is received through the serial port from a PC or similar source.
- The timer for telemetry transmissions has timed out
- A switch has been closed on one of the inputs of the terminal block

The Transmitter

Aptel's transmitter transmits messages to the Base Stations by means of Direct Sequence Spread Spectrum technology in the 900 MHz frequency range. Its transmission power is 1 watt - the maximum allowed for non-licensed ISM transmission.

Each bit of information is multiplied by the length of a pseudo-random sequence. The transmission length of each bit thus equals the length of the sequence (255 bits). As a result, the transmission is spread over a wide spectrum. The spreading process is performed by an Aptel ASIC.

Transmission is initiated in one of the following ways:

- Cyclical initiation - messages are transmitted at regular intervals.
- Status Alert - tamper inflicted on the Unit.
- User initiation - a request entered on a PC connected to the serial port.

Chapter 3: Installing the Remote Unit

Installing the AP-WM

Installation Kit

- Four mounting screws and wall inserts, or pipe mounting kit
- Installation template

Required tools

- 4" flat screwdriver
- Phillips 4" screwdriver

Mounting the AP-WM Unit on the Wall

1. Mount/connect the inputs to the proper devices (e.g. water meters).
2. Choose a convenient position for the Unit.
3. Mark the position of the holes to be drilled on the wall, using the template.
4. Drill the four holes and insert the wall inserts.
5. Open the unit's lid and screw in the mounting screws. Secure the unit but do not overtighten.
6. Program the Unit (if required) via its RS232 connection.
7. Close the Unit lid.

Note:

When programming, make sure that COM1 is dedicated to the RS-232 channel between the transceiver and the host PC, and is not used for any other purpose.

Installing the Software

The software used in order to program the Unit is provided on a 3.5" diskette containing:

- Host PC software "tx126a.exe"
- Auxiliary software "menu1.rez"

Note:

The software runs under MS - DOS. Make sure that this operating system is available on the host PC.

To install the software:

1. Copy the following files from the 3.5" diskette to the host PC root directory:
 - tx126a.exe
 - menu1.rez
2. Type **tx126a** and press Enter; the Main Screen appears and the command box opens.

Chapter 4: Operating the System

This chapter describes in detail the operation of the Remote Unit. It includes a description of the user interface and operating instructions.

Operating the AP-WM

With Aptel's remote unit software you can:

- Read, set and update transmitter parameters
- Send messages

The Transmitter Parameters Main Screen

Figure 4 - 1 shows the Main Screen as it appears when you operate the software. For information about installing the software, see Chapter 3.

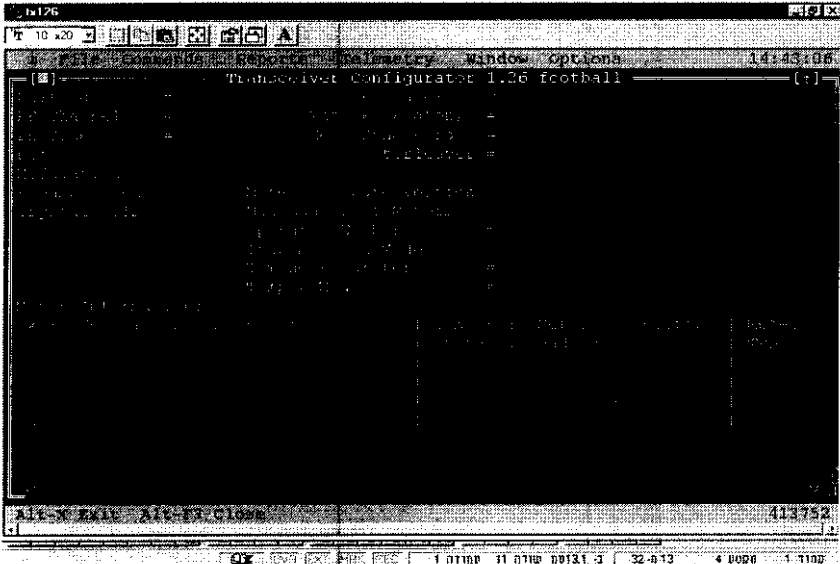


Figure 4 - 1: The Transceiver Parameters Main Screen

The Menu Bar Displays 7 menus and a real time clock. When clicked with the left mouse button, the menus open to display windows and dialog boxes.

The Transceiver Parameters Window	Appears as a background window. When clicked, the window is activated, and allows you to enter or change parameters.
The Commands Dialog Box	Appears as a foreground window. Allows you to enter and send commands.
The Hot Key Bar	Displays hot keys for exiting the program and closing a window.

You can use both the mouse and the keyboard to move around in a window.

- To move the cursor to the Menu Bar, press the F10 key.
- To bring a window to the front, click it or press the F6 key.
- To move between fields in a dialog box, press the TAB key.
- Dialog box commands have their first letters highlighted. To choose a command, press ALT + (highlighted) letter.

The various windows, boxes and features you can access from the Menu Bar are listed below:

Menu	Access to
=	Video mode; About; Calculator; Calendar
File	View file; Change Dir; DOS shell; Exit
Commands	Commands dialog box
Reports	Report window; Message window; Save reports
Telemetry	Open; Save; Restore
Window	Next; Zoom; Cascade; Tile
Option	Colors; Graphic

Windows, Boxes and Features

= Menu



Figure 4 - 2: The = Menu

- | | |
|-------------------|--|
| Video mode | Reduces font size to include more information on the screen. To return to normal mode, click Video mode again. |
| About | General information about the software. |
| Calculator | Enables use of built in calculator, using the mouse only. |
| Calendar | Opens multi-year calendar with current date highlighted. To move between months, use up/down direction keys. |

File Menu



Figure 4 - 3: The File Menu

- | | |
|------------------|---|
| View File | Displays the Open File dialog box. The status bar shows file name, size in bits and creation date. To open a file, type in the file name or choose a file from the Files list and click Open. |
|------------------|---|

- Change dir.** Displays the Change Directory dialog box, which includes a Directory Name list box and the corresponding Directory Tree display. To change the directory, choose a directory from the list and click “Chdir”.
- DOS shell** Enables you to work in DOS.
- Exit** Enables you to exit the program.

Commands Menu

- Open Commands Dialog** Opens the Commands dialog box, which displays a list of commands that you can use to control the transmitter’s operation and to configure its parameters. See below for details.

Reports Menu

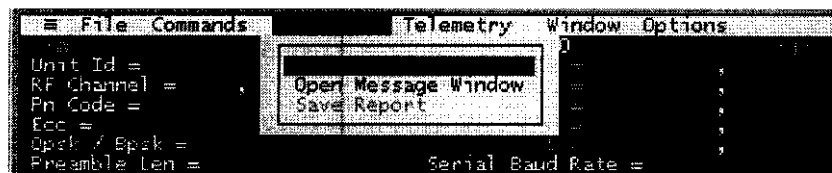


Figure 4 - 4: The Reports Menu

- Open Report Window** Opens the Report window, which displays information about special events, under the headings Time, Code and Description.
- Open Message Window** Opens the Message window, which displays details of messages received and time of transmission.
- Save Report** Opens a window that allows you to save the report under a name of your choice by clicking OK.

Telemetry Menu



Figure 4 - 5: The Telemetry Menu

- | | |
|---------------------------------|--|
| Open Telemetry Window | Opens a window displaying information about the transceiver's general parameters. |
| Save Telemetry Window | Opens a dialog box that allows you to save telemetry files. Enter a file name in the Name field, or select a file from the Files list and click OK. |
| Restore Telemetry Window | Opens a dialog box that allows you to restore telemetry files. Enter a file name in the Name field, or select a file from the Files list and click OK. |

Window Menu



Figure 4 - 6: The Window Menu

- | | |
|----------------|---|
| Next | Brings the next window to the front of the display. |
| Zoom | Zooms in and out of open windows. |
| Cascade | Arranges open windows one below the other. |
| Tile | Arranges open windows one next to the other. |

Options Menu



Figure 4 - 7: The Options Menu

- Colors** Opens the Colors dialog box. In this box you choose foreground and background colors for different groups of items.
- Graphic** Opens the Graphic dialog box. In this box you change the graphic representation of the open windows.

Commands List (accessed from Command dialog box)

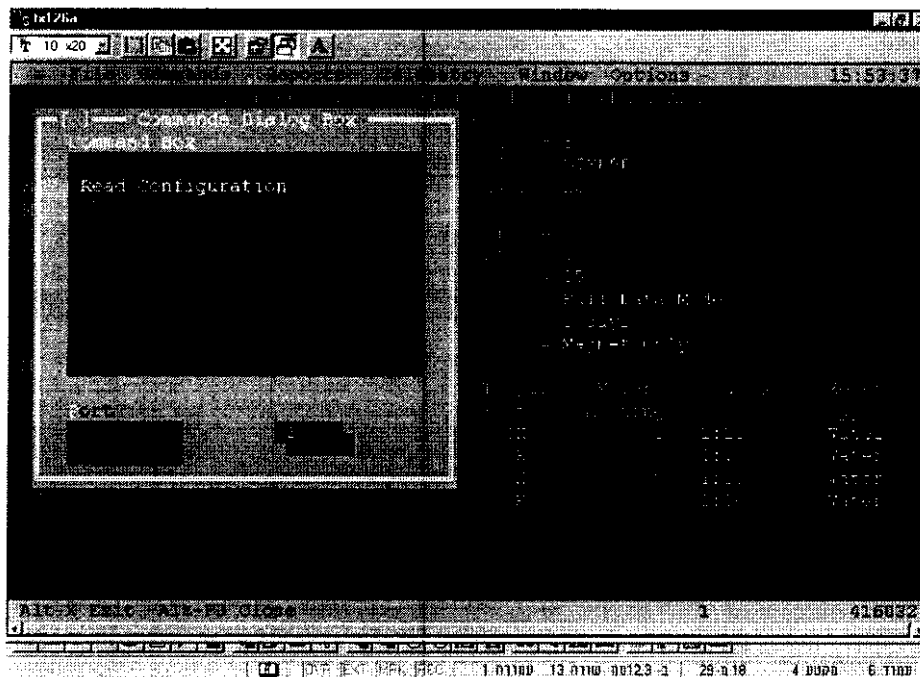


Figure 4 - 8: The Commands List

- Transmit Data** Sends the default message to the air. The message structure is programmed to the unit and includes the unit ID, readings and status flags.

Read Configuration	Reads the current configuration and presents the parameters on the main window.
Reset Water Meter Readings	Resets to zero the water meter readings.
Set Unit Configuration	Enables the user to program the operator number (when several operators exist in the same area) and the Tamper Mode (Magnetic & Cut Wire, or Magnetic Only), and to set which inputs connected to the unit are valid (out of the four available inputs)
Set and Read Timing Parameter	Opens a window showing the current interval between consecutive telemetry messages and allowing programming of that parameter. A value of zero turns the transmitter off.
Set Meter Parameters	Each meter connected to the Unit is programmed to a name, number, current reading, factor and meter type (water/electric/gas).
Port	Choice of connection to COM1 or COM2 of the host PC