Operating manual

Rel. 1.0

Shark

Broadcast Digital Equipment

Mpx + RDS version

ELENOS

INDICE

1 INTRODUCTION

Shark processor is the result of pluriannual experience of a team made up of radio technicians, psycho-acoustic experts and designers specialised in the development of professional audio equipment based on digital DSP technology.

Shark is a powerful, state-of-the-art digital equipment integrating, in a single rack unit, a MPX stereo coder, a Stereo enhancer, a 5 band Limiter and an RDS coder.

SHARK target

- Middle/big radio stations, which can choose ***Shark*** in its single configurations (only Coder MPX, Limiter, Stereo Enhancer or RDS coder), and as a powerful tool for splitting applications.

- Networks, which can use ***Shark*** in remote sites to relay the network signal received via satellite or via radio link.

- Small radio stations, which can enjoy ***Shark*** in its multifunction configuration, simplifying the transmitting chain.

- All broadcasters who need to remotely control several transmission parameters.

- All broadcaster who need to get a fully digital TX chain.

- TX manufacturers, who can integrate the Shark OEM version.

Main Advantages

- A single equipment instead of four units: an extraordinary space and money saving.

- No more compatibility problems in connecting equipment of different qualities and manufacturers.

- A wide range of configurations and modules.

- Fully digital signal processing: top audio quality from the console desk to the final TX.

- Complete control (local and remote) through analogue and digital modem, satellite, TCP/IP network, etc…the whole network under Yr fingers.

- A single integrated control for several utilities to assure maximum ease in radio station operative management.

Main Features

- The Mpx Stereo plug allows to implement all the functions of a top class Stereo coder, which expands Shark application field. F.i., it can be used in all sites requiring terrestrial relay (adding RDS coding) of a bi-channel audio signal received from satellite.
  All the Mpx parameters (pilot phase and level, Mpx level, etc) are user adjustable.

  Mpx plug can also be used together with the Limiter/ Stereo Enhancer plug, assuring a perfect modulation control and avoiding the signal deterioration typical of different equipment chains.

  Internal generated 50 and 75 μsec preemphasis is available, too.

- The sophisticated AGC (Automatic Gain Control) system compensates the input level variations, always keeping the useful signal at 0dB. The parameters setting the AGC operation are: AGC Speed, MaxGain, Hold time and freezing threshold (GATE).

- The digital input and output support a wide range of audio format (AES3/EBU, S/PDIF, IEC60958, EIAJCP1201). Input do not require any special setting as it can automatically recognise the injected signal.

- The digital, top quality **Stereo Enhancer** plug (optional) features all the setting parameters needed to reach the psycho-acoustic desired effect (Effect Depth, Effect Band, Effect Level).
  As it is fully built in inside the processor, it does not require any supplementary external equipment into the audio chain and it is completely armonized with other processing stadiums.

- Up to 4 serial ports allow a powerful control through a PC connection (local or remote), GSM and analog modems, satellite receivers, RDS programmers compliant with UECP protocol, etc..
  You can program a single equipment at a time or a group of equipment as well.

- The RDS (Radio data System) plug generates an RDS signal matching the last CENELEC standards (EN 50067, release 1998).

  RDS control interface and communication protocol are designed in accordance with UECP SPB 490 (Version 5.1 - 1997). RDS programming can be easily managed through every UECP compliant software besides the BNS software by AXEL TECHNOLOGY.

- BSN - Broadcast System Navigator is the powerful and reliable software running on Windows 95, 98 and NT platforms and specially conceived for SHARK remote/direct control.

  BSN allows real time control and setting of all functions and technical parameters, including RDS messages.

  In systems including several SHARK equipment, BSN allows to control every single unit through a subdirectory tree layout. The whole equipment network is completely under finger tip!

- The Limiter/Stero Enhancer module features all utilities provided by a high quality, 5 band digital limiter, especially conceived to cope with signal alterations which might be introduced by radio or satellite links (phase distortions, gain reductions, etc).
  SHARK is ideal for those applications requiring modulation control without modifying the sound dynamics & colour.

SHARK POSSIBLE CONFIGURATIONS

Shark L MPX	Limiter + MPX stereo encoder
Shark L MPX/RDS	Limiter + MPX stereo encoder + RDS encoder
Shark MPX	MPX stereo encoder
Shark RDS	RDS encoder
Shark MPX/RDS	MPX stereo encoder + RDS encoder

Optional	Description
Shark P 2S	2 additional serial ports
Shark P AES/EBU	AES/EBU digital input (optical and XLR-type connectors)
Shark SE BSN	Broadcast System Navigator extended version

- *Shark* has been developed in collaboration with:

2 Shark BASIC CONCEPTS

Linear phase digital filters

Shark implements high quality, low delay, linear phase digital filters. In respect to IIR filters, the Shark ones (FIR type) assure no phase rotation or distortion and a highly selective shaping.

F.i., with reference to the composite Mpx signal, the attenuation is as follows: - 0.1 dB@15 kHz, - 70 dB@17 kHz, - 100 dB@19 kHz.

Furthermore, Shark processing layout assures short Group Delay and short processing time. Linear phase processing is applied also in Oversampling

3 INSTALLATION AND HOUSING

A correct installation and an optimum level setting are crucial for a good operating and the exploitation of all the processor capacities. Please pay attention to the following notes:

- The installation must be carried on by skilled technicians.

- For a corect operating, the processor needs a good aeration.

- We highly suggest to use high quality wires, well protected, and balanced connections.Make sure the cable integrity. If possible, use digital link (through the optional Digital Input plug-in)

- Make sure the AC main voltage corresponds to that indicated in the technical specifications. If a different voltage (ex. 110/115 VAC) is available, open the equipment cover and set the voltage switch on the main supply circuit, located behind the VDE socket.

- Make sure the ground connection is available. Audio ground and earth must be separated.

- Disable – wherever possible - the preemphasis from transmitters and radio links, as it is highly recommended that the unique pre-emphasis in transmission chain is generated by the processor.

- In case of technical problems or faults please do not open the cover and contact the manufacturer

- This manual images could differ a bit from the equipment real design.

- Please keep this instruction manual after reading it in detail

4 EQUIPMENT DESCRIPTION

4.1   FRONT PANEL
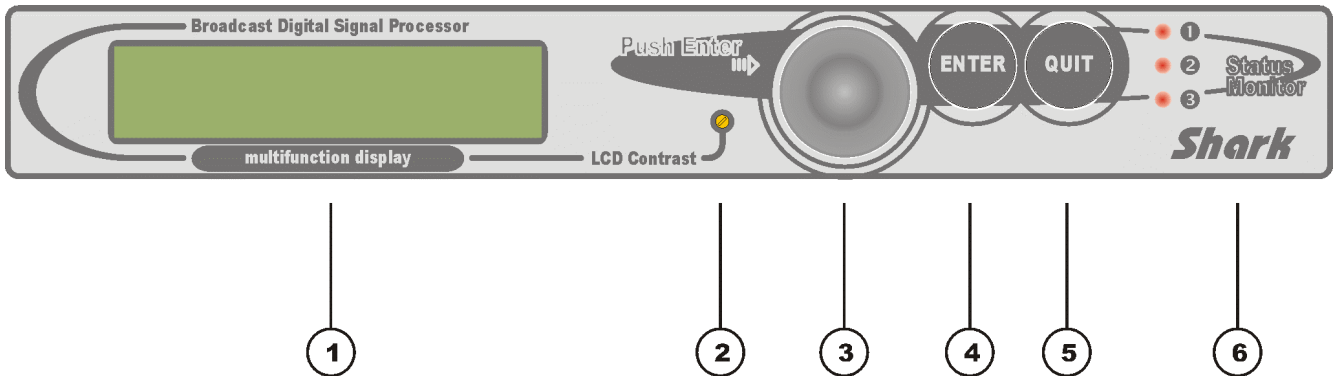
1. Multifunction display multifunction display showing the equipment operating conditions.

2. LCD contrast: trimmer to set the contrast of the display. Please use a small screwdriver.

3. shuttle: multifunction shuttle to scroll the menu and modify the parameters. It can also be pressed, having the same control function as Enter key.

4. ENTER: key which gives access to the parameters submenu and selects the new values.

5. QUIT: key to quit the current menu and go back to the previous one. By pressing this key the modifications realised by accident on the selected parameter are not executed.

6. Led: they show special operating modes, depending on the different lighting combinations.

4.2 BACK PANEL
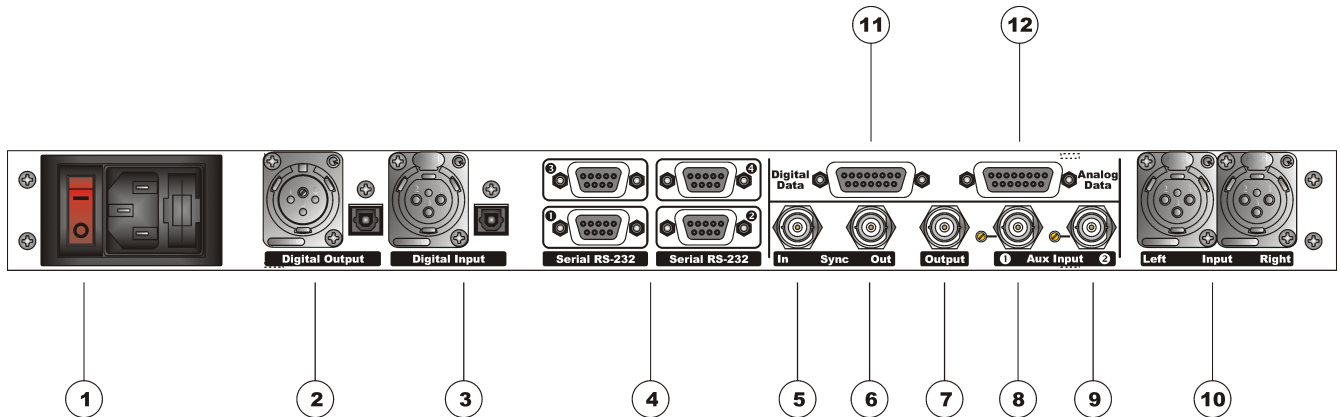
1. **ON/OFF main switch**, the led inside switchs on/off accordingly. If it is off while the switch is ON, please check **the** supplied AC cord and the fuse.

2. **VDE**: the power supply socket has an integral fuse drawer containing the power fuse and a spare, both of the same value.
   > for 220/230 V AC the fuse is rated at 630mA T
   > for 110/115 V AC tension the fuse is rated at 1.6 A T

   If the unit is to be used with a mains input operating voltage diferent to that for which the unit is supplied, set the voltage change-over switch, which is placed inside the box, close to the AC transformer.

3. **Digital output** **. It features two connectors: use the XLR female for coaxial connections or the tos-link for optical connections.

4. **Digital input** *. It features two connectors: use the XLR female for coaxial connections or the tos-link for optical connections

5. **Seriali RS232**: optoisolated serial ports for connection to PCs or satellite receivers.

6. **Sync-in*****: synchronism input: provide 19KHz / 5Vpp to lock Shark to external equipment.

7. **Sync-out*****: synchronism output. It features 19KHz at 5Vpp to lock external equipment (for instance RDS coders).

8. **Main Out***** It features MPX, MPX +RDS, MPX + RDS + SCA depending on the input signals and on the Shark version.

9. **Multipurpose Aux In (for RDS, SCA..)*****: the injected signal is adjusted by the related trimmer (near to the Bnc), mixed to the Shark internally generated signal and output by the MAIN OUT connector. Factory preset: 0 dB gain. This Aux input let you also to extract 19 kHz reference tone from a Mpx injected signal.

10. **Analog Input**: bi-channel output electronically balanced on XLR female. The input level is set through menu.

11. **Digital Data Port**: multi purpose 9 pin optoisolated connector. It supports TTL signals for RDS M/S and TP services and many other TTL signallings.

12. **Analog Data Port**: It support up to 6 analog signals which are available for Telemetry facilities: one is factory preset for internal temperature monitoring. Telemetry data can be alsop carried out on the TDC RDS channel

* available as an option (*AES/EBU* digital IN plug-in)
** available as an option (*AES/EBU* digital OUT plug-in)
*** available as an option (*MPX* plug-in)

5 WIRING AND CONNECTIONS

We suggest to use high quality wires, well protected, and balanced connections to avoid external disturbs.
Make sure that the EARTH connection is good and that earth and audio ground are separated.

5.1   ANALOG AUDIO INPUT

The processor features electronically balanced XLR female inputs.
XLR pinout:

Pin 1	Gnd
Pin 2	Signal
Pin 3	Return

If any balanced connection is possible, please connect the cold pole (Pin 3) to the ground (Pin 1).
Factory preset input impedance is 10 kΩ. Input impedance of 600 Ω is available too, simply setting jumpers on the I/O audio board.

The input level – factory preset to 0 dB – can be adjusted in the +/- 6 dB range (see chapter) Attention: while enabling the digital input, the analogue one is disabled.

EXAMPLE OF UNBALANCED CONNECTION

INPUT

XLR FEMALE

1. GND
2. SIGNAL
3. RETURN
4. EARTH

EXAMPLE OF BALANCED CONNECTION
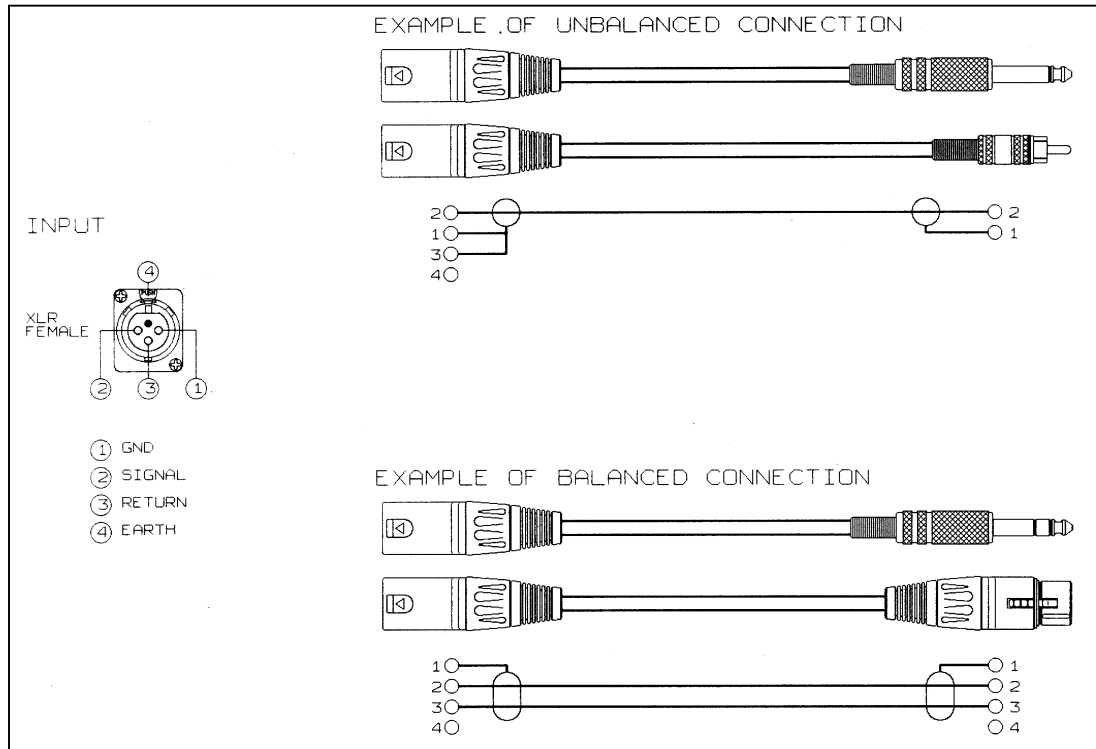
5.2   DIGITAL AUDIO INPUT *

The digital input (available as an option) features two connectors: a coaxial one and a optic one.
Please connect just one connector at a time for a correct equipment operation.
Supported formats are: AES3/EBU, S/PDIFprotocols with sample rate 32KHz, 44.1KHz, 48KHz and 96KHz.

While not used, keep covered the tos-link connector.

The optical input is transformer balanced, and so immune from external disturbs and noise.

XLR pinout:

Pin 1	Gnd
Pin 2	Signal
Pin 3	Return

If case of unbalanced connection (as required by S/Pdif format), please connect the cold pole (Pin 3) to ground (Pin 1).
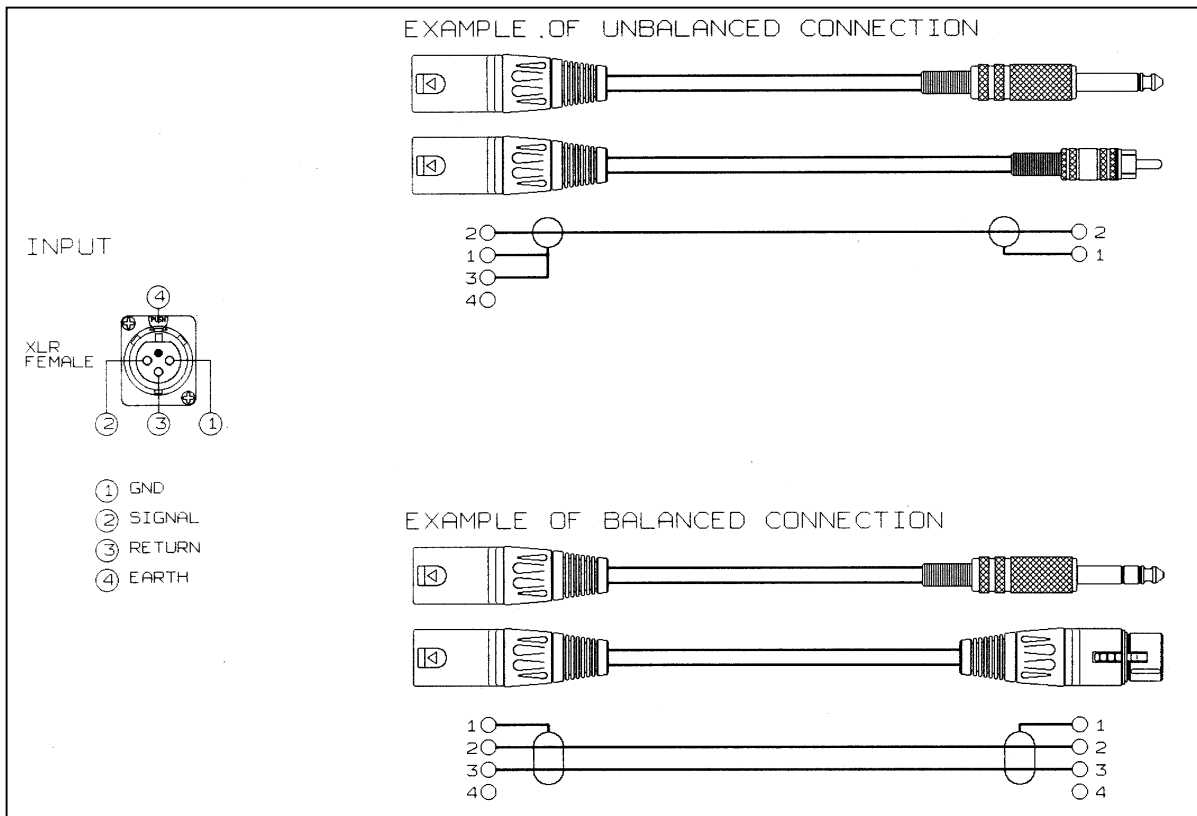
Digital input level is automatically set.

The *Digital Input* enabling is showed by the related front panel led configuration.
Attention: while enabled, the digital input disables the analogue one

The equipment can automatically tune the input digital format (AES EBU, SPDIF, etc) and the connection kind (optical or coaxial).

* available as an option

5.3   AUXILIARY INPUTS (*Aux Input*)

In case of <u>Shark Mpx version</u>, Aux inputs (Bnc connectors, 10 kΩ impedance) are wide band inputs especially designed for the connection to those external equipment (such as RDS coders, SCA generators), whose signals have to be mixed into the Shark Mpx output signal.

If an external RDS coder (or SCA generator) is available, please connect it to Aux 1 (or Aux 2) input while considering that:

- Make sure Shark doesn't generate any own RDS signal in case of external RDS injection.

- The RDS/SCA injection level can be adjusted by means of the related trimmer. Factory preset is 0 dB gain, while tuning range is -∞ ÷ +12dB.

- Standard RDS level is - <u>31.5dBm (≈60mVpp / 2.0 kHz deviation) in respect of 0 dBm MPX level</u>

- You have to separately adjust Stereo Composite signal level, RDS and SCA levels in order to get the right overall multiplexed signal.

In case of Shark <u>RDS version</u>,

- The Aux inputs allow the Mpx injection from an external stero coder. The resultant signal (Rds+ Mpx) is available on the output connector.

- the RDS subcarrier phase can be locked to the external Mpx pilot phase. To get this, provide the Mpx reference signal to the Aux 1 input or, better, provide a 19 kHz TTL signal to the 'Sync In' input.

5.4   *Output connector*

Depending on the Shark version, Output BNC connector (50 Ω impedance) features Stereo Composite signal and/or RDS signal (with or without Mpx signal mixed into).

Please note that:

- Preemphasis can be set at 50 or 75 μsec from Shark menu

- Pilot Phase and Level, Stereo Composite Level and RDS level are settable from Shark menu.

- A reference tone (400 Hz / 0 dBm + pilot tone 19 kHz / - 20 dBm) is available, which identifies maxium frequency deviation.

5.5   *SYNC Out*

SYNC OUT output features a 19 kHz / 5Vpp (TTL), square wave to lock external equipment such as RDS encoders.

5.6   *SYNC In*

Sync In: provide a TTL signal (5 Vpp) to synchronize Shark to an external reference signal.

5.7   SERIAL PORTS

Shark features up to four optoisolated serial ports which allow the RDS programming and the Mpx control either through local - or remote PCs, which can be connected, f.i., via GSM modem, analog modems, satellite data channels*.
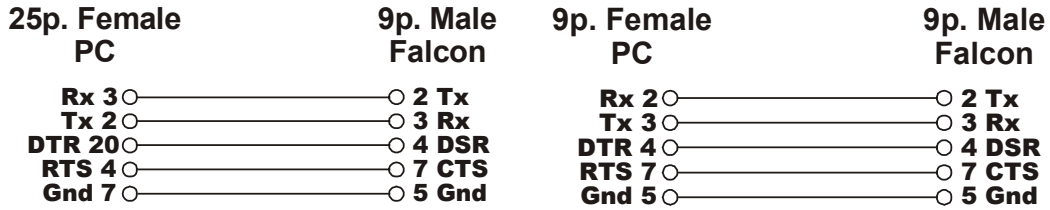
The ports can separately be enabled / disabled from menu

UECP protocol allow the user to assign different rights, data speed, Time out, etc to every

The first serial port is used to up-date Shark firmware and to directly control it from PC. It features the Tx and Rx signals plus the DSR and CTS.
The second serial port is used to connect it to other equipment or satellite receivers and features only Rx and Tx controls.

* Not available on the first firmware version.

25p. Female PC	9p. Male Falcon	9p. Female PC	9p. Male Falcon
Rx 3	2 Tx	Rx 2	2 Tx
Tx 2	3 Rx	Tx 3	3 Rx
DTR 20	4 DSR	DTR 4	4 DSR
RTS 4	7 CTS	RTS 7	7 CTS
Gnd 7	5 Gnd	Gnd 5	5 Gnd

Serial port 1 connections

5.8   DIGITAL DATA Port

Shark digital port supports TTL signals for enabling of TP, TA, M/S RDS coding information.

5.9   ANALOG DATA Port

It support up to 6 analog signals which are available for Telemetry facilities: one is factory preset for internal temperature monitoring. Telemetry data can be alsop carried out on the TDC RDS channel.

6   SHARK MENU

6.1   INTRODUCTION

This chapter shows all the parameters and functions You can set through the Shark front panel (as showed by MENU layer at the following page). It is useful to remark that you can access all the menu settings and parameters also in a faster and more confortable way trough the supplied PC control software, which allows easy and effective remote monitoring and control, too.

How to browse the Shark menu:

Main Menu

The *shuttle* knob allows you to scroll through the main menu choices. The menu structure is similar to a *Windows* menu.

Entering a sub-menu

Once you have selected a main menu item by pressing the knob or pressing the 'Enter' key, you enter the corresponding sub-menus. You can scroll through them turning the knob and press 'Enter' or push the knob to access the second sub-menu layer.

Saving

You can return to the main menu without saving by pressing the *Esc* key or by choosing the '*quit'* option.

Every time you access a parameter or function, Shark displays its current value or status. Alternative values are blinking.
Please note that when a new value is only displayed – even blinking – it is immediately loaded into the equipment processing so that the user can get a real time response.

Having displayed a new (blinking) value, you can save it or discard it.

- Press *Enter* a first time to enter the *Save* function and then a second time to confirm

- Press *Esc* to quit the menu without saving and get the upper menu layer.

You can access all the menu settings and parameters also in a faster and more confortable way trough the supplied PC control software, which allows easy and effective remote monitoring and control, too.

6.2   **MENU LAYOUT**

- Preset

- Serial Module
  - RS232 Serial1 ——— Serial ON / Serial OFF
  - RS232 Serial2 ——— Serial ON / Serial OFF
  - RS232 Serial3 ——— Serial ON / Serial OFF
  - RS232 Serial4 ——— Serial ON / Serial OFF

- MPX Module
  - Pilot Level ——— OFF, -17.25 to -23 dB, 0.25 dB step
  - Pilot Phase ——— -6.0 to 6.0 Deg, 0.5 Deg step
  - MPX Level ——— -6.0 to +15 dBm, 0.1 dB step
  - Clipper THR. ———
  - Preenphasis ——— OFF, 50μsec, 75μsec

- RDS Module
  - RDS level ——— 0 ÷ 12000 mVpp
  - RDS Phase ——— -180 ÷ +180 Deg
  - EXT Pilot Lock ——— Locked / UnLocked

- Digital Input Module —— Dig. Input ON / Dig. Input OFF

- StrEnH Module
  - Effect Delay ——— 0 to 30 msec
  - Effect Band ——— 3KHz / 5KHz / 8KHz to 15KHz
  - Effect Level ——— -40 to -10 dBu
  - Effect Gate ——— -40 to -10 dBu
  - Effect Attach Time —— 100 msec to 3 sec

- Limiter Module
  - Limiter ——— Limiter ON / Limiter OFF
  - AGC Gate ——— -40 ÷ -10 dB
  - AGC Hold ——— 0 ÷ 5 sec
  - AGC Speed ——— OFF, 0 ÷ 1 dB
  - Density ——— 0 ÷ 3 dB

- Optional Control
  - Temperature
  - Firmware Code
  - Firmware
  - Display References

- Analog Input Gain —— -6.0 to 6.0 dB, 1 dB step

- Output Mode
  - Normal Opertaion
  - Peak Reference Tone
  - Processor Bypass

6.3   SERIAL PORT ENABLING (*Serial ports*)

The **Serial Ports** module displays the serial port status and allows their enabling / disabling.

Please note that:

- The serial ports are by default enabled

- Firmware upgrade and remote control are possible only with enabled ports.

- **Serial Ports** acces doesn't affect normal equipment operating

Having got this feature inside the **Optional Controls** sub-menu, through the shuttle knob you can select / modify:

- Port status: **RS 232 Serial 1**   **Off:** port disabled / **On:** port enabled
                                    RS 232 Serial 2   **Off:** port disabled / **On:** port enabled
                                    RS 232 Serial 3   **Off:** port disabled / **On:** port enabled
                                    RS 232 Serial 4   **Off:** port disabled / **On:** port enabled

To save a new preset, firstly press Enter to enter the Save function and then a second time to confirm

Press Quit to escape the menu without saving and get the upper menu layer

Press Quit again to get the upper menu layer.

6.4   MPX SIGNAL SETTING *(MPX Module)*

MPX Module menu allows you to set all the parameters needed for stereo broadcasting: phase and level of 19 kHz pilot tone, preemphasis time, overall MPX signal level, clipper threshold.

Having got this feature inside the menu root, through the *shuttle* knob you can select / modify:

- **Pilot Level**. Default level is – 20 dB in respect of MPX signal. It can be adjusted from -26dB to -14dB (0.25 dB step). Pilot tone can be also disabled, by turning the knob anticlockwise up to get the *Off* option .
  NOTE: Front panel *warning* led switchs on if pilot level offset exceeds 2 dB in respect of its standard value (-20.00 dB).

- **Pilot Phase**. Default level is 0.0 Deg**.** It can be adjusted in the -6.0 ÷ +6.0 Deg range (0.5 Deg step).
  NOTE: Front panel *warning* led switchs on if pilot phase offset exceeds 4.5 Deg in respect of its default value (0.0Deg).

- **Clipper Threshold**

- **MPX (Stereo Composite) Level**. Default level is 0 dBm (2.2. Vpp). It can be adjusted in the - 6 to +15 dBm range (0.1 dB step).

- **Preemphasis time:**
                        75uSec On / 75uSec Off
                        50uSec On / 50uSec Off

To save the changes, firstly press Enter to get the Save function and then a second time to confirm

Press Quit to escape the menu without saving and get the upper menu layer

Press Quit to get the upper menu layer.

6.5   DIGITAL INPUT ENABLING *(DigInp Module)*

You can enable / disable the audio digital input by means of **DigInp Module** menu.

The digital input can be connected in two ways: through a balanced XLR connector or a standard fiber optic connector. This input supports AES3/EBU, S/PDIF, IEC60958, EIAJCP1201 protocols with 32KHz, 44.1KHz, 48KHz, 96KHz sample rate. The digital input does not require any special setting since Shark can recognize the injected digital signal and configure it shelf automatically.

Please note that:

- Digital input comes disabled even if purchased.

- Use only one connector type (coaxial or optic) at a time to avoid bad equipment operating

- Digital input enabling is showed by front panel leds.

- while digital input is enabled, the analogue one is disabled.

- Digital input level is not adjustable

Having got this feature inside the menu root, through the *shuttle* knob you can select / modify:

- **Digital Input** status:

Digital Input Off or Digital Input On.

To save the changes, firstly press Enter to get the Save function and then a second time to confirm

Press Quit to escape the menu without saving and get the upper menu layer

Press Quit to get the upper menu layer.

6.6   RDS SIGNAL SETTING *(RDS Module)*

Shark-generated RDS signal level and phase can be adjusted by means of **RDS Module** menu.

Having got this feature inside the menu root, through the *shuttle* knob you can select / modify:

- **RDS signal Level.** Default level is 58 mVpp. It can be adjusted in the 0-12000 mVpp range (10 mVpp steps). RDS signal can be also disabled, by turning the knob anticlockwise up to get the *Off* option .

- **RDS signal phase.** Default level is 0.0 Deg**.** It can be adjusted in the -180 ÷ +180 Deg range (1 Deg step).

To save the changes, firstly press Enter to get the Save function and then a second time to confirm

Press Quit to escape the menu without saving and get the upper menu layer

Press Quit to get the upper menu layer.

NOTE: The Shark menu allows only RDS signal level and phase setting. RDS messages programming and all the other related facilities requires the supplied Pc control software. RDS signal is mixed together the Stereo Composite signal into MPX signal and it can not be available separately.

6.7   ANALOG AUDIO INPUT LEVEL SETTING *(Gain Offset)*

The gain factor on analog audio input can be adjusted by means of the **Input Calibration** menu.
The gain factor affects only ỳíthe analog input (as the digital one is automatically set).

Having got this feature inside the menu root, through the *shuttle* knob you can select / modify:

- **Gain Offset**. Default level is 0 dB. It can be adjusted in the + /- 6 dB range (0.5 dB steps).

To save the changes, firstly press Enter to get the Save function and then a second time to confirm

Press Quit to escape the menu without saving and get the upper menu layer

Press Quit to get the upper menu layer

6.8   OPERATING MODE (*Operating Mode*)

Operating Mode menu allows you to select different equipment operating modes.

Choose this option inside the menu root. By turning the *shuttle* knob you can select:

- **Normal operation:** allows the normal equipment operating.

- **Peak Reference Tone.** 400 Hz / 0 dB tone + 19 kHz / - 20 dB pilot tone are output**. They allow to identify the maximum output level, which corresponds to the maximum deviation peak. *Warning* led is switched on.

- **Processor ByPass:** all the processing circuits are disabled. It allows tests and reference measurements. *Warning* led is switched on.

To save the changes, firstly press Enter to get the Save function and then a second time to confirm

Press Quit to escape the menu without saving and get the upper menu layer

Press Quit to get the upper menu layer

** Pilot signal can be disabled by selecting Off option inside Mpx module menu before enabling Peak reference Tone mode.

6.9   AUXILIARY DATA (*Optional Controls*)

Optional Controls menu groups the view-only following data:

6.9.1 *Firmware Code*

Firmware Code sub-menu shows firmware serial code. The user might have to communicate it to the manufacterer in order to get some new facility.

Press Quit to get the upper menu layer

6.9.2   Temperature

Temperature sub-menu shows the equipment internal temperature.

Current temperature value is updated every time you enter this option. We suggest to control temperature after a few hours operation.

An operating stop is automatically enabled when temperature exceeds 55 °C.

6.9.3   Firmware version

Firmware Version sub-menu shows the current version of Yr Shark firmware.

Press Quit to get the upper menu layer

6.9.4   Display References

Display References sub-menu shows in a cyclic mode the name and the operating range of every element displayed during normal Shark operation.

After that, the default display screen is restored. Press Esc or Enter to abort the display before its end.

7 THE PC CONTROL SOFTWARE

7.1 INTRODUCTION

BSN - Broadcast System Navigator is the powerful and reliable software running on Windows 95, 98 and NT platforms and specially conceived for SHARK equipment remote/direct programming and control.

The software screen reproduces in an effective and intuitive way all the controls and the settings already available from the front panel menu and integrates them with new and useful functions orientated to the remote programming; i.e., it is possible to give a specific name to every equipment (*Target name*) and to assemble them into groups (*Group name,* i.e. corresponding to a region), so to enable a selective programming of them.

Easy to install on every PC even of not recent generation, the software can operate in accordance with two different ways.

The first one is named **bidirectional (or local),** as it allows either the visualization in real time of the processor current configuration or its modification.

This modality is useful every time you need a direct and complete equipment control and it needs a serial bidirectional connection (with "return channel") to the equipment.

Examples of typical applications:

- the equipment configuration directly in the transimitting site, for example by means of a portable PC (notebook)

- the remote control through one of the PC already installed in the control room or in the broadcasting room (on condition that the connection serial cable does not exceed 20 meters length)

The **second connection mode** is named **unidirectional** as it doesn't involve any return channel. It is possible to send commands to the equipment from remote siting, but it is not possible to have neither a remote monitoring of the machine, nor a confirmation of well reception of controls.

The typical application is the centralized control - via satellite - of equipment installed in different transmitting sites.

The Send button showed in each window allows you to send to the Shark the changes, once you have configured them on the BSN screen.

The **software** is available in two versions

The **Basic version** (or **Limited**) is supplied free together with the equipment. It allows different facilities, such as the remote visualization of all parameter levels and the RDS section programming. Except for RDS, every parameter edit or configuration change is hovewer disabled.

The **second version** (named **Extended**) allows the complete control of every functionality without any restriction. The passage from the Basic version to the Extended one does not require any new software installation, but only the connection on the PC parallel port of a special "hardware key" available only on payment

7.2   SET UP OF PC CONTROL SOFTWARE

- Close all the applications opened on PC

- Run the file SETUP.EXE

- The set up will continue in a totally automatic way asking only the name of the folder that will be visualized in the 'Programs' menu. Please accept the creation of a new folder in the default position.
- Once installed the program *Shark – Remote Control* will be executed starting from Menu 'Programs' .
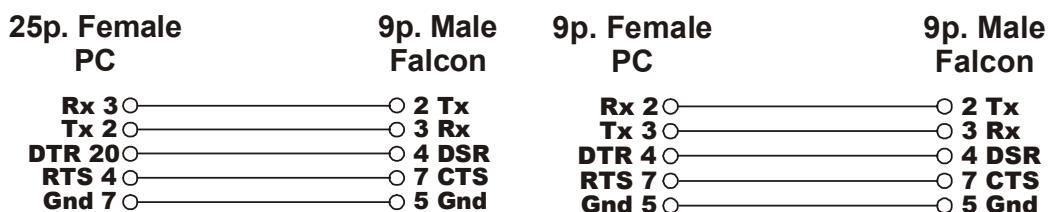
7.3   UPGRADE PROCEDURE OF PC CONTROL SOFTWARE

When required, the software can be updated with the last version available.
To do this, it is firstly necessary to uninstall the existing version.

- enter the Windows "Control Panel"

- click on the " Application Set up " icon

- choose the "equipment item in the list and select it

- click on the "Add/Remove" button

- confirm deleting of all the proposed files

- install the new software version as described in the previous paragraph.

7.4   PC CONNECTION

Connect the Pc to one of the available serial ports.

Wiring diagrams are:

25p. Female PC	9p. Male Falcon	9p. Female PC	9p. Male Falcon
Rx 3	2 Tx	Rx 2	2 Tx
Tx 2	3 Rx	Tx 3	3 Rx
DTR 20	4 DSR	DTR 4	4 DSR
RTS 4	7 CTS	RTS 7	7 CTS
Gnd 7	5 Gnd	Gnd 5	5 Gnd

For connections use standard serial cables pin to pin type. Cable lenght must not exceed 20 mt.

Always close the control program before removing the connection. In case the front panel operation is freezing, switch off and switch on the equipment.

Please note that the serial ports are by default enabled. In case of their enabling or status control, please follow the steps indicated at paragraph

7.5 SOFTWARE CONFIGURATION

The BSN software allows You to control every single SHARK unit through a Windows-like directory/subdirectory tree layout that You can configure.

Run the program. Select the User access (f.i. User 0): the related access panel is automatically showed.
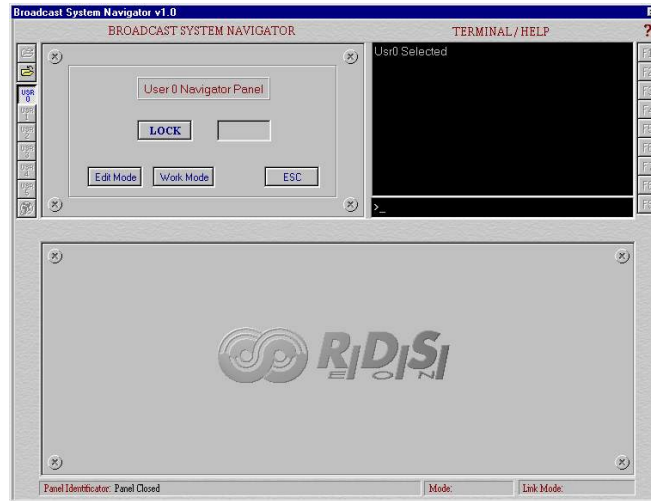

Please note that Shark BSN (Broadcast System Navigator) software allows to choose among **different users**, each one having different access rights to the system.

The '**Lock**' function allows you to avoid every access to processors menu through its front panel controls.
The panel block/unblock is achieved only through the Pc control software: you have to enter a generic password (you have to choose it!) in the Lock mask and click on the related button. To unlock, enter the SAME password and press 'unlock'.
The password can be so modified at every access.
If you have the rights, you can also choose an **edit mode** or **a work mode**. The first allows to create the system tree (i.e.: group the equipment into groups which share the same communication channel, define the programming capabilities of each one, etc). The second mode (Work mode) allows the physical access to a single equipment in order to control and program it.
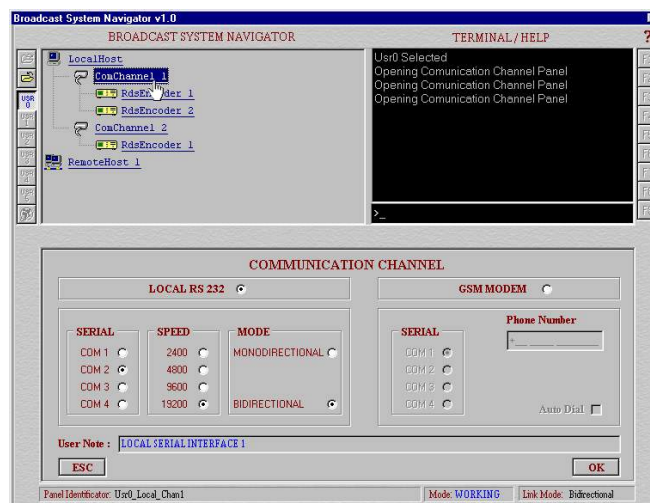

Communication Channel setup

Having displaced the "equipment" into a tree-like structure (also named "broadcast system"), you have to configure the first communication channel (which allows the control of RDS Encoder 1 and 2) and then all the others (Comchannel 2, 3 etc).
The first communication channel can be a serial link, a satellite link, etc. Furthermore, It can be bidirectional or monoidirectional and supports different Baud Rate.
F.i., we configure channel 1 as serial, bidirectional, related to Serial Port 2 of our PC (COM 2) and able to support maximum data speed.

Please note that also a GSM channel could be available: in this case, you have just to enter the modem phone number to establish a link with the target encoder.

Having correctly configured the communication channel, you can select the Encoder to be controlled. By clicking on the related item (f.i. RDS Encoder 1), the main programming screen will be displayed (please note that a Bidirectional link is established, so that encoder current configuration are remotely available).
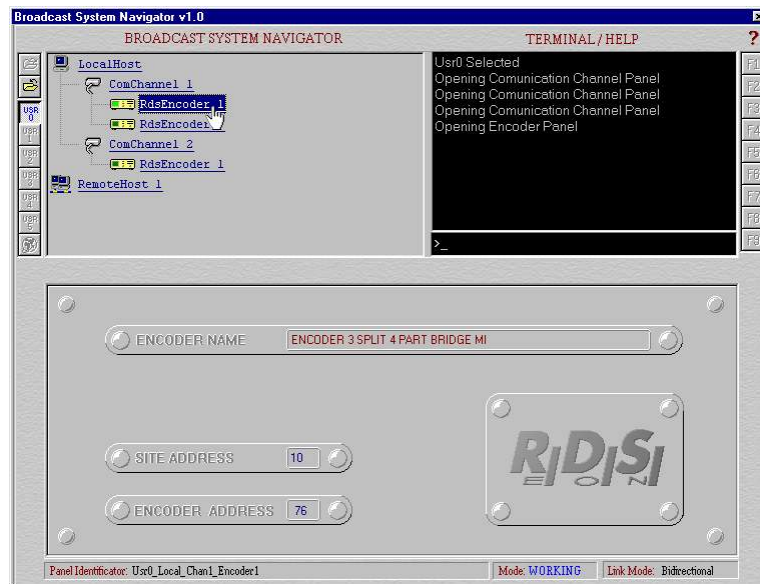
Each equipment is characterized by an its own address (see Encoder Address) and by a Site Address (f.i. related to the geographic site where is installed). In order to facilitate user access, an alphanumeric code can be associated to the numerical Encoder Address, too (f.i. Encoder 3 split 4 part bridge MI).

The next screen is related to the main encoder parameters.

The *Setting* screen allows:

- modification of Identification parameters (Site and Encoder Address) and of Encoder name.
- modification of Telemetry parameters (enabled / disabled, sampling frequency, data automatic average).
- modification of Preemphasis time
- enabling of a reference tone for a modulation test.

Having set some new option into the mask, the *Send* button allows to update the local or remote equipment
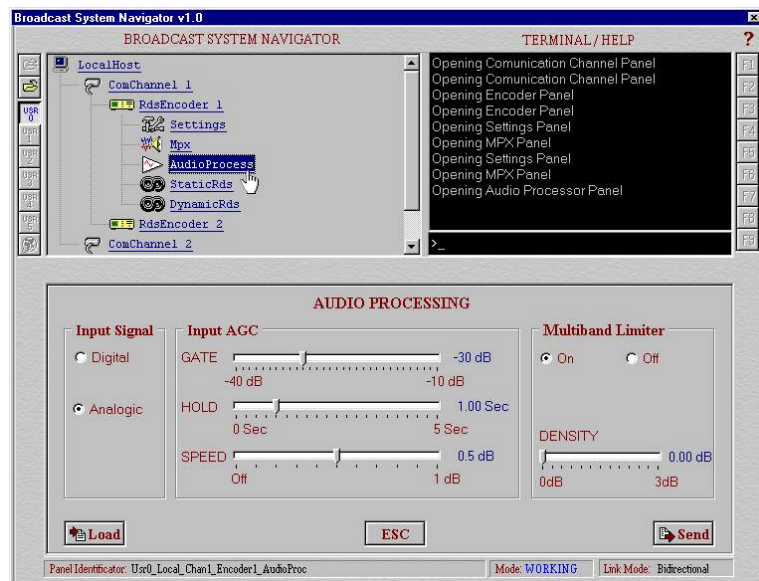
7.6   MPX PLUG SETUP
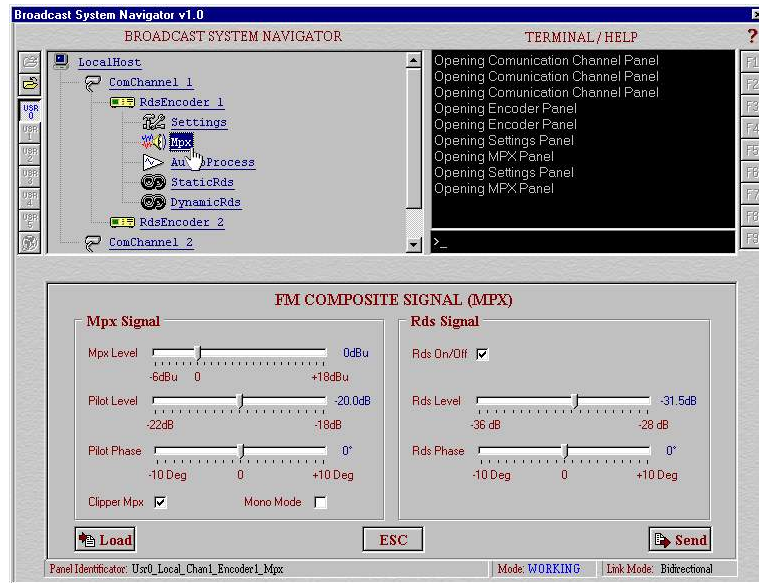
MPX window

The MPX window allows the modification of all the general parameter related to Stereo Coding and to RDS encoding (levels, phase, etc).
Please note that MPX Clipper and RDS signal can be enabled/disabled is also possible.

7.7   LIMITER PLUG SETUP

Audio Processing / Limiter window

The Audio Processing window allows you to configure all the parameters related to the Shark audio section The Audio Processing window is mainly related to the Shark **Limiter** plug.

You can select the audio input (analog or digital), adjust three AGC operating parameters (the Gate threshold, the Hold time and the Speed), enable/disable the 5 band Limiter operation and modify the signal density into the 0 –3 dB range.

7.8   STATIC RDS PROGRAMMING – RT CLOCK

The next window is related to the Static RDS facilities. By clicking on the related ICON, a multiple layer sub-tree will be displayed, which presents the Real Time Clock setting panel and many folders (named General Purpose) which are mainly related to EON facilities and to the setting of the target Encoder.
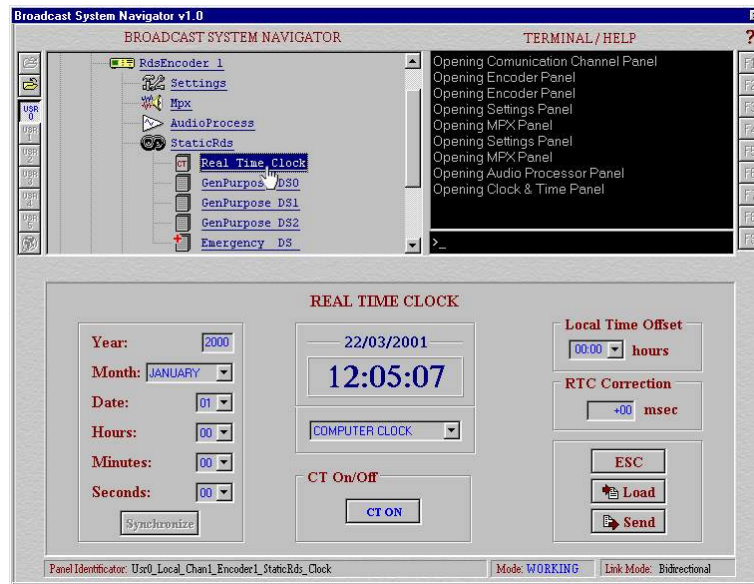
Static RDS window

Shark internal clock can be synchronized to the PC clock or to the time and date entered in the related mask (on the left).

The selection between these two synchronisation mode is achieved through the related menu, at the center of the screen.

Please note that you can set a 'time offset' in respect of the current time in order to consider the connection delay and a Local Time offset in case of different time zone.

Clock and Time information can be carried by the RDS signal by activating the related button (CT On).

7.9   GENERAL PURPOSE DATA SET

As per UECP standard protocol, the RDS general settings are grouped into many General Purpose DS (Data Set), each one containing two sub-preset menu: the Main PS one (related to the radio station broadcasting the tuning frequency) and the EON one (related to programme services other than the one received).

Main PS presents many sub-menu windows: Basic Services, Alternative Frequencies, RtEdit, PinPtyEdit, PsnEdit, Scheduler.
NOTE: Shark sw allows to set for each equipment up to four indipendent General Purpose Data Set, each one
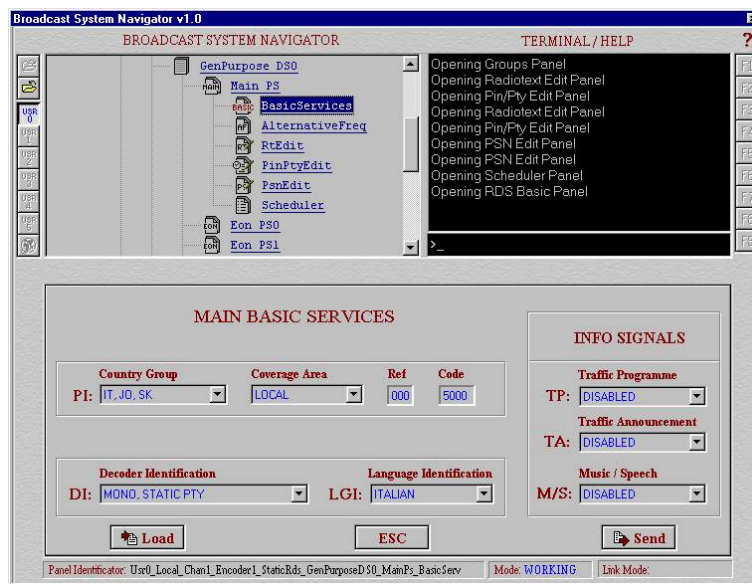
Static RDS- Main programming window

having its scheduling window, its PS editor, and so on..)
Must be noted that Shark supports either services and facilities fully compliant to EUCP protocol, or "custom" facilities wich have been introduced by Axel Technology in order to expand the system flexibility (f.i., UECP doesn't include any Scheduling task..). Features UECP compliant features are generally named as "MAIN XX" .

The first window is named *Basic Services* and allow to set:

PI - Programme Identification
This information consists of a code enabling the receiver to distinguish between countries, areas in which the same programme is transmitted, and the identification of the programme itself. The code is not intended for direct display and is assigned to each individual radio programme, to enable it to be distinguished from all other programmes. One important application of this information would be to enable the receiver to search automatically for an alternative frequency in case of bad reception of the programme to which the receiver is tuned; the criteria for the change-over to the new frequency would be the presence of a better signal having the same Programme Identification code.
PI code contains four hexadecimal numbers (see 'Code' box): the first one assigns the broadcast country and it is automatically provided from the SW clicking the country acronyms (see Country Group). The second hexadecimal number assigns the coverage area profile (i.e. national , local etc.) Click on the most suitable item inside the Coverage Area window and the application provides the hexadecimal corresponding number. The window 'Ref' contains a number from 1 to 255 (normally assigned from the law authorities to the broadcaster). If the entire hexadecimal code is already known, you can enter it into the 'Code' box.

DI - Decoder Identification and dynamic PTY indicator
These bits indicate which possible operating modes are appropriate for use with the broadcast audio and to indicate if PTY codes are switched dynamically.

TP - Traffic Programme identification
This is a flag to indicate that the tuned programme carries traffic announcements. The TP flag must only be set on programmes which dynamically switch on the TA identification during traffic announcements. The signal shall be taken into account during automatic search tuning.

TA - Traffic announcement identification

This is an on/off switching signal to indicate <u>when a traffic announcement is on air</u>. The signal could be used in receivers to:

a. switch automatically from any audio mode to the traffic announcement;
b. switch on the traffic announcement automatically when the receiver is in a waiting reception mode and the audio signal is muted;
c. switch from a programme to another one carrying a traffic announcement, according to possibilities available through EON.

After the end of the traffic announcement the initial operating mode will be restored

Shark allows two different remote TA switching commands:

1. External TTL signal provided through the Digital Port
2. External Serial command provided through a Serial Port to be selected (ref to UECP protocol)

M/S - Music/Speech switch

This is a two-state signal to provide information on whether music or speech is being broadcast. The signal would permit receivers to be equipped with two separate volume controls, one for music and one for speech, so that the listener could adjust the balance between them to suit his individual listening habits.

Shark allows two different remote M/S switching commands:

3. External TTL signal provided through the Digital Port
4. External Serial command provided through a Serial Port to be selected (ref to UECP protocol)

7.9.1   ALTERNATIVE FREQUENCIES LISTS
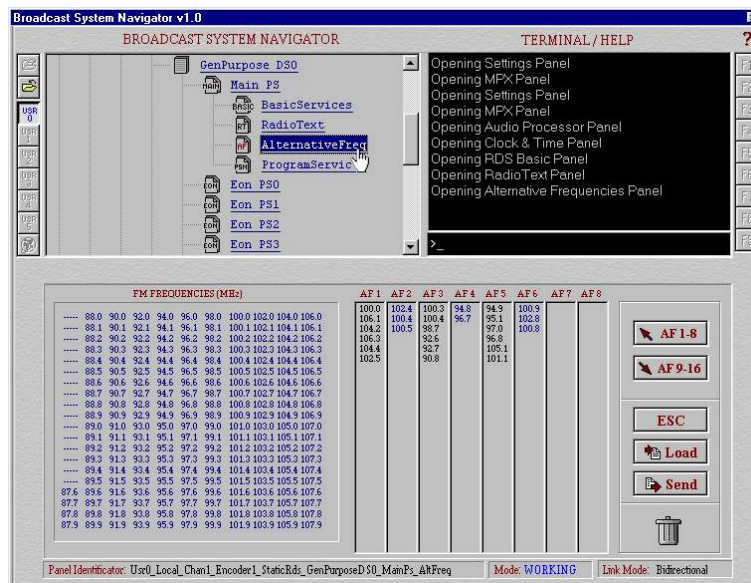
Alternative Frequency window

The list(s) of **alternative frequencies** give information on the various transmitters broadcasting the same programme in the same or adjacent reception areas, and enable receivers equipped with a memory to store the list(s), to reduce the time for switching to another transmitter. This facility is particularly useful in the case of car and portable radios.

The alternative frequencies (AF) list can be transmitted following two methods: A Method and B Method.
In both methods the alternative frequencies lists must contain only the frequencies of the adjacent transmitters and repeaters with overlapped transmitting areas.

Practically, the A method is applied for a list not exceeding 25 frequencies while B method is applied for the lists exceeding 25 frequencies. B method is recommended when splitting areas or different programmes are broadcast.

Note: A or B encoding method is not explicitly assigned by a dedicated signal broadcast to receiver, but the receiver itself is able to identify the method analyzing the transmitted data structure (organization 'by pairs' or not).

A METHOD

As above, this method is the simplest one and it is applied for a small number (up to 25) of alternative frequencies.

Compile the AF1 list assigning, in the first position, the tuning frequency (i.e. the frequency carrying the list of alternative frequencies) and then enter, in the strictly increasing order, the alternative frequencies transmitting exactly the same program.

We suggest to load, in different AF lists, the alternative frequencies related to adjacent transmitters and repeaters with overlapped transmitting areas, too, paying attention that the first frequency assigned be the frequency carrying the list of alternative frequencies.

Example: Consider the above figure situation. It shows three transmitters (B, D, E) having two overlapped transmission areas (between B and D and between D and E).
The lists of each transmitter should be the following :
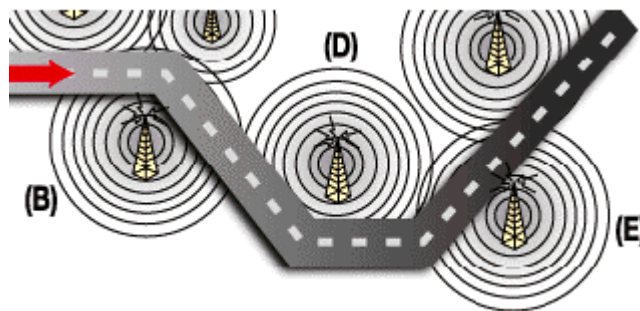
The AF list broadcast by Transmitter B will be:

Tx B (*Tuning frequency* : f Tx B)	AF1	AF2	Note: Transmitter C frequency is not present in the list.looking that C coverage area do not overlap A transmitter's coverage area
	f Tx B, f Tx D	f Tx D, f Tx B	

The AF list broadcast by Transmitter D will be:

Tx D (Tuning frequency : f Tx D)	AF1	AF2	AF3	Transmitter's D coverage area is partially overlapped from Tx B and Tx E ones so you must load the lists of both adjacent transmitters. Pay attention that, inside each list, the frequencies following the tuning one being in increasing order
	f Tx D, f Tx B, f Tx E	f Tx B, f Tx D	f Tx E, f Tx D	

The AF list broadcast by Transmitter D will be:

Tx E (Tuning frequency : f Tx E)	AF1	AF2	Note : It is not assigned in the list the transmitter B frequency looking that its transmitting area do not overlap E transmitter's coverage area.
	f Tx E, f Tx D	f Tx D, f Tx E	

To compile the AF lists use the following procedure:

- Choose one of the 16 lists (from AF1 to AF16)
- Select the AF from the available frequencies in the left window and follow the drag & drop procedure to load them into the AF list
- To remove a frequency from the list follow the procedure drag & drop to move to recycle bin or cancel them by pressing on the 'Cancel' button.
- Lists containing at least one AF are showed in blu color.

B METHOD

B method is used with more then 25 AF and when the transmitter diffuse also the frequencies carrying different scheduled programs (splitting, local programs etc.)
Before to switch to another frequency, the mobile receiver should check if the AF diffuse the same program as the tuning frequency.

Every list begins with a tuning frequency and continues with until 12 frequency couples each containing the tuning frequency and an alternative frequency. If there are more then 12 possible alternative frequencies the list will be continued in another list.

The order of the frequencies inside each couple follow the following rule :

- An increasing order of the frequencies is used if the alternative frequency diffuse the same program as the tuning frequency.
- A decreasing order of the frequencies is used if the alternative frequency and the tuning frequency diffuse different programs.

- In the following example are considered five AF, coupled with tuning freq. (89.3 MHz) and ordered to inform the receiver about the carrying program (the same program or different ones in the different hours of day).
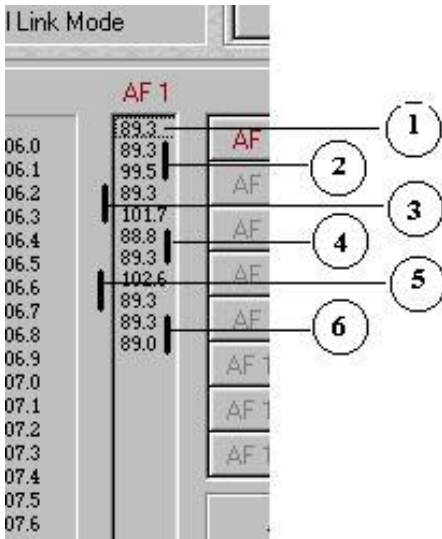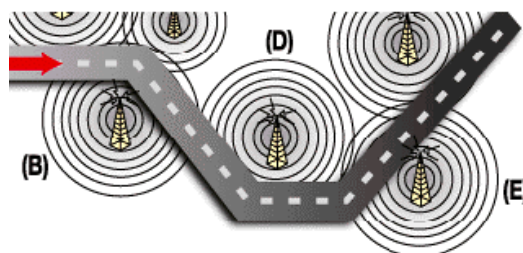

1. 89.3 is the *tuning frequency*

2. . 99.5 is an AF.There is an increasing order inside the couple i.e. alternative and tuning frequencies transmit the same program

3. 101.7 is an AF. There is an increasing order inside the couple i.e. alternative and tuning frequencies transmit the same program.

4. 88.8 is an AF. There is an increasing order inside the couple i.e. alternative and tuning frequencies transmit the same program

5. 102.6 is an AF. There is a decreasing order inside the couple i.e. alternative and tuning frequencies transmit different programs.

6. 89.0 is an AF . There is a decreasing order inside the couple i.e. alternative and tuning frequencies transmit different programs.

Reconsider now the example of B, D E transmitters in the figure (the B and E transmitting area are not overlapped). Considering B method criteria and probable different programs in the alternative frequencies, two lists must be assigned in the B transmitter.

	AF1	AF2	
Tx B (tuning frequency f Tx B)	f Tx B,	f Tx D,	The B transmitter. tuning frequency appears twice in AF1 list: in the first position as a tuning frequency and then as a couple with fTxD.
	f Tx B,	f Tx D,	If f TxB<f TxD transmitters B and D diffuse the same program If f TxB>f TxD the programs are different.
	f Tx D	f Tx B	

The AF lists concerning the other transmitters are compiled following the same criteria.

Note :

If the same tuning frequency is used from more then one transmitter inside the same network, the corresponding AF lists must not be consecutive (i.e. AF1 and AF2). They must be interrupted from the list(s) concerning different tuning frequencies.

To compile the AF lists considering B method use the following procedure :

Choose one of the 16 lists (from AF1 to AF16).
Select the AF from the available frequencies in the left window and follow the drag & drop procedure to move them at AF list.
Apply the procedure drag & drop to remove a frequency from frequencies list to the recycle bin. You can use also 'Cancel' button.
The lists containing at least one frequency (not empty ones) are blue highlighted.

7.9.2   RADIO TEXT EDIT
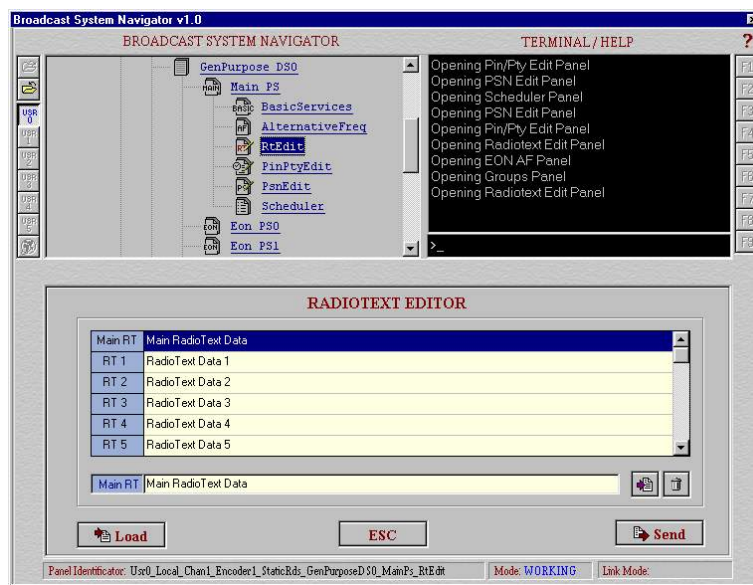
Radio Text window

By selecting the Radio Text window, up to 16 Radio Text messages can be entered, each one having up to 64 characters (spaces included). This refers to text transmissions, primarily addressed to consumer home receivers, which would be equipped with suitable display facilities.
This feature can be used to display cyclic messages. The first raw (MAIN RT) is referred to the Radio Txt message wich only can be programmed through the UECP protocol.
RT messages can be scheduled through the Scheduler window (see).

7.9.3 PIN PTY EDIT
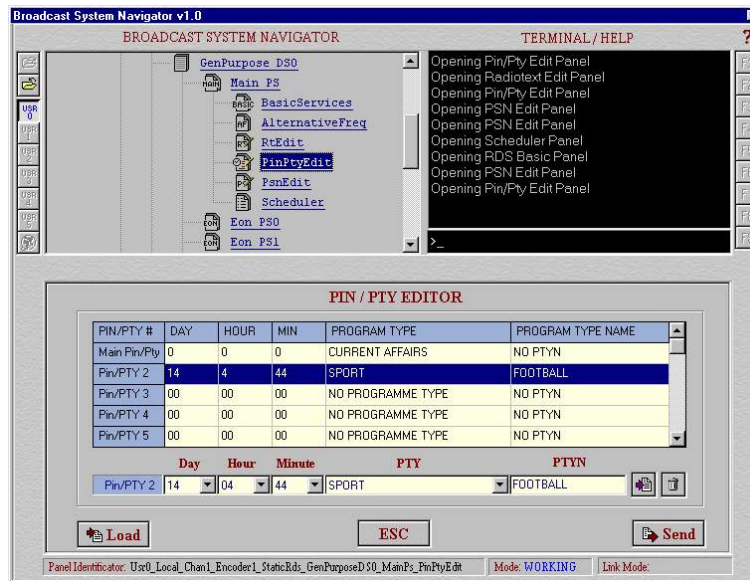
PIN / PTY EDITOR allows you to set up to 32 different Pin / Pty / Ptyn items.

For each PIN/ PTY couple, you can set the PIN Time / Date reference, select the Program Type and the Program Type Name (which is a specification of PTY).

Every time you select a raw in the upper part of the screen , it will be reported in the lower one (editing mask). Having edit the item, you can load (confirm it) or discard it.
PIN/PTY items can be scheduled through the Scheduler window (see).

PIN - Programme Item Number
> The code should enable receivers and recorders designed to make use of this feature to respond to the particular programme item(s) that the user has preselected. Use is made of the scheduled programme time, to which is added the day of the month in order to avoid ambiguity.

PTY - Programme Type
> This is an identification number to be transmitted with each programme item and which is intended to specify the current Programme Type within 31 possibilities. This code could be used for search tuning. The code will, moreover, enable suitable receivers and recorders to be pre-set to respond only to programme items of the desired type. The last number, i.e. 31, is reserved for an alarm identification which is intended to switch on the audio signal when a receiver is operated in a waiting reception mode.

PTYN - Programme TYpe Name
> The PTYN feature is used to further describe current PTY. PTYN permits the display of a more specific PTY description that the broadcaster can freely decide (eg PTY=4: Sport and PTYN: Football). The PTYN is not intended to change the default eight characters of PTY which will be used during search or wait modes, but only to show in detail the programme type once tuned to a programme. If the broadcaster is satisfied with a default PTY name, it is not necessary to use additional data capacity for PTYN. The Programme Type Name is not intended to be used for automatic PTY selection and must not be used for giving sequential information.

7.10   PSN PROGRAMMING
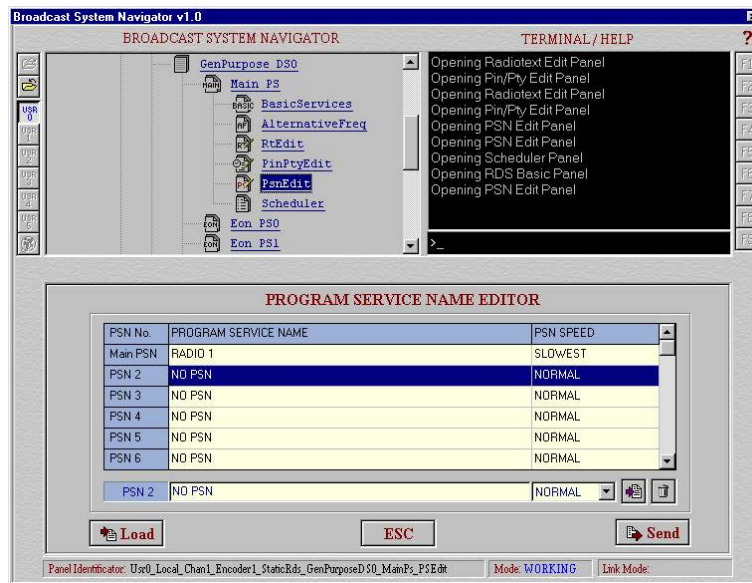
PSN Editor window

The message contains up to 64 words with 8 characters each one.
As explained, UECP standard provides for only One PSN word of 8 char. (MAIN PSN item). You can create PSN sequences through the Axel Technology's schduler facility (see). In this case, the visualization rate of each word is set though the PSN Speed menu (providing five options: slowest, slow, normal, fast, fastest).

7.10.1 SCHEDULER
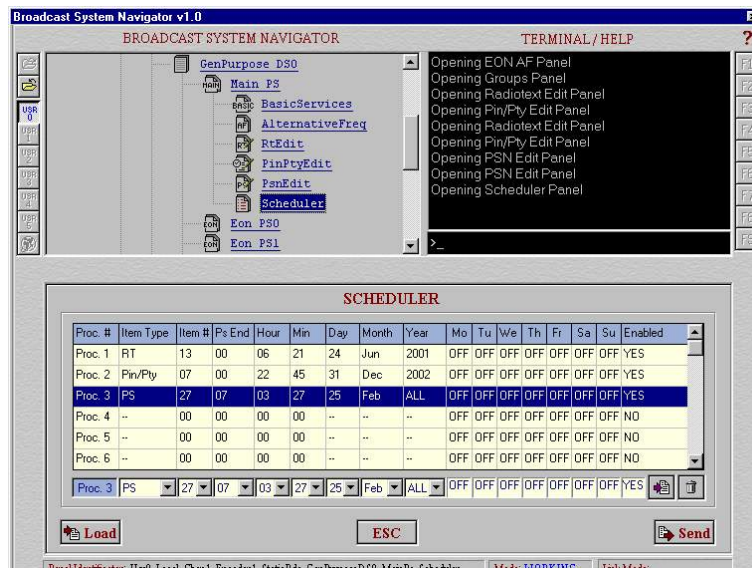
Th sechduler window allows you to schedule PTY, PSN and RT messages (Item Type column).
You can set up to 64 different events (f.i. PSN enabling/disabling) spanned on different years.
The screen here above shows you three events (Process). The first is a radio text enabling: Message number 13 is broadcast beginning from 06:21 of June, 21th 2001. As we set a specific day (24th of June) the scheduling mask based on week days is disabled. The last option in the raw is referred to the general status (enabled / disabled) of the event.

In case of PSN messages, you are allow to create PSN word sequence by setting the first word number (Item #) and the last word number (PS End).

F.i. if the PSN message to be broadcast is "RADIO LONDON INTNL" (i.e. , it is a sequence of three words), you have to enter the first word in PSN editor window, Raw 1 (as Main PS), the second into Raw 2 (PSN 2) and the third into Raw 3 (as PSN 3). Furthermore, you have to set the display speed for each one.

To broadcast the whole sequence, you select PS as Item type, Item # = 1 and PS End = 3.

Please note that:
- Scheduling window can be disabled if You can use only strictly UECP-compatible facilities
- An event will be broadcast lasting in the taime beginning from the scheduled time untill a new scheduled event will replace it.
- Some events (as a 'Merry Christmas' message) can be scheduled as 25 of Dec Years = ALL (they are not refered to a particular year).

7.11   EON (Enhanced Other Networks) PROGRAMMING

This feature can be used to update the information stored in a receiver about programme services other than the one received. Alternative frequencies, the PS name, Traffic Programme and Traffic Announcement identification as well as Programme Type and Programme Item Number information can be transmitted for each other service. The relation to the corresponding programme is established by means of the relevant Programme Identification. Linkage information, consisting of four data elements, provides the means by which several programme services may be treated by the receiver as a single service during times a common programme is carried. Linkage information also provides a mechanism to signal an extended set of related services.
The enhanced information about other networks consists of a collection of optional RDS features relating to other programme services, cross-referenced by means of their PI codes. Features which may be transmitted using EON for other programme services are: AF), PIN, PS, PTY, TA, TP and Linkage .
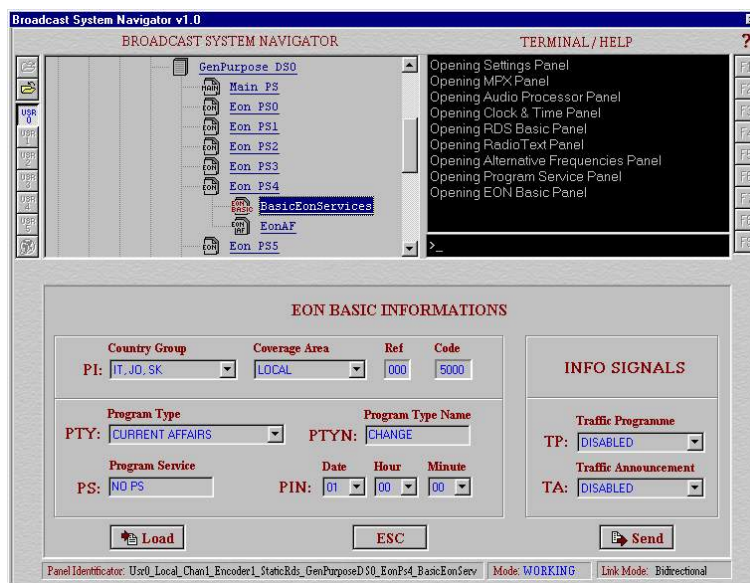

EON basic setting

EON basic setting window presents several facilities already present in the Main PS window (refer to Par. 7.9).

EON AF window regarding A Method is very similaro the Main AF window:
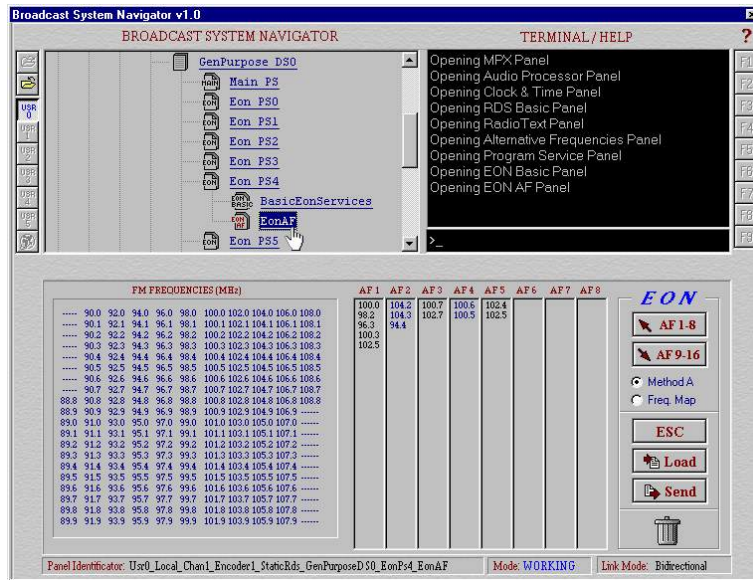
EON AF Method A

Attention is drawn to the fact that two distinct options, namely AF method A and the Mapped Frequency Method, exist for the transmission of frequencies of cross-referenced programme services. A broadcaster should choose the most appropriate AF method for each cross-referenced programme service.
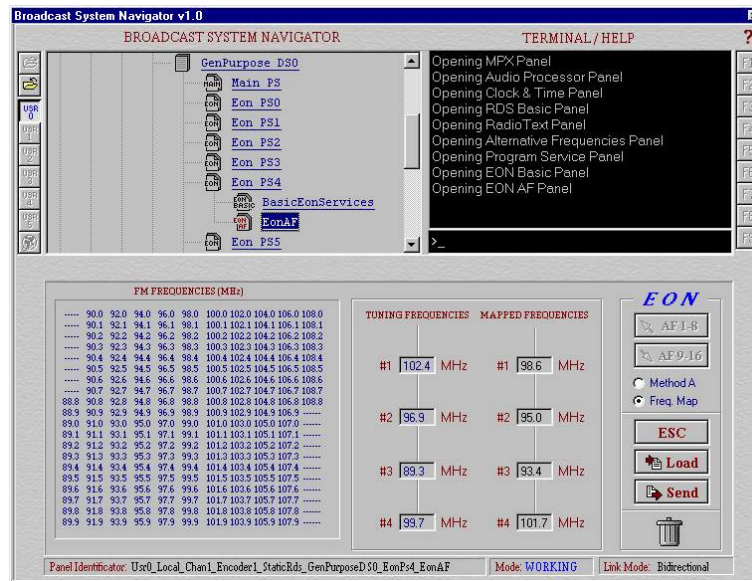
EON AF Frequency Map Method

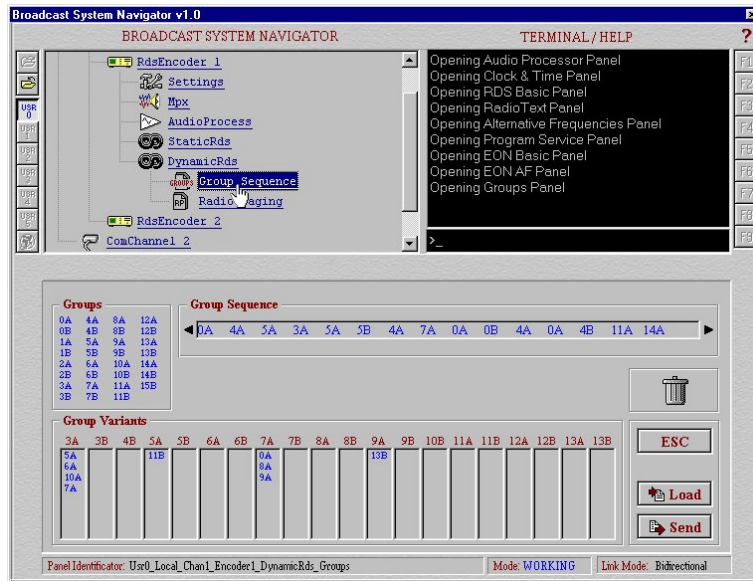BSN allows you to set several Mapped Frequencies related to Tuning Frequencies.

7.12   DYNAMIC RDS

Dynamic RDS menu present two sub-page: Group sequemce facility and the Radio Paging service.

7.12.1 GROUP SEQUENCE

BSN software allows you – as per UECP protocol – to configure – with the maximum detail – the order of Groups to be broadcast (Group sequence) and thier variants..


Group Sequence editor

7.12.2 RADIO PAGING

The RP feature is intended to provide radio paging using the existing VHF/FM broadcasts as a transport mechanism, thereby avoiding the need for a dedicated network of transmitters. Subscribers to a paging service will require a special pocket paging receiver in which the subscriber address code is stored.
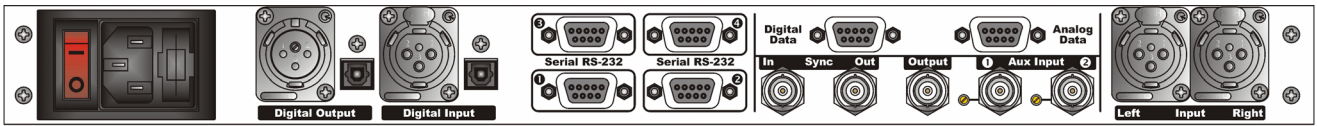
Shark supports Radio Paging system (as per UECP protocol), where the page streaming must be generated by dedicated EXTERNAL software. BSN software just includes a special DEMO version, which allows you to broadcast some DEMO message.
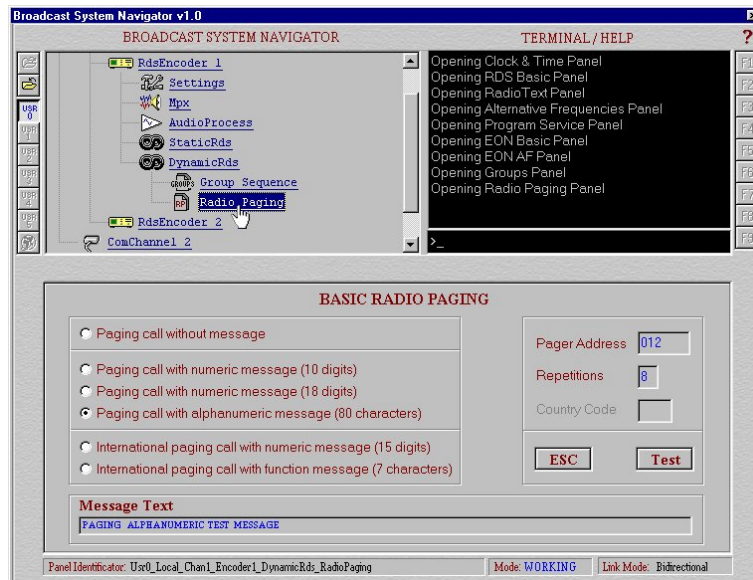
7.13 WEB SUPPORT

8 SHARK TECHNICAL SPECIFICATIONS

GENERAL FEATURES

Weight	4.5 Kg (depending on the chosen configuration)
Dimensions	1 rack unit, 352 mm x 483 mm x 44 mm
Power supply	220 Vac (+/- 15%, 50Hz) / 110 Vac (60 Hz)
Operating temperature range	- 10 ÷ 55 °C

ANALOG AUDIO INPUT

Conversion	24bit
Connector type	XLR female electronically balanced
Maximum Input Level	26dBu
Level adjust	between +32dB and –32dB (0.5dB step)
Impedance	600Ω / 10KΩ (Electronically balanced Jumper selectable) EMI -suppressed
Agc Speed	Adjustable from 0.1dB/sec to 1dB/sec.

ANALOG DATA PORT

SubD 9 pin connector	dedicated to Telemetering purpose

DIGITAL DATA PORT

SubD 9pin connector	for 5 TTL active-low signals (like TP, Ta, M/S, etc)

AUX IN (1 and 2)

Connector type	BNC floating over chassis, EMI sup.
Input level	Adjustable through trimmer.
Purpose	external Mpx, SCA, RDS input (wide band inputs)

FRONT PANEL DESIGN

Liquid Crystal Display (LCD)	2 X 20 characters
LED	3, assignable depending on the SHARK implemented configuration
Shuttle encoder	multifunction, for menu browsing and menu sublayer entering

DIGITAL AUDIO INPUT (Automatic switching on Analog ones in case of extra low quality on digital inputs)

Connector type	XLR female transformer balanced + optical toslink
Formats	AES3/EBU, S/PDIF.
Sample Rates	32KHz / 44.1KHz / 48KHz / 96KHz/ 192KHz (Mono)
Sample Rate Conv.	24 Bit/ 126 dB (Range dinamico)
Agc Speed	Adjustable from 0.1dB/sec to 1dB/sec

REMOTE CONTROL PORTS

RS232 serial ports	4 optically decoupled SubD 9 pins connectors
Baud Rate	1.200 – 38.400 Baud/sec

SOFTWARE & HARDWARE PLUG-IN

MPX +CLIPPER

Pilot Frequency	19 KHz ± 1Hz
Pilot Injection	Adjustable from -26dB to -14dB
Pilot Phase	Adjustable ±6 degrees (0.5 dB step)
S/N	**>**90 dB (on 100 kHz band)
Stereo Separation	70 dB (typical on the whole band)
Cross-talk Main to Sub	>65 dB (minimum)
Cross-talk Sub to Main	>65 dB (minimum)
38 KHz Subcarrier Suppression	>85dB (typical)
Composite output level	- 6 to +15 dBm (0.1 dB step)
Composite output distortion	0.01 % (typical on the whole band)
Pilot distortion	0.1 % (typical)
Output Connector type	BNC floating over chassis, EMI sup.
Sync Out phase error	±2 degrees (maximum)
Stability	+/- 10 ppm (- 10 to + 55 °C)
Pre-emphasis	50uS / 75uS
Digital input filter	15 kHz (- 0.1 dB), 17 kHz (- 70 dB), 19 kHz (- 100 dB)

User-enable Mpx Clipper module is adjustable with precision of 0.1dBr (related to the Mpx signal maximum level).
Automatic control of Pilot and Rds signal integrity.

RDS

RDS signal : fully compliant to CENELEC EN 50067 (1998) specifications
Standard coding methods available: PI, TP, TA, M/S, RT, PSN, PTY, DI, AF, PIN, EON, TDC, TMC*, CT, EWS*, IH, RP.

RDS programming is compliant to standard UECP EBU / RDS Forum document SPB 490 (Version 5.1 -dated 22.08.97) communication protocol

RDS subcarrier freq	57 kHz +/- 3 Hz
RDS output level	adjustable in the 0-12000 mVpp range (10 mVpp steps)
Connector type	BNC floating over chassis, EMI sup.
Synchronization	Either to 19Khz pilot tone or to FM stereo MPX signal.Automatic switchover to internal oscillator in case of absence or low quality of external reference signal.
Ext Ref Level (Mpx input)	max 9 Vpp
Mpx output level	equal to the input level, hard bypass connected in case of power supply failure
RDS Pilot phase	adjustable +/-180 deg (referred to MPX pilot). 1 deg step
Linear Distortion	0.01 dB

LIMITER +STEREO ENHANCER

Stereo Enhancing controls

Effect Delay	0mSec to 30mSec
Effect Band	3KHz / 5KHz / 8KHz to 15KHz
Effect Level	-40 dBu to –10 dBu
Effect Gate	-40 dBu to –10 dBu
Effect Attach Time	100 msec to 3 sec

Limiting control is implemented through 5 FIR digital filter

Density	0 o 6 dB
AGC speed	0.1 to 2 dB/sec
AGC gate	- 40 to 10 dBu