FMX480 DIGIPLEXER

USER'S MANUAL

Date: 08/07

CONTENTS

1. Introduction

1.1 GENERAL INFORMATION

1.1.1 About Audemat-Aztec

Audemat-Aztec offers a complete range of AM, FM, and TV sound metering equipment that allows radio and television broadcasters and regulation authorities to control and optimize an entire broadcast transmission chain.

Since 2000, Audemat-Aztec products have been awarded 8 times at NAB (Awards are delivered by recognized broadcasting engineers to "products that offer substantial improvement over previous technology", that is to say to innovative products).

Audemat-Aztec is the only company to be awarded 9 times in a row over the last 5 years !

Headquarter is in Bordeaux Mérignac, France, Audemat-Aztec has a US subsidiary located in Miami, Florida.

1.1.2 About RDS

The RDS system is governed by the CENELEC EN50067 European standard. This system was initially designed to assure the functions directly associated to the radio broadcasting program:

- Automatic frequency change
- Display of the station name on radios
- Display of radio-text for home tuners
- Use of pre-select buttons on radios to memorise a station and not a frequency

The RDS system transmits data via a 57 kHz sub-carrier. Audemat-Aztec's reputation is mainly due to its specialisation in the RDS field, which makes it a privileged supplier of many public and private operators using RDS.

1.1.3 About FMX 480

This product contains high technology developments implementing the most sophisticated signal processing techniques.

In practice, DSPs (Digital Signal Processor) assure all the synthesis functions of the various elements of the multiplex composite signal delivered by the Digiplexer by software.

Owing to its technological advance in RDS (Radio Data System), AUDEMAT-AZTEC has technologically invested in the stereophonic encoding and processing of the multiplex signal (clipping, energy enrichment, AGC) of the Digiplexer.

The FMX480 Digiplexer differs from the other Digiplexer models in that it offers network connectivity (TCP/IP, Web server, UDP servers, FTP server, SNMP agent).The FMX480 Digiplexer assures the RDS and R**B**DS functions.

DIGIPLEXER: 10 key points...

- Price reduction of the functions owing to their integration in one unit
- Reduction of space in the CDMs and transmission sites
- Flexibility of the AUDIO, STEREO, RDS configurations and multiplex processing
- Simplicity and reproducibility of the digital configuration
- The suppression of drift thanks to a DSP based digital architecture
- Extremely easy to set up thanks to its PC configuration software
- A digital multiplex deviation clipper which processes the multiplex signal at its source
- A system and signal sampling frequency around 500kHz
- Total remote control of parameters, by TCP/IP network (Ethernet 10BaseT)

The technology in the Digiplexer...

- Digital audio input (AES/EBU S-PDIF)
- Number of DSPs: 5, DSP operating frequency = 60MHz approx.
- Sampling frequency > 400kHz
- Variable Gain Bypass function
- Calculations and Multiplex encoding performed on 24 bits, Fech > 400kHz
- Digital adjustment of the analogue input level over a large dynamic range
- Direct expression of the Multiplex signal level in kHz
- TCP/IP access with associated services, buried Web server,

1.2 BEFORE STARTING

Be sure that the supply voltage is that indicated to the back of the equipment (230 VAC or 110 VAC).

2. PRODUCT PRESENTATION

2.1 LIST OF INCLUDED ACCESSORIES

Check that all elements are present in the box:

- 1 Power supply cable
- 1 RS232 cable
- 1 RJ45 cable
- 1 installation CD-ROM

2.2 GENERAL SPECIFICATIONS OF THE FMX480

Audio inputs outputs:

Digital audio input:
XLR connector, galvanic insulation, symmetrical format. Auto-adaptation to the AES/EBU data format applied.
Compatible with the digital audio formats:
AES/EBU, IEC958, S/PDIF, EIAJ CP-340

Backup: In case of non-synchronisation on digital audio frames, automatic switching and sound signal taken on the analogue audio input.

Analogue audio input:
1 XLR connector per channel
Symmetrical format
Impedance: 600 ohms (easily modifiable)
Adjustable nominal level: -18dBu to +18dBu.
Nominal reserve: 6dB

Multiplex input:
BNC, asymmetrical format.
Adjustable nominal level: -18dBu to +18dBu.
"Bypass" and "adder" function: configurable retransmission gain: -60dB to +20dB
Extraction of a 19000Hz pilot signal contained in the MPX signal applied to place the Digiplexer clock in phase.

Stereophonic Encoding:

Harmonic distortion: < 0.03% (1kHz)
Separation:
Over 60 dB: (1kHz sinus)
Suppression 38kHz: Over 70 dB.
Audio pass band: 20Hz and 15000Hz

Low pass filter for each audio channel:
Attenuation greater than -86 dB at 16.7 kHz Linear phase.
Pass band ripple: Less than 0.1 dB

Deviation of the 19KHz pilot signal:
Adjustable in kHz, in steps of 0.1 kHz (via the front panel, RS232 or DIGIPLEX configuration software)

Stability of the 19 KHz pilot signal: 0.5Hz 0°C to 50°C

Test signals:
Predefined: 593.75Hz, 1187.5Hz, 14843Hz sinus
Combinations of channels:
Left only
Right only
Left = Right
Left = -(Right).

RDS Encoding:

Out of band rejection:
Conforms to the standard CENELEC EN50067 (less than -96dB).

57kHz suppression: greater than 70dB

Deviation: adjustable in kHz (unit of deviation), 0.1kHz steps

UECP-SPB490 compatibility: total

Data transmission from
- RS232: COM0, COM1, COM2 (UECP)
- TCP/IP (UDP): UECP encapsulation
- FTP FILE: .UCP type (cyclic or not)

Multiplex signal processing

Limiter (clipper): Predictive algorithm (propriety of Audemat-Aztec). Can be enabled / disabled via the front panel.

AGC: dynamic control of the analogue audio input sensitivity, with adjustment of the rise time (ATTACK), fall time (DECAY) and of an inactivity threshold (GATE).

Energy gain: 0 to 5 dB adjustable (Selection in 1dB steps).
Different processes (configurable) according to the density of the sound signal applied to the inputs.

Action on L-R: increase or decrease the stereophonic effect

Communication port(s):

COM0 on the front panel
RS232 (9600 bits/s) (DB9)
COM1, COM2: RS232 (DB9)
COM2 RS485 (DB9 male, DB9 female)
ETHERNET 10BaseT (RJ45)

Visualisation of parameters:

Display:
High brightness LED alphanumeric display.
Indicates the numeric values of the parameters related to Stereophonic Encoding, the input levels, measured intermediate levels and measured output level.

Real deviation bar-Graph indicator
11 green LEDs, 1 yellow LED, 3 red LEDs, zoom mode, peak value of the real deviation.

DIGIPLEX configuration software:
Can be used to access all the configuration parameters and also to visualise a histogram of the output Multiplex signal level.

Configuration:

Via TELNET (TCP/IP) or COM0
ASCII commands with a user-friendly protocol can be used with a "terminal" application.

Via the "DIGIPLEX.EXE" PC SOFTWARE:
Configuration software delivered with the product running in Windows© that can be used to configure the Stereo Encoding, limiter and RDS data sections. The DIGIPLEX software integrates remote control by Modem.

Via the Front panel:
2 buttons and an LED alphanumeric display can be used to configure the Digiplexer physical parameters.

Saving of the configurations:
2 memories containing user-defined configurations.

1 "factory configuration" memory can be called to quickly change the configuration.
Saving and management of the configurations on diskette or hard disk via the DIGIPLEX.EXE configuration software .

TCP/IP:

IP2 operating system
(Refer to the IP2 system manual)
- Buried Web Server (HTTP), multi-client
- Multi-client FTP Server
- File system
- Log
- Calendar clock
- Event handling: SNMP, SMTP
- Time client
- TELNET console (multi-client)
- UDP Server

Monitoring:

Display:
- Deviation: peak value, resolution 0.1kHz
- MPX power: resolution 0.1dB
- AGC action: indication of the AGC action

Bar Graph (LED indicator):
peak value, automatic zoom function in case of absence of modulation.

DIGIPLEX configuration software:
- Deviation graph
- AGC action
- Multiplex power

Power supply:

Supply voltage: 115V / 230V
Voltage tolerance: +/-10%
Mains frequency: 45-65 Hz
Mains filter: yes
Parallel protection element: Gemov
Fuse: 250mAT (230V) / 500mAT (115V)
Consumption: 25VA

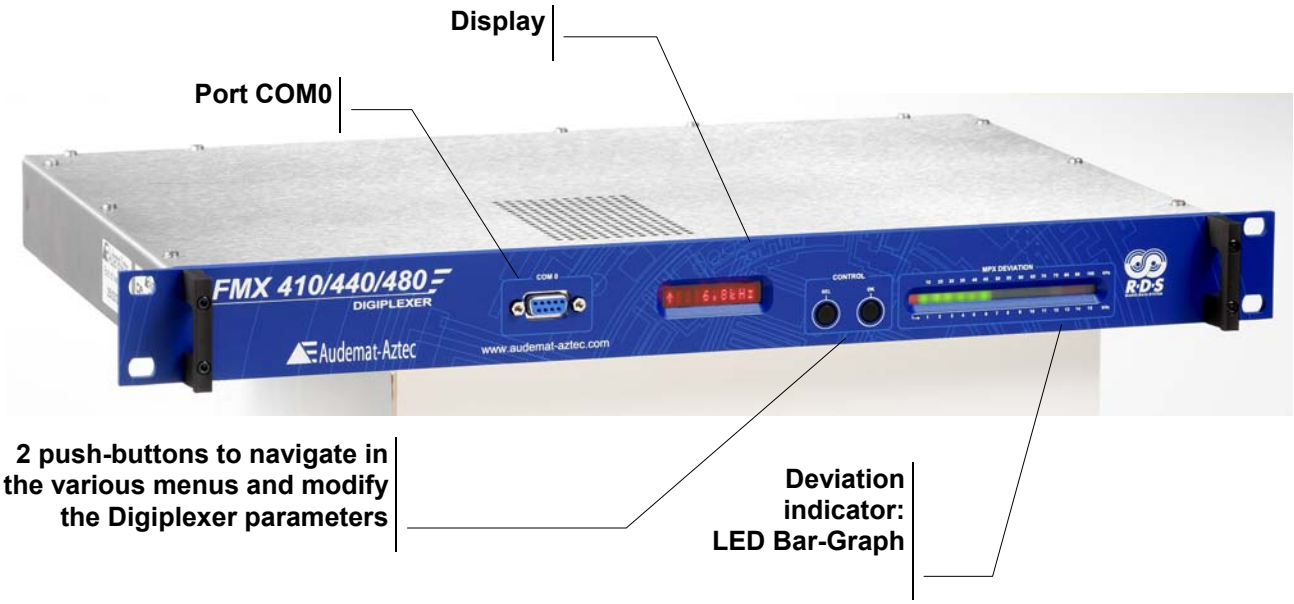
Mechanical aspects:

Height: 1U (44,5 mm)
Width: 483 mm
Depth: 220 mm
Net weight: 7 kg

Environmental data:

Temperature (operating):
0°C to 50°C ambient
Temperature (storage):
-30°C to 80°C ambient
Altitude: 0 to 5000 metres
Humidity: class F, DIN50040
EMC: EN50022 and generic standard
Noise immunity: 10V/m minimum

2.3 FRONT PANEL



Deviation indicator (bar-graph)

The table below shows the behaviour of the bar-graph, this indicator reflects the value displayed by the menu **"⇧_vvv.vkHz"**

BAR-GRAPH: MULTIPLEX		
	Visualisation of Multiplex output "⇧ xxx.xkHz"	Visualisation of Multiplex output "⇧ xxx.xkHz"
LED	**the signal exceeds...**	**the signal exceeds...**
red	**lit = expanded scale**	**off = normal scale**
green n°1	**1 kHz**	**10 kHz**
green n°2	**2 kHz**	**20 kHz**
green n°3	**3 kHz**	**30 kHz**
green n°4	**4 kHz**	**35 kHz**
green n°5	**5 kHz**	**40 kHz**
green n°6	**6 kHz**	**45 kHz**
green n°7	**7 kHz**	**50 kHz**
green n°8	**8 kHz**	**55 kHz**
green n°9	**9 kHz**	**60 kHz**
green n°10	**10 kHz**	**65 kHz**
green n°11	**11 kHz**	**70 kHz**
yellow	**12 kHz**	**75 kHz**
red n°1	**13 kHz**	**80 kHz**
red n°2	**14 kHz**	**90 kHz**
red n°3	**15 kHz**	**100 kHz**

	10	20	30	35	40	45	50	55	60	65	70	75	80	90	100	kHz
R1	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	J	R1	R2	R3	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	kHz

The switching between the normal scale and expanded scale is done automatically: the first red LED flashes when the display is in expanded scale, which allows the influence of the sub-carrier levels to be observed.

"COM0" RS232 port (female)

"COM0" RS232 PORT (female)	
Pin	**Signal**
1	Do not use
2	TX of the DIGIPLEXER (DCE)
3	RX of the DIGIPLEXER (DCE)
4	Connected to pin 6
5	DIGIPLEXER ground
6	Connected to pin 4
7	Connected to pin 8
8	Connected to pin 7
9	Do not use

Display

The display has 10 alphanumeric LED characters. The brightness can be configured.

2 Push buttons

2 push-buttons, associated to the display make up the physical base of the Digiplexer's MMI. The left push-button is used to navigate between the menus, the right button to confirm or modify a parameter in a menu.

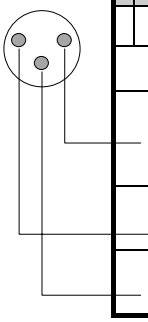
2.4 REAR PANEL AND CONNECTIONS

▲ **WARNING**: the ground of the equipment is close to the chassis potential: consequently, ensure that the equipment is connected to earth via the IEC power connector or the earth connection screw and not simply via the ground of one of the XLR, SUB-D or BNC connectors used.

The inputs / outputs on the rear panel are now described in detail, starting from the left, from top to bottom, seen from behind.

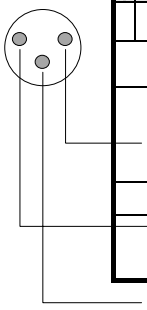
RF output: RF OUT (option)
This output is only used for demonstration applications or for factory use or on car radio production lines, all types of tuners and FM receivers. The Digiplexer is then used as a test generator. For more information concerning this type of operation, contact AZTEC.

Digital audio input: "AES/EBU"
AES/EBU signal input. The signal to be applied is symmetrical and floating. A transformer assures the galvanic insulation of this input relative to the potential of the Digiplexer. The AES/EBU input is insensitive to the polarity of the signal applied.



AES-EBU digital input	
Female XLR connector	
Pin	**Signal**
1	**Ground** of the Digiplexer. It is recommended to connect the screen of the cable used to this pin, where possible.
2	**AES+**.
3	**AES-**

Symmetrical analogue audio inputs (right channel, then left channel)



Symmetrical Audio Inputs	
Female XLR connectors	
Pin	**Signal**
1	**Ground** of the Digiplexer. It is recommended to connect the screen of the cable used to this pin, where possible..
2	**Audio (+)**.
3	**Audio (-)**This pin is to be connected to pin 1 (ground) for an asymmetrical audio supply

19000Hz / FM-SYNC synchronisation signal Input / Output

"SYNC" Input / Output (asymmetrical)	
BNC connector	
Pin	**Signal**
Central	Synchronisation **signal**
Ground of the connector	Digiplexer **Ground**

This input/output is often called the " SYNC port " in this document.

Multiplex composite Signal Input - (asymmetrical)

"MPX" input	
BNC Connector	
Pin	**Signal**
Central	Multiplex composite **Signal** applied to the Digiplexer
Ground of the connector	Digiplexer **ground**

Multiplex composite Signal Output - (asymmetrical)

"MPX" output	
BNC connector	
Pin	**Signal**
Central	**Composite Multiplex Signal** Multiplex
Ground of the connector	Digiplexer **ground**

10BaseT Ethernet Port (TCP/IP)

This port can be used to connect the FMX480 Digiplexer to a 10BaseT TCP/IP network. RJ45 connector. Before any connection to an IP Intranet or to Internet, please configure the IP parameters of the equipment, to do this, refer to the IP2 system manual supplied with the product.

COM2 communication port, RS485 access

2 RS485 accesses with identical pin-out, except that one is male and the other is female can be used to chain equipment on a transmission site.
If you use this communication port, do not use the RS232 port of COM2

"COM2" RS485 PORTS male at the top, female on the bottom	
SUBD9 pin	**Signal**
1	RX+
2	RX-
3	TX+
4	TX-
5	Digiplexer ground
6	Nc
7	Nc
8	Nc
9	Nc

COM2 communication port, RS232 access (at the top)

This RS232 access for the COM2 communication port is an OR logic between the 2 RS485 accesses
If you use this RS232 communication port, do not use the RS485 access of COM2.

Use: RDS data access with USEP and UECP protocols

"COM2" RS232 PORT (male)	
Pin	**Signal**
1	DCD
2	RxD (Digiplexer)
3	TxD (Digiplexer)
4	DTR
5	Digiplexer ground
6	DSR
7	RTS
8	CTS
9	RI

COM1 communication port, RS232 access (at the bottom)

Use: RDS data access with USEP and UECP protocols

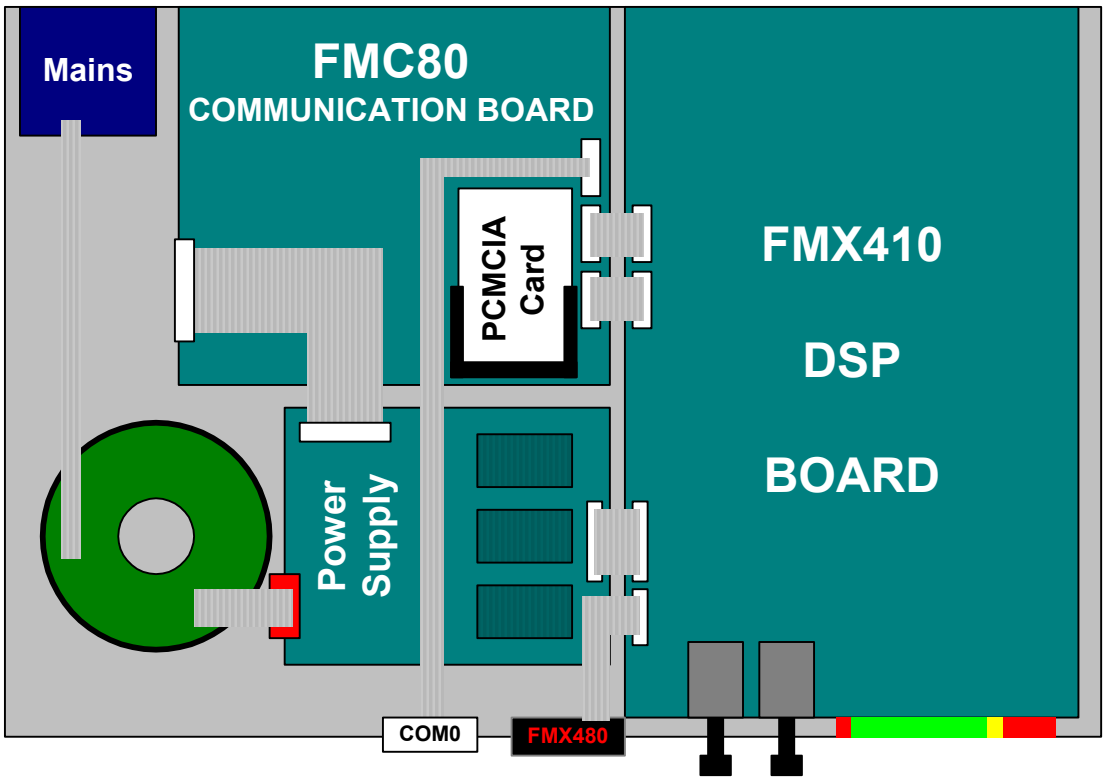
	"COM1" RS232 PORT (male)
Pin	**Signal**
1	DCD
2	RxD (Digiplexer)
3	TxD (Digiplexer)
4	DTR
5	Digiplexer ground
6	DSR
7	RTS
8	CTS
9	RI

Input output ports related to the RDS encoding (at the bottom)

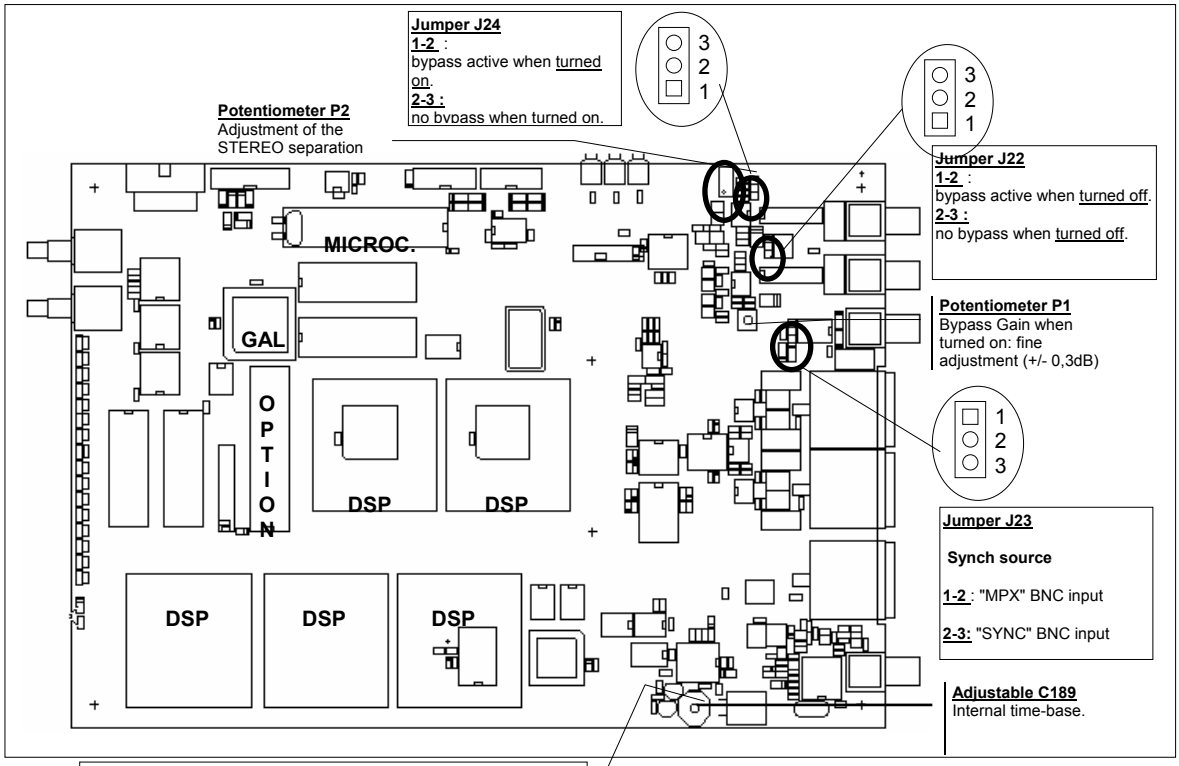
	RDS logic Inputs / Outputs PORT (male)
SUBD15 pin	**Signal**
1	INP0 logic input: selection of the active Data Set Bit 0 (Enabled = connected to ground Disabled: floating)
2	INP1 logic input: selection of the active Data Set Bit 1 (Enabled = connected to ground Disabled: floating)
3	INP2 logic input: selection of the active Data Set Bit 2 (Enabled = connected to ground Disabled: floating)
4	INP3 logic input: TA command (if the ASCII parameter RDS.IN<>3) Or activation of retransmission mode (if RDS.IN=3) (Enabled = connected to ground Disabled: floating)
5	RELAY A1: make Timeout exceeded on at least one of the communication ports
6	RELAY A1: break Timeout not exceeded on the communication ports or inactive function
7	RELAY A2: make RDS decoding correct and power supply present
8	RELAY A2: break When error signalled by the RDS decoder or absence of power supply
9	RDS encoder ground
10	RDS encoder ground
11	RDS encoder ground
12	RDS encoder ground
13	RELAY A1: common
14	Nc
15	RELAY A2: common

2.4 INTERNAL COMPOSITION OF THE FMX480

The figure below shows the electronic and electrical components of the FMX480 Digiplexer.



2.6 FMX410 BOARD OF THE FMX480 : JUMPERS, ADJUSTMENT POINTS



IMPORTANT:

The stereo separation can be adjusted using the potentiometer P2.

The adjustment of this parameter must be carried out in the best conditions possible and particular attention must be given to the choice of the measurement cables (quality, impedance).

3. Installation and initial configuration of the FMX480

3.1 MAIN SUPPLY

Check the value of the fuse at the back of the equipment (1AT) for 230V operation. Position the corresponding jumper on the mains connector of the equipment.

The FMX480 doesn't need to be powered up via an uninterruptible power supply: insensitive to short power-cuts, it meets requirements and thresholds that are considerably worse than those required for the European directive related to the electromagnetic compatibility of electronic equipment.

▲ **WARNING:** check that the equipment is ***directly*** connected to earth via its mains cable and not indirectly connected to earth via its chassis, one of the communication ports or the ground of one of the BNC connectors.

3.2 GENERAL PHYSICAL INSTALLATION MEASURES FOR THE EQUIPMENT

- **Physical position in a rack**

AUDEMAT-AZTEC has avoided resorting to forced ventilation of the Digiplexer, so as not to penalise the product with potential mechanical problems. Therefore, take care not to cover the upper and lower openings of the product, which allow air to circulate naturally, from the bottom to the top.

- **Electromagnetic compatibility**

The Digiplexer has been designed to be installed in FM transmission sites. Therefore, it meets criteria and thresholds that are considerably worse than those required by the European directive related to the electromagnetic compatibility of electronic equipment. In principle, no additional component is to be added to the product.

- **A few precautions to take when wiring the product**

The RS232 ports of the equipment are protected by means of 15V zener diodes mounted head to tail: this measure makes these ports more robust, nevertheless, AUDEMAT-AZTEC strongly advises against directly connecting to these ports cables from neighbouring premises, outside the location in which the Digiplexer has been placed (large potential differences possible, for example, in case of lightning).

3.3 WHERE TO CONNECT THE MPX OUTPUT OF THE DIGIPLEXER FMX 480 ?

The MPX output (Multiplex composite) is unique. It is asymmetrical and must be connected to the input of the FM pilot transmitter. The MPX output is asymmetrical and the use of a 75 ohm coaxial cable or a good quality screened cable is recommended to make this connection. In addition, this connection must be as short as possible.

The adjustment procedure for the MPX output level is the subject of a separate paragraph in this chapter.

The Digiplexer can of course be connected to another type of equipment other than a pilot transmitter:
- Analog or digital outgoing multiplex radio link
- RDS encoder

3.4 TO USE THE "BYPASS" FUNCTION

The "BYPASS" function of the Digiplexer FMX 480 is subtle and makes the product simple to connect in most transmission architectures. The BYPASS function is to be considered in the following 2 cases:

- **BYPASS when off**: determined by the position of jumper J22, the "BYPASS when off" function when it is selected, can be used to passively retransmit any signal applied to the MPX input to the MPX output. This function can be used to make the Digiplexer "transparent" to the Multiplex composite signal when it is turned off.

- **BYPASS when on**: determined by the position of jumper J23, the "BYPASS when on" function retransmits the signal applied to the MPX input to the MPX output. The retransmission is done with a gain which can be configured by the command **GAIN=** and refined in hardware with the potentiometer P1 located on the Digiplexer board, close to the rear panel.

The following paragraphs non-exhaustively describe a range of clever uses of the BYPASS when on and off function.

3.5 TO INSTALL THE DIGIPLEXER WITH AN EXTERNAL RDS ENCODER

When an external RDS encoder is preferred to the one that is integrated in the Digiplexer, respect the configuration described in the figure below.

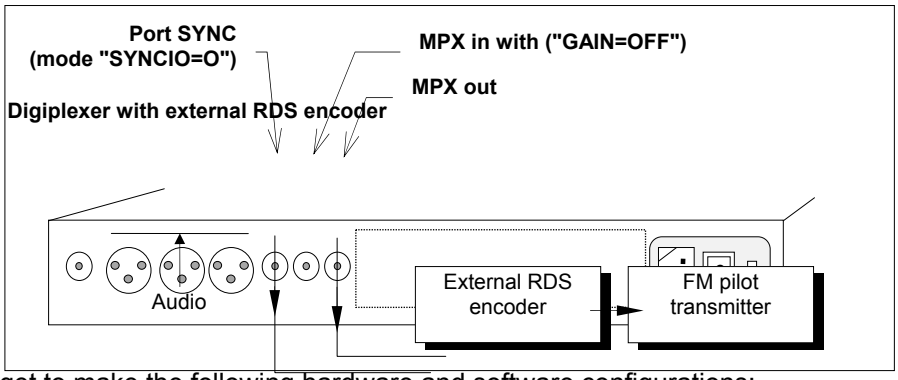
▲ **IMPORTANT NOTE 1**: ensure that the input level of the "MPX" input is configured to "OFF", (**GAIN=OFF**) to avoid any noise which could come from this port configured as an input when the input is floating.

▲ **IMPORTANT NOTE 2**: configure the SYNC port in 19kHz output mode (**SYNC_IO=O**) and master mode (**SYNC=INT**), so that the Digiplexer delivers a 19kHz synchronisation signal from this output to the outside.

2 possibilities then exist for the synchronisation of the RDS encoder:

➪ **synchronisation by extraction of the pilot clock from the MPX signal**
The "SYNC" port is not used in this configuration. This configuration applies if the RDS encoder does not possess an external synchronisation input.

➪ **synchronisation by separate 19kHz clock**
The "SYNC" port is to be connected to the "SYNCHRO" input of the RDS encoder.

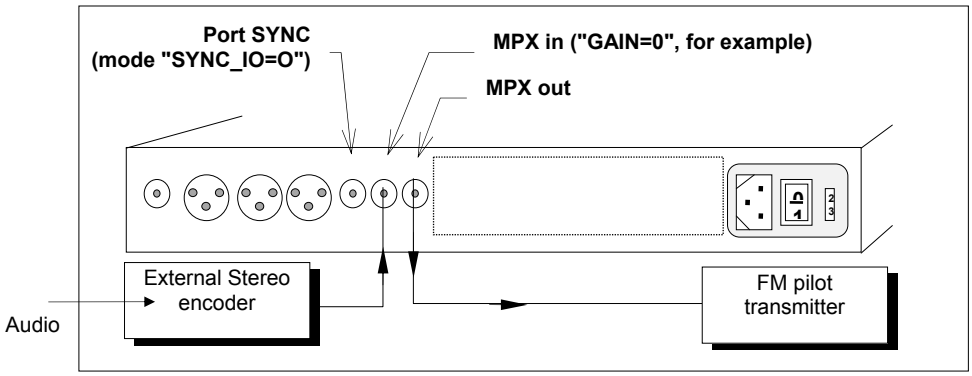


Do not forget to make the following hardware and software configurations:
- jumpers J22 and J24 in non-activated BYPASS mode
- jumpers J23: position irrelevant
- configuration: **SYNC_IO=O**
- configuration: **SYNC=INT** (the Digiplexer generates the clock, master mode)

3.6 TO INSTALL THE DIGIPLEXER FMX 480 WITH AN EXTERNAL STEREOPHONIC ENCODER

If an external stereophonic encoder is preferred to the one in the Digiplexer, insert the Digiplexer in the transmission chain as follows:

Digiplexer with external stereo encoder

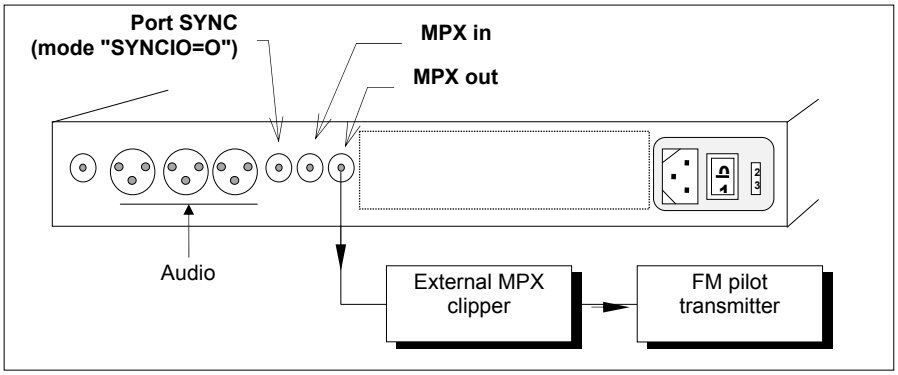


Do not forget to make the following hardware and software configurations:

- jumpers J22 and J24 in BYPASS mode activated
- jumper J23 in position synchro by MPX input
- configuration: **SYNC_IO=O**
- configuration: **SYNC=EXT** (the Digiplexer receives the clock, slave mode)
- configuration: **AUDIO=0**
- configuration: **STEREO=0**

3.7 TO INSTALL THE DIGIPLEXER WITH AN EXTERNAL COMPOSITE CLIPPER

Digiplexer with external Multiplex clipper

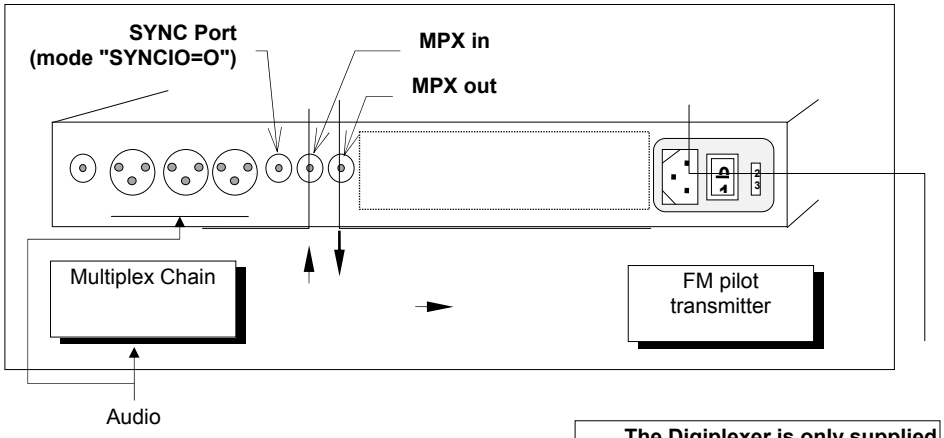


- jumpers J22 and J24 in BYPASS mode non activated
- jumper J23: position irrelevant
- configuration: **SYNC_IO=O**
- configuration: **SYNC=INT** (the Digiplexer supplies the clock, master mode)

3.8 TO INSTALL THE DIGIPLEXER AS A BACKUP FOR EXISTING EQUIPMENT

In this mode, the Digiplexer FMX480 is used to back up equipment that generates the Multiplex signal. Insert the Digiplexer FMX480 just before the pilot transmitter. The BYPASS function will be permanently enabled. If a problem is observed, the Digiplexer FMX 480 can be started via an automatic device or manually. Starting the Digiplexer FMX480 will assure the backup of the chain generating the Multiplex composite signal.

Digiplexer assuring the backup of a Multiplex chain



The Digiplexer is only supplied when it must assure its backup function!

Do not forget to make the following hardware and software configurations:

- jumper J22 in mode BYPASS activated (turned off)
- jumper J24 in mode BYPASS non-activated (turned on)
- jumper J23: position irrelevant
- configuration: **SYNC_IO=O**
- configuration: **SYNC=INT** (the Digiplexer supplies the clock, master mode)

3.9 TO CONNECT BACKUP EQUIPMENT TO THE DIGIPLEXER

In the same way as the previous paragraph, use the BYPASS function judiciously to allow a backup Multiplex signal to pass through the Digiplexer FMX480 : interrupting the power supply will allow the backup action to be performed simply.

3.10 TO USE THE MPX INPUT TO INSERT AN SCA OR ADDITIONAL SIGNAL

The MPX input can be used to inject any type of signal into the Digiplexer. A positive or negative gain is assigned to the signal applied to this input (command **GAIN=<v>** where v is from –64 to +32 (dB)); the resulting signal is then added to the outputted MPX signal on the condition that jumper J24 is set to "bypass activated when turned on".
This particularly interesting function therefore allows the Digiplexer FMX480 to accept any type of SCA, RDS signal or other sub-carrier on its input.

▲ **WARNING 1**: The Digiplexer FMX480 does not process the signal applied to its MPX input on the frequency level: this signifies that you must control the spectral quality of the signal, which will be reflected at the output and weighted with the gain fixed with the command **GAIN=…**

▲ **WARNING 2**: in the same way, the deviation indicated by the Digiplexer FMX480 does not take into account the nature of the SCA signal (or other) applied to the MPX input!

3.11 TO SYNCHRONISE THE DIGIPLEXER BY AN EXTERNAL CLOCK (19KHZ)

The FMX480 knows how to operate in slave mode, i.e. it knows how to synchronise its hardware and software clocks on a clock coming from an external source: This function, can be used to control a group of FMX480 from one clock and to offer a synchronism of FM modulation at low cost.

In the "standard" equipment configuration, this clock has a frequency of 19000Hz to establish synchronisation with the standard elements intervening in the generation of the Multiplex composite signal. AUDEMAT-AZTEC knows how to adapt the internal software of the FMX480 Digiplexer to other clock frequencies on request.

In the case where the FMX480 receives the synchronisation signal from the outside, configure **SYNC=EXT** (front panel of the Digiplexer or DIGIPLEX configuration software).

The "synchronisation" can either occur by the MPX input, or by the SYNC port:

- **Synchro via MPX input**: extraction of the 19kHz signal embedded in the multiplex signal applied to the "MPX IN" input. This is the default mode at the delivery of the equipment.

- configure J23 (synchro source) into mode "MPX input"
- configure **SYNC_IO=O** (a 19kHz clock signal resulting from the synchronisation will be delivered by the SYNC port).

- **Synchro via SYNC port**: uses a 19kHz signal (level advised above 100mVcc, recommended form: sine) to synchronise the Digiplexer

- configure J23 (synchro source) into mode "input by SYNC port
- configure **SYNC_IO=I**: the SYNC port is used as an input

▲ **WARNING**: check the quality of the signal used to synchronise the Digiplexer! To do this, you can check that the synchro LED (on the Digiplexer board) is off. (see diagram of the PCB in the paragraph " internal composition of the Digiplexer"). A signal for which the frequency would be shifted of +/- 2Hz from the 19000 Hz would not be taken into account by the Digiplexer.

3.12 TO RECOVER OF THE CLOCK REFERENCE OF THE DIGIPLEXER (19KHZ)

The Digiplexer knows how to supply a synchronous 19kHz +- 1Hz signal with the transmitted pilot signal by its "SYNC" port. To do this, make the following configuration operations:

- Jumper J23: in "MPX input" position
- **SYNC=INT**: the Digiplexer supplies the synchronisation (Master mode)
- **SYNC_IO=O**: port SYNC in "output" mode

The clock signal delivered may be used to assure the FM synchronism (synchronous FM).

4. To control the FM Multiplex generated by the FMX480 Digiplexer

The FMX 480 DIGIPLEXER is a global and digital synthesiser of the Multiplex composite signal used in Radiobroadcasting by frequency modulation. This chapter presents a few technical elements related to this signal.

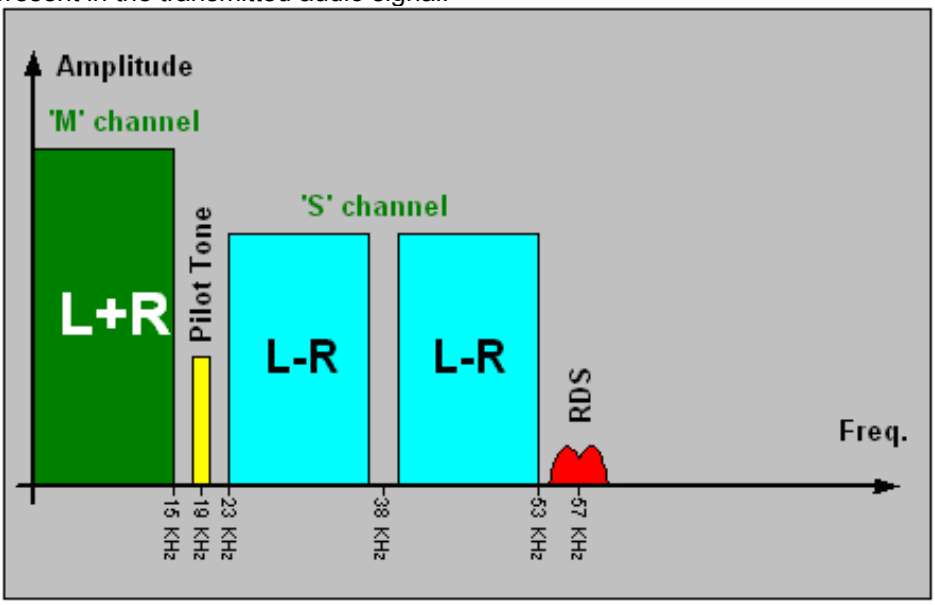
4.1 COMPOSITION OF THE MULTIPLEX SIGNAL

Contrary to the Audio signal that normally occupies a 20Hz-20000Hz frequency band, the multiplexing used in FM radiobroadcasting today uses a 0-100kHz frequency band.

Indeed, the transmission of the stereophonic signal and additional sub-carriers like those of RDS (RBDS for the USA) is performed by frequency multiplexing the various channels.

The reasons for this multiplexing are historic and stereophonic encoding uses a principle developed in the 1950s. If this Stereophonic encoding principle has not changed since this time, its implementation has followed the evolution of technology, in as much the multiplexing as the demultiplexing (stereophonic decoding).

The stereophonic effect (L-R) is shifted in frequency by amplitude modulating a 38kHz sinusoidal signal by this stereophonic component (L-R). The absence of 38000Hz carrier is explained by the fact that no DC component is present in the transmitted audio signal.



The 19kHz 'pilot' sub-carrier transports a time division and frequency division reference signal used by the stereophonic decoders, to demodulate the stereophonic effect (L-R).

The **RDS** signal obeys the same type of transposition in frequency, implementing a slightly more complex AM modulation technique, since it can be seen as the combination of 2 modulating signals phase-shifted by 90°. Extremely strict synthesis characteristics prevent the **RDS** signal from encroaching upon on the 'top' of the stereophonic component.

For the sub-carriers, we will observe the use of frequencies that are multiples of one another: this precaution is essential to avoid the noise resulting from intermodulation products "falling" in the LF range, which are often generated by medium quality FM receivers.

4.2 LEVELS AND UNITS USED TO DESCRIBE THE MULTIPLEX SIGNAL

The levels and units used to express the magnitudes of the Multiplex signal (frequency, amplitude) often cause confusion.

Indeed, the confusion comes from the fact that the Multiplex signal frequency modulates the carrier (HF) located in the FM band (87.6 to 107.9 MHz): the higher the Multiplex signal level, the larger will be the resultant HF carrier ***deviation***.

The deviation of the HF carrier is expressed in a unit of frequency as it is relative to the frequency of the HF carrier: when we hear that a transmitter, which transmits for example at 97.6 MHz ***'deviates at 70 kHz'***, this means that the amplitude or the level of the Multiplex signal applied to the transmitter provokes a deviation of the HF carrier between 97.530 MHz and 97.670 MHz and at the ***'rate'*** of the modulation contained in the Multiplex signal.

Thus, we can say that the pilot sub-carrier whose frequency is 19 kHz 'deviates' or 'provokes a deviation' (intrinsic) of 8 kHz: in more technical terms, this means that the carrier frequency of the transmitter at 97.6 MHz varies between 97.592 and 97.608 MHz at the rate of 19000 times per second.

The international standardisation has retained specifying a **maximum instantaneous deviation of 75kHz** on both sides of the HF carrier. As this limit is fixed as a reference, it is also common to see deviations specified in **%**: 75 kHz of deviation = 100%.

In the USA we prefer to talk of injection levels which are expressed generally in % of 75 kHz: 100% deviation corresponding to 75kHz deviation.

▲ **IMPORTANT**: in the rest of this manual the 'deviations' or 'injection levels', which represent the same thing are expressed in kHz.
The table below gives as example, the standardised deviations (in kHz) for the STEREO, RDS or HSS sub-carriers (High speed sub-carrier, etc...) as well as their corresponding value in %. At the Digiplexer level, these deviations will result in output "levels".

	Typical deviation	Max Deviation	Min Deviation
Multiplex Signal as a whole		**75.0 kHz 100 %**	
19 kHz pilot signal	**6.8 kHz 9.0 %**		
57kHz RDS signal	**4.0 kHz 5.3 %**	**8 kHz 10.6 %**	**1.25KHz 1.6%**

Table: standardised or specified deviations and corresponding values in %

NOTE: AUDEMAT-AZTEC has organised the configuration of the Multiplex signal deviation level of the FMX480 Digiplexer so that it appears as clear as possible: the Digiplexer **directly expresses** the unit of amplitude for the Multiplex signal **in kHz**.

The use of the kHz as unit is one of the wonderful advantages that the Digiplexer provides by its ***global synthesis*** of the Multiplex signal: the level of the Digiplexer MPX output must be determined at the beginning, once and for all, according to the characteristics of the transmitter.

4.3 DIGITAL SYNTHESIS PRINCIPLES OF THE MULTIPLEX COMPOSITE SIGNAL

The Digiplexer uses DSPs (Digital Signal Processor) to perform the digital synthesis operations of the signal.

The audio signal applied to the analogue (or digital) inputs is over-sampled by a digital process (dedicated DSP) at the frequency of the Digiplexer system (500kHz approx.): this extremely complex operation, *which consists of obtaining a high sampling frequency is essential for high quality signal processing where the objective is to be transmitted in FM*. The audio signal is processed using digital filters, using operations called 'convolutions'. The 'convolutions' use parameter tables and modifying the contents of these tables acts on the following parameters:

- response curve
- pass band (typically 20Hz - 15000Hz) or other configurable limits
- pass band ripple

The AM modulation operations (stereo L-R and RDS sub-carriers) strictly follow the mathematical equations describing these types of modulation. No approximation is performed in the implantation of the concerned algorithms, which operate on 24 bits and at the operating frequency of the system (Fech>456kHz).

The RDS signal is generated from the time division equation of each RDS symbol, which spreads in time over several thousand samples of Multiplex signal. The direct use of the mathematical equation ensures that the spectrum characteristics imposed by the cosinusoidal filtering of the RDS signal are faultlessly respected (-86dB at 2.4 kHz of the RDS central frequency, which is 57kHz).

All the signals (L+R), (L-R) modulated at 38 kHz, 19 kHz pilot signal, RDS signal are then added by respecting a weighting coming from the configuration made by the user.

The phase criteria between sub-carriers (19 kHz, 38kHz and 57 kHz) are easily respected, since these signals come from the same system clock.

The actual system clock can be synchronised by an external source (19 kHz) which allows several Digiplexers to be synchronised together, and offers a synchronism of the multiplex signal for ***synchronous FM applications*** for example.

4.4 INTERESTS OF THE GLOBAL DIGITAL SYNTHESIS OF THE MULTIPLEX SIGNAL

***GLOBAL* generation of the Multiplex composite signal...**

▼ **Suppression of equipment cascading** each one bringing its noise level

▼ Determination of the amplitude of the various components in the generated spectrum, with one single unit of deviation (the kHz).

▼ **No more sub-carrier synchronisation problems**

▼ **Multiplex Synchronism** assured by the synchronisation functions, ideal for synchronous FM applications.

▼ **No more impedance and level adaptation problems** between the various equipment.

▼ **Mutual protection of the various sub-carriers and sub-bands**. In traditional architectures, the Stereophonic encoders and the Multiplex clippers often generate harmonics or unwanted elements above the useful band. This is not the case for the Digiplexer.

▼ **Increased reliability**

***DIGITAL* generation of the Multiplex composite signal...**

▼ **Suppression of the dispersion of characteristics.** Finished are the differences of level between the 2 channels and the doubts on the sub-carrier levels.

▼ **Configuration flexibility**. The various amplitudes (audio and sub-carrier channels) can be independently adjusted, within realistic limits.

▼ **Perfectly controlled filtering characteristics.** The digital processing perfectly predicts the result to be obtained. Thus the residual ripple of the input audio filter characteristics, in the 0-15kHz band can be specified and / or modified, as well as the cut-off frequency that can be easily configured.

4.5 INSTANTANEOUS DEVIATION AND POWER RELATED TO MODULATION

Limiting the deviation to 75kHz is imposed on an almost world-wide level by various regulations concerning FM radiobroadcasting. This is an instantaneous limit i.e. this deviation value must not be exceeded at any time or under any circumstance.

Some radio stations can often be measured as exceeding the 75kHz limit by 20% without necessarily being able to tell this by listening to it. Inversely, we can often be surprised by the sound intensity of a radio station and have doubts about its respect of the standard, doubts that are sometimes contradicted by a disconcerting measurement! Why?
The deviation considered alone, is not the only revealing parameter of the acoustic level (sound) that the listener can sense. Indeed, if the deviation is an amplitude that describes a voltage, a level, it does not completely describe the notion of signal "power" or "density".

The "power" of the composite or Multiplex signal is that which the listener notices. By associating the time factor to the deviation, we reach the notion of deviation power. The deviation power is today the subject of studies with the intention of being regulated: this project does not have a technical origin like the 75kHz limitation but a desire to harmonise the power of the audio signal transmitted by the stations to obtain listening and reception quality.

According to some radio stations, whose opinion is clearly opposed to limiting the power of the sound signal, the degree of freedom on sound power is a wonderful instrument of differentiation between the radio stations: the sound of each station is different and will remain different as it carries subjective impressions, which will be largely removed by power harmonisation.

The direct effect of strictly limiting the Multiplex signal deviation to 75kHz is to increase its power, as due to the presence of a safeguard, the audio input level (the one which comes out of the mixing table or the sound processor) can be increased by 1 to 3 dB without necessarily risking to exceed the 75kHz limit.

The Digiplexer integrates this limiter function, which can be enabled (according to 11 predetermined settings) or disabled.

4.6 THE " MULTIPLEX LIMITER " OR " MULTIPLEX CLIPPER " FUNCTION

The concept of the deviation limiter or "clipper" has always been controversial as placing a Multiplex composite signal limiter at the end of the audio and Multiplex chain often had the effect of harming the spectral quality of the delivered signal and the integrity of the 19kHz and RDS sub-carriers.

Actually, at the origin, a "clipper" is nothing more than a peak limiting function: the amplitude bumps exceeding a given threshold were simply "shaved". The result is of course spectrally catastrophic, as much inside the audio band as outside it where a fraction of the pilot or RDS sub-carrier signals were brutally amputated, according to the fluctuations of the audio signal!

Since then, substantial progress has been made by a lot of American or French analogue equipment. The notion of peak limiting is still present, but it only affects the audio bands and an efficient filtering (by "rounding off the edges") brings substantial improvements to the process.

The process used by Audemat-aztec, even if it resembles the family of composite signal limiters and not sound processing, nevertheless has an approach opposed to that of peak limiting. By using digital processing, the Digiplexer knows how to perfectly anticipate at a given time T what the Multiplex signal will be in T+ΔT: it can then act during ΔT on the processed signal (ΔT: short = inaudible, but long for digital processing = complex calculations and processes made possible).

4.7 THE MULTIPLEX SIGNAL CONCENTRATION FUNCTION

Modelled on the same principle as the Multiplex Limiter, it is possible, within reasonable limits (1 to 5 dB) to enrich the power of the Multiplex signal by a digital process when the 75 kHz limit has not been reached.
Of course, the Multiplex signal deviation enrichment function must be combined with the Limiter function in order to respect the 75kHz limit in all cases.

4.8 THE MPX LIMITER POWER FUNCTION

4.8.1 Description of the new commands

Following commands have been included in the menu GOTOPROCESS of the 8 LED screen in the front side. They are also available in console or via HTML.

- **MPX Power limiter Activation:**

LIMITER=0	NO limiter
LIMITER=1	Hard forced Power Limiter
LIMITER=2	Smooth forced Power Limiter
LIMITER=3	Very smooth forced Power Limiter

- **Maximum MPX power level expected in dB (0db by default):**

PWLVL=X.X	0<X.X<+6dB by step of 0,1 dB

MPX power limiter action can be controlled via the 8 LED screen in front side after the deviation and MPX power display:

L: OFF Inactive Limiter

G:+12 A:1 Active Limiter with Gain (NMPA or NMPN)= 12dB and ADDPWR to 1 dB

4.8.2 Activation of the MPX Power Limiter

1/ PROCESS=1: Process in active mode

2/ ADDPWR=x: Set the Add Power function at x dB (0>= x >=6). This enable to manage an offset of Power augmentation of x dB above the expected MPX power level, without any deviation lost.

3/ Adjust the input gain (NMPA or NMPN), in order to obtain an average MPX level according to the program type and the expected MPX power level.

4/ PWLVL=x: Set the MPX power threshold level at x dB. (Above this value the limiter will act)

5/ LIMITER=1: limiter activation.

Two-limiter regulation modes are available:

- First one is Hard forced Power mode = maximum variation up to 0.4 dB/s **(LIMITER=1)**
- Second is Smooth forced Power mode = maximum variation up to 0.1 dB/s **(LIMITER=2)**

Note: It is strongly advice to do not activate the AGC with the MPX power limiter.

4.9 SUB-CARRIER DEVIATION

The deviation of the sub-carriers obeys rules that are simpler than those of the sound signal for the simple reason that the mean amplitude (or their "envelope") is not supposed to vary in time.

4.10 19000 HZ "PILOT" SUB-CARRIER

This is the case for the non-modulated "pilot" sub-carrier, which is simply a 19000Hz sinusoidal signal. The amplitude of this sub-carrier is fixed by the standards to 9% of the maximum deviation, i.e. approximately 6.8 kHz.

There is no point in increasing this value. Actually, the current stereo FM receivers mostly use this signal even when it is set to a considerably lower value. By default, the Digiplexer assures a deviation of the pilot sub-carrier at 6.8kHz.

4.11 RDS SUB-CARRIER SIGNAL

This modulated signal presents a near constant envelope amplitude. The deviation level of the RDS sub-carrier must be located between 1kHz and 8kHz for a reasonable operation.

Contrary to the pilot sub-carrier, the value of the RDS signal deviation has a decisive impact on the behaviour of car radios in RDS.

A large signal level (higher than 4kHz) will have the effect of "holding" a large number of car radio models on the frequency received: actually, these car radios take into account the quality of the RDS signal received to switch frequency.

With the RDS sub-carrier set between 3 and 4kHz, the quality of the RDS signal is generally close to that of the audio signal and the frequency switching is performed at the moment when the listening quality becomes subjectively precarious.

With the RDS sub-carrier set to lower than 2 kHz, we encourage the car radio to switch frequency as soon as the signal presents minor quality defaults. Such a setting is suitable when the broadcasting network has a coverage where the transmitters considerably overlap.

The Digiplexer takes 4kHz as the default deviation value for the RDS sub-carrier. It is possible to set this deviation level above 10kHz.

4.12 INCIDENCE OF THE SUB-CARRIER DEVIATION ON THE GLOBAL DEVIATION

When they are added, the pilot and/or RDS sub-carriers modify the instantaneous deviation accordingly. Therefore, a transmission without pilot sub-carrier, without RDS and without stereophonic effect can in some cases (stereo effect sustained) devote to the mono channel (L+R) more than double the instantaneous deviation the same stereophonic transmission could with RDS.

SIGNAL Deviation	STEREO with RDS	STEREO without RDS	MONO with RDS	MONO without RDS
RDS (kHz)	4		4	
Pilot Signal (kHz)	6,8	6,8		
L+R (kHz)	32,1	34,1	71	75
L-R (kHz)	32,1	34,1		
Global audio (L+R) and (L-R)	64,2	68,2	71	75
TOTAL (kHz)	75	75	75	75

Table: Distribution of the deviation between the various signals of an FM transmission in stereo and in RDS.

* Indicates here a possible mean distribution but arbitrarily indicative (example).

When the limiter (clipper) of the Digiplexer is enabled, the Digiplexer, in its basic configuration (mono/stereo, RDS or without RDS) will make a 75kHz limitation by taking into account the levels attributed to each of the sub-carriers (stereo, RDS).

4.13 TO ADJUST THE NOMINAL OUTPUT LEVEL OF THE DIGIPLEXER

The purpose of adjusting the Digiplexer output level is to adapt the output characteristics of the Digiplexer to those of the equipment to which the Multiplex signal will be applied: in general it is an FM pilot transmitter or an outgoing radio link.

▲ **WARNING: to perform these adjustments, all the Multiplex signal processing functions must be disabled (Menu Process : PROCESS=0).**

- **"Theoretical" adjustment:**

Assign the value of the signal level (400 Hz sinus) to the parameter **LVLO=** (Output LEVEL) which on its own provokes an FM deviation of 75kHz on the pilot transmitter (mono without RDS or other sub-carriers).
The Digiplexer takes into account the pilot, RDS and additional programmed sub-carriers. The negative and positive values are accepted for the "LVLO" parameter.

- **"Purely practical" adjustment:**

◆ **IMPORTANT:** before making this adjustment, it is imperative to enter the desired FM transmission mode **beforehand**:

* configure the presence or absence of stereo (**STEREO=1** or **STEREO=0**)
* set the deviation of the pilot sub-carrier to the desired value (**LVL19=**)
* configure the presence or absence of RDS transmission (**RDS=1** or **RDS=0**)
* set the deviation of the RDS sub-carrier to the desired value (**LVL57=**)
* Start the TEST1 mode: L,R
* Then adjust "LVL0" to reach the 75kHz value indicated by a test receiver (RDS Monitor or FM Navigator for ex.). It is also possible to use a spectrum analyser or the indication supplied by the bar-graph or the vu-meter of the pilot used (on the condition that we can be sure of the accuracy of the measurement).

◆ **IMPORTANT NOTE:** the value **LVLO has no impact on the display** of the deviation value, or on the bar-graph of the Digiplexer. The deviation values indicated by the Digiplexer are not measurements and the accuracy of this indication depends on the quality of this LVLO parameter setting.
In some cases, it may be necessary to alter again, when it is possible, the input level setting of the pilot transmitter used to make an optimal adjustment (to the nearest 0.1dB).

4.14 TO VIEW THE MULTIPLEX SIGNAL LEVEL

VALUE INDICATOR: the displayed output level is given in the menu **"⇧_vvv.vkHz"** in kHz: this value **only reflects in a relative way** the level delivered by the Digiplexer to the FM pilot. This is why, we must play with the **LVLO** parameter to perfectly adapt the Digiplexer to the equipment (pilot or outgoing link) to which it delivers the Multiplex composite signal. The LVLO value is expressed in dBu and corresponds to the output voltage level when the display indicates **"⇧ 75.0kHz"**.
The ASCII command **MPX?** returns the instantaneous value of the Multiplex signal amplitude (expressed in kHz).

4.15 TO VIEW THE PROJECTED DEVIATION (MULTIPLEX SIGNAL) ON A PC

Using the "DIGIPLEX" configuration software: the evolution of the instantaneous multiplex signal and the action of the Multiplex processes (AGC, CLIP, ADDPWR, EXTLVLOK) can be observed in graphic form.

The levels indicated are "indisputable" and do not come from measurement: they represent the "peak" result of the mathematical operations performed by the Digiplexer 500 000 times per second.

The displayed deviation is only "projected" in as far as its accuracy depends on the adjustment accuracy of the "LVLO" parameter and the characteristics (modulation linearity) of the equipment driven by the Digiplexer.

4.16 TO VIEW THE PROJECTED MULTIPLEX SIGNAL POWER

VALUE INDICATOR: the power of the Multiplex signal is given in the menu **"PWRavv.vdB"** in dB. This value is permanently calculated on all the digital samples of the Multiplex signal for the previous minute. The calculation is performed over a sliding minute.
The Multiplex power can also be seen on a PC using the ''DIGIPLEX'' software.

◆ **NOTE:** the power displayed is only "projected" in as far as its accuracy depends on the adjustment accuracy of the "LVLO" parameter and the characteristics (modulation linearity) of the equipment driven by the Digiplexer.
ASCII command: **POWER?**

4.17 TO SYNCHRONISE THE RDS SUB-CARRIERS WITH THE PILOT SIGNAL

If the RDS receivers never use the pilot sub-carrier (19kHz) to perform the RDS decoding, an absence of phase relationship between the RDS sub-carrier (57kHz) and (19kHz) can generate beats from 0 to a few Hz, which can interfere with the RDS decoding or the stereophonic decoding.

When the Digiplexer assures the RDS and stereophonic encoding, the synchronisation between the 2 or 3 signals is assured implicitly and perfectly (without any possible variation or phase noise). In this mode, the RDS phase should be set to 90° (**PHASE=90**) rather than to 0°: the effect of this measure is to reduce the combined 19kHz + RDS deviation by approximately 10% and in the process reduces the effects due to audio intermodulation phenomena on old FM receivers.

When the Digiplexer is used as a stereophonic encoder, it is useful to configure the "SYNC" input/output in 19kHz "output" mode (**SYNC_IO =O**) to supply the clock reference as master to an RDS encoder.

When the Digiplexer is used as an RDS encoder, it will be necessary to configure the "SYNC" input/output in 19kHz "input" mode (**SYNC_IO =I**) (or according to the case the MPX input as reference input) to accept a pilot signal and synchronise on it.

When a synchro signal is expected from an external source, the ASCII command **PILOT?** returns the state of the detection device:

- ➪ 0 = no signal or signal not compliant
- ➪ 1 = signal detected compliant

5. Audio operation of the Digiplexer

5.1 ARRIVAL OF THE AUDIO SIGNAL IN ANALOGUE FORM

The audio inputs exist in the form of 2 XLR connectors , one for the left channel, the other for the right channel. Refer to the chapter "Physical elements and interfaces", paragraph "The rear panel" to find the pin-out of these connectors. Ensure that the indications mentioned in this paragraph concerning the use of these inputs in symmetrical or asymmetrical mode are scrupulously respected.

"Symmetrical" mode: the arrival of the audio signal is normally in the form of 2 screened cables, each one having 2 conductors, usually twisted.

"Asymmetrical" mode: the arrival of the audio signal is normally in the form of 2 screened or coaxial cables, each one having only one central conductor.

The Digiplexer does not eliminate the dc voltages at the input. The use of isolating transformers is required when the signal arrives on the transmitting site via dedicated lines: these isolating transformers generally equip the parameter equalising device of the dedicated lines.

The input impedance of the Digiplexer is 600 ohms, regardless of the mode (symmetric or asymmetric) used. This purely resistive impedance consists of a 600 ohm resistance directly connected between the positive and negative pins of each input on the Digiplexer.

NOTE: if the audio source with which you wish to supply the Digiplexer has an impedance which is considerably greater than 600 ohms, a consequent attenuation of the input level will be seen. In this case, AUDEMAT-AZTEC recommends using a line amplifier in order to make the most of the Digiplexer's characteristics. For the experienced technical departments, AUDEMAT-AZTEC can indicate the means of increasing the impedance of the Digiplexer's audio inputs by deleting 2 electronic components (SMC resistors close to the analogue audio inputs).

5.2 ARRIVAL OF THE AUDIO SIGNAL IN DIGITAL FORM (AES/EBU)

This input exists in the form of an XLR connector. Refer to the chapter "Physical elements and interfaces", paragraph "The rear panel" to obtain the pin-out for this connector.

This port uses the AES/EBU format and supports a range of variants associated to this format. The Digiplexer automatically recognises each format variant and knows how to adapt to use the maximum dynamic range of the audio signal (16 bits to 32 bits, floating point).

▲ **IMPORTANT:** when the Digiplexer does not detect a valid signal at the terminals of its digital audio input, the analogue audio input is used for the sound transmission. During digital audio use, the audio analogue inputs can be connected to an analogue audio back-up input or left unconnected.

NOTE: the Digiplexer continually analyses the digital audio input, and continues to do so even when the transmission is made from the analogue inputs. If the "AES_EBU" parameter is set to 0 (**AES_EBU=0**), the Digiplexer will select the analogue inputs for the transmission **in all cases**. When **AES_EBU=1**, the Digiplexer automatically opts for the Digital input, if a valid digital signal arrives at its AES_EBU input.
The command **INP?** sends back "DIGITAL" if the digital input is used for the transmission, "ANALOG" if it is the analogue inputs.

5.3 TO SET THE NOMINAL SENSITIVITY OF THE DIGIPLEXER'S AUDIO INPUTS

This operation consists of adapting the characteristics of the Digiplexer's inputs to the level of the audio signal to be applied.
When the Digiplexer uses the AES/EBU digital audio input, the level applied to the Digiplexer is set using the **NMPN** parameter: Maximum Permitted Digital Level (**N**iveau **M**aximum **P**ermis **N**umérique).
When the analogue inputs are used (or likely to be used as back-up) the sensitivity of the analogue audio inputs is set using the **NMPA** parameter: Maximum Permitted Analogue Level (**N**iveau **M**aximum **P**ermis **A**nalogique).
These adjustments are performed via the front panel, or via a PC terminal application, or using the "DIGIPLEX" configuration software.

To simplify, the purpose of the adjustment procedure for the audio input sensitivity is to assign "the largest number of bits" to the audio signal that you will apply to the input of the Digiplexer.

2 methods to calibrate the nominal level of the analogue inputs

- **"Theoretical" adjustment:**

This type of adjustment can be made if you know exactly and to the nearest dB, *the nominal level* of the audio signal that you will apply to the Left and Right analogue inputs.
The *nominal level* is defined as being the audio signal level (frequency 400Hz) which in mono will produce a maximum deviation (75kHz) in FM.
This level must be expressed in dBu and represents the NMPA parameter :
Example 1: the nominal level applied to the Digiplexer is +12dBu, therefore configure **NMPA=12**dB (configuration value on delivery).

Example 2: the nominal level applied to the Digiplexer is -6dBu, therefore configure **NMPA=-6**dB.

- **"Purely practical" adjustment (the most sure):**

Inject the audio level into the Digiplexer that is considered as representative of the Maximum Permitted Level.
Adjust the NMPA parameter until
- all the green LEDs in the bar-graph indicator are lit
- The yellow LED flashes, but not lit permanently (corresponds to 75kHz)
- The red LEDs are never lit (no more than nominal deviation)
- if the level observed is too high ☛ **increase** NMPA
- if the level displayed is to low ☛ **decrease** NMPA

To calibrate the digital audio input level

The NMPN parameter (Maximum Permitted Digital Level - Niveau Maximum Permis Numérique) is expressed in dBfs (dB full scale) knowing that the full-scale reference corresponds to the maximum value that a digital audio sample can be.
The most common nominal working level corresponds to a value of **NMPN=-4**dBfs (configuration value on delivery).
Work in a similar way as for the adjustment of the analogue inputs (2 methods suggested) by acting on the NMPN parameter.

NOTE: these adjustments can be made without the Digiplexer connected to the pilot transmitter.

5.4 TO ADJUST THE PRE-EMPHASIS

The pre-emphasis operation consists of raising the high audio frequency levels relative to the low audio frequencies. The purpose of this is to reduce the signal/noise ratio in a proportion of 10 to 15dB by performing the inverse operation at the receiving level.
The Digiplexer performs the pre-emphasis operations in a purely digital manner, regardless of the transmission mode, stereo or mono. According to the place in the world where it is installed, configure P**_EMPH=50** (µS) (Europe) or **P_EMPH=75** (µS) (USA).
If the pre-emphasis operation is performed by external equipment, configure **P_EMPH=NONE** to inhibit the Digiplexer's pre-emphasis function.
Reread the parameter with **P_EMPH?**

5.5 TO TRANSMIT IN STEREO

Stereophonic transmission consists of transmitting the following 2signals in addition to the monophonic signal:

- stereophonic effect (signal at 38kHz).
- 19kHz pilot signal.

We configure **STEREO=1** to place the Digiplexer in this operating mode.

5.6 TO ADJUST THE PILOT SIGNAL LEVEL

Use the command **LVL19=<xx.x>**
Define the deviation level of the FM pilot sub-carrier (19kHz). The level is to be expressed **in kHz** and not in %. Reread the parameter with **LVL19?**.

5.7 TO TRANSMIT IN MONO

Monophonic transmission consists of only transmitting the Mono channel (Left+Right) and the RDS signal.
To do this, configure the "STEREO" parameter to 0 (**STEREO=0**). The Digiplexer will then proceed in a purely digital manner with the erasure of the following 2 signals:

- stereophonic effect (signal at 38kHz) deleted.
- pilot signal (19kHz) deleted.

The suppression of the pilot signal allows the audio level to take a considerably larger deviation part than in the case of a stereophonic transmission. The Multiplex limiter obviously takes into account this aspect to carry out its action.

◆ **IMPORTANT NOTE:** for a monophonic transmission, it is essential to supply the 2 inputs of the Digiplexer either with a mono program, or with a stereophonic program: the Digiplexer always performs the L+R operation. If the Digiplexer is only supplied in mono by one of the audio inputs, 6dB must be subtracted from the NMPA setting value in order to compensate the absence of signal on the other input.

5.9 TO TRANSMIT TEST SIGNALS

Several types of test signals can be transmitted by the Digiplexer at various possible frequencies. They can be used to calibrate the transmission chains. The table below shows the different test signals that can be obtained with the Digiplexer.
The front panel, the ASCII protocol or the "DIGIPLEX" configuration software can be used to activate these test signals.

◆ **NOTE 1:** the test signal transmission mode is limited to 2 minutes, therefore it must be reactivated as required.

Test signal: TESTn:xxxx

xxxx ⇨ n	L,R	L,-R	L,0	0,R
0	No test signal TEST0=L+R	No test signal TEST0=L-R	No test signal TEST0=L	No test signal TEST0=R
1	593,75Hz Left = Right (mono) TEST1=L+R	593,75Hz Left = -Right (L-R channel) TEST1=L-R	593,75Hz Left = 0 TEST1=L	593,75Hz Right=0 TEST1=R
2	1187,5Hz Left = Right (mono) TEST2=L+R	1187,5Hz Left = -Right (L-R channel) TEST2=L-R	1187,5Hz Left = 0 TEST2=L	1187,5Hz Right=0 TEST2=R
3	14843Hz Left = Right (mono) TEST3=L+R	14843Hz Left = -Right (L-R channel) TEST3=L-R	14843Hz Left = 0 TEST3=L	14843Hz Right=0 TEST3=R

◆ **NOTE 2:** The test signals are always sinusoidal. The adjustment of the input sensitivity does not affect the test signals. The deviation produced by the test signals is always 75kHz.

◆ **NOTE 3:** the test signals are transmitted by respecting the Digiplexer configuration and the level transmitted in this mode is automatically defined so that:

75,0kHz = {Audio level L+R} + {LVL19} + {LVL57} + {LVL76}

The 593.75Hz test signal "L+R" (TEST1=L,R) can be used to calibrate the output level of the Digiplexer: in this mode you can adjust the nominal output level "LVLO" of the Digiplexer so that it generates a carrier deviation equal to 75kHz on the pilot transmitter or the transmission chain used. See the adjustment procedure in the paragraph "To adjust the nominal output level of the Digiplexer" in the chapter "Installation and User Guide..."

Use the command **TEST=OFF** to stop the test signal.

5.10 AUTOMATIC CALIBRATION PROCEDURE FOR THE ANALOGUE INPUTS

An automatic "CALIBRATE" procedure allows the DIGIPLEXER to self-calibrate its analogue inputs. This procedure can be used to eliminate any dc component that could come from the existing analogue components for these inputs. The noise level present on the analogue input is also analysed and an error message appears on the display (example: "ERROR L NOIS") if an abnormal level is detected: in this case contact your distributor.

IMPORTANT: before starting the "CALIBRATE" procedure it is essential to disconnect the analogue inputs of the DIGIPLEXER.

◆ **NOTE1 :** this procedure is performed for each of the 74 values of NMPA (the progression is shown on the display), it takes approximately 5 minutes.

◆ **NOTE2 :** if this procedure is performed with an audio signal present, it has to be done one again with all audio inputs disconnected.

6. To use the audio processes of the Digiplexer

6.1 TO ACTIVATE THE AUDIO AND MULTIPLEX SIGNAL PROCESSING FUNCTIONS

The Multiplex signal processing functions are either enabled via the MMI on the front panel or by ASCII protocol with the command **PROCESS=1** (enable) and **PROCESS=0**

6.2 TO CONFIGURE THE AUTOMATIC GAIN CONTROL OF THE ANALOGUE AUDIO INPUTS

This function can be used to dynamically control the sensitivity of the analogue audio input of the Digiplexer in a range from +6 to –6dB. It can be used to regulate level differences on the audio signal, particularly if no sound processing system is present before it. The Digiplexer can be used to adjust the reaction time parameters for this function. The AGC function differs from the limiter, compressor or expander functions, amongst others, by a relatively slow action.

Enable the AGC function by setting **AGC=1**, disable with **AGC=0**, reread with **AGC?**

GATE=<v> with the value v between –50 and –10 (dB): threshold value of the audio input level below which the AGC function freezes. Reread with **GATE?**.

ATTACK=<n> defines the reaction time on a rising edge of the audio signal present at the analogues audio inputs. n=1 corresponds to a fast reaction: 0.2s for a drop in sensitivity of 1dB; n=99 corresponds to a slow reaction of 20s/dB. Reread the parameter with **ATTACK?**.

DECAY=<n> with n from 1 to 99. Reaction time on a drop in the audio signal at the input. Same principle as ATTACK= but in the other direction. Reread with **ATTACK?**

These parameters can be adjusted either via the front panel (buttons and display) or using the DIGIPLEX software or even with the ASCII protocol commands: **AGC=1**, **AGC=0**.
Note: the AGC function does not operate if **PROCESS=1**

6.3 TO VIEW THE ACTION OF THE AGC FUNCTION

VALUE INDICATOR: the gain or the attenuation generated by the AGC function on the analogue audio input can be viewed in the menu **''AGC :av.v x".** a=+ or -, x=G if the audio signal is lower than the GATE threshold, the function is then frozen.
v.v indicates the gain if a=+ or the attenuation if a= -, applied to the analogue audio input.

The action of the AGC function can also be viewed on a PC using the ''DIGIPLEX'' software.
◆ **NOTE:** this menu only appears if the function is enabled: **AGC=1** and **PROCESS=1**.
ASCII command: **AGC_VALUE?**

6.4 TO IMPROVE THE SUBJECTIVE POWER OF THE SOUND WITH ADDPWR

With this function, the Digiplexer enriches the Multiplex power by predictive algorithm and knows how to increase it respectively from 1 to 5 dB. This function must be associated to the CLIP function in order to respect the 75kHz deviation limit.
ASCII command: **ADDPWR=<v>** with v between 0 and 5 (dB) inclusive.
Note: the ADDPWR function only operates if **PROCESS=1**

6.5 TO REDUCE OR INCREASE THE STEREOPHONIC EFFECT WITH SEFFECT

SEFFECT acts on the L-R component of the Multiplex signal and can be used to reduce the stereophonic effect (SEFFECT= -1 to –9) or to increase it (SEFFECT= 1 to 9).
ASCII command: **SEFFECT=<v>** with v between –9 and +9

Note: the SEFFECT function only operates if **PROCESS=1**

6.6 TO OPTIMISE THE PROCESSING OF DENSE SOUND SIGNALS APPLIED TO THE DIGIPLEXER

To refine the signal processing applied to the audio signal on the Digiplexer input, we can tell the Digiplexer if the audio signal which is applied to it is already correctly processed (EXTLVLOK=5) or if it is not at all (**EXTLVLOK=0**).
The larger EXTLVLOK is, the less the Digiplexer will process the audio signal. For EXTLVLOK=5, only the MPX output clipper is digitally applied to the signal. The value EXTLVLOK=5 is highly recommended when the Digiplexer is attacked by a signal processed by specific audio equipment.
ASCII command: **EXTLVLOK=<v>** with v between 0 and 5 inclusive.
Note: the function related to EXTLVLOK only operates if **PROCESS=1**

6.7 TO ENABLE AND CONFIGURE THE MULTIPLEX "CLIPPER"

The Multiplex limiter (clipper) implanted in the Digiplexer is one of the most complex tasks performed by the equipment. With this proprietary algorithm, the Digiplexer knows how to act in limiter mode on the multiplexed sound signal (L+R) and (L-R) in order to scrupulously respect the 75kHz limit whilst guaranteeing an action that is imperceptible in the audio quality (as long as the input level remains within reasonable limits).

ASCII protocol command: **CLIP=<v>** with v between 60 and 99 (kHz)

Note: the CLIPPER function only operates if **PROCESS=1**

7. To use the RDS sub-carrier

To configure the RDS modulator (physical level)

To enable the RDS signal

The command **RDS=<b>** (b=1 or 0) defines whether or not the RDS signal must be produced by the Digiplexer and integrated to the Multiplex global signal. Reread the parameter with **RDS?**

To adjust the RDS signal level

Use the command **LVL57=<xx.x>**
Defines the deviation level of the RDS signal (57kHz). The level is to be expressed **in kHz** and not in %. Reread the parameter with **LVL57?**. Possible values between 0 and 16.0 (kHz).

For compatibility reasons with the UECP protocol (RDS), it is also possible to define the RDS signal level by entering the voltage that we require on the output with the command **LEVEL=<v>** where v is expressed in millivolts and must be between 0 and 1861mV. Caution, the correspondence between this voltage value and reality only exists if **LVLO=+12** (dB). The level can be reread with the command **LEVEL?**

To adjust the phase of the RDS signal, relative to that of the pilot signal

Use the command **PHASE=<v>** where v is expressed in degrees and is 0 or 90°. Reread with the command **PHASE?**.

To inhibit the RDS data output by conserving the carrier

It is possible to transmit only the bits with value 0 on the RDS sub-carrier by sending the command **DATA=0**. Do not forget to restart the transmission of normal RDS data with **DATA=1**.

8. To use RDS with the FMX480 Digiplexer

Functionalities of the FMX480 Digiplexers and resultant compatibility with the "SPB490" EBU-UER specification

This chapter summarises the functionalities of the FMX480 Digiplexer and particularly the compatibility with the "SPB490" EBU-UER specification for each function and each parameter.

- the "SPB490" specification recommends the use of a precise model for the classification of RDS data.
- it also specifies the universal communication protocol between the data server (broadcasting or configuration) and several hundred RDS encoders.

The following table essentially refers to the document, the latest edition is available on order from the following address:

EBU/UER
B.P. 67
CH1218 Grand Saconnex (GE)
SWITZERLAND

Or on Internet:
ftp://ftp.rds.org.uk/pub/acrobat/s490e51.pdf

The RDS-MCS2 software described in the RDS1982 technical manual supports this communication protocol and allows the RDS encoders (not necessarily those of AZTEC) to be easily configured for diverse applications.

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
Communication ports		**Yes**	**3 communication ports** for the FMX480 Digiplexer. **COM0** (RS232 DCE): 9600 baud, signals other than RxD and TxD **not controlled by this port.** Refer to the chapter **Installation and initial configuration of the Digiplexer,** section **communication ports** Unlimited number of message Elements per frame, 255 characters maximum per protocol frame (according to SPB490).
PI RDS parameter *Program Identifier*	The PI code gives the RDS receivers an ultra rapid recognition of the station received.	**Yes**	Nothing to report Controlled by the FMX480 Digiplexer.
PS RDS parameter Name of the program in 8 characters *(Program Service)*		**Yes**	Nothing to report Controlled by the FMX480 Digiplexer.
Scrolling PS (Function)	Function prohibited by the RDS standard CENELEC EN50067.	**No**	function (deliberately) not implanted in the FMX480 Digiplexer .
PIN RDS parameter Program start time *(Program Item Number)*	Function not presently used by radio broadcasters and radio stations.	**Yes**	Parameter controlled by the FMX480 Digiplexer. This parameter is dynamic by definition, its value is not saved in the non-volatile memory.
DI	Parameter rarely used		Nothing to report

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
RDS parameter Audio decoder identifier *(Decoder Identifier)*	by RDS receivers.	**Yes**	Controlled by the FMX480 Digiplexer.
TA TP RDS parameters TP='traffic info' program TA= Traffic Announcement in progress *(Traffic Program)* *(Traffic Announcement)*	The "TA" parameter can be switched by: - external switch - software	**Yes**	Command accepted and hardware remote control on DB15, Inp 3, (pin 4/GND) The hardware switch has priority over the EBU commands. **Note:** a maximum activation delay can be defined, see details of the ASCII command 'TIMEOUT.TA '
PTY RDS parameter Program type		**Yes**	Command accepted.
PTYN RDS parameter Program type		**Yes**	Command accepted.
MS RDS parameter Music/speech switch *(Music/Speech)*	Parameter rarely used by the RDS receivers.	**Yes**	Command accepted.
Radio Text RT Radio Text function and data	Function used by practically all the commercially available RDS tuners. **▲ IMPORTANT: the Radio Text function is not used by car radios.**	**Yes**	Command accepted. 10 Radio Text messages for each DataSet. The messages are stored in a non-volatile memory.
AF RDS parameters	These frequencies are the ones that allow the	**Yes**	The FMX480 Digiplexer accepts an AF list of 300 elements for

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
Alternative frequencies	automatic switching of frequencies for car radios.		each Main Program Service.
EON RDS parameters Alternative frequencies, PI, PS, TA, TP etc... for the other networks in relation with the main network		**Yes**	The FMX480 Digiplexer accepts 8 EON Program Services for each DataSet. Each EON AF Program Service contains a maximum of 90 (30 x 3) EON-AF elements with the corresponding codes.
LINK Link information *(linkage actuator)*		**Yes**	Command accepted. This parameter is dynamic by definition; its value is not saved in the non-volatile memory.
SLC RDS data *(Slow labelling Codes)* Slow transmission "Label" codes	Allows the synchronisation of the RDS receivers for diverse RDS services. (type 1 RDS groups)	**Yes**	Command accepted.
ODA RDS data *Open Data Applications*		**Yes**	Command accepted. Buffers with queues of 150 grp for each type. The cyclic buffers can be configured up to 1600 grp. Buffer of 5 groups for "Extremely urgent" or "Immediate" transmission The transmission modes 'Burst mode' and 'Spinning wheel mode' are supported. 2 MSG can be defined for each ODA application
TDC RDS data *(Transparent Data Channel)*	Allows the transmission of diverse RDS services. (type 5 RDS groups)	**Yes**	Command accepted. The queue buffers have 150 grp. The cyclic buffers can be configured up to 1600 grp.

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
TMC RDS data *(Traffic Message Channel)*	Data channel dedicated to the encoded digital information messages related to traffic.	**Yes**	Command accepted. The queue buffers have 150 grp. The cyclic buffers can be configured up to 1600 grp (150 by default). High priority buffer: 10 grps.
EWS RDS data *(Emergency Warning System)*	(type 9 RDS groups) Data channel dedicated to alert messages of a sensitive nature	**Yes**	Command accepted. The queue buffers have 150 grp. The cyclic buffers can be configured up to 1600 grp (150 by default).
IH RDS data *(In House)* Data channel reserved for applications that are internal to the radio broadcaster.	(type 6 RDS groups)	**Yes**	Command accepted. The queue buffers have 150 grp. The cyclic buffers can be configured up to 1600 grp (150 by default).
Free format groups *(Free Format Groups)* RDS encoder function		**Yes**	Command accepted. The queue buffers have 150 grp. The cyclic buffers can be extended for a given type and version of group up to 1600 grp (150 by default). Such buffers are in volatile memory
"Standard" Paging Message transmission system	The "standard" paging does not integrate the **"EPP"** paging protocol. *(Enhanced Paging Protocol)*	**Yes**	Command accepted. Buffer of 160 groups per interval. The repetition parameter must be 0, the possible repetitions must be managed by the server.

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
"EPP" Paging Message transmission system	A software version RDS1750 available from AUDEMAT-AZTEC integrates **"EPP"** paging. *(Enhanced Paging Protocol)*	**No**	
CT RDS data *(Clock Time)* Calendar clock		**Yes**	The command related to time correction (adjustment in milliseconds) is ignored. the FMX480 Digiplexer does not integrate real time correction
RDS ON/OFF RDS encoder function		**Yes**	This command acts in the same way as the ASCII command 'RDS=x' described in this manual in the chapter 'ASCII instruction set relative to the hardware configuration of the FMX480 Digiplexer' On the FMX480: 'RDS=x' is also accessible using the buttons via the menu "GotoParams" in the display on the front panel.
RDS phase RDS encoder function		**Yes**	The UECP command must be addressed to all the tables (reference 0) and the values are converted into 0 or 90.
RDS level RDS encoder function		**Yes**	The associated protocol command must be addressed to all the tables (reference 0). the level is defined in mV for an output level adjusted to LVLO=12 dBu
A.R.I. ON/OFF RDS encoder function	This command is only used on certain German national networks.	**No**	Command ignored.
RDS group		**Yes**	Command accepted by the FMX480 Digiplexer.

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
sequence (Internal RDS encoder function related to the EBU protocol)			Group sequence of up to 252 elements for each DSN.
Extended RDS Group sequence (Internal RDS encoder function related to the EBU protocol)		**Yes**	Command accepted by the FMX480 Digiplexer. Extended sequence group sequence of 252 elements for each DSN.
Access rights of the encoder Internal encoder parameter relative to the EBU protocol		**Yes**	For each of the communication ports COM1 and COM2 and for each "MEC" an access right can be defined.
Site address (Site Address) Internal encoder parameter related to the EBU protocol		**Yes**	The FMX480 Digiplexer accepts 10 site addresses + 1 individual site address for the RDS function. The individual site address can only be modified with one of the ASCII protocol commands (SITE= or SITE.HEX=) or with the specific TDF command described in the Appendix. The others can be modified by the appropriate EBU command. The address "0" is always accepted by the Digiplexer FMX480.
Encoder address(s) (Encoder Address) Internal encoder parameter related to the EBU protocol		**Yes**	the FMX480 Digiplexer accepts 10 encoder addresses + 1 individual encoder address for the RDS function. The individual encoder address can only be modified with one of the ASCII protocol commands (ENCODER= or ENCODER.HEX=) or with the

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
			specific TDF command described in the Appendix. The others can be modified by the appropriate EBU command. The address "0" is always accepted by the FMX480 Digiplexer.
SQC Sequence Counter Internal encoder function related to the EBU protocol		**Yes**	Function controlled with a depth of 100 for the COM1 and COM2 ports. Any frame received with an SQC that is already processed generates a positive acknowledgement (if communication mode 2) and the command is ignored. If a frame is received with an SQC that is already processed in the last 100 frames received, a negative acknowledgement (REPLYMODE=1) relative to the last SQC value not processed is generated, then the command is processed. If REPLYMODE=0, a negative acknowledgement by missing SQC is generated. The last 100 values of SQC processed are saved. **Note 1**: After reception of a MEC 2C command or an SQC with the value 0, the SQC memory of the port used is erased, any SQC value is then accepted for the following frame. **Note 2**: The SQC values are examined on all the frames received even those where the address does not correspond to the encoder
CRC of the protocol		**CRC tested**	All the protocol commands with a "CRC" error are ignored by the FMX480 Digiplexer.

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
Internal encoder function related to the EBU protocol			
DSN (Data Set Number) Internal encoder parameter related to the EBU protocol		**Yes**	6 DSNs for the FMX480 Digiplexer. The active DataSet can be selected by software with the corresponding UECP command or via the logic inputs. The latter having priority.
PSN (Program Service Number) Internal encoder parameter related to the EBU protocol		**Yes**	For the FMX480 Digiplexer: 1 + 8 PSN : 1 main one and 8 for the EON data (8 EON stations).
Communication mode Internal encoder function related to the EBU protocol		**No**	Protocol commands accepted by the FMX480 Digiplexer, MEC 2C and MEC 3B
EON-TA and TA control Function related to the transmission of 14B and 15B groups		**Yes**	Protocol command accepted by the FMX480 Digiplexer.
'Usage Code' Parameter related to the 1A and 14A groups		**Yes**	Protocol command accepted by the FMX480 Digiplexer.
Table of characters (PST) RDS data, text transmission mode		**Yes**	Protocol command accepted by the FMX480 Digiplexer.

RDS function, and characteristics related to the RDS encoder and encoding	Comments	Function assured by the FMX480 Digiplexer	Compatibility of the function with the SPB490 EBU-UER UECP protocol FMX480 Digiplexer
Acknowledgement messages Internal encoder function related to the EBU protocol		**Yes**	**Error 0**: OK, message received **Error 1**: CRC error **Error 2**: SQC **Error 3**: Command not recognised by the FMX480 Digiplexer. **Error 4**: DSN error **Error 5**: PSN error **Error 6**: parameter out of limits **Error 7**: "MEL" error **Error 8**: "MFL" error **Error 9**: message not acceptable **Error 10**: "FF" missing at the end of the message **Error 11**: input buffer saturated **Error 12**: incorrect encoding (*"byte stuffing"* error)
Manufacturer specific command *(Manufacturer specific command)*	The designation code which was attributed to us by the EBU for RDS encoders made by the company is: MED n°1 = "A" MED n°1 = "Z"	**Yes**	the FMX480 Digiplexer accepts all the ASCII commands that it supports in ASCII mode as manufacturer command . This function is particularly useful for example to perform a "RESET". The ASCII command is to be 'packed' in an EBU protocol frame by respecting all the encoding instructions and can be sent as it is to the RDS encoder. If the communication mode of the RDS encoder is "2", then a manufacturer command is sent in response (packed ASCII). Example: RESET 2D 07 41 5A 52 45 53 45 54 A Z R E S E T

9. RDS implementation and configuration of the FMX480

9.1 UP AND DOWNLOADING OF ONE RDS CONFIGURATION

The command **?RDS_CFG** returns the full RDS current configuration with a list of ASCII commands that can be interpreted for a downloading. This list can be stored with the function "receive file text" of Hyperterminal.
The command **FILE.RDS_CFG** generates or updates the file /RDS_CFG.TXT in the IP2 file system. This file is accessible through the Web server, FTP or Telnet.
Uploading of a configuration can be done with a similar file placed with FTP in the IP2 file management system with a ***.CMD extension** then **"executed"** with the help of the command **COMMAND=** (please refer to the IP2 manual for additional details regarding the use of the ASCII *.CMD file commands).

Example :
COMMAND=RDS_CFG.CMD

9.2 PAGING

The FMB40/FMX480 encoder allows the extended use of Paging in RDS. In standard version, it supports the 'standard' paging system i.e. the one which is specified in the RDS standard EN50067 dated 1992.
A second paging process, compatible and improving the first one called "EPP" (Enhanced Paging Protocol) is also available. AUDEMAT-AZTEC proposes EPP as an option. This option is granted under licence for a group of FMB40 RDS encoders and/or FMX480 Digiplexers. This option can be installed by software, without hardware intervention on the equipment.

To configure a "paging" application

Insert 7A type groups in the group sequence using the command **DSN(d).GS=g1,g2,g2,…gn** where d = 1 to 6 specifies the assigned DSN, n<=252 and g1,g2,..gn = 0A, 0B, 1A,…to 15A. (The values 4A, 14B and 15B are prohibited).

The number of 7A type groups present in the group sequence must guarantee the possibility of broadcasting at least one to two 7A groups per interval for numeric paging and twenty 7A groups for the 80 character text paging (1 interval representing approximately 66 groups).

Define the value of the GRPD code with the command **DSN(d).GRPD=i** with i=0 to 7.
Possibly define the parameter GRPD.TO=c where c = 0(function disabled), 1 or 2: this function can be used to fix the value of the GRPD parameter to 0 according to the inactivity on the COM c port, inactivity defined by the parameter **TIMEOUT.COMc=t**, c = 1 or 2, t = 1 to 254 (maximum inactivity delay accepted in minutes), 255 (function disabled)

9.3 OPEN DATA APPLICATIONS (ODA)

The FMB40 / FMX480 encoders allow the use of Open Data Applications in RDS. They support all the modes (FIFO, Cyclic, Burst mode, Spinning Wheel mode, extremely urgent and Immediate) that are specified in the RDS standard prEN50067 version 2.4 and in the protocol UER-EBU UECP SPB490 version 5.1.

To configure an "ODA" application

An ODA application is defined by its AID code and by the type of group used, these two parameters figure in the 3A type groups used as service locating. The command **ODA.gv.AID=aaaa** can be used to define the AID code aaaa associated to the gv type group, gv=3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B.
The 3A type groups and the type of group used for the ODA application must figure in the 'group sequence' defined by the command **DSN(d).GS=g1,g2,g2,…gn** where d = 1 to 6 specifies the assigned DSN, n<=252 and g1,g2,..gn = 0A, 0B, 1A,…to 15A. (The values 4A, 14B and 15B are prohibited).
The broadcasting of the 3A type groups is managed, according to the type of group associated to an AID code, by the parameter **SEQ.3A=U1,U2,…Un** where n <= 16, Un defines the type of group used by the ODA application, U1, U2,…Un= 3A (specific case), 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A, 13B.
The messages included in the 3A groups (block C) are defined by the commands **ODA.gv.MSG=bbbb** and **ODA.gv.MSG2=bbbb** gv=3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B; bbbb=0000 to FFFF represents the message. A Timeout (maximum inactivity delay) can be defined by the command **ODA.gv.TO=t** where gv=3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B; t = 0(function disabled) to 255 in minutes.
The various transmission modes, "BURST" and "SPINNING WHEEL" are respectively defined by the commands:
ODA.gv.REPEAT=n, n = repetition number
ODA.gv.SPACE=x, x = minimum number of groups between two gv type groups
and
ODA.gv.NB=n, n = number of windows defined in a one minute cycle
ODA.gv.WINDOW=t, t = in seconds the inactivity period in the cycle
ODA.gv.DELAY=d, d in seconds defines the delay between the start of a minute (second =0) and the start of the active period.
With gv=3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B

9.4 RADIOTEXT

The FMX480 allows the transmission of static or dynamic RadioText by using all the possibilities of the associated UECP protocol command (UER-SPB490): repetition of messages, saved buffer of 10 messages for each DataSet.

To configure a Radiotext application
Define 2A type groups in the group sequence using the command **DSN(d).GS=g1,g2,g2,…gn** where d = 1 to 6 specifies the DSN assigned, n<=252 and g1,g2,..gn = 0A, 0B, 1A,…to 15A. (The values 4A, 14B and 15B are prohibited).
The number of 2A type groups will determine the transmission speed of this function.
The following command allows the capture of a Radio-text message, after deleting the possible existing messages: **DSN(d).RT=r,f,texte…** where d = 1 to 6 specifies the DSN assigned, r the repetition number for the message, f =1 the toggling of the "flag A/B", f=0 no change of the "flag A/B", text…= a string of at least 64 characters.
The command **DSN(d).RT+=r,f,texte…** adds a message, with a maximum of 10, to the Radiotext buffer according to the same syntax as the previous command.
Radio-text messages can be saved according to two modes defined by the commands:
RADIOTEXT=LONG: any message is made up of exactly 64 characters, the shorter messages that may be entered are completed with <space> characters
RADIOTEXT=SHORT: the messages are saved as entered and terminated with the <CR> character if the length is less than 64 characters.

9.5 TO BROADCAST RDS DATA

To broadcast in one time an RDS data file

Download manually or via an automatical process (FTP TCP/IP protocol) in the main directory of the FMX480 Digiplexer file management system, one file of *.UCP file.
The *.UCP files are binary files that contains standard UECP sequences. In the file system, the RDS encoder generates the associated temporary file named ~RUN.UCP in order to indicate the processing of the file and/or its broadcasting. The RUN.UCP file disappears one the broadcasting phase is finished. The file will "executed" with the command **COMMAND=** .
Example : **COMMAND=DATA.UCP**

To broadcast cyclically RDS data
The UECP defines cyclic buffers for the RDS groups for the data broadcasting. All the broadcasting phase has to be based on these buffers. These buffers can be loaded with *.UECP files. An automatic loading of the data after a power on of the Digiplexer can be done with the RESET event of the IP2 system (refer to IP2 manual).

To broadcast data arriving to the RDS encoder via COM0, COM1 ou COM2
Be sure that the protocol associated to the communication port is really the UECP !
COM<n>.PROTOCOL=UECP where COM<n> represents COM0, COM1 or COM2
Define the speed of the COM port (except for COM0 fixed at 9600) **COM<n>.RDS.SETTINGS=*v*** where COM<n> represents COM1 or COM2, ***v*** the speed from 75 to 115200 bit/s. Adjust the communication mode **COM<n>.MODE=*m*** where COM<n> represents COM1 or COM2, ***m*** the communication mode :
0 : half duplex ;1 : full duplex on reply request ; 2 : full duplex spontaneous.

To broadcast RDS data arriving to the RDS encoder in UDP (TCP/IP)

Please refer to the chapter « communication ports» and its UDP subpart.

9.6 TO RETRANSMIT RDS DATA

The RDS FMB40/FMX480 encoders can be used to decode any type of RDS or MPX signal injected into the input of the encoder. This signal can be supplied by any FM demodulator, taken on any modulation input of a transmitter, or outputted from an RDS encoder. Any RDS group type and version can be selected and a multiple selection is possible. This mode can be initialised for a time-out relative to the communication ports COM1 or COM2, in a permanent way, or remote controlled via the logic input Inp3 (connector SUB-D15 on the rear panel).

> **▲ IMPORTANT:**
> **The input signal must allow an "errorless" decoding. The FMB80 / FMX480 encoders would automatically stop the retransmission mode if an RDS error is detected on the decoded signal. The "status" of the decoder can be controlled via the ASCII command P12.**

To configure the RDS data retransmission mode
Select the type of group to be retransmitted using the command **GROUPS=i**, i=00000000 to FFFFFFFF represents a 32 bit word, each bit being associated to a type of RDS group.
Examples:
GROUPS=00000002 selects the retransmission of 0B type groups
GROUPS=0000000A selects the retransmission of 0B and 1B type groups
GROUPS=40000000 selects the retransmission of 15A type groups

Choose the activation mode for this function, the various modes are:

RDS.IN=i

i = 0 function OFF
i = 1-2 function active after Timeout on COM1-2
i = 3 remote function using logic input INP3
i = 4 function active

Control the decoder operation, in particular the RDS error rate by displaying page page **?RDS.ENCODER** or **P12**

The groups selected for retransmission:
- have priority relative to the defined 'Group Sequence'
- they do not respect 'Group Sequence'

In addition, these types of groups can no longer be generated internally by the local encoder.
Example: if the 2A type groups are retransmitted from the MPX signal applied to the input, then the Radio-text functions of the FMX480 are inhibited. And, whether or not there are 2A groups in the 'Group Sequence', the 2A groups broadcast will only reflect the data broadcast by the transmitter where the signal is applied to the MPX input of the FMX480.

9.7 TO CONFIGURE AND USE THE RDS DATA "TIMEOUT" RELAY 1

The state of relay 1 indicates exceeding a maximum inactivity time on COM1 and/or COM2. This indication can be defined or inhibited using the command (MEC 3D) of the UECP EBU protocol or even using the commands:
TIMEOUT.COM1=t, t in minutes defines the maximum inactivity time on the port Com1 before action on the relay
TIMEOUT.COM2=t, t in minutes defines the maximum inactivity time on the port Com2 before action on the relay
Where t=1 to 254 delay expressed in minutes, t=255 or t=OFF disables the Timeout function

Relay active: when one of these queuing times is exceeded

The contacts of relay 1 are accessible on the connector DB15 I/O RDS :
common = pin 13, make = pin 5, break = pin 6

9.8 TO USE THE RDS "STATUS" RELAY 2

The state of this relay is determinated by :

Supply power	Parameter RDS.CTRL=	State of the RDS decoder (BNC input : RDS)	Relay 2 STATUS
0	X	X	Default : inactive
1	0	X	OK : active
1	1	Errors	Défaut : inactive
1	1	OK	OK : active

X indcates the the value can be either '0' or '1' ; 'Errors' or 'OK'

The integrated RDS decoder can continuously control one RDS signal connected to the BNC "RDS signal input" at the rear panel and gives a binary state that signals the presence of a valid RDS signal.

9.9 TO SELECT THE ACTIVE DATASET AND RDS ON/OFF BY LOGIC INPUTS

Inp 0 DB15 RDS I/O Pin 1	Inp 1 DB15 RDS I/O Pin 2	Inp 2 DB15 RDS I/O Pin 3	Encoder status
0	0	0	DataSet active selected by Software
1	0	0	DataSet 1 active
0	1	0	DataSet 2 active
1	1	0	DataSet 3 active
0	0	1	DataSet 4 active
1	0	1	DataSet 5 active
0	1	1	DataSet 6 active
1	1	1	RDS OFF

State 1 = Pin connected to ground, State 0 = Pin isolated
The ground is accessible on pins 9 to 12 of the connector DB15 I/O RDS

9.10 REMOTE CONTROL OF THE TA OR EON-TA OR OF THE RETRANSMISSION MODE (RDS) BY LOGIC INPUT

The action of the input Inp3 (DB15 I/O RDS, pin 4) depends on the parameters **RDS.IN=** and TA of the Main Program of the active DataSet.

Inp3 DB15 E/S RDS Pin 4	ASCII parameter RDS.IN	TP of the main PSN of the active DATASET	Encoder status
0/1	0,1,2,4	0	TA=0/1 for the 1st PSN-EON of the active DataSet
0/1	0,1,2,4	1	TA=0/1 for main PSN of the active DataSet
0/1	3	-	RDS data retransmission mode enabled/disabled

State 1 = Pin connected to ground, State 0 = Pin isolated

9.11 TO USE THE UER SPB490 PROTOCOL WITH THE FMX480

The 3 communication ports COM0, COM1 and COM2 can be used simultaneously. In addition, the speed of the ports COM1 and COM2 can be set from 75 to 115200 baud

To configure the ports COM0, COM1 and COM2, refer to the chapter **Installation and initial configuration of the Digiplexer,** section **communication ports**.

Note: the COM0 port can be configured to be compatible with the ASCII and UECP protocols at the speed of 9600 only. Therefore, depending on its configuration, COM0 can interpret both UECP and ASCII commands, which can be strung together without any switching instruction.

9.12 ASCII COMMAND INTERPRETER (RDS): GENERAL INFORMATION.

Conventions relative to the ASCII command interpreter

The FMX480 Digiplexer supports the ASCII protocol, described in the following chapter, via COM0, TELNET, UDP (according to configuration).

The coexistence of the ASCII and UECP protocols (or USEP, depending on the configuration) on the port COM0 is entirely transparent.

ASCII and UECP commands (or USEP) can be strung together, the possible responses are returned in the protocol used for the command, and for the UECP protocol, by respecting the defined communication mode.

▲ **WARNING:** the ASCII character chr$(254) is the start indicator for a UECP frame (or USEP), consequently, take care not to send this character in an ASCII command. All the characters which follow will then be ignored by the ASCII interpreter until the detection of :

- a character chr$(255) signalling the end of an UECP frame (or USEP)

or

- the reception of 500 characters

or

- after a time-out on the communication port corresponding to the transmission delay of several characters

▲ **IMPORTANT**

All the ASCII commands that refer to a DataSet respect the following syntax: **DSN(d).XXX** example: **DSN(1).GS?** to display the group sequence of DataSet 1.

To simplify entering commands, it is possible to specify a DataSet for the current edition using the command DSN=d. d = 0 (DSN active), 1 to 6.

Example :

DSN=3

RT? Will display the Radio-text messages of DataSet 3. Equals **DSN(3).RT?**

In the same way, for the commands relative to a Program (PSN), the syntax is of the form:

DSN(d).PSN(p).XXX example: DSN(2).PSN(32).PI? will return the PI code of Program 32 of DataSet 2.

In the same way as above, it is possible to simplify this syntax by specifying the default PSN for editing with the command PSN=p where p=0(Main program), or refers to a PSN defined for the considered DataSet.

Example:

DSN=6

PSN=65 (PSN 65 must be defined in DataSet 6)

PI ?

Equals the command: **DSN(6).PSN(65).PI ?**

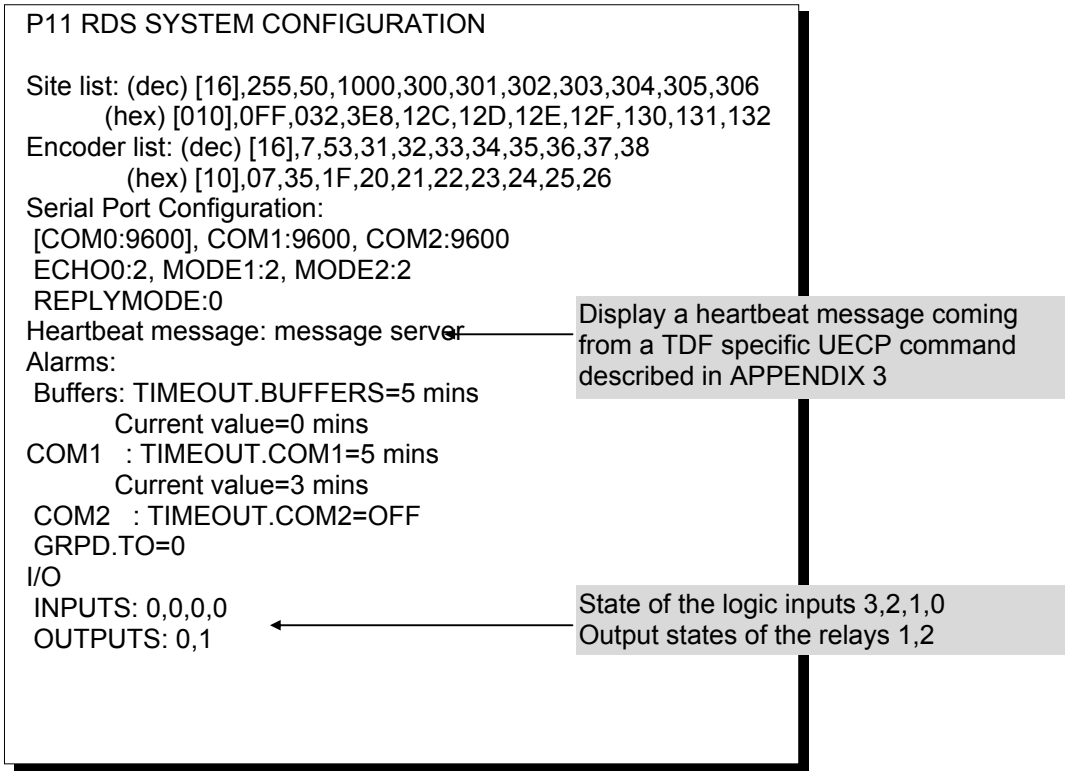
9.13 TO DISPLAY HELP PAGES, TO VIEW THE CONFIGURATION AND STATUS PAGES

	Help page	Configuration and status page	Shortcuts
RDS system parameters	HELP.RDS.SYSTEM	?RDS.SYSTEM	P11
RDS encoder parameters	HELP.RDS.ENCODER	?RDS.ENCODER	P12
RDS group buffers	.	?RDS.BUFFERS	P13
RDS paging buffers	.	?RDS.PAGING	P14
UECP command authorisations	.	?RDS.ACCESS	P15
ODA configuration	HELP.RDS.ODA	?RDS.ODA	P16
SQC management state	.	?RDS.SQC	P17
DataSet parameter	HELP.RDS.DSN	?RDS.DSN(d)	DSNd / DSN
Program parameters	HELP.RDS.PSN	?RDS.DSN(d).PSN(p)	PSNd,p / PSN

The following sections show and comment the contents of the configuration and status pages

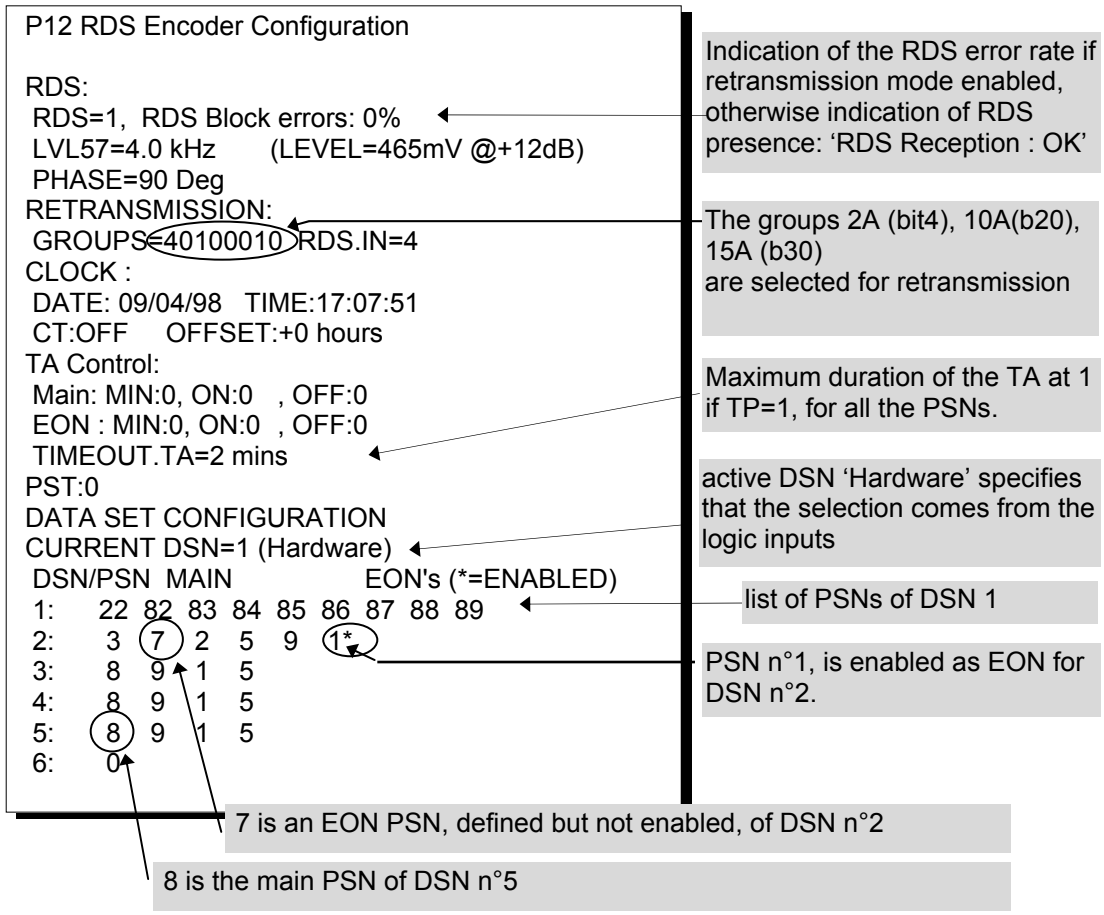
?RDS.SYSTEM

Displays the following parameters with their values.



?.RDS.ENCODER

Displays the following parameters with their values.



?RDS.BUFFERS

Displays the size and contents of each RDS group buffer.

P13 RDS Buffers

GSIZE.CYC=16

	A CYCLIC SIZE	No	A QUEUED SIZE	No	B CYCLIC SIZE	No	B QUEUED SIZE	No
0	20	0	20	0	20	0	20	0
1	20	0	20	0	20	0	20	0
2	20	0	20	0	20	0	20	0
3	20	0	20	0	150	0	150	0
4	20	0	20	0	150	0	150	0
5	150	0	150	0	150	0	150	0
6	150	0	150	0	150	0	150	0
7	150	0	150	0	150	0	150	0
8	150	0	150	0	150	0	150	0
TMC (HIGH PRIORITY)			10	0				
9	150	0	150	0	150	0	150	0
10	150	0	150	0	150	0	150	0
11	150	0	150	0	150	0	150	0
12	150	0	150	0	150	0	150	0
13	150	0	150	0	150	0	150	0
14	20	0	10	0	20	0	20	0
15	20	0	10	0	20	0	20	0

?RDS.PAGING

Displays the paging parameter and the contents of the buffers concerned.

P14 Paging Information

CURRENT DSN=1 (EBU)
CURRENT GRPD:0
CURRENT OPC:3 ECC:1 PAC:2 CCF:4
EPP CFG: 50 bits, 60s, sorted ---
CURRENT INTERVAL:0 EVEN MIN

	ONE MINUTE		TWO MINUTES			
			EVEN MIN		ODD MIN	
INT	MSGS	GPS	MSGS	GPS	MSGS	GPS
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0

Visible with the EPP firmware only

Number of paging messages in the conventional PAGING buffer of interval n°2

Number of 7A groups in the buffer of interval n°6.

?RDS.ACCESS

Displays the access state of the 2 ports COM1 and COM2 for each EBU command.

P15 RDS UECP Command Access

COM1

00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

COM2

00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
80	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

MEC 3A (Access right) is inhibited on COM1: This table can only be edited via COM2

?RDS.ODA

Displays the ODA parameters for each possible type of ODA group.

P16 RDS ODA Configuration

GROUP	AID	MSG	MSG2	T.O.	Rpts	Space	N	Window	Delay
3A	7654	1210	3456	0/255					
3B	003B	FEDC		OFF	0	0	1	0	0
4B	004B	BA98		8/10	0	0	1	0	0
5A	05A0	AAAA	1233	OFF	0	0	1	0	0
5B	0000	0000		OFF	0	0	1	0	0
6A	0000	0000		OFF	0	0	1	0	0
6B	0000	0000		OFF	0	0	1	0	0
7A	0000	0000		OFF	8	2	1	0	0
7B	0000	0000		OFF	0	0	1	0	0
8A	7777	6666		OFF	0	0	1	0	0
8B	0000	0000		OFF	0	0	1	0	0
9A	0000	0000		OFF	0	0	1	0	0
9B	009B	0000	1234	0/5	0	0	1	0	0
10B	010B	5678	0002	0/100	0	0	3	15	5
11A	0000	0000		OFF	0	0	1	0	0
11B	0000	0000		OFF	0	0	1	0	0
12A	0000	0000		OFF	0	0	1	0	0
12B	0000	0000		OFF	0	0	1	0	0
13A	0000	0000		OFF	0	0	1	0	0
13B	0000	0000		OFF	0	0	1	0	0

Relative priority: 7A, 13B ,

ODA Timeout for 4B type grp fixed to 10 minutes. Present value: 8 minutes

The 7A ODA groups in burst mode are transmitted 8 times with at least 2 other groups between two 7A groups.

The 10B ODA spinning Wheel mode is defined as follows for each minute: transmission active from second 5 to second 10, from sec 25 to sec 30 and from sec 45 to sec 50

Defines the order of priority of the groups for 'IMMEDIATE' transmission

?RDS.SQC

Displays a table showing the management of the SQC parameter of the UECP frames for each of the RDS COM ports.

```
P17 RDS UECP SQC Table

COM0 SQC=7A NEXT SQC=7B
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00011111 11111111 11111111 11111110 11111111 11111111 11100000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
COM1 SQC=00 NEXT SQC=01
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
COM2 SQC=00 NEXT SQC=01
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

UDP1    SQC=00 NEXT SQC=01
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
…..
```

The SQC values 4B to 7A except 68 have been received on port COM 0.

Note : only the UDP defined ports have been mentioned.

?RDS.DSN(d) (d=0,1 to 6)

DSN displays the parameters of the previously selected DataSet with the command **DSN=d**
DSNd displays the parameters of the DataSet **d** independently of the selected DSN and without changing the selection.
DSN0 displays the parameters of the active DataSet (being transmitted).

```
DATA SET INFORMATION
DSN 1

CURRENT DSN=1    (HARDWARE)
          MAIN              EON's (*=ENABLED)
PSN's:   22   82*  83   84   85   86   87   88   89*
Group Sequence: 0A, 7A, 2A, 8A,
Extended Group Sequence : 7A-8A-2A-14A, 8A-14A,
1A Usage Sequence: 0
3A Usage Sequence: 4B, 10B, 7A
14A Usage Sequence: 0, 1, 2, 3, 5, 12, 13, 14
GRPD:0
CURRENT OPC:0   ECC:0   PAC:0   CCF:0
EPP CFG: 50 bits, 60s, sorted ---
Slow labelling codes:0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000
RADIOTEXT BUFFERS (INDEX, No of transmissions, Toggle, Text:)
1, 3,0, RADIOTEXT Message 1
2, 4,1, Message 2 repeated 4 TIMES
```

The active DataSet is selected by the logic inputs

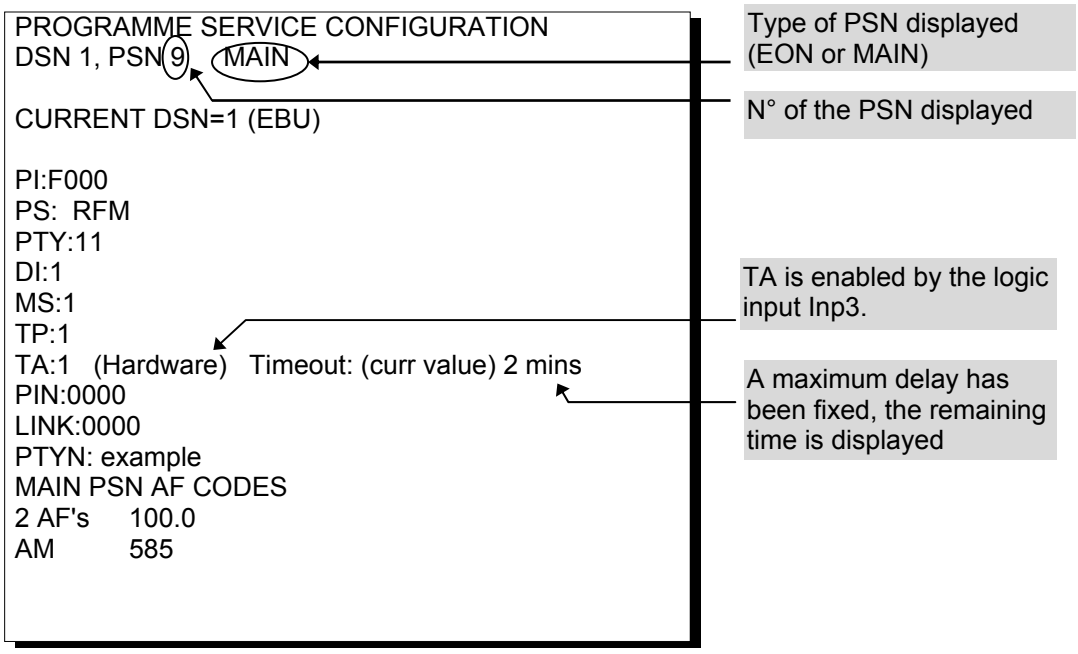
only visible with the EPP firmware

The A/B flag is unchanged for this Radio Text message

Message n°1 is transmitted 3 times, then message n°2 is transmitted 4 times and so on.

?RDS.DSN(d).PSN(p) (d=0,1 to 6 ; p=0, a PSN defined for the DSNd)

PSN displays the parameters relative to the Program Service previously selected with the command **PSN=p** of the DSN previously selected with the command **DSN=d**
PSNd,p displays the parameters relative to the Program Service **p** of the DSN **d**, independently of the PSN and DSN previously selected and without changing the selection.
PSN0,0 displays the parameters relative to the Main Program Service of the active DSN (being transmitted).



9.14 ASCII INSTRUCTION SET OF THE FMX480 RELATIVE TO THE RDS CONFIGURATION

Note: the following commands can also be used via the EBU protocol as manufacturer specific commands (MEC 2D, code AZ). The responses in mode 2 are packed in the same way.

<table>
<tr><th>Syntax
(system functions)</th><th colspan="3">Description of the ASCII command to the FMX480
Com0, TELNET, UDP(according to config), UECP (Manufacturer specific)</th></tr>
<tr><td>INIT.RDS</td><td>Initialises all the RDS parameters to their default values.
Erases all the PSNs programmed in each DSN. Erases all the site addresses and the encoder addresses.

Note: the parameters related to the other non-RDS functions are not affected.

(1) The ports COM 0,1,2 are only affected on the condition that they are UECP defined:
COMx.PROTOCOL=UECP
see ?COM</td><td>COM1.SETTINGS=9600 (1)
COM2.SETTINGS=9600 (1)
MODE1=0
MODE2=0
REPLYMODE=1
TIMEOUT.BUFFERS=OFF
TIMEOUT.COM1=OFF
TIMEOUT.COM2=OFF
GRPD.TO=OFF
RDS=0
LEVEL=465
PHASE=90
GROUPS=00000000
RDS.IN=0
CT=0
TA.CONTROL=0,0,0
EONTA.CONTROL=0,0,0
TIMEOUT.TA=OFF
PST:0
DSN.CURR=1
GSIZE.CYC=16
For any type ODA gv :
ODA.gv.AID=0000
ODA.gv.MSG=0000
ODA.gv.MSG2=0000
ODA.gv.TO=OFF
ODA.gv.REPEAT=0
ODA.gv.SPACE=0
ODA.gv.NB=0
ODA.gv.WINDOW=0
ODA.gv.DELAY=0
UECP authorisation any MEC for any port n :
COMn.ACCESS.ALL=1</td><td>And for each DSNd...

DSN(d).GS=0A,
DSN(d).EXTGS=
DSN(d).SEQ.1A=0
DSN(d).SEQ.3A =
DSN(d).SEQ.14A
=0,1,2,3,5,12,13,14
DSN(d).GRPD=0
DSN(d).SLC=0,0,0,0,0,0,0,0
DSN(d).RT=empty
All PSNs deleted:
DSN(d).LIST=0

For each PSNp... (after new creation in a DSN)
DSN(d).PSN(p).PI=F000
DSN(d).PSN(p).PS=
DSN(d).PSN(p).PTY=0
DSN(d).PSN(p).DI=0
DSN(d).PSN(p).MS=0
DSN(d).PSN(p).TP=0
DSN(d).PSN(p).TA=0
DSN(d).PSN(p).PIN=0000
DSN(d).PSN(p).LINK=0000
DSN(d).PSN(p).PTYN=
For the Main PSN:
DSN(d).PSN(p).AF=224,205
Pour les PSN EON :
DSN(d).PSN(p).EON=0
DSN(d).PSN(p).AF=empty</td></tr>
<tr><td>GSIZE.PRIORITY=
g1,g2,...
GSIZE.PRIORITY=
GSIZE.PRIORITY?
g1,g2,...= 0A, 0B,…15A,15B.</td><td colspan="3">g1,g2,... represents the groups for which the cyclic data buffers must be increased. Updates the size of a cyclic buffer by reorganising it in agreement with the priorities.
GSIZE.PRIORITY= deletes any priorities
GSIZE.PRIORITY? returns the defined priorities.</td></tr>
<tr><td>REPLYMODE=i
REPLYMODE?
i = 0,1</td><td colspan="3">Fixes a unique (i=1) or multiple (i=0) acknowledgement MEC18 to the UECP frames which contain several MECs (Case of communication mode 2).</td></tr>
<tr><td>GRPD.TO=i
GRPD.TO?
i=0,1,2</td><td colspan="3">I = 0: function inactive
i = 1-2 : fixes GRPD (Group Paging Designation) to 0 in case of timeout on Comi</td></tr>
</table>

Syntax (system functions)	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer specific)
GROUPS=*i* **GROUPS?** **i=00000000 to FFFFFFFF**	Selects the type of group for the retransmission function. 32 bit words, each bit represents a type of group. Examples : i = 00000002 selects the 0B type groups to be retransmitted i = 0000000A selects the 0B et 1B type groups to be retransmitted i = 40000000 selects the 15A type groups to be retransmitted
RDS.IN=*i* **RDS.IN?** **i = 0 to 4**	Modifies / displays the retransmission mode: i = 0 function OFF i = 1-2 function active after Timeout on COM1-2 i = 3 remote function using the logic input INP3 i = 4 function active
TIMEOUT. BUFFERS=*i* **TIMEOUT. BUFFERS?** i = OFF or i= 0 to 254	Fixes / displays the delay (in <i> minutes) before clearing the cyclic buffers. The delay is reinitialised after receiving any EBU SPB490 "free format" or ODA command.
ECHO=*i* **ECHO?** I= 0,1,2	Enables / displays the state of the echo function of the characters received. This parameter is independent for each of the ports COM0, TELNET, UDP. ECHO=2 ⇔ communication mode 2 UECP for ASCII/UECP combined ports.
G=bbbbccccdddd	Transmits the RDS group defined by bbbbccccdddd (Blocks 2,3,4). **Note 1** : the bits of the block 2 containing the PTY and TP are ignored in this command, they are controlled by the encoder in function of the current values of these parameters. **Note 2** : the this command priority over the 'Group Sequence'.

The following commands are described in association to the code of the equivalent UECP command.

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
SITE_LIST ? **SITE_LIST.HEX ?**		Return the list of SITE addresses, in decimal and hexadecimal format respectively.
SITEn? **SITEn.HEX ?**		Return the SITEn address, in decimal and hexadecimal format respectively.
SITE=*i* (⇔**SITE0=i**) **SITEn=*i*** n=0,1,…10 *i* = 0 to 1023 (individual SITE address)	23	1+10 SITE addresses can be defined. The first SITE0 address can only be modified with the ASCII protocol (it cannot be modified with the EBU UECP protocol). This 'individual' address can also be defined after an INIT.RDS, using the UECP command described in APPENDIX 1 The other addresses in the SITE list (SITE1,…SITE10) can be defined or modified by UECP and ASCII commands.
SITEn.HEX=*i* n=0,1,…10 *i* = 0 to 3FF		Identical to the SITEn=*i* command above, with the parameter defined by its hexadecimal value. Note: **SITE.HEX=*i*** ⇔ **SITE0.HEX=*i***
ENCODER_LIST? **ENCODER_LIST.HEX?**		Returns the list of encoder addresses, in decimal and hexadecimal format respectively.
ENCODERn? **ENCODERn.HEX?**		Returns the encoder n address, in decimal and hexadecimal format respectively.
ENCODERn=*i* n=0,1,…10 I = 0 à 63 (ENCODER address)	27	1+10 ENCODER addresses can be defined. The first ENCODER0 address can only be modified with the ASCII protocol (it cannot be modified with the EBU UECP protocol). This 'individual' address can also be defined after an INIT.RDS, using the UECP command described in APPENDIX 1 The other addresses in the ENCODER list (ENCODER 1,… ENCODER 10) can be defined or modified by UECP and ASCII commands.
ENCODERn.HEX=*i* i = 0 to 3F		Identical to the ENCODERn=*i* command above, with the parameter defined by its hexadecimal value. Note: **ENCODER.HEX=*i*** ⇔ **ENCODER0.HEX=*i***
COMn.ACCESS.hh=b **COMn.ACCESS.ALL=b** **COMn.ACCESS.hh?** n= 1 or 2 hh= 00 to FF b= 0 or 1	3A	n: n° of the communication port COM1 or COM2. (For COM0, all the commands are always enabled) **COMn.ACCESS.hh=b** Enables (b=1) or disables (b=0) the commands UECP MEC hh on COMn. **COMn.ACCESS.ALL=b** Enables (1) or disables (0) all the functions for port n. Visualisation: **COMn.ACCESS.hh ?** (one command) and **VIEW.RDS.ACCESS** or **P15** (All commands on all ports)

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
TIMEOUT.TA=*i* **TIMEOUT.TA?** i = OFF or i= 0 to 254	(Manufacturer's specific) 2D 05 41 5A 04	Delay (in <i> minutes). Fixes / displays a maximum duration during which the TA parameter can remain at 1 if the associated TP (same PSN) is at 1. This function concerns the main PSN and all the EON PSNs of the active DataSet. This function occurs if the TA is activated by UECP command or if it is activated by the logic input Inp3. This parameter can also be defined using the command described in the APPENDIX.
TIMEOUT.COMn=*i* **TIMEOUT.COMn=*i*** n= 0,1 i= 1,..254, OFF	3D	Fixes / displays the maximum acceptable inactivity time (i in minutes) for the port COMn. After this acceptable time, the corresponding relay is activated.
COMn.RDS.SETTINGS =s s= 75,150, 300, 600,1200,2400,4800,9600,19200,38400,57600, or 115200	3C	Configuration of the speed of the ports COM1 and COM2 **Note :** COM0 set to 9600. Refer to the UECP SPB490 specifications for the particular case of a speed change on the current communication port.
MODEn=*i* **MODEn?** n= 1,2 i= 0,1,2	3B	Fixes / displays the UECP communication mode for the port COMn. i =1: unidirectional mode i =1: bi-directional mode on request i =2: spontaneous bi-directional mode **Note :** for the mode 2 the ASCII command (specific to AZTEC) "REPLYMODE=i" defines if a global acknowledgement (i=1) or an acknowledgement received by MEC (i=0) is returned for the frames containing more than one MEC
LEVEL=i **LEVEL?** i =1 to 1861mVcc	0E	Fixes / returns the RDS output level The value expressed in mVcc is valid for an output level defined at +12dBu (**LVLO=12**). The command **LVL57=** can be used to define an RDS level expressed in deviation. **LVL57=4** will give 4KHz an RDS sub-carrier level generating 4KHz deviation in the FM frequency. **Note related to the command UECP '0E'** : only one reference table is handled : the commands must be addressed with the reference 0.
PHASE=*i* **PHASE?** i= 0 or 90	22	Fixes / returns the relative phase between the pilot and the RDS signal. **Note related to the command UECP '22'** : only one reference table is handled : the commands must be addressed with the reference 0. All values are accepted and then converted in 0° or 90°.

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
RDS=*i* **RDS?** i= 0 or 1	1E	Activates (i=1), deactivates (i=0) the RDS sub-carrier. **RDS?** Returns the state of the function.
CT=*i* **CT?** i= 0 or 1	19	Activates (i=1), deactivates (i=0) the transmission of the time and date each minute. (4A type Groups). If the paging mode is active and CT=Off the 4A groups transmitted each minute contain 0s.
TIME=hh :mm **TIME=hh:mm:ss** **TIME ?**	 0D 09	Sets / returns the time. Date and hour are stored in a specific component with 10 years warranty. **Note for command UECP 'OD'** : cents of seconds are ignored. **Note for command UECP 'O9'** this command is ignored
DATE=jj:mm:aa **DATE ?**	(0D)	Sets / returns the date.
CT.OFFSET=i **CT.OFFSET ?** i= -24 to 24	(0D)	Sets : returns the offset between the local time and the universal time. i expressed in ½ hours.
TA.CONTROL=*a*,*b*,*c* **TA.CONTROL?** a= 0 to 8 b= 0 to 15 c= 0 to 15	2A	Sets / displays the transmission mode of the 15B type groups during the value change of the TA parameter of the main program of the active DataSet. a = minimum number of groups between two 15B groups b = number of groups transmitted for the TA transition 0 => 1 c = number of groups transmitted for the TA transition 1 => 0 If b=15 or c=15 then the 15B groups are transmitted continuously for the corresponding state.
EONTA.CONTROL=*a*,*b*,*c* **EONTA.CONTROL?** A= 0 to 8 B= 0 to 15 c= 0 to 15	15	Function similar to the previous one (TA.CONTROL) but applied to the EONTAs with the 14B type groups.
PST=*i* **PST?** i= 0 to 3	2F	Selects an extended character table for the transmission of the PS. i=0: no extended table

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
DSN.CURR=d **DSN.CURR?** d= 1 à 6	1C	Selects / displays the active DataSet. As the selection by logic input has priority on the 'software' selection, **DSN.CURR?** may not coincide with a value given by **DSN.CURR=d**
DSN(d).LIST=p1,..pn **DSN(d).LIST?** **LIST=p1,..pn** **LIST?** p<=9 pn=1 to 255	28	Defines / displays the constitution of a DataSet: number of Programs and numbers attributed to each program. Example: **DSN(3).LIST=65,66,89** defines the DataSet 3 with the main PSN n°65 and the PSN EON n° 66 and 89.
ODA.*gv*.AID=*hhhh* **ODA.*gv*.AID?** **ODA.*gv*.MSG=*hhhh*** **ODA.*gv*.MSG?** **ODA.*gv*.MSG2=*hhhh*** **ODA.*gv*.MSG2?** **ODA.*gv*.TO=*t*** **ODA.*gv*.TO?** hhhh=0000 to FFFF t=0 to 255	40	Identification and short messages for ODA applications. MSG2 is only transmitted if it is different from 0000. Timeout: if t=0 function inactive, otherwise t expressed in minutes. gv= 3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B **Note 1 :** an ODA application is seen as defined if the AID relative to the considered type of group is not null. **Note 2 :** if an ODA application is defined for the 7A group type, the paging mode, generally activated by the presence of 7A groups is then inhibited.
Transmission of ODA data *(No ASCII command)*	42	**Note :** the data are stored in the same 'Buffer' as these affected to the 'Free Format Group' data. For the transmission modes "Extremely urgent" and "Immediate" the size of the buffer is 5 groups.
ODA.*gv*.REPEAT=r **ODA.*gv*.REPEAT?** **ODA.*gv*.SPACE=s** **ODA.*gv*.SPACE?** r= 0 to 15 s= 0 to 15	44	Configuration of the "Burst Mode" transmission mode for ODA applications gv= 3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
ODA.*gv*.NB=n **ODA.*gv*.NB?** **ODA.*gv*.WINDOW=w** **ODA.*gv*.WINDOW?** **ODA.*gv*.DELAY=d** **ODA.*gv*.DELAY?** n= 1 to 60 w= 0 to 60 d= 0 to 59	45	Configuration of the "Spinning Wheel" transmission mode for ODA applications gv= 3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A or 13B
ODA.RPGS=g1,…,gn **ODA.RPGS?** n <= 16	43	Fixes / displays the order of priority relative to the groups for the "IMMEDIATE" ODA transmissions.
DSN(d).GS=g1,…,gn **DSN(d).GS?** **GS=g1,…,gn** **GS?** d=0,1,2…6 n<=252 gn=0A,0B,1A,….15A.	16	Defines / displays the Group Sequence.
DSN(d).EXTGS=g1,..gn **DSN(d).EXTGS?** **EXTGS=g1,…,gn** **EXTGS?** d=0,1,2…6 n<=252 gn=0A,0B,1A,….15A.	38	Defines / displays the extended Group Sequence. Syntax details : EXTGS=6A-6B-8A,9A-10B,5A-5B The groups of types 6B and 8A (if no 6B group is to be transmitted) are the alternate solutions to 6B groups. The 10B are transmitted if no 9A is to be transmitted. The 5B are transmitted if no AA is to be transmitted. The number of alternate solutions is not limited. Only the total number of element is limited to 252. (Limit of 255 bytes for MSG in UECP frame).
DSN(d).SEQ1A=v1,..vn **DSN(d).SEQ3A=v1,..vn** **DSN(d).SEQ14A=v1,.vn** **DSN(d).SEQ1A?** **DSN(d).SEQ3A?** **DSN(d).SEQ14A?** **SEQ1A=v1,…,vn** **SEQ3A=v1,…,vn** **SEQ14A=v1,…,vn** **SEQ1A?** **SEQ3A?** **SEQ14A?** d=0,1,2…6 n<=16	29 41 (ODA)	Defines / displays the Group Variant code Sequence for the 1A type groups (Slow Labelling Codes), 3A(Open Data Applications) and 14A (Enhanced Other Networks information). **For 1A :** vn=0,1,..7 **For 3A :** vn= 3A, 3B, 4B, 5A, 5B, 6A, 6B, 7A, 7B, 8A, 8B, 9A, 9B, 10B, 11A, 11B, 12A, 12B, 13A, 13B **For 14A :** vn=0,1,..14

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
DSN(d).GRPD=r **DSN(d).GRPD?** **GRPD=r** **GRPD?** d=0,1,2…6 r=0 à 7	12	Defines / displays the network designation parameter for a paging application.
DSN(d).SLC=s0,s1,s2, s3,s4,s5,s6,s7 **SLC=s0,s1,s2,s3,s4,s5, s6,s7** **DSN(d).SLC?** **SLC?** d=0,1,2,…6 si=000 to FFF	1A	Defines / displays the Slow Labelling Codes for the DSN d. **Note** : particular parameters are defined for the EPP paging correspond to Slow Labelling Codes.
DSN(d).RT=n,f,msg **DSN(d).RT=** **DSN(d).RT+=n,f,msg** **RT=n,f,msg** **RT=** **RT+=n,f,msg** **DSN(d).RT?** **RT?** d=0,1,2,…6 n=0 to 15 f=0 or 1 msg= string containing 64 characters maximum **RADIOTEXT=SHORT** **RADIOTEXT=LONG**	0A	Defines / displays the Radio-text messages for DataSet d. **DSN(5).RT+=3,1,Music Radio** adds the "Music Radio" message to the Radio-text Buffer of DataSet 5 with the repetition parameter 3 and toggles the enabled A/B Flag. **DSN(0).RT=** erases any Radio-text message for the active DataSet. For each DSN from 1 to 6, the Radiotext buffer can only contain 10 messages of maximum 64 characters. These elements are stored in none volatile memory. **Note** In the case where a message contains less than 64 characters : UECP command - if it is ended by the hexa code 'OD', only the defined characters are transmitted, then the 'OD' character is transmitted signalling the end of the message. - If it is not ended by the hexa code 'OD' then the transmitted message will contain 64 characters, <space> charcters fill in the message ASCII dommand The transmission format is fixed by a parameter defined by ASCII commands **RADIOTEXT=SHORT** **RADIOTEXT=LONG**
DSN(d).PSN(p).PI=xxxx **PI=xxxx** **DSN(d).PSN(p).PI?** **PI?** d=0,1,2,…6 xxxx=0000 to FFFF	01	Defines / displays the PI code of the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for the DataSet d

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
DSN(d).PSN(p).PS=ccccccc **PS=cccccccc** **DSN(d).PSN(p).PS?** **PS?** d=0,1,2,…6 cccccccc= a string containing 8 characters maximum	02	Defines / displays the PS of the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for the DataSet d
DSN(d).PSN(p).TA=b **DSN(d).PSN(p).TP=b** **TA=b** **TP=b** **DSN(d).PSN(p).TA?** **DSN(d).PSN(p).TP?** **TA?** **TP?** d=0,1,2,…6 b=0 or 1	03	Defines / displays the parameter TA / TP of the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for the DataSet d
DSN(d).PSN(p).DI=x **DI=x** **DSN(d).PSN(p).DI?** **DI?** d=0,1,2,…6 x=0 to 15	04	Defines / displays the DI parameter of the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for the DataSet d
DSN(d).PSN(p).MS=x **MS=x** **DSN(d).PSN(p).MS?** **MS?** d=0,1,2,…6 x=0 or 1	05	Defines / displays the MS parameter of the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for the DataSet d
DSN(d).PSN(p).PIN=xxxx **PIN=xxxx** **DSN(d).PSN(p).PIN?** **PIN?** d=0,1,2,…6 x=0000 to FDFB	06	Defines / displays the PIN parameter of the program p defined in DataSet d. p=0 for the main program or a PSN n° defined for DataSet d

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
DSN(d).PSN(p).PTY=x **PTY=x** **DSN(d).PSN(p).PTY?** **PTY?** d=0,1,2,…6 p=0 or a PSN n° defined for the DataSet d x=0 à 31	07	Defines / displays the PI code of the program p in DataSet d. p=0 for the main program or a PSN n° defined for DataSet d
DSN(d).PSN(p).PTYN=cccccccc **PTYN=cccccccc** **DSN(d).PSN(p).PTYN?** **PTYN?** d=0,1,2,…6 cccccccc= a string containing 8 characters at most	3E	Defines / displays the PTYN of the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for DataSet d
DSN(d).PSN(p).LINK=xxxx **LINK=xxxx** **DSN(d).PSN(p).LINK?** **LINK?** d=0,1,2,…6 x=0000 to FFFF	2E	Defines / displays the LINK parameter of the program p defined in DataSet d. p=0 for the main program or a PSN n° defined for DataSet d **Note 1** : this parameter is defined to ne dynamically generated , its value is not stored in non-volatile memory. **Note 2** : the parameter 'Linkage Actuator' is automatically handeld as soon as 'Link Information' is not 0. Both parameters are transmitted if the 'Group Sequence' of the active DSN include at least one groupe of 14A and if the use of the code sequence for the groupes of type 14A include the code 12.

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
DSN(d).PSN(p).AF=a1, a2,…an **AF=a1, a2,…an** **DSN(d).PSN(p).AF+=a1, a2,…an** **AF+=a1, a2,…an** **DSN(d).PSN(p).AF ?** **AF ?** **DSN(d).PSN(p).AFCODE?** **AFCODE?** d=0,1,2,…6 **For PSN Main :** n<=300 **For PSN EON :** n<=90	13 (Main) 14 (EON)	Defines / displays the AF list (alternative frequencies) for the program p defined in the DataSet d. p=0 for the main program or a PSN n° defined for DataSet d **Values a1, a2, ..an :** **a1=224 to 249** (defines the AF number in a list: 224=0AF, 225=1AF,…249=25AF) **a2,a3,..=1 to 204** (encoding of the FM frequencies from 87.6 to 107.9) **or a2,a3,..=87.5,..88.0,..107.0, to 107.9** direct entry of the frequency. **an-1=205** fill value for lists having an even number of AFs **250** for encoding the AFs in the AM bands **an= 0** (end of AF list). Example for Main program: AF=228,88.0,88.7,90.1,106.0,205,0 For all details on the encoding of the AF and EON AF lists consult the CENELEC EN 50067 standard.
DSN(d).PSN(p).EON=b **EON=b** **DSN(d).PSN(p).EON?** **EON?** d=0,1,2,…6 b=0 (disable) b= 1 (enable)	0B	Enables, disables / displays the transmission of the EON program p defined in the DataSet d. p= EON Program n° defined for the DataSet d
Data transmission (no equivalent ASCII command)	24 (Free format) 25 (IH) 26 (TDC) 2B (EWS) 30 (TMC)	An independant buffer exists for each type of group. The cyclic buffers are also independent of the FIFO buffers. The size of the cyclic buffers can be defined with specific manufacturer command '**GSIZE.CYC=**' or '**GSIZE.PRIORITY=**'. For the TMC messages "Extremely urgent" , the size of the buffers is equal to 10 groups. The P13 page gives the status of the different buffers.

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
ALPHA=*ggaaaa,message* ggaaaa : address of the pager (gg = group addresse) *message* : chain of 80 charcters maximum **NUM10= *ggaaaa,nnnnnnnnnn*** ggaaaa : address of the pager (gg = group address) *nnnnnnnnnn* : ten numbers generating the message to be transmitted	08 (num10) 0C (empty) 1B (alpha80) 20 (num18) 31 à 35 (EPP option)	Transmission of Paging messages **Note 1 :** AUDEMAT-AZTEC thinks that the number of repetition of paging messages has to be generated by the paging system server. The repetition parameter is not handeld by the encoder and must be set to the value 0. The size of the buffer dedicated to the paging is equal to 160 RDS groups for each interval. **Note 2 :** the messages are not accepted if the address group contained in the message is not compatible with the GRPD parameter. **Note 3 (EPP) :** three independant buffers exist for the minutes odd, the minutes even and the traditionnal paging.
ARI system	21 0F 1F	ARI is not supported by this equipment
Reference input select	1D	This command is ignored. Every command doing reference to this table must use the reference 0.
Message aknowledg.	18	**Note concerning the SQC processing** : ● a positive acknowledgement is returned for replying to a frame with an SQC already received (within the 100 latest received values) and the frame is ignored. ● a negative acknowledgement is returned for replying to a frame for which the SQC leave appear the previous missing value. However the frame is processed. The value of the missing SQC is contained in the message. **Note concerning the UECP frames containing several MEC (element of messages)** See the command REPLYMODE=i . Function of this parameter : If i=1 (default value) only one global acknowledgement per frame is generated. If i=0, an acknowledgement per MEC is returned.
Request message	17	No particular remark

Syntax (system functions)	MEC Equivalent UECP	Description of the ASCII command to the FMX480 Com0, TELNET, UDP(according to config), UECP (Manufacturer's specific)
'Manufact. Specific' Commande	2D	All ASCII commands can encapsulated in a manufacturer 2D command : use the manufacturer code AUDEMAT-AZTEC "AZ". Example : sending the ASCII command 'RESET' 2D 07 41 5A 52 45 53 45 54 A Z R E S E T NOTE : See ANNEXE describing the specific additional commands.

APPENDICES

RDS APPENDICES: UECP manufacturer specific commands

TO PROGRAM THE INDIVIDUAL SITE + ENCODER ADDRESS

	MSB LSB	
MEC	2D	
MED	07	
MED	54	T
MED	44	D
MED	05	MEC TDF 05
MED	01	Control bit: 01=write (00=read)
MED	00..03	MSB site address
MED	00..FF	LSB site address
MED	00..3F	Encoder address

Example :

To program the individual Site address : 048H, Encoder: 18H

<2D><07><54><44><05><01><00><48><18>

◆ **Note**: this command is only accepted after an INIT of the encoder (individual address: 0,0)

TO READ THE SITE + ENCODER INDIVIDUAL ADDRESS

	MSB LSB	
MEC	2D	
MED	07	
MED	54	T
MED	44	D
MED	05	MEC TDF 05
MED	00..01	Control bit: 00=read (01=write)
MED	00	(MSB site address)
MED	00	(LSB site address)
MED	00	(Encoder address)

response from the encoder:

	MSB LSB	
MEC	2D	
MED	07	
MED	54	T
MED	44	D
MED	05	MEC TDF 05
MED	00	Control bit: 00=read (01=write)
MED	00..03	MSB site address
MED	00..FF	LSB site address
MED	00..3F	Encoder address

TO PROGRAM A MAXIMUM ACTIVATION TIME FOR THE TA (MAIN AND EON)

	MSB LSB	
MEC	2D	
MED	05	
MED	41	A
MED	5A	Z
MED	04	MEC AZTEC 04
MED	01	Control bit: 01=write (00=read)
MED	00..FF	Maximum time value of the TA (00=function disabled)

Example :

To program a maximum TA duration of 10 minutes :

<2D><05><41><5A><04><01><0A>

◆ **Note**: this command changes any active TA after the fixed limit time if the value of the associated TP is 1.

TO READ A MAXIMUM ACTIVATION TIME FOR THE TA

	MSB LSB	
MEC	2D	
MED	04	
MED	41	A
MED	5A	Z
MED	04	MEC AZTEC 04
MED	00	Control bit: 00=read (01=write)

response from the encoder:

	MSB LSB	
MEC	2D	
MED	05	
MED	41	A
MED	5A	Z
MED	04	MEC AZTEC 04
MED	00	Control bit: 00=read (01=write)
MED	00..FF	Maximum time of the TA (0=inactive)

FORMAT OF A HEARTBEAT MESSAGE

	MSB LSB	
MEC	2D	
MED	13	
MED	54	A
MED	44	Z
MED	01	MEC AZTEC 04
MED	20..FF	1st byte of information
MED	20..FF	2nd byte of information
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	
MED	20..FF	16th byte of information

◆ **Note**: the last information message received that is contained in an UECP command of this type is clearly displayed in the 'P2' information page. The P2 Page is displayed in response to the ASCII command ‘P2’ on the port COM0.

Frequently Asked Questions (FAQ) RDS

This chapter is updated each time you call AUDEMAT-AZTEC and ask a question where answer does not appear obvious in this manual.

WHAT IS THE RELATIONSHIP BETWEEN THE REAL RDS LEVEL AND THE ONE DEFINED IN THE UECP PROTOCOL (UER-SPB490) ?

The RDS level defined in the Digiplexer is in fact a deviation in kHz. The UECP protocol talks of level in mV, it is essential to specify that the Digiplexer converts the voltage parameter into deviation. The programmed level corresponds to the actual output level of the DIGIPLEXER in the case where LVLO=12 dBu. (valid for the FMX410 and FMX480 Digiplexer)

Example: LEVEL=465mV will set up an RDS sub-carrier that generates a deviation of 4kHz.

LEVEL=465 <=> LVL57=4

WHAT IS THE RELATIONSHIP BETWEEN THE REAL RDS PHASE AND THE ONE DEFINED IN THE UECP PROTOCOL (UER-SPB490)

The relative phase of the 57kHz and 19kHz signals must either be 0° or 90° according to the RDS standard (CENELEC EN50067). For this reason, the Digiplexer integrating the RDS Encoder and the Stereo Encoder only accepts these 2 phase shift values.

Therefore, the Digiplexer only accepts 0° or 90°as correct phase shift values via the UECP protocol.

THE FIRST CHARACTER OF THE PS DISPLAYED ON SOME CAR RADIOS CHANGES

Check that the value of the RDS parameter PST is 0. When PST is different from 0, a code signalling the use of a special character table (defined in the standard CENELEC EN50067) is transmitted at the same time as the first character of the PS code. Some receivers that do not handle this case can then display a character on receiving this code.

System management and special operations

TO MODIFY THE DISPLAY BRIGHTNESS OF THE DIGIPLEXER

The command **DISPLAY=n** adjusts the brightness of the 10-digit display from the minimum (n=1) to the maximum (n=5). Value saved in permanent memory.

TO DISPLAY THE SOFTWARE VERSIONS

Software version of the FMX410 board: D_**VER?**
The expected reply is RDS 1545<v> where v is the version of the software

Software version of the FMC80 board:**VER**
The expected reply is RDS2347<v> where v is the version of the software

TO SAVE A CURRENT CONFIGURATION IN A USER MEMORY

This function (**SAVE>USER1** or **SAVE>USER2**) can be used to place 2 different and typical Digiplexer "signal" configurations in permanent memory, to be able to call them up as required. These commands do not concern the configuration of the IP2 operating system, or the RDS configuration.

TO USE THE CONFIGURATION OF THE USER MEMORY FOR TRANSMISSION

The functions **REST<USER1**, **REST<USER2**, **REST<FACTY** can be used to configure the Digiplexer with the parameters previously saved in the user memories.

It is possible to recover the "factory configuration" of the equipment, by enabling the function "**REST<FACTY**".

TO SECURE THE ACCESS TO THE DIGIPLEXER "BROADCAST" PARAMETERS

This function has been defined for restricted access to the parameters that can affect the maximum audio excursion. These parameters can be under the responsibility of the broadcaster.

The parameters submitted to this restricted access are :

LVLO=, CLIP=, PROCESS=, PROTECT=, SYNC=, AUDIO=, AES_EBU=, GAIN=, BYPASS= and INIT.DIGIPLEXER

The access protection is defined with the following parameters :

attribution or change of the password **PASSWORD=<password1>,<password2>** where <password1> is the existing password, <password2> the new one.
If **PROTECT=0** then <password1> is optional, **PASSWORD=<password2>** is accepted.
<password> can contain 0 to 8 characters, the lower case characters are automatically converter to capital characters.

Examples :
PASSWORD=,NONO (valid if no password has been defined)
PASSWORD=NONO,TOTO
PASSWORD=TATA (valid si PROTECT=0)

Activation, inhibition of the protection **PROTECT=<password>,<v>** <password> is the existing password, <v> = 1 for activation of the restriction acces, <v>=0 for inhibition.

Example :
PROTECT=NONO,1 (valid if the existing password is NONO)

The command **PROTECT?** Gives the possibility to know if the access restriction is active => reply =1 or inactive => reply=0.

Note : the commande PASSWORD? Does not exist!

🗎 TO UNSECURE THE ACCESS TO THE « BROADCAST PARAMETERS » OF THE DIGIPLEXER

This operation has to be done locally with the front panels push buttons.
menu PROTECT= in the sub-menu GoToAction. The protection is inhibited if PROTECT=0 is displayed.
Then it is possible to see with the ASCII command **PASSWORD=<password>** to redefine a new password without knowing the previous one.

🗎 TO REMOTELY CHECK THE TYPE OF EQUIPMENT

Use the command **TYPE?**

The expected reply is :
FMX480 (FMX440)

🗎 TO RESET THE EQUIPMENT

Use the ASCII protocol command **RESET**

THE INITIALISATION COMMANDS

A list of initialisation commands for different Digiplexer modules (System, RDS, users) is available by invoking the command **INIT**. Enter this command in console mode (COM0 or Telnet).

THE HELP MENUS

Each AUDEMAT-AZTEC product and in particular the products that integrate the IP2 system, like the FMX480 Digiplexer, have several help sections accessible by connecting in console mode (COM0 or Telnet). To obtain the list of help sections contained in the Digiplexer, type **HELP**.

To operate via the Front Panel

TO USE THE DISPLAY AND THE 2 BUTTONS "SEL" AND "OK"

The display on the front panel, the buttons and the bar-graph are there to allow a simple and rapid hardware configuration of the Digiplexer. Those who know the way in which the AUDEMAT-AZTEC AZ1 RDS Monitor works will find one of the characteristics that made the success of this product on the Digiplexer.
The 2 buttons are to be used independently. There are no subtle actions that require pressing the 2 buttons at the same time.

The "SEL" button is used to navigate in a *group of menus*. The ENTER button can be used to modify the value of a displayed parameter, or to perform the action suggested by the display. There are 3 groups of menus:

- display of states and values menu group
- menu group to display and modify the parameters
- menu group to perform actions

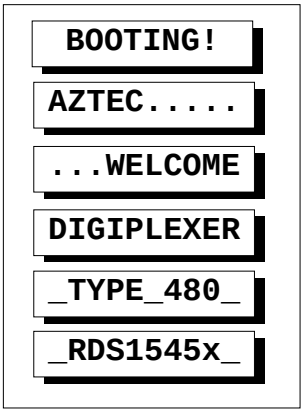
Concerning the parameters, the first press on ENTER makes the "=" flash that separates the parameter from its value: whilst the "=" is flashing, it is possible to modify the value of the parameter by playing with each "SEL" and "ENTER" button, which respectively decrements or increments the value or the index of the value displayed. Before moving on to another parameter, wait approximately 2 seconds, the time for the "=" character to stop flashing: the parameter is then taken into consideration and placed in memory.

◆ **NOTE 1:** for a better ease of use, the syntax used to display the parameters, to modify them and perform actions is compatible with the one used by the ASCII protocol.
◆ **NOTE 2:** Brightness of the display: use the command or the menu "**DISPLAY=**" to adjust the brightness of the 10 digit display.

◆ **VERY IMPORTANT:** the RDS configuration parameters other than those influencing the RDS sub-carrier (layer 1: **RDS=**, **LEVEL=**, **PHASE=** and **DATA=** for tests) are not accessible from the front panel.

WELCOME MESSAGES ON THE FRONT PANEL

Power up or RESET of the Digiplexer

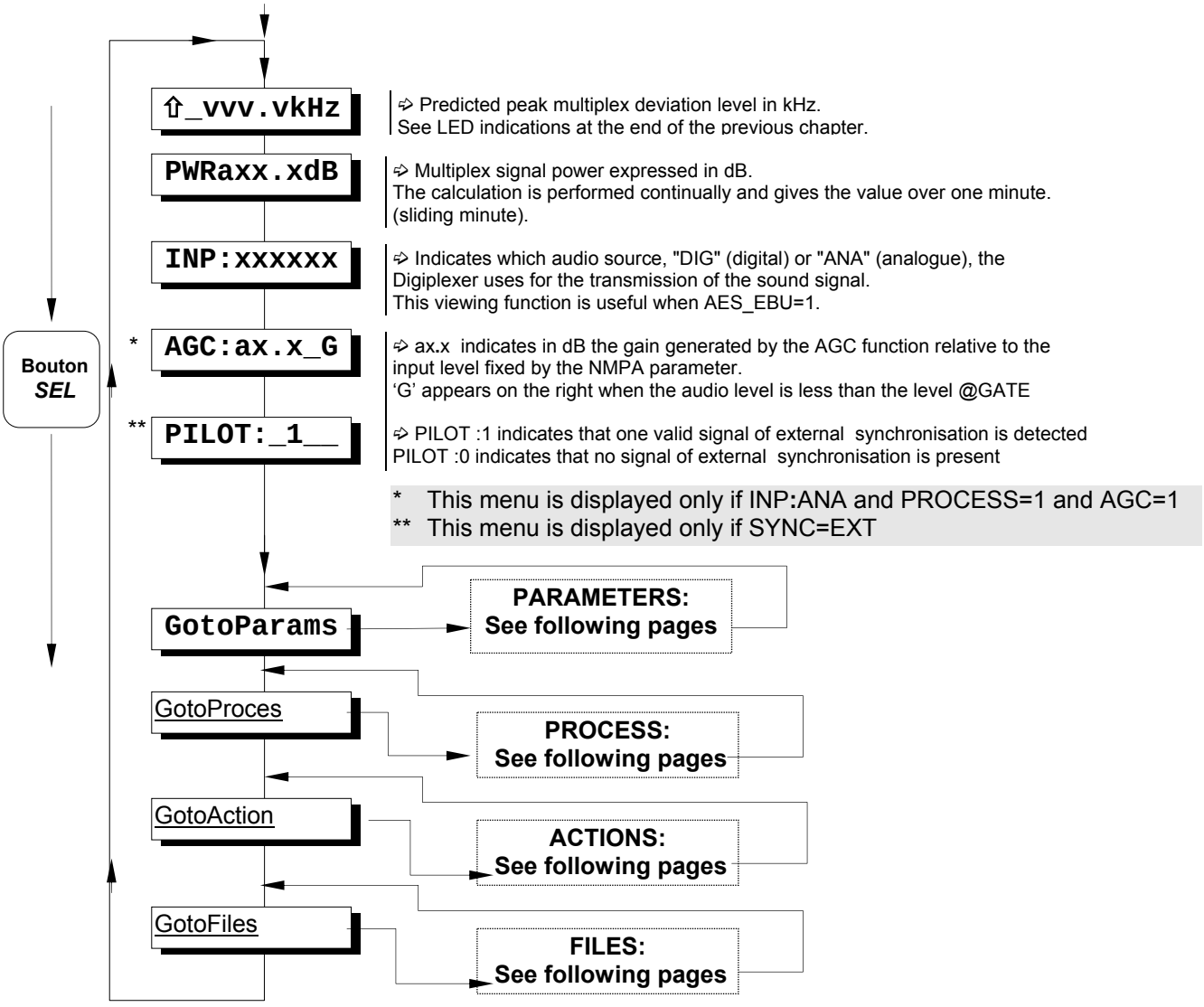


➪ Welcome messages that appear on power up of the equipment or after a RESET.

In every case:

➪ TYPE of Digiplexer
➪ Version (VER:)

TO VIEW THE PARAMETERS ON THE FRONT PANEL



➪ Predicted peak multiplex deviation level in kHz.
See LED indications at the end of the previous chapter.

➪ Multiplex signal power expressed in dB.
The calculation is performed continually and gives the value over one minute. (sliding minute).

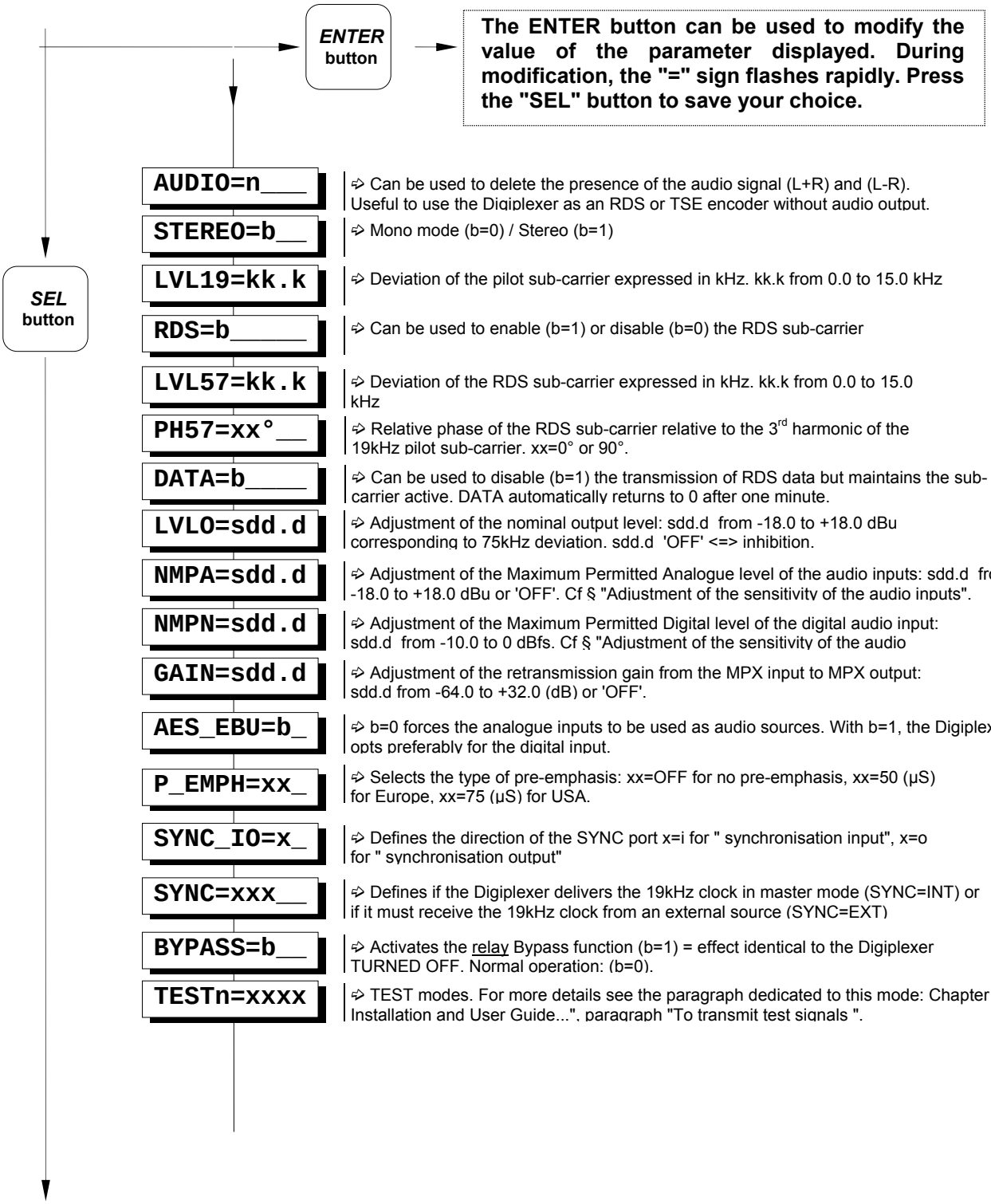
➪ Indicates which audio source, "DIG" (digital) or "ANA" (analogue), the Digiplexer uses for the transmission of the sound signal.
This viewing function is useful when AES_EBU=1.

➪ ax.x indicates in dB the gain generated by the AGC function relative to the input level fixed by the NMPA parameter.
'G' appears on the right when the audio level is less than the level @GATE

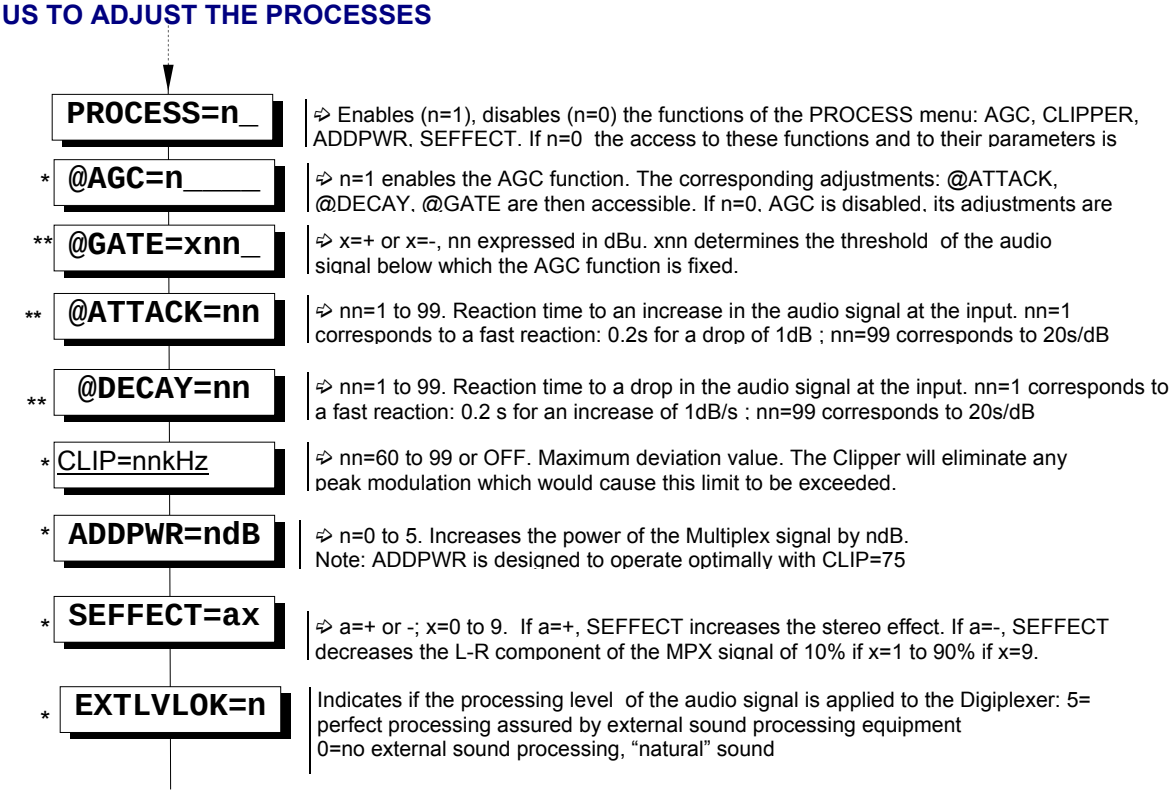
➪ PILOT :1 indicates that one valid signal of external synchronisation is detected
PILOT :0 indicates that no signal of external synchronisation is present

* This menu is displayed only if INP:ANA and PROCESS=1 and AGC=1
** This menu is displayed only if SYNC=EXT

MENUS TO MODIFY THE PARAMETERS

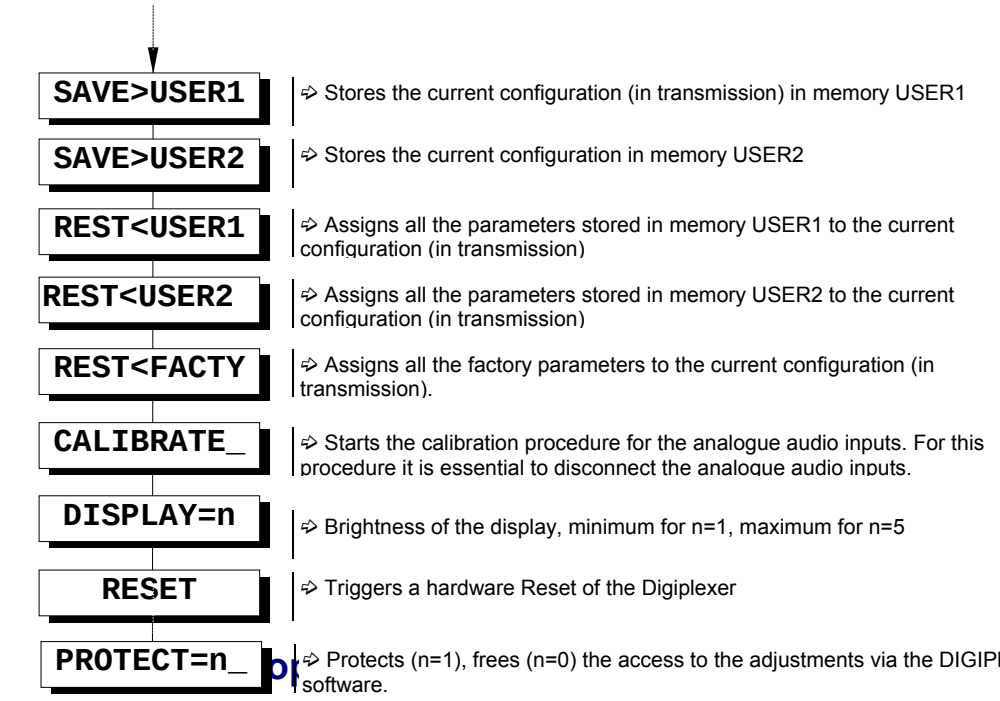


MENUS TO ADJUST THE PROCESSES



* These menus are only visible if PROCESS=1
** These menus are only visible if PROCESS=1 and AGC=1

MENUS TO EXECUTE ACTIONS



🗎 TO CONFIGURE THE RS232 COMMUNICATION PORTS: COM0, COM1 AND COM2

To view the configuration of all the communication ports, use the command **?COM**

Speed of the V24 (RS232)communication ports

COM<x>.SETTINGS=<vitesse>

COM<x> : COM1 and COM2 (COM0 is always at 9600,N,8,2)

Speed : 75 to 115200

To reread the configuration of a given communication port: **COM<x>. SETTINGS?**

To configure the protocol(s) associated to each port COM0,1 and 2

3 protocols are supported by the V24 (RS232) communication ports of the FMX480 Digiplexer:

- ASCII: dialogue in command lines
- UECP: Universal Encoder Protocol (RDS), specified by the document UER-SPB490

For each communication port COM0, COM1 or COM2, it is possible to select the UECP protocol **or** the USEP protocol. To do this, use the command **COM<x>.PROTOCOL=UECP** or **COM<x>.PROTOCOL=USEP** where COM<x> represents COM0, COM1 or COM2.
The communication ports COM1 and COM2 can accept in addition to the UECP protocol **or** USEP protocol the ASCII protocol, the command become :
COM<x>.PROTOCOL=ASCII+UECP or **COM<x>.PROTOCOL=ASCII+USEP**

Particular cases associated to the port COM0, with the console mode

The effect of the command **ECHO=0**, which only concerns the port COM0, is to delete the echo returned by the Digiplexer on the communication port COM0. **ECHO=1** enables the echo. Reread with **ECHO?**
The ASCII protocol still exists on the port COM0.

The coexistence of the ASCII and UECP (or ASCII and USEP) protocols on the ports is entirely transparent.

ASCII and UECP (or ASCII and USEP) commands can be strung together indifferently, the possible responses are returned in the protocol used for the command, and for the UECP protocol, by respecting the communication mode defined.

▲ **WARNING:** the ASCII character chr$(254) is the indicator of the start of a UECP frame, consequently, ensure that you do not send this character in an ASCII command. All the characters which will follow will then be ignored by the ASCII interpreter until one of the following cases :

- the detection of a character chr$(255) signalling the end of an UECP frame
-the reception of 500 characters
- a time-out of 5 seconds on the communication port

🗎 TO CONNECT SEVERAL FMX480 DIGIPLEXERS ON AN RS485 NETWORK

The COM2 port is accessible in RS485 form via 2 connectors of identical pin-out: one of the connectors is female, the other male to simplify the connection aspects as much as possible.
All the Digiplexers and FMB40 encoders on the same transmission site can be networked together, all physically connected in "parallel": all the TX+ together, all the TX- together, the same applies for the "RX+", the "RX-", and the respective grounds.

◆ **Note 1:** when the port COM2 is used in RS485, the RS232 interface of COM2 should not be used.

◆ **Note 2:** when COM2 transmits externally from the encoder, the RS485 coupler activates TX+ and TX-. When COM2 of the encoder is not transmitting (inactive) TX+ and TX- are in the "high impedance" state. It is obvious that the communication mode of the FMB40 encoders and/or FMX440 Digiplexers must be configured accordingly (mode 1) in order to avoid any conflict.

🗎 TO CONFIGURE THE ETHERNET 10BASET COMMUNICATION PORT (TCP/IP)

The connection and the operation of the Digiplexer by this port meets the specifications of the IP2 system described in the document of AUDEMAT-AZTEC . This document is supplied in electronic form on the AUDEMAT-AZTEC website : http://www.aztec-radiomedia.com

🗎 TO CONFIGURE THE UDP LOGIC ACCESSES IN IP

AUDEMAT-AZTEC has reserved a number of UDP logic accesses (TCP/IP protocol) for the transmission of RDS data. The number of these reserved logic accesses varies according to the uses. In principle, there are 5 configurable UDP accesses.
To view the configuration of the UDP ports, use the command **?.UDP**

To define the port n° for each UDP logic access

The command **UDP<n>.PORT=<port>** can be used to associate an UDP port number to each logic access, for the data transmission. If the value **port** is set to 0, then the port is inactive and inaccessible.

To define the protocol used for each UDP logic access

The command **UDP<n>.PROTOCOL=<protocole>** can be used to de define the protocol used to communicate on the UDP logic access.

When **UDP<n>.PROTOCOL =UECP** then the RDS encoder of the FMX480 Digiplexer meets, on this UDP access, the specifications relative to the UDP operation described in the UECP specification (currently under study by the WG RDS UECP at the date this manual was written, June 99).
When **UDP<n>.PROTOCOL =ASCII**, an ASCII dialogue with the command interpreter of the FMX480 Digiplexer can be established.

Access protection to each UDP logic access of the Digiplexer

In order to be able to restrict the access to the UDP ports, it is possible to define a UDP filter with the command UDP<n>.FILTER=<x.x.x.x> where **<x.x.x.x>** represents the IP address authorised to connect in UDP to the UDP access n°**n**. It should be noted that the expression of this IP address can contain the wildcard character "*" to authorise all the IP addresses.
Example: **UDP3.FILTER=195.132.19.*** authorises all the IP addresses beginning with 195.132.19 to connect to the UDP access n°3.

To define the dialogue modes associated to the UDP logic accesses

The command **UDP<n>.MODE=<m>** can be used to define the dialogue mode associated to each UDP logic access n°**n**.
Mode 0: m = 0: unidirectional mode (valid only in USEP and UECP protocols)
Mode 1: m = 1: mode with response on request
Mode 2: m = 2: mode with spontaneous response

TO USE THE FMX480 DIGIPLEXER WITH A MODEM

Warning! The Digiplexer is used via an Ethernet socket with the TCP/IP protocol: before investing in a modem, assure that a network-orientated solution is not better suited to your tele-management application of the equipment. Mini-routers exist, available at similar prices to that of advanced modems.

If network access is not suitable, it is possible to connect a commercially available modem to the FMX480 Digiplexer, which can be accessible at any moment: you can configure all the parameters of the Digiplexer remotely and even observe the variations in the input and output level.

The MODEM is to be configured with an auto-answer sequence, written in its non-volatile memory. Consult the on-line technical support of the AUDEMAT-AZTEC WEB site (www.aztec-radiomedia.com) to obtain examples of initialisation strings.

You can connect a Modem to the port COM0 of the FMX480 Digiplexer.

DIGIPLEXER - MODEM connection cable:

Subd 9 female Digiplexer*	SubD 9 male Digiplexer*	SubD 9 male Modem	SubD 25 male Modem
3	**2**	3	2
2	**3**	2	3
5	**5**	5	7
		Connect pins 4 and 6 Connect pins 7 and 8	Connect pins 4 and 5 Connect pins 6 and 20

* particular versions of the FMX480 (TDF version) are equipped with DB9 males for COM0

Details of the wiring of the DIGIPLEXER - MODEM connection

🗎 TO CONNECT A PC TO THE PORT COM0

A PC can be connected to the Digiplexer for configuration requirements via the SUBD9 connector located on the front panel and marked "COM0". Locate an unused communication port on your PC, if the free port exists in the form of a DB25 connector, use a standard SUBD9 (male) to SUBD25 (female) adapter. Do not use the port assigned to the mouse. Connect the free communication port of your computer to the Digiplexer port with a straight cable. In function of the version, please user either a straight cable if COM0 is female and a « Null-modem » if COM0 is male.

🗎 TO CHOOSE A "TERMINAL" APPLICATION AND PRINCIPLES OF THE ASCII DIALOGUE

To communicate as directly as possible with the Digiplexer, AUDEMAT-AZTEC recommends using an ASCII terminal running in MS-DOS© or in Windows©. The DIGIPLEX configuration software also integrates a "terminal" application that is simple to use and pre-configured.

Terminal proposed in Windows© 3.x, Hyper Terminal in Windows© 95 present all the characteristics to easily communicate in ASCII mode with the Digiplexer. If you desire a higher level interface, please refer to the following chapter, describing in detail the installation of the AZTEC® configuration software for a very user-friendly configuration.

Windows© 3.X

In the Windows© program manager, open the "accessories" group automatically installed with Windows©. In this group you will find the "Terminal" application generally represented by an icon containing a blue PC screen on which a yellow telephone is superimposed with a modem underneath it.
Start the application. In the "Parameters" menu select "Communications" and adjust the parameters as follows:

- ▼ **Transmission speed**: 9600
- ▼ **Data bits**: 8
- ▼ **Stop bits**: 2
- ▼ **Parity**: None
- ▼ **Flow control**: None
- ▼ **Port**: the one that you have identified as free on your PC
- ▼ **Parity checking**: do not tick the box
- ▼ **Carrier detection**: do not tick the box

Windows© 95, 98 or 2000

In the Start menu, choose Programs, then Accessories and open the Hyper Terminal folder
Start the Hypertrm application and give it a name, for example: DIGIPLEXER.

Then select "Direct to Com x" in "Connect by using": with x representing the free port of your PC.
In the 'COMx properties' window that appears, select:

▼ **Bits per second**: 9600
▼ **Data bits**: 8
▼ **Parity**: None
▼ **Stop bits** : 2
▼ **Flow control**: None

Once configured, the terminal can be used. To check if the hardware and logic configuration work as planned, type "?" then <Enter> to display the software version of the Digiplexer. If nothing is displayed on the screen, try again a second time, otherwise, check the following points:

➪ Digiplexer turned on?
➪ Cable used
➪ Transmission speed
➪ Recheck the configuration of the terminal application

To display the commands entered at the keyboard on the screen, type the command "ECHO=1".
Before studying the many commands possible, we will explain the structure of the Digiplexer's command interpreter:

The Digiplexer command interpreter meets the following rules. Any instruction sent to the Digiplexer must be validated by <Enter>.

- Command without parameter (action) **<name of the action>**
  Ex: RESET <Enter>

- Command with parameter **<name of the action> = <value>**
  Ex: TEST1=0,R

- Allocation of a value to a parameter **<name of the parameter> = <value>**
  Ex: STEREO=1

If a command entered results in a process with **success**, the character **"+"** followed by one or more line return characters are returned by the Digiplexer. In the case of a **failure** (command not understood or parameter incorrect) the character **"!"** is returned in similar conditions.

The syntax of the commands in ASCII protocol is compatible with the syntax used to display the parameters, modify them and perform actions via the front panel.

IP2 operation via the Ethernet 10BaseT port

The operations listed below bearing the mark (*) are largely documented in the IP2 system manual supplied with the Digiplexer.

SECURITY AND PROTECTION

- (*) declaration of users, of their levels and the associated passwords
- (*) rights
- (*) protection in Telnet
- (*) protection in FTP
- (*) protection in HTTP

ACCESS BY TELNET

- (*) syntax rules
- (*) number of simultaneous users

ROLE AND USE OF THE FTP SERVER

- (*) to update the internal program of the Digiplexer
- (*) to update the buried Web server
- (*) particular case of the log file (HISTO.TXT)
- (*) to create batch files
- (*) to send protocol commands via FTP

TO CONFIGURE THE BURIED WEB SERVER IN THE DIGIPLEXER

- (*) welcome page
- (*) protected and unprotected pages
- (*) personalisation of the Web server, personalised pages
- (*) inserting ASCII protocol commands
- (*) addressing of commands by CGI
- (*) control by Java applets or JavaScript

LOG FILES AND EVENTS

- (*) principle of the log file
- (*) principle of event handling
- (*) association of an event to a command file
- (*) to send an email during an event
- (*) to send an SNMP trap during an event

SNMP ADMINISTRATION

The MIB II standard and the MIB AUDEMAT-AZTEC IP2SYSTEM and DIGIPLEXER(*) are implanted

(*) under implantation at the time of writing this manual.

Surveillance of parameters and log

The IP2 system, around which the Digiplexer is built, integrates the notion of events. Please refer to the IP2 system manual to understand the event handling in detail and the handling of the file histo.txt (historic of the events)

The command **?STATUS** or **P2** can be used to obtain all the various surveillance states described below with the associated TIMEOUT values. ***P2** refreshes automatically what is displayed.

```
*** : P2   Supervision Status ***

                  CONTROL   TIMEOUT  CURRENT VALUE    STATUS
RDS:
 PRESENCE          0          /          /              PB
 COM1 UECP         0          /          /              /
 COM2 not configured for UECP

AUDIO:
 AUDIO LEFT        0          0s         0s             PB_L
 AUDIO RIGHT       0          0s         0s             PB_R
 AES_EBU           0          0s         0s             PB
 MPX               1          30s        /              PB
 MPX.MINVAR=3, MPX.VAR=0
```

TIMEOUT ON COMMUNICATION PORTS, RDS-UECP PROTOCOL (COM1,COM2)

It is possible to define a surveillance of the communication ports COM1 and COM2, when they are configured in UECP protocol by defining a TIMEOUT (delay) after which, in the absence of data to the Digiplexer, an event is generated.

COM0:

COM<n>.TO=<v>: If **<v>** is null or **<v>=OFF**, no activity surveillance on the communication port **COMn** (COM1 or COM2), otherwise **<v>** defines the delay in seconds, after which an event is generated if no data reception is detected on this port.

The following IP2 events are to be associated to this surveillance configuration.

COM1: **COM1_OK** **COM1_PB**

COM2: **COM2_OK** **COM2_PB**

The **relay A1** is active when there is no communication problem on the communication ports declared in surveillance (value **v** different from 0)

To read the status: **COM.STATUS?** returns OK or PB_COM0, and/or PB_COM1 and/or PB_COM2

SURVEILLANCE OF THE RDS PRESENCE BY RDS RE-DECODING

The commands **RDS.CTRL=0** and **RDS.CTRL=1** can be used to declare inactive or active the surveillance of the correct detection of the RDS (signal applied to the input RDS, BNC on the rear panel of the Digiplexer with a specific external cable).

If RDS errors occur or if there is no RDS detection, then the IP2 event **RDS_PB** is generated, when the RDS decoding is again active the event **RDS_OK** is generated.

To read the status: **RDS.STATUS?** returns PB or OK

The **relay A2** is active when RDS is detected without problem.

SURVEILLANCE OF AUDIO PRESENCE ON LEFT AND RIGHT INPUTS

The parameter **AUDIO.TO=<v>** can be used to declare active (v different from 0) the surveillance of the correct detection of presence of audio signal on the left and right inputs of the Digiplexer's internal stereophonic encoder. This surveillance is therefore done on the audio signal used for the transmission, whether it is digital (AES/EBU) or analogue.

The value **v** is expressed in seconds. If there is no AUDIO signal detected during v seconds on one of the 2 channels, then the IP2 event(s) **AUDIO_L_PB** and/or **AUDIO_R_PB** appear(s).

A return to normal is marked by the IP2 events **AUDIO_L_OK** and **AUDIO_R_OK** .

To read the status: **AUDIO.STATUS?** returns PB_LR, PB_L, PB_R or OK

The relay B1 is active when the audio signal is detected without problems and **RELAYB1.FUNCTION=AUDIO**.

Note: the detection threshold of the audio signal is fixed, on each of the left and right channels to 2% of the nominal level NMPA or NMPN, i.e. –34dB below the nominal level.

SURVEILLANCE OF DIGITAL AUDIO PRESENCE ON DIGITAL INPUT

The parameter **AES_EBU.TO=<v>** can be used to declare active (v different from 0) the surveillance of the correct detection of presence of digital audio signal on the AES/EBU input.

The value **v** is expressed in seconds. If there is no AES/EBU signal detected during **v** seconds on one of the 2 channels, then the event **AES_EBU_PB** appears.

A return to normal is marked by the event **AES_EBU_OK** .

To read the status: **AES_EBU.STATUS?** returns PB or OK

SURVEILLANCE OF THE MULTIPLEX SIGNAL DEVIATION

The parameter **MPX.TO=<t>** can be used to determine the Timeout (t=delay in seconds, 0 to 1000) associated to the surveillance of the Multiplex level.

The surveillance of the Multiplex level is based on the detection of a variation in the Multiplex signal delivered by the Digiplexer on the period defined by **MPX.TO=<t>.** If a variation of the Multiplex at least

equivalent to the value of the parameter MINVAR (defined afterwards) signal is not obtained during MPX.TO then the IP2 event **MPX_PB** is generated, the return to normal is marked by the IP2 event **MPX_OK**.

The parameter **MPX.MINVAR=<v>** defines in kHz the minimum variation of the amplitude of the Multiplex signal. The calculation principle resides in a sampling once per second of the Multiplex signal, stored in a sliding manner and dynamically in a memory. Therefore, there is MPX.TO samples in this memory, if these MPX.TO samples do not diverge by more than MPX_MINVAR an event **MPX_PB** is generated.
To read the status: **MPX.STATUS?** returns PB or OK
The **relay B2** is active when the MPX is detected without problem and **RELAYB2.FUNCTION=AUDIO**..

Note 1: for the very dense sound signals, MPX_MINVAR must be configured to a value sufficiently low to avoid false problem detection.
Note 2: the principle of this surveillance, based on the analysis of the signal shift can be used in particular to detect the absence of modulation in the presence of residual levels related to the presence of pilot sub-carriers (19KHz), RDS (57KHz).