SAT DIVIMOD

TECHNICAL MANUAL
EXHIBIT III

QAM MODULATOR UNIT

PQM 2100

SERIES MODULATOR

USER'S GUIDE

SAT DIVIMOD

QAM Modulator Unit

Coffret Modulateur MAQ

PQM 2100

User's Guide

Guide Utilisateur

UG (*GU*) - N° N56714640101

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SAGEM

FOREWORD

SAT reserves the right to modify the characteristics of its product without notice to take advantage of technical improvements. This guide is subjected to various technical developments and may be modified at any time without notice.

This guide consits of two parts:

- the first one in English marked "UG" on all pages,

- the second one in French marked "GU" on all pages.

AVANT-PROPOS

Les informations figurant dans ce guide sont soumises aux différentes évolutions techniques, la SAT se réserve le droit de modifier les caractéristiques de ses produits pour les faire bénéficier de perfectionnementst techniques.

Ce guide comprend 2 parties :

- la première en Anglais marquée "UG" sur toutes les pages,

- la deuxième en Français marquée "GU" sur toutes les pages.

CAUTION

THE DEVICE MUST BE CONNECTED TO MAINS VIA A DIFFERENTIAL CIRCUIT-BREAKER.

UNAUTHORIZED MODIFICATIONS VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

THIS UNIT MUST NOT BE CONNECTED TO AN I.T. MAIN POWER.

UL LISTING VALID ONLY FOR 120 V.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS:

1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND,

2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

NOTE: This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication.
Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

IMPORTANT

L'EQUIPEMENT DOIT ÊTRE RACCORDE A L'ALIMENTATION PRINCIPALE PAR L'INTERMEDIAIRE D'UN CIRCUIT DIFFERENTIEL.

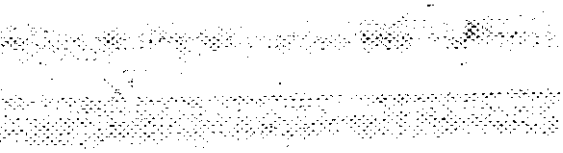
TOUTE MODIFICATION DU PRODUIT DECHARGE LE FABRICANT DE TOUTE RESPONSABILITE.

CE COFFRET N'EST PAS RACCORDABLE A UN RESEAU I.T.

HANDBOOK CHANGE LIST
REPERTOIRE DES MISES A JOUR

(A new edition replaces any previous versions)
(Une nouvelle édition annule et remplace les précédentes)

No. *N°*	Date *Date*	Change Description *Description de la mise à jour*	Page *Page*
01 *01*	April 1997 *Avril 1997*	Creation of original User's Guide *Création du Guide Utilisateur à l'édition originale*	All pages *Toutes pages*



PAGE INDEX

Blank pages :0-4, 0-6, 0-10, 0-12
1-18,
2-2, 2-8,
4-2,
5-2, 5-8
A-2, A-4, A-12.

CONTENTS

LIST OF ABBREVIATIONS

BB	Baseband
BER	Bit Error Rate
CATV	CAble TeleVision
Clk	Clock
DVB	Digital Video Broadcasting
FCC	Federal Communication Commission
Flt Ind	Fault Indication
I^2C®	Communications Bus designed by PHILIPS
IF	Intermediate Frequency
LAN	Local Area Network
LO	Local Oscillator
LVDS	Low Voltage Differential Signaling
Maj Alm	Major Alarm
Min Alm	Minor Alarm
MPEG2	Moving Pictures Experts Group
MPEG2-TS	MPEG2 - Transport Stream
PLL	Phase Locked Loop
QAM	Quadrature Amplitude Modulation
RF	Radio Frequency
Sym. Clk	Symbol Clock
TCM	Trellis Coded Modulation
TS	Transport Stream
TV	TeleVision
UL	Under Writers' Laboratories

SECTION 1

INTRODUCTION

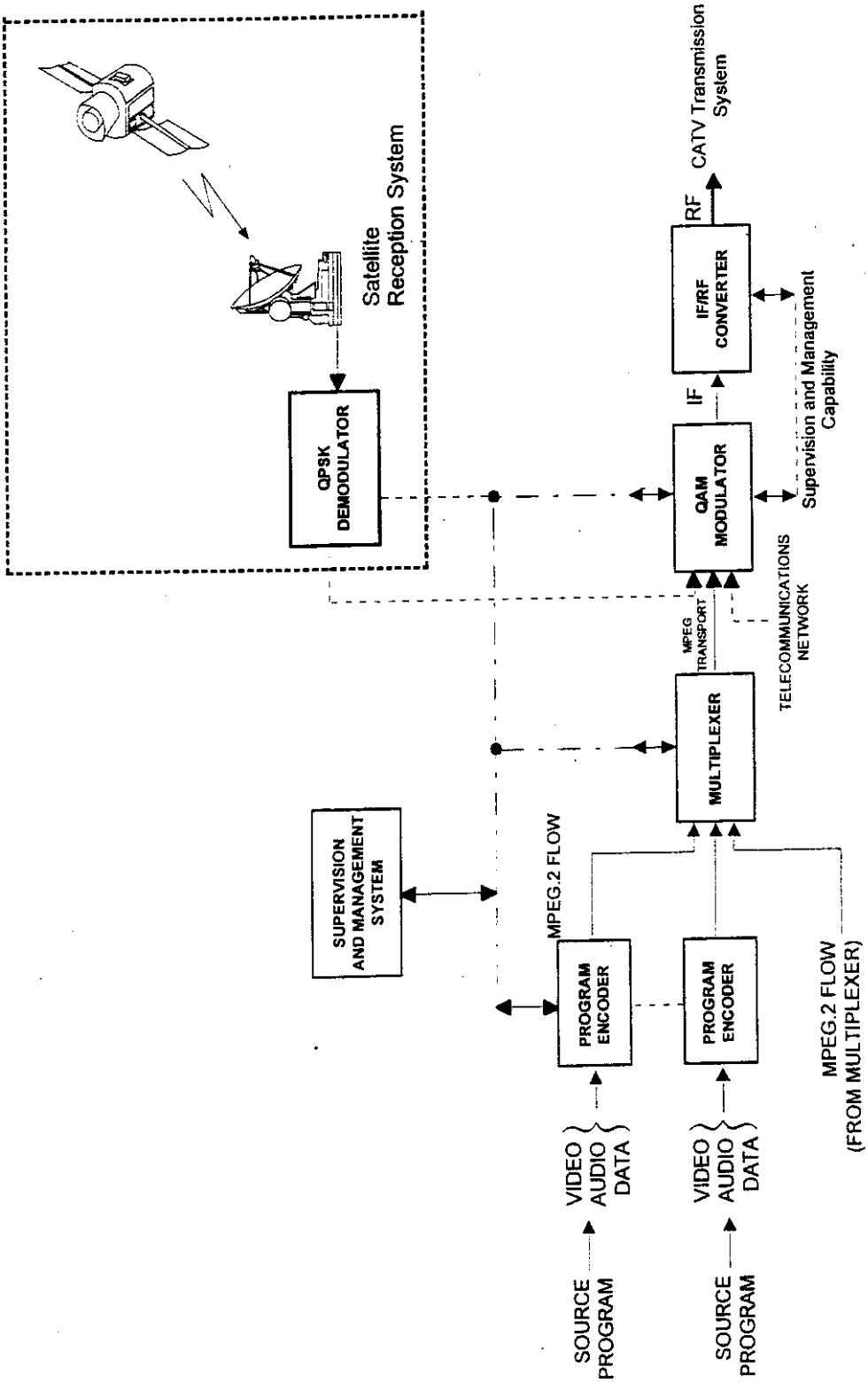


Figure 1.1 - Example of Use of the PQM 2100 Unit in a CATV Transmission System

1.1 - Introduction

The QAM PQM 2100 Unit is available in two equipment versionswhich mainly differ in their INR input interface:

PQM2100 ASI Rx Interface, 34 or 45 Mbit/s G.703 Interfaces

PQM2100-M2P M2P Rx Interface (RS422).

The PQM 2100 QAM Modulator has been designed for digital TV signal transmission over cable networks (fig. 1.1). It provides channel encoder and QAM modulator functions in full compliance with DVB recommendations, including the following operations:

- processing the MPEG2 TS bit stream (transport frame) received from program encoding or multiplexing equipment, from a telecommunication network, from a satellite reception.

- generating a QAM-modulated IF carrier for supply to the CATV network headend.

Due to the following features:

- high reliability, performance reproducibility and cost-effectiveness inherent in a digital system,
- capability of variable symbol rate operation without any adjustment or change,
- possibility of generating and adjusting an RF frequency by adding an external IF-RF converter unit supervised and managed by the equipment (see Note),
- IF output level control when no external converter unit is supervised or managed by the equipment,
- ease of supervision, management and configuration through the use of built-in (Ethernet) network interfaces for remote supervision and keypad/display and RS232 local supervisory interfaces. The delivery may include an ETHERNET network interface or an RS232 interface,
- compatibility with several types of MPEG2 multiplex input interfaces,
- small size and low power consumption,
- ease of installation and operation,
- protection from interference,
- compliance with European standards,

PQM 2100 is well suited to digital signal CATV transmission.

Note: The PQM 2100 Unit can supervise and manage, via the I²C® bus, an external IF-RF Converter Unit detailed in the appendix.

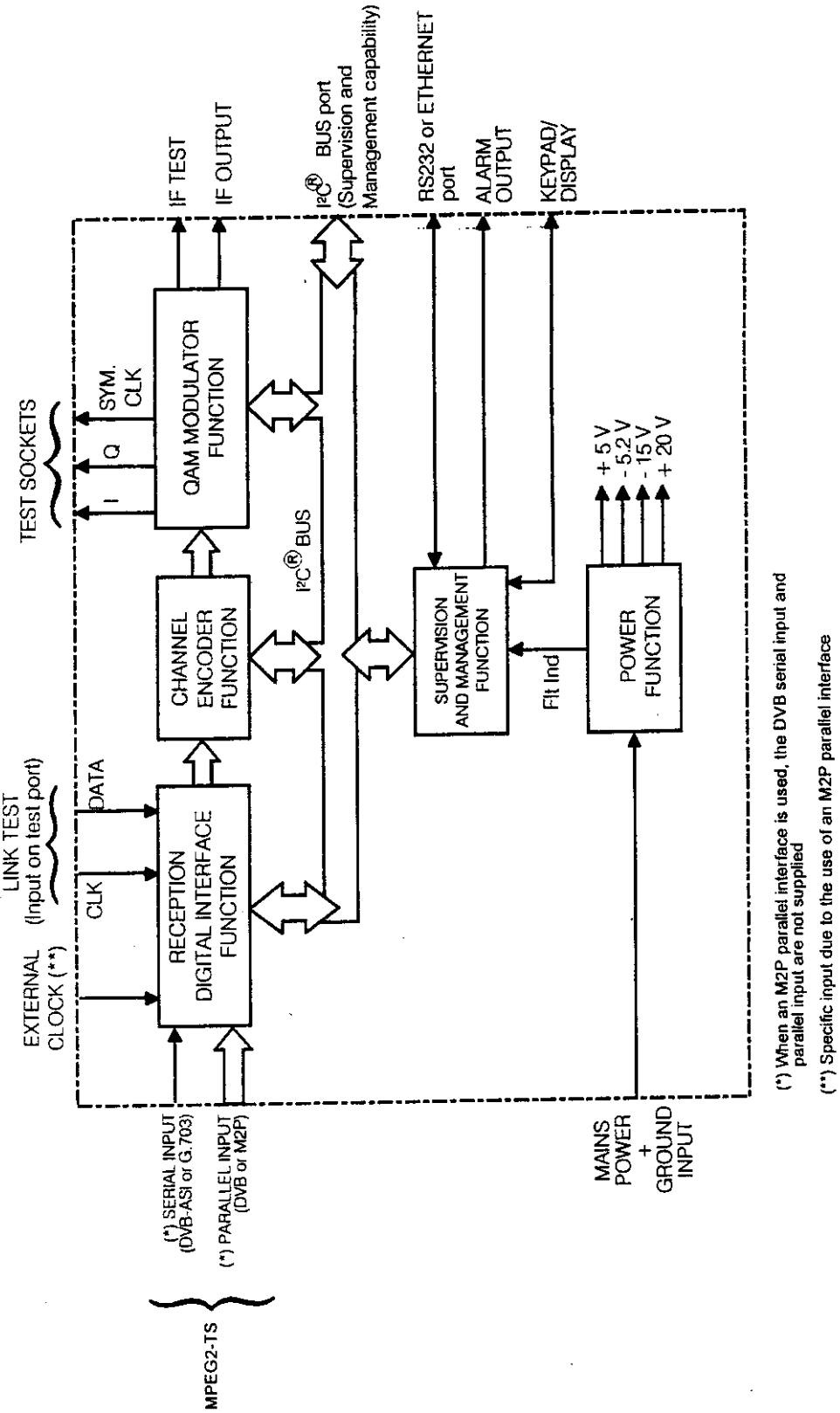


Figure 1.2 - PQM 2100 Unit Block Diagram

1.2 - Functional Description

The PQM 2100 QAM Modulator Unit comes in a 1-unit high 19-inch rack-mounting enclosure containing the following six modules (cards or units):

- Reception Digital Interface Card,
- DVB-QAM Encoder Card,
- QAM Modulator Card,
- Supervision and Management Card,
- I²C® Interface Card,
- Power Supply Unit.

RECEPTION DIGITAL INTERFACE

PQM2100

The Reception Digital Interface Card alternatively provides connection to:

- a telecommunication network (G.703 interface),
- encoding or multiplexing equipment via a parallel DVB interface or a serial DVB-ASI interface,
- a QPSK demodulator.

The Card is available in two different types depending on the desired interface:

34 or 45 Mbit/s compliance with ITU-T recommendation G.703, or DVB-compliant ASI.

The parallel DVB-based interface is supplied in all cases.

PQM2100-M2P

The Reception Digital Interface Card provides connection of the PQM 2100-M2P Unit to encoding or multiplexing equipment through the proprietary M2P (RS422) parallel interface.

DVB-QAM ENCODER

The DVB-QAM Encoder Card provides channel encoding of the bit streams and associated clock signals transmitted by the Reception Digital Interface Card. Bit streams are encoded in compliance with DVB recommendations for transmission to the QAM modulator function.

The DVB-QAM Encoder Card functions include:

- energy dispersal (scrambling),
- forward error correction (Reed/Solomon),
- interleaving,
- differential inner encoding,
- mapping into QAM symbols.

QAM MODULATION

The QAM Modulator Card provides square-root Nyquist filtering in compliance with DVB recommendations, and amplitude modulation of two carriers in phase quadrature (QAM).

Three types of cards can perform this function:

- QAM - IF Modulator card = 36 MHz - 5.5 to 7 Mbaud,
- QAM - IF Modulator card = 36.15 MHz - 5.5 to 7 Mbaud,
- QAM - IF Modulator card = 44 MHz - 4 to 5.2 Mbaud.

Note: In the case of the QAM - IF = 36 MHz Modulator card, three types of IF-RF Converter Units are available:

- VHF1 IF-RF Converter Unit (108 - 240 MHz),
- VHF2 IF-RF Converter Unit (240 - 470 MHz),
- UHF IF-RF Converter Unit (470 - 862 MHz),

SUPERVISION AND MANAGEMENT

The Supervision and Management Interface Card monitors the PQM 2100 Unit through processing of Fault indications (Flt Inds) supplied by the various PQM 2100 Cards. The corresponding major and minor alarms are transmitted through relay contacts.

Local configuration access to the PQM 2100 Cards is available via the front panel keypad/display or using a PC connected to the RS-232 interface. Remote configuration access can also be provided through an interface to a (Ethernet) LAN.

NOTE: One interface only (RS-232 or ETHERNET) is supported by each PQM 2100 Unit.

Test functions (see Sub-section 5.4) activated via the respective operating software options allow Unit and link supervision.

The I²C® bus supports communications between the various PQM 2100 subassemblies and the Management and Supervision Interface Card, as well as a IF-RF Converter unit in some cases (*). The IF/RF Converter connection is provided by a I²C® Interface card via the corresponding connector.

(*) An external IF-RF Converter Unit may or may not be supervised and managed by the equipment.

POWER SUPPLY

The Power Supply Unit produces the tertiary voltages necessary for operation of the PQM 2100 Cards from the mains power supply (230-240 VAC or 120 VAC).

1.3 - Specifications

1.3.1 - Mechanical Specifications

Height	44 mm,
Width	430 mm,
Width (including mounting brackets)	480 mm (19-inch rack-mount),
Depth	450 mm,
Standard	ETS300.019 part 2 (CSEI13-10),
Weight	Less than 7 kg.

1.3.2 - Electrical Specifications

1.3.2.1 - Main Specifications

To DVB recommendations:	
Modulation type	M-QAM, M= 16, 32, 64, 128 or 256,
Filter type	Square-root Nyquist or Full Nyquist (test),
Roll-off factor	0.15 or 0.13,
Symbol rate (Ds)	5.5 to 7 MBd (channel bandwidth = 7 or 8 MHz), 4 to 5.2 MBd (channel bandwidth = 6 MHz),
External code	RS (204, 188, 8),
Interleaving	Convolutional, Forney type, Depth I = 12,
Differential Inner Code	DVB with no TCM DAVIC with TCM
Inner code (switchable ON/OFF)	DAVIC Trellis, 4D, 16 States, Rate $R = \frac{[2\mathrm{Log}_{(2)}M]-1}{2\mathrm{Log}_{(2)}M}$ R=1 with no TCM
Energy dispersal	Following DVB recommendations,

Data rate (MPEG-2 transport)	D (Mbit/s) = 188/204 x $\log_{(2)}$M x Ds (Mbaud),
Bit Rate (with RS)	D (Mbit/s) = $\log_{(2)}$M x R x Ds (Mbaud).

1.3.2.2 - Data Interface

Parallel interface

Complies with DVB recommandations.

Level	LVDS
Format	MPEG.2 transport (204 bytes),
Connector type	25-pin female HE 501 (on rear panel).

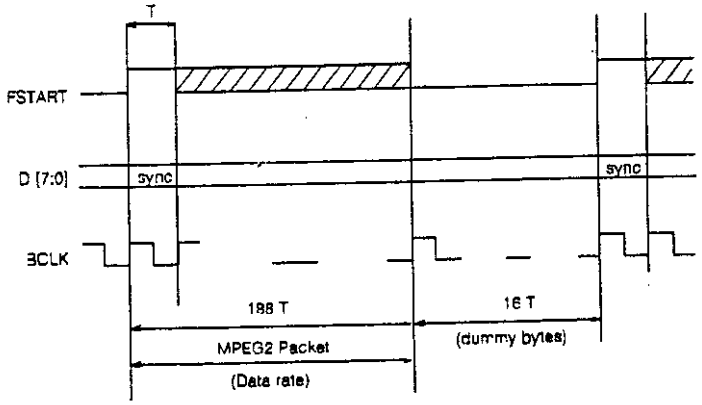
or

M2P Parallel interface

It is the M2P type (RS422).

Format	MPEG.2 transport (204 bytes),
Impedance	100 Ω,
Connector type	25-pin female HE 501 on rear panel).

The parallel input interface timing is given in figure below.



sync 47_{hex}

D7 = MSB D0 = LSB

$f_{EXTCLK} = 8 \times f_{OUTCLK} = 8 \times f_{BCLK}$

ASI Serial Interface

Complies with DVB recommandations.

Impedance	75 Ω
Connector type	Female BNC (on rear panel).

or

34 Mbit/s Serial Interface

Complies with ITU-T recommendation G.703 (HDB3).

Impedance	75 Ω
Line rate	34 Mbit/s,
Max. useful rate	33.96525 Mbit/s (see Sub-section 4.3.3.1 - Bit rate)
Connector type	Female BNC (on rear panel).

or

45 Mbit/s Serial Interface

Complies with ITU-T recommendation G.703 (HDB3).

Impedance	75 Ω
Line rate	45 Mbit/s,
Max. useful rate	44.21175 Mbit/s (see Sub-section 4.3.3.1 - Bit rate)
Connector type	Female BNC (on rear panel).

1.3.2.3 - External Clock Interface (only with M2P Int.)

Ext Clk Input

Clock	Continuous
Impedance	75 Ω,
Typical level	TTL
Connector type	Female BNC (on rear panel)

1.3.2.4 - Intermediate Frequency Interface

IF output

Connector type	Female BNC (on rear panel).
Frequency	36 MHz, 36.15 MHz, 44 MHz,
Impedance	75 Ω,
Output Level (programmable in 1 dB steps)	Lo = -27 dBm to -7 dBm,

Note: In the case of supervision and management of an IF-RF Converter, the output level (Lo) is automatically programmed to -10 dBm by default.

1.3.2.5 - Test Signal Interface

The use of test signals is described in Sub-section 5.4.

IF Test Output

Frequency	36 MHz, 36.15 MHz, 44 MHz,
Impedance	75 Ω,
Output Level	Lo -10 dB,
Connector type	Female BNC (on front panel).

Symbol Clock Test Output

Frequency	Sym. Clk,
Impedance	75 Ω,
Level	TTL,
Connector type	Female BNC (on front panel).

I and Q Test Outputs

Impedance	75 Ω,
Output pulse amplitude	≈ 250 mVpp,
Connector type	Female BNC (on front panel).

Link Test Input Clock

Clock	Continuous,
Impedance	75 Ω,
Level	TTL,
Connector type	Female BNC (on rear panel).

Link Test Input Data

Impedance	75 Ω,
Level	TTL,
Connector type	Female BNC (on rear panel).

1.3.2.6 - Alarm Interfaces

Major alarm (make = normal operation)	Two relay contacts,
Minor alarm (make = normal operation)	Two relay contacts,
Max. voltage	72 VDC,
Max current.	50 mA,
Connector type (on rear panel).	9-pin male HE501

1.3.2.7 - Supervision and Management Interfaces

RS-232 interface

Baud rate	9600 Bd,
Connector type	9-pin female HE501 (on rear panel).

(Ethernet) LAN Interface

Connector type	female RJ45 (on rear panel).

I²C® Interface

Connector type	female RJ45 (on rear panel).

NOTE: One interface only (RS-232 or ETHERNET) is supported by each PQM 2100 Unit.

1.3.2.8 - Power Requirements

Mains input voltage	120 VAC or 230-240 VAC on request,
Mains power frequency	47 Hz to 63 Hz,
Power consumption	100 VA (for 120 VAC Power Supply option), 0,5 A (for 230-240 VAC Power Supply option),
Connector type	Male connector, 2 phases + ground (on rear panel).

1.3.3 - Environmental

Temperature

To recommendation ETS300.019, Part 2 (CSE I11-10) with the following features:

Ambient temperature range	+ 5°C to + 45°C,
Relative humidity	≤ 95% at 25°C,
Storage temperature range	- 20°C to + 70°C,

Electromagnetic Compatibility

Conducted and radiated interference	To NF-EN 55022 Class B, NF-EN 50081-1 and CSE I12-10 and FCC Part 15A,

Electrostatic Discharge

To recommendations NF-EN 55022, NF-EN 50082-1, IEC 801-2, and CSE I16-10 with the following features:

Level 2 (4 KV)	normal operation,
Level 3 (8 KV)	no irreversible degradation,
Level 4 (15 KV)	no component deterioration.

Electrical Safety and Dielectric Strength

To recommendation NF-EN 60950/A3 (IEC 950), NF-EN 601010, NF-EN 41003 and UL 1419.

All electrical ports include SELV type safety provisions. The 230-240V/120V port and the associated mains power cable are the « dangerous voltage » type.

When the Unit is equipped with an ETHERNET card, the latter can only be connected to a standard ETHERNET port complying with Safety Extra Low Voltage (SELV) provisions.

Susceptibility

Radiated susceptibility	To IEC 801-3 (level 2),
Electrical fast transients	To IEC 801-4 (level 2) and CSE I19-10,
Immunity from shock waves	To IEC 801-5 (level 2).

Power Supply Access

To recommendation NF-EN 60950/A3, CSE I23-10 and UL 1950.

Acoustical

To recommendation CSE I15-10.

Note: UL compliance is applicable to the 120 VAC versions only, whereas compliance with French and European standards is applicable to the 230-240 VAC versions.

1.3.4 - Bit Rate Range Depending on QAM Modulation Type, Modulator Symbol Rate Range and TCM mode

α = Roll-off factor
BW = User band
D' = Bit rate

Ds = Symbol rate
D = Data rate

	Bit Rate (D' in Mbit/s with no TCM)				
Symbol Rate in MBaud (Ds)	4	5.2	5.5	6.1	7
16-QAM (N=4)	16.0	20.8	22.0	24.4	28.0
32-QAM (N=5)	20.0	26.0	27.5	30.5	35.0
64-QAM (N=6)	24.0	31.2	33.0	36.6	42.0
128-QAM (N=7)	28.0	36.4	38.5	42.7	49.0
256-QAM (N=8)	32.0	41.6	44.0	48.8	56.0
BW = 6 MHz					
BW = 7 MHz					
BW = 8 MHz					

Table 1 - Bit Rate D' (Mbit/s) including RS (204,188) with no TCM

	Bit Rate (D' in Mbit/s with TCM)				
Symbol Rate in MBaud (Ds)	4	5.2	5.5	6.1	7
16-QAM (N=4)	14.0	18.2	19.25	21.35	24.5
32-QAM (N=5)	18.0	23.4	24.75	27.45	31.5
64-QAM (N=6)	22.0	26.8	30.25	33.55	38.5
128-QAM (N=7)	26.0	33.8	35.75	39.65	45.5
256-QAM (N=8)	30.0	39.0	41.25	45.75	52.5
BW = 6 MHz					
BW = 7 MHz					
BW = 8 MHz					

Table 2 - Bit Rate D' (Mbit/s) including RS (204,188) with TCM

Symbol Rate in MBaud (Ds)	Data Rate (D in Mbit/s with no TCM)				
	4	5.2	5.5	6.1	7
16-QAM (N=4)	14.7	19.2	20.3	22.5	25.8
32-QAM (N=5)	18.4	24.0	25.3	28.1	32.3
64-QAM (N=6)	22.1	28.8	30.4	33.7	38.7
128-QAM (N=7)	25.8	33.5	35.5	39.4	45.2
256-QAM (N=8)	29.5	38.3	40.5	45.0	51.6

Table 3 - Data Rate D (MPEG2 Transport Layer) (Mbit/s) with no TCM

Symbol Rate in MBaud (Ds)	Data Rate (D in Mbit/s with TCM)				
	4	5.2	5.5	6.1	7
16-QAM (N=4)	12.9	16.7	17.7	19.6	22.5
32-QAM (N=5)	16.5	21.5	22.8	25.3	29.0
64-QAM (N=6)	20.3	26.3	27.9	30.9	35.5
128-QAM (N=7)	23.9	31.1	32.9	36.5	41.9
256-QAM (N=8)	27.6	35.9	38.0	42.1	48.4

Table 4 - Data Rate D (MPEG2 Transport Layer) (Mbit/s) with TCM

$D' = \log_2(M) * R * Ds$ where $M = 2^N$

$D = D' * 188/204$

$Ds = BW/1+\alpha$ $\rightarrow$ Ds = 5.2 MBaud (where $\alpha = 0.15$ and BW = 6 MHz)

The various (PQM 2100) Modulator Unit configurations are used depending on particular constant symbol rate requirements (4 to 5.2 Mbaud or 5.5 to 7 Mbaud). Therefore, constellation pattern(s) 1 or 2 may be used as shown in figures 1.3 to 1.6 below at a given user rate. When the user rate corresponds to two constellation patterns, the software allows the operator to select the modulation best suited to his requirements.

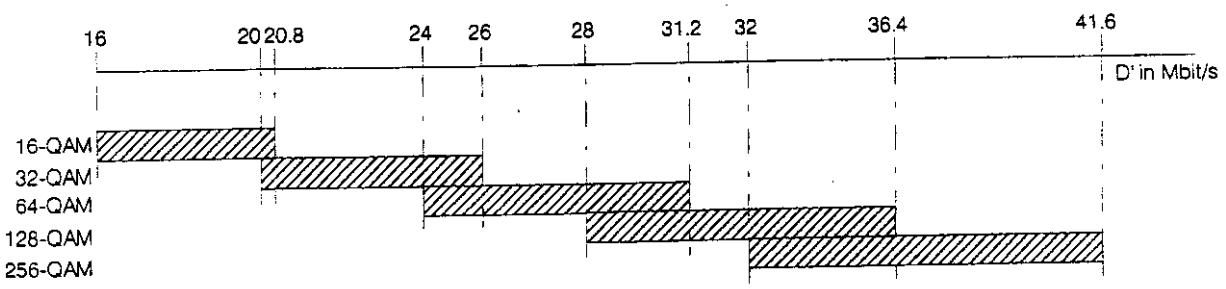


Figure 1.3 - QAM Modulator Bit Rate Ranges Depending on Modulation Type for $4 \leq Ds \leq 5.2$ Mbaud with no TCM

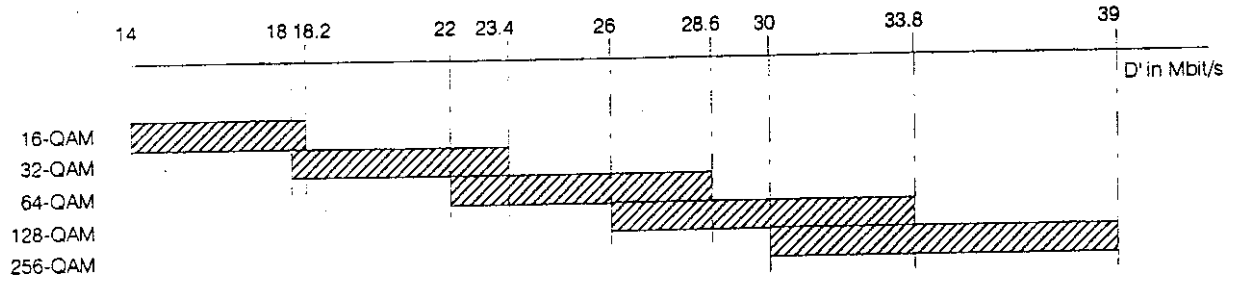


Figure 1.4 - QAM Modulator Bit Rate Ranges Depending on Modulation Type for $4 \leq Ds \leq 5.2$ Mbaud with TCM

Where D' = Bit rate in Mbit/s
Ds = Symbol rate in Mbaud
M = Modulation type

$D' = \log_2 (M) \times Ds$

$M = 2^N$

M values: 4, 5, 6, 7, 8

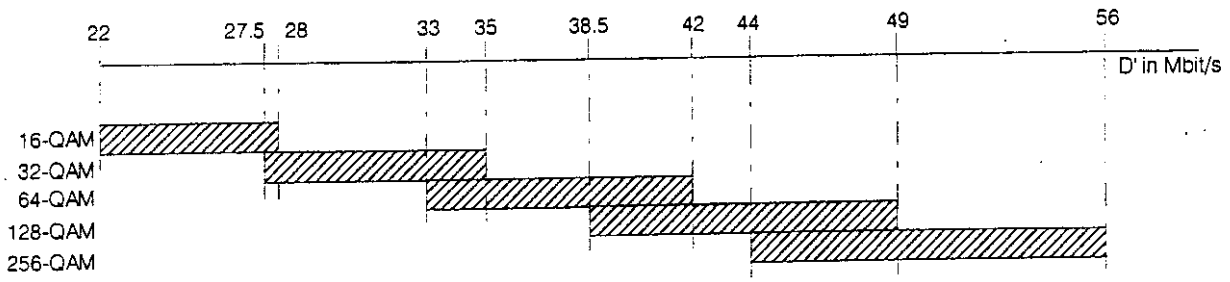


Figure 1.5 - QAM Modulator Bit Rate Ranges Depending on Modulation Type for 5.5 ≤ Ds ≤ 7 Mbaud with no TCM

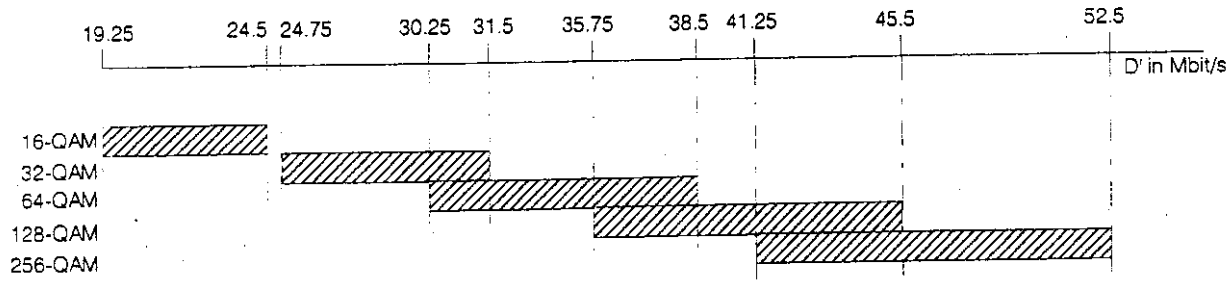


Figure 1.6 - QAM Modulator Bit Rate Ranges Depending on Modulation Type for 5.5 ≤ Ds ≤ 7 Mbaud with TCM

Where D' = Bit rate in Mbit/s
Ds = Symbol rate in Mbaud
M = Modulation type

$D' = \log_2 (M) \times Ds$

$M = 2^N$

M values: 4, 5, 6, 7, 8

SECTION 2

DESCRIPTION

The PQM 2100 Unit is contained in a 1-unit high enclosure fitted with two side 19-inch rack-mounting brackets. The front and rear panels are described below. Connector pin assignments are given in Section 3. Figure 2.1 is a general view of the PQM 2100 Unit.

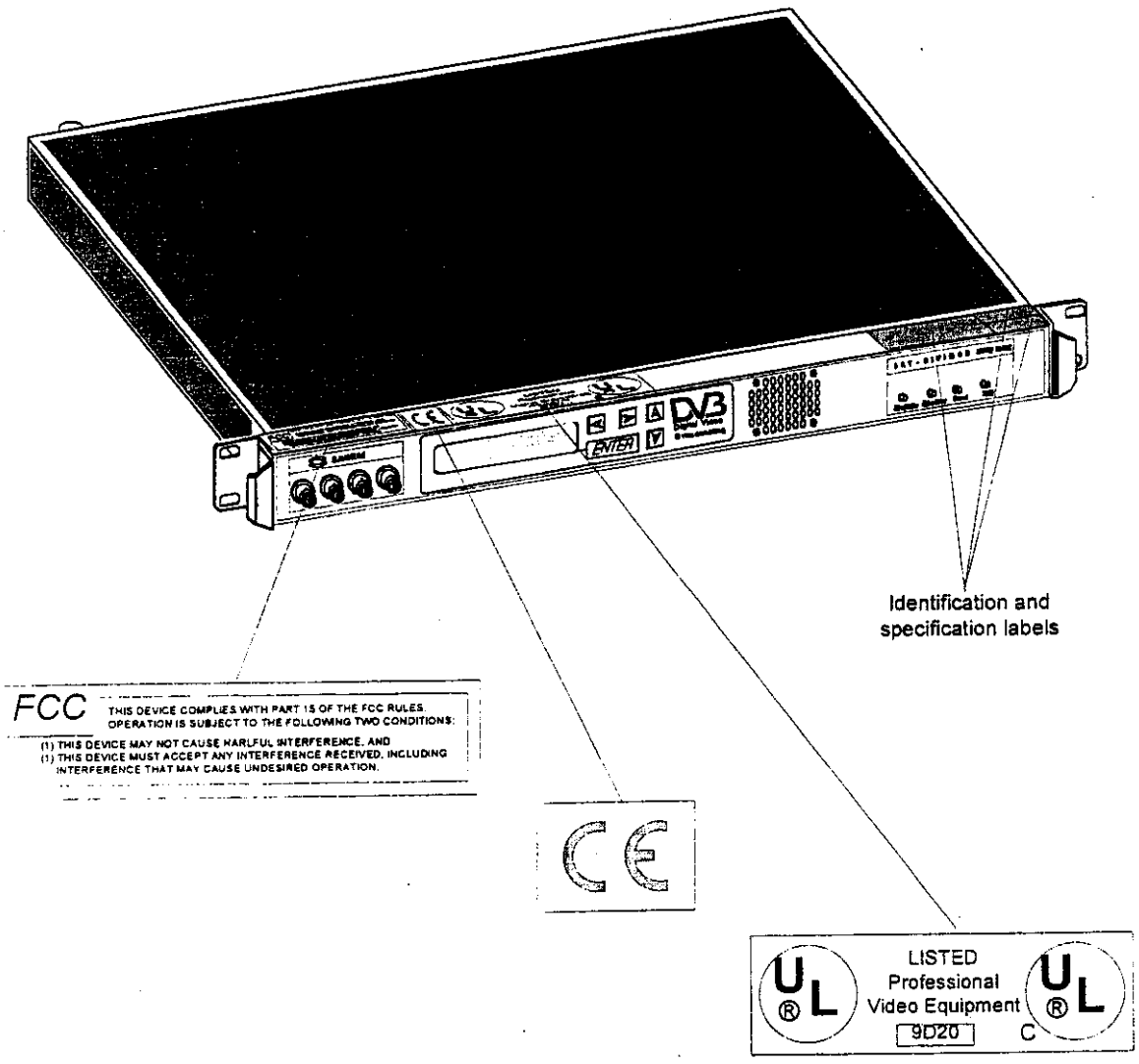


Figure 2.1 - PQM 2100 Unit

REMARK: SAT reserves the right to change Unit label positions to comply with current regulations in the countries in which the Unit is marketed.

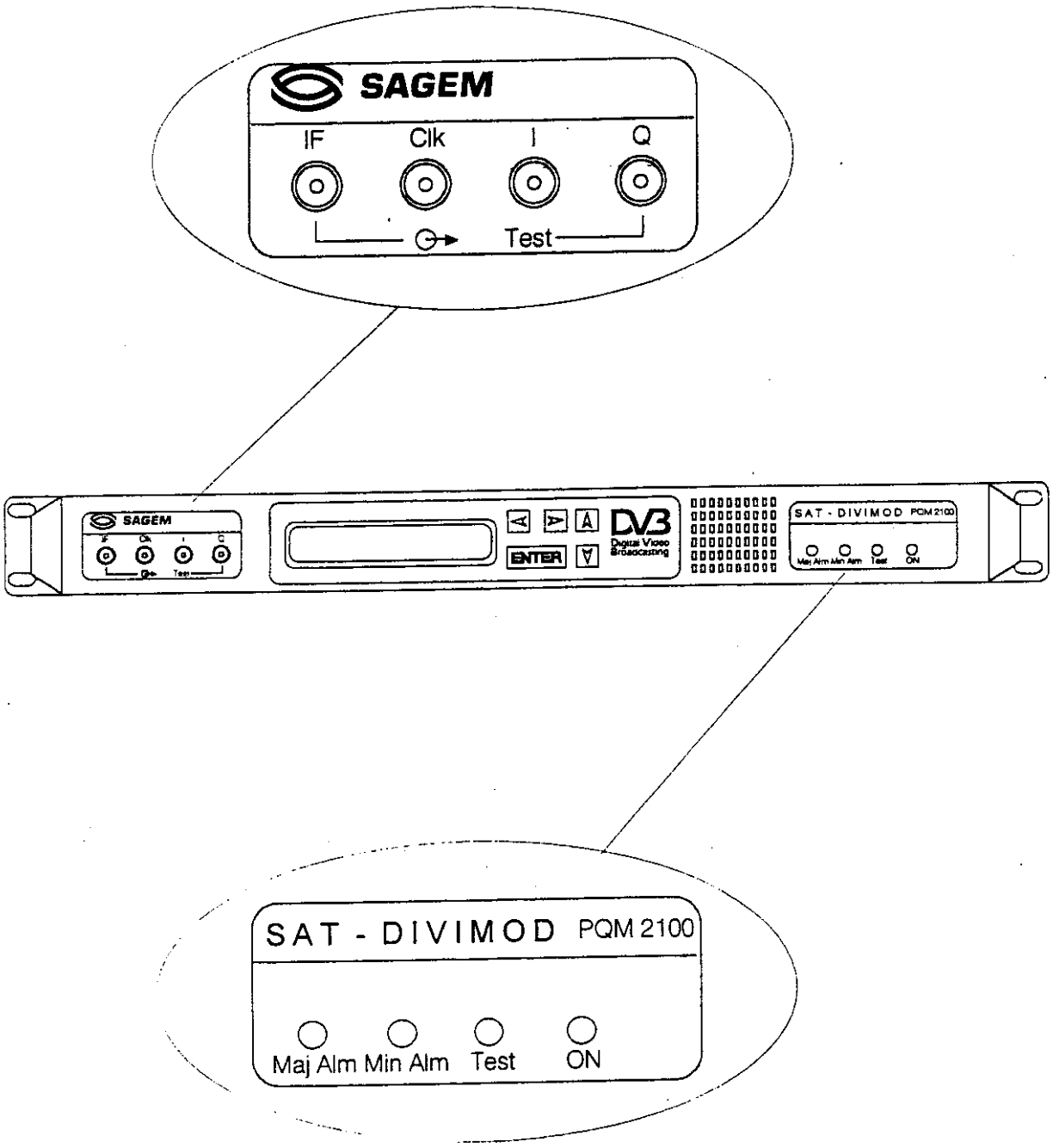


Figure 2.2 - PQM 2100 Unit Front Panel

2.1 - Front Panel

The front panel is identical for the two Unit types (PQM 2100 or PQM 2100-M2P).

The front panel consists of three sections (see figure 2.2):

In the left hand side section, the following four BNC connectors (see figure 2.2), from left to right:

- **IF** connector: modulated IF output test socket,
- **Clk** connector: symbol clock output test socket,
- **I** connector: baseband I output test socket,
- **Q** connector: baseband Q output test socket.

In the middle section, a keypad/display provides local control access to the PQM 2100 and PQM 2100-M2P Units. The display screen consists of two 24-character lines and the keypad has the following keys:

<	Left (L)
>	Right (R)
^	Up (U)
v	Down (D)
ENTER	Validate (V)

In the right hand side section, the following four LEDs:

- red **Maj Alm** LED indicating a major alarm condition (when lit: at least one major alarm),
- red **Min Alm** LED indicating a minor alarm condition (when lit: at least one minor alarm),
- yellow **Test** LED which, when lit, indicates that a test is in progress,
- green **ON** LED which, when lit, indicates that (230-240 VAC or 120 VAC) mains power is on, and when unlit, mains power or (+20 V) secondary voltage failure.

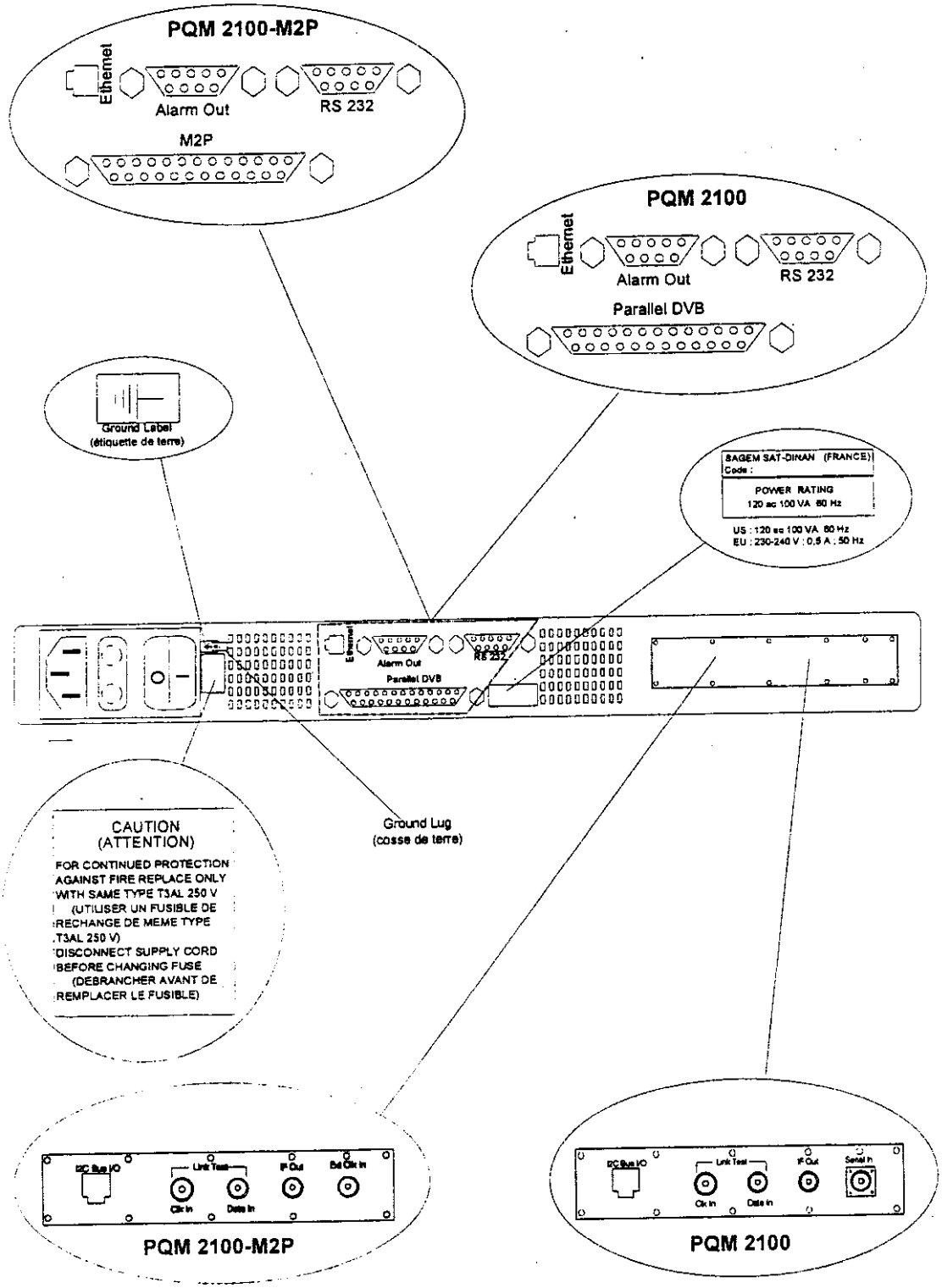


Figure 2.3 - PQM 2100 Unit Rear Panel

2.2 - Rear Panel

The rear panel depends on the Unit type (PQM 2100 or PQM 2100-M2P).

The rear panel consists of three sections (see figure 2.3).

In the left hand side section:

- (male, 2-phase + ground) power connector (IEC connector),
- fuse holder containing two 3 Amp delay fuses (Part No. HA20T3A) protecting each phase,
- ON/OFF (I/O) switch for switching the PQM 2100 Unit on,
- caution label for fuse removal,
- a lug for grounding the Unit to chassis ground and the corresponding graphic symbol label on the Unit rear panel next to the lug.

In the middle section, the following four connectors:

- female RJ45 connector marked **Ethernet**: provides connection to a (Ethernet) LAN,
- 9-pin HE 501 male connector marked **Alarm Out**: Alarm port,
- 9-pin HE 501 female connector marked **RS 232**: provides connection to a PC,
- 25-pin HE 501 female connector marked **Parallel DVB**: Parallel DVB input port,

or

- 25-pin HE 501 female connector marked **M2P**: M2P parallel input port (RS-422),

and an identification label (see figure 2.3).

In the right hand side section, the following five connectors:

- female RJ45 "I2C I/O Bus" connector, which may be used via an I^2C® Bus interface for IF-RF converter supervision and management,
- "Clk In" 75 Ω BNC connector used for the maintenance link test (data on TEST IN),
- "Data In" 75 Ω BNC connector used for the maintenance link test (data on TEST IN),
- "IF Out" 75 Ω BNC connector delivering the modulated IF output,
- 75 Ω BNC female connector marked Serial In, isolated from the ground, and providing connection to the DVB serial input or 34 Mbit/s G.703 input,

or

- 75 Ω BNC female connector marked **Ext. Clk In**, and providing connection to the external clock for synchronization of the MPEG.2 frame carried by the M2P Rx Int Card.

2 - DESCRIPTION

SECTION 3

INSTALLATION and START-UP

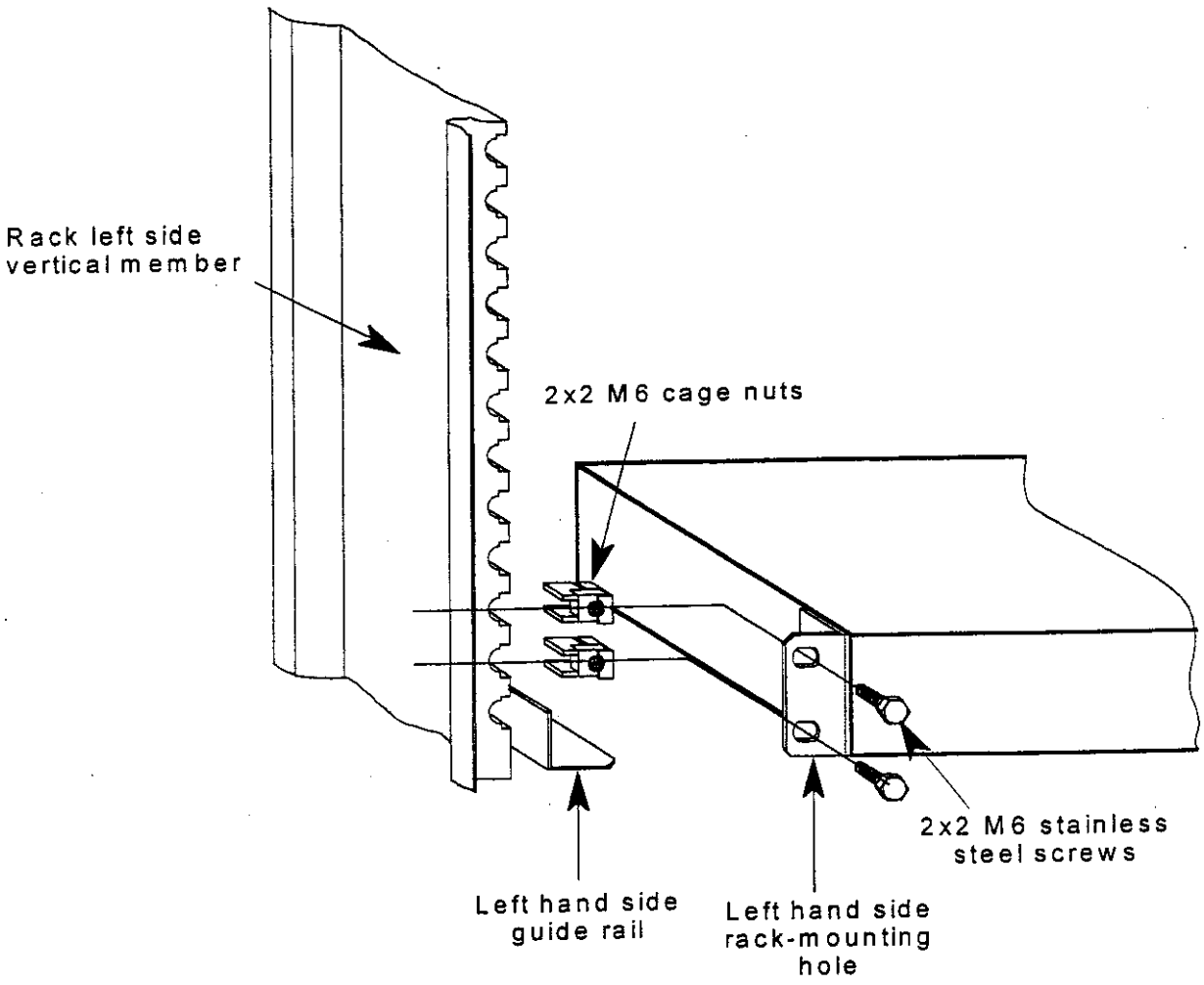


Figure 3.1 - PQM 2100 Unit 19-inch Rack-mounting

The PQM 2100 Unit is factory-set to the configuration options specified in the order. Therefore, no internal intervention configuration is required in the field on site. The following options are available:

- power supply (120 VAC or 230-240 VAC on request),
- management mode used, that is, local management (RS-232 interface) or remote management through an ETHERNET network using the SNMP protocol.

PQM 2100 Unit installation and start-up are performed in the following steps:

- installation,
- connections,
- power-up,
- test connections.

3.1 - Unit Installation

The PQM 2100 Unit comes in a 1-unit high enclosure suited to:

- desktop mounting with no particular precautions, or 19-inch rack-mounting.

Table top installation

For table top installation, the Unit is placed on a support providing stability and air circulation, with a 1U space between the table and the Unit. Grounding is performed using the Unit ground lug.

19-inch Rack-mounting

The PQM 2100 Unit is delivered with its side 19-inch rack-mounting brackets fitted.

Perform installation as follows:

- Mount the PQM 2100 Unit into the rack by sliding it in along the side guide rails provided for this purpose,
- attach the PQM 2100 Unit with four M6 screws onto the corresponding rack cage nuts, through the two oblong holes in each side rack-mounting bracket as shown in figure 3.1,
- Connect the PQM 2100 Unit to rack chassis ground.

PRECAUTION: It is recommended to leave one unit of rack height between the PQM 2100 Unit and the remaining rack equipment units in order to allow thermal dissipation and easy wiring.

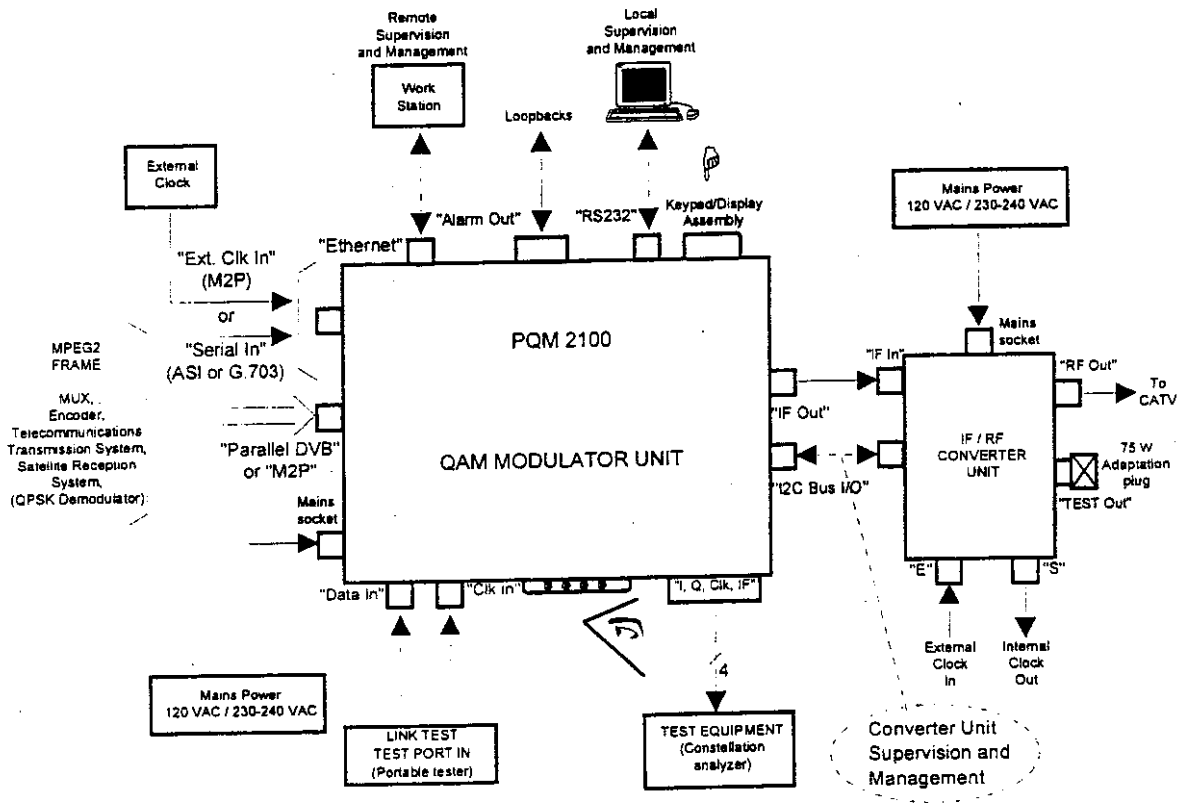


Figure 3.2- PQM 2100 Unit Interconnections

3.2 - Unit Connections

General Rules

Figure 3.2 shows the various signals to be connected: power, data, alarms, and management information. All connections are performed on the enclosure rear panel (see figure 3.3), with power off (ON/OFF switch set to the OFF position).

The PQM 2100 Unit is delivered with:

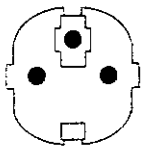
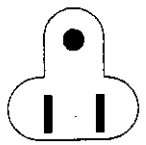
- 2 power cables for (120 VAC or 230-240 V AC) mains power to the PQM 2100 Unit,
- and a 9-pin HE501 female connector (SAT Part No. 4099967) and its cap (SAT Part No. 6485276) providing relay contact alarm connections.

IMPORTANT: Connections to thePQM 2100-Unit must be performed with shielded cable for compliance with electromagnetic compatibility standards.
When a IF-RF Converter is supervised and managed by the PQM 2100 Unit, the interconnexion cables (IF and I2C® bus) are delivered with this equipment.

3.2.1 - Mains Power Connection

Connection to the mains electricity supply is performed with a power cable to the 2-phase + ground male connector on the far left hand side of the enclosure rear panel.

The cable type depends on the mains power supply voltage (230-240 VAC or 120 VAC) used by the customer. The following table gives the reference number of the lead according to voltage.

Input Voltage	Cable Type	Connector Front View	SAT Cable Part No.
230-240 VAC	"Europe"		4980029
120 VAC	"US"		4980168

Note: The box ticked in the connector right side label indicates the factory-set option, following the ordering information given by the customer.

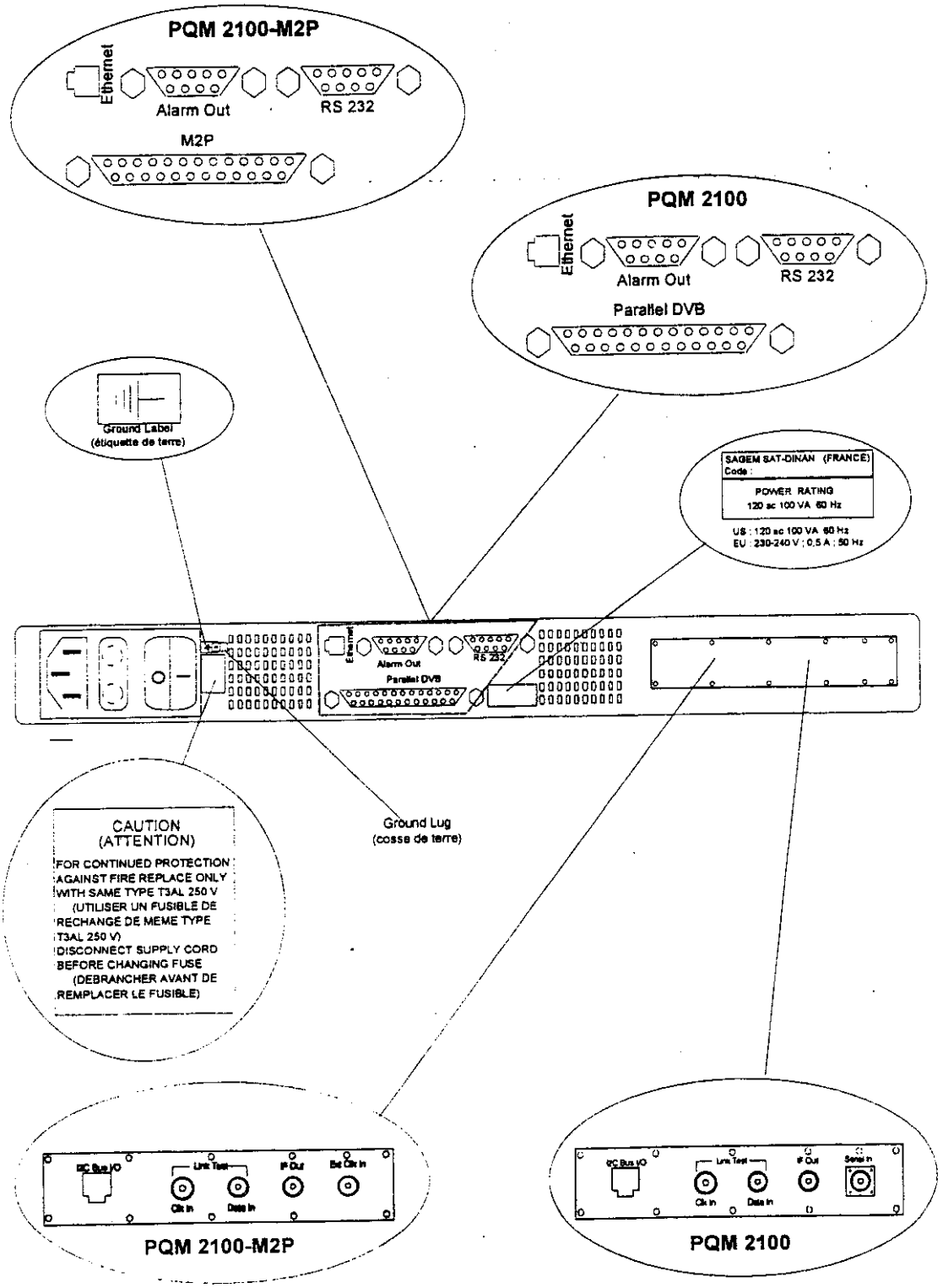
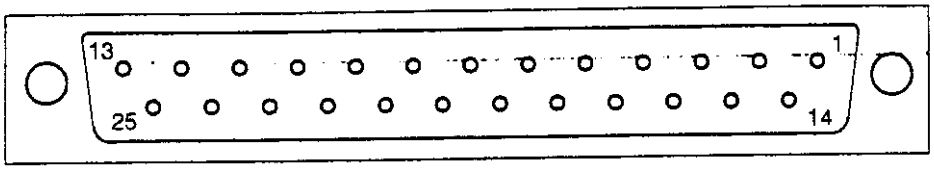


Figure 3.3 - Connector Layout on the PQM 2100 Unit Rear Panel

3.2.2 - Reception Digital Interface Connection

Parallel DVB Interface Connection

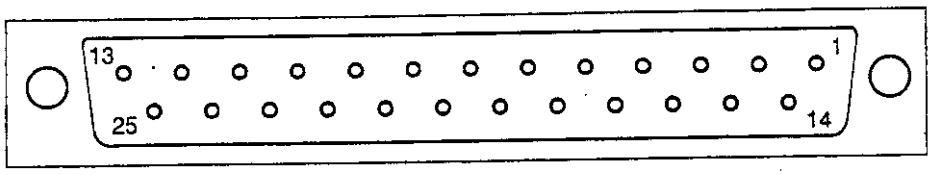
Connection is performed to the 25-pin HE501 connector marked **Parallel DVB** in figure 3.3. Connector pin assignments are given below.



Pin No.	Signal Name	Abbreviation
1	Channel A clock	CLK A
2	OV (GND)	System Gnd
3	Channel A data bit 7 (MSB)	Data 7A
4	Channel A data bit 6	Data 6A
5	Channel A data bit 5	Data 5A
6	Channel A data bit 4	Data 4A
7	Channel A data bit 3	Data 3A
8	Channel A data bit 2	Data 2A
9	Channel A data bit 1	Data 1A
10	Channel A data bit 0	Data 0A
11	Channel A data validation signal	DVALID A
12	Channel A data synchronization	PSYNC A
13	Shield	Cable Shield
14	Channel B clock	CLK B
15	OV (GND)	System Gnd
16	Channel B data bit 7 (MSB)	Data 7B
17	Channel B data bit 6	Data 6B
18	Channel B data bit 5	Data 5B
19	Channel B data bit 4	Data 4B
20	Channel B data bit 3	Data 3B
21	Channel B data bit 2	Data 2B
22	Channel B data bit 1	Data 1B
23	Channel B data bit 0	Data 0B
24	Channel B data validation signal	DVALID B
25	Channel B data synchronization	PSYNC B

M2P Port Connection

Connection is performed to the 25-pin HE501 connector marked **M2P** in figure 3.3. Connector pin assignments are given below.



Pin No.	Signal Name	Abbreviation
1	P Reference master clock (output)	OUTCLK_P
2	P Frame byte clock	BCLK_P
3	Not connected	NC
4	P frame start bit	FSTART_P
5	P data bit 0	D0_P
6	P data bit 1	D1_P
7	P data bit 2	D2_P
8	P data bit 3	D3_P
9	P data bit 4	D4_P
10	P data bit 5	D5_P
11	P data bit 6	D6_P
12	P data bit 7	D7_P
13	0 V	GND
14	N reference master clock (output)	OUTCLK_N
15	N frame byte clock	BCLK_N
16	Not connected	NC
17	N frame start bit	FSTART_N
18	N data bit 0	D0_N
19	N data bit 1	D1_N
20	N data bit 2	D2_N
21	N data bit 3	D3_N
22	N data bit 4	D4_N
23	N data bit 5	D5_N
24	N data bit 6	D6_N
25	N data bit 7	D7_N

Serial Interface Input Port Connection

Connection is performed to a 75 Ω BNC connector, isolated from the ground and marked **Serial In** as shown in figure 3.3. This serial input port is used with the ASI-DVB interface, 34 or 45 Mbit/s Interfaces (PQM 2100).

or

External Clock Input Port Connection

Connection is performed to a 75 Ω BNC female connector, marked **Ext Clk In** as shown in figure 3.3. This input port is used with the M2P (RS422) interface (PQM 2100-M2P).

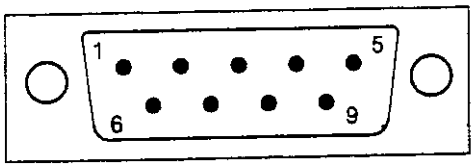
3.2.3 - Modulated IF Output Port Connection

Connection is performed to the 75 Ω BNC female connector marked **IF Out** as shown in figure 3.3.

The connector provides connection to the corresponding IF-RF Converter Unit rear panel connector using appropriate cable (SAT Part No. 6485648).
The interconnection diagram is given in figure 3.2.

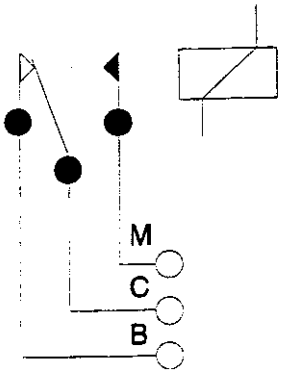
3.2.4 - Alarms Port Connection

Connection is performed to a 9-pin HE501 male connector marked **Alarm Out** as shown in figure 3.3. Connector pin assignments are given below.



Pin No.	Signal name	Abbreviation
1	Not Connected	NC
2	Relay 1 common return	Com-1
3	Not Connected	NC
4	Relay 2 common return	Com-2
5	0V (Gnd)	0V (Gnd)
6	Relay 1 make	Make-1
7	Relay 1 break	Break-1
8	Relay 2 make	Make-2
9	Relay 2 break	Break-2

Relay 1 is for the Major Alarm and relay 2 for the Minor alarm.



RELAY 1	RELAY 2
6	8
2	4
7	9

Two modes of operation are available for relay contact alarms:

- "Normal" mode,
- "Default" mode.

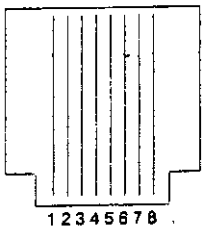
Both modes can be configured via the PQM 2100 Unit supervisory software. They operate as follows:

Relay Contact Alarm Mode of Operation	Unit Operation Without Any Alarm	Unit Operation With Alarms
Normal	Common - Make	Common - Break
Default	Common - Break	Common - Make

3.2.5 - Management Interface Connection

Connection to I²C® port

Connection is made to an RJ45 connector located on the right and marked **I2CBus I/O** in figure 3.3, details of which are as follows.

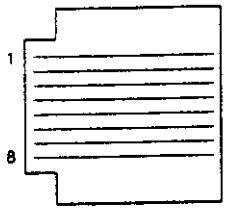


Pin No.	Signal name	Abbreviation
8	I²C® clock	I²C®-SCL
7	I²C® data bus	I²C®-DSA
6	I²C® confirmation	I²C®-ENA
5	Not connected	NC
4	Not connected	NC
3	Not connected	NC
2	0V (Gnd)	0V (Gnd)
1	Not connected	NC

This connector allows an IF-RF Converter Unit supervised and managed by the supervisory software to be connected via a lead (SAT part No. 6992863), to the connector on the rear panel of the same type marked **Interface E/S 1**.

Ethernet Port Connection (female RJ45)

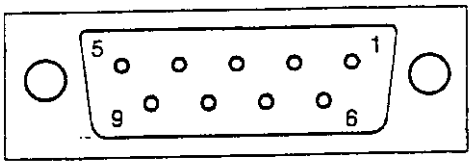
This port is used for remote operation through a (Ethernet) LAN. Connection is performed to the connector marked **Ethernet** as shown in figure 3.3. Connector pin assignments are given below.



Pin No.	Signal name	Abbreviation
1	Transmitted data (TXD) +	ETHTDP
2	Transmitted data (TXD) -	ETHTDN
3	Received data (RXD) +	ETHRDP
4	Not Connected	NC
5	Not Connected	NC
6	Received data (RXD) -	ETHTRDN
7	Not Connected	NC
8	Not Connected	NC

RS-232 Port Connection

This port is used for local operation using a personal computer. Connection is performed to the 9-pin HE501 female connector marked **RS232** as shown in figure 3.3. Connector pin assignments are given below.



Pin No.	Signal name	Abbreviation
1	Not Connected	NC
2	Transmitted data (ED)	RSTX
3	Received data (RD)	RSRX
4	Data Set Ready (DSR)	RSDSR
5	0V (Gnd)	0V (Gnd)
6	Data Terminal Ready (DTR)	RSDTR
7	Clear To Send (CTS)	RSCTS
8	Request To Send (RTS)	RSRTS
9	Not connected	NC

The various connectors are shown in figure 3.3.

3.3 - Power-up

PRECAUTION: Before applying power to the PQM 2100 Unit:

- check that the mains voltage value printed in the label is the same as one actually used in the installation,
- check for the presence and condition of the two 3 Amp delay fuses (Part No. HA20T3A),
- check the mains power cable connection.

IMPORTANT: If the external IF-RF converter is supervised and managed by the PQM 2100 Unit, it must be powered up before the PQM 2100 Unit.

Set the ON/OFF switch to the ON position, causing the front cover green "ON" LED to light up.

3.4 - TEST Port Connection

No connection is required to the TEST ports for normal operation. On the other hand, as the tests provide significant assistance for maintenance (see Sub-section 5.4), the ports are described in Sub-section 2.1.

SECTION 4

OPERATION

Three modes of control access to the PQM 2100 Unit are available:

- local control via the keypad/display,
- local control using a PC (on request),

or

- remote control through an (Ethernet) LAN (on request).

Local control access via the keypad/display only is described in the following Sub-sections. The remaining modes of operation are described in separate documents (Line Terminal User's Guide - ref. No. 56714340 and System Controller User's Guide - ref. No. 56714300).

4.1 - Keypad/Display Description

The keypad/display provides local control access to the PQM 2100 QAM Unit.

It offers the following functions depending on the operator's user class:

- read access to equipment information (including card software versions, equipment composition),
- equipment configuration access,
- test access.

4.1.1 - User Interface

Most operations are performed using the PQM 2100 Unit front panel keypad.

Software functions are accessible from a pull-down menu.

Depending on the particular menu used, the keys may be used for moving in the tree menu structure and for activating some functions.

Keys	Description	Function
<	Left key	Returns to the upper level menu or to the welcome screen or is inoperative or selects by moving the cursor by one digit value
>	Right key	Proceeds to the lower level menu, if any or is inoperative or selects by moving the cursor by one digit value
^	Up key	Returns to the previous menu of the same level or increments a value or selects a status from a circular list
v	Down key	Changes to the next menu of the same level or decrements a value or selects a status from a circular list
ENTER	Valid key	Accepts a value or an option in a lower level menu or is inoperative (warning beep) in all other menus

4.1.2 - User Classes

The clearance levels available are:

0 Observer mode with no write commands available,

1 User mode (configuration access) protected by a password, and with all read/write commands available.

4.2 - Welcome Screen

Upon power up or reinitialization of the PQM 2100 Unit (warm reset) this equipment executes all its self-tests.

Note : The **warm reset** control (see **Utillities** menu) is displayed if the O & M Ethernet card is present.

Upon PQM 2100 identification by the supervisory software, the following screen is displayed:

```
PQM2100 (C) SAT 1996
Press any key for access
```

Pressing any of the five keys causes the Password entry screen to be displayed:

```
PASSWORD
-
```

The PQM 2100 Unit is delivered without a password (password blank). To gain access the main menu, press ENTER. Enter the desired password using the Password modification menu (see Sub-section 4.3.6).

If the password exists, enter the current password, and confirm it by pressing ENTER to gain access to the first sub-menu in the main menu (see Sub-section 4.3.1).

Entry of an incorrect password causes the following error message to be displayed:

```
Access denied
Press any key
```

Upon pressing any one of the 5 keys, the operator is assigned the Observer user class, and gains access to the first sub-menu in the main menu (see Sub-section 4.3.1).

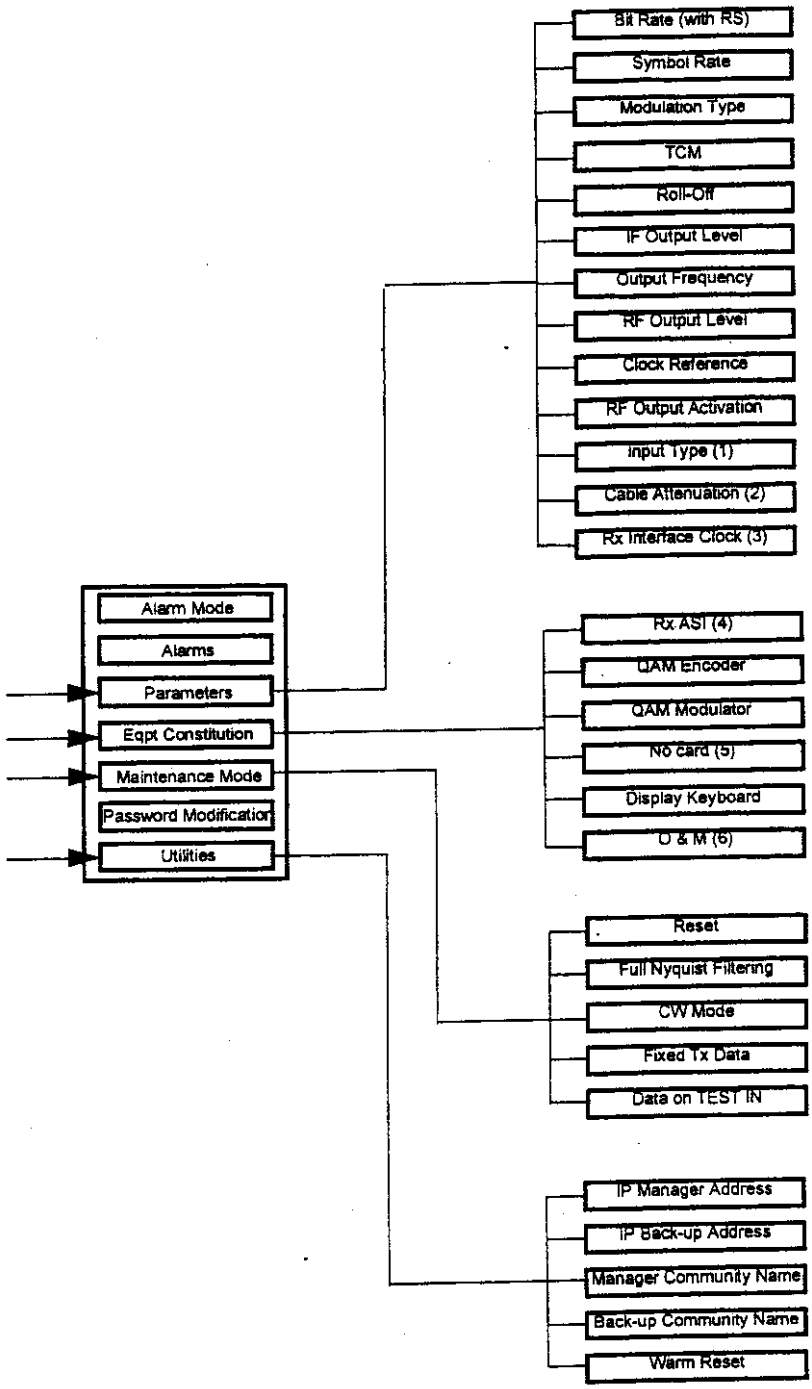
Comment: Failure to identify the PQM 2100 Unit upon power-up causes the following screen to be displayed:

```
DIVIMOD (C) SAT 1996
Press any key for access
```

Pressing any of the five keys causes the following screen to be displayed:

```
DIVIMOD (C) SAT 1996
Eqpt constitution->
```

The screen provides access to the Equipment constitution sub-menu only in the main menu (see Sub-section 4.3.4). Note the error and contact the After Sales department.



(1) 34 Mbit/s G703 Int. or 45 Mbit/s G703 Int. or ASI-DVB Int.
Int. G703 à 34 Mbit/s ou Int. G703 à 45 Mbit/s ou Int. ASI-DVB
(2) 34 Mbit/s G703 Int. only
seulement carte Int. G703 à 34 Mbit/s
(3) M2P Int. only
Int. M2P seulement
(4) or 34 Mbit/s G703 Int. or 45 Mbit/s G703 Int. or M2P Int.
ou Int. G703 à 34 Mbit/s ou Int. G703 à 45 Mbit/s ou Int. M2P
(5) or VHF1 (VHF2 or UHF) IF/RF Converter
ou Transposeur FI/RF VHF1 (VHF2 ou UHF)
(6) RS232 or Ethernet
RS232 ou Ethernet

Figure 4.1 - Main Menu Tree Structure for Operation with the Keypad/Display Assembly

4.3 - Main Menu Tree Structure

The main menu consists of six menus which are accessible from a pull-down menu (see figure 4.1).

The menus are arranged circularly in the following order:

1) Alarm Mode,

2) Active Alarms,

3) Parameters,

4) Equipment constitution,

5) Maintenance Mode,

6) Password Modification,

7) Utilities.

4.3.1 - Alarm Mode Menu

The Alarm mode menu is displayed upon user password identification.

```
PQM2100 (C) SAT 1996
Alarm mode->
```

Press ➢ to gain access to the Alarm mode selection screen.

Alarm Mode Selection Screen

```
Alarm mode:
Normal (or Default)
```

Two modes of operation are available for relay contact alarms (see Sub-section 3.2.4 - Alarm Port Connection):

- Normal mode: alarm relay contact opening in the event of an alarm.

- Default mode: alarm relay contact closure in the event of an alarm.

Press ⮝ or ⮟ to change the desired mode, then press **ENTER** to accept.

4.3.2 - Alarms Menu

```
PQM2100 (C) SAT.1996
Alarms->
```

Press ➢ to gain access to the Active Alarms display screen.

Active Alarms Display Screen

In the absence of any active alarm, the following screen is displayed:

```
Alarms:
No active alarm
```

Upon initiation of an active alarm, the following screen is displayed:

```
Alarms:
Encoder in clock fail
```

Alarms may be displayed using the keys. The alarm display is arranged circularly. The ⩓ and ⩔ keys provide access to the various active alarms in increasing or decreasing order.

The table after lists all active alarms (Flt Inds) available for PQM 2100 Unit Cards.

Active Alarm	Display
Power Supply Unit	
Power Supply Unit Alarm	Pwr Sup Unit Alm
Digital Rx Int Card	
G.703 input signal failure (34 or 45 Mbit/s G.703 Rx Int Cards only)	G.703 In Signal Fail
Loss of 34 MHz synchronization (34 Mbit/s G.703 Rx Int Cards only)	34 MHz G.703 Clock Fail
Loss of 45 MHz synchronization (45 Mbit/s G.703 Rx Int Card only)	45 MHz G.703 Clock Fail
Loss of Line Frame Alignment (34 or 45 Mbit/s G.703 Rx Int Cards only)	G.703 LFA
Rx Int Card bit PLL unlock	Rx Int PLL Alm
Loss of MPEG2 signal frame alignment	MPEG2TS-F LFA
MPEG-2 frame error uncorrected by R-S encoder (34 or 45 Mbit/s G.703 Rx Int Cards only)	Uncorrected errors
DVB Encoder Card	
Encoder Input Clock Fail	Encoder In Clock Fail
Non-conforming MPEG2 Frame	Non-conforming MPEG2TS-F
Encoder bit rate PLL Alarm	Encoder bin rate PLL Alm
Encoder symbol rate PLL Alarm	Encoder sym rate PLL Alm
IF/RF Converter Unit (*)	
IF/RF Converter Access Error	IF/RF. Conv. Access Err.
Converter Power Supply Unit Alarm	Conv. Pwr Sup Unit Alm
IF/RF Converter PLL Alarm	IF/RF Conv. PLL Alm
Output RF Signal Fail	Out RF Signal Fail
IF-RF Converter reference signal Fail	External Clock Fail
RF output level variation > ± 5 dB	Out variation > ±5 dB
RF output level variation > ± 2 dB	Out variation > ±2 dB

(*) These alarms are only taken into account if the external IF-RF converter is supervised and managed by the equipment.

4.3.3 - Parameters Menu

The menu provides read and/or write access to the following PQM 2100 Unit parameters depending on the operator's user class:

1) Bit rate,
2) Symbol rate,
3) Modulation type,
4) TCM Mode,
5) Roll-Off,
6) IF Output Level,
7) RF Output Frequency,
8) RF Output Level,
9) IF/RF Converter Clock,
10) RF Output Activation,
11) Selection of input type used (serial, parallel),
12) Cable attenuation (34 Mbit/s G.703 Rx Int Card only),
13) Rx Interface Clock (M2P Interface Card only).

ATTENTION: Parameters 7 to 10, which concern the external IF-RF converter, can only be displayed and/or modified if the Converter Unit is supervised and managed by the equipment.

IMPORTANT: In the **Observer** user class, read only access is available to this menu. Press ⋖ to exit from the current display.

The parameters are displayed in two orders according to the use or not the use of the FI/RF unit and/or the 34 Mbit/s G.703 Rx Interface Card and the M2P Interface Card (see summary table below).

With IF-RF Converter	Without IF-RF Converter
1) Bit rate	1) Bit rate
2) Symbol rate	2) Symbol rate
3) Modulation type	3) Modulation type
4) TCM Mode	4) TCM Mode
5) Roll-Off	5) Roll-Off
6) RF Output Frequency	6) IF Output Level
7) RF Output Level	7) Selection of input type used (serial, parallel) (*)
8) IF/RF Converter Clock	8) Cable attenuation (**)
9) RF Output Activation	9) M2P Int. Clock (***)
10) Selection of input type used (serial, parallel) (*)	
11) Cable attenuation (**)	
12) M2P Int. Clock (***)	

(*) Except M2P Int. Card.

(**) If a 34 Mbit/s G.703 Rx Int Card is used.

(***) If a M2P Int. Card is used.

The display for this menu is as follows:

```
PQM2100 C) SAT 1996
Parameters->
```

4.3.3.1 - With IF-RF Converter

Press ➢ to access the Bit Rate screen

1) Bit Rate

This option provides the capability of reading and/or changing the bit rate parameter value.

```
Parameters:
Bit rate (with RS)->
```

The Bit Rate Display Screen below is selected by pressing ➢.

```
Bit rate (with RS):
21250 kbit/s
(ou 21250.00 kbit/s) (*)
```

(*) Accuracy is roughly 1/10 bit with an INR - M2P Card using a synthesizer.

This parameter can only be changed by operators having the user class **User** (indicated by a cursor).

The operator enters a new value using the keypad as follows:

Key	Description
➢	Returns to Bit Rate or shifts the cursor to the left if possible
➢	Shifts the cursor to the right if possible
➢	Increments the underlined digit
➢	Decrements the underlined digit
ENTER	Accepts

Pressing the ENTER key can have five effects:

1) The value entered is correct and does not require the modulation type or modulation mode to be changed; **the change is saved.**

2) The value entered is correct and requires the modulation type to be changed; **changes are saved and the following screen is displayed.**

```
Modulation type:
xxQAM
```

xx can have the following values: 16, 32, 64, 128 or 256.

Pressing any key causes return to the following screen:

```
Parameters:
Bit rate (with RS)->
```

3) The value entered is correct and requires the TCM mode to be changed; **changes are saved and the following screen is displayed.**

```
TCM:
ON (or OFF)
```

Pressing any key causes return to the following screen:

```
Parameters:
Bit rate (With RS)->
```

4) The value entered is correct and requires the modulation type and the TCM mode to be changed; **changes are saved and the following screen is displayed.**

```
Modulation type:
xxQAM
```

xx can have the following values: 16, 32, 64, 128 or 256.

Then, when pressing any key,**the following screen is displayed.**

```
TCM:
ON (or OFF)
```

Pressing any key causes return to the following screen:

```
Parameters:
Bit rate (With RS)->
```

5) The value entered is incorrect and does not range between the maximum and the minimum bit rate values.; **the following screen is displayed.**

```
Out of range
Press any key
```

Pressing any key causes return to the Bit rate display and modification screen.

Bit rate (D') limitation

In the case of a 34.368 Mbit/s G.703 input, bit rate (D') is a multiple of 0.13425 Mbit/s ± 20 ppm, and therefore is limited to 33.96525 Mbit/s.

In the case of a 44.736 Mbit/s G.703 input, bit rate (D') is a multiple of 0.17475 Mbit/s ± 20 ppm, and therefore is limited to 44.21175 Mbit/s.

Note: The display screen resolution is 1 kbit/s.

Relationship Between Symbol Rate, Bit Rate and Modulation Type

This relationship is given by:

$Ds = D' / ((M + 4)xR)$

Where : R is the inner rate,
Ds is symbol rate in MBaud,
D' is bit rate in Mbit/s,
M is modulation type for 0 = 16-QAM, 1 = 32-QAM, 2 = 64-QAM,
3 = 128-QAM, 4 = 256-QAM.

D' min. = Ds min. x Rmin x (Mmin. + 4) and D' max. = Ds max. x x Rmax x (Mmax. + 4)

Bit rate limit values depend on the Modulator Card type used, the Rx Interface Card used and the TCM mode.

The bit rate cannot be less than:

- 4 x 7/8 x 4 = 16 Mbit/s (IF = 44 MHz, TCM on),

- 5.5x 7/8 x 4 = 19.25 Mbit/s (IF = 36 MHz and 36.15 MHz, TCM on).

In the case of an Rx Int Card using a 34 or 45 Mbit/s G.703 serial interface, the maximum bit rate limit value is respectively equal to 33.96525 or 44,21175 Mbit/s. The minimum bit rate limit value depends on the Modulator Card type used (4 to 5.2 MBaud or 5.5 to 7 MBaud).

The maximum bit rate limit value is given by the Modulator Card type used (4 to 5.2 MBaud).

The bit rate cannot be greater than:

- 5.2 x 8 x1 = 41.6 Mbit/s (IF = 44 MHz, TCM off),

- 7 x 8 x 1 = 56 Mbit/s (IF = 36 MHz and 36.15 MHz, TCM off).

2) Symbol Rate

This option provides read only access to the symbol rate parameter value.

```
Parameters:
Symbol rate->
```

Access to the Symbol rate display screen below is gain by pressing ➢, causing the PQM 2100 Unit symbol rate to be displayed.

```
Symbol rate:
5100 kbaud
```

3) Modulation type

This option provides the capability of displaying and/or changing the M-QAM modulation type (M = 16, 32, 64, 128 or 256) used. Read access to Modulation type is available from the following screen.

```
Parameter:
Modulation type->
```

Access to the Modulation type display or change screen below is gained by pressing ➢ .

```
Modulation type:
64 QAM
```

This parameter can only be changed by operators having the user class **User** (indicated by a cursor).

Control via the keypad is as follows:

Keys	Description
➢	Returns to Modulation type screen
➢	Inoperative (warning beep)
➢	Modulation type 128 QAM*
➢	Modulation type 32 QAM *
ENTER	Accepts

* The preset values available are those allowed by the bit rate/min. and max. Ds value consistency check.

4) TCM mode

This option is used to switch on the Trellis Coded Modulation.

```
Parameter:
TCM->
```

Access to the TCM mode display or change screen below is gained by pressing ➢ .

```
TCM:
ON (or OFF)
```

This parameter can only be changed by operators having the user class **User** (indicated by a cursor).

Press ⋏ or ⋎ to select the desired mode by changing from no TCM mode ("OFF") to TCM mode ("ON") or vice versa, then press ENTER to accept.

Pressing the ENTER key can have two effects:

1) The value entered is correct and does not require the modulation type to be changed; **the change is saved.**
2) The value entered is correct and requires the modulation type to be changed; **changes are saved and the following screen is displayed.**

```
Modulation type:
xxQAM
```

xx can have the following values: 16, 32, 64, 128 or 256.

Pressing any key causes return to the following screen:

```
Parameter:
TCM->
```

5) Roll-Off

This menu provides the capability of displaying and/or changing the roll-off from 0.15 to 0.13, and vice-versa, as shown below:

```
Parameters:
Roll-Off->
```

Access to the Roll-Off display or modification screen below is gained by pressing ➢.

```
Roll-Off :
0.15
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⋏ or ⋎ to change the selected roll-off from 0.15 to 0.13, or vice versa, then press **ENTER** to accept.

6) RF Output frequency

IF-RF Converter RF output frequency may be programmed via the keypad/display supervisory software via the I²C® bus.

The menu allows RF output frequency to be displayed and/or changed using the RF Output frequency screen below:

```
Parameters:
Output frequency->
```

Comment: The function is only accessible when the RF output is activated (see Sub-section 4.3.3.1 - RF Output Activation).

The RF Output frequency display or change screen below is selected by pressing ➢.

```
Output frequency:
170.5625 MHz
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

The operator can gain access to the functions using the keypad as follows:

Keys	Description
◁	Returns to the RF Output Frequency screen or moves the cursor to the left
▷	For the first four digits: Moves the cursor to the right For the decimal value: no effect (warning beep)
△	For the first three digits: Increments the underlined digit For the decimal value: Increases the value * in steps of 62.5 kHz
▽	For the first three digits: Decrements the underlined digit For the decimal value: Reduces the value * in steps of 62.5 kHz
ENTER	Validation

* Admissible minimum values: 108 MHz for the VHF1 IF-RF converter,
240 MHz for the VHF2 IF-RF converter,
470 MHz for the UHF IF-RF converter.

Admissible maximum values: 240 MHz for the VHF1 IF-RF converter,
470 MHz for the VHF2 IF-RF converter,
862 MHz for the UHF IF-RF converter.

At values below the minimum and above the maximum values, the following screen appears:

```
Out of range
Press any key
```

7) RF Output Level

The IF-RF Converter RF output level may be programmed via the keypad/display supervisory software via the I^2C® bus.

This menu allows the RF output level to be displayed and/or modified from the RF Output Level screen below:

```
Parameters:
RF Output level->
```

The RF Level Display or change screen below is selected by pressing ➢ .

```
RF Output level:
0 dBm
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⋏ and ⋎ to respectively increase or decrease the underlined value* in steps of 1 dBm then press **ENTER** to confirm.

* The standard minimum admissible value is -16 dBm
  The standard maximum admissible value is +4 dBm.

8) IF/RF Converter Clock

The IF-RF Converter Clock reference may be programmed via the keypad/display supervisory software via the I^2C® bus.

This menu allows the chosen clock reference to be displayed and/or modified from the Clock Reference screen below:

```
Parameters:
IF/RF Converter Clock->
```

The Clock reference display or change screen below is selected by pressing ➢ .

```
IF/RF Converter Clock:
Internal (or External)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⋏ or ⋎ to change the selected clock reference from "Internal" to "External" or vice versa, then press **ENTER** to confirm.

9) RF Output activation/deactivation

The activation or desactivation of the IF-RF Converter RF Output may be programmed via the keypad/display supervisory software via the I^2C® bus.

The menu allows the RF output status (ON, OFF or AUTO) to be displayed and/or changed using the RF Output Activation screen below:

```
Parameters:
RF output activation->
```

The RF output activation screen below is selected by pressing ➢.

```
RF output activation:
ON (or OFF or AUTO)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

ON — RF Output Activation

OFF — RF Output Deactivation

AUTO — The RF Output is active if only a MPEG.2 signal is present at the PQM 2100 Unit Input ; the RF signal is automatically deactived If a MPEG.2 signal is absent at the PQM 2100 Unit Input

Press ⋏ or ⋎ to switch the RF output status (ON, OFF or AUTO), then press **ENTER** to confirm.

10) Selection of the input used

The function provides the capability of displaying and/or changing the serial (34 or 45 Mbit/s G.703 or ASI) or parallel (DVB) input type in order to select the MPEG2-TS transport stream to be applied to the Rx Int Card contained in the PQM 2100 enclosure. The Input type selection screen below is displayed.

```
Parameters:
Input type->
```

The Input type display and/or change screen below is selected by pressing the key ➢.

Input interface type display or change screen

```
Input.type:
ASI (or G703 or Parallel)
```

This parameter, which depends on the Rx Int Card type installed, is only accessible to operators having the user class **User** (identified by the presence of the cursor).

Press the keys ⋏ or ⋎ to change the serial (G.703 or ASI) or parallel (DVB) input type by changing from the serial interface selection (G.703 or ASI) to the parallel interface selection (Parallel) or vice versa, then **ENTER** to confirm.

IMPORTANT: In the case of a 45 Mbit/s G.703 Rx Int Card using a parallel input, if bit rate is too high (greater than 44.21175 Mbit/s), selection of the serial G.703 interface is not available.

11) Cable attenuation

The Cable attenuation parameter is only available if a 34 Mbit/s G.703 Rx Int Card is used. It provides the capability of compensating for attenuation to the interconnecting cable.

The function allows display and/or change of the value of compensation for attenuation due to the interconnecting cable using the Cable attenuation screen below:

```
Parameters:
Cable attenuation->
```

The Cable attenuation display or change screen below is selected by pressing the key ➢.

```
Cable attenuation:
0 to 6 dB (or 6 to 15 dB)
```

This parameter can only be changed by operators having the user class **User** (identified by the presence of the cursor).

Press the keys ⋏ or ⋎ to change from the values 0 to 6 dB (0 to 6 dB) to the values 6 to 15 dB (6 to 15 dB) or vice versa, then **ENTER** to confirm.

12) Rx Interface Clock

This menu provides the capability of displaying and/or changing the M2P Int. Card clock using the M2P interface clock screen below:

```
Parameters:
Rx Interface Clock->
```

Access to the M2P Int. clock display or modification screen below is gained by pressing ➢.

```
Rx Interface Clock
Internal (or External)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⋏ or ⋎ to change the selected M2P interface clock option from Internal to External, or vice versa, then press **ENTER** to accept.

Two kinds of M2P Int. cards can be installed in the PQM 2100 Unit, the one with a VCXO function, the other with a synthetizer function.

The **External** mode is used to connect a external clock for synchronization of the MPEG.2 frame carried by the M2P Rx Int Card.

The **Internal** mode allows :

- in the case of a M2P Int. card with a VCXO function, the mode display followed by the synchronization frequency (VCXO frequency expressed in kHz),

- in the case of a M2P Int. card with a synthetizer function, only the mode display ; the synthetizer frequency being directly related to the bit rate.

4.3.3.2 - Without IF-RF Converter

Press ➢ to access the Bit Rate screen.

1) Bit rate

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter.

2) Symbol rate

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter.

3) Modulation type

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter. The next parameter to be processed is TCM Mode.

4) TCM Mode

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter. The next parameter to be processed is Roll-Off.

5) Roll-Off

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter. The next parameter to be processed is IF Output level.

6) IF Output Level

This option is only available in the absence of any IF-RF converter. It provides the capability of displaying and/or changing IF output level via the screen below:

```
Parameters:
IF output level->
```

Access to the IF output level display or change screen below is gained by pressing ➢ .

```
IF output level:
-10 dBm
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor.

Press ⩓ and ⩔ to increase or decrease, respectively, the underlined value* in 1 dBm steps, then press **ENTER** to accept.

* The minimum limit value available is -27 dBm and the maximum limit value, -7 dBm.

Note: In the case of supervision and management of an IF-RF converter, the Output Level (Lo) is automatically programmed to a default value of -10 dBm.

7) Selection of the input used (serial or parallel)

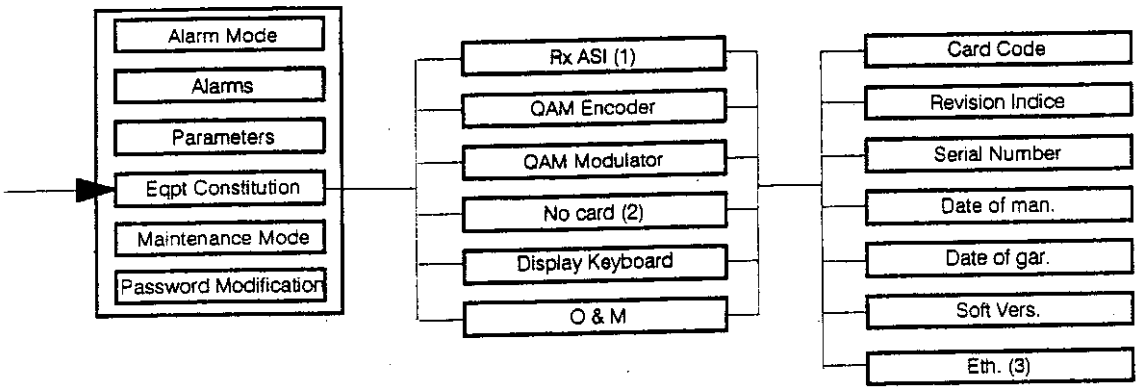
Refer to the same parameter described previously for a QAM modulator with an IF-RF converter.

8) Cable attenuation

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter.

9) Rx Interface Clock

Refer to the same parameter described previously for a QAM modulator with an IF-RF converter.



(1) or 34 Mbit/s G.703 Int. or 45 Mbit/s G.703 Int. or M2P Int.
ou Interface G.703 à 34 Mbit/s ou Interface G.703 à 45 Mbit/s
ou Interface M2P
(2) or VHF1 (VHF2 or UHF) IF/RF Converter
ou Transposeur FI/RF VHF1 (VHF2 ou UHF)
(3) For O & M, IF/RF Converter and Display/Keypad cards only
Pour cartes O & M, Transposeur FI/RF et Ecran/Clavier seulement

Figure 4.2 - Equipment Constitution Menu Tree Structure

4.3.4 - Equipment Constitution Menu

The Equipment Constitution menu (Figure 4.2) is related to the previous menu. It provides read access to the equipment constitution and to some information items relative to PQM 2100 Cards.

The menu screen is as follows:

```
PQM2100 (C) SAT 1996
Eqpt constitution->
```

Access to the Card Information sub-menu below is gained by pressing ➢.
Card information sub-menu
This sub-menu provides the capability of displaying the equipment constitution from the screens below.

```
Equipment constitution:
1-Rx ASI Int.->
```

The ⋏ and ⋎ keys provide access the Card information sub-menus, which are arranged circularly and in the following order:

`1-Rx ASI->`	ASI Rx Int Card
or	
`1-34 Mbit/s G703 Int.->`	34 Mbit/s G.703 Rx Int Card
or	
`1-45 Mbit/s G703 Int.->`	45 Mbit/s G.703 Rx Int Card
or	
`1-M2P Rx Int.->`	M2P Interface Card (RS422)
`2-QAM Encoder->`	DVB QAM Encoder Card
`3-QAM Modulator->`	QAM Modulator Card
`4-No card`	Empty slot
or	
`4-VHF1 IF-RF Converter->` (VHF2 or UHF)	IF-RF converter when it is supervised and managed by the software via the I^2C® bus,
`Display Keypad->`	Keypad/Display Card
`O & M->`	Supervision and Management Card

Card information screen

```
O&M
Code: K5617959
```

The ⩓ and ⩔ keys provide access the Card information screens, which are arranged circularly and in the following order:

`Code`	Manufacturer's part number,
`Release number`	Card management specifications (Operating Index (2 charact.) and Version (2 charact.)),
`Serial number`	Card serial number,
`Date of Fab.`	Date of manufacture,
`Date of Gar.`	End of guarantee date,
`Soft vers. (*)`	Card software version,
`Eth. (**)`	Ethernet Address.

(*) This information is specific to the O & M and Keypad/Display Cards and the external IF-RF Converter Unit when it is supervised and managed by the software via the I^2C® bus.

(**) This information is specific to the Ethernet O & M.

The table after gives Card positions and available Card combinations:

Slot	Cards	Possible Combinaisons
1	ASI Rx Int.	XXXXXXXXX
	34 Mbit/s G.703 Rx Int.	XXXXXXXXXX
	45 Mbit/s G.703 Rx Int.	XXXXXX
	M2P Int. (RS422)	XXXX
2	DVB QAM Encoder	XXXXXXXXXXXXXXXXXXXXXXXX
3	QAM Modulator - IF = 36 MHz 5.5 to 7 Mbaud	XXXXXXXXXXXX
	QAM Modulator - IF = 36.15 MHz 5.5 to 7 Mbaud	X X X
	QAM Modulator - IF = 44 MHz 4 to 5.2 Mbaud	XXXXXXXXXXXX
4	IF-RF converter - VHF 1 (managed)	X X X X X X
	IF-RF converter - VHF 1 (managed)	X X X X X X
	IF-RF converter - UHF (managed)	X X X X X X
	Empty (IF-RF converter not managed)	XX X X XX X

(*): When the external IF-RF converter is supervised and managed via the keypad/display supervisory software via the I^2C® bus, it is considered as a Card incorporated within the PQM 2100 Modulator Unit in slot 4.
When the external IF-RF converter is not supervised and managed by the software, slot 4 is empty.

4.3.5 - Maintenance Menu

The Maintenance menu is related to the previous menu. It provides the capability of displaying and/or changing PQM 2100 Modulator Unit maintenance operations, depending on the operator's user class:

1) Reset Cards

2) Nyquist Filtering,

3) CW Mode,

4) Link test (MPEG2 test frame),

5) Link test (Data on TEST IN),

The above functions are described in Sub-section 5.4.

The display screen for this menu is as follows:

```
PQM2100 (C) SAT 1996
Maintenance mode->
```

Press ➢ to gain access to the Reset Cards screen.

1) Reset Cards

This function allows all unit Cards to be reset from the following Reset cards screen:

```
Maintenance mode:
Reset cards->
```

Access to the Reset cards display or change screen below is gained by pressing ➢.

```
RESET CARDS:
OFF (or ON)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

OFF is the selection by default (cards no-reset).

Press ⩓ or ⩔ to change from "OFF" to "ON" (cards reset).

Press ENTER to accept card reset ; upon card reset completion, the parameter returns automatically to "OFF" and the "Reset Cards" menu again is displayed.

Press ⩓ or ⩔ to change the selected Card reset option from "ON" to "OFF", or vice versa, then press **ENTER** to accept.

2) Nyquist Filtering

This function controls selection of full or square root Nyquist filtering from the following Nyquist Filtering screen:

```
Maintenance mode:
Full Nyquist filtering->
```

The Nyquist filtering change screen below is selected by pressing ➢.

```
Full Nyquist filtering:
ON (or OFF)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press the ⋏ or ⋎ keys to select the desired filtering type by changing from Full Nyquist Filtering ("ON") to Square root Nyquist Filtering ("OFF") or vice versa, then press **ENTER** to accept.

3) Pure Carrier (CW) Mode

This function provides the capability of checking for link establishment and measuring transmitter output power. The following CW Mode screen allows the function to be displayed or activated.

```
Maintenance mode:
CW Mode->
```

Access to the CW Mode change screen below is gained by pressing ➢.

```
CW Mode:
ON (or OFF)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⋏ or ⋎ to select PQM 2100 generation of a pure carrier wave by toggling from "OFF" (modulated carrier) to "ON" (pure carrier), or vice versa, then press **ENTER** to accept.

4) Link Test (MPEG2 Test Frame)

This function allows an MPEG2 test frame (FAW and binary zeros) internally generated by the PQM 2100 Unit to be transmitted for detection by the demodulator. This function allows link performance testing after Reed-Solomon encoding. The following Fixed Tx data (MPEG2 test frame) screen allows the function to be displayed or activated.

```
Maintenance mode:
Fixed Tx data->
```

Access to the Fixed Tx data change screen below is gained by pressing ➢.

```
Fixed Tx data:
ON (or OFF)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⮝ or ⮟ to activate PQM 2100 link testing (Fixed Tx data) by toggling from "ON" to "OFF" or vice versa, then pressing **ENTER** to accept, and return to the link test (Fixed Tx data) screen. Upon pressing the ENTER key and provided that the Fixed Tx data link test is activated, the link test (with data on TEST IN) command is deactivated (if initially active).

5) Link Test (Data on TEST IN)

The function provides the capability of transmitting a random test pattern from the Test port, together with its associated clock signal, without scrambling, Reed-Solomon encoding, and interleaving. The test pattern is detected at the receiving end and recovered before de-interleaving. Link error rate performance can thus be monitored. The Link test (data on TEST IN) screen allows the function to be displayed or activated.

```
Maintenance mode:
Data on TEST IN->
```

Access to the Link test (data on TEST IN) change screen below is gained by pressing ➢.

```
Data on TEST IN:
ON (or OFF)
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ⮝ or ⮟ to activate link testing (data on TEST IN) by toggling from "ON" to "OFF" or vice versa. Then press **ENTER** to accept and return to the Link Test (data on TEST IN) screen. Upon pressing the ENTER key, and provided that the link test command (data on TEST IN) has been activated, the Fixed Tx data link test is deactivated (if initially active).

4.3.6 - Password Modification Menu

The Password modification menu allows the password to be modified.

The display screen for this menu is as follows:

```
PQM2100 (C) SAT 1996
Password modification-->
```

Access to the Password modification screen below is gained by pressing ➢.

```
Enter OLD PASSWORD
********
```

Enter the password using the ➢ , ➢, ➢ and ➢ keys, and accept. If no password has been added, press ENTER.

1) Incorrect Password

The following screen is displayed:

```
Access denied
Press any key
```

Pressing any key returns to the Password modification menu. **The operator must have the user class Observer.**

2) Correct password

The following screen is displayed:

```
Enter NEW PASSWORD
********
```

The password consists of 4 to 8 characters corresponding to the ➢, ➢, ➢ and ➢ keys. Pressing each key causes an asterisk (*) to be displayed on screen.
Press ENTER for validation.

Note: Just press ENTER for use without a password.

The password is correct

The following screen is displayed:

```
Confirm NEW PASSWORD
********
```

If the password entered is different from the new password, the following screen is displayed:

```
Wrong PASSWORD
Press any key
```

Pressing any key returns to the Password modification menu.

The password is incorrect

The password is incorrect if the number of characters entered is other than "0" (operation without a password), less than 4 or greater than 8 (warning beep). The following screen is displayed:

```
Enter 4 of 8 characters
Press any key
```

Pressing any key returns to the Password modification menu.

IMPORTANT: If an operator has forgotten his passwords, call the manufacturer or an authorized representative.

4.3.7 - Utilities Menu

The Utilities menu provides the capability of displaying and/or changing IP address and Community Strings of the System Manager as well as resetting the PQM 2100 without having to switch the power on and off, depending on the operator's user class.

The **Utilities** menu consists of five menus which are accessible from a pull-down menu (see figure 4.1).

The menus are arranged circularly in the following order:

- IP Manager Address,
- IP Back-up Address,
- Manager Community Name,
- Back-up Community Name,
- Warm Reset.

The display screen for this menu is as follows:

```
PQM2100 (C) SAT 1996
Utilities->
```

Press ➢ to gain access to the IP Manager Address screen.

1) IP Manager Address

This function allows the user to set the IP address of the system manager:

```
Utilities:
IP Manager Address->
```

Access to the IP Manager Address display or change screen below is gained by pressing ➢.

```
IP Manager Address:
xyz.xyz.xyz.xyz
```

This address can only be changed by operators having the user class **User** (indicated by the presence of a cursor). The IP Manager Address consists of a serie of four 3-digit groups (x, y and z) separed by a point. These digits can have the following values:

- "x" 0, 1 or 2,
- "y" 0 to 9,
- "z" 0 to 9.

Note: The user can only enter digit values between 0 and 255 for each group.

Press ➢ or ➢ to increase or decrease digit value, ➢ or ➢ to move to the previous or next digit, then press **ENTER** to accept.

2) IP Back-Up Address

The function allows the user to set the IP address of the back-up system manager:

```
Utilities:
IP Back-Up Address->
```

Access to the IP Back-Up Address display or change screen below is gained by pressing ➢.

```
IP Back-Up Address:
xyz.xyz.xyz.xyz
```

This address can only be changed by operators having the user class **User** (indicated by the presence of a cursor). The IP Back-up Address consists of a serie of four 3-digit groups (x, y and z) separed by a point. These digits can have the following values:

- "x" 0, 1 or 2,
- "y" 0 to 9,
- "z" 0 to 9.

Note: The user can only enter digit values between 0 and 255 for each group.

Press ➢ or ➢ to increase or decrease digit value, ➢ or ➢ to move to the previous or next digit, then press **ENTER** to accept.

3) Manager Community Name

The function allows the user to access parameters equipment by the system manager via the SNMP protocole:

```
Utilities:
Manager Community Name->
```

The Community Name screen below is selected by pressing ➢.

```
Manager Community Name:
abcdef--------
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press the ➢ or ➢ keys to scroll up or down the parameter characters in alphanumerical order and to select the character "_". Press the ➢ or ➢ keys to move to the previous or next character, then press **ENTER** to accept. The last character different from '-' is considered as the end of the system manager community name.

4) Back-up Community Name

The function allows the user to access parameters equipment by the back-up system manager via the SNMP protocol:

```
Utilities:
Back-Up Community Name->
```

The Community Name screen below is selected by pressing ➢.

```
Back-Up Community Name:
abcdef--------
```

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press the ➢ or ➢ keys to scroll up or down the parameter characters in alphanumerical order and to select the character "_". Press the ➢ or ➢ keys to move to the previous or next character, then press **ENTER** to accept. The last character different from '-' is considered as the end of the back-up system manager community name.

5) Warm Reset

This function provides the capability of resetting the PQM 2100 without cutting the link. The following Warm Reset screen allows the function to be displayed or activated.

```
Utilities:
Warm Reset->
```

Access to the Warm Reset screen below is gained by pressing ➢.

```
Warm Reset:
OFF (or ON)
```

OFF is the selection by default.

This parameter can only be changed by operators having the user class **User** (indicated by the presence of a cursor).

Press ➢ or ➢ to select "OFF" or "ON".

OFF Press **ENTER** to accept and to cause return to the previously selected screen:

```
Utilities:
Warm Reset->
```

ON Press **ENTER** to reset the equipment and to display the following screen:

```
Reset in progress...
```

This screen indicates that the equipment is running its warm reset (self-tests). The reset of the equipment takes about 2 minutes.

When the equipment warm reset is completed, the following screen is displayed:

```
PQM2100 (C) SAT 1996
Press any key for access
```

Then, follow instructions given in § 4.2.

SECTION 5

MAINTENANCE

5.1 - Preventive Maintenance

No preventive maintenance is applicable to the PQM 2100 Modulator Unit.

5.2 - Corrective Maintenance

Policy

Corrective maintenance is restricted to PQM 2100 Unit replacement.

Maintenance Facilities

The PQM 2100 Unit continuously produces information to which the operator can gain access via:

- alarm and status LEDs,
- relay contact alarms,
- keypad/display supervisory software,
- PC-based supervisory software.

IMPORTANT: When the equipment is used in an Ethernet network, the O & M Card network address and the equipment network address (IP address) may be displayed via the equipment constitution menu (see Sub-section 4.3.4).

5.3 - Front Panel LEDs

The four front panel LEDs provide the following indications:

Red Maj Alm LED

- when lit: major alarm initiation upon detection of one of the following events:
  - Converter alarm,
  - 34 Mbit/s clock alarm,
  - 45 Mbit/s clock alarm,
  - Loss of Frame Alignment on line,
  - Rx Int Card bit rate PLL alarm,
  - MPEG2 Frame Alignment Loss,
  - MPEG2 Frame uncorrected by Reed/Solomon encoder,
  - Encoder input signal clock fail,
  - MPEG2 Frame non compliance,
  - Encoder bit rate PLL Alarm,
  - Encoder symbol rate PLL Alarm,
  - Converter port fail,
  - Converter alarm,
  - Converter PLL alarm,
  - RF output signal fail,
  - RF output level variation > ± 5 dB,
- when unlit: major alarm inactive.

Red Min Alm LED

- when lit: minor alarm initiation upon detection of one of the following events:
  - G.703 input signal fail,
  - Converter interface clock signal failure,
  - RF output level variation > ± 2 dB,
- when unlit: minor alarm inactive.

Note: These alarms are given by default but can be configured by PC in case the supervision is the RS232 local supevision.

Yellow TEST LED

- when lit: test in progress (see Sub-section 5.4),
- when unlit: normal operation.

Green ON LED

- when lit: mains and tertiary voltage on,
- when unlit: mains or tertiary voltage off.

5.4- Test Functions

Test functions provide the following capabilities:

- modulator reset,
- modulator performance testing,
- link establishment test,
- transmitter output power measurement,
- link testing,
- bit error rate measurement.

The above functions may be configured via the software through one of the following interfaces:

- keypad/display interface,
- RS-232 interface,
- or ETHERNET interface.

Reset Cards Function

The function provides the capability of resetting all PQM 2100 QAM Modulator.

Nyquist Filtering Function

The I, Q and Clk signals may be applied to a constellation analyzer for testing. Filtering is performed by the sole modulator, with the remaining circuits being considered to be disconnected.

NOTE: A link needs essentially one equivalent Nyquist filtering for optimized transmission performance. Filtering includes a receiving section (demodulator with square-root Nyquist filter) and a transmitting section (modulator with square-root Nyquist filter).

Pure Carrier Function

The function provides the capability of checking pure carrier characteristics (including transmitter output power, noise, spurious signals).

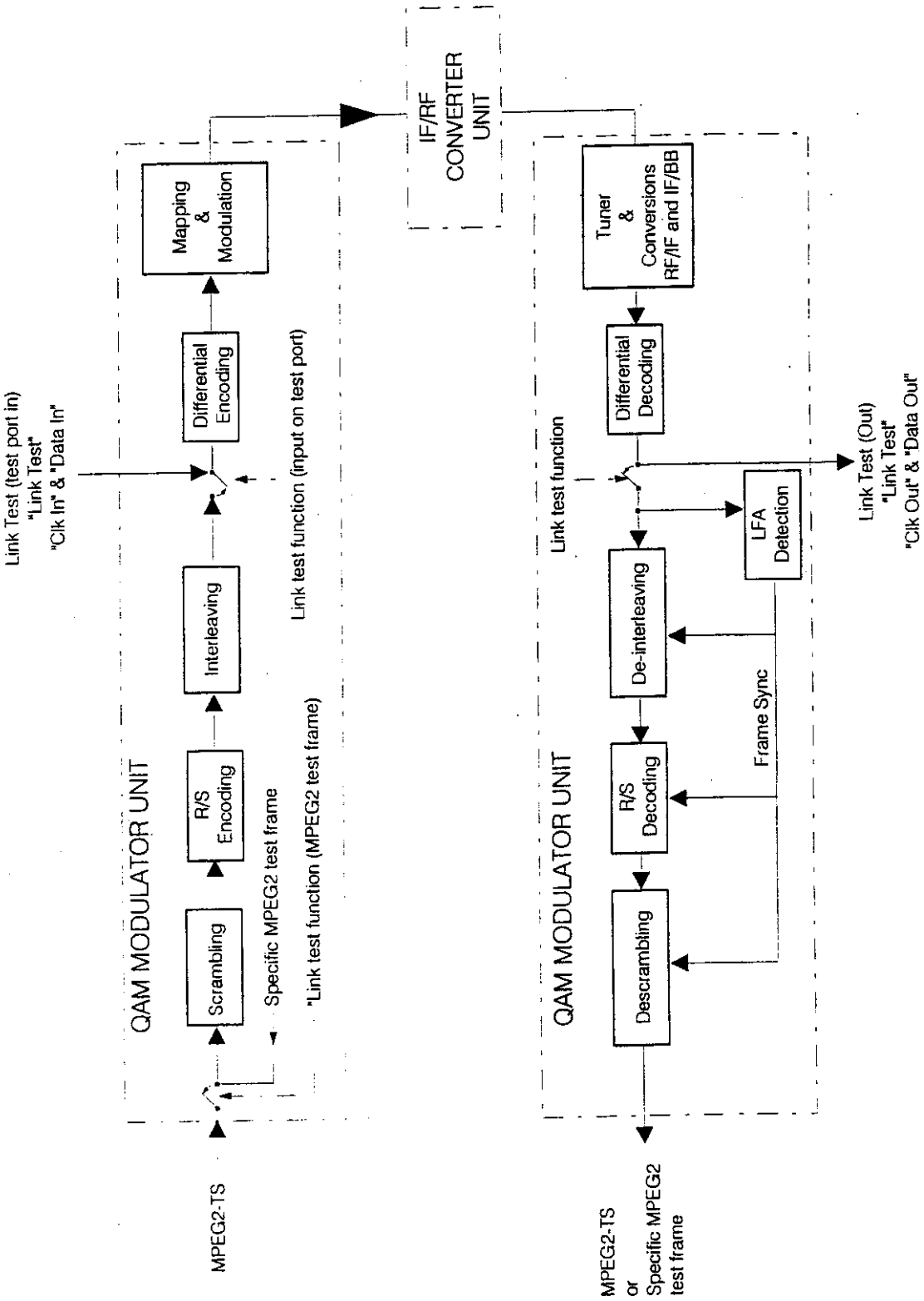


Figure 5.1 - Link Test Function Schematics

Link Test (Fixed Transmitter Data) Function

This function allows transmission of a special MPEG2 test frame (Frame Alignment Word (FAW) and binary zeros) for detection at the receiving end (demodulator). It allows testing of the link performance including:

- scrambler,
- Reed-Solomon encoder,
- interleaver,
- symbol mapping,
- modulator.

Nota : Special test frame synchronization can be performed as follows:
- using a clock sent on serial or parallel input,
- or using a 38 MHz internal clock. The bit rate must be set at 38 Mbit/s. For the Demodulator configuration, the symbol rate value is well-defined by reading the output frequency of "Clock Test" Unit front panel connector.

Use of test results by the receiving-end synchronization, de-interleaver, Reed-Solomon decoder, and descrambler functions depends on the demodulator type used.

Note: The above facilities are provided by the SAT DIVIMOD product range.

Link Test (Input on Test Port) Function

The function allows transmission of a random test pattern and the associated clock signal to the Data In and Clk In rear panel test ports, without processing by the Reed-Solomon encoder nor interleaving.

The test pattern is detected at the receiving end before de-interleaving.

Use of test results depends on the demodulator type used.

Note: The above facilities are provided by the SAT DIVIMOD product range.

Link bit error rate performance can be measured using this function.

APPENDIX

IF-RF CONVERTERS

CONTENTS

1 - General Information

The IF-RF Converter Units provide conversion of (36 MHz) IF signals. They consist of 19-inch rack-mounting 1-unit high units.

The three Units correspond to the VHF or UHF output frequency bands:

- 950030 VHF1 (108 - 240 MHz),
- 950031 VHF2 (240 - 470 MHz),
- 950040 UHF (470 - 862 MHz).

The Units have the following specifications:

- suited to 19-inch rack-mounting,
- output frequency agility,
- high RF output level,

They support:

- an IF input,
- a reference clock input,
- a reference clock output,
- an I^2C® I/O interface bus,
- an RF Output,
- une prise de test à -20 dB typique,
- un réglage fin du niveau de sortie par potentiomètre.

They are equipped with a microcontroller and the following parameters can be programmed via the associated PQM 2100 Modulator Unit:

- output frequency,
- RF output level,
- output signal disable (également possible par le bus d'interface E/R),
- (internal or external) reference clock.

Clock inputs and outputs are used for synchronizing all IF-RF converters in a system. This allows the effects of intermodulation on the networks (HRC and IRC systems) to be minimized.

The IF-RF converters comply with current European directives: ECM 89/336/CEE and 73/23/CEE Low Voltage.

They are equipped with a level detection module.

A major alarm is initiated and the IF-RF converter unit is disabled upon detection of:

- variations in output signal level by more than ± 5 dB,
- loss of oscillator synchronization,
- mains (230-240 VAC or 120 VAC) power supply or tertiary voltage (24 or 5V) failure.

A minor alarm is initiated upon detection of:

- variations in output signal level by more than ± 2 dB,
- in the external clock mode, external clock failure (the IF-RF converter switches to the internal clock mode).

2 - Specifications

2.1 - Electrical Specifications

Description	Specification (1) Min	Typical	Max	Unit	Note
IF Input					
IF input frequency		36		MHz	8 MHz bandwidth
Nominal input level	-11	-10	-9	dBm	
Input impedance		75		Ω	
Return loss	20			dB	For Fe = 36 ± 5 MHz
RF Output					
Output frequency VHF1 model VHF2 model UHF model	108 240 470		240 470 862	MHz MHz MHz	
Nominal output level (for Ne = -10 dBμV)	+3		+6	dBm	
Programmed output level adjustment	-20		0	dB	in 1 dB steps (3)
Output level stability [5 to 45°C]			± 0.5	dB	
Output frequency programming steps		62.5		kHz	
Output frequency accuracy			± 5	ppm	synchronization to external source
Output frequency stability			± 5	ppm	synchronization to external source
Channel spectrum occupancy			8	MHz	depending on Baud rate
Output impedance		75		Ω	
Return loss in the output filter band 108/240 MHz model 240/470 MHz model 470/862 MHz model	 16 16 16			 dB dB dB	 (2) (2) (2)
Channel ripple			1	dB	peak to peak
Spurious radiation [108 to 862 MHz]	60			dB	
IM3 channel at 0 dBm method using 2 equal output carriers	60			dB	(4)
Reverse intermodulation	60	70		dBc	Lout = +3 dBm and Pout = -17 dBm (5)
Squelch protection	50			dB	
Channel group delay		10	15	ns	associated with filter F12 p to p
Phase Noise	110	112		dBc	at 100 kHz from the carrier
Dual band phase noise	-45	-50		dBc	from 25 kHz to 4 MHz

.../...

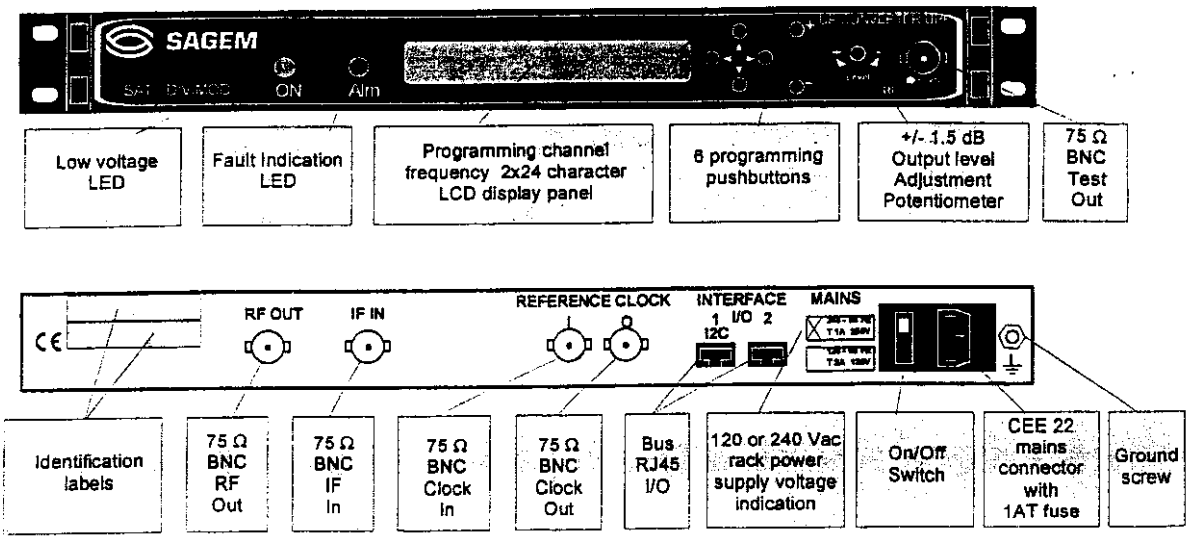
Description	Specifications (1) Min	Typical	Max	Unit	Note
.../...					
Noise power at ± 12 MHz from the carrier at ± 16 MHz from the carrier at ± 48 MHz from the carrier	 -140 -144 -148			 dBm/Hz dBm/Hz dBm/Hz	at Lout = +3 dBm
Test output	-23	-20	-17	dB	
Power supply					
Power supply voltage		230-240		V AC	can be switched to 120 V AC
Frequency		50		Hz	
Power consumption at 230-240 VAC		24		W	
To EMC standards					
Mains interference NF EN 50081 - 1 NF EN 55022	Class B				
Electrostatic discharge NF EN 50082 - 1	Severity 2: criterion A Severity 4: criterion C				contact discharge
Electrical safety NF EN 50083 - 1					1 fuse on phase
Susceptibility IEC 801 - 3	Level 2				
Mains transients IEC 801 - 4	Level 2				
Temperature					
Storage temperature range	-20		+70	°C	
Operating temperature range without irreversible damage	-5		+50	°C	
Operating temperature range (guaranteed specifications)	+5		+45	°C	
Storage relative humidity			95	%	RH at +25°C
Operating relative humidity			85	%	RH at +25°C

Note	
1	The "min" and "max" specifications are guaranteed at 25°C
2	Outside channel ZS ≥ 10 dB
3	Step accuracy ≤ 0.5 dB
4	Output attenuator = 0 dB
5	A power Pe signal is applied at the output

2.2 - Mechanical Specifications

Mechanical construction	: 19-inch 1-unit high rack-mounting unit
Overall dimensions	: 483 x 470 x 44 mm
Weight	: 7 kg
Sealing	: IP 20 B to NF EN 60529
Connectors: 230-240 VAC supply	: CEE 22 female connector
Output RF Test Output	: 75 Ω BNC
IF input - clock in and out	: 75 Ω BNC
I/O Interface	: RJ 45 female connector

3 - Overview



4 - Start-up

4.1 - Connections

Check on the unit rear cover that the IF-RF converter is compatible with the station power supply (120 VAC or 230-240 VAC).

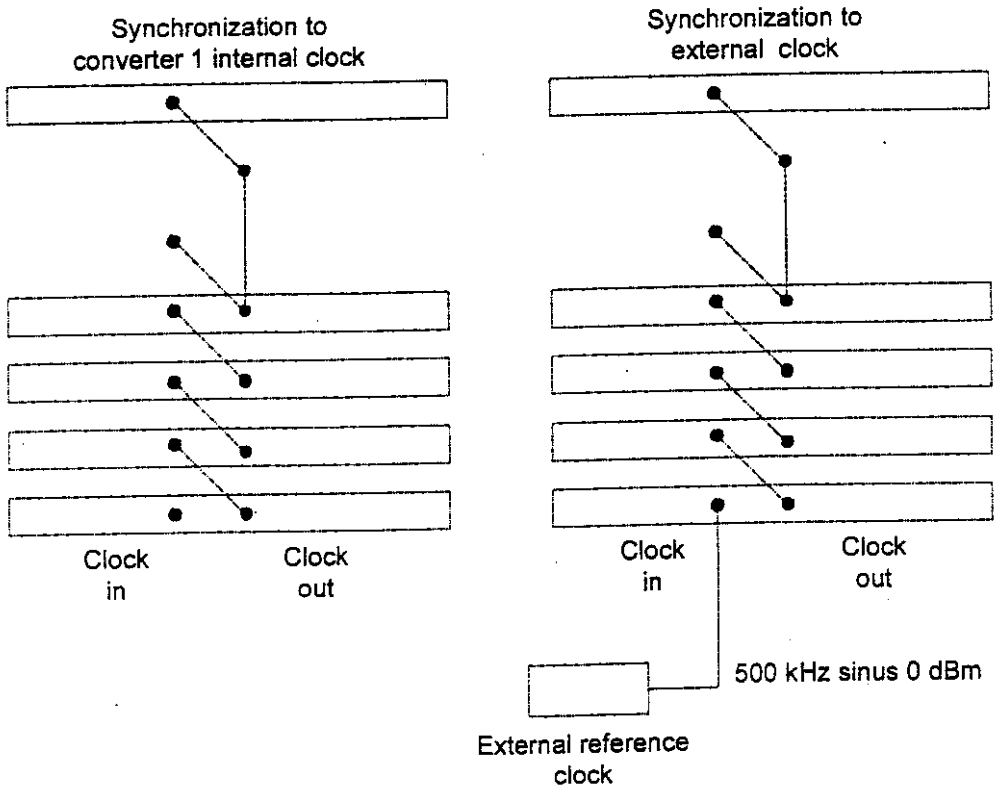
- Mount the Unit into the rack.
- It is recommended to leave one unit of rack height between the IF-RF converters to allow heat dissipation and easier wiring.
- Secure the Unit to the rack vertical members with four screws.
- Terminate the test output with 75 Ω,
- Connect the IF input to the PQM 2100 Unit.
- Connect the RF output to the multiplexer.
- Connect the RJ45 interface connector 1 to the PQM 2100 Unit.
- Connect the unit to the 230-240 VAC or 120 VAC power supply as indicated on the Unit rear cover.
- Switch the IF-RF Converter Unit on.

Note: The IF-RF Converter must be switched on before the QAM Modulator, so that the latter can identify it.

4.2 - Clock

The IF-RF Converter Unit is equipped with a clock input and a clock output allowing synchronization of all IF-RF converters in a rack. This allows the effects of intermodulation in the networks (HCR and IRC systems) to be minimized. All IF-RF converters may be synchronized to an external 500 kHz sinusoidal 0 dBm clock or to the clock output of only one of them.

This is achieved simply by connecting the clock output of the first IF-RF converter to the clock input of the next one with a 75 Ω BNC/BNC cable assembly.



Warning: In order to operate in external synchronization mode, the IF-RF converters must be programmed to operate in the external clock mode, rather than in the internal clock mode, which is the default mode.
In the external clock mode, failure of the clock causes the system to switch to the internal clock mode and a minor alarm to be initiated.

4.3 - Programming

The IF-RF converter parameter values may be changed via the PQM 2100 Modulator Unit, through the rear cover I²C® bus.

NOTE: The IF-RF Converter Unit front cover keypad is inoperative.

5 - Maintenance

The IF-RF Converter Unit front cover supports the following two LEDs:

- green LED marked ON which, when lit, indicates that mains power supply voltage (230 VAC - 240 VAC or 120 VAC) and tertiary voltages (+24 V and +5 V) are on,
- red LED marked Alm which when lit indicates that a major alarm has been initiated.

Note: When the major alarm (Alm) LED is lit, the "equipment failure" message is displayed on the front cover screen.

The IF-RF Converter Unit major and minor alarms may be displayed via the PQM 2100 QAM modulator operating system.

In the event of an IF input signal failure or an equipment failure, the IF-RF Converter Unit detects an output level drop by -5 dB and the Alm LED is lit. The Unit resets automatically. If the fault persists, the unit displays the message "equipment failure" and switches to the idle mode. In this event, switch the IF-RF Converter Unit off and check for the presence of the IF signal. When power is switched back on, all information items relative to the IF-RF Converter Unit that are stored in the QAM Modulator memory are transferred to the IF-RF Converter Unit.

If, after checking for IF signal presence, the IF-RF Converter Unit continues to detect an incorrect output level, replace the defective Unit.

6 - Connector Pin Assignmetns (External Rear Views)

I/O INTERFACES
No. 1 (RJ45)

1 : NC		
2 : Ground		
3 : NC		
4 : NC		
5 : NC		
6 : ENA	I^2C® BUS	
7 : SDA	I^2C® BUS	
8 : SCL	I^2C® BUS	

I/O INTERFACES
No. 2 (RJ45)

1 : +5 Vcc		
2 : Masse		
3 : NC		
4 : MS_EN_SI	Enabling/Disabling	TTL
5 : RST	Reset	TTL
6 : RXD	Serial input	TTL
7 : TXD	Serial output	TTL
8 : WDO	Watchdog output	TTL