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PT 5780

DVB-T Modulator (ASIC)

Instruction Manual



Trade Mark of the DVB Digital Video Broadcasting Project



PROTELEVISION technologies
An ISO 9001 Certified Company

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1 Safety

Read this chapter carefully before installation and use of the instrument.

1.1 Introduction

The instrument described in this manual has been designed for use by properly trained personnel only.

Adjustment, maintenance and repair of the exposed equipment should only be carried out by qualified personnel who are aware of hazards involved.

1.2 Safety Precautions

For the correct and safe use of the instrument, it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual. Specific warning and caution statements, where applicable, are found throughout this manual. Note that warning and caution statements and/or symbols are marked on the instrument as well.

This manual provides technical information important for safe operation of the equipment. Please refer to the relevant sections of the manual for technical specifications, installation and operating instructions.

Special attention must be paid to the following issues:

- ◆ Protective earthing of the instrument is required for the accessible terminals to be safe.
(IEC 1010-1 Safety class I instrument)
- ◆ The actual environmental conditions must be checked against the specification
- ◆ Mains voltage must be inside the specified range

The opening of covers or removal of parts, except those to which access can be gained by hand, is liable to expose live parts and terminals.

If adjustment, maintenance, or repair of the opened instrument is unavoidable, it must only be carried out by a skilled person who is aware of the hazards involved.

1.3 Caution and Warning Statements

Caution

Used to indicate correct operation or maintenance in order to prevent damage to, or destruction of equipment or other property.

Warning

Used to indicate a potential hazard that requires correct procedures or practices in order to prevent personal injury.

1.4 Impaired Safety Protection

1.4.1 Technical Specifications

This manual provides technical information important for safe operation of the equipment.

Please refer to the Chapter **Product Data** for information regarding technical specifications and the Chapter **Installation and Operating Instructions** regarding instructions for use.

Technical assistance may be obtained from your local **ProTelevision Technologies** customer support organization or from:

ProTelevision Technologies

Marielundvej 16

DK-2730 Skovlunde

Denmark

Phone : +45 4470 0000

Fax : +45 4470 0001

E-Mail : helpdesk@protelevision.com

Website : <http://www.protelevision.com>

1.4.2 Equipment Ratings

The instrument can be used with a mains voltage supply of:

Voltage range:

90 – 132VAC / 180 - 250 V AC

Frequency:

47 - 63 Hz

The power consumption:

Does not exceed 50 VA

The instrument is designed for the following environmental conditions:

- ♦ Indoor use
- ♦ Altitudes up to 2000 m
- ♦ Temperatures between 5°C and 40°C

Maximum relative humidity of 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.

The instrument is equipped with a number of input and output terminals as described in the Chapter **Product Data**.

The terminals are protected from becoming hazardous live by means of basic insulation and protective screening.

Whenever it is likely that safe operation is impaired, the instrument must be made inoperative and secured against unintended operation. The appropriate servicing authority must be informed.

For example, safety is likely to be impaired if the instrument fails to perform the intended measurements or shows visible damage.

WARNING: Protection provided by the equipment may be impaired, if the equipment is used in a manner not specified by this manual.



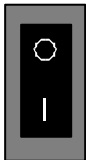
ATTENTION

1.5 Electrostatic Sensitive Devices

All ICs and many other semi-conductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce lifetime drastically.

When repairing, make sure that you are connected to the same potential as the mass of the set via a wrist wrap with resistance. Keep components and tools also at this potential.

1.6 Symbols

Symbol	Colour:	Explanation:
	Red	High voltage terminal: a terminal at which a voltage, with respect to another terminal or parts exists or may be adjusted to 1000 V or more. (High voltage > 1000 V).
	Black/Yellow	Live part shock risk of electric shock.
	Black/Yellow	To preserve the instrument from damage the operator must refer to an explanation in the instruction manual.
	White/Black	Protective earth (grounding) terminal.
	Black	Alternating current (placed on the identification plate).
	White/Black	Off (supply - mains switch). On (supply - mains switch).

2 Introduction and Applications

Designed to meet the most demanding requirements of today's Digital Terrestrial Television Broadcast Market, the DVB-T Modulator PT 5780 from ProTelevision Technologies is ranked number one in its class. A key factor in the products success is the quality of the coding and modulation process. The unit is furthermore highly flexible and therefore easily tailored to provide the exact features required in a specific application. This means that you will only have to pay for the functional features that you need. Retrofitting of features is easy. Normally, the retrofitting only involves uploading new firmware and software by means of a standard PC.

2.1 Applications

The performance and flexibility of the PT 5780 allows it to excel in any application related to DVB-T modulation. Being a DVB-T modulator the core function of the PT 5780 is to modulate an MPEG-2 transport stream (input) onto a DVB-T compliant COFDM spectrum (output) in accordance with the rules for channels coding and modulation specified in the DVB-T standard ETSI EN 300 744.

Basic version

The basic version of the PT 5780 delivers the COFDM spectrum on a user-defined frequency between 35 and 37 MHz. The default polarity of the spectrum is 'Inverted' as normal for a DVB-T IF signal. However, the user can freely switch the polarity to 'non-inverted' if required. The spectrum bandwidth may be user configured to 8 or 7MHz as required. This flexibility will allow the user to interface the IF signal to a wide range of transmitters and frequency converters.

The basic unit has two MPEG-2 inputs (ASI format). Switching between the two inputs can be done manually and automatically. The latter option provides near seamless switching to a secondary transport stream in case the primary transport stream source fails (a truly valuable feature for broadcast applications.)

The user can configure the basic version to any transmission mode listed in ETSI EN 300 744 (excluding hierarchical mode and SFN mode.)

Optional features

A broad range of optional features allows tailoring the modulator for the specific application.

If the output COFDM spectrum is required on a frequency not covered by the basic version (35-37MHz) the **RF Converter option PT 8715** is the answer. This high performance converter covers the entire frequency range from 30MHz to 1GHz in steps of just 1Hz. The user can freely set the polarity of the spectrum to inverted or Non-inverted as required. With this converter the PT 5780 will cover any spectrum application and frequency requirement that you will come across in the field of DVB-T.

To upgrade the PT 5780 for SFN transmission you will only need to add the **SFN option PT 8732**. This option provides the PT 5780 with market leading SFN performance with respect to basic timing accuracy and extent of the local delay offset range. Also, even when the SFN option is installed you can still select MFN mode via the front panel controls. A convenient feature when conducting pre-testing and alignment of RF parameters on transmitter installations before the timing references and transport stream with MIP are in place (as a general rule SFN modulators must mute the output if either of these signals is absent).

To extend the standard range of transmission modes to include support of hierarchical modulation the **Hierarchical Modulation option PT 8733** must be added. Hierarchical modulation allows simultaneous transmission of two MPEG-2 transport streams. The compromise between data rate and ruggedness can be set differently between the two virtual channels. For example:

- a highly protected channel for transmission to mobile and/or portable receivers and
- a high capacity channel, at the expense of ruggedness, for transmission to rooftop antennas.

Another typical application is simulcasting of the same program in high definition resolution and standard definition resolution. A significant benefit of hierarchical modulation is that the total data-rate available in a system with two hierarchically modulated RF channels is higher than what is available for a two-channel non-hierarchical system where one RF channel is strictly dedicated to mobile/portable receivers and the other RF channel is strictly dedicated for transmission to rooftop antennas.

The hierarchical option itself is often supplemented by adding also an extra set of ASI inputs (**dual input option PT 8716**) thereby upping the total to four ASI inputs. Access to four ASI inputs will preserve the possibility also in hierarchical mode to switch almost seamlessly to a secondary transport stream source in case the primary transport stream source fails (HP primary input, HP secondary input, LP primary input, LP secondary input).

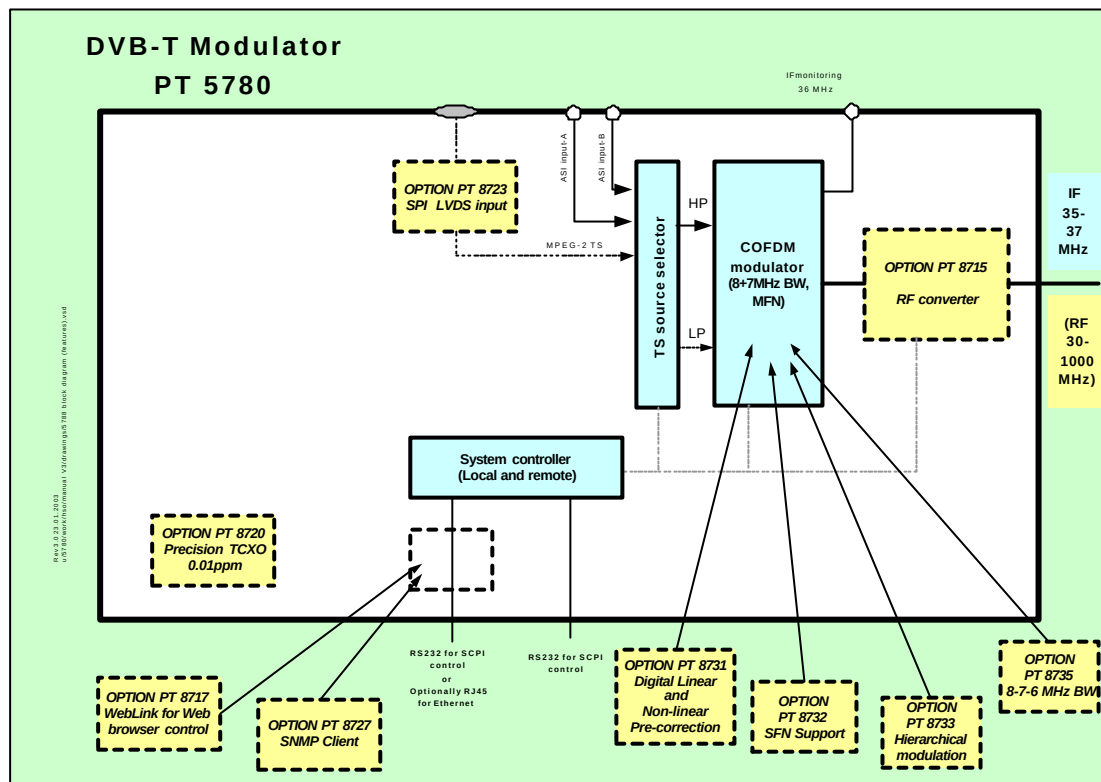
By adding the **6MHz BW option PT 8735** the PT 5780 will, in addition to the standard 8 and 7 MHz BW, also support transmission in the 6MHz bandwidth mode that is intended for applications in North and South America, Korea, Japan and elsewhere where 6MHz channel raster is standard. Including this option for T&M and R&D applications is also highly attractive as the user simply executes the switching between the three bandwidths via the instrument front panel (one instrument covers all bandwidths defined by the ETS for DVB-T transmission).

To maximise the performance of the transmitter in which the modulator is installed the **Digital Linear and Non-linear Pre-corrector PT 8731 option** is recommended. The *Non-linear pre-corrector* balances out gain and phase non-linearity in the transmitter RF power amplifier thereby reducing significantly the in-band as well as out of band intermodulation generated by the amplifier. This optimisation of the performance will extend the transmitters coverage area and ease the performance requirement from the transmitter output filter used for suppressing the radiation in adjacent channels below the maximum allowed level. The *linear pre-corrector* balances out level and group delay variations over the channel bandwidth caused by the transmitter antenna filter and/or channel combiner filters. The linear optimisation of the signal radiated from the transmitter means that the channel equalizer of the DVB-T receiver may focus all its correction capacity on level and group delay errors originating from the actual transmission path. The characteristics of the linear and non-linear pre-correction curves are set by means of an easy to use and highly intuitive graphical user interface, the IMD Buster software package (Windows compatible).

Two options for remote control of the PT 5780 exist. The **WebLink option PT 8717** allows remote control of the PT 5780 via Ethernet (TCP/IP). The system is based on a Web server mounted inside the PT 5780. The Web pages stored on the Web server are designed as a complete graphical user interface (GUI) for testing the status and setting the parameters of the modulator. The *WebLink* concept is popular because remote control with this system only requires a standard PC with a network interface card (NIC) and a Web browser (Microsoft Explorer 5.0). The **SNMP client option PT 8727** allows remote control of the PT 5780 in

accordance with the SNMP protocol (Get, Set and SNMP traps). This remote control option is intended for systems solutions where it is desired to integrate the control of a range of (SNMP compliant) equipment in a common management system, the SNMP manager. The management system must be adapted/designed to the specific systems requirements and it is therefore not included with the supplied SNMP client option.

2.1.1 Block Diagram (PT 5780 features)



2.2 Transmission Modes Supported

- ◆ MFN mode and SFN mode (SFN requires option PT 8732)
- ◆ 6, 7, 8 MHz (6MHz requires option PT 8735)
- ◆ FFT size: 2k or 8k
- ◆ Guard Interval: 1/4, 1/8, 1/16, and 1/32
- ◆ Code Rates: 1/2, 2/3, 3/4, 5/6, and 7/8
- ◆ Modulation Constellations: QPSK (4 QAM), 16 QAM, and 64 QAM
- ◆ Hierarchical α 1, 2, 4 (hierarchical mode requires option PT 8733)

2.3 Transport Stream Inputs

The standard version of the PT 5780 DVB-T modulator is provided with two serial (ASI) inputs. By non-hierarchical mode the active input is selected either via the front panel or the remote control. By hierarchical mode one input is assigned to the high priority stream and the other input is assigned to the low priority stream. The inputs accept an MPEG transport stream according to the DVB recommendation. Both 188 and 204 byte transport packets are supported (in the 204 byte mode the last 16 bytes are always overwritten by the Reed-Solomon redundancy data generated by the modulator). The available data rate for transmission is stated in the tables below in accordance with the selected constellation, code rate and guard interval. Please notice that separate tables applies to 8MHz , 7MHz, and 6MHz bandwidth respectively.

By hierarchical mode 64 QAM constellation and 16QAM constellation can be selected. The available data rate is divided between the *high priority* channel and the *low priority* channel. The bit rate for the *high priority* channel is equal to the capacity stated in the QPSK section of the applicable table irrespective of the constellation chosen. For the *low priority* channel the capacity depends on the chosen constellation (64Qam or 16QAM). By 64QAM constellation the capacity of the hierarchical *low priority* channel is equal to the capacity stated in the 16QAM section of the applicable table. By 16QAM constellation the capacity of the hierarchical *low priority* channel is equal to the capacity stated in the QPSK section of the applicable table.

In Table 2-1 the maximum useful bit rates are indicated for all valid transmission modes in an 8 MHz system.

Modulation	Code rate	Guard interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4,98	5,53	5,85	6,03
	2/3	6,64	7,37	7,81	8,04
	3/4	7,46	8,29	8,78	9,05
	5/6	8,29	9,22	9,76	10,05
	7/8	8,71	9,68	10,25	10,56
16-QAM	1/2	9,95	11,06	11,71	12,06
	2/3	13,27	14,75	15,61	16,09
	3/4	14,93	16,59	17,56	18,10
	5/6	16,59	18,43	19,52	20,11
	7/8	17,42	19,35	20,49	21,11
64-QAM	1/2	14,93	16,59	17,56	18,10
	2/3	19,91	22,12	23,42	24,13
	3/4	22,39	24,88	26,35	27,14
	5/6	24,88	27,65	29,27	30,16
	7/8	26,13	29,03	30,74	31,67

Table 2-1 Available data rate for 8MHz DVB-T

In Table 2-2 the maximum useful bit rates are indicated for all valid transmission modes in a 7 MHz system.

Modulation	Code rate	Guard interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	4,354	4,838	5,123	5,278
	2/3	5,806	6,451	6,830	7,037
	3/4	6,532	7,257	7,684	7,917
	5/6	7,257	8,064	8,538	8,797
	7/8	7,620	8,467	8,965	9,237
16-QAM	1/2	8,709	9,676	10,246	10,556
	2/3	11,612	12,902	13,661	14,075
	3/4	13,063	14,515	15,369	15,834
	5/6	14,515	16,127	17,076	17,594
	7/8	15,240	16,934	17,930	18,473
64-QAM	1/2	13,063	14,515	15,369	15,834
	2/3	17,418	19,353	20,491	21,112
	3/4	19,595	21,772	23,053	23,751
	5/6	21,772	24,191	25,614	26,390
	7/8	22,861	25,401	26,895	27,710

Table 2-2 Available data rate for 7MHz DVB-T

In Table 2-3 the maximum useful bit rates are indicated for all valid transmission modes in a 6 MHz system.

Modulation	Code rate	Guard interval			
		1/4	1/8	1/16	1/32
QPSK	1/2	3,732	4,147	4,391	4,524
	2/3	4,976	5,529	5,855	6,032
	3/4	5,599	6,221	6,587	6,786
	5/6	6,221	6,912	7,318	7,540
	7/8	6,532	7,257	7,684	7,917
16-QAM	1/2	7,465	8,294	8,782	9,048
	2/3	9,953	11,059	11,709	12,064
	3/4	11,197	12,441	13,173	13,572
	5/6	12,441	13,824	14,637	15,080
	7/8	13,063	14,515	15,369	15,834
64-QAM	1/2	11,197	12,441	13,173	13,572
	2/3	14,929	16,588	17,564	18,096
	3/4	16,796	18,662	19,760	20,358
	5/6	18,662	20,735	21,955	22,620
	7/8	19,595	21,772	23,053	23,751

Table 2-3 Available data rate for 6MHz DVB-T

With 204 byte packet input the maximum bit rates are increased accordingly.

With Multi Frequency Network operation (MFN) the built-in Transport Stream Adapter (TSA) performs the function of discarding any stuffing present on the input stream, inserting new stuffing (0-packets) to adjust the bit rate and finally recalculating the PCR values of the MPEG2 transport stream. Thus the modulator will accept any transport stream with a useful bit rate lower than the maximum indicated in the table.

When operating in the single frequency network mode, the bit rate must be exact. The applied transport stream must furthermore include valid MIP information.

2.4 Alarm Circuits

Two independent alarm circuits are provided. Each circuit may be “armed” for a number of conditions important for correct operation. Alarm output is via floating contacts on the rear panel as well as via the remote control. A red LED on the front panel indicates an existing alarm condition while the display will show the nature of the alarm.

2.5 Operation

The DVB-T Modulator may be configured and operated from either the front panel or via the remote control port. The front panel control is implemented as a menu system. The status or configuration menu of interest is displayed on a 2-line LCD display. Navigation between the menus is done by means of a set of cursor keys (UP, DOWN, LEFT, RIGHT and an EXECUTE key). To facilitate the remote control of several transmitters each modulator may be individually named (16 characters). This “name” appears on the front panel display and is available on the remote port.

Also the modulator may be controlled by data embedded in the incoming MPEG transport stream itself. If this mode is enabled, it will have highest priority and other controls will be inhibited. Note this will be the normal mode of operation in a *Single Frequency Network* (SFN). When not assisting in configuration or mode selection, the front panel display will show the status and operational modes of the modulator. In case of an alarm the nature of the cause of the alarm will be shown.

All settings are always saved in an internal non-volatile storage. This means that the last saved configuration will automatically be recalled at power on.

2.6 Frequency References

The modulator is equipped with an internal frequency reference with stability of $\pm 1\text{ppm}$, adequate for many applications including multi frequency applications. Where higher accuracies are required, an external 10 MHz frequency reference input is provided.

In Single Frequency Networks (SFN) this input must be connected to an external 10 MHz reference typically obtained via GPS. In SFN mode the separate 1 pulse per second reference input must also be connected to the special 1 PPS output of the GPS reference.

2.7 Test Facilities

The DVB-T Modulator PT 5780 features a range of useful test signal for both off-line and on-line testing.

Single carrier:

The single carrier test signal is an off-line test signal (i.e. it interrupts the modulators data transmission). When the single carrier test signal is activated the normal DVB-T spectrum is substitutes for a single continuous sine wave located at the centre frequency of the normal in-service DVB-T spectrum. The RMS level of the sine equals the average RMS level in the full bandwidth of the normal DVB-T spectrum. The signal is therefore excellent for adjusting transmitter level and/or verifying frequency accuracy or phase noise performance for the modulator output.

-1 Carrier test signal

For special tests any single one of the carriers in the DVB-T spectrum can be switched off. This test signal is in principle an off-line test signal. However, as the FEC of the COFDM coding will normally cope with the loss of a single carrier without difficulty the signal can be activated during normal transmission with marginal influence to the performance (slight increase in BER may be noticed).

-50 Carrier test signal

To allow analysis of in-band intermodulation in a transmitter system 50 consecutive carriers in the DVB-T spectrum can be switched off. The location of the 50-carrier hole can freely be selected but typically the hole is placed at the centre of the spectrum. It is recommended to use this test signal only for off-line tests. However, in most cases the transmission service is maintained despite the loss of 50 carriers thanks to the FEC of the COFDM coding.

TS Stuffing

This test signal facilitates testing of a transmission systems IF and/or RF parameters even when no MPEG-2 input is available (MFN mode only). When the TS Stuffing signal is activated a pseudo random bit sequence as described in section 9.16.1 of the DVB-T Measurement Guidelines ETR 290 is transmitted.

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3 Installation

3.1 Initial Inspection

Check the contents of the shipment for completeness and possible transport damage. If the contents are incomplete or damaged, a claim should be filed with the carrier immediately, and the ProTelevision Help Desk should be notified in order to facilitate the repair or replacement of the instrument.

3.2 Safety Instruction

3.2.1 Earthing

Before any other connection is made, the instrument must be connected to a protective earth conductor in one of the following ways: via the three-core mains cable via the protective earth terminal marked. 

Before connecting the equipment to the mains of the building installation, the proper functioning of the protective earth lead of the building installation needs to be verified.

Warning: Any interruption of the protective conductor inside or outside the instrument, or disconnection of the protective earth terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

3.3 Mains Voltage Cord and Fuses

Different power cords are available for the various voltage outlets.

Note:

If the mains plug has to be adapted for local use, only a qualified person should carry out this task.

This instrument is equipped with a tap-less switch mode power supply that covers most nominal voltage ranges in use: 90-132 VAC RMS / 180-250 VAC RMS. This obviates the need to adapt to the local mains voltage.

The mains frequency is 48-65 Hz.

Warning: This instrument shall be disconnected from all voltage sources when renewing a fuse.

Mains fuse rating: 2 pcs. 1.25A slow blow, 250 V.

The mains fuse-holder is located on the rear panel of the instrument.

If the mains fuse has to be replaced please proceed as follows:

1. Remove the mains cable.
2. Lift the plastic cover (fuse-holder) by means of a small screwdriver.
3. Insert the new fuse into the top of the fuse-holder.
4. Re-insert the cover (fuse-holder).

Warning: Make sure that only fuses of the required rating, voltage, and of the specified type are used for replacement. The use of repaired (jumped) fuses and/or the short-circuiting of the fuse holder are prohibited. Fuses must only be replaced by a qualified person who is aware of the hazards involved.

3.4 Rack Mounting

This instrument is delivered in a 19" cabinet. Four self-adhesive rubber feet are supplied together with this instrument.

If several cabinets are mounted in a 19" rack, special attention must be paid to the temperature inside the rack.

The DVB-T modulator is equipped with cooling fans and air inlets on the side of the cabinet.

Note: The operation of the fan is temperature controlled.

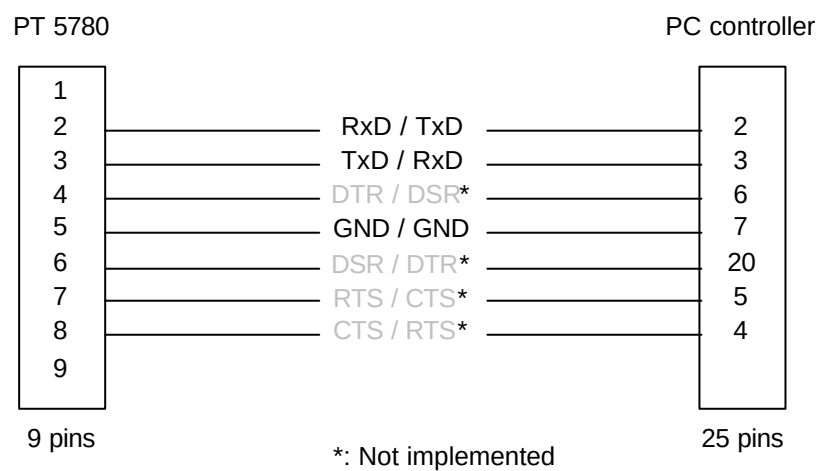
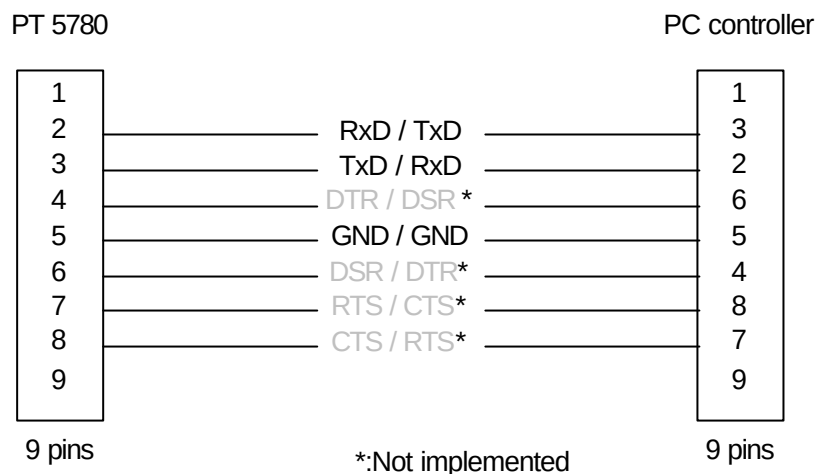
If the DVB-T Modulator is mounted between other instruments with high surface temperature, this cooling may not be sufficient. Under these circumstances, it is recommended to make space between the instruments, and to establish forced circulation (cooling) in the rack.

3.5 Cleaning

- Disconnect the instrument from the mains voltage supply before cleaning
- Use only a damp cloth
- Make sure that no liquid is spilled inside the instrument

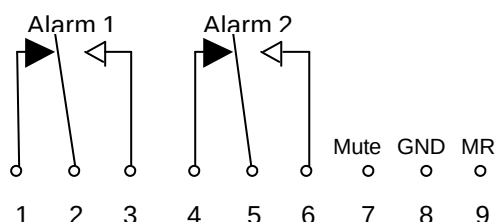
3.6 Configuration

3.6.1 Wiring schemes for RS 232 (handshake not implemented)



3.6.2 Alarms

Wiring of ALARM CONNECTIONS



Note: Contact ratings 60V, 0.2A max. 5W load.

3.6.3 Mute

The modulator output can be forced to the muted state by establishing a connection between pin 7 and 8 of the Alarm connector (see paragraph 3.6.2 above).

3.6.4 Reset

The modulator can be reset by briefly establishing a connection between pin 7 and 9 of the Alarm connector (see paragraph 3.6.2 above).

3.7 Access to and Replacement of Parts

3.7.1 Safety

Warranty will be void if any person without specific authorisation from ProTelevision Technologies opens the modulator chassis.

The opening of covers or removal of parts, except those to which access can be gained by hand, is liable to expose live parts.

The instrument must be disconnected from all voltage sources before performing any adjustment, replacement, maintenance, or repair, which requires the instrument to be opened. If repair of the opened instrument is unavoidable, it must only be carried out by a skilled person, who is aware of the hazards involved. To guarantee safety only original spare parts must be used.

3.7.2 Access to the Units

Warranty will be void if any person without specific authorisation from ProTelevision Technologies opens the modulator chassis.

To gain access to the units, remove the screws that secure the top cover of the instrument and lift the cover up.

4 Operating Instructions

4.1 Front Panel

All operational control and configuration are conveniently carried out from the front panel.

The two line by forty characters LCD display, in conjunction with four cursor keys and an **EXECUTE** button, allows easy operation of the PT 5780 DVB-T Modulator.

The display is used to indicate the status of various system parameters and also allows changes to be made to these system parameters.

The cursor keys and EXECUTE button are used to navigate through the menu system and to configure system parameters.



Front of the Instrument

4.1.1 Front Panel Indicators

Green POWER ON LED

When lit up, the green LED indicates that power is available from the supply.

Red ALARMS LED

This LED indicates the presence of an irregularity when any of the alarm conditions (e.g. "Sync Loss", "Reference Loss", etc) are "active" AND they have been configured to output to one of the relays. See Chapter 4.3.4.5 Alarm menu system for more details.

In addition this LED may flash. This occurs when there is a test signal active.

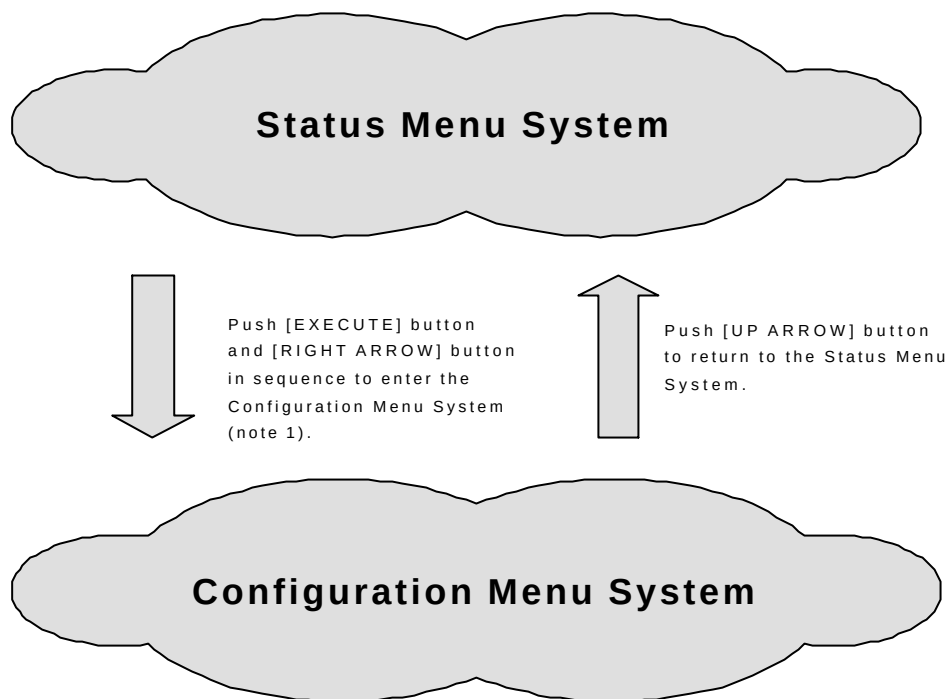
Red UNLOCKED LED

When lit up, the red LED indicates failure of the modulator in synchronizing to the incoming transport stream or external frequency reference signal.

Note that the Alarm & Unlocked LEDs flash when the DVB-T modulator output is muted. Note that the output in SFN mode will mute irrespective of the general programming of mute conditions until the modulator have established synchronising to the timing references (1PPS, 10MHz and MIP).

4.1.2 Front Panel Controls (The menu system)

For cursor buttons and an execute button plus an LCD display are available for front panel control of the DVB-T Modulator. The front panel functions are divided between read-out of status information (transmission mode, output frequency, alarm status, etc.) and actual setting/change of parameters that will affect the modulator output. To navigate between the two functionalities (status and configuration) please refer to the drawing in figure 4-1



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Note 1: Activates the Configuration Menu System at the top-level default entry point (Menu ID 1000 - <TRANSMISSION>). Alternatively, by pushing the [EXECUTE] key twice the Configuration Menu System will be activated at a sub menu relevant to the currently selected status display. For example, pushing [EXECUTE] twice when the Input Status display is active will open the configuration sub menu for control of input configuration

Figure 4-1 Front panel menu system

Dependent on the specific function being operated via the front panel the cursor keys may have the following functions:

The ▲ button is used to either

- Scroll through the different sub displays provided within the status menu system (refer to the enclosed Status Menu System diagram)
- Exit the current menu and enter a higher-level menu
- Increase alpha-numerical parameters
- Abort confirmation of a change

The ▼ button is used to either

- Scroll through the different sub displays provided within in the status menu system (refer to the enclosed Status Menu System diagram).
- Exit the current menu and enter a sub-menu
- Decrease alpha-numerical parameters
- Abort confirmation of a change

The ◀ and ▶ buttons are used to scroll between the main displays provided in the status menu system (refer to the enclosed Status Menu System diagram) and to scroll between the functions available in the configuration menu system.

The **EXECUTE** button is used to

- Enter the configuration menu system (GENERAL or SPECIFIC) when in the status menu system.
- Confirm changes made to configurable parameters.

4.1.3 Front Panel Display

To guide the user through operations, symbols of the push buttons, which are active at that particular time appear in the top right hand side of the display.

◀ and ▶ indicate that the left and right arrow buttons can be used; a ▲ indicates that the up button can be used; a ▼ indicates that the down button can be used; a ◆ indicates that both the up and down buttons can be used; and an **E** indicates that the EXECUTE button can be used.

▲ ▼ ◀ ▶ Indicates which arrow buttons are active.

E Indicates that the EXECUTE button must be pressed to activate the required selection.

< > These flashing brackets indicate the position of the cursor when in a menu option listing, also described as the “current” menu option in this manual.

[] These flashing brackets indicate the position of the cursor when in a enumerated parameter listing or when in a parameter set listing. Also described as the “current” parameter in this manual.

¼ Indicates that more items are available in the menu option or parameter listing than can be fitted in the display. Scrolling right with the ▶ button will display these items.

Guide to Menu Display

In addition, the top line of the display also usually shows the current menu option and status. The bottom line of the display indicates possible menu options or parameter settings.

4.2 Rear Panel

4.2.1 Rear Panel Connections

Safety Ground (chassis)



Mains Connector

Mains voltage receptacle with ON/OFF switch.

ON: When "I" is pressed.

OFF: When "O" is pressed.

Input Connectors A and B

Two BNC inputs (A and B) are provided for asynchronous serial transport streams (ASI).

Remote Connectors 1 and 2

Two 9 pole male Sub-D connectors are utilised for the remote connectors. They are configured as RS 232 connections. For configuration of these connectors refer to the CONFIGURE menu system in Chapter 4.3.4.7.

Monitor Output Connector

A BNC connector (ASI format¹) is provided for output monitoring purposes.

Alarms Connector

A 9 pole male sub-D connector of floating-contact type is provided to connect the two alarm switches to external alarm indicators. The connector also includes contact points for ground-closure activated output muting and instrument reset. For connections, refer to the Installation chapter of this manual. For configuration of alarms, refer to Chapter 4.3.4.5 Alarm menu system.

Reference Inputs

1 PPS - A BNC connector is provided for a 1 pulse per second input signal for SFN synchronization.

10 MHz - A BNC connector is provided for an external frequency reference input of 10 MHz.

IF Output

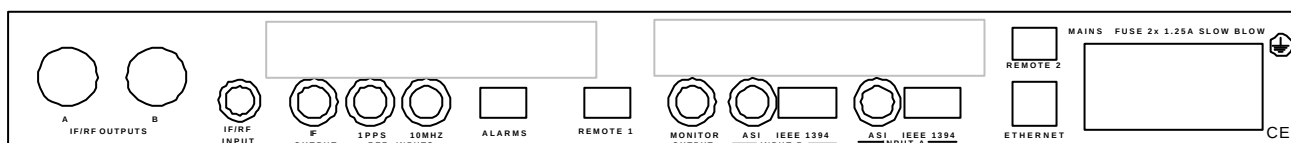
A BNC connector (with a 50 Ω impedance) is provided for the IF output signal.

IF/RF Output A

An N-type connector (with a 50 Ω impedance) is provided for the main IFR/RF OFDM output.

IF/RF Output B

An N-type connector is also provided for an optional IF/RF output signal.



Rear of the Instrument

¹ When monitoring the internally processed MPEG-2 streams (Demodulator output or the TSA adapted input) the clocking out of the useful data takes place during the actual COFDM symbol – no data is clocked out during the COFDM signals guard interval (the data stream is therefore of a bursty nature)

4.3 Menu System – Description and Operation

The PT 5780 DVB-T Modulator is equipped with different functions dependent on the purchased options.

An operating menu chart, which reflects the structure of the menu system when all possible functions are installed and enabled, is provided in appendix A..

The menu system is designed as a “tree” structure, with a number of different “branches”. Each “branch” is made up of a “menu options”. The lowest “branch” contains a configurable menu option with a list of parameters to choose from.

Note that additional configurable options are available via remote access/control. See Chapter 6.2.3.

The menu system has two main functions:-

1. system status display - the display of various modulator configuration settings through “status windows”
2. system configuration - the ability to modify the modulator’s configuration settings through “configuration windows”.

On start up the modulator always enters the system status menu.

There are two ways to enter the configuration menu system; by pressing [EXECUTE] followed by the [RIGHT] arrow button the configuration system will be opened at the top level entry point and the user will be able to navigate freely between all the menus. Alternatively, the user can press [EXECUTE] twice to open the menu system at a sub menu relevant to the status menu parameters being displayed when the key-press sequence is initiated. When using this navigation method pressing the [UP] arrow key will recall the last status display.

4.3.1 Power Up

The start-up process includes the following status windows:

```
-----
PT5780 DVB-T Modulator          PTV
- Power-up -          2001-07-08,  3:07:33
-----
```

This text is a site specific identification and can be modified by the customer via the Remote Interface only.

The current date and time is displayed until the back-end controller is powered up.

And later:

```
-----
PT5780 DVB-T Modulator          PTV
Release X.X ←
-----
```

The software release is momentarily displayed before the modulator enters the first status window.

In case new micro-code has to be installed, the following is displayed:

```
-----
****  R E C O N F I G U R I N G  ****
=-    micro-code being installed    -=
-----
```

The first line will flash. After new micro-code has been downloaded, the system automatically reboots.

Following successful start-up, the first status display window appears – see Chapter 4.3.3.1.

Switching the instrument off and then back on again retains all system configuration settings.

4.3.2 Operating Menu System Chart

A set of charts describing the menu system is provided (see appendix A) in order to diagrammatically show the structure of the menu system, with the various menu options and parameters. The charts enclosed are:

- Status Menu System
- Configuration Menu System (page 1 of 2)
- Configuration Menu System (page 2 of 2)

All menu windows in the menu system contain a four-digit number in the top right hand position. This number is known as the menu identification number and is useful for referencing and navigating purposes and is shown in “red” in the Menu System Charts. The menu-structure has a maximum of four levels; hence the four-digit identification.

4.3.3 Status Menu System

If all hardware/software options are installed, enabled and turned on, the system status menu consists of a maximum of eight main “status windows”. Each main “status window” can be divided into a number of sub windows. The “status windows” display the settings of various configurable options and system variables.

A description of each status window is provided below. Each status window is identified with a flashing character (‘a-n’ through to ‘h-n’) in the lower right hand corner of the display (n is an integer decimal value 1, 2, 3,... that identifies the specific sub window). These status window identification characters flash at approximately 1 Hz to indicate that the device is running. If preferred, the status display identifiers can be removed from the display altogether or left as a constant display by using the CONFIGURE – STATUS MENU ID menu option. Chapter 4.3.4.7 describes how to configure this Menu ID.

As mentioned previously, certain status windows are only accessible if the appropriate hardware/software options are installed.

The operator may navigate through the main status windows by using the left or right cursor keys. Navigation between sub status windows is where applicable done by means of the up or down arrow keys. On reaching the last or first status window the system loops round to the first and last respectively.

The information in the status display windows are updated approximately every 1/2sec.

4.3.3.1 Description of Status Display Windows

Status Window 'a1' – The Input (or High Priority Input in the case of a hierarchical system) Status Window

The example given here is for a hierarchical system:

```

-----
INPUT  HP: A  ASI / 204 OK          ' ◆ ' E
Ref:Ext                               a1
-----

```

Status Window 'a2' – The Low Priority Input Status Window

This window is only available when the hierarchical version of the modulator is in use. However if the hierarchical mode is set to "NONE" through the menu TRANSMISSION – MODE – HIERARCHICAL MODE, the following window is displayed, as there has been no hierarchical alpha parameter configured:

```

-----
INPUT  LP: Non Hierarchical Mode  ' ◆ ' E
Ref: Int                             a2
-----

```

However if the hierarchical alpha parameter is set to one of the hierarchical modes (alpha 1, alpha 2 or alpha 4), the following window is displayed (assuming that input B has been selected as LP source):

```

-----
INPUT  LP: B  ASI / 204 OK          ' ◆ ' E
Ref:Int                             a2
-----

```

The Input status windows show the data packet size, the input signal type and the source of the 10MHz system reference clock (Internal or External)

Status Window 'a1' – Signal loss vs. Auto Substitute function

When the modulator cannot detect an input signal and the auto substitute function is disabled, the following input status window appears (assuming that input A signal source is lost in non-hierarchical mode):

```

-----
INPUT   :      A ASI No Sync          ' ◆ ' E
Ref:Int                               a1
-----

```

Note: "No Sync" flashes.

If the input specified as primary source in non-hierarchical mode is lost when the auto substitute function is enabled, the following input status window appears (assuming that the input specified as secondary source (B) is available):

```

-----
INPUT   Prim: A ASI No Sync          ' ◆ ' E
Ref:Int  Sec: B ASI /204 OK <Actual a1
-----

```

Note: "No Sync" flashes.

Status Window 'b1' – The Mode Status Window

This window shows the output configuration settings: IFFT, constellation, Code rate, network mode (MFN or SFN), hierarchical mode (none, a1, a2 or a4)), and guard interval. An example of a mode status window for a non-hierarchical modulator configuration is:

```

-----
MODE  IFFT:8k, Cons:64QAM, CR-HP:1/2  ◀ ◆ ▶ E
MFN Hier:None, Guard:1/32                                     b1
-----

```

Status Window 'b2' – The Preset Status Window

This window displays the number and name of the preset whose settings are currently loaded into the modulator.

```

-----
PRESET                                     ◀ ◆ ▶ E
No: 3, Name: "Preset Name"                b2
-----

```

Status Window 'c1' (MFN config.) –TS Buffer fill indicator Status Window

This window is only available in MFN mode. It displays the number of transport stream packages waiting in the input buffer (readings between 0 and 8 packages are considered normal, the displayed value may fluctuate if the bit rate of the applied stream is not constant).

```

-----
TS Buffer fill indicator                   ◀ ◆ ▶ E
2 packages                                c1
-----

```

Status Window 'c1' (SFN config.) – The SFN delay status display

This window is only available in SFN mode. It displays the *maximum network delay* value extracted from the MIP (100ns resolution) and the delay margin (1 ms resolution). The delay margin is defined as the time (in ms) that a mega frame is stored in the input buffer before the network-wide timing dictates transmission.

```

-----
SFN Max Delay:350,000.0 is                ◀ ◆ ▶ E
Margin: 258ms                             c1
-----

```

Status Window 'c2' – The SFN Setup Status Window

This window is only available in SFN mode. It displays the method used for controlling the transmission parameters (control via TS control ON or OFF), the transmitter identification number assigned to the modulator (TX ID), and the local delay offset value set via the <Signal> → <Output> → <SFN DELAY> sub menu.

```

-----
TS Control:ON, TX ID:55                    ◀ ◆ ▶ E
Local Delay 000,000.0 is                    c2
-----

```

Status Window 'c3' – The SFN Optional Data Status Window

This window is only available in SFN mode. It displays the optional time offset, frequency offset and power offset data values received via the MIP. The DVB-T Modulator implements only the

optional delay value. The modulator does not implement the frequency offset and the absolute power value but both values can be extracted via the modulator remote control (SCPI/RS232) for use by the transmitter control system if desired.

```
-----
Optional Delay Time:-30.0 is      '◆' E
Freq:400 Hz Power:10.0 dBm      c3
-----
```

Status Window 'd1' – The Output Status Window

This status window displays the IF/RF (dependent on whether the RF converter is installed and enabled for use) output frequency, the output bandwidth and the output level. The output level is displayed in dB relative to nominal level.

If the RF converter is not installed, the following window is displayed:

```
-----
OUT IF-Freq:36,000,000 Hz (8MHz)  '◆' E
Level:0.0 dB                     d1
-----
```

note: Nominal IF level is +6dBm

If the RF converter is installed and enabled, the following window is displayed:

```
-----
OUT RF-Freq:1,000,000,000 Hz(8MHz) '◆' E
Level: 0.0 dB                     d1
-----
```

note: Nominal IF level is 0dBm

Status Window 'd2' – The Pre-Corrector Status Window

This window is only available if the pre-corrector option PT 8731 is installed. On the first line of the window, the display shows whether the non-linear and linear pre-correction functions are currently in operation. On the second line the origin of the employed pre-correction curves is indicated. The pre-correction curves can be loaded from the preset bank (in this case the number and name of the preset is indicated). Alternatively, the curves originate from the default pre-corrector curve bank (in this case the display will indicate: "No saved Pre-correction curve loaded". The default pre-corrector curve bank contains the curve that can be manipulated by means of the IMD Buster PC software that is supplied together with the pre-corrector option. The IMD Buster software allows transfer of the curve from the default curve bank to one of the curve pre-set bank.

```
-----
PRE-CORRECTOR      NLC: ON, LC: ON  '◆' E
NLC:#1/2001-0-20T;LC:#7/2001-0-20R  d2
-----

PRE-CORRECTOR      NLC: ON, LC: OFF  '◆' E
No saved pre-correction curve loaded d2
-----
```

Note that the second line display is evenly split between the names of the non-linear and linear pre-correction curves.

Status Window 'f1' – Demodulator Status Window

This window displays the status of the built-in COFDM demodulator. The COFDM demodulator monitors, when enabled, the modulators IF output. If the output signal is a valid COFDM signal the display will indicate the signals transmission parameters (IFFT, Constellation, Code rate, Hierarchy, and guard interval.). If the output signal is not a DVB-T compliant COFDM spectrum one or more of the parameter indications will be replaced by “—” and the status indication “Unlock” will be shown.

```

-----
DEM1  IFFT: 8K  Const: 64QAM  CR: 2/3  ◀◆▶ E
Locked  Hier: None  Guard: 1/16      f1
-----

-----
DEM1  IFFT: --  Const: --  CR: --  ◀◆▶ E
Unlock  Hier: --  Guard: --      f1
-----

```

Status Window 'g1' – The Alarm Status Window

The alarm status display provides a detailed description of the cause of any active (currently present) alarm conditions. If more than one alarm are active simultaneously the individual alarms can be observed one-by-one by scrolling through the list by means of the UP or DOWN cursor keys. If the “Auto Open Alarm Window” mode is enabled via the configuration menu (default setting), the alarm status window will automatically be opened (displayed) whenever an alarm is raised.

Example 1 (no active alarms, last active alarm was “Sync Loss”)

```

-----
ALARMS: Sync Loss          ◀◆▶ E
  0      Not active
-----

```

Example 2 (One active alarm : “Sync Loss”, High priority input)

```

-----
ALARMS: Sync Loss          ◀◆▶ E
  1      HP
-----

```

Example 3 (Four active alarms, use the UP or DOWN cursor keys to view each of the four alarms)

```

-----
ALARMS: Sync Loss          ◀◆▶ E
  4      HP
-----

```

Additional information about each alarm can be obtained via the configuration sub menu <ALARM> → <ALARM INFORMATION> menu ID 3200 (accumulated count of the alarm type and specific information for generic alarms). The event log configuration menu <EVENTLOG> → <VIEW> menu ID 8100 may provide information about the exact start and stop time for each type of alarm (requires that the alarm type has been routed to the event log by specifying Event Log “on” for the alarm type in the configuration sub menu <ALARM> → <DEFINE ALARM SYSTEM> menu ID 3100).

If an alarm is “unstable” and alternates between being active and inactive AND the <CONFIGURE> → <AUTO OPEN ALARM WINDOW> (menu ID 5300) is set to “On” the alarm display will be opened automatically as explained above. However, to allow uninterrupted operation of the instrument via the front panel during repeated occurrence of an intermittent alarm the alarm window will not open until five seconds after the last key-press of any front panel key have taken place.

Status Window 'h1' – The Test Signal Status Window

```

-----
TEST SIGNAL ACTIVE          ◀ ◆ ▶ E
Single Carrier              h1
-----

```

This status window displays the current test signal configuration and is only available if a test signal is active via the <TEST SIGNAL> → <SELECT TEST> sub menu Menu ID 6000. Note that the test signal menu is only available if the TEST SIGNAL lock in the sub menu <CONFIGURE> → <LOCK> menu ID 5100 is “OFF”.

4.3.4 Configuration Menu System

Two methods for accessing the configuration menu system exist. The first step is always to push the **[EXECUTE]** button. This action will open the following display:

```

-----
Entering Menus, Press Right Arrow  ◀ ◆ ▶ E
or EXECUTE for specific...
-----

```

note: the display will close automatically after about 3 seconds if the user does not press the [RIGHT ARROW] key or the [EXECUTE] key

Top-level menu access

Pressing the **[RIGHT ARROW]** button during the above display mode will open the configuration menu system at the default entry point (Transmission parameters, menu ID 1000). For further details see paragraph 4.3.4.1

Context sensitive menu access

Pressing the **[EXECUTE]** button during the above display mode will open directly the configuration sub menu that is related to the status menu window in which the activation of the configuration menu system was initiated. For further details see paragraph 4.3.4.2. Note: when entering the menu system via the context sensitive method it's not possible to navigate to a different menu without first exiting the configuration menu system (pressing the [UP] arrow key).

4.3.4.1 Top-level configuration menu access

To enter the configuration menu at the top level of the menu hierarchy press the [EXECUTE] button followed by the [RIGHT ARROW] button. After pressing the [EXECUTE] button the below display will be shown. If the [RIGHT ARROW] button is not pressed within about 3 seconds the display will close automatically and return to the last open status window.

```

-----
Entering Menus, Press Right Arrow  ◀▶▶E
or EXECUTE for specific...
-----

```

The <TRANSMISSION> menu (ID 1000) is the top-level entry point in the menu hierarchy. The complete hierarchy is provided in the attached menu structure diagrams.

All menu windows in the configuration menu system contain a four-digit number in the top right hand position. This number is known as the menu identification number and is useful for referencing purposes. The menu-structure has a maximum of four levels; hence the four-digit identification. See examples below.

Examples of the top level of the configuration menu system are shown below in Examples A and B. The character string "DVB-T Modulator" is always positioned on the left hand side of the display when in the top level of the configuration menu system. The available menu items are shown on the second line and may be scrolled through using the ◀ and ▶ buttons.

The "current" menu option is always shown in capitalised format with flashing "< >" brackets. If more menu options are possible than the display allows, three (3) dots are shown in the lower right position.

Example A

```

-----
DVB-T Modulator          <1000> ◀▶▶
<TRANSMISSION>  Signal  Alarm  Preset ...
-----

```

Pressing ▶ produces Example B:

```

-----
DVB-T Modulator          <2000> ◀▶▶
<SIGNAL>  Alarm  Preset  Configure  Te...
-----

```

Moving down a level to the next menu option by pressing the ▼ button produces a display like that shown in Example C.

Example C

```

-----
Signal, Input            [2110: ON] ◀▶▶
<AUTO SUBSTITUTION>      Input
-----

```

The "current" parameter is shown in the top right hand side of the display together with the menu identification number, which is surrounded by square brackets. If the parameter name is

longer than 8 characters, the name is truncated and a dot (.) is included as the 8th character. In a few cases, the “current” parameter is automatically updated in the display window, e.g. the Clock.

The lowest level of any particular “branch” of the menu system produces a window that displays the available parameter list, a configurable value or a non-configurable value. At this level the only information given in the upper right hand corner is the menu identification number.

If a parameter list is obtained (see Example D), the “current” parameter is always the first item and is capitalised and surrounded by flashing square brackets.

Example D

```
-----
Signal, Input, Auto Substitute <2110> ◀ ▶ E
[ON] off
-----
```

If an editable value is accessed (see Example E) the current parameter value is shown in the bottom left hand side of the display. The last digit of the “current” parameter value flashes to indicate that this digit will be changed if the [UP] or [DOWN] keys are pressed. The other digits of the value can be edited by navigating to the digit using the [LEFT] or [RIGHT] keys. The valid range for the parameter is indicated in square brackets in the bottom right hand side of the display.

Example E

```
-----
Sig.Out. RF Level (dB)      <2250> ◀ ▶ E
00,0                        [-10.0 ..0.0]
-----
```

Finally if a non-configurable parameter value is accessed the window shown in Example F is displayed. The menu parameter is enclosed in brackets, whilst the “current” parameter value is shown in the upper right hand corner of the menu window, with no brackets.

Example F

```
-----
Instrument Identity          123456 ◀ ▶ E
INSTRUMENT KU NUMBER
-----
```

4.3.4.2 Context sensitive menu access

To use the context sensitive menu access press the [EXECUTE] button twice. After the first pressing of the EXECUTE button the below window will open. If the EXECUTE button is not pressed a second time within about 3 seconds the window will close automatically and return to the last open status window.

```
-----
Entering Menus, Press Right Arrow ◀ ▶ E
or EXECUTE for specific...
-----
```

The context sensitive access to the configuration system will open directly the configuration sub menu that is related to the status menu window in which the activation of the configuration menu system is initiated. For example, pressing [EXECUTE] → [EXECUTE] when the “Input status” display is active will open the <SIGNAL> → <INPUT> sub menu for configuration of input source. Likewise, pressing [EXECUTE] → [EXECUTE] when the “output status” display is active will open the <SIGNAL> → <OUTPUT> sub menu for configuration of frequency, level, etc.

Status menu	Associated configuration menu (accessed by pressing [EXECUTE] → [EXECUTE])
Input Status (a1, a2)	<SIGNAL> <INPUT> menu ID 2120
Mode Status (b1)	<TRANSMISSION> <MODE> menu ID 1200
TS Buffer fill (c1 - MFN)	<TRANSMISSION> menu ID 1000
TS Control Status (c2 – SFN)	<TRANSMISSION> <SFN TS Control> menu ID 1100
Optional Time, Freq,(c3 –SFN)	<TRANSMISSION> <SFN TS Control> menu ID 1100
Output Status (d1)	<SIGNAL> <OUTPUT> menu ID 2200
Pre-Corrector status (d2)	<SIGNAL> <Non-Lin Pre-Corrector> menu ID 2300
Alarm status (g1)	<ALARM> <DEFINE ALARM SYSTEM> menu ID 3100

Table 4-1 Context sensitive menu access

4.3.4.3 TRANSMISSION Menu System (Menu ID 1000)

The top level of the transmission menu system (menu ID 1000) is accessed by pressing the [EXECUTE] button followed by the [RIGHT ARROW] button as described in paragraph 4.3.4.1. By applying the [LEFT] , [RIGHT] , [UP] , [DOWN] keys as required (see attached Configuration Menu System diagram) it is possible to navigate to a number of sub menus:

SFN TS Control (ID 1100)

This menu, which is only available when the instrument is configured for SFN mode, allows the user to select if the transmission parameters (constellation, guard interval, code rate, hierarchy) are to be controlled via the MIP (default setting) or if the parameters are to be set manually. If the manual mode is selected it is the operators responsibility to ensure that the selected parameters correspond to the parameters applicable to the transport stream to be transmitted. If the manually selected parameters do not match those applicable to the applied transport stream transmission in SFN mode is not possible (output will be muted).

MODE (ID 1200)

This menu allows the user to select the COFDM parameters for the transmission. Sub menus are available for setting Hierarchy (if hierarchical option is installed), IFFT, Code rate constellation and guard interval. The mode menu cannot be accessed if SFN TS control is set to “ON”.

MFN/SFN (ID 1300)

The menu allows selection of the network mode to be applied for the transmission; Multi Frequency Network – MFN or Single Frequency Network – SFN. *Note: The menu is only accessible when the SFN option PT 8732 is installed.*

4.3.4.4 SIGNAL Menu System (Menu ID 2000)

The signal menu system (menu ID 2000) is accessed by pressing the [EXECUTE] button followed by the [RIGHT ARROW] button as described in paragraph 4.3.4.1. When the menu system is entered at menu TRANSMISSION use the [RIGHT ARROW] button to navigate to the SIGNAL menu.

INPUT menu (ID 2100)

This menu allows the user to select the input source(s) and to set the status of the auto substitution function.

In the non-hierarchical configuration the input menu (ID 2120) allows the user to assign a primary input source and a secondary input source. The instrument offers as standard a choice between two input sources (ASI input "A" and ASI input "B" corresponding to the BNC input sockets located in the rear panel of the modulator). Additional input sources such as two more ASI inputs (input "C" and "D") or an SPI LVDS input are available as options (When installed the SPI LVDS input is identified as input "C").

For non-hierarchical applications the user will typically program input "A" as the "primary" and input "B" as the "secondary" input source. Should the "primary" signal source fail in this configuration the instrument will automatically switch over to the "secondary" input if the Auto substitution function is set to "ON" (requires that a valid MPEG-2 transport stream is applied to the "secondary" input).

For hierarchical applications the user will typically assign input "A" as primary source for the High Priority input (Menu ID 2120) and assign input "B" as primary source for the Low Priority input (menu ID 2130). If the option that provides two additional ASI inputs is installed (Input "C" and "D") the user may choose to program Input C as secondary input source for the High Priority input (menu ID 2120) and to program Input D as secondary input source for the Low Priority input (menu ID 2130) if it desired to add redundancy by means of the Auto Substitution function. That is, when the auto substitute function is set to "ON" the unit will automatically switch to the secondary input source if the primary input source fails (requires that a valid MPEG-2 transport stream is applied to the "secondary" input).

OUTPUT (ID 2000)

This menu allows the user to set a range of parameters that affect the generated COFDM spectrum. Sub menus are available for setting (centre) frequency, bandwidth, level, sideband filter (window) function, spectrum polarity, and local transmission delay (SFN only).

A sub menu (menu ID 2210) allows the user to set the **output frequency**. The IF version allows setting of the frequency in the range between 35-37MHz. The RF version covers the range from 30MHz to 1000MHz. *Note: In case of the RF version (option PT 8715 installed) the IF output is fixed to 36MHz.* The RF version allows furthermore the user to set the output frequency by channel number (menu ID 2220). The applicable channel raster is programmable via the channel set-up menu (menu ID 2230). The channel set-up menu offers selection between a

choice of standard channel rasters (ITU UHF combined with either the VHF B, VHF L or VHF I raster) and a user defined channel raster. When the user-defined raster is selected the user can configure this raster via sub menu 2231 with respect to base frequency and start channel number. The 'base frequency' represents the centre frequency of the first channel in the user-defined raster (for example 529,5 MHz). The 'start channel number' represents the number to be assigned to the first channel in the user-defined raster (for example 28). The step size of the channel raster will always follow the bandwidth of the modulator (for example 7MHz). These three parameters values (529,5 MHz, ch no. 28, BW 7MHz) provides a channel raster that steps as follows: CH28: 529,5MHz, CH29: 536,5MHz, CH30: 543,5MHz(Australian UHF System B)

The **bandwidth** sub menu (ID 2240) allows the user to switch the bandwidth of the COFDM spectrum between 8, 7 and 6MHz (6MHz bandwidth requires that option PT 8735 is installed).

The **Output Level** sub menu (ID 2250) allows the user to set the Output level. The adjustment range for the IF version is +2/-8dB in steps of 0.1dB relative to nominal output level +6dBm. For the RF version the adjustment range is +0dB/-10dB relative to nominal output level (0dBm). *Note: In case of the RF version (option PT 8715 installed) the IF output level is fixed to +6dBm*

The **Window On/Off** sub menu (ID 2260) allows the user to switch on/off the "window" type spectrum sideband filter function as required (as default the filter is switched on).

The **Window RollOff** sub menu (ID 2270) allows the user to adjust the trade-off between obtained sideband suppression and cross talk between two successive COFDM symbols. The default window ratio 1/64 provides maximum sideband suppression.

The **Spectrum** sub menu (ID 2280) allows the user to set the polarity of the spectrum as required. When NORMAL polarity is selected carrier number 1 of the COFDM spectrum is located at the lowest frequency whereas the last carrier number (1705 by 2K and 6817 by 8K) is located at the highest frequency. When inverted polarity is selected carrier number 1 of the COFDM spectrum is located at the highest frequency whereas the last carrier number (1705 by 2K and 6817 by 8K) is located at the lowest frequency. *Note: for the RF version the selected spectrum polarity refer to the RF output (the IF output will have the opposite polarity of the polarity selected for the RF output).*

The **SFN Delay** sub menu (ID 2290) allows the user to set a local delay offset relative to the transmission timing specified via the MIP (the menu is only available in SFN mode). The nominal adjustment range is +/- 999.999,9 ms in steps of 100ns. However, in practice the applied value must respect the timing window set by the actual propagation delay from the head-end to the modulator relative to the network delay specified in the MIP (maximum delay). The transmission time cannot be advanced beyond the actual propagation delay from the head-end to the modulator (the modulator must obviously receive the mega frame before it can transmit it).

Non-Linear Pre-Correction (ID 2300)

This menu allows the user to control the non-linear pre-corrector function (only available when option PT 8731 is installed). Sub menus are available for switching the pre-corrector function on/off (menu ID 2310), for setting the gain of the pre-corrector (menu ID 2320), for setting the peak clipping menu (ID 2330), and for recalling a correction curve from the preset library (menu

ID 2340). The menu for setting the peak clipping level allows the user to control the ratio between peak power and average RMS power of the COFDM spectrum. If the clip level is set to 0dB the peak power is limited to +17dB relative to average RMS power. If the clip level is increased to 4dB the peak power relative to average RMS power will be limited to 13dB. The average RMS power remains unchanged.

$$\text{Peak level} = 17\text{dB} - \text{clip level} - \text{precorrector gain}$$

The clip function is implemented as hard clipping without band limitation. The definition of pre-correction curves must be done via the remote interface by means of the separate PC software tool (IMD Buster) supplied with the pre-corrector option.

Linear Pre-Correction (ID 2400)

This menu allows the user to control the linear pre-corrector function (only available when option PT 8731 is installed). Sub menus are available for switching the linear pre-corrector function on/off (menu ID 2410) and for recalling a correction curve from the preset library (menu ID 2420). The definition of pre-correction curves must be done via the remote interface by means of the separate PC software tool (IMD Buster) supplied with the pre-corrector option.

Monitor (ID 2500)

This menu allows the user to specify which signal that is to be routed to the monitor output located in the rear panel of the DVB-T modulator. It is possible to monitor the following signals:

Menu choice	Description	Remarks
HP Input	Monitors the selected input (HP input by hierarchical mode) before any processing has taken place	
HP Output	Monitors the selected input (HP input by hierarchical mode) after the transport stream bit rate adaptation has taken place.	
LP Input	Monitors the selected LP input before any processing has taken place	Only available in hierarchical mode
LP Output	Monitors the selected LP input after the transport stream bit rate adaptation has taken place.	Only available in hierarchical mode
Demodulator	Monitors the output from the on-board COFDM demodulator (i.e. the transport stream obtained by demodulating the modulators IF output)	

Reference input (ID 2600)

This menu allows the user to select the 10MHz clock reference source and to configure parameters with respect to the 10MHz and 1PPS reference inputs. Sub menus are available for selecting 10MHz source (menu ID 2610), impedance for the 1PPS reference input (menu ID 2620), impedance for the 10MHz reference input (menu ID 2630), and trigger level for the 1pps input.

The 10MHz reference source can be set to Internal, External or Auto. By auto mode the unit will synchronize to an external reference if available and automatically switch to the internal reference if no external reference is available (no alarm will be raised if the unit switches to internal reference). By external reference mode the unit will synchronize to an external 10MHz when available and switch to the internal reference if no external reference is available (an alarm will be raised if the unit in this mode needs to switch to internal reference due to absence of external reference). Note: for SFN mode external reference should be selected.

4.3.4.5 ALARM Menu System (Menu ID 3000)

The alarm menu system (menu ID 3000) is accessed by pressing the [EXECUTE] button followed by the [RIGHT ARROW] button as described in paragraph 4.3.4.1. When the menu system is entered at menu TRANSMISSION use the [RIGHT ARROW] button to navigate to the Alarm menu.

Define Alarm menu (ID 3100)

This menu allows the user to program the desired response for each of the possible alarms that can be raised by the unit. For each type of alarm the user can choose to route the alarm to one or several of the following destinations:

Alarm destination	Description
Mute	When the Mute option for an alarm is set to "ON" the alarm will be routed to the mute control circuit. In this case the modulator output will mute whenever the alarm is active.
Event Log	When the Event Log option for an alarm is set to "ON" the alarm will be routed to the Event Log. In this case the time and date when the alarm is raised and the time and date when the alarm is lowered will be recorded in the event log together with the specific name of the alarm type.
Relay 1	When the Relay 1 option for an alarm is set to "ON" the alarm will be routed to Alarm 1 relay control circuit. In this case the Alarm 1 relay contacts will be activated whenever the alarm is active. The red ALARM led located in the front panel will be on for the duration of the alarm.
Relay 2	When the Relay 2 option for an alarm is set to "ON" the alarm will be routed to Alarm 2 relay control circuit. In this case the Alarm 2 relay contacts will be activated whenever the alarm is active. The red ALARM led located in the front panel will be on for the duration of the alarm.

There are a total of 13 possible alarm types. Five of the alarm conditions are independent of the instrument version while eight of the alarm conditions are only available for specific instrument configurations.

ID Number	Alarm Source/Condition	Description
1	Sync and/or Data Loss	Package sync byte (47H) missing and/or no input data activity (stuffing only). By hierarchical mode the affected stream will be indicated (HP and/or LP)
2	Data rate	Input data rate too high (overflow). By hierarchical mode the affected stream will be indicated (HP and/or LP)
3	COFDM	Error detected in the COFDM parameters of the output signal (code rate, guard interval, constellation and hierarchy). Note: This alarm is only available when the built-in demodulator (Demodulator-1) is configured for monitoring of the output signal
4	10MHz reference loss	10MHz reference not available
5	System error	Internal malfunction alarm
6	Timing adjusted	Indicates that the modulator has adapted the internal system clock or internal 1PPS timing to allow for a mismatch between the local network timing reference (10MHz and 1PPS) and the timing reference (MIP) embedded in the incoming transport stream. NOTE: ONLY AVAILABLE WITH SFN OPTION PT 8732
7	1PPS Reference loss	Indicates that external 1PPS reference is absent (operation may continue based on internal 1PPS provided instrument was correctly synchronised before loss of external 1PPS). NOTE: ONLY AVAILABLE WITH SFN OPTION PT 8732
8	Mega-Frame (MIP) Loss	Indicates that no valid MIP is available in the applied transport stream. NOTE: ONLY AVAILABLE WITH SFN OPTION PT 8732
9	RF converter / "type"	Indicates that an alarm of the specified type has been raised for the RF converter module (for specific alarm types see below). NOTE: ONLY AVAILABLE WITH RF CONVERTER OPTION PT 8715

Continued:

continued from previous page:

ID Number	Alarm Source/Condition	Description
10	RF tuner / "type"	Indicates that an alarm of the specified type has been raised for the RF tuner module (for specific alarm types see below). NOTE: ONLY AVAILABLE WITH DVB-T RE-MODULATOR PT 5788
11	RF Tuner level	Indicates that the RF input level has dropped below the threshold specified via the <Alarm> <Alarm Limits> <RF Tuner...> submenu. NOTE: ONLY AVAILABLE WITH DVB-T RE-MODULATOR PT 5788
12	Demodulator 1 / "type"	Indicates that an alarm of the specified type (BER pre-Viterby, BER-post Viterby and UCE) has been raised to signal that the associated threshold has been exceeded. The thresholds are specified via the <Alarm> <Alarm Limits> <Demodulator 1 Alarm Limits> submenu. NOTE: ONLY AVAILABLE WITH DVB-T RE-MODULATOR PT 5788
13	Demodulator 2 / "type"	Indicates that an alarm of the specified type (BER pre-Viterby, BER-post Viterby and UCE) has been raised to signal that the associated threshold has been exceeded. The thresholds are specified via the <Alarm> <Alarm Limits> <Demodulator 2 Alarm Limits> submenu. NOTE: ONLY AVAILABLE WITH DEMODULATOR-2 OPTION PT 8722

In addition to the name of the alarm condition, further information may be available in the status window or the ALARM INFORMATION "Additional Information" menu:

Alarm condition	Additional information
Sync and/or Data Loss	HP, LP or HP+LP
RF Converter	No HW (No hardware), TEMP (Temperature tolerance exceeded), 10V (10V supply voltage out of range), LO1 (Local Oscillator 1 voltage out of range), LO2 (Local Osc. 2 voltage out of range), REF (Reference voltage out of range), DDS (Direct Digital Synthesis circuit out of lock)
RF Tuner	TBA
System Error	Various – contact ProTelevision Technologies

Alarm Information menu (ID 3200)

This menu allows the user to access further information concerning the status of the various alarms. For each alarm type a separate sub menu is available which provides information about whether the alarm is currently active, indicates the total number of times the alarm has been raised since the alarm counter was reset and, where applicable, more detailed information about the nature of the alarm (for example, in case of "Sync Loss" alarm it will be indicated if the sync loss pertains to the HP or the LP input).

Do notice that the Alarm Counters are reset via the separate sub menu Reset Alarm Counter (ID 3500).

Reset Alarm Counter menu (ID 3300)

This menu allows the user to reset the alarm counters. The menu features both a common alarm reset option (Reset all) and facilities for resetting the counters on an individual basis. Note that the alarm counters will automatically reset on reaching a count of 65536.

Alarm Limits menu (ID 3400)

This menu allows the user to set the threshold for the alarms that are triggered when exceeding a specific parameter value. Subject to the options installed sub menus are available setting the threshold of the temperature alarm, the RF level alarm (only with PT 5788), and of the bit error alarms (only with PT 5788).

- **Controller Board Temperature** (sub-menu ID 3410): Allows user specification of the internal instrument temperature at which the temperature alarm is to be raised. ProTelevision Technologies recommends that the default threshold 82 °C be not exceeded.
- **RF Tuner input level** (sub-menu ID 3420): Allows user specification of the minimum RF input level accepted. If the received level drops below this threshold the RF Tuner Input Level alarm will be raised (10 – 100dBuV , default value is 10dBuV). Note: This function is only available with DVB-T Re-Modulator PT 5788.
- **Demodulator 1 Alarm Limits** (sub-menu ID 3430): User definition of the BER and UCE counts above which the Demodulator 1 alarm will be raised. Only available with PT 5788.
 - **Pre-Viterby BER** (sub-menu ID 3431): User definition of the bit error rate threshold above which the demodulator-1 alarm for Pre-Viterby bit error rate is raised. Default bit error rate threshold is 1E-2. The adjustable range is 1E-9 to 1E-1.
 - **Post-Viterby BER** (sub-menu ID 3432): User definition of the bit error rate threshold above which the demodulator-1 alarm for Post-Viterby bit error rate is raised. Default bit error rate threshold is 1E-4. The adjustable range is 1E-10 to 1E-1.
 - **UCE** (sub-menu ID 3433): User definition of the UCE counter value at which the demodulator-1 alarm for UCE is raised. Default UCE count is 10000. The adjustable range is 1 to 1000. Count of an UCE (uncorrectable error) is equivalent to detection of an Uncorrectable MPEG-2 TS packet (UP) as described in section 6.2 of the ETR 290 measurement guidelines (the demodulators Reed-Solomon error correction overloaded by excessive bit error rate). The UCE counter is reset to zero count via the sub-menu <RECEPTION> → <DEMODULATOR 1> → <RESET UCE>
- **Demodulator 2 Alarm Limits** (sub-menu ID 3440): User definition of the BER and UCE counts above which the Demodulator 2 alarm will be raised (only available when option PT 8722 is installed).
 - **Pre-Viterby BER** (sub-menu ID 3441): User definition of the bit error rate threshold above which the demodulator-2 alarm for Pre-Viterby bit error rate is raised. Default bit error rate threshold is 1E-2. The adjustable range is 1E-9 to 1E-1.

- **Post-Viterby BER** (sub-menu ID 3442): User definition of the bit error rate threshold above which the demodulator-2 alarm for Post-Viterby bit error rate is raised. Default bit error rate threshold is 1E-4. The adjustable range is 1E-10 to 1E-1.

UCE (sub-menu ID 3442): User definition of the UCE counter value at which the demodulator-2 alarm for UCE is raised. Default UCE count is 10000. The adjustable range is 1 to 1000. Count of an UCE (uncorrectable error) is equivalent to detection of an Uncorrectable MPEG-2 TS packet (UP) as described in section 6.2 of the ETR 290 measurement guidelines (the demodulators Reed-Solomon error correction overloaded by excessive bit error rate). The UCE counter is reset to zero count via the sub-menu <RECEPTION> → <DEMOMULATOR 2> → <RESET UCE>.

Auto Open Alarm Window (ID 3300)

This menu allows the user to select whether the unit shall switch automatically to the alarm status display whenever an alarm is raised. If the auto open function is set to off the user must manually navigate to the alarm status display to check whether an alarm is raised. The default mode is auto open "on". In this case the user will instantly be notified about the alarm by the instrument automatically opening the alarm status display when the alarm is raised. However, to allow uninterrupted operation of the instrument via the front panel during repeated occurrence of an intermittent alarm the alarm window will not open until five seconds after the last key-press of any front panel key have taken place.

4.3.4.6 PRESET Menu System (Menu ID 4000)

The PRESET menu options provide the capability of saving (STORE) the modulator's current configuration of all parameters in the

- TRANSMISSION,
- SIGNAL – INPUT,
- SIGNAL – OUTPUT (apart from the CHANNEL SETUP menu),
- SIGNAL – MONITOR and
- SIGNAL – REFERENCE INPUT

menus into a preset "location", naming this "location" (NAME) and recalling and activating (RECALL) any one of these saved configurations at a later stage.

There are ten preset "locations", with default names, "Pres Name 1", "Pres name 2", etc, etc. These default presets contain the default values of all the parameters in the above listed menus and can be overwritten at any time with user-defined presets. These presets are not reset on carrying out a factory reset.

4.3.4.7 CONFIGURE Menu System (Menu ID 5000)

The CONFIGURE – LOCK – PANEL menu (menu ID 5100) provides the facility to "lock" the front panel. When the panel lock is "On", only the status displays and the CONFIGURE – LOCK menu are available.

It is also possible to "lock", i.e. prevent local user access, to the PRE-CORRECTION, TEST SIGNAL AND REFERENCE INPUT menu options, through the CONFIGURE – LOCK menu option. Note that these functions will still operate within the modulator, even though local user access is denied.

The CONFIGURE – AUTO ESCAPE MENU menu (menu ID 5200) allows the user to enable (ON) or disable (OFF) the return to the last active Status Display window (Chapter 4.3.3), from the Configuration Menu System (Chapters 4.3.4 and 4.3.4.1) when no key has been activated for 60 seconds.

The CONFIGURE – AUTO OPEN ALARM WINDOW menu (menu ID 5300) allows the user to enable (“ON”) or disable (“OFF”) the automatic opening of the alarm status window when there are changes in any of the alarm conditions.

The CONFIGURE –DISPLAY CONTRAST menu option (menu ID 5400) allows the user to observe the display contrast gradually change to decide what setting is best. When a suitable contrast is obtained, the “EXECUTE” button is pressed to save the setting. The CONFIGURE – DISPLAY CONTRAST menu (menu ID 5400) allows a similar operation, but without the “online” variation in contrast.

The CONFIGURE – SERIAL 1 menu (menu ID 5500) allows the user to set the baud rate for the serial communication interface SERIAL 1. Two sub menus are available: the SIO PRESETS sub menu (ID 5510) and the BAUD RATE sub menu (ID 5520). The SIO PRESETS sub menu allows the user to set the baud rate directly according to the specific application. The choices are: WebLink (57600), IMD Buster (57600), Software Upgrade (115200). The baud rate menu offers a general choice of baud rates (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200). Do notice that SERIAL 1 is not accessible via the rear panel connector when the WebLink option is installed. WebLink will be internally wired to the serial port no. 1 and the baud rate for SERIAL 1 should not be changed from the nominal setting (57600).

The CONFIGURE – SERIAL 2 menu (menu ID 5600) allows the user to set the baud rate for the serial communication interface SERIAL 2. Two sub menus are available: the SIO PRESETS sub menu (ID 5610) and the BAUD RATE sub menu (ID 5620). The SIO PRESETS sub menu allows the user to set the baud rate directly according to the specific application. The choices are: WebLink (57600), IMD Buster (57600), Software Upgrade (115200). The baud rate menu offers a general choice of baud rates (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200).

The CONFIGURE – DIAGNOSE – FACTORY RESET menu (menu ID 5730) performs the same initialisation as a factory reset (see Chapter 4.4) apart from the fact it does not carry out an initialisation of the log/event register. It resets all configurable menu and sub-menu parameters in the TRANSMISSION, ALARM and TEST SIGNAL menus, and some of the menu parameters in the SIGNAL and CONFIGURE menu options, to their default settings. The “bronze filled” items in the Operating Menu System Chart indicate which menu options are NOT reset.

The CONFIGURE – TX IDENT menu (menu ID 5800) allows the user to assign a unique identification number to the modulator for remote setting via the MIP of the optional SFN parameters tx_time_offset, tx_frequency_offset, and tx_power described in section 6 of the TS 101 191 standard. The number is as default set to 0. However, as the SFN adapter to address all transmitters in the network uses “0” as a broadcast address it is necessary to set a unique address to allow sending the optional data to a specific transmitter in the network.

The CONFIGURE – CLOCK menu (menu ID 5900) allows the user to set the time and date clock maintained by the instrument for stamping events in the event log and for indicating time and date when the instrument is powered up.

The CONFIGURE – INSTRUMENT OPTIONS – INSTALL OPTIONS menu (menu ID 5A20) displays the options key (16 digit number) that defines the functionality available in the particular

instrument in question. The menu allows furthermore the user to input a new options key if additional options are to be installed/enabled at a later date.

The CONFIGURE – STATUS MENU ID (menu ID 5B00) configures the manner in which the status menu ID shown in the bottom right hand corner of every Status Display window (See Chapter 4.3.3) is displayed. It can either be turned off (“Off”), flash, or be displayed as normal.

4.3.4.8 TEST SIGNAL Menu System (Menu ID 6000)

The TEST SIGNAL menu system is only available if the CONFIGURE – LOCK – TEST menu option (menu ID 5100) is “OFF”. In addition, the TEST SIGNAL status window is only available if a test signal has been selected from the TEST SIGNAL – SELECT TEST menu option (menu ID 6100). The default test signal mode is “OFF”

Sub menus are available for selecting a specific test signal (Single Carrier, -1 carrier, -50 carrier and TS Stuffing) and for setting parameters for a test signal where applicable (for example specification of which carrier to be removed with the –1carrier test signal).

The test signal functions are only for MFN mode. Per definition SFN mode does not allow transmission of signals that are not bit synchronous to the signal transmitted from the other transmitter of the network.

Single carrier:

The single carrier test signal is an off-line test signal (i.e. it interrupts the modulators data transmission). When the single carrier test signal is activated the normal DVB-T spectrum is substitutes for a single continuous sine wave located at the centre frequency of the normal in-service DVB-T spectrum. The RMS level of the sine equals the average RMS level in the full bandwidth of the normal DVB-T spectrum. The signal is therefore excellent for adjusting transmitter level and/or verifying frequency accuracy or phase noise performance for the modulator output.

-1 Carrier test signal

For special tests any single one of the carriers in the DVB-T spectrum can be switched off. This test signal is in principle an off-line test signal. However, as the FEC of the COFDM coding will normally cope with the loss of a single carrier without difficulty the signal can be activated during normal transmission with marginal influence to the performance (slight increase in BER may be noticed).

-50 Carrier test signal

To allow analysis of in-band intermodulation in a transmitter system 50 consecutive carriers in the DVB-T spectrum can be switched off. The location of the 50-carrier hole can freely be selected but typically the hole is placed at the centre of the spectrum. It is recommended to use this test signal only for off-line tests. However, in most cases the transmission service is maintained despite the loss of 50 carriers thanks to the FEC of the COFDM coding.

TS Stuffing

This test signal facilitates testing of a transmission systems IF and/or RF parameters even when no MPEG-2 input is available (MFN mode only). When the TS Stuffing signal is activated a pseudo random bit sequence as described in section 9.16.1 of the DVB-T Measurement Guidelines ETR 290 is transmitted.

4.3.4.9 RECEPTION Menu System (Menu ID 7000)

The RECEPTION menu is only available with the DVB-T Re-Modulator PT 5788 (RF Tuner must be enabled). The reception menu contains sub menus for user definition of the tuner reception frequency and bandwidth and for definition of the mode and function for the demodulator(s):

- **FREQUENCY** (sub-menu ID 7100): Allows user specification of the centre frequency for the DVB-T channel to be received. The default setting is 474MHz (CH E21). The range available is 30 – 954MHz in steps of 1Hz.
- **BANDWIDTH** (sub-menu ID 7200): Allows user specification of the IF filter bandwidth. The default setting is 8MHz. Selectable settings are 8 and 7 MHz. (6MHz bandwidth requires installation of additional filter option).
- **DEMODULATOR 1** (sub-menu ID 7300): contains sub menus for definition of the mode and function for demodulator number 1.
 - **FUNCTION** (sub-menu ID 7310): User definition of the function of Demodulator 1. Two choices are available: *Reception Demodulator* where the input for the demodulator is taken from the tuner module and *Output Monitor* where the input for the demodulator is taken from the output of the IF modulator module.
 - **BANDWIDTH** (sub-menu ID 7320): User definition of the bandwidth setting for Demodulator 1. The bandwidth must be set in accordance with bandwidth of the applied DVB-T signal. Default setting is 8MHz. Selectable settings are 8, 7 and 6MHz.
 - **PRIORITY** (sub-menu ID 7330): User definition of the virtual channel to be extracted from the DVB-T signal by hierarchical mode. Default setting is HP channel. Selectable settings are HP and LP.
 - **PARAMETER MODE** (sub-menu ID 7340): User definition of the method used for setting the reception parameters of the demodulator. Two choices are available: *Auto* mode where the demodulation parameters (Hierarchy, FFT, Code rate, constellation, guard interval and spectrum polarity) are automatically set by the demodulator in accordance with the received signal and *Manual* mode where the demodulation parameters must be set explicitly by the user. Default setting is Auto mode.
 - **DEFINE PARAMETERS** (sub-menu ID 7350): User definition of the demodulation parameters (this menu is only available if manual mode is selected).
 - o **Hierarchical mode** (Sub-menu ID 7351): User definition of the hierarchical mode of the received signal. Default setting is None hierarchical. Selectable settings are none, alpha-1, alpha-2, alpha-4.
 - o **IFFT** (Sub-menu ID 7352): User definition of the IFFT mode of the received signal. Default setting is 8K. Selectable settings are 2K and 8K.
 - o **Code rate** (Sub-menu ID 7353): User definition of the code rate of the received signal. Default setting is 2/3. Selectable settings are $\frac{1}{2}$ 2/3, $\frac{3}{4}$ 5/6 and 7/8.
 - o **Constellation** (Sub-menu ID 7354): User definition of the constellation type of the received signal. Default setting is 64QAM. Selectable settings are QPSK, 16QAM and 64QAM.
 - o **Guard** (Sub-menu ID 7355): User definition of the guard interval of the received signal. Default setting is 1/8. Selectable settings are $\frac{1}{4}$, 1/8, 1/16 and 1/32.

- o **Spectrum** (Sub-menu ID 7356): User definition of the spectrum polarity for of the received signal at the tuner input. Default setting is Normal (carrier 1 located at lowest frequency). Selectable settings are Normal and Inverted (carrier 1 located at highest frequency).
- **Reset UCE** (sub-menu ID 7360): This menu contains the reset function for the demodulator 1 UCE counter (counter value displayed in the Demodulator 1 bit error rate status display (index f2)).
- **DEMODULATOR 2** (sub-menu ID 7400): contains sub menus for definition of the mode and function for the demodulator number 2 (only available if Demodulator-2 option PT 8722 is installed).
 - **Reset UCE** (sub-menu ID 7410): This menu contains the reset function for the demodulator 1 UCE counter (counter value displayed in the Demodulator 1 bit error rate status display (index f2)).
 - **SETTINGS CONTROL** (sub-menu ID 7420): This sub menu allows the user to select whether Demodulator 2 shall automatically be synchronised to the setting of Demodulator 1 (*synchronisation ON*) or if the setting of demodulator 2 is to be explicitly set by the user (*synchronisation OFF*)
 - **BANDWIDTH** (sub-menu ID 7430): User definition of the bandwidth setting for Demodulator 1. The bandwidth must be set in accordance with bandwidth of the applied DVB-T signal. Default setting is 8MHz. Selectable settings are 8, 7 and 6MHz.
 - **PRIORITY** (sub-menu ID 7440): User definition of the virtual channel to be extracted from the DVB-T signal by hierarchical mode. Default setting is HP channel. Selectable settings are LP and HP. This menu is only available if one of the hierarchical modes is selected via the transmission parameter menu.
 - **PARAMETER MODE** (sub-menu ID 7450): User definition of the method used for setting the reception parameters of the demodulator. Two choices are available: *Auto* mode where the demodulation parameters (Hierarchy, FFT, Code rate, constellation, guard interval and spectrum polarity) are automatically set by the demodulator in accordance with the received signal and *Manual* mode where the demodulation parameters must be set explicitly by the user. Default setting is Auto mode.
 - **DEFINE PARAMETERS** (sub-menu ID 7460): User definition of the demodulation parameters (this menu is only available if manual mode is selected via sub menu 7450).
 - o **Hierarchical mode** (Sub-menu ID 7461): User definition of the hierarchical mode of the received signal. Default setting is None hierarchical. Selectable settings are none, alpha-1, alpha-2, alpha-4.
 - o **IFFT** (Sub-menu ID 7462): User definition of the IFFT mode of the received signal. Default setting is 8K. Selectable settings are 2K and 8K.
 - o **Code rate** (Sub-menu ID 7463): User definition of the code rate of the received signal. Default setting is 2/3. Selectable settings are $\frac{1}{2}$ 2/3, $\frac{3}{4}$ 5/6 and 7/8.
 - o **Constellation** (Sub-menu ID 7464): User definition of the constellation type of the received signal. Default setting is 64QAM. Selectable settings are QPSK, 16QAM and 64QAM.
 - o **Guard** (Sub-menu ID 7465): User definition of the guard interval of the received signal. Default setting is 1/8. Selectable settings are $\frac{1}{4}$, 1/8, 1/16 and 1/32.
 - o **Spectrum** (Sub-menu ID 7466): User definition of the spectrum polarity for of the received signal at the tuner input. Default setting is Normal (carrier 1

located at lowest frequency). Selectable settings are Normal and Inverted (carrier 1 located at highest frequency).

4.3.4.10 EVENT LOG Menu System (Menu ID 8000)

The event log menu system allows the user to observe the recorded events (sub menu ID 8100) and to clear the event log (sub menu ID 8200). When entering the event log system the menu will in addition to the two choices <VIEW> and <CLEAR> indicate the total number of events recorded since the event log was cleared.

```
-----
Event log      [8100: 67 Events]    ◀ ▶
<VIEW>  Clear
-----
```

When entering the event log VIEW display the last recorded event is displayed. The first display line indicates the event number and the time and date for the event. The second display line shows the identification number and name for the recorded event type plus when applicable additional information concerning the event.

```
-----
Event 67      2003-01-24,  17:34:36  ◀ ▲ ▶ E
2240 Sync    Unlock, HP
-----
```

By pressing the [LEFT] or [RIGHT] button the other events recorded in the log can be observed one-by-one. When pressing the [RIGHT] button when observing the last recorded event the display will wrap around to the first event which will always be the “log cleared” event:

```
-----
Event 0      2003-01-15,  16:44:43  ◀ ▲ ▶ E
1411 Log     Cleared, No info
-----
```

4.3.5 Configuring Parameters

4.3.5.1 Selection from Enumerated Values

```
-----
Signal, Input, HP, Primary    <2121> ◀ ▲ ▶ E
[DEMODULATOR] Inp A  Inp B  Inp C  In...
-----
```

(the square brackets flash at approx. 2 Hz)

The current value is shown as the first item in the list, in capitalised format and in square brackets.

Navigating:

- ◀ Scrolls the previous item into the “current position”.
- ▶ Scrolls the next edit item into the “current position”.
- ▼ No effect.
- ▲ Aborts editing and moves up one menu level.
- <EXECUTE> Saves the “current” item as the active parameter and returns to the menu level above.

4.3.5.2 Editing of Numerical Values

```
-----
Cfg. TX Ident          <5800> ◀ ▶ E
65, 335              [0 . . 65, 535]
-----
```

(the character 5 alternates between '5' and '_' at approximately 2 Hz)

The configurable value that appears on the display is always the current value and the cursor is always initially positioned on the last digit. The valid range is displayed in square brackets on the bottom line's right hand side.

Navigating:

- ◀ Positions the cursor on the previous character. Jumps to the last character when the cursor is on the first.
- ▶ Positions the marker on the next character. Jumps to the first character when the marker is on the last.
- ▼ Decrements the value at the cursor's position. If the value is '0', using the ▼ button causes the value to change to '9'. If the value can be a negative number, using the ▼ button in the first character space toggles between the negative sign (-) and a blank (positive).
- ▲ Increments the value at the cursor's position. If the value is '9', using the ▲ button causes the value to change to '0'. If the value can be a negative number, using the ▲ button in the first character space toggles between the negative sign and a blank (positive).

EXECUTE Completes editing.

Note that if a numerical configurable item has a minimum and/or maximum value, the user cannot modify the value to below the minimum or above the maximum values.

If the value has been modified, the following window will be displayed on pressing the EXECUTE button, requesting validation:

```
-----
SAVE Changes?          (YES=execute) ◀ ▶ E
60, 000                [0 . . 65, 535]
-----
```

(the character = flashes at approximately 2 Hz)

Again, the valid range is displayed in square brackets on the bottom line's right hand side.

Navigating:

- ◀ Aborts any changes made and moves up one menu level.
- ▶ Aborts any changes made and moves up one menu level.
- ▼ Aborts any changes made and moves up one menu level.
- ▲ Aborts any changes made and moves up one menu level.
- EXECUTE Saves the edited value to memory and returns to the menu level above.

4.3.5.2.1 Instantly Updated Parameters

In some cases the parameter is updated instantly in the hardware as the changes are made to a parameter. These menu options are characterised by a flashing 'E' whilst in the display of the configurable value.

```

-----
Sig. Out. RF Level (dB)      <2250> ◀ ▶ E
-0.07                        [-10.0 .. 0.0]
-----

```

(the characters **E** and **7** flash at approximately 2 Hz)

In this case all the buttons perform the same functions as when editing a configurable value.

Important: As the parameter is instantly updated in the hardware, if it has been modified and there is a power outage or the CONFIGURE – AUTO ESCAPE MENU is set to “On” and the display times out (see Chapter 4.3.4.7) the new value will be automatically retained.

If the value has been modified and the EXECUTE button is depressed, the following window will be displayed, requesting confirmation:

```

-----
CONFIRM Changes?           (YES=execute) ◀ ▶ E
-0.05                      [-10.0 .. 0.0]
-----

```

(the characters **E** and **=** flash at approximately 2 Hz)

As before, all buttons perform the same functions as when saving a change and again if the display times out or there is a power outage the new value will be retained.

4.3.5.3 Editing of Text

```

-----
Preset, Name: #1           <4310> ◀ ▶ E
Hove Tx 12
-----

```

(the character **H** alternates between 'H' and '_' at approximately 2 Hz)

The current text string is shown as the editable value. The characters A..Z, a..z, 0..9, - (minus), _ (underscore) and " (space) are supported.

Navigating:

- ◀ Positions cursor on previous character.
- ▶ Positions cursor on next character.
- ▼ Decrements the current edit item in a circular manner.
- ▲ Increments the current edit item in a circular manner.
- EXECUTE Completes editing.

If the text has been changed, the following window will be displayed requesting validation:

```

-----
SAVE Changes?             (YES=execute) ◀ ▶ E
Preset 2
-----

```

(the character **=** flashes at approximately 2 Hz)

Navigating:

- ◀ Aborts any changes made and moves up one menu level.
- ▶ Aborts any changes made and moves up one menu level.
- ▼ Aborts any changes made and moves up one menu level.
- ▲ Aborts any changes made and moves up one menu level.
- EXECUTE Saves the edited value to memory and returns to the menu level above.

4.3.5.4 Editing of Percentage Values

```

-----
Cfg. Display Contrast          <5400> ◀ ◆ ▶ E
████████████████████████████ 86%
-----

```

(the character '%' flashes at approximately 2 Hz)

The bar gives an indication of the current value, with the actual value displayed after the bar. Every full box represents 25% of the maximum percentage.

Navigating:

- ◀ Decrements the value. Wraps round to the max. percentage value after '0'.
- ▶ Increments the value. Wraps round to '0' after max. percentage value.
- ▼ Decrements the value. Wraps round to max. percentage value after '0'.
- ▲ Aborts editing and moves up one menu level.
- EXECUTE Saves the current edited value and returns to the menu level above.

4.4 Factory Reset

Carrying out a factory reset resets all configurable menu and sub-menu parameters in the TRANSMISSION, SIGNAL, ALARM and TEST SIGNAL menus, and some of the menu options in the CONFIGURE menu, to their default settings. It does NOT overwrite the "User Name" and CONFIGURE – CLOCK parameters, nor does it overwrite the parameters stored in the system PRESET locations or those stored in the non-linear and linear pre-corrector preset locations.

In addition a factory reset does not make any changes to the non-configurable menu items shown in the Operating Menu System Chart in the CONFIGURE – DIAGNOSE – SYSTEM IDENTITY menu in double quotes (" ").

The "bronze filled" menu items, in the Operating Menu System Chart in Chapter 4.3.2, represent those options that are NOT reset. In addition, a factory reset initialises the log/event system, which is only accessible by remote control.

The factory reset function should only be employed in very unusual situations.

There are two ways in which to carry out a factory reset locally.

The first, most simple, method is to use the CONFIGURE – DIAGNOSE – FACTORY RESET and CONFIGURE – DIAGNOSE – INITIALISE LOG/EVENT facilities in the menu system. See Chapter 4.3.4.7.

The second method is to simultaneously depress the ◀, ▶ and EXECUTE buttons whilst switching the modulator on. On doing this, the following window is displayed:

```

-----
*****  DEFAULT  DATA  LOADED  *****
=-              Release Keys              -=
-----

```

On releasing the keys, the following window is displayed for approximately 1 second (LUI – Local User Interface):

```

-----
*****      REBOOTING      *****
              LUI Factory Reset
-----

```

After this the system reboots and the display reflects this. All system settings, as mentioned earlier, return to their default values (shown as **bold** parameters in the menu system chart in Chapter 4.3.2).

In an SFN system, the following variables are re-configured on carrying out a Factory Reset:

- The SFN local delay is reset to 0
- The SFN maximum delay is reset to 990 msecs
- The SFN optional time, frequency and power offsets are reset to 0

Note as a result of the SFN optional time offset being stored in non-volatile memory, if the instrument is moved from a location (stream) where optional data information was used to one where optional data information is not used, it is necessary to carry out a Factory Reset to reset this optional time offset parameter to 0.

4.5 SFN Mode of Operation

Special attention should be drawn to the following points regarding an SFN system.

SFN Mode and External 10 MHz Reference (Preferred mode of operation)

If the SFN system is set up with the 10 MHz reference source set to “External” and the external reference signal is lost, the Reference Loss alarm will occur and the output signal is muted.

Using this reference setting in SFN will provide a system that mutes the output in case of loss of frequency reference.

SFN Mode and Internal 10 MHz Reference

As the internal 10 MHz reference signal is asynchronous to the network, it should not be used as a reference when operating an SFN system.

If the SFN system is set up with an internal 10 MHz reference signal, there will be no monitoring of the external reference signals (and therefore no alarm) as they will not be used in the system.

Operating in SFN mode will normally always require that the modulator is locked to a network-wide, common frequency reference. Seen in that perspective it is not recommended that the INTERNAL REFERENCE setting and the SFN mode are combined, although it is technically possible.

SFN Mode and Auto 10 MHz Reference

When the SFN system is set up with the 10 MHz source on auto-switching (“Auto”) and the external signal is lost, the 10 MHz reference switches to the internal source and there is an

alarm to warn the user that the (external) reference signal has been lost. Note, as before, there is no automatic muting of the output signal, whilst the internal 10 MHz signal is in operation. A short discontinuity in the output signal will occur when the instrument switches from the external to internal frequency reference.

Once the external reference has been re-established the 10 MHz reference switches back to the external source and the alarm is removed. The output signal is muted for 2 secs on switching back to the external reference source, which is seen as a short discontinuity of the output signal.

Using this reference setting in SFN will provide a system that continues operation in SFN in case of loss of frequency reference. This may disturb some receivers located in transmitter overlap regions, as a receiver may receive two non-synchronized SFN signals on the same transmit frequency.

4.6 Fatal Alarms

There are a two possible "FATAL ALARM" messages that may be displayed by the modulator.

4.6.1 Modulator Board Controller Not Responding

If the modulator board stops responding, or does not respond during the start-up process, the following window will be displayed:

```
-----  
***** F A T A L   E R R O R   *****  
=- BACK-END CONTROLLER NOT RESPONDING -=  
-----
```

The first line flashes. If the back-end controller starts responding or if the user presses the "EXECUTE" button, the system automatically resets, and the system tries to recover.

4.6.2 Instrument Too Hot

Temperature sensors are mounted on the printed circuit boards; one on the master controller board, two on the modulator board and one on the RF converter board.

Two alarm limits (lower and upper) are set for each sensor. On rising above a lower alarm level, an alarm pending message is provided, with an indication to which temperature sensor is causing this condition. If any of the board temperatures rise above their pre-defined upper limits, the following display is shown (the first line flashes):

```
-----  
***** F A T A L   E R R O R   *****  
=- Temperature too high in Instrument -=  
-----
```

Local user access to the front panel controls is prohibited until the "EXECUTE" button is pressed, which causes the system to automatically reset. At this point the system tries to recover.

4.7 Error Handling and Codes

If any system errors arise, the alarm status display will list the alarm ID number to indicate the source of the error. Please contact ProTelevision Technologies for advice.

5 Remote Interface

5.1 General Description

The serial remote allows control of virtually all functions in the modulator as well as the monitoring of various instrument settings.

The serial remote operates electrically as an RS 232C communication port. The settings for the RS 232 communication port can be set up using the front panel of the modulator (see Chapter 4.3.2) or SCPI commands.

The PT 5780 communication protocol uses the:

- ♦ SCPI 1995.0:
Standard Commands for Programmable Instruments, Vol I-IV. This protocol is based on the IEEE 488.2 (IEEE Standard Codes, Formats, Protocols, and Common Commands).

In the following description of the commands a basic knowledge of the operation of the instrument is assumed.

To use the serial remote a basic understanding of SCPI programming and computer control is also recommended. The paper: "A Beginner's Guide to SCPI" by Barry Epler, Hewlett-Packard Press®, 1991 can be used to gain a basic knowledge of the ideas behind the SCPI system.

5.2 General Description of the Interface Syntax

5.2.1 General Information

The remote interface system is organized in a tree structure. In order to access commands lower in the tree or in different branches the entire command string should be used. Indentation is used to indicate the root level and the branches, with the highest level to the left. The complete command always includes all the root levels.

Enter more than one command on a line by using a semicolon (";") as a divider. If the next command is part of the same command system the separation is a ";" only. If the next command is part of another command system the ";" is followed by a ":". A command line is terminated by <LF>.

The valid parameter ranges are shown in the command tables. Non-valid values generate an internal error message.

5.2.2 Syntax of Program Messages

A command or query command is called a program message unit. Such a program message unit consists of a header or a header separated by a space from one or more parameters. The program header separator between the header and the first parameter must be at least one “white space” character. The header consists of one or more mnemonics (key words) describing the command. The parameters in a message unit are also referred to as “Data Elements”. They are mutually separated by a comma (,), which is referred to as “Data Separator”. Furthermore the following rules are valid:

- ♦ Any one of the “white space” characters (decimal values 0..9, 11.. 32) may:
 - precede a header
 - precede the Message Terminator
 - be placed in between the header and the parameter
 - be placed in between two consecutive parameters
- ♦ String data in a parameter must be specified between quotes. A quote may either be an ASCII “single quote” (decimal 39) or an ASCII “double quote” character (decimal 34)
- ♦ One or more program message units (commands) may be sent within a single program message. Program message units are separated by a semicolon (;). A message of one or more units is terminated by a program message terminator
- ♦ The program message terminator must be the following code:
 - LF <line feed> (decimal10) code

Basically there are two types of program headers:

- ♦ Compound headers
 - Commands have a compound header consisting of one or more key words (mnemonics), mutually separated by a colon (:) character. Such as a colon may also precede the header
- ♦ Command headers
 - The program messages that are standardized are called common commands. Their headers always start with an asterisk (*) character

Each keyword in a compound command header represents a node in the command tree. The left most key word is the root node, representing the highest hierarchical level in the command tree. Subsequent keywords represent sub nodes under the root node.

5.2.3 Syntax of Response Messages

The response to a query command is a response message unit, consisting of one or more parameters (data elements). Successive parameters are separated by a comma (,). All command queries end with a question mark (?), with no space between the command header and the question mark. If a parameter is required in a query command, it is placed after the question with a space between the two, for example:

SYST:PRES:NAME? 2

where this command requests the name of preset number 2.

If there are multiple queries in a program message, the multiple response message units are grouped together in the corresponding response message.

Response message units are separated by a semicolon (;) and are terminated by a response message terminator.

The instrument will always send the response data in capitals. Headers are not sent in the response messages, only the parameters.

5.2.4 Long and Short Form

Program messages may be sent in either long or short form.

- ♦ The long form is the full word
- ♦ The short form is usually the first four characters of the long form

The short form in a syntax specification is shown in upper case, and the remaining part of the long form is shown in lower case characters.

Note: Upper and lower case, as used in syntax specification, is only a notation habit to facilitate distinction between long and short form. The instrument itself does not differentiate between upper and lower case characters.

In program messages, either the long or short form may be used in any mix of upper or lower case characters. There is no semantic difference between upper and lower case in program messages.

5.2.5 Syntax Elements

;	Semicolon separates two commands on a command line and does not change the path.
:	Colon separates the keywords of a command. In a command line, a colon “:” after a separating semicolon “;” indicates the root control level. Moves down for level.
,	Comma separates parameters.
?	Question mark identifies a query command. (Query commands are formed by adding a question mark to the header command).
*	Asterisk identifies a common command. (Common commands consists of a header command preceded by an asterisk and possibly followed by one or more parameters)
' or "	Single or double quote introduces and terminates a character string.
Space	Space character separates the command header and parameters.
	Parameters divided by a “ ” indicates an “or” selection between the values shown. Only one value may be used at a time.
[xxxx]	Square brackets indicate an optional specific string parameter used by some command systems.

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6 RS232 Communication

6.1 References

- IEEE 488.2-1987: IEEE Standard Codes, Formats, Protocols, and Common Commands.
- SCPI 1995.0: Standard Commands for Programmable Instruments, Vol I-IV.
- "A Beginner's Guide to SCPI", Barry Epler, HEWLETT-PACKARD PRESS, 1991.
- <http://www.scpiconsortium.org/>
- http://ourworld.compuserve.com/homepages/acea/Scpi_uk.htm

6.2 Commands Explanation

6.2.1 Mandated Commands

Mandated commands are those commands that are necessary for compliance with the SCPI standard.

- ***CLS CLEAR STATUS**

Clears the instrument's error queue. This command should also reset the event registers, but this has NOT been implemented.

- ***ESE STANDARD EVENT STATUS ENABLE COMMAND**

The device accepts this command but does not act on it.

- ***ESE? STANDARD EVENT STATUS ENABLE QUERY**

The device accepts this query command but does not act on it. Note that this query command responds with a "0".

- ***ESR? STANDARD EVENT STATUS REGISTER QUERY**

The device accepts this query command but does not act on it. Note that this query command responds with a "0".

- ***IDN? IDENTIFICATION QUERY**

Provides a unique identification of the modulator. The response contains four fields:

Field 1: Company name

Field 2: Product name

Field 3: Instrument serial number

Field 4: Software release

Example:

**IDN?*

Response: *PTV,PT5780,KU123456,SW01.0*

- ***OPC OPERATION COMPLETE**

The device accepts this command but does not act on it.

- ***OPC? OPERATION COMPLETE QUERY**

The device accepts this query command but does not act on it. Note that this query command responds with a "0".

- ***RST RESET**

Reboots the device, leaving all configurable parameter settings as they were.

- ***SRE SERVICE REQUEST ENABLE**

The device accepts this command but does not act on it.

- ***SRE? SERVICE REQUEST ENABLE QUERY**

The device accepts this query command but does not act on it. Note that this query command responds with a "0".

- ***STB? READ STATUS BYTE QUERY**

The device accepts this query command but does not act on it. Note that this query command responds with a "0".

- ***TST? SELF-TEST QUERY**

The device accepts this query command but does not act on it.

- ***WAI WAIT TO CONTINUE**

The device accepts this command but does not act on it.

6.2.2 Required Commands

Required commands are those that required in all SCPI compliant instruments.

6.2.2.1 SYSTem commands

- **SYSTem:ERRor?**

Query command for reading an SCPI error message from the error queue. See Chapter 6.4 for a complete list of error codes.

Example:

SYST:ERR?

Response: *-102,"Syntax error"*

- **SYSTem:VERSion?**

Query command for reading the SCPI version to which the RS232 implementation complies.

Example:

SYST:VERS?

Response: *1995.0*

6.2.2.2 STATus commands

- **STATus:OPERation[:EVENT]?**

The device accepts this command but does not act on it.

- **STATus:OPERation:CONDition?**

The device accepts this query command but does not act on it.

- **STATus:OPERation:ENABLE**

The device accepts this command but does not act on it.

- **STATus:QUESTionable[:EVENT]?**

The device accepts this query command but does not act on it.

- **STATus: QUESTionable:CONDition?**

The device accepts this query command but does not act on it.

- **STATus: QUEStionable:ENABLE**

The device accepts this command but does not act on it.

- **STATus: PRESet**

The device accepts this command but does not act on it.

6.2.3 Instrument Commands

6.2.3.1 DIAGnostic commands

- **DIAGnostic:DISPlay**

The device accepts this command but does not act on it.

- **DIAGnostic:ERRorqueue:RESet**

The device accepts this command but does not act on it.

Command to reset the internal error queue of the modulator. The error queue is a circular queue consisting of a number of entries.

- **DIAGnostic:ERRorqueue?**

The device accepts this command query but does not act on it.

Command to read an entry in the error queue and point to next entry in the error queue. This command should be executed five times to read the complete error queue.

6.2.3.2 SYSTem commands

- **SYSTem:PRESet[:RECall]**

Command to recall a stored modulator configuration from a preset. The configuration settings that a preset saves are listed in Chapter 4.3.4.6. There are 10 user presets, from 1 to 10, available.

Example:

SYST:PRESet:REC 3

Recall preset 3 in the modulator

SYST:PRESet:REC?

Response: 3, i.e. preset 3 is currently active

- **SYSTem:PRESet:STORe**

Command to store the present modulator configuration in a preset. Ten user presets from 1 to 10 are available. There is no equivalent query command.

Example:

SYST:PRESet:STOR 2

Store configuration in preset 2

- **SYSTem:PRESet:NAME**

Command for naming these user presets. Ten user presets from 1 to 10 are available. The number of characters in the name are limited to sixteen (16).

Example:

SYST:PRESet:NAME 2,"WHAT"

Name preset number 2 "WHAT"

SYST:PRESet:NAME? 2

Response: "WHAT"

- **SYSTem:DATE**

Command to amend the system date using the format yyyy,mm,dd.

Example:

SYST:DATE 2001,6,28

Store 28 June 2001 as the current date

SYST:DATE?

Response: 2001,6,28

- **SYSTem:TIME**

Command to amend the system time using the format hh,mm,ss.

Example:

SYST:TIME 14,20,36

Store 14:20:36 as the current time

SYST:TIME?

Response: 14,20,36

- **SYSTem:OINStalled**

This commands changes the installed hardware/software options and can only be used with a coded string, available from ProTelevision Technologies. The options are coded in a 16-digit character string.

Example:

SYST:OINS "AAAA.AAAA.AAAA.AAAA"

Change the options available for use

SYST:OINS?

Response: AAAA.AAAA.AAAA.AAAA

- **SYSTem:OUSed**

Command to enable/disable the installed hardware/software options in an "On" (1), "Off" (0) format. There can be up to 32 hardware/software options, however at the moment there is a maximum of 11 possible options, which are arranged as shown in the table below.

Option No.	Option
1	Demodulator, check
2	Signal input 3+4
3	RF Converter
4	RF Tuner
5	Alarm relay 3..8
6	For future use
7	For future use
8	For future use
9	For future use
10	For future use
11	For future use
12	For future use
13	For future use
14	For future use
15	For future use
16	For future use
17	SFN
18	Hierarchical
19	Pre-correction, non-linear

Option No.	Option
20	Pre-correction, linear
21	Test Picture Input
22	6 MHz bandwidth (def: 7+8)
23	For future use
24	For future use
25	For future use
26	For future use
27	For future use
28	For future use
29	For future use
30	For future use
31	For future use
32	For future use

Example:

SYST:OUS "11000000000000001110000000000000"

Enable options 1 (demodulator, internal check), 2 (signal inputs C & D), 17 (SFN), 18 (Hierarchical) and 19 (Non linear pre-correction).

SYST:OUS?

Response:

"11000000000000001110000000000000"

- **SYSTem:COMMunicate:SERial:TRANsmit:BAUD**

Command to set or query the baud rate on the RS232 serial ports 1 and 2. Baud rates of 1200, 2400, 4800, 9600, 19200 and 115200 are possible.

Example:

SYST:COMM:SER:TRAN:BAUD 1,19200

Set a baud rate of 19200 on RS232 port 1.

SYST:COMM:SER:TRAN:BAUD? 1

Response: *19200*

- **SYSTem:FRESet**

Command to carry out a factory reset of the device. See Chapter 4.4 for details of system parameters that are reset on performing a factory reset. There is no associated query command.

Example:

SYST:FRES

Carry out a factory reset.

6.2.3.3 USER commands

- **USER:NAME**

Command for naming the instrument, using a maximum of 16 characters. This name is the site specific identification displayed during start-up. Carrying out a factory reset does not change this name.

Example:

USER:NAME "Mulholland-CH5"

Sets the instrument's name to "Mulholland-CH5".

6.2.3.4 DISPlay commands

- **DISPlay:CONTRast**

Adjusts the display contrast in percentage terms.

Example:

DISP:CONT 20

Set the display contrast to 20%.

DISP:CONT?

Response: *20*

6.2.3.5 INPut commands

- **INPut:ASWitch**

Command for automatically switching between the primary & secondary inputs. The default setting is such that this facility is turned off.

Example:

INP:ASW off

Do not automatically switch between the primary and secondary inputs.

INP:ASW?

Response: *OFF*

- **INPut:PRIMary**

Command for selecting the primary input from the following choices: A, B, C, or D. However note that some choices are only available if the relevant hardware/software options were purchased.

- For selections C and D – Additional signal inputs 3 and 4 need to have been purchased.
- When the SPI LVDS input option is installed the SPI LVDS input is identified as input "C")

In addition if the hierarchical version of the modulator was purchased, it would also be possible to select both high and low priority primary inputs.

Example for non-hierarchical version:

INP:PRIM A

Select primary input A.

INP:PRIM?

Response: *A,B*

The second parameter should be ignored in this case (non-hierarchical version).

Example for hierarchical version:

INP:PRIM A,B

Select inputs A (high priority) and B (low priority).

INP:PRIM?

Response: *A, B*

- **INPut:SECOndary**

Command for selecting the secondary input from the following choices: A, B, C, or D, However note that some choices are only available if the relevant hardware/software options were purchased.

- For selections C and D – Additional signal inputs 3 and 4 need to have been purchased.
- When the SPI LVDS input option is installed the SPI LVDS input is identified as input "C").

Again if the hierarchical version of the modulator was purchased, it would also be possible to select both high and low priority primary inputs.

Example for non-hierarchical version:

INP:SEC A

Select secondary input A.

INP: SEC?

Response: *A*

Example for hierarchical version:

INP: SEC A,B
INP: SEC?

Select inputs A (high priority) and B (low priority).
Response: *A, B*

- **INPut:REFeRence:SOURce**

Command for selecting the 10 MHz input reference source from AutoDetect, External or Internal.

Example:

INP:REF:SOUR INT
INP:REF:SOUR?

Select an internal 10 MHz reference source.
Response: *INTERNAL*

- **INPut:REFeRence:PPS**

Command for selecting the 1 PPS Impedance input reference signal, choosing between a 50 Ω or high impedance signal.

Example:

INP:REF:PPS O_50
INP:REF:PPS?

Select 50 Ω 1PPS input reference signal
Response: *O_50*

- **INPut:REFeRence:MHZ**

Command for selecting the 10 MHz impedance input reference signal, choosing between a 50 Ω or high impedance signal.

Example:

INP:REF:MHZ HIMP
INP:REF:MHZ?

Select a high impedance 10MHz reference signal.
Response: *HIMPEDANCE*

- **INPut:REFeRence:PPSTlevel**

Command for selecting the 1 PPS trigger level. A range of 0 to 3.5 V is available.

Example:

INP:REF:PPST 0.4
INP:REF:PPST?

Select a 1PPS trigger level of 0.4 V.
Response: *0.4*

- **INPut:REFeRence?**

Query command only. Provides a list of the three above parameters, i.e. source, 1 PPS impedance, 10 MHz impedance and 1 PPS trigger level.

Example:

INP:REF?

Response: *INTERNAL, O_50, HIMPEDANCE, 0.4*

- **INPut:BUFFerfill?**

Query command only. Provides the transport stream buffer fill indicator in terms of number of packages. This command is applicable to either the single signal in a non-hierarchical system or high priority signal in a hierarchical system.

Example:

INP:BUFF?

Response: *1*

- **INPut:BUFFerfill:HP?**

Query command only. Provides the transport stream buffer fill indicator for the high priority signal in a hierarchical system, in terms of number of packages.

Example:

INP:BUFF:HP?

Response: *1*

- **INPut:BUFFerfill:LP?**

Query command only. Provides the transport stream buffer fill indicator for the low priority signal in a hierarchical system, in terms of the number of packages.

Example:

INP:BUFF:LP?

Response: *0*

- **INPut:TXIDent**

Command for selecting the address for receiving optional MIP data. This command is only available in SFN versions of the modulator. A valid address between 0 and 65535 can be selected (address "0" is reserved for broadcasting messages from the SFN Adapter. To be able to address the specific modulator in question a unique address in the range 1 – 65535 must be selected).

Example:

INP:TXID 25

Select address 25.

INP:TXID?

Response: *25*

6.2.3.6 OUTPut commands

- **OUTPut:MODE:IFFT**

Command to select the FFT size from either 2k or 8k.

Example:

OUTP:MODE:IFFT F2K

Set system for 2k IFFT

OUTP:MODE:IFFT?

Response: *2K*

- **OUTPut:MODE:CODerate**

Command to select the code rate (high priority if hierarchical option of modulator). Parameter choices are $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{6}$, or .

Example:

OUTP:MODE:COD R1_2

Set code rate to $\frac{1}{2}$

OUTP:MODE:COD?

Response: *R1_2*

- **OUTPut:MODE:LPCoderate**

Command to select the low priority code rate. This command is only available if the hierarchical option was purchased with the modulator. Choices of code rate are $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{6}$, or .

Example:

OUTP:MODE:LPC R1_2

Set low priority code rate to $\frac{1}{2}$

OUTP:MODE:LPC?

Response: *R1_2*

- **OUTPut:MODE:CONStell**

Command to set the constellation. Parameter choices are QPSK, QAM16 and QAM64.

Example:

OUTP:MODE:CONS QPSK

Set constellation to QPSK.

OUTP:MODE:CONS?

Response: *QPSK*

- **OUTPut:MODE:GUARd**

Command to set the guard interval. Parameter choices of guard interval are $\frac{1}{4}$, $\frac{1}{16}$ and $\frac{1}{32}$.

Example:

OUTP:MODE:GUAR G1_4

Set guard interval to $\frac{1}{4}$.

OUTP:MODE:GUAR?

Response: *G1_4*

- **OUTPut:MODE:HIERarchy**

This command is only available in the hierarchical version of the modulator. Alpha parameter choices are 1, 2 or 4. The hierarchical mode can also be set to NONE with this command.

Example:

OUTP:MODE:HIER H_2

Set hierarchical alpha parameter to 2.

OUTP:MODE:HIER?

Response: *2*

- **OUTPut:MODE:TSEnable**

This command is only available in the SFN version of the modulator. The command is used to set the transport stream control on or off. Setting the TS control off allows the user to configure the transmission mode settings when the information is not available in the transport stream.

Example:

OUTP:MODE:TSEN ON

Set transport stream control ON.

OUTP:MODE:TSEN?

Response: *ON*

- **OUTPut:MODE?**

Query command to retrieve the output mode parameters: Hierarchical mode, IFFT, code rate(s), constellation, guard interval and SFN TS control.

Example:

OUTP:MODE?

Response: *NONE,F8K,R7_8,QAM64,G1_32,OFF*

- **OUTPut:IF:FREQency**

This command is used to set the IF value in the IF version of modulator. The frequency range possible is 35 to 37 MHz in 1 Hz steps. Values entered can be different units; Hertz, kHz, MHz, GHz or "to the power of" format. The response units are always Hertz. Note that the command :OUTPut:FREQency could also be used – see this command description below.

Example of Hertz format:

OUTP:IF:FREQ 36150000

Set IF to 36.15 MHz.

OUTP:IF:FREQ 36e6

Set IF to 36 MHz.

OUTP:IF:FREQ 36000khz

Set IF to 36 MHz.

OUTP:IF:FREQ 36.15mhz

Set IF to 36.15 MHz.

OUTP:IF:FREQ?

Response: *36150000*

- **OUTPut:IF:LEVel**

This command is used to set the IF level in the IF version of modulator. The level range possible is -2 to 8 dB in 0.1 dB steps. Note that the command :OUTPut:LEVel could also be used – see this command description below.

Example

OUTP:IF:LEV -1.0

Set level to -1dB.

OUTP:IF:LEV?

Response: -1.0

- **OUTPut:RF:FREQuency**

This command is used to set the RF value in the RF version of modulator. The frequency range possible is 30 to 1000 MHz in 1 Hz steps. Values entered can be different units; Hertz, kHz, MHz, GHz or "to the power of" format. The response units are always Hertz. Note that the command :OUTPut:FREQuency could also be used – see this command description below.

Example of Hertz format:

OUTP:RF:FREQ 64025000

Set RF to 64,025 MHz.

OUTP:RF:FREQ 64e6

Set RF to 64 MHz.

OUTP:RF:FREQ 64000khz

Set RF to 64 MHz.

OUTP:RF:FREQ 64.025mhz

Set RF to 64,025 MHz.

OUTP:RF:FREQ?

Response: *64025000*

- **OUTPut:RF:LEVel**

This command is used to set the RF level in the RF version of modulator. The level range possible is -10 to 0 dB in 0.1 dB steps. Note that the command :OUTPut:LEVel could also be used – see this command description below.

Example

OUTP:RF:LEV -1.5

Set RF level to -1.5 dB.

OUTP:RF:LEV?

Response: -1.50

- **OUTPut:FREQuency**

Command to set the output frequency value. The output frequency set would be the IF value for the IF version of the modulator and RF value for the RF version

Example for IF system:

OUTP:FREQ 36.150mhz

Set the IF frequency to 36.150 MHz.

OUTP:FREQ?

Response: *36150000*

Example for RF system:

OUTP:FREQ 474mhz

Set the RF frequency to 474.00 MHz.

OUTP:FREQ?

Response: *474000000*

- **OUTPut:LEVel**

Command to set the output level. The output level set would be the IF level for the IF version of the modulator and the RF level for RF version. The level is set in dB relative to nominal output level.

Example

OUTP:LEV 0.0

Set level to 0 dB.

OUTP:LEV?

Response: *0.0*

- **OUTPut:CRASter**

Command to select between the fixed ITU UHF, ITU VHF, ITU UHF and VHF channel rasters and the user programmable channel raster (UCHannel). Applicable only if the RF converter is installed and enabled.

Example:

OUTP:CRAS UCH

Select the user defined channel raster.

OUTP:CRAS?

Response: *UCHANNEL*

- **OUTPut:VSUBsystem**

Command to select the VHF standard from either standard B, standard L or standard I. Applicable only if the VHF or the UHF and VHF channel raster options are selected.

Example:

OUTP:VSUB vhfB

Select standard B

OUTP:VSUB?

Response: *VHFB*

- **OUTPut:UCDefinition**

Command for user channel raster definition with the first parameter specifying the start channel number and the second parameter specifying the base frequency. Applicable only if the RF converter is installed and enabled and the user defined channel raster is selected.

The format of the command is as follows:

:OUTP:UCD <start channel no.>, <base frequency>

where

<start channel no.> is the channel number of the first channel (1 - 99)

<base frequency> is start frequency for the band, i.e. the lower edge of the first channel

Example:

OUTP:UCD 28,526mhz

Select User channel raster starting with channel number 28, lower edge of band being 526MHz.

OUTP:UCD?

Response: *28,526000000*

- **OUTPut:CHANnel**

Command to select the output channel number. The raster to be used must be selected in advance with the OUTPut:CRASter command. Applicable only if the RF converter is installed and enabled.

Valid channels numbers are dependent on the channel raster selected:

ITU VHF with standard L:	0 to 5	Bandwidth of 7 Hz
ITU VHF with standard B:	5 to 12	Bandwidth of 8 Hz
ITU VHF with standard I:	1 to 6	Bandwidth of 8 Hz
ITU UHF:	21 to 69	Bandwidth of 8 Hz
User Defined:	0 to 99	Bandwidth – user defined

Example

OUTP:CHAN 21

Set output channel 21.

OUTPCHAN?

Response: *21*

- **OUTPut:BANDwidth**

Command to select the output channel bandwidth. Parameters available for this command are 6, 7 and 8 MHz. However the 6 MHz parameter option is only available if the 6 MHz option is installed and enabled in the modulator.

Example:

OUTP:BAND 7

Select a 7 MHz bandwidth.

OUTP:BAND?

Response: 7

- **OUTPut:WINDow:ENABLE**

Command for enabling (ON) and disabling (OFF) the spectrum window filter.

Example:

OUTP:WIND:ENAB ON

Activate spectrum window filter.

OUTP:WIND:ENAB?

Response: ON

- **OUTPut:WINDow:ROLLoff**

Command for setting the spectrum window filter roll-off. The parameter choices are $\frac{1}{64}$, $\frac{1}{128}$, $\frac{1}{256}$ and $\frac{1}{512}$.

Note: The parameter $\frac{1}{x}$ specifies the proportion out of the total number of symbol samples (useful symbol + guard interval) that are used for creating the smooth transition between consecutive symbols. The largest proportion ($\frac{1}{64}$) gives the highest sideband suppression and the lowest proportion ($\frac{1}{512}$) gives the lowest suppression. There is a trade off between useful guard interval and sideband suppression.

Example:

OUTP:WIND:ROLL W1_64

Set window filter roll off to 1/64.

OUTP:WIND:ROLL?

Response: W1_64

- **OUTPut:WINDow?**

Query command to list the spectrum window filter and the spectrum window filter roll off settings.

Example:

OUTP:WIND?

Response: ON, W1_64

- **OUTPut:POLarity**

Command to set the spectrum polarity to either normal or inverted.

Example

OUTP:POL INV

Invert spectrum.

OUTP:POL?

Response: INV

- **OUTPut:PEAK:CLIPping**

Command to set the signal peak clipping (-10 to 0 dB) . The peak clipping affects the back-off (headroom) as follows: Back-off = 17dB – Peak-clipping – Gain. For example, by 5dB peak clipping and 0 dB gain setting the back-off will be 12dB. That is, the distance between the output RMS level and the output clip level is 12dB.

Example:

OUTP:PEAK:CLIP 5

Set clip level to 5dB.

OUTP:PEAK:CLIP? Or :OUTP:PEAK?

Response: 5

6.2.3.7 **MONitor command**

- **:MONitor:SOURce**

Command to select a source to monitor. Choices are HP Input, HP Output, LP Input, LP Output, Test picture, or Demodulator.

Example:

MONitor:SOURce HPIN

Monitor the HP input signal.

MONitor:SOURce?

Response: *HPIN*

6.2.3.8 **PRECorrect (Nonlinear Pre-corrector) commands**

- **PRECorrect:ENABle**

Command to activate (ON) or deactivate (OFF) the non-linear pre-corrector function. Switching the pre-corrector on activates the pre-corrector function and downloads the “active curve”. The “active curve” is defined as the curve that is functional when the pre-correction function is operational.

Example:

PREC:ENAB ON

Activate the non-linear pre-corrector function.

PREC:ENAB?

Response: *ON*

- **PRECorrect:GAIN**

Command to change the non-linear pre-corrector input gain.

Example:

PREC:GAIN 1.0

Set the gain to 1.0 dB.

PREC:GAIN?

Response: *1.0*

- **PRECorrect:DESCription**

Text string for identifying the “active” curve using a maximum of 30 characters.

Note that the query command returns an empty string if there have been no non-linear pre-correction curves recalled.

Example:

PREC:DESC “Test 2”

Names the “active” pre-corrector curve, “Test 2”

PREC:DESC?

Response: *Test 2*

- **PRECorrect:USERpoints**

String data describing the user point location and the active view type for the “active” curve, using a maximum of 130 characters.

Example:

[illegible]

Describes the non-linear pre-corrector user point location.

```
PREC:USER?
```

Response: "0000202020A000202040202020204

0204020200040202040202020202010404020002210202020202020202020202020202
020202020202020201010404010"

- :PRECorrect:POINT

Command to define a point <n> in the ‘active’ non-linear pre-correction curve, where <n> ranges from 0 to 255, with <real> and <imag> values. The query command reads the real & imaginary values of point <n> in the “active” curve. <real> and <imag> are 16-bit signed values.

Example:

PREC:POIN 2,8192,0

Define point 2 of the “active” non-linear pre-correction curve to have values 8192 (real) and 0 (imaginary).

PREC:POIN? 2

Response: 8192,0

- :PRECorrect:CURVe

Transfer curve to or read curve from the “active” curve location. A curve is defined as all points from 0 to 255.

Example:

[illegible]

Define the “active” curve as shown.

[illegible]

- **PRECorrect:CURVe:CHECksum**

Query command only. This is a 32-bit simple addition sum of ALL points from 0 to 255 for the curve in the “active” location (curve 0) or a curve in a preset location (preset locations 1 to 10).

Example:

```
PREC:CURV:CHEC? 0
```

Response: 2097158

- :PRECorrect:CURVe:PRESet

Command to store a pre-corrector curve configuration in a preset or to read the pre-corrector curve configuration from a preset . Ten user presets are available, from 1 to 10.

The format of this command is as follows:

PREC:CURV:PRES Preset 1 to 10, "Curve Description", Pre-corrector Gain, Clip Level, "User Point Location", {real, imaginary curve points from 0 to 255}

Example:

PREC:CURV:PRES 3,"Curve Name",-2,0.5,"0000202020A0002020402020202040204020200
04020204020202020201040402000221,02,0.5,"0000202020202020202020202020202020202
020201010404010",8192,-4,6514,-3,7056,-3,7494,-3,7838,-4,8097,-4,8281,-4,8398,-4,8458,-4,
8471,-4,8446,-4,8392,-4,8319,-4,8236,-4,8152,-4,8076,-4,8019,-4,7990,-4,7997,-4,8050,-4,815
9,-4,8332,-4,8570,-4,8831,-4,9069,-4,9235,-5,9283,-5,9164,-4,8830,-4,8235,-4,7372,-3,6393,-3,
5483,-2,4827,-2,4613,-2,5024,-2,6249,-3,8472,-4,11526,-6,14232,-8,16199,-9,17499,-9,18209,-
10,18400,-10,18149,-10,17530,-9,16617,-9,15485,-8,14207,-8,12859,-7,11515,-6,10250,-5,913
8,-4,8253,-4,7657,-4,7333,-3,7228,-3,7291,-3,7470,-3,7714,-4,7971,-4,8190,-4,8335,-4,8413,-4,
8436,-4,8417,-4,8368,-4,8302,-4,8232,-4,8170,-4,8127,-4,8103,-4,8095,-4,8100,-4,8113,-4,813
1,-4,8149,-4,8166,-4,8176,-4,8180,-4,8181,-4,8177,-4,8171,-4,8163,-4,8155,-4,8147,-4,8141,-4,
8137,-4,8134,-4,8134,-4,8136,-4,8140,-4,8146,-4,8154,-4,8165,-4,8177,-4,8190,-4,8202,-4,821
1,-4,8218,-4,8221,-4,8219,-4,8211,-4,8198,-4,8183,-4,8166,-4,8150,-4,8137,-4,8127,-4,8122,-4,
8124,-4,8133,-4,8147,-4,8163,-4,8180,-4,8196,-4,8209,-4,8216,-4,8216,-4,8211,-4,8202,-4,819
0,-4,8177,-4,8165,-4,8155,-4,8149,-4,8148,-4,8153,-4,8161,-4,8171,-4,8183,-4,8195,-4,8207,-4,
8216,-4,8223,-4,8227,-4,8228,-4,8227,-4,8224,-4,8219,-4,8214,-4,8207,-4,8200,-4,8194,-4,818

7,-4,8181,-4,8175,-4,8171,-4,8168,-4,8167,-4,8167,-4,8170,-4,8174,-4,8179,-4,8185,-4,8192,-4,8199,-4,8206,-4,8213,-4,8219,-4,8224,-4,8228,-4,8231,-4,8232,-4,8231,-4,8228,-4,8222,-4,8214,-4,8205,-4,8196,-4,8186,-4,8177,-4,8169,-4,8164,-4,8161,-4,8161,-4,8162,-4,8165,-4,8169,-4,8173,-4,8177,-4,8180,-4,8182,-4,8183,-4,8182,-4,8181,-4,8179,-4,8177,-4,8175,-4,8173,-4,8171,-4,8169,-4,8168,-4,8167,-4,8166,-4,8166,-4,8165,-4,8164,-4,8164,-4,8163,-4,8163,-4,8162,-4,8161,-4,8159,-4,8158,-4,8156,-4,8154,-4,8152,-4,8150,-4,8148,-4,8147,-4,8146,-4,8146,-4,8147,-4,8150,-4,8154,-4,8159,-4,8165,-4,8172,-4,8180,-4,8189,-4,8198,-4,8208,-4,8218,-4,8227,-4,8235,-4,8240,-4,8243,-4,8243,-4,8239,-4,8232,-4,8222,-4,8210,-4,8197,-4,8185,-4,8173,-4,8164,-4,8156,-4,8152,-4,8152,-4,8156,-4,8161,-4,8168,-4,8177,-4,8186,-4,8194,-4,8201,-4,8207,4,8212,-4,8215,-4,8218,-4,8219,-4,8221,-4,8222,-4,8224,-4,8224,-4

Store this curve configuration in preset 3.

PREC:CURV:PRES? 3

Response: "Curve Name",-2,0.5,"00002

02020A00020204020202020204020402020004020204020202020202010404020002210201010404010",8192,-4,6514,-3,7056,-3,7494,-3,7838,-4,8097,-4,8281,-4,8398,-4,8458,-4,8471,-4,8446,-4,8392,-4,8319,-4,8236,-4,8152,-4,8076,-4,8019,-4,7990,-4,7997,-4,8050,-4,8159,-4,8332,-4,8570,-4,8831,-4,9069,-4,9235,-5,9283,-5,9164,-4,8830,-4,8235,-4,7372,-3,6393,-3,5483,-2,4827,-2,4613,-2,5024,-2,6249,-3,8472,-4,11526,-6,14232,-8,16199,-9,17499,-9,18209,-10,18400,-10,18149,-10,17530,-9,16617,-9,15485,-8,14207,-8,12859,-7,11515,-6,10250,-5,9138,-4,8253,-4,7657,-4,7333,-3,7228,-3,7291,-3,7470,-3,7714,-4,7971,-4,8190,-4,8335,-4,8413,-4,8436,-4,8417,-4,8368,-4,8302,-4,8232,-4,8170,-4,8127,-4,8103,-4,8095,-4,8100,-4,8113,-4,8131,-4,8149,-4,8166,-4,8176,-4,8180,-4,8181,-4,8177,-4,8171,-4,8163,-4,8155,-4,8147,-4,8141,-4,8137,-4,8134,-4,8134,-4,8136,-4,8140,-4,8146,-4,8154,-4,8165,-4,8177,-4,8190,-4,8202,-4,8211,-4,8218,-4,8221,-4,8219,-4,8211,-4,8198,-4,8183,-4,8166,-4,8150,-4,8137,-4,8127,-4,8122,-4,8124,-4,8133,-4,8147,-4,8163,-4,8180,-4,8196,-4,8209,-4,8216,-4,8216,-4,8211,-4,8202,-4,8190,-4,8177,-4,8165,-4,8155,-4,8149,-4,8148,-4,8153,-4,8161,-4,8171,-4,8183,-4,8195,-4,8207,-4,8216,-4,8223,-4,8227,-4,8228,-4,8227,-4,8224,-4,8219,-4,8214,-4,8207,-4,8200,-4,8194,-4,8187,-4,8181,-4,8175,-4,8171,-4,8168,-4,8167,-4,8167,-4,8170,-4,8174,-4,8179,-4,8185,-4,8192,-4,8199,-4,8206,-4,8213,-4,8219,-4,8224,-4,8228,-4,8231,-4,8232,-4,8231,-4,8228,-4,8222,-4,8214,-4,8205,-4,8196,-4,8186,-4,8177,-4,8169,-4,8164,-4,8161,-4,8161,-4,8162,-4,8165,-4,8169,-4,8173,-4,8177,-4,8180,-4,8182,-4,8183,-4,8182,-4,8181,-4,8179,-4,8177,-4,8175,-4,8173,-4,8171,-4,8169,-4,8168,-4,8167,-4,8166,-4,8166,-4,8165,-4,8164,-4,8164,-4,8163,-4,8163,-4,8162,-4,8161,-4,8159,-4,8158,-4,8156,-4,8154,-4,8152,-4,8150,-4,8148,-4,8147,-4,8146,-4,8146,-4,8147,-4,8150,-4,8154,-4,8159,-4,8165,-4,8172,-4,8180,-4,8189,-4,8198,-4,8208,-4,8218,-4,8227,-4,8235,-4,8240,-4,8243,-4,8243,-4,8239,-4,8232,-4,8222,-4,8210,-4,8197,-4,8185,-4,8173,-4,8164,-4,8156,-4,8152,-4,8152,-4,8156,-4,8161,-4,8168,-4,8177,-4,8186,-4,8194,-4,8201,-4,8207,4,8212,-4,8215,-4,8218,-4,8219,-4,8221,-4,8222,-4,8224,-4,8224,-4

- **:PRECorrect:CURVe:RECall**

Command to transfer a stored pre-corrector configuration from a non-linear pre-correction preset location into the “active” location. Ten non-linear pre-corrector presets, from 1 to 10, are available.

Example:

PREC:CURV:REC 3

Recall the pre-corrector configuration stored in preset 3.

PREC:CURV:REC?

Response: 3

Note: The non-linear pre-corrector function is active only if it is also enabled by means of the command `PRECorrect:ENABLE`.

6.2.3.9 LPRecorrect (Linear Pre-corrector) commands

- **LPRecorrect:ENABLE**

Command to activate (ON) or deactivate (OFF) the linear pre-corrector function. Switching the linear pre-corrector on activates the linear pre-corrector parameters in the “active” preset location.

Example:

LPR:ENAB ON

Activate the linear pre-corrector function.

LPR:ENAB?

Response: *ON*

- **LPRecorrect:COEFficient**

Command to save linear pre-correction coefficients into, or read coefficients from, the “active” location. COEFFicient is defined as all coefficients from 0 to 23. <real> and <imag> are 16-bit signed values.

Example:

[illegible]

Set the configuration of the coefficients in the “active” location as shown.

```
:LPR:COEF?
```

Response: 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,511,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0

- **LPRecorrect:DESCription**

Text string for identifying the “active” linear pre-correction curve, using a maximum of 30 characters.

Example:

LPR:DESC "Test 1"

Name the “active” coefficient “Test 1”.

LPR:DESC?

Response: “*Test 1*”

Note that the query command returns an empty string if there have been no linear pre-correction curves recalled.

- **LPRecover:USER**

String data describing the user point location and the active view type for the “active” linear pre-correction curve, using a maximum of 130 characters.

Example:

[illegible]

Describes the linear pre-correction user point location.

LPR:USER?

0204020200040202040202020202010404020002210202020202020202020202020202
020202020202020201010404010"

- **LPRecorrect:CHECKsum**

Query command only. This is a simple 32-bit addition sum of all the coefficients from 0 to 23 in the “active” location or in a particular preset location. The number of ‘preset’ curves can vary from 1 to 10.

Example:

LPR:CHEC? 2

Response: 511

- **LPRecorrect:PRESet**

Transfer coefficients to, or read coefficients from, a preset location. The format of this command is as follows:

LPR:PRES Preset 1 to 10, "Curve Description", "User Point Information", {real, imag curve points from 0 to 23}

Example:

LPR: PRES 2, "Name 2", "0000202020A0002020402020202040204020200040202040

[illegible]

404010",0,

0,0,0,0,0,0,0,0,0,0,0,0,0,0

Save these linear pre-correction coefficients, with the name "Name 2" in preset 2.

LPR: PRES? 2

Response: "Name 2",,"0000202020A0002020402

0202020402040202000402020402020202020104040200022102020202020202020202020202

[illegible]

,0

- **LPRecorrect:RECall**

Transfer the linear pre-correction curve configuration from a preset location to the “active” location. There are ten linear pre-correction preset locations, 1 to 10.

Example:

LPR:REC 3

Recall linear pre-correction curve from preset location 3 into the “active” location.

LPR:REC?

Response: 3

6.2.3.10 SFN commands

- **SFN DELay**

Command to set the local SFN Delay in multiples of 100 ns. The response is also in multiples of 100 ns.

Example:

SFN:DEL 6

Set the SFN delay to 600 ns.

SFN:DEL?

Response: 6

- **SFN:MARGIn?**

Query only command to view the actual delay (in ms) from a mega-frame is received in the input buffer till it's transmitted from the modulator. For a hierarchical system this query represents the actual delay for the high priority signal.

Example:

SFN:MARG?

Response: 350

- **SFN:MARGin:HP?**

Query only command to view the actual delay (in ms) from the high-priority mega-frame is received in the input buffer till it's transmitted from the modulator (only available when the instrument is configured SFN and hierarchical mode).

Example:

SFN:MARG:HP?

Response: 350

- **SFN:MARGin:LP?**

Query only command to view the actual delay (in ms) from the low-priority mega-frame is received in the input buffer till it's transmitted from the modulator (only available when the instrument is configured SFN and hierarchical mode).

Example:

SFN:MARG:LP?

Response: 350

- **SFN:MAXDelay?**

Query only command to view the maximum network delay in multiples of 100 ns. The example below shows a maximum network delay of 500 msecs.

Example:

SFN:MAXD?

Response: 5000000

- **SFN:OPTional:TIMEoffset?**

Query command to view the optional time offset in multiples of 100 ns. The example below shows a time offset of 1 µsec.

Example:

SFN:OPT:TIM?

Response: 10

- **SFN:OPTional:FREQoffset?**

Query command to view the optional frequency offset in Hz.

Example:

SFN:OPT:FREQ?

Response: 0.500

- **SFN:OPTional:POWER?**

Query command to view the optional power setting in multiples of 0.1 dBm. The example below shows a power offset of 10 dBm

Example:

SFN:OPT:POW?

Response: 100

- **SFN:MIPData**

Command to output MIP data on the RS232 serial ports 1 or 2. The query command provides the serial port number to which the MIP data is output. If there is no MIP data output, the response to this command is 0.

The MIP frames (used parts only) can only be output at a 115200 baud rate. As a result the baud rate will need to be reset to it's original value using the SYSTem:COMMunicate:SERIal:TRANsmit:BAUD command – see SYSTEM Commands above (Chapter 6.2.3.2).

Examples:

SFN:MIPD ON,1

Output MIP data to serial port 1.

SFN:MIPD?

Response: 1

SFN:MIPD OFF

Turn off MIP data output.

SFN:MIPD?

Response: 0

6.2.3.11 ALARM commands

- **ALARm:SDEFinition**

Command to define an alarm condition/source to carry out an “alarm action”, i.e. to Mute (M), send to Relay 1 (1), send to Relay 2 (2) and send to the Event Log (E).

The format of the command is as follows:

ALAR:SDEF <ID Number of Alarm Condition>, <“Alarm Action”>

See table below for the ID numbers of the alarm conditions. Note that ID “0” is used for all alarm sources/conditions.

Example:

ALAR:SDEF 1,"M1E"

For a sync loss alarm, mute the output and send the alarm signal to relay 1 (and therefore to the ALRM LED also) and to the Event Log.

ALAR:SDEF? 1

Response: *M1E*

ID Number	Alarm Source/Condition	Description
1	Sync and/or Data Loss	Package sync byte (47H) missing and/or no input data activity (stuffing only).
2	Data rate	Input data rate too high (overflow).
3	COFDM	Error detected in the COFDM parameters of the output signal (code rate, guard interval, constellation and hierarchy). Note: This alarm is only available when the built-in demodulator (Demodulator-1) is configured for monitoring of the output signal
4	10MHz reference loss	10MHz reference not available
5	System error	Internal malfunction alarm

continued

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ID Number	Alarm Source/Condition	Description
6	Timing adjusted	Indicates that the modulator has adapted the internal system clock or internal 1PPS timing to allow for a mismatch between the local network timing reference (10MHz and 1PPS) and the timing reference (MIP) embedded in the incoming transport stream. NOTE: ONLY AVAILABLE WITH SFN OPTION PT 8732
7	1PPS Reference loss	Indicates that external 1PPS reference is absent (operation may continue based on internal 1PPS provided instrument was correctly synchronised before loss of external 1PPS). NOTE: ONLY AVAILABLE WITH SFN OPTION PT 8732
8	Mega-Frame (MIP) Loss	Indicates that no valid MIP is available in the applied transport stream. NOTE: ONLY AVAILABLE WITH SFN OPTION PT 8732
9	RF converter	Indicates that an alarm has been raised for the RF converter module NOTE: ONLY AVAILABLE WITH RF CONVERTER OPTION PT 8715
10	RF tuner	Indicates that an alarm of the specified type has been raised for the RF tuner module. NOTE: ONLY AVAILABLE WITH DVB-T RE-MODULATOR PT 5788
11	RF Tuner level	Indicates that the RF input level has dropped below the threshold specified via the ALAR:LIM:RFTL command. NOTE: ONLY AVAILABLE WITH DVB-T RE-MODULATOR PT 5788
12	Demodulator 1	Indicates that an alarm has been raised by demodulator 1 to signal that one or more of the set thresholds have been exceeded. The thresholds are specified via the commands ALAR:LIM:BERB, ALAR:LIM:BERB and ALAR:LIM:UCER. NOTE: ONLY AVAILABLE WITH DVB-T RE-MODULATOR PT 5788

continued

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ID Number	Alarm Source/Condition	Description
13	Demodulator 2	Indicates that an alarm has been raised by demodulator 2 to signal that one or more of the set thresholds have been exceeded. The thresholds are specified via the commands ALAR:LIM:BERB, ALAR:LIM:BERB and ALAR:LIM:UCER. NOTE: ONLY AVAILABLE WITH DEMODULATOR-2 OPTION PT 8722

- **ALARm:STATus?**

Query command to query the status of each alarm source.

Response format:

<Alarm ID No(1 to 13)>,

<Is alarm active?(1 (yes), 0 (no))>,

<Alarm counter, i.e. number of times alarm has been raised since the last counter reset or factory reset>

See table above for the ID numbers of the alarm conditions.

Example 1, an active alarm:

ALAR:STAT? 1

Response: 1,1,3

That is, the alarm source 1, Sync/Data loss, has an active alarm. The Sync/Data loss alarm has been raised 3 times since the last counter reset.

Example 2, an inactive alarm:

ALAR:STAT? 4

Response: 4,0,0

That is, the alarm source 4, 10MHZ reference loss, is inactive. No 10MHZ reference loss alarms has been raised since the last counter reset.

- **ALARm:CRESet**

Command to reset the alarm counter(s). No query for this command. The format of the command is:

ALAR:CRESet <ID Number of Alarm Condition>

Note: The alarm counter is automatically reset on reaching 65536.

Example:

ALAR:CRESet 0

Reset all alarm counters

ALAR:CRESet 2

Reset the Data rate alarm counter

6.2.3.12 EVENT commands

- **EVENT:COUNT**

Command to read the total number of events recorded in the event log since the last reset of the log system.

Example:

EVEN:COUNT?

Response: 35

That is, 35 events are recorded in the log system.

- **EVENT:CLEAR**

Command to clear the event log memory (event log cleared will be recorded as the first event in the reset event log).

Example:

EVEN:CLEAR

- **EVENT:VIEW nnn**

Command to read the event details for a specific event number.

Example:

EVEN:VIEW? 1

Response: "1411,"2003-02-04, 12:01:34","Log ClearedRam
lost","

The response string consists of three sections:

1. A unique identification number for the recorded event type (in this case 1411)
2. A time and date stamp in the format "yyyy-mm-dd, hh:mm:ss"
3. A text string providing additional information about the event (in this case "Log Cleared Ram lost" which is the event that follows the users reset of the event log system by means of the command EVEN:CLEAR).

Note: If event details are requested for an event number that exceeds the number of events currently recorded in the event log the event message "No more" with ID number 1413 will be returned (example: "1413,"2003-02-12, 12:19:47","No more",")

6.2.3.13 TEST commands

- **TEST:ENABLE**

Command to set the test signal to either Off, single carrier, -1 carrier, -50 carrier or TS stuffing.

Example:

TEST:ENAB OFF

Switch the test signal off.

TEST:ENAB?

Response: OFF

- **TEST:M1C**

Command to define the start carrier for the -1 carrier test signal. Available only when a -1 carrier test signal has been enabled.

TEST:M1C 3

Start carrier of 3.

TEST:M1C?

Response: 3

- **TEST:M50C**

Command to define the start carrier for the –50 carrier test signal. Available only when a –50 carrier test signal has been enabled.

TEST:M50C 1600

Start carrier for –50 carrier test signal of 1600.

TEST:M50C?

Response: *1600*

6.2.3.14 **FACTORY commands**

Only the query formats of these commands are accessible by the customer.

- **FACTory:SNINst**

Command to query the modulator's serial number.

Example:

FACT:SNIN?

Response: *1234567*

- **FACTory:SNXAcboard**

Command to query the serial number of the XA control board.

Example:

FACT:SNXA?

Response: *1234567*

- **FACTory:MONitor:LIMits**

Command to query various lower and upper factory limits, namely limits for the master controller's board temperature (MC_BT), the 2.5 V (MC_025V), 3.3 V (MC_033V), 5.0 V (MC_050V) and the 12V (MC_120V) supply voltages and the chip voltages VCCP1 (MC_VP1) and VCCP2 (MC_VP2).

Example:

FACT:MON:LIM? "MC_BT"

Response: *50,55*

Note the alarm limits for the temperature sensor are "level" limits, i.e. a warning is given on reaching the first alarm level, in the form of an alarm pending message. On reaching the second, upper, limit, the modulator displays a "FATAL ERROR message. Note remote control is still possible in this situation.

The other alarm limits are "out of window" limits. A warning, in the form of a pending alarm, will be given when the actual level goes out of the window range limit.

- **FACTory:MONitor:CURRent?**

Command to query the current value of the various factory monitored parameters, namely the master controller's board temperature (MC_BT), the 2.5 V (MC_025V), 3.3 V (MC_033V), 5.0 V (MC_050V) and the 12V (MC_120V) supply voltages and the chip voltages VCCP1 (MC_VP1) and VCCP2 (MC_VP2).

Example:

FACT:MON:CURR? "MC_BT"

Response: *52*

6.3 Commands Summary

All commands listed consist of both a set and request command unless specifically listed in the table.

6.3.1 Mandated Commands

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
*CLS			
*ESE			No action
*ESE?			No action
*ESR?			No action
*IDN?			
*OPC			No action
*OPC?			No action
*RST			
*SRE			No action
*SRE?			No action
*STB?			No action
*TST?			No action
*WAI			No action

6.3.2 Required commands

6.3.2.1 SYSTem subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:ERRor?			Query only
:VERSion?			Query only

6.3.2.2 STATus subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:OPERation			
[:EVENT]?			Query only. No action
:CONDition?			Query only. No action
:ENABLE	0 to 65535		No action
:QUESTion			
[:EVENT]?			Query only. No action
:CONDition?			Query only. No action
:ENABLE			No action
:PRESet			No action

6.3.3 Instrument commands

6.3.3.1 DIAGnostic subsystem

Command	Parameter	Status after Factory Reset	Remarks
:DISPlay	-	-	No query. No action
:ERRorqueue?	-	-	Query only. No action
:ERRorqueue			
:RESet	-	-	No query. No action

6.3.3.2 SYSTem subsystem

Command	Parameter	Status after Factory Reset	Remarks
:PRESet			
[:RECall]	1 to 10	-	
:STORe	1 to 10	-	No query.
:NAME	1 to 10, <"Name">	-	Name – string data format. Query command format is :PRES:NAME? <System Preset No. 1 to 10>.
:DATE	<YYYY,MM,D>	2002,01,01	
:TIME	<HH,MM,SS>	00,00,00	
:OINStalled	<"xxxx.xxxx.xxxx.xxxx">		String data format
:OUSed	<"101001....">		String data format consisting of 1's and 0's
:COMMunicate: SERial:TRANsmi t :BAUD	<Port no.>, <Baudrate> 1 2 , 1200 2400 4800 9600 19200 115200	On both ports - 19200	
:FRES		See Chap. 4.4	No query.

6.3.3.3 USER subsystem

Command	Parameter	Status after Factory Reset	Remarks
:NAME	<"Name">		String data

6.3.3.4 DISPlay subsystem

Command	Parameter	Status after Factory Reset	Remarks
:CONTRast	0 to 100 %	25	

6.3.3.5 INPut subsystem

Command	Parameter	Status after Factory Reset	Remarks
:ASWitch	OFF ON	OFF	
:PRImary	<high priority>, <low priority> (low priority only useful in hierarchical version of modulator) A B C D DEModulator	High priority = A Low priority = B	The low priority input parameter should be ignored in a non- hierarchical modulator.
:SECondary	<high priority>, <low priority> (low priority only useful if hierarchical version of modulator) A B C D DEModulator	High priority = B Low priority = A	The low priority input parameter should be ignored in a non- hierarchical modulator.
:REFerence			
:SOURce	ADEtect EXTErnal INTernal	ADET	
:PPS	HIMPedance O_50	HIMP	
:MHZ	HIMPedance O_50	O_50	
:PPSTlevel	0 to 3.5 V	3.5 V	
:REFerence?			Query only
:INPut:BUFFerfill? or :INPut:BUFFerfill: HP?			Query only
:INPut:BUFFerfill: LP?			Low priority in an hierarchical system. Query only
:TXIDent	0 to 65535	0	Only available in SFN- version

6.3.3.6 OUTPut subsystem

Command	Parameter	Status after Factory Reset	Remarks
:MODE			
:HIERarchy	NONE H_1 H_2 H_4	NONE	Only available in Hierarchical version
:IFFT	F2K F8K	F8K	
:CODerate	R1_2 R2_3 R3_4 R5_6 R7_8	R2_3	High Priority Code Rate in the Hierarchical version.
:LPCoderate	R1_2 R2_3 R3_4 R5_6 R7_8	R2_3	Only available in Hierarchical version
:CONStell	QPSK QAM16 QAM64	QAM64	
:GUARd	G1_4 G1_8 G1_16 G1_32	G1_8	
:TSENable	OFF ON	OFF in non- SFN version. ON in SFN version.	Only available in SFN version
:MODE?	-	-	Query only

Command	Parameter	Status after Factory Reset	Remarks
:IF			
:FREQuency	35 to 37 MHz	36 MHz	Only in IF version. Step size of 1Hz. Query only in RF version.
:LEVel	-2.0 to 8.0 dB	0.0	Only in IF version. Step size of 0.1dB. Query only in RF version.
:RF			
:FREQuency	30 to 1000 MHz	474 MHz	Only in RF version. Step size of 1Hz.
:LEVel	-10.0 to 0.0 dB	0.0	Only in RF version. Step size of 0.1dB.
:FREQuency	35 to 37MHz (if IF version) 30 to 1000 MHz (if RF version)	36 MHz (if IF version) 474 MHz (if RF version)	
:LEVel	-2.0 to 8.0 dB (if IF Version) -10.0 to 0.0 dB (if RF version)	0.0	
:BANDwidth	6 7 8 MHz	8	
:CRASter	IUHF IVHF IUVH UCH (<i>short form</i>) IUHF IVHF IUVHF UCHANNEL (<i>long form</i>)	IUHF	Only in RF version. The corresponding query replies are: IUHF IVHF IUVHF UCHANNEL
:VSUB	VHFB VHFL VHFI	VHFB	Only in RF version and VHF raster is selected.
:UCDefinition	<Start channel>, <Base frequency>	Start = 21, Base freq = 470 MHz	Only in RF version and user defined raster is selected.
:CHANnel	Dependent on channel raster: IUHF: 21 to 69 IVHF & VHF(L): 0 to 5 IVHF & VHF(B): 5 to 12 IVHF & VHF(I): 1 to 6 UCH: 0 to 99	21 (ITU UHF)	Only in RF version.
:WINDow?			Query only
:[ENABLE]	OFF ON	ON	
:ROLLoff	W1_64 W1_128 W1_256 W1_512	W1_64	
:POLarity	NORMal INVerted	NORMal	
:PEAK			
:CLIPping	-10.0 to 0.0 dB	0.0	Steps of +0.5dB

6.3.3.7 MONitor subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:SOURce	HPIN LPIN HPOUT LPOUT TPICture DEModulator	HPIN	

6.3.3.8 PRECorrect (Nonlinear Pre-corrector) subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:ENABLE	OFF ON	OFF	
:GAIN	-3.0 to 3.0 dB	0.0	Steps of 0.2 dB
:POINt	0 to 255, {<real>, <imag>}		Query command format is :PREC:POIN? <Point No>
:CURVe	{<real>,<imag>}		
:DESCRiption	<"Curve Description">		Curve Description is in string data format.
:USERpoints	<"User Point Information">		User Point Information is in string data format.
:CURVe :PRESet	<Preset No. 1 to 10>, <"Curve Description">, <Pre-corrector Gain>, <Clip Level>, <"User point information">, {<real>,<imag>}		Query command format is :PREC:CURV:PRESet? <Preset No. 1 to 10>.
:CURVe :CHECKsum?	0 to 10		Query only. Note curve '0' indicates the "active" location.
:CURVe :RECall	1 to 10		

6.3.3.9 LPReCorrect (Linear Pre-corrector) subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:ENABLE	OFF ON	OFF	
:COEFFicients	{<real>,<imag>}		
:DESCRiption	<"Coefficient Description">		Coefficient Description is in string data format.
:USERpoints	<"User Point Information">		User Point Information is in string data format.
:CHECKsum?	0 to 10		Query only. "0" indicates the "active" location.
:PRESet	1 to 10, <"Coefficient Description">, <"User Point Information">, {<real>,<imag>}		Query command format is LPR:PRESet? <Preset No. 1 to 10>
:RECall	1 to 10		

6.3.3.10 SFN subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:DEL	-1 to 1 sec	0	In 100ns steps.
:MARGin? Or :MARGin:HP?			Query only. Response in msecs.
:MARGin:LP?			Query only. Response in msecs.
:MAXDelay?			Query only.
:OPTional			
:TIMEoffset?			Query only.
:FREQoffset?			Query only.
:POWer?			Query only.
:MIPData	OFF ON,1 ON,2	OFF	Query command provides serial port no. to which MIP data is output. If "port no." is 0, MIP data output is not active.

6.3.3.11 ALARm subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:SDEFinition	<alarm condition>, <"alarm destination "> 0 to 13, any combination of "M12E"		If "alarm condition" = 0, definition applies to all alarm condition. M – Mute control 1 to 2 – Relays 1 to 2 E – Event Log
:STATus?	1 to 13		Query only. Response format is: <Alarm ID No(1 to 12)>, <Is alarm active? (1,0)>, <Alarm counter, i.e. number of times alarm has been raised since last counter reset or power on>
CRESet	0 to 13		No query. 0 - resets all alarm counters.

6.3.3.12 EVENT subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:COUNT?			Query only. Response format is: <n> n : total number of events recorded in the log
:CLEAR			No Query. Clears the entire event log.
:VIEW?	n n = 0 to max event count		Query only. Response format is: <id number, "tds", "info"> id number : identification number for the recorded event type tds: time and date stamp for the event in the format "yyyy-mm-dd, hh:mm:ss" info: Supplementary text string describing the event type

6.3.3.13 TEST subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:ENABLE	OFF SCARrier M1Carrier M50Carrier TSSuffling	OFF	
:M1Carrier	1 to 1705	1	-1 carrier in 2k mode.
	1 to 6817	1	-1 carrier in 8k mode.
:M50Carrier	1 to 1705	1	-50 carrier in 2k mode.
	1 to 6817	1	-50 carrier in 8k mode.

6.3.3.14 FACTory subsystem

<u>Command</u>	<u>Parameter</u>	<u>Status after Factory Reset</u>	<u>Remarks</u>
:SNINst?	<Instrument Serial No>		
:SNXAcboard?	<XA Serial No>		
:MONitor :LIMits?	"MC_BT" "MC_025V" "MC_033V" "MC_050V" "MC_120V" , <lower limit>, <upper limit>		Format for query command: :FACT:MON:LIM? "MC_BT"
:MONitor :CURRent?	"MC_BT" "MC_025V" "MC_033V" "MC_050V" "MC_120V"		Query only.

6.4 Error Codes

6.4.1 Command errors [-199, -100]

Error Number	Error string [description/explanation/example]
-100	Command error The command is invalid or incorrect.
-101	Invalid character A command or parameter contains an invalid character, e.g. a header containing an ampersand, SYST:VERS&.
-102	Syntax error An unrecognised command or data type was encountered, e.g. a string was received when the generator did not accept strings.
-103	Invalid separator A separator was expected, but an illegal character was encountered, e.g. the semicolon was omitted after a command, *IDN?:SYST:ERR?;
-104	Data type error A data element different than one allowed was encountered, e.g. numeric data was expected but string data was encountered.
-108	Parameter not allowed More parameters was received than expected for the command, e.g. the *IDN?; command accepts no parameters, so receiving *IDN? 2; is not allowed
-109	Missing parameter Fewer parameters were received than expected for the command.
-110	Command header error An error was detected in the command header.
-111	Header separator error A character which is not a legal header separator was encountered, e.g. no white space followed the header, thus SYST:PRES:NAME"MACRO" is an error.
-112	Program mnemonic too long The header contains more than twelve characters.
-113	Undefined header The header is syntactically correct, but is not defined for the device.
-114	Header suffix out of range The command is invalid because the value of the numeric suffix attached to the program mnemonic is out of range, e.g. OUTP:ALAR3? is illegal because only 2 alarm outputs exists.
-120	Numeric data error An error in the numeric data was encountered.
-121	Invalid character in number An invalid character for the data type was encountered, e.g. an alpha in a decimal value.
-123	Exponent too large The magnitude of the exponent was larger than 32000.
-124	Too many digits The mantissa of a decimal numeric data element contained more than 255 digits.
-125	Numeric data not allowed A legal numeric data was received, but the device does not accept one.
-130	Suffix error An error in the suffix was encountered.

Error Number	Error string [description/explanation/example]
-131	Invalid suffix The suffix is syntactically incorrect.
-134	Suffix too long The suffix contains more than twelve characters.
-138	Suffix not allowed A suffix was encountered after a numeric element that does not allow suffixes.
-140	Character data error An error in the character was encountered.
-150	String data error An error in the string data was encountered.
-151	Invalid string data A string data element was expected, but was invalid for some reason, e.g. an END message was received before the terminal quote character.
-158	String data not allowed A string data element was received but was not allowed by the device.
-160	Block data error There is an error in the block data received.
-161	Invalid block data A block data was expected, but was invalid for some reason.
-170	Expression error There is an error in the expression received.

6.4.2 Execution errors [-299, -200]

Error Number	Error string [Description/explanation/example]
-200	Execution error
-203	Command Protected Indicates that a legal protected program command or query could not be executed because the command was disabled.
-220	Parameter error Indicates that a program data element related error occurred.
-222	Data out of range Indicates that a legal program data element was received but could not be executed because the interpreted values was outside the range as defined by the device, e.g. the command OUTP:GAIN 5; is illegal since the gain cannot exceed 3 dB.
-223	Too much data Indicates that a legal program data element of block, expression, or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.
-224	Illegal parameter value Used where exact value, from a list of possible, was expected.
-233	Invalid version Indicates that a legal program data element was parsed but could not be executed because the version of the data is incorrect to the device.

Error Number	Error string [Description/explanation/example]
-241	Hardware missing Indicates that a legal program command or query could not be executed because of missing device hardware.

6.4.3 Device specific errors [-399, -300]

Error Number	Error string [Description/explanation/example]
-300	Device-specific error
-350	Queue overflow A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.
-360	Communication error A communication error on the serial port was detected
-361	Parity error in program message Parity bit not correct when data received on the serial port
-362	Framing error in program message A stop bit was not detected when data was received, e.g. a bad rate mismatch.
-363	Input buffer overrun Software or hardware input buffer on serial port overflows.

6.4.4 Query errors [-499, -400]

Error Number	Error string [Description/explanation/example]
-400	Query error An error occurred during a query.
-410	Query INTERRUPTED Indicates that a condition causing an INTERRUPTED Query error occurred.
-420	Query UNTERMINATED Indicates that a condition causing an UNTERMINATED Query error occurred.
-430	Query DEADLOCKED Indicates that a condition causing an DEADLOCKED Query error occurred.

6.4.5 Device specific errors [1, 32468]

None.

Appendix A Menu System Maps

A set of charts describing the menu system is provided attached overleaf in order to diagrammatically show the structure of the menu system and the various menu options and parameters. The charts enclosed are:

- Status Menu System
- Configuration Menu System (page 1 of 2)
- Configuration Menu System (page 2 of 2)

All menu windows in the menu system contain a four-digit number in the top right hand position. This number is known as the menu identification number and is useful for referencing and navigating purposes and is shown in "**bold**" in the Menu System Charts. The menu-structure has a maximum of four levels; hence the four-digit identification.

Appendix B Document History

Rev.:	Date:	Name:	Details:
1.0	280801	DG	First version of manual.
1.1	181001	DG	Amendments made to reflect changes made in software from software version 1.01 to software version 1.1.
2.0	301101	DG	Amendments made to reflect changes made in software from software version 1.1 to software version 2.0.
3.0	30.01.2003	HSO	Amendments made to reflect changes to the menu structure and introduction of new features (event log). This update only applies to modulator units based on ASIC technology. SW release 3.02
3.1	13.03.2003	HSO	Selection of SPI LVDS input via "C" input. UBS logo and text references substituted for ProTelevision logo and text references.
3.11	25.08.2003	HSO	3.6.1: RS232 wiring schemes updated (handshake not implemented). 4.2.1: Presentation method for useful ASI data on the monitor output described.