



**TM600-8VSB**  
**ATSC BROADCAST MODULATOR**

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## 1.0 SAFEGUARDS

### General Safeguards

This section is written as a general guide to keep all 5 fingers on your hand and is intended for those having previous knowledge and experience with these kinds of equipment. It is not intended to contain a complete statement of all safety precautions, which should be observed by personnel using this or other electronic equipment.



**DOCUMENTATION** - Read, retain and follow instructions before operating the equipment. There is a lot of useful information in the manual, and besides, we spent a lot of time writing it!



**ENVIRONMENT** - To reduce the risk of fire or electric shock, do not expose this equipment to rain, moisture, or rye and sodas at the company Christmas party. Refer all servicing to qualified service personnel.



**SERVICING** - Do not attempt to service this equipment yourself as opening or removing covers can result in a warm tingly feeling and will void the warranty. Refer all servicing to qualified service personnel.

## Safety and First Aid

Personnel engaged in the installation, operation, maintenance, or servicing of electronic equipment are exposed to the hazard of high voltage. It is imperative that all safety regulations and precautions are consistently observed. Knowledge of first aid procedures is recommended. The following information is presented as a reference only.



DANGEROUS VOLTAGES AND CURRENTS MAY BE PRESENT IN THE EQUIPMENT EVEN THOUGH THE POWER IS OFF. REFER SERVICING TO QUALIFIED PERSONNEL.

- At all times, avoid placing any part of the body in series between ground and circuit points, whether power is on or off.
- It is the duty of all personnel to be prepared to give adequate emergency first aid treatment and thereby prevent avoidable loss of life.
- There are three principle degrees of burns, recognizable as follows:
  - A first-degree burn reddens the skin.
  - A second-degree burn blisters the skin.
  - A third degree burn chars the flesh and frequently places the victim in a state of shock accompanied by respiratory paralysis.
- Respiratory paralysis can cause death by suffocation within seconds. It is imperative that the approved methods of artificial respiration are initiated immediately and continue until the victim's breathing is normal.
- A muscular spasm of unconsciousness may render the victim unable to break free of the electric power. If this is the case, turn the power off immediately.



DO NOT TOUCH THE VICTIM OR YOU MAY SHARE THE SAME PREDICAMENT.

- If the power cannot be turned off immediately, very carefully loop a dry rope, article of clothing, length of strong cloth or a rolled-up newspaper around the victim and pull the victim free of the power source. Carefully avoid touching the victim or clothing.
- Once free of the power source, the victim must be placed in a reclining position and covered with a blanket or newspapers to keep warm. At the first opportunity, enlist help in summoning a doctor. If a doctor cannot be summoned, transport the victim to the doctor or a hospital. Be sure the victim is kept well covered and warm while awaiting professional treatment.

## 2.0 WARRANTY

Our legalese is straightforward. It is simply designed to give you peace of mind and helps you resist the temptation to have your electronics friend try to repair your Technalogix product.

Technalogix Ltd. products have been completely tested and found to meet specifications and be in proper operating condition. They are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment. If the system becomes damaged in shipment and there are obvious signs of damage to the outside of the packaging, notify your courier immediately before that courier walks out the door.

Technalogix Ltd. will not be liable for damages of whatever nature arising out of or in connection with the equipment or its use thereof. Technalogix does not assume responsibility for injury or damage resulting from the practices of untrained or unqualified personnel in the handling of this equipment.

Technalogix Ltd. warranty does not include:

- Misuse, neglect or accident.
- Incorrect wiring and /or improper installation.
- Unauthorized repairs, modifications or use in violation of instructions issued by Technalogix.
- Incidental or consequential damages as a result of any defect.
- Reshipment cost or insurance of the unit or replacement units or parts.
- Acts of nature or terrorism.

Technalogix agrees, at our option, to remedy warranted defects or furnish a new part in exchange for any part of a unit which, under normal installation, use and service, becomes defective. The user will pay for transportation costs to and from the repair centre. If you require technical service on the site, the cost to you will be \$800.00 US per day plus air fare and meals.

To claim your rights under this warranty:

- Contact Technalogix and describe the problem in as much detail as possible. See troubleshooting section in this manual. If a solution cannot be found at this time, it may be determined that the unit will have to be returned to Technalogix for repair, once a Return Materials Authorization (RMA) number is provided. Please look under our web site ([www.technalogix.ca](http://www.technalogix.ca)) for the RMA form (Service) and fill it out. Either fax it to us or email to us.
- Package equipment carefully for prepaid shipment to Technalogix. Include a written description of the problem experienced, a copy of the original invoice establishing warranty status, and the RMA.

Technalogix reserves the right to make revisions in current production of the equipment and assumes no obligation to incorporate these changes in earlier models.

Shipping Address:

Technalogix Ltd.  
ATTN: RMA# \_\_\_\_\_  
#4, 8021 Edgar Industrial Place  
Red Deer, Alberta, Canada  
T4P 3R3  
Ph: 403.347.5400  
Made in Canada, returned for repairs

## **Terms & Conditions of Sale**

Sales by Technalogix Ltd (“Seller”) are made only on the terms which are contained in this Terms and Conditions of Sale Policy. Seller hereby gives notice of its objection to any different or additional terms and conditions. All sales are expressly conditional upon Buyers’ assent to the terms and conditions set forth below. These terms and conditions may be modified or supplemented only by a written document signed by the authorized representative of Seller. These terms and conditions supersede any prior and/or contemporaneous agreements or correspondence between Buyer and Seller. Any order received and accepted by Technalogix Ltd (Seller) shall be construed as an acceptance of Seller’s offer to sell its products to the purchaser (Buyer) in accordance with the terms and conditions of sale set forth herein. No waiver, whether express or implied, by Seller of any of the terms or conditions hereof shall be deemed a continuing waiver or trade custom between the parties, but shall apply solely to the instance to which the waiver is directed.

### **Ordering Information**

All orders must be in writing and/or accompanied by a PO. 50% down payment is required with all orders. No orders are considered an order until the down payment has been paid.

### **Order Confirmation**

A purchase order is not binding on Seller until Buyer has received Seller’s order confirmation or acknowledgement.

### **Pricing Policy**

Prices for products do not include taxes or any additional charges. All prices are FOB shipping point and prices do not include freight/handling charges and insurance charges. All prices are in U.S. currency.

All prices published or quoted by Seller may be changed at any time without notice. Unless otherwise specified, written quotations expire thirty (30) days from the date issued and are subject to change or termination by notice during this period.

### **Taxes**

Prices for all products do not include any sales, use, excise or other taxes. Buyer agrees to pay all applicable federal, state, and local taxes, duties and other fees on product and services ordered. If Buyer claims an exemption from any tax, Buyer shall submit to Seller the appropriate exemption certificates.

### **Terms of Payment**

Seller will provide credit terms to Buyer at its discretion. Such terms are subject to change at all times. If credit is provided, Seller will invoice Buyer on the date the product is ordered. Such invoices will be due and payable net thirty (30) days from date of

invoice, subject to credit approval. If credit is not established or maintained, terms shall be net cash on or prior to the Delivery Date. Seller reserves the right, at its sole discretion at any time to revoke any credit previously extended.

Past due accounts shall be charged two percent (2%) per month, or the highest rate permitted by Alberta law, whichever is less, and will be added to the outstanding balance. In the event Buyer defaults on payment, Buyer shall be liable for all collection cost, including reasonable attorney's fees and costs.

### **Changes and Cancellation**

Purchase orders that have been accepted by Seller may not be changed or cancelled, in whole or in part, without written consent of Seller. All changes must be include in a change order reflecting the purchase order number and submitted to the Seller. All other changes will not be accepted or acknowledged. Changes may affect delivery dates. Expenses incurred because of the changes shall be charged to the Buyer. Buyer will be liable for Seller's costs incurred, plus a reasonable profit, for the portion of the work terminated, in accordance with generally accepted accounting principle, together with cancellation charges.

Orders for standard product may be changed by Buyer, with no penalty to the Buyer, provided that Buyer provides Technologix notification at least 30 days prior to the scheduled ship date. Order changes received within 30 days of the scheduled ship date may be subject to an order change charge; a schedule detailing these charges will be forwarded to Buyer when Buyer's change order is acknowledged. In no event can any aspect of the order be changed after product shipment has occurred.

Orders for custom product may be cancelled by Buyer, provided that Buyer pays Seller for completed work allocated to Buyer's order at the time of termination of the work at the unit selling price and all costs, direct and indirect for work-in-progress as well as costs resulting from cancellation and a reasonable profit therein. Specific cancellation charges will be dependent on the type of custom product ordered; a schedule detailing these charges will be forwarded to Buyer when Buyer's cancellation is acknowledged. Orders for custom product are subject to a cancellation fee of up to 100% of the order, depending on the stage of completion of the order at the date the cancellation or revision is accepted.

### **Custom Products Policy**

Custom items are not returnable; items other than "off the shelf" products are considered custom. Custom products, by their nature, are products and materials which have been altered, modified, cut, amended and customized to your order, and are not resalable or returnable. Orders for custom product are subject to a cancellation fee of up to 100% of the order, depending on the stage of completion of the order at the date the cancellation or revision is accepted.



## **Returns**

The return of Products without a written authorization by Seller will not be accepted. Returns are accepted only with a valid Return Material Authorization (RMA) number for items to be returned. To receive authorization for Product return, please call customer service. There is a standard 25% restocking cost assessed on most returns.

All returned products must be unused, and in original condition. No refund or credit shall be given for damaged products.

We do not accept return packages without a valid RMA number and we do not accept postage-due or C.O.D. packages at any time for any reason.

## **Excusable Delay**

Seller shall not be liable for any loss or damage resulting from any delay in delivery or failure to deliver which is due to any cause beyond Seller's control, including, without limitation, acts of nature, unavailability of supplies or sources of energy, riots, wars, fires, floods, epidemics, lockouts, strikes and slowdowns, delays in delivery by supplies, or acts or omissions of the Buyer. The Buyer shall be liable for stage charges, including but not limited to all third party costs and expenses incurred by Seller, in holding or storing products for the Buyer or at the Buyer's request.

## **Assignment**

Buyer shall not assign any duties nor assign any order or any interest therein without the written consent of the Seller. Any such actual or attempted assignment shall entitle Seller to cancel the order upon written notice to Buyer.

## **Installation**

Seller assumes no obligation to install any product sold or to place any products in working order at Buyer's premises

## **Validity of Separate Clauses**

If any provisions of this agreement shall be held invalid, illegal, or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected or impaired thereby.

## 3.0 OVERVIEW

### General Description

The TM600-8VSB is a cost effective 8-VSB professional modulator especially designed for digital TV broadcasting applications. The TM600-8VSB accepts a MPEG-2 Transport Stream, processes it, and modulates it onto a UHF channel.

In order to bring the highest performance in the smallest package, TM600-8VSB integrates up-to-date FPGA technology as well as sophisticated digital signal processing algorithms, especially for the modulation and the output filtering processes.

Clock system has been carefully designed to reach a very low phase noise clock as well as the flexibility required to operate with different synchronization schemes.

TM600-8VSB fulfils ATSC referenced standards. The modulator generates a fully modulated analogue signal and includes all the clock & synchronization features necessary for high quality ATSC synchronization.

The TM600-8VSB modulator includes linear and non-linear pre-corrections.

### Standard Features

- SMPTE-310 input management
- ASI-320 input management
- ATSC Framing
- ATSC Channel encoding
- Linear pre-correction
- Non linear pre-correction
- 8-VSB modulation
- 6 MHz channel
- 0 dBm RF Output
- Output Level Control
- User Interface RS-232
- AC Breaker
- All aluminum enclosure
- Simple design using commonly available parts ensures reliable operation

## Specifications

Characteristics	Typical Value	Comment
<b>SMPTE Inputs</b>		
Packet size	188 bytes	
Maximum useful bit rate	19.39 Mbps	Shall comply with ATSC
<b>ASI Inputs</b>		
Packet size	188/204 bytes	With RS or not
Maximum useful bit rate	19.39 Mbps	Auto-adapted to ATSC
<b>Modulation</b>		
According to ATSC A/53	8-VSB	
Channel bandwidth	6 MHz	
<b>UHF Outputs</b>		
Adjustable Frequency (1Hz step):	470 MHz to 860 MHz	Accuracy: $\pm 3$ Hz
Output level <ul style="list-style-type: none"> <li>- Main signal</li> <li>- Monitoring signal</li> <li>- Output level stability</li> <li>- Return loss</li> </ul>	0 dBm $\pm$ 2 dB -20 dB $\pm$ 2 dB $\pm$ 0.1 dB > 12dB	Atten. -0 to 10dB  At 25°C
Error Vector Magnitude <sup>1</sup>	< 2.5%	w/o Equalizer
Inband SNR <sup>1</sup>	> 32 dB	w/o Equalizer
Shoulder <sup>1</sup>	> 60 dBc	From Pilot level.
Ripple (In-band Flatness) <sup>1</sup>	< $\pm 0.5$ dB	
Pilot carrier phase noise <sup>1</sup>	< -106dBc/Hz @ 20KHz	At 25°C
Spurious	< -50 dBc	@ Output = 0 dBm
<b>Clocks &amp; Synchronization</b>		
Internal 10 MHz clock	VCTCXO	
T° Stability	< $\pm 1$ ppm	0 $\rightarrow$ 50°C
Tuning	$\pm 5$ ppm	
Aging (Time Stability)	< $\pm 1$ ppm / Year	
10 MHz reference output	0 dBm $\pm 3$ dB	
External 10 MHz reference input: <ul style="list-style-type: none"> <li>- Impedance</li> <li>- Level</li> <li>- Frequency</li> </ul>	50 Ohms -15dBm to +15 dBm	

<sup>1</sup> Performances measured with EFA Equipment (Rohde & Schwarz)

	10MHz $\pm$ 5 ppm	
10 MHz lock control type	Analog	
Frequency auto control	Locked: $< \pm 1.10^{-9}$ Unlocked: $< \pm 5.10^{-8}$	At 25°C
<b>Control</b>		
RS-232	- 9600 to 115200 Bauds - 8 data bits - 1 STOP bit - No parity bit	

### Input / Output Interfaces

<b>SMPTE input interface</b>		<b>x 2</b>
General	Function: Standard: Name: Connector: Type:	Data stream inputs SMPTE-310 SMPTE_IN1 / SMPTE_IN2 SMA - 75 $\Omega$ Input
Performances	Data rate: Format:	19.4 Mbps 188 bytes

<b>ASI input interface</b>		<b>x 2</b>
General	Function: Standard: Name: Connector: Type:	Data stream inputs ASI-320 ASI_IN1 / ASI_IN2 SMA - 75 $\Omega$ Input
Performances	Data rate: Mode: Format:	60 Mbps max. Burst or Packet mode ASI-320: 188/204 bytes

<b>Clock reference input</b>		<b>x 1</b>
General	Function: Name: Connector: Type:	10 MHz reference input 10 MHz_IN SMA - 50 $\Omega$ Input
Performances	Frequency: Level:	10 MHz From -15 to +15 dBm

<b>Clock reference output</b>		<b>x 1</b>
General	Function:	10 MHz reference output
	Name:	10 MHz_OUT
	Connector:	SMA - 50 $\Omega$
	Type:	Output
Performances	Frequency:	10 MHz
	Level:	0 dBm $\pm$ 3 dB

<b>RF Output</b>		<b>x 1</b>
General	Function:	UHF output
	Standards:	ATSC
	Name:	RF_OUT
	Connector:	SMA - 50 $\Omega$
	Type:	Output
Performances	Frequency:	470 MHz - 860 MHz
	Level:	0 dBm

<b>Monitor Output</b>		<b>x 1</b>
General	Function:	Monitoring output
	Standards:	ATSC
	Name:	Monit_OUT
	Connector:	SMA - 50 $\Omega$
	Type:	Output
Performances	Frequency:	See RF
	Level:	See RF (-20 dB)

## Physical Characteristics

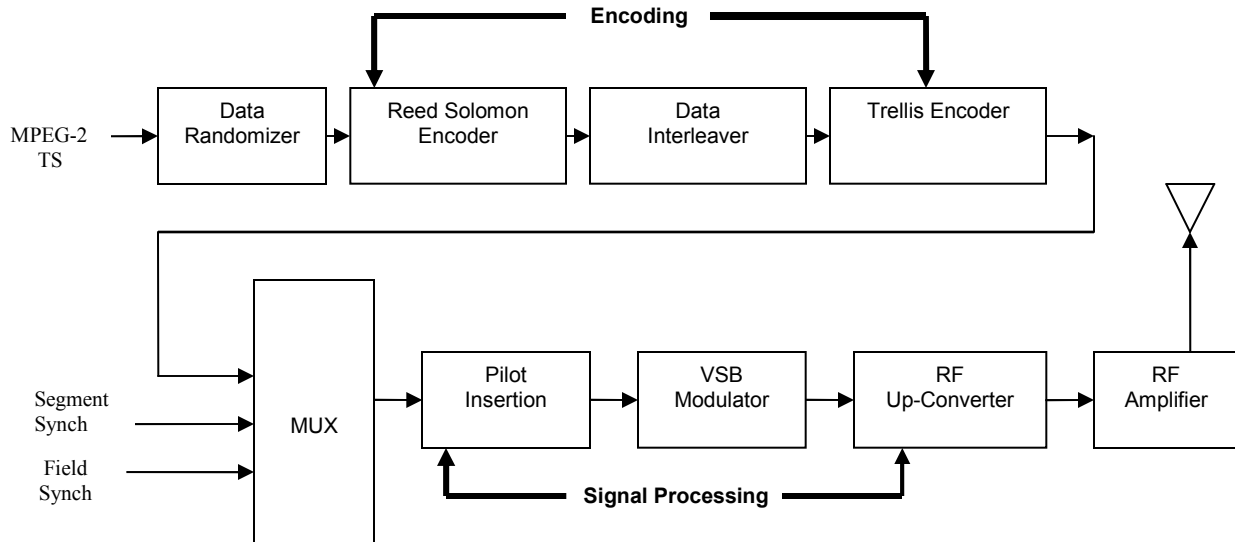
<b>Dimension</b>		
General	Width:	17"
	Depth:	13.4"
	Height:	3.5"
	Rack Unit:	2U

## Electrical Specifications

<b>Power Requirements</b>		
General	Vac	110 V
	Iac	0.5 A

## Principle of operation / Block Diagram

The input of 8-VSB modulator is a MPEG-2 Transport Stream (TS) based on MPEG-2 at a fixed bit rate of 19.39265846Mbs. The TS has 188 byte packet structure. The 8-VSB spectrum is contained in a 6 MHz channel.



The first byte (sync byte) of the MPEG-2 data packet is stripped and the remaining 187 bytes are randomized using a polynomial generator to prevent long strings of fixed states (1 or 0) that may occur and could increase chances of error.

The Reed Solomon encoder operates on blocks of 187 data bytes to produce blocks of 207 bytes (data plus forward error correction bytes).

The data is then interleaved in order to spread the bits to make it more immune to burst noise.

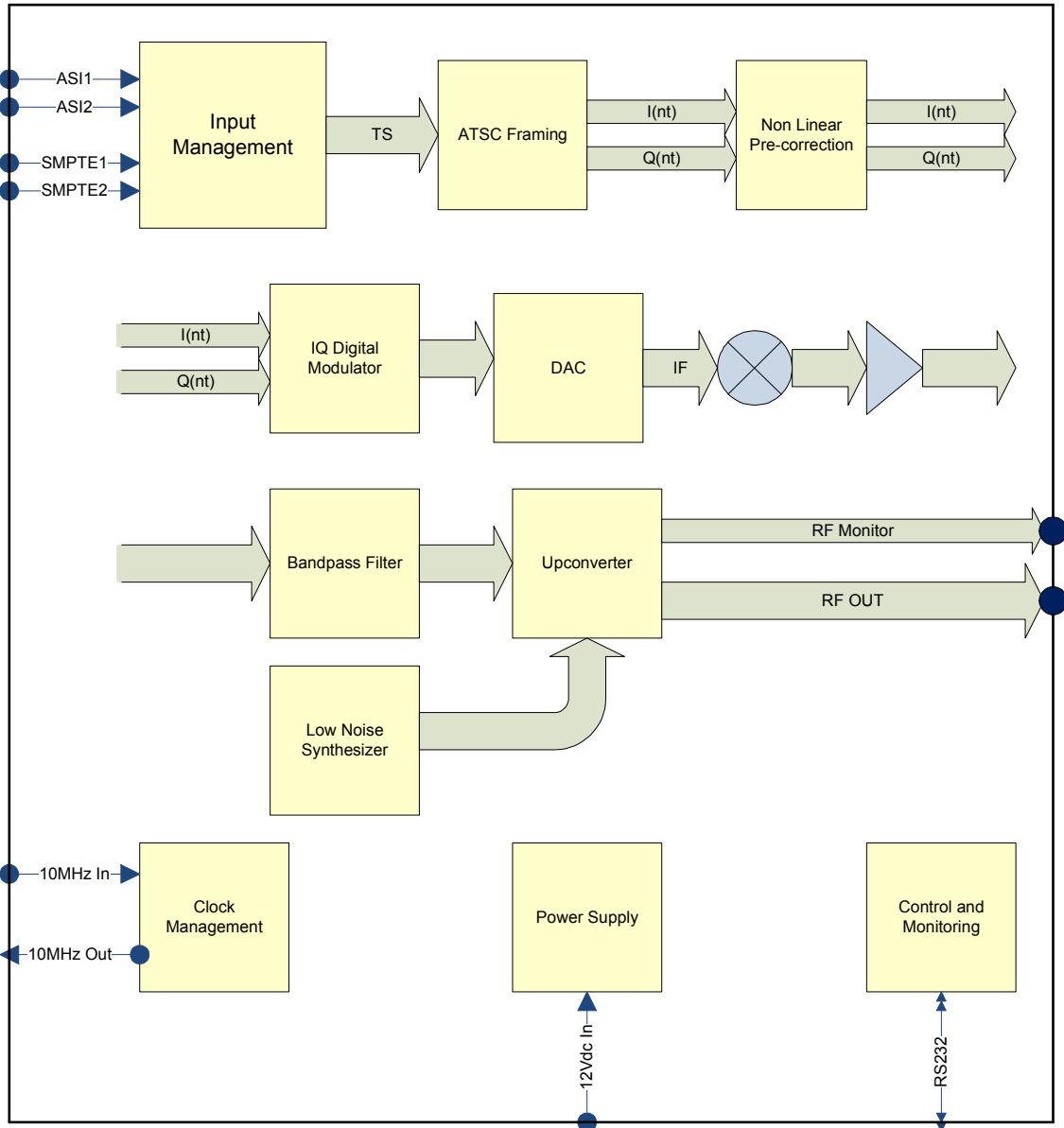
The trellis encoder converts each byte to four 8-level channel symbols. This is important for the modulation stage.

The Mux inserts a sync byte after each 828 symbols. This is inserted to recover synchronization of the MPEG packets as the MPEG sync bytes are removed.

The low level pilot is added to the baseband data. The low level pilot is 11.3 dB below the average data signal power. The pilot is inserted 310 KHz from the lower band edge. The low level pilot aids carrier recovery and is independent of data.

The VSB modulator processes symbols to produce a very short pulse occurring at exactly the center of the symbol times but still maintains their proper 8-levels of amplitude. These short pulses are then applied to a raised cosine filter (Nyquist Filter).

The signal is then up-converted to 44 MHz IF and then to the desired RF channel. The output of RF channel coming from the modulator is amplified by the power amplifier.



## Data Input Interfaces

The module accepts a MPEG2-Transport Stream dedicated to ATSC transmission as specified in SMPTE-310 and ATSC Standard A/53. It also supports an ASI-320 stream format. Two data inputs are implemented to allow for an input data stream redundancy (Primary input / Secondary input).

## Data Input Management

The data input management consists of several processes:

- Bit rate adaptation and PCR (Program Clock Reference) re-stamping:

The ATSC transmission scheme relies on a very stable and accurate data stream clock. The SMPTE-310 data clock will be at the exact standardized clock frequency. At the same time, the modulator will synchronize with this input data stream to be able to recover the same clock. In the case of using an external clock reference (10 MHz), the global clock synchronization might be plesiochronous (i.e. a small clock deviance between the multiplexer clock and the modulator reference clock). In that case, it is recommended to enable the “bit rate adaptation” on the modulator. When this mode of operation is enabled, the unit discards or inserts Null packets to adapt the MPEG-TS input bit rate to the precise bit rate defined by the ATSC mode. PCR re-stamping is then executed accordingly.

- **Switching performance:**  
The switching is not expected to be seamless. However, in the case of feeding the exact same data stream on both inputs (Primary & Secondary), the modulator will perform seamless switching from one input to the other. Switching is made on a per packet basis.
- **Automatic mute:**  
The user can enable or disable the automatic mute for when an error on either the SMPTE-310 or the ASI-320 input is detected. The delay for the detection of the loss of the SMPTE-310 input is 1 second. In case the user disables the automatic mute, null packets are inserted to reach the required bit rate.
- **Test mode:**  
Test modes available:
  - 23 bits of random data sequence
  - Single tone insertion

## Output Interface Management

- **Channel Encoding:**  
The modulator performs channel encoding according to the ATSC standard:
  - Randomization (energy dispersal)
  - Reed Solomon coding (RS coding)
  - Data field interleaving
  - Trellis coding (constellation building)
- **Channel modulation:**  
The modulator performs channel modulation according to the ATSC standard:
  - Frame building
  - Pilot insertion
  - Constellation mapping
  - Nyquist filter
- **Output processes:**
  - Linear pre-correction.  
The modulator can perform linear pre-correction adjustment. It is possible to configure the amplitude and group delay values. The group delay correction is from -2 to +2 $\mu$ s while the amplitude adjustment is +/- 3dB. A Tilt function has been implemented to correct for up-converter distortions. It uses a set of 64 coefficients that are computed by the control software.



Using the software, the user will define their linear pre-correction curve. Then the points will be used to compute complex coefficients to be sent to the module. It needs 64 complex coefficients and these coefficients are used in the module to configure the filter.

- Non Linear pre-correction.

The modulator can perform non linear pre-correction over a 20 MHz bandwidth. The modulator can also perform amplitude and phase correction over the full spectrum of the signal. For these purpose two tables (AM-AM and AM-PM) of a maximum of 16 points (abscissa and ordinate values for each point) are downloaded in the modulator ("1S mode"). In "2S mode", the user sets and downloads two groups of 16 points for each table. The first group corrects the "left" side of the spectrum and the second group corrects the "right" side of the spectrum. The "2S" mode provides more pre-correction adjustment accuracy and allows the opportunity to perform different pre-corrections that will have a corresponding impact on the left and right sides of the spectrum. This has been developed particularly to correct asymmetric shoulder levels. Each table defines the amplitude and the phase pre-correction that will be applied on the spectrum.

The AM-AM pre-correction table defines the AM/AM curve that will be applied across the channel spectrum. For each point, the abscissa can be defined from -12 dB to +12 dB in 0.05 dB steps and the ordinate can be defined from -6 dB to +6 dB in 0.05 dB steps.

The AM-PM pre-correction table defines the AM/PM curve that will be applied to the spectrum. For each point, the abscissa can be defined from -12 dB to +12 dB in 0.05 dB steps and the ordinate can be defined from -25° to +25° in 0.2° steps. All 16 points are equally spaced over the useful spectrum in 1S mode and over each left/right segment of the spectrum in 2S mode. These tables can easily be defined by using the control software.

- RF Output signal:

The main signal is available on the "RF Out".

The centre frequency of the signal can be set from:

- 470 MHz to 860 MHz with a step of 1 Hz.

The user will be able to setup attenuation between 0 to 10 dB in 0.1 dB steps. An offset gain is also available from -2 to +2 dB in 0.1 dB increments if finer adjustment is desired. The output can be muted either by the user or by pre-determined conditions. The mute can be direct (abrupt muting) or progressive.

A sample of the signal is available at the test point at an attenuated level of -20 dB.

## 4.0 INSTALLATION

This section contains installation recommendations, unpacking, inspection, and installation instructions for the Technalogix TM600-8VSB Modulator. Carefully read all material in this section prior to installation. Also, read and review the operating procedures later in this section.

### Building Recommendations

The quality of the building is of great importance if you are to expect long life and continued performance from the modulator. The building must be clean, dry, temperature controlled and secure. The modulator takes up a single 2-U high space on a 19" rack. Do not forget to allow space in the building for any additional racks to house test equipment, a workbench area, line regulating transformers, ladders, equipment and parts storage, first aid kit, emergency generator if used, as well as heating and cooling devices that may be unique to your installation. A sloping roof will tend to develop leaks less rapidly. The building should be well roofed with good material. The cooling load will be lowered with reflective or light colored roofing material.

## Heating and Cooling Requirements

The environment's temperature will contribute greatly to the length of the modulator's life. Technalogix recommends that the building's filtered air intake must have capacity for all air-flow in the building plus an additional 20%. Keep the intake below the roofline to avoid intake of solar heated air. Please ensure that the intake and exhaust areas are on the same side of the building to avoid pressure differentials during windy conditions. Also, do not position intake near exhaust's preheated air. If air conditioning is required to cool the shelter, discuss the situation with a qualified HVAC technician. Under average conditions, 12,000 BTUs will cool approximately 500 square feet to a comfortable level.

## Electrical Service Recommendations

Technalogix recommends that a qualified, licensed local electrician be consulted for the required electrical service. We suggest local electricians because:

- The personnel knows the local codes
- The personnel can be on site readily
- You are apt to get better overall support if you give what business you can to local suppliers

Technalogix recommends that proper AC line conditioning and surge suppression be provided on the primary AC input to the power amplifier. All electrical service should be installed with your national electrical code in your area, any applicable provincial or state codes, and good engineering practice. Special consideration should be given to lightning protection of all systems in view of the vulnerability of most transmitter sites to lightning. Lightning arrestors are recommended in the service entrance. Straight and short grounds are recommended. The electrical serviced must be well grounded. Do not connect the unit to an open delta primary power supply, as voltage fluctuations could harm the unit. Branch your circuits. Do not allow your lights, your workbench plugs, and your transmitting or translating equipment off of one circuit breaker. Each transmitter should have its own circuit breaker, so a failure in one does not shut off the whole installation.

## **Antenna and Tower Recommendations**

Your preliminary engineering workgroup should establish your antenna and tower requirements, both for receiving and transmitting antennas. Construction of sturdy, high quality antenna/tower systems will pay off in terms of coverage of your service area, the overall quality and saleability of your radiated signal, and reduced maintenance expenses. Technalogix provides complete turnkey antenna systems if needed. Transmitting antennas can enhance or seriously impair the transmitter output. It is assumed that one has been selected prior to system installation, but the best-designed antenna system will function poorly if shortcuts and compromises are used during installation. Follow the manufacturer's instructions exactly, along with any engineering data prepared for the site.

The selection, routing, and length of coaxial cable are extremely important in the installation. If there is a 3 dB line loss in the cable between your unit's output and the transmitting antenna, a 500 watt unit will only deliver 250 watts to the antenna. Buy the best cable you can obtain, route it via the shortest way to the antenna, and keep it straight. Do not form it into sharp bends on its way. Do not use any more cable fittings for the installation than absolutely necessary. All cautions here apply equally to all coaxial cables in the system - input and output. The better known tower manufacturers offer complete technical and safety documentation with their towers. Be sure that you have this information as it regards wind loading, guying, etc. Be absolutely safe and certain about this aspect as human lives may be at stake.

## **Shelter Security**

The FCC requires that the transmitter be secure from entry or control by unauthorized persons, and that any hazardous voltages or other dangers (including most tower bases) be protected by locks or fences as necessary to protect personnel and prevent unauthorized tampering or operation. Security of the building further implies that it be secure from wildlife. Use sturdy construction materials, including sheet metal if necessary. Holes around conduit, cable, and other similar entry points should be stuffed with steel wool and caulked to prevent entry of wildlife. Other features of security for your shelter may include its location with respect to the prevailing wind conditions. Location leeward of some natural topographical feature will prevent wind damage and snowdrifts. Check the soil runoff conditions that may slow or hasten wind or water erosion and other concerns that may be unique to your location.

## Unpacking and Inspection

Check the outside of the container. Carefully open the container and remove the modulator. Retain all packing material that can be reassembled in the event that the equipment must be returned to the factory.



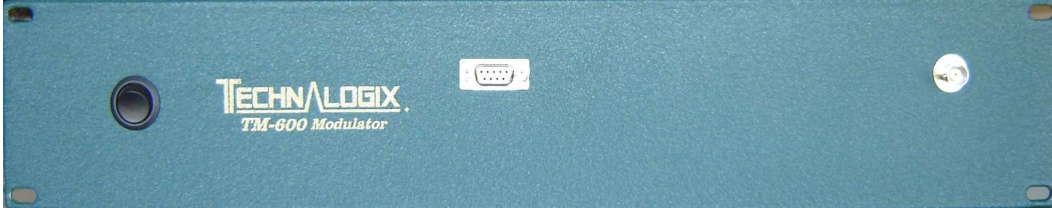
EXERCISE CARE IN HANDLING EQUIPMENT DURING INSPECTION  
TO PREVENT DAMAGE DUE TO ROUGH OR CARELESS HANDLING.

Visually inspect the enclosure of the modulator for damage that may have occurred during shipment. Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in connectors. Inspect all connectors for bent connector pins. If the equipment is damaged, a claim should be filed with the carrier once the extent of the damage is assessed. Technalogix cannot stress too strongly the importance of immediate careful inspection of the equipment and subsequent immediate filing of the necessary claims against the carrier if necessary. If possible, inspect the equipment in the presence of the delivery person. If the equipment is damaged, the carrier is your first area of recourse. If the equipment is damaged and must be returned to the factory, phone for a return authorization. Claims for loss or damage may not be withheld from any payment to Technalogix, nor may any payment due be withheld pending the outcome thereof. Technalogix cannot guarantee the carrier's performance.

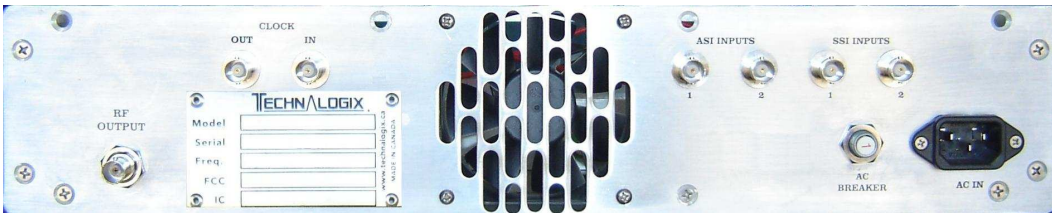
## Location and Function of Controls and Connectors

The following illustrations depict the location of the installation connectors when installing the modulator portion of the system.

### FRONT



### BACK



### Front Panel:

**Test Point-** Provides a sample of the RF output level. RF test point is only a relative indicator of the actual RF output level and may vary. All RF operating measurements should be made at the RF output of the unit.

**RS232 -** Textual low level command interface.  
User supplies DB9 male to mate to DB9 female on front panel.

### Rear Panel:

**ASI In -** ASI-320 MPEG-2 encoded transport stream inputs (BNC).

**SMPTE In -** SMPTE-310 MPEG-2 encoded transport stream inputs (BNC).

**10 MHz In -** Accepts external 10 MHz clock reference (BNC).

**10 MHz Out –** Provides a 10 MHz clock reference (BNC).

**RF Output -** Modulated transport stream, ATSC compliant signal (BNC).



## Modulator Operation

1. Terminate modulator into a 50 ohm load before applying power.
2. Connect the power cord of the Technalogix modulator to a proper electrical source as indicated on the back of the unit.
3. Connect the MPEG-2 encoded input to the jack on the rear panel (either ASI-320 or SMPTE-310).
4. Connect the RS232 on the front panel to a computer and run the control software. If the power is applied and the signal is present, the power and status LED will illuminate on the software interface.
5. Select the desired output channel by entering the center frequency on the "Frequency" space.
6. On the front panel, connect the test point to a spectrum analyzer. Make sure that the signal is present, at the correct frequency, and at the proper level.
  - Allow for 30 seconds delay for the signal to be present after turn on.
7. Connect the RF output to a spectrum analyzer and verify the signal, the frequency, and the level.



TECHNALOGIX POWER SUPPLIES IN THE MODULATORS ARE DESIGNED SO THAT UNDER CERTAIN POWER LINE OR HEAT BUILDUP CONDITIONS, THE UNIT SHUTS OFF. AN INDICATOR WOULD BE NO RF OUTPUT. IF THIS OCCURS, UNPLUG THE POWER CORD AND WAIT TWO MINUTES BEFORE RE-POWERING. UPON APPLYING POWER, YOU SHOULD AGAIN HAVE RF OUTPUT. IF NOT, OR SHOULD THE UNIT RETURN TO SHUTDOWN MODE, PLEASE CONTACT TECHNALOGIX FOR ASSISTANCE. TECHNALOGIX HIGHLY RECOMMENDS A 1.75 INCH AIR CIRCULATION SPACE BETWEEN ANY PIECES OF RACK MOUNTED EQUIPMENT.



THE MODULATOR WILL TAKE APPROXIMATELY ONE HOUR TO REACH A STABLE OUTPUT LEVEL DUE TO TEMPERATURE WARM-UP.

Look at the transmitted output using a suitable monitor. The picture and sound quality should be clean and sharp. If the output picture and sound quality is unsatisfactory, check the input signal, the input and output connections, and make sure that the attenuation to the monitor is within the range specified by the manufacturer.

**THANK YOU  
FOR CHOOSING  
TECHNALOGIX Ltd.**