ATSC/ISDB -T/DVB MODULATOR

TM-800

OPERATION MANUAL
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Technalogix Ltd. The information and specifications contained in this document is subject to change at
any time without notice.
1. Introduction

Please take a few minutes to read the manual and familiarize yourself with your new Technalogix TM800 modulator.

This user manual, the Final Inspection Report, and of course our equipment, should be everything you need to create a modulated signal to drive your power amplifier. We understand that a capable and confident user will get the most out of our product and we have made every attempt to educate readers of all technical levels. If there is something that is not clear, or you require further information, please do not hesitate to contact us and we’ll be glad to help out.

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All information that is specific to your unit is contained within the Final Inspection Report included in the shipped equipment container. This report summarizes performance specification and this manual provides wiring hookup details and outlines specific components found in the system.

We truly appreciate that you have chosen us as your RF equipment supplier. Happy transmission!
2. **General Safeguards**

This section is written as a general guide for safe operation of the equipment 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 these instructions before operating the equipment.

**Environment**

To reduce the risk of fire or electric shock, do not expose this equipment to rain or moisture. Refer all servicing to qualified service personnel.

**Servicing**

Do not attempt to service this equipment yourself as opening or removing covers can result in personal injury and will void the warranty. Refer all servicing to qualified service personnel.

2.1. **Safety and First Aid**

Personnel engaged in the installation, operation, maintenance, or servicing of this 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. The user should ensure that they are trained in proper first aid and the necessary precautions, which may not be contained in this manual, are followed.

- At all times, avoid placing any part of the body in series between ground and circuit points, whether power is on or off.
- Dangerous voltage may be present in equipment. Do not open the cabinet. Refer servicing to qualified service personnel.
- It is the duty of all personnel to be prepared to give adequate emergency first aid treatment and thereby prevent avoidable loss of life.
- 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. Call for medical help immediately.

2.2. Operating Safeguards

Load Impedance

Technologix equipment is designed to operate with 50-ohm load impedances. It is imperative you maintain 50-ohm impedances throughout your system for your equipment to provide maximum power transfer to the load and decreased reflected power heading back towards the amplifier pallets. Failure to provide a 50-ohm path throughout the system may result in damage to your equipment. Before anything is turned on, ensure that there is a 50-ohm path from the output of each stage to the input of the next, all the way to the load.

Application of RF Drive Signal

In addition to maintaining proper 50-ohm impedances throughout the signal chain, it is also important, whenever possible, to make sure that the modulator is fully configured for your application before connecting the RF output to the amplifier. Any modulator supplied by Technologix as part of an amplifier system will operate with the amplifiers and will be configured to the specifications supplied by you, the customer, at the time of purchase. When you first turn your modulator on, the DC power supply’s output voltage may take a while to stabilise to a safe operating voltage. There will also be a delay after applying DC power to allow the completion of the initialisation sequence of the modulator before the modulator applies the RF drive to the amplifiers.

Operating Warnings

Our transmitter equipment is designed to operate reliably at a specific RF output power level. Failing to adhere to power levels, frequency ranges, and switching recommendations and other warnings can decrease the reliability of your system and may result in damage to the unit.

The radiated power from the cabinet of this device is below the Industry Canada radio frequency exposure limits. The device should be used in such a manner that the potential for human contact with an RF signal or antenna during normal operation is minimized.
3. Terms of Sale

Sales by Technalogix Ltd. ("Seller") are made only on terms which are contained in this policy. Seller hereby gives notice of its objection to any different/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/supplemented only by written document signed by authorized representative of the Seller. These terms and conditions supersede any prior and/or contemporaneous agreements/correspondence between Buyer and Seller. Any order received and accepted by Seller shall be construed as acceptance of Seller's offer to sell its products to the Buyer in accordance with 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 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 Purchase Order. A minimum down payment is required with all orders. No orders are considered an order until the payment has been made.

Pricing Policy

All prices are FOB shipping point and prices do not include freight, handling, and insurance. All prices published/quoted by Seller may be changed at any time without notice. Unless otherwise specified, written quotations expire 30 days from date issued and subject to change/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 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.

Shipping

Shipping is the responsibility of the Buyer. This includes all freight, customs and brokerage charges, duties, and insurance.

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 the date of invoice, subject to 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 the payment, Buyer shall be liable for all collection costs, including reasonable attorney’s fees and costs. Non-payment of past due accounts will result in a lien against parts and all subsequent assemblies or products that our components are in. Goods remain the property of Seller until invoice is paid in full.
Changes and Cancellation

Purchase orders that have been accepted by Seller may not be changed/ cancelled, in whole or part, without written Seller consent. All changes must be included in change order reflecting purchase order and submitted to the Seller. All other changes will not be accepted/acknowledged. Changes may affect delivery dates. Expenses incurred because of changes shall be charged to Buyer. Buyer will be liable for Seller’s costs incurred, plus a reasonable profit, for the portion of work terminated, in accordance with generally accepted accounting principles, together with cancellation charges. Orders for standard product may be changed by Buyer, with no penalty to Buyer, provided that Buyer provides Seller notification at least 30 days prior to scheduled ship date. Order changes received within 30 days of 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 the product shipment has occurred. Custom orders may be cancelled by Buyer, provided that Buyer pays Seller for completed work allocated to Buyer’s order at time of termination of the work at selling price and all costs for work-in-progress and costs resulting from cancellation and reasonable profit therein. Specific cancellation charges dependent on the type of custom product ordered. A schedule detailing these charges will be forwarded to Buyer when Buyer’s cancellation fee of up to 100% of the order, depending on the stage of completion of the order at the date the cancellation or revised is accepted.

Custom Products Policy

Custom items are not returnable. Items other than “off the shelf” products are considered custom and are products/materials which have been altered, amended and customized to your order, and not resalable.

Returns

Product return without written authorization by Seller will not be accepted. Returns accepted only with a valid Return Material Authorization (RMA). To receive authorization for product return, call Seller. There is a standard 25% restocking cost assessed on most returns. All returned products (non-repair) must be unused, and in original condition. No refund/credit given for damaged products. We do not accept postage-due/ C.O.D. packages at any time.

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 written consent of the Seller. Any such actual or attempted assignment shall entitle Seller to cancel the order upon written notice to the Buyer.
Installation

Seller assumes no obligation to install any product sold to place any products in working order at Buyer’s premises and not responsible for freight damage.

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.
4. **Warranty**

Technalogix products have been completely tested and found to meet specifications and be in proper operating condition. Technalogix-manufactured products are warranted to be free from defects in materials and workmanship for a period of two years from the date of shipment. Products sold through, but not directly manufactured by Technalogix, carry the original manufacturer’s warranty. Seller 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 and does not include misuse, neglect or accident, incorrect wiring and/or improper installation, unauthorized repairs, modifications or use in violation of instructions issued by Seller, 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, damages due to AC or DC power supplied by customer to power the equipment (see installation recommendation for surge protection), or acts of terrorism. Seller agrees, at our option, to remedy warranted defects or furnish a new part in exchange for any part of unit which, under normal installation, use and service, becomes defective. The user pays for transportation costs to and from repair facility. If you require on-site service, please contact our sales department for pricing and conditions.
5. **Principle of Operation**

The TM800 modulator is designed to take an input digital signal and provide a modulated RF output of up to 2W output power (depending on options selected) that can be used to drive a transmitter amplifier. Choice of the particular modulation scheme is determined by software installation, and can be upgraded, so ensuring future proofing of your investment.

The internal modulator card provides all signal processing from an input of ASI or TSoIP to the output of frequency agile RF. The internal modulator card gives instant access to market leading DVB-T/H/T2, ISDB-T/b and ATSC 1/3 modulator performance. The modulator will be supplied with the modulation scheme defined at the time of purchase.

In addition to a state-of-the-art implementation of the mandatory channel coding and modulation in compliance with the relevant standards, the modulator card also includes:

- Sophisticated management of input substitution (redundancy switching).
- User programmable transport stream network ID verification for easy implementation of safeguards against accidental transmission of unauthorized transport streams.
- Input sense lines for on-card management of external alarm conditions.
- Fully programmable alarm management including user programmable muting, event logging, e-mail transmission and SNMP trap generation.
- Optional on-card GNSS receiver for cost effective SFN synchronization (GPS, GLONAS, GALILEO and BEIDOU).
- Linear and non-linear Precorrection for optimization of transmitter performance. Adaptive pre-correction is available as an option.
- Frequency agile RF output supports any frequency from 30MHz to 860MHz in steps of 1Hz, with frequency stability options (2ppm, 0.25ppm, 0.01ppm).
- On-line SW/FW upgrade over Ethernet.

Several possibilities for management and control are supported as standard:
- on-card Ethernet Web interface (user friendly GUI for local and remote control).
- on-card Ethernet SNMP client function (set/get and traps).
- Serial interface port (RS232/RS485) featuring simple text string commands (SCPI protocol).

The Block Diagram is included in this manual to illustrate the component flow of the TM800 modulator and to provide specific configuration information (see chapter 10).
6. Installation

This section contains unpacking, inspection, and installation instructions for the modulator. Please read the following sections carefully prior to setting up the equipment.

6.1. Unpacking and Inspection

Check the outside of the container. Carefully open the container and remove the modulator and any accessories. 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 or fan failures. Inspect all connectors for bent connector pins. Check for a cracked screen or damaged controls. 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 number. 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.
6.2. Rear Panel Connections

AC IN: Single phase AC input to feed internal AC/DC switching power supply. Power supply is universal 110/220V.

Linear Precorrection: RF linear precorrection signal input (BNC)

Nonlinear Precorrection: RF nonlinear precorrection signal input (BNC)

External Interface: System control and alarms (DB25)

TSoIP 3: Data/Control connector (RJ45)

TSoIP 2: Data/Control connector (RJ45)

RF OUT: RF signal output (BNC)

10MHz In: External 10MHz clock signal input (BNC)

GPS: GPS antenna connector (BNC)

10MHz Out: External 10MHz clock signal output (BNC)

ASI Out C: ASI output (BNC)

1PPS In: External time reference input (BNC)

ASI In A: Primary ASI input (BNC)

1PPS Out: External time reference output (BNC)

ASI In B: Secondary ASI Input (BNC)

TSoIP 1: Data/Control connector (RJ45)
6.3. Front Panel

- **Vent**: Air vent for cooling
- **Screen 1**: Information screen 1
- **Screen 2**: Information screen 2
- **1<>2**: Button to switch between screen 1 and 2
- **ESC**: Escape button
- **OK**: Navigation and OK buttons
- **LEDs**: Power On, Alarm, Mute and Service LEDs
- **Set IP**: Reset IP address to default
- **Local**: Activate Local front panel control
- **Ethernet**: Data/Control connector (RJ45)
- **Vent**: Air vent for cooling
6.4. Initial Hook Up

1. If applicable, ensure that the antenna or alternative load has been swept and, ideally, has a return loss of greater than 20dB (VSWR = 1.2:1) and is connected to the system amplifier.

2. Place the modulator in its permanent location near a receptacle supplying the required AC mains voltage. Leave the modulator turned off.

3. Place an appropriate AC power line protector, conditioner, and/or surge suppressor across the supply line. This small investment is highly recommended to protect the equipment from power surges and spikes (not covered by warranty).

4. Install a lightning surge arrester or Gas Discharge Tube (GDT) on the coax near the antenna or alternative load to protect the amplifier. This small investment is highly recommended to protect the equipment from lightning (not covered by warranty).

5. Connect the system amplifier input cable to the RF OUT female connector (BNC type) on the modulator enclosure’s RF output. Leave the amplifier off until the modulator has been tested. Alternatively, Technalogix recommends that the system should be tested into a 50-ohm load before any on air transmission.

6. Connect the data source (ASI or TSoIP) to the appropriate input connectors (BNC or RJ45). Check that all connections are firm.

7. Connect the control port to your computer or ethernet network using a standard network cable. Technalogix recommends using a computer to assist with the setup of the modulator.

8. If using precorrection, connect the nonlinear precorrection to a tap-off point after the amplifier but before the filter, and connect the linear precorrection to a tap-off point after the filter. Ensure that the signal level on these connectors is less than +10dBm. Technalogix recommends using this feature.

9. Connect additional equipment as required (GPS, External interface, External sources, etc)

At this stage, the system is set up and ready to do a preliminary start up, as outlined in the “Operating Procedure” section.
7. Operating Procedure

Assuming the previous installation instructions have been completed and cautions noted proceed with the following steps to place the system in operation. The modulator has been factory aligned for specific frequencies (per system specification), signal levels and optimum performance.

**IT IS HIGHLY RECOMMENDED THAT YOU RUN YOUR SYSTEM INTO A DUMMY LOAD BEFORE INSTALLING TO MAKE SURE THERE ARE NO DAMAGES CAUSED IN SHIPPING AND THE UNIT IS RUNNING PROPERLY**

1. Verify that all control and RF cables are tight and properly seated in or on the mating connector.

2. Turn on the power to the modulator. Verify that the fans are on, that the display is operational and that the front panel controls work, after the unit has completed the startup sequence.

3. Connect to the Webservice interface

4. Check the parameters of the system, including the network settings. Remember that the output power is dependent upon the type of internal RF amplifier, if one is installed. If there is no input signal, the modulator will mute the RF output

5. To test the modulator without an input signal, navigate to the Input functional block on the Webserver and set up a test signal. The PRBS signal will simulate an active incoming data stream. Remember to turn this function off when operating with a real signal.

6. Navigate to the Output functional block on the Webserver and check that the output frequency and level is correct. Remember that the output power is dependent upon the type of internal RF amplifier, if one is installed.

7. If using or creating the available references, check that these are operational.

8. Check the operation of the Alarms and external interfaces.

9. If required set the passwords for the Admin, Operator and Observer. Ensure that you keep a record of these passwords. Set the front panel screen saver and other front panel functions. Set the date and time. These operations can be found in the System section.

10. If using a dummy load for this setup procedure, mute the output of the modulator and connect the modulator to the amplifier system. If it is safe to do so, power up the whole system and check that the modulator is operating correctly.

The TM800 modulator is now ready for operation. At this time, Technalogix recommends that you document your measurements to use as a reference over time, and save the unit software setup.
8. Programming

8.1. Overview

The TM800 uses the ProTelevision modulator card. Therefore, the programming interfaces are defined by ProTelevision, and the detailed operations of this software can be found in the attached Appendix. Note that that manual refers to the PT3000 series modulators produced by ProTelevision, but the Technalogix TM800 has different electrical interfaces and other options than listed in that manual. The information below will highlight some of the information from the ProTelevision manual, but please refer to that manual for more detailed information. References to the sections of the ProTelevision manual will be proceeded by the letters PT

8.2. Webservice Operation

The Webservice operation is the preferred means of connection to the modulator. This allows a visual overview of the device as well as the detailed programming information. Connection to the device is through a standard web browser. There are four levels of login – Factory, Admin, Operator and Observer. You can see the default user names and passwords in section PT5.1.1

8.3. Webservice Main Page

Connection to the Webservice function is established simply by entering in the Web browser’s address field the IP address of the modulator. As soon as the connection has been opened the primary control and status page will appear. The page is divided into an upper section and a lower section:

- The upper section provides a graphic representation of the block schematic of the device. The block schematic provides general status information about the device and serves as navigation tool for accessing specific status and configuration menus.
- The lower section provides space for simultaneous display of three control and status panels for specific functional areas of the unit. The control panels are easily adapted to the current activity by dragging-and-dropping the required functional block from the upper section of the screen to the lower section of the screen. Dropping the functional block into this area will allow full control over the parameters associated with that particular functional block.

In case an alarm condition exists for one of the functional elements shown in the upper section of the screen the particular element will be shown in red color. Functional elements that are in the normal operational status will be shown in green color. Functional elements that are outside the normal operational status will be shown in yellow color. Functional blocks that are not used in the current configuration are shown in grey color.

See section PT5.1.2

8.3.1. System parameters

A number of system oriented parameters can be accessed by left-clicking the [System] button located in the lower-left corner of the web page. See section PT5.1.3.5 and section PT6.1
8.4. Main Function Blocks

The following main function blocks are defined in the system: Input, Reference, Mode, Pre-Correction, and Output.

For Input refer to section PT6.2. This function block allows control of the input selection, ASI or TSoIP, as well as associated parameters and alarms. From this block you can also initiate a test data stream, define switching parameters and set the monitor output.

For Reference refer to section PT6.3. This function block deals with the various references that can be associated with the system. These are the GNSS (Global Navigation Satellite System) interface, the 10MHz reference and 1PPS reference.

For Mode refer to section PT6.4. The mode function block is dependent upon the modulation scheme implemented in the modulator.

For Pre-Correction refer to section PT6.5. The Pre-Correction main function block gives a graphical illustration of the Non-Linear and Linear sense inputs. The Non-Linear sense input must be connected to a suitable coupler/tap-off at a point right after the power amplifier before any band limiting filter. Notice further that the bandwidth between the RF output of modulator and the input of the power amplifier must be at least 20MHz wide to ensure effective nonlinear precorrection of the amplifiers non-linearity. The Linear sense input must be connected to a suitable coupler/tap-off point after the channel filter.

For Output refer to section PT6.6. Use this functional block to define the output frequency and level. The level defined here has to take into account the gain provided by the optional amplifier if installed.

8.5. Alarms

Alarms and events can be signaled to the user either via the Webservice interface, an SNMP Manager, an email messaging system, or it can be indicated by an alarm led on the front panel. The alarm system consists of a number of group alarms, which contain one or more sub-alarms. A group alarm always reflects the state of its sub-alarms e.g. if a sub-alarm is active the group alarm will display an active state.

The Alarm System allows to setup an array of actions bound to every alarm – both group alarms and sub-alarms. These actions are:

1. Event Log – If an alarm is raised it will be written to the event log.
2. Input Status – (see Appendix PTB, paragraph PTB.1.1, event ID 7712).
3. Exciter Alarm – If an alarm is raised a logic output exciter alarm is activated.
4. SNMP Trap – If an alarm is raised a notification can be sent to up to five SNMP Manager trap destinations (see paragraph PT7.2.1.2).
5. Email – If an alarm is raised an email notification can be sent to an email address.
6. Alarm led – If an alarm is raised the front panel alarm led will be lit (see paragraph PT7.2.1.4).
7. Mute – If an alarm is raised the output signal can be muted.
8. Reboot – If an alarm is raised the exciter/modulator can be rebooted.

If no actions are activated for a sub-alarm it is in a state of ‘Ignored’. The group alarm will still report the ‘OK’ status even if all its sub-alarms are in an ‘Ignored’ state.

See section PT7.1, PT7.2 for more details on the alarm system.
9. Ethernet Connections

9.1. General characteristics

- Four physical RJ45 10/100/1000 Base-T Ethernet interfaces are available (ETH0, ETH1, ETH2 and ETH3).
- ETH0, ETH1, ETH2 and ETH3 have separate MAC Addresses.
- ETH2 and ETH3 are optimized for management purposes. ETH0 and ETH1 are optimized for management and/or TSoIP traffic.
- The Ethernet connections are managed within the modulator based on up to five individual LAN configurations (address spaces). The five LANs are named respectively 1st Interface (FLAN), 2nd Interface (ALAN), 3rd interface (TLAN), 4th interface (BLAN) and 5th interface (PLAN).
- The 1st Interface (FLAN) is by default enabled and cannot be disabled by the user.
- The 2nd Interface (ALAN), 3rd interface (TLAN), 4th interface (BLAN) and 5th interface (PLAN) are as default disabled but can be enabled as required by the user.
- ETH1 is as default enabled and associated with the 1st Interface (FLAN).
- The user may freely associate any of the LAN interfaces with any of the physical interfaces. Note: a LAN interface may only be associated with one physical interface at a time but multiple LAN interfaces can be associated with the same physical interface.
- The four physical interfaces ETH0, ETH1, ETH2 and ETH3 are separate isolated networks. Inbound/outbound traffic on one physical port is completely isolated from traffic on the other three ports.

The default configuration for the Ethernet connections is as follows:

<table>
<thead>
<tr>
<th>LAN interface</th>
<th>Status</th>
<th>PHY</th>
<th>IP / Mask</th>
<th>VLAN (status and ID)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Interface (FLAN)</td>
<td>ENABLED</td>
<td>ETH1</td>
<td>192.168.168.168/255.255.0.0</td>
<td>Status: DISABLED ID: 10</td>
</tr>
<tr>
<td>2nd Interface (ALAN)</td>
<td>DISABLED</td>
<td>ETH1</td>
<td>10.2.1.250/255.255.0.0</td>
<td>Status: DISABLED ID: 11</td>
</tr>
<tr>
<td>3rd Interface (TLAN)</td>
<td>DISABLED</td>
<td>ETH2</td>
<td>10.3.1.250/255.255.0.0</td>
<td>Status: DISABLED ID: 12</td>
</tr>
<tr>
<td>4th Interface (BLAN)</td>
<td>DISABLED</td>
<td>ETH3</td>
<td>10.4.1.250/255.255.0.0</td>
<td>Status: DISABLED ID: 13</td>
</tr>
<tr>
<td>5th Interface (PLAN)</td>
<td>DISABLED</td>
<td>ETH3</td>
<td>10.5.1.250/255.255.0.0</td>
<td>Status: DISABLED ID: 14</td>
</tr>
</tbody>
</table>

The built-in Ethernet switch that connects the three RJ45 10/100 Base-T Ethernet ports available for management of the device provides for a multitude of connection possibilities; some typical examples are:

**Direct management by PC:** connect your PC directly to one of the three available ports using an Ethernet patch cable (you may use a cable with direct or crossed wiring; the
modulator will automatically detect the cable type). The IP address of the PC and the IP address of the modulator must be set to compatible addresses.

**Management across a network:** connect one of the three modulator management ports to the network.

**Management across a network with the modulator supporting the network with additional Ethernet ports:** connect one of the three modulator management ports to the network. The unused management ports of the modulator may serve for connection of additional modulators to the network as well as for connecting third-party devices to the network (the built-in switch of modulator will direct the traffic to and from the network).

## 9.2. LED Pattern for Ethernet RJ45 Connectors

Each of the RJ45 physical connections includes two LED’s for indicating the status of the connection. The following pattern is defined for the modulator:

![Physical ethernet port](image)

**Figure 2-8 Physical ethernet port.**

<table>
<thead>
<tr>
<th>LED</th>
<th>10Mbit activity</th>
<th>100Mbit activity</th>
<th>1000Mbit activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREEN</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>AMBER</td>
<td>Flashing</td>
<td>Flashing</td>
<td>Flashing</td>
</tr>
</tbody>
</table>

## 9.3. Front Panel RJ45 Setup

The front panel RJ45 connector is factory configured as PHY0. This may be reconfigured, by adjusting the internal network cables. The LEDs are configured on the TM800 interface board. Factory installation is zero-ohm resistors at R7 and R11. If selecting PHY1 move the zero-ohm resistors to R6 and R10. If selecting PHY2 move the zero-ohm resistors to R5 and R9. If selecting PHY3 move the zero-ohm resistors to R4 and R8.

The connector X151 on the internal modulator card with four RJ45 sockets provides connection for the four Ethernet interfaces PHY0, PHY1, PHY2 and PHY3. When viewed from the front the interfaces are positioned as follows:

```
[ PHY 3] [ PHY 1]
[ PHY 2] [ PHY 0]
```
9.4. Ethernet PHY1 front/rear routing

For modulator card hardware revisions 1.XX and 2.XX it’s possible to re-route the PHY1 RJ45 on the modulator card to the backplane PCB interface connector Control TSoIP 1 (to facilitate backward compatibility with the TM700 unit). PHY1 will be connected to Control TSoIP 1 when slide switch SW150 is moved towards the rear of the modulator card PCB. From modulator card hardware revision 3.XX a fifth PHY (PHY4) is added and permanently wired to the backplane PCB connector Control TSoIP 1.
10. **TM800 System Overview**

10.1. **System Overview**

The TM800 modulator is comprised of several subsystems, but is centered around the modulator card from ProTelevision. This modulator card comes installed with firmware to configure it to either DVB, ATSC or ISDBT modulation schemes. The front panel allows local access to the modulator configuration and monitoring, but the modulator card can also be accessed via local or remote computer connections, depending upon the configuration of the unit. The TM800 interface board allows for alarm interfacing and data connections through RS232 or RS485. The optional RF amplifier is used where the standard maximum output level of +10dBm is too low for integrating into a transmission system. The backplane is used for the interface of the incoming data signals and for connecting various references to the TM800 modulator.

10.2. **Overall System Block Diagram**

The following block diagram shows the connections to the modulator. The systems indicated by the dashed lines are to be supplied by the customer.
Unit Block Diagram

This block diagram shows the various functional blocks within the modulator. The components shown with the dashed lines are options that can be ordered with the system.
10.3. Modulator Board

The internal modulator card provides all signal processing from an input of ASI or TSoIP to the output of frequency agile RF. The internal modulator card gives instant access to market leading DVB-T/H/T2, ISDB-T/b and ATSC 1/3 modulator performance. The modulator will be supplied with the modulation scheme defined at the time of purchase. The modulator is characterized by a high RF and MER performance and by its unique ability to optimize the performance of any third-party power amplifier being utilized together with the modulator.

The RF output is adjustable from 30-860 MHz in steps of 1 Hz, with a level between -10dBm to +10dBm. The optional RF amplifier can provide a higher output level. Standard frequency stability of the modulator is 2ppm, but can be upgraded to 0.25ppm or 0.01ppm.

For more detail on the modulator refer to the Appendix.

10.4. Front Panel

The Front panel is the interface for local control of the TM800. It provides displays, warning LEDs and controls for the monitoring and configuration of the unit, as well as a connection point for one of the gigabit network connectors. Ventilation for the unit is also included on the front panel.

The front panel is supplied with power from the TM800 interface board, the network data connection is to the internal modulator and the control/data signals for running the front panel are also connected to the internal modulator.
10.5. TM800 Interface Board

The TM800 interface board provides an integrated connection point for alarm signals and RS232 or RS485 communication paths, as well as some internal operations.

The following table lists the connections for the DB25 connector:

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Name</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>Pin not activated – no connection</td>
</tr>
<tr>
<td>2</td>
<td>RS232 RX</td>
<td>Also, RS485 RX+</td>
</tr>
<tr>
<td>3</td>
<td>RS232 TX</td>
<td>Also, RS485 TX-</td>
</tr>
<tr>
<td>4</td>
<td>N/A</td>
<td>Pin not activated – no connection</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>N/A</td>
<td>Pin not activated – no connection</td>
</tr>
<tr>
<td>7</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>RF Fail Normally Open</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>9</td>
<td>RF Fail Common</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>10</td>
<td>RF Fail Normally Closed</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>11</td>
<td>Alarm 1 Normally Open</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>12</td>
<td>Alarm 1 Common</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>13</td>
<td>Alarm 1 Normally Closed</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>14</td>
<td>RS485 TX+</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>RS485 RX-</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>N/A</td>
<td>Pin not activated – no connection</td>
</tr>
<tr>
<td>17</td>
<td>N/A</td>
<td>Pin not activated – no connection</td>
</tr>
<tr>
<td>18</td>
<td>N/A</td>
<td>Pin not activated – no connection</td>
</tr>
<tr>
<td>19</td>
<td>+3.3V</td>
<td>Output current limited to 140mA maximum</td>
</tr>
<tr>
<td>20</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>External Mute In</td>
<td>Ground to activate, internally connected to +3.3V</td>
</tr>
<tr>
<td>22</td>
<td>Reset In</td>
<td>Ground to activate, internally connected to +3.3V</td>
</tr>
<tr>
<td>23</td>
<td>Alarm 2 Normally Open</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>24</td>
<td>Alarm 2 Common</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
<tr>
<td>25</td>
<td>Alarm 2 Normally Closed</td>
<td>Voltage free contact 1 A 30 V DC (resistive load)</td>
</tr>
</tbody>
</table>

10.5.1. RS232/RS485

The board can be configured for serial control over:

a) RS232 (single ended RX and TX wire pair),
b) RS485 (balanced RX and TX pairs)

Note: A null modem connection (crossed TX/RX wires) shall be used for the connection between the TM800 interface board and the controller.

The pins 2,3,14 and 15 connect directly to the on-card transceiver/UART circuit. To avoid damage to the modulator card care must be taken not to introduce reverse voltages when connecting the pins to
external circuitry. Relevant EMC precautions shall furthermore be applied if connecting the lines to this equipment.

Serial interface mode selection:
The serial interface mode is selectable from:
a) the WEB GUI3,
b) via SNMP set commands
c) by SCPI control4 over Ethernet or
d) via the RS232/RS485/RS485HD interface itself
Note: the latter configuration method will modify the format of the serial interface used for the configuration itself, so the terminal or the controller used for changing the interface format will become incompatible with the interface once the configuration command has been submitted).

Communication parameters:
The default communication parameters are:
• Baud rate: 115200
• Data bits: 8
• Stop bits: 1
• Parity: None
• Handshake: None
The communication protocol is SCPI. Any command or command line sent to the card over the serial interface must be terminated by a new-line character (\n / 0x0A).

10.5.2. RF Fail

Output connection for signaling RF level out of range fault. Thresholds for raising the alarm can be configured and enabled from the serial command system (SCPI), from the WEB GUI and via SNMP set commands. This is a voltage free contact.

10.5.3. Alarm 1 and Alarm 2

Output connection for signaling the status of the user programmable alarms Alarm-1 and Alarm-2. The alarms can be programmed to activate for any of the available alarm conditions monitored by the modulator alarm system. Programming of the Alarm 1 and Alarm 2 masks may be carried out from the serial command system (SCPI), from the WEB GUI and via SNMP set commands. These are voltage free contacts.

10.5.4. External Mute In

Connection for forcing the modulator RF output to muted condition. The Muting is activated and maintained by pulling the connection to ground level (ground closure operated). When the mute control is released (floating or logic high) the RF output signal will be soft started (gradual ramp up to set level under processor control). The connection has a built-in pull-up to +3.3V supply via 10K ohm resistor. CAUTION: External circuitry connected to the external mute pin shall not exceed a voltage potential relative to the modulator ground of more than +/- 12V DC.
10.5.5. Reset In

Connection for forcing a reset of the modulator card controller. The Reset is activated by briefly pulling the connection to ground level (ground closure operated). The connection has a built-in pull-up to +3.3V supply via 10K ohm resistor.

CAUTION: External circuitry connected to the reset pin shall not exceed a voltage potential relative to the modulator ground of more than +/- 12V DC.

10.5.6. Circuit Diagram
10.6. RF Amplifier

Different RF amplifiers are available depending upon frequency, the output power required and the degree of degradation allowed in the system. Higher output levels will result in a slight reduction in the quality of the generated RF signal and a reduction of the available bandwidth, although the resulting output still has excellent specifications. The precorrection systems contained within the modulator card can improve the overall system performance and are recommended to be used to achieve optimal signal transmission.

Example amplifiers:

- **AMP0013** – This is a broadband amplifier (50MHz to 1000MHz) able to deliver 200mW (+23dBm) of output power.
- **AMP0003** – This is a UHF band amplifier (470MHz to 860MHz) able to deliver a minimum 2W of output power.
- **AMP0024** – This is a VHF high band amplifier (170MHz to 230MHz) able to deliver a minimum of 2W output power.
- **AMP0025** – This is a VHF low band amplifier (45MHz to 90MHz) able to deliver a minimum of 2W output power.
10.7. Backplane

The backplane provides for some of the external connections as well as for some internal connections. The following connectors are on the backplane:

10.7.1. 10MHz In
Jack for input of external 10MHz reference, level 100mVpp – 3Vpp, AC coupled. BNC Connector. User selectable impedance – High impedance (greater than 1Kohm, Default) or 50 ohms.

10.7.2. 10MHz Out
Jack for output of 10MHz reference, level 800mVpp into a 50ohm load, 2Vpp into a high impedance load (greater than 1Kohm), AC coupled. BNC Connector.

10.7.3. 1PPS In
Jack for input of external 1PPS reference, level 0V – 5V, DC coupled. BNC Connector. User selectable impedance – High impedance (greater than 1Kohm, Default) or 50 ohms. User selectable trigger level – 1.6V (Default) or 1.0 ……. 1.6 V. User selectable trigger edge – rising( Default) or falling.

10.7.4. 1PPS Out
Jack for output of external 1PPS reference, level 0-1.5V into a 50ohm load, 0-4.5V into a high impedance load (greater than 1Kohm). BNC Connector. Pulse duration 100 microseconds. Timing point is the rising edge.

10.7.5. GPS
Jack for input of RF feed from the GNSS antenna. Note: DC bias may be injected into the RF feed for supply of active antenna. 50ohm impedance. BNC Connector. User selectable DC bias – Off (Default), +3VDC or +5VDC.

10.7.6. ASI Out C
Jack for output in ASI format of the input source selected by the user for external monitoring purpose. Note: This connector is referred to by the alias ASI Monitor in the user interfaces provided for control and monitoring (Webservice and front display/control). Impedance 75ohm. BNC Connector.
10.7.7. ASI In A
Jack for input of TS in ASI format. Note: This connector is referred to by the alias ASI-1 in the user interfaces provided for control and monitoring (Webservice and front display/control). Impedance 75ohm. BNC Connector.

10.7.8. ASI In B
Jack for input of TS in ASI format. Note: This connector is referred to by the alias ASI-2 in the user interfaces provided for control and monitoring (Webservice and front display/control). Impedance 75ohm. BNC Connector.

10.7.9. Control TSoIP 1
Jack for input of TS in TSoIP format, or the control interface/network connection. Note: This connector is referred to by the alias either ETH1 or ETH5 (depending upon the version of the modulator card) in the user interfaces provided for control and monitoring.

10.8. Other Rear Panel Connections

10.8.1. RF Out
BNC type connector provides the RF output for the modulator card. The modulator supports frequency agile setting of the RF output in the entire range from 30MHz to 860MHz in steps of 1Hz. The nominal output level is 0dBm into a 50 ohm load (range -10 to +10dBm, to +7dBm for operation within specification). The optional RF amplifier can increase this output power up to 2W (+33dBm)

10.8.2. Linear Precorrection
BNC type connector provides the sense input for the adaptive precorrection function. The linear sense port shall be connected to a point after the antenna filter. Impedance 50ohms. Level -10dBm to +10dBm maximum useful range. The webservice will raise a warning when operating with sense level below -9dBm and above +9dBm.

10.8.3. Non-Linear Precorrection
BNC type connector provides the sense input for the adaptive precorrection function. The non-linear sense port shall be connected to a sense point after the power amplifier but before the antenna filter. Impedance 50ohms. Level -10dBm to +10dBm maximum useful range. The webservice will raise a warning when operating with sense level below -9dBm and above +9dBm.

10.8.4. Control TSoIP 2
Jack for input of the control interface/network connection. Note: This connector is referred to by the alias ETH2 in the user interfaces provided for control and monitoring. This jack can be reconfigured within the unit to become one of the other ethernet ports.

10.8.5. Control TSoIP 3
Jack for input of the control interface/network connection. Note: This connector is referred to by the alias ETH3 in the user interfaces provided for control and monitoring. This jack can be reconfigured within the unit to become one of the other ethernet ports.
11. **Hardware Components**

11.1. **Modulator Board**

The modular board is the ProTelevision PT3000 series OEM modulator.

![Modulator Board Image](image1)

11.2. **TM800 Interface Board**

The TM800 interface board provides an integrated connection point for alarm signals and RS232 or RS485 communication paths, as well as some internal operations.

*TM800 Interface Board PCB3040*
11.3. RF Amplifiers

Different RF amplifiers are available depending upon frequency, the output power required and the degree of degradation allowed in the system.

AMP0013 – Broadband Amplifier

Amp0003 – UHF Amplifier

Amp0024 - VHF High
11.4. Backplane

The backplane provides for some of the external connections as well as for some internal connections.
11.5. Power Supply

Switching AC-DC power supplies are used to power the control circuits, the amplifiers and all of the fans. The DC control system voltage is set at 5Vdc nominally. All fans run off this same DC supply. The amplifier voltage is determined by what amplifier is installed but would typically be 24VDC.

AC is fed into the power supply enclosure via an AC entry connector and then through a circuit breaker/switch. Typical operational AC current draw with the amplifiers installed is 0.5 A at 110Vac, 0.25A at 220Vac. AC is then converted to DC using the AC-DC switching power supplies.

The following are the switching power supply data sheets used to convert the AC to DC for the internal components.
### 25W Single Output Switching Power Supply

**RS-25 Series**

#### Features:
- Universal AC input / Full range
- Protections: Short circuit / Overload / Over voltage
- Cooling by free air convection
- LED indicator for power on
- 100% full load burn-in test
- All using 105°C long life electrolytic capacitors
- Withstand 300VAC surge input for 5 second
- High operating temperature up to 70°C
- Withstand 5G vibration test
- No load power consumption < 0.5W
- High efficiency, long life and high reliability
- 3 years warranty

### Specification

#### Model

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Adj. Range</td>
<td>2.85 ~ 3.6V</td>
<td>4.75 ~ 5.5V</td>
<td>10.8 ~ 13.2V</td>
<td>13.5 ~ 16.5V</td>
<td>22 ~ 27.6V</td>
<td>42 ~ 54V</td>
</tr>
</tbody>
</table>

#### Input

| Voltage Range  | 88 ~ 264VAC | 125 ~ 373VDC (Withstand 300VAC surge for 5sec. Without damage) |
| Efficiency (Typ.) | 73.5% | 78.5% | 81.5% | 83.5% | 86% | 85% |
| Frequency Range | 47 ~ 63Hz |

#### Protection

- Overload: 110 ~ 180% rated output power
  - Protection type: Hiccup mode, recovers automatically after fault condition is removed
- Over Voltage: 3.8 ~ 4.45V
  - Protection type: Shut off o/p voltage, clamping by zener diode

#### Environment

- Working Temp.: -20 ~ +70°C (Refer to "Derating Curve")
- Working Humidity: 20 ~ 90% RH non-condensing
- Storage Temp. Humidity: -40 ~ +85°C, 10 ~ 95% RH
- Temp. Coefficient: ±0.03%/°C (0 ~ 50°C)
- Vibration: 10 ~ 500Hz, 5G 10min./1cycle, period for 60min. each along X, Y, Z axes

#### Safety & EMC

<table>
<thead>
<tr>
<th>Safety Standards</th>
<th>UL60950-1, TUV EN60950-1 approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withstand Voltage</td>
<td>I/P-O/P: 3KVAC</td>
</tr>
<tr>
<td>ISO/ISolation Resistance</td>
<td>I/P-O/P, I/P-FG, O/P-FG: 100M Ohms / 500VDC / 25°C / 70% RH</td>
</tr>
<tr>
<td>EMI Emission</td>
<td>Compliance to EN55022 (CISPR22) Class B, EN61000-3-2,3</td>
</tr>
<tr>
<td>EMC Immunity</td>
<td>Compliance to EN61000-4-2,3,4,5,6,8,11, light industry level, criteria A</td>
</tr>
</tbody>
</table>

#### Others

- MTBF: 309.7Khrs min. (MIL-HDBK-217F [25°C])
- Dimension: 78.5x128mm (L*W*H)
- Packing: 0.2Kg, 60pcs/13Kg, 46CUFF

### Note

1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.
3. Tolerance: includes set up tolerance, line regulation and load regulation.
4. Line regulation is measured from low line to high line at rated load.
5. Load regulation is measured from 0% to 100% rated load.
6. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies." (as available on http://www.meanwell.com)
### Mechanical Specification

**Terminal Pin No. Assignment**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC/L</td>
</tr>
<tr>
<td>2</td>
<td>AC/N</td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>DC OUTPUT -V</td>
</tr>
<tr>
<td>5</td>
<td>DC OUTPUT +V</td>
</tr>
</tbody>
</table>

![Mechanical Diagram](image)

**AMBIENT TEMPERATURE (°C)**

-20 0 20 30 40

**LOAD (%)**

0 20 40 60 80 100

**OUTPUT VOLTAGE (V)**

25 50 75 100 125 150 175 200 225 250

**OUTPUT RIPPLE (mVp-p)**

25 50 75 100 125 150 175 200 225 250

**Ta=25°C**

**fosc : 60KHz**

**Block Diagram**

- EMI FILTER
- RECTIFIERS & FILTER
- POWER SWITCHING
- PWM CONTROL
- RECTIFIERS & FILTER
- DETECTION CIRCUIT

**Static Characteristics (24V)**

**INPUT VOLTAGE (VAC) 60Hz**

60 80 100 120 140 160 180 200 220 240 264

**OUTPUT VOLTAGE (V)**

25 50 75 100 125 150 175 200 225 250

**OUTPUT RIPPLE (mVp-p)**

25 50 75 100 125 150 175 200 225 250

**Derating Curve**

File Name: RS-25-SPEC 2011-08-19
# Features:
- Universal AC input / Full range
- Built-in active PFC function
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Cooling by free air convection
- Built-in constant current limiting circuit
- 1U low profile 30mm
- Remote ON-OFF control
- LED indicator for power on
- 100% full load burn-in test
- 3 years warranty

## SPECIFICATION

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DC VOLTAGE</th>
<th>RATED CURRENT</th>
<th>CURRENT RANGE</th>
<th>RATED POWER</th>
<th>RIPPLE &amp; NOISE (max.)</th>
<th>VOLTAGE ADJ. RANGE</th>
<th>VOLTAGE TOLERANCE</th>
<th>LINE REGULATION</th>
<th>LOAD REGULATION</th>
<th>SETUP, RISE TIME</th>
<th>HOLD UP TIME (Typ.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSP-150-3.3</td>
<td>3.3V</td>
<td>30A</td>
<td>0 ~ 30A</td>
<td>69W</td>
<td>100mVp-p</td>
<td>3.14 ~ 3.33V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-5</td>
<td>5V</td>
<td>30A</td>
<td>0 ~ 30A</td>
<td>150W</td>
<td>100mVp-p</td>
<td>4.75 ~ 5.5V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-7.5</td>
<td>7.5V</td>
<td>20A</td>
<td>0 ~ 20A</td>
<td>150W</td>
<td>100mVp-p</td>
<td>7.13 ~ 8.25V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-12</td>
<td>12V</td>
<td>12.5A</td>
<td>0 ~ 12.5A</td>
<td>150W</td>
<td>100mVp-p</td>
<td>11.4 ~ 13.2V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-15</td>
<td>15V</td>
<td>10A</td>
<td>0 ~ 10A</td>
<td>150W</td>
<td>100mVp-p</td>
<td>12.8 ~ 14.9V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-24</td>
<td>24V</td>
<td>6.3A</td>
<td>0 ~ 6.3A</td>
<td>150W</td>
<td>150mVp-p</td>
<td>14.3 ~ 16.5V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-27</td>
<td>27V</td>
<td>5.6A</td>
<td>0 ~ 5.6A</td>
<td>150W</td>
<td>250mVp-p</td>
<td>22.8 ~ 24.6V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
<tr>
<td>RSP-150-48</td>
<td>48V</td>
<td>3.2A</td>
<td>0 ~ 3.2A</td>
<td>150W</td>
<td>150mVp-p</td>
<td>25.7 ~ 27.9V</td>
<td>±2.0%</td>
<td>±0.5%</td>
<td>±1.0%</td>
<td>600ms</td>
<td>16ms at full load</td>
</tr>
</tbody>
</table>

## INPUT

<table>
<thead>
<tr>
<th>VOLTAGE RANGE</th>
<th>FREQUENCY RANGE</th>
<th>POWER FACTOR (Typ.)</th>
<th>EFFICIENCY (Typ.)</th>
<th>AC CURRENT (Typ.)</th>
<th>INRUSH CURRENT (Typ.)</th>
<th>LEAKAGE CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 ~ 264VAC</td>
<td>47 ~ 63Hz</td>
<td>PF &gt; 0.93 &amp; 0.90</td>
<td>81.5%</td>
<td>1.6A/115VAC</td>
<td>COLD START 45A/230VAC</td>
<td>&lt;2mA/240VAC</td>
</tr>
</tbody>
</table>

## PROTECTION

<table>
<thead>
<tr>
<th>OVERLOAD</th>
<th>OVER VOLTAGE</th>
<th>OVER TEMPERATURE</th>
<th>FUNCTION</th>
<th>ENVIRONMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>105 ~ 135% rated output power</td>
<td>5.5 ~ 6.75V</td>
<td>100°C (212°F)</td>
<td>REMOTE CONTROL</td>
<td>TEMP. COEFFICIENT</td>
</tr>
<tr>
<td>Protection type: Constant current limiting, recovers automatically after fault condition is removed</td>
<td>13.2 ~ 16.2V</td>
<td>10 ~ 90% RH non-condensing</td>
<td>CN: +0 ~ 0.8VDC POWER ON, +4 ~ 10VDC POWER OFF</td>
<td>±0.05%/°C (0 ~ 50°C)</td>
</tr>
<tr>
<td>Protection type: Shut down c/o voltage, re-power on to recover</td>
<td>14.85 ~ 18.15V</td>
<td>VIBRATION</td>
<td>WORKING TEMP.</td>
<td>MIL-HDBK-217F (25°C)</td>
</tr>
<tr>
<td>Protection type: Shut down c/o voltage, recovers automatically after temperature goes down</td>
<td>26.4 ~ 32.4V</td>
<td>10 ~ 500Hz, 2G/min in 1 cycle, or 60min. each along X, Y, Z axes</td>
<td>TEMPERATURE</td>
<td>199 x 95 x 33mm (L x W x H)</td>
</tr>
</tbody>
</table>

## SAFETY & EMC

<table>
<thead>
<tr>
<th>SAFETY STANDARDS</th>
<th>WITHSTAND VOLTAGE</th>
<th>ISOLATION RESISTANCE</th>
<th>EMC EMISSION</th>
<th>EMC IMMUNITY</th>
<th>OTHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL60950-1, UL62368-1, TUV EN60950-1, EN61558-1, EN61558-2-16, CCC GB4934 approved</td>
<td>IP: O/P 3.75kVAC</td>
<td>O/P: D: 2kVAC O/P: D: 0.5kVAC</td>
<td>Compliance to EN55022 (CISPR22) Class B, EN61000-3-2, GB9264 class B</td>
<td>Compliance to EN61000-4-2, 3, 4, 5, 6, 8, 11, EN55024, light industry level, criteria A</td>
<td>MTBF</td>
</tr>
<tr>
<td>ISO: O/P 3.75kVAC</td>
<td>O/P: D: 2kVAC O/P: D: 0.5kVAC</td>
<td>O/P: D: 2kVAC O/P: D: 0.5kVAC</td>
<td>290 ± 10% hrs. min.</td>
<td>199 x 95 x 33mm (L x W x H)</td>
<td></td>
</tr>
</tbody>
</table>

## Packing

<table>
<thead>
<tr>
<th>PACKING</th>
<th>NOTE</th>
</tr>
</thead>
</table>
| 0.6Kg, 24pcs/15.4Kg/0.92CUFT | 1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature. 
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf of parallel capacitor. 
3. Tolerance: includes set up tolerance, line regulation and load regulation. 
4. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to “EMI testing of component power supplies.” (as available on http://www.meanwell.com) 
5. Derating may be needed under low input voltages. Please check the derating curve for more details. |
## Mechanical Specification

![Dimensions Diagram](image1)

### Terminal Pin No. Assignment

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Assignment</th>
<th>Pin No.</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC/L</td>
<td>4, 5</td>
<td>DC OUTPUT -V</td>
</tr>
<tr>
<td>2</td>
<td>AC/N</td>
<td>6, 7</td>
<td>DC OUTPUT +V</td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Remote ON/OFF (CN1): JST B-XH or equivalent (optional)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Assignment</th>
<th>Mating Housing</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RC+</td>
<td>JST XHP</td>
<td>JST SXH-001T</td>
</tr>
<tr>
<td>2</td>
<td>RC-</td>
<td>or equivalent</td>
<td>or equivalent</td>
</tr>
</tbody>
</table>

## Block Diagram

![Block Diagram](image2)

- EMI/Filter & Rectifiers
- PFC Circuit
- Power Switching
- Rectifiers & Filter
- Active Start Circuit
- O.L.P.
- O.V.P.
- Constant Current Limiting & Detection Circuit
- O.T.P.
- Remote Control

PFC fosc: 67KHz
PWM fosc: 67KHz

## Derating Curve

![Derating Curve](image3)

**Output Derating VS Input Voltage**

![Output Derating VS Input Voltage](image4)

File Name: RSP-150 SPEC 2013-07-01
12. Facility Recommendations

12.1. Building Recommendations

The quality of the building is of great importance if you are to expect long life and continued performance from the modulator, power amplifier or transmitter. The building must be clean, dry, temperature controlled and secure. Don’t 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.

12.2. 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 know the local codes
- The personnel can be on site readily
- You are apt to get better overall support if you cultivate business relationships with local suppliers

Technalogix recommends that proper AC line conditioning and surge suppression be provided on the primary AC input to the power amplifier or transmitter. If DC is used as a source, a DC-DC converter is recommended to provide isolation between the supply and the load. 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 many sites to lightning. Lightning arrestors are recommended in the service entrance. Gas Discharge Tubes (GDT) may help in preventing lightning, which was forecast for another day, from creating a bad day. Straight and short grounds are recommended. The electrical service 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 to operate on one circuit breaker. Each amplifier or transmitter should have its own circuit breaker, so a failure in one does not shut off the whole installation.

12.3. Antenna and Tower Recommendations

Your preliminary engineering workgroup should establish your antenna and tower requirements, if applicable, 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 sale-ability of your radiated signal, and reduced maintenance expenses. Technologix provides
complete turnkey antenna systems if needed. If your site is serving as a translator, your receiving antenna should be in line of sight to the originating station all year round. The foliage will change with season. Transmitting antennas can enhance or seriously impair the amplifier or transmitter output.

The selection, routing, and length of coaxial cable are extremely important in the installation. If there is a 3dB line loss in the cable between your unit’s output and the transmitting antenna, the unit will only deliver half power. 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.

Pay attention to radial ice accumulation when designing the transmission system. It is not uncommon for at least an inch of ice to build up on a tower or antenna in some locations. This in turn significantly increases the weight, cross section, and wind loading of the system, not to mention creating issues from reflective power.

Attaching the transmission line to the tower is crucial to maintain a safe and reliable operation. Nylon wire ties and electrical tape will breakdown in the sunlight and ultimately fail, creating a potentially dangerous situation. It is important to use proper clamps and hoisting grips and also ensure that the transmission line is grounded to the tower in several locations. When high currents flow through the tower in the event of lightning strikes, some of that current will flow through the outer conductors of the transmission lines. Due to the resistance difference between the steel tower and copper transmission line, a significant voltage can be developed, often resulting in arcing between the outer jacket and outer conductor, thus pitting the conductor.

Preventative maintenance is crucial in ensuring that safety is maintained. Specifically, check that transmission line grounds are tight and are not missing any hardware. Frequently inspect support clamps or spring hangers. Consider investing in an ice break, if you haven’t already done so, as shards of falling ice can damage the transmission line – and if it is going to happen, it will happen at an important time. Check the tower light photocells and conduit.

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. 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. Be absolutely safe and certain about this aspect as human lives may be at stake.

12.4. Shelter Security

The FCC requires that the equipment 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. Locations 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.
12.5. Heating and Cooling Requirements

The environment’s temperature will contribute greatly to the length of the power amplifier’s or transmitter’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. The fans internal to the enclosures help cool the components.
13. **Maintenance**

If your unit employs a filter on the air inlet for the fans, the filter should be cleaned every 30 days. If the equipment is operated in a severe dust environment, the filters on the inlet fan may need to be cleaned more regularly. Turn the system off and unplug all of the AC inlet cords. The filter can be lifted off the fan and cleaned using an air compressor at low pressure. While the filter is out, clean the fan blades themselves with a small brush. The fans themselves do not need lubrication.

The interior of the cabinets should be cleaned and inspected annually. Turn the system off and unplug all of the AC inlet cords. Remove the top lid by unscrewing the 6-32 machine screws.

⚠️ Use extreme caution when working near the AC input terminal. The power supply could store hazardous voltages.

Using compressed air or nitrogen and a brush with soft bristles, loosen accumulated dust and dirt and blow out the interior of the cabinet. Complete a visual inspection of the interior, making sure there are no loose connections or discolorations on any components from heat. Generally, nothing inside the modulator enclosure exceeds a temperature that is not comfortable to the touch under normal operating conditions except when running at maximum RF power, so any signs of discoloration indicate potential damage.

All modular components inside the enclosure are attached to aluminum mounting plates for easy removal and replacement. Ensure that plates are secured and the mounting hardware is tight.
14. **Troubleshooting**

The first and most important aspect of troubleshooting anything is to be systematic. Note where you have looked and what you found.

Look first for the obvious.

- Make a physical inspection of the entire facility. Are all necessary connections properly made? Do you see any signs of obvious damage within the equipment?
- Is the AC power ‘ON’ to the site and the equipment? (Check fuses and circuit breakers if necessary.)
- Are all the switches in the correct operating position?
- Is the input signal present and at the correct level?
- Are all cables connected and tight?

Some common software issues and suggested steps:

Monitor Application not connecting to units

- Ensure Modulator is on
- Ensure Ethernet Cables are connected
- Check network settings ie DHCP enabled, ports not blocked
- Incorrect password or IP address

The following flowchart is an aid in determining a power supply fault, if some aspect of the system is not operating.
AC - DC Power Supply (PSU) Troubleshooting

1. Apply AC power to back panel (check voltage)
2. Turn on AC switch on back panel
3. Display On? YES → PSU is OK
   NO → Fuse Blown? YES → Turn off switch on back panel
   NO → Fuse Blown? YES → Replace Fuse, use same type and rating
   NO → Turn off AC switch on back panel
4. Remove top cover
5. Turn on AC switch on back panel
6. AC voltage present at PSU input? NO → Broken wire or replace faulty AC entry
   YES → DC voltage present at PSU Output? YES → Faulty fan or control system
   NO → Disconnect control board, Turn unit off then turn unit back on
7. DC voltage present at PSU Output? YES → Troubleshoot control system
   NO → Replace failed PSU

Dangerous Voltages Inside!
## 15. Specifications

<table>
<thead>
<tr>
<th>General Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Number</td>
<td>TM-800</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>30-860  MHz, in 1Hz steps</td>
</tr>
<tr>
<td>Input</td>
<td>ASI or TSoIP 2 ASI inputs and 2 TSoIP inputs, selectable</td>
</tr>
<tr>
<td>Output Power</td>
<td>33 dBm max, +10dBm standard</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>88-264 V AC 1Phase</td>
</tr>
<tr>
<td>Supply Current</td>
<td>0.5 Amps AC typ at 110VAC and +33dBm</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-20 to 40 °C</td>
</tr>
<tr>
<td>Max Relative Humidity</td>
<td>90 % noncondensing</td>
</tr>
<tr>
<td>Impedance</td>
<td>50 ohms</td>
</tr>
</tbody>
</table>

| Operation             |         |
| Display               | 2 OLED screen, Local operation and display |
| Ethernet              | 2 front and back panels |
| Control               | front panel, network or RS232/RS485 |
| Software              | Protelevision control software |
| LED Indicators        | Power on, Alarm, Mute, Service |

| Mechanical            |         |
| Size                  | 483x450x44 WxDxH, mm |
| Rack Mounting         | Yes |
| Weight                | 6 kg |
| Controls and Connections | Mounted on front and rear panels |
| Cooling               | Fan Internal mount |
16. Appendix

16.1. PT3000 Product Family Product Manual
Thank you for choosing Technalogix Ltd.

If there is anything we can do to help in your success, please do not hesitate to contact us. We also welcome suggestions for product improvements or feature enhancements.