# INTELLIGENT REFERENCE / TM-4M™

## TIME & FREQUENCY SYSTEM
## WITH INTEGRATED RECHARGEABLE BATTERY PACK / UPS

## ADDENDUM TO TM-4 USER MANUAL

The Intelligent Reference/TM-4M™ contains an Intelligent Reference/TM-4™, and this addendum is intended to describe the additional features and operational differences incorporated into this product. Users should refer to the User Manual for the Intelligent Reference/TM-4™ (Spectrum part number 40013-001) in conjunction with this addendum for complete information. In particular, see Section 2 of the User Manual for installation instructions and the Quick Start Guide in Section 3.

## DESCRIPTION

The TM-4M contains an Intelligent Reference/TM-4OEM™, combined with a sealed lead acid (SLA) battery and an advanced battery charger. The front panel has six BNC jacks for input and output signals to and from the internal TM-4. The user may assign any of the outputs and inputs using jumpers located on the circuit board.

## POWER ON

The power switch is a locking type, to prevent accidental power status changes. To move the switch, pull it out gently and place it in the desired position.

The TM-4M is powered via an internal 12-volt SLA battery that is continuously charged with an internal battery charger. The front-panel ON/OFF switch only controls power from the battery to the internal TM-4, it does not disable the battery charger. When the ON/OFF switch is in the ON position and the battery is charged, power is applied to the TM-4. When AC input power is removed, the battery continues to provide power to the TM-4 and recharges when AC input power is reapplied.

The SLA battery has a 2.3Ah capacity, yielding approximately 8 hours of use between charges, assuming no warm-up requirement. The TM-4 uses more power during its initial warm-up period as the oven in the OCXO comes up to temperature. Battery life calculations assume that the initial warm-up period is complete before switching to battery power. It is possible to cold-start the unit using only the battery, but total battery life will be somewhat reduced due to the increased initial current demand.

A front-panel LOW BAT LED will illuminate red when the battery has discharged to a level that will provide a reserve capacity of approximately 30 minutes of remaining time. AC input power must be applied before the battery becomes completely discharged in order to maintain time synchronization with the GPS satellites.

The LOW BAT indicator is designed to alert the user to impending battery depletion. **There is no protection built into the TM-4M to guard against completely discharging the battery.** This is because there are possible scenarios where a mission-

## POWER ON (cont'd.)

critical application is more important than the service life of the rechargeable battery. Use good judgment when operating the unit in the low battery condition, as discharging the battery too much will significantly affect its performance and capacity. When the LOW BAT indicator illuminates, apply AC power to start charging the battery as soon as possible. AC power may be applied at any time without disturbing the operation of the unit.

The TM-4M will continue to operate well below the safe discharge level of the battery. Allowing the battery to discharge to (or beyond) the point where the TM-4M ceases to operate will cause permanent cell damage. Avoid operating the unit in the low battery condition for longer than 30 minutes if possible.

## POWER SUPPLY and BATTERY CHARGING

The battery charger/power supply built into the Intelligent Reference TM-4M™ is a sophisticated three-stage design that monitors battery condition and power demands, and adjusts its output accordingly. The CHG LED on the front of the unit indicates the state of the charger. It illuminates red when the charger is actively charging the battery and changes to green when the battery is fully charged and the charger enters standby mode. Note that during use of the TM-4M with the AC cord attached, this indicator will usually appear as red, since the TM-4M draws enough current to take the charger out of the standby mode. It is also possible for the indicator to toggle between red and green while the unit is operating.

It is not possible to overcharge the battery in the TM-4M. You may leave the AC cord connected to the unit continuously. The charger will automatically monitor the condition of the battery and keep it fully charged.

Note that it takes longer to charge the battery while the unit is operating. It is also not usually possible to determine if the battery is fully charged while the unit is operating, due to the continuous current consumption of the TM-4M. To determine if the battery is fully charged, turn off power to the unit and wait a few moments while observing the CHG LED. When the LED changes to green, the battery is at full capacity.

The input power specification of the battery charger/power supply is 90-264 VAC / 47-63 Hz. AC power is supplied either via an IEC 320-compatible connector on the rear of the unit, or optionally, via an MS3122E14-5P connector on the front panel. Pin assignment of the MS3122E14-5P connector is as follows:

- Pin A: AC Power In (live, usually black)
- Pin B: AC Power Return (neutral, usually white)
- Pin C: Ground (green)

The power connectors are mutually exclusive. Both cannot exist on the same unit.

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## TM-4M FRONT PANEL

The front panel of the unit comprises almost all of the available functions and connections for the unit. In addition to the ON/OFF switch, LOW BAT and CHG LEDs, the front panel has:

- Six BNC connector jacks (OUT A – F) for assignable TM-4 signals
- ALARM, READY, and POWER LEDs that mirror those of the internal TM-4
- D-Sub 9-Pin female connector for serial communications (CONTROL PORT)

The six BNC connectors (OUT A – F) can be assigned TM-4 signals by removing the cover of the TM-4M and setting jumpers on the main board. Each connector has a dual-row header showing the available signal assignments, which correspond to selected pins of the HD-15 D-Sub (SYSTEM INTERFACE) connector of the TM-4. These are:

- **1PPS**
- **10 MHz (analog sine wave)**
- **AUX232**
- **OUT1 / ANALOG IRIG-B**
- **EVENT TIME TAG (ETT) INPUT**
- **MUXOUT2**
- **ALARM**
- **PROGRAMMED OUTPUT PULSE (POP)**
- **MUXOUT1**
- **TPTXD232 (SERIAL TIME PORT)**
- **OUT2**

[See **SECTION 7, HARDWARE INFORMATION** of the TM-4 User Manual for the definitions and specifications for these signals, which normally appear on the TM-4's rear panel HD-15 D-Sub connector.]

## DANGER - SHOCK HAZARD.

**LIVE AND POTENTIALLY LETHAL ENERGY EXISTS AT VARIOUS POINTS ON AND NEAR THE POWER SUPPLY SECTION. *NEVER REMOVE COVER WITHOUT DISCONNECTING AC POWER SUPPLY CORD.* NEVER TOUCH POWER SUPPLY OR POWER SUPPLY AREA WITH FINGERS OR OBJECTS.**

The factory default settings for the TM-4M are:

**OUT A: 1PPS**
**OUT B: 10 MHz (analog sine wave)**
**OUT C: Programmed Output Pulse (POP)**
**OUT D: Event Time Tag (ETT) Input**
**OUT E: MUX1 Multiplexer Output**
**OUT F: TPTXD232 Serial Time Port**

Always turn the unit off before removing the cover or making connection changes.

## TM-4M FRONT PANEL (cont'd.)

It's important to note that all of the BNC input/output jacks are connected in parallel, in bus-style fashion. This allows the user to assign any function to any jack, but it also allows the user to make a mistake and assign the same function to more than one jack. The jacks are not buffered or isolated from each other, so exercise caution when making assignments. It is possible to send the same signal to more than one jack if desired, but the user must be aware of possible signal interaction or degradation if this is done, particularly if two or more low-impedance inputs are to be driven.

The DB-9 connector is the means by which the TM-4M is connected to a personal computer ("host") and contains the serial communication lines for control of the TM-4M and for receiving status messages from the unit. This interface is standard RS-232C and can be used for communicating with any host device. The TM-4M uses a simple ASCII message format (described in the TM-4 User Manual) for communication. Operating the unit with the included Spectrum Control/Display software package requires the unit to be connected to a personal computer running Windows 95 or higher. See SECTION 6 of the User Manual for more details.

Use a standard 9-pin monochrome monitor extension cable, or a straight-through serial cable to make connections. Do not use a crossover-type cable. Pin 2 (CPTXD232) is the transmit line for sending serial data (messages) to the host computer; Pin 3 (CPRXD232) is the receive line for receiving serial data (commands) from the host computer. The communications parameters for these pins are 9600 baud, 8N1 (8 data bits, no parity, one stop bit).

## REAR PANEL

The rear panel allows for GPS antenna and power connections. See the TM-4 User Manual for GPS antenna details. AC power is supplied to the unit via the IEC 320-compatible AC input connector, unless the unit is fitted with the optional MS3122E14-5P connector on the front.

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