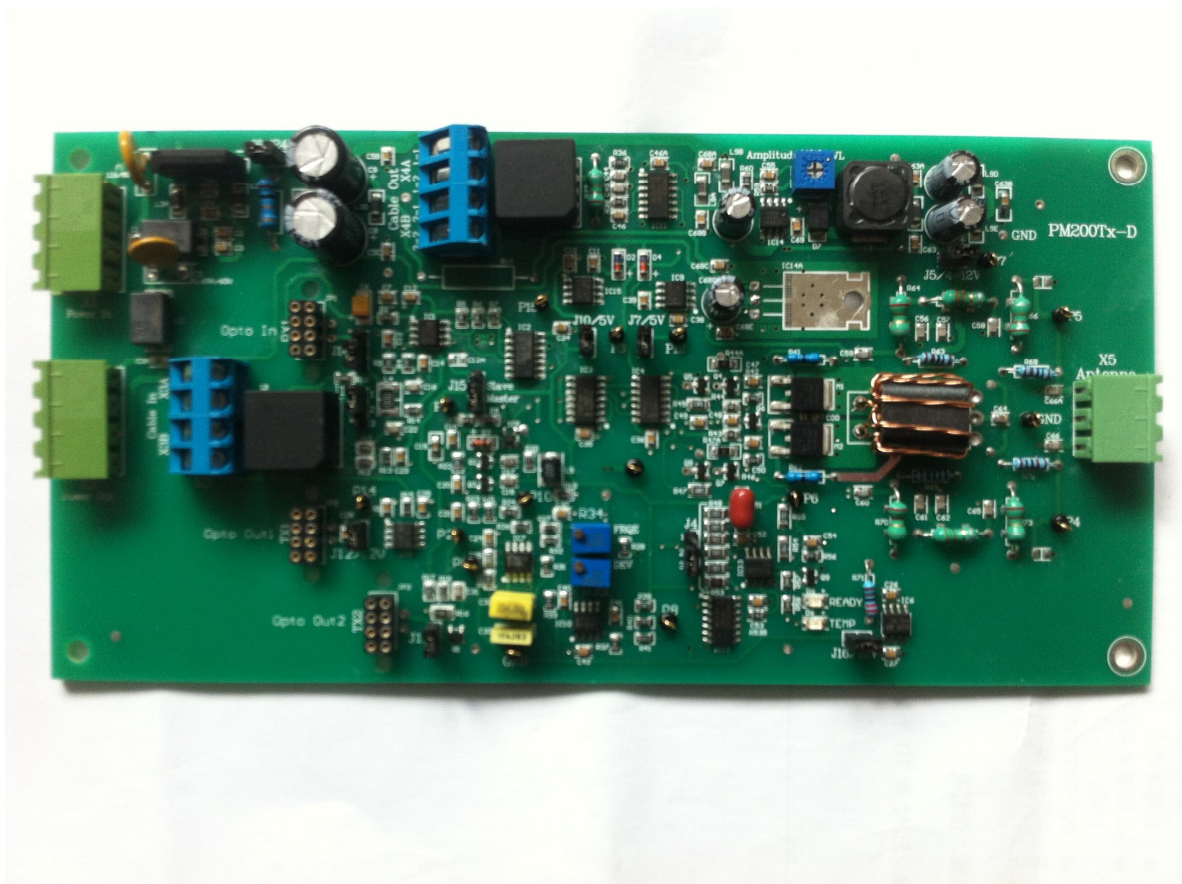


# TX Tuning Guide



## T200

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# 1. Introduction

This manual describes the T200(Universal Transmitter Board) as well as the setup and tuning procedures needed to put the T200 and R-3000D electronics into operation. For details on the receiver board, see the RX (R-200) Tuning Guide.

## 1.1. Basic Description of the Transmitter Electronics

Each transmitter electronic is able to feed one Century antenna with a swept HF signal of 8.2 MHz. The frequency and swept range of this HF signal can be fine tuning. In order to avoid disturbances between the emitted HF signals, synchronization with other transmitters must be guaranteed.

The standard version of the T200 board allows the 82 Hz sinusoidal modulated 8.2 MHz HF carrier signal to be:

- generated locally (oscillator circuit for master applications), or alternatively.
- to be regenerated from an optically received swept HF signal of another TX (opto receiver for slave applications).

The bi-opto version of the T200 additionally allows the onboard generated (master) or received-and-then-regenerated-(slave)-swept HF-signal to be converted and transmitted in order to optically synchronize additional transmitters.

The two opto transmitters used in the bi-opto version allow:

- a master transmitter to synchronize two other optically slaved (and possibly repeating) transmitters.
- an optically slaved transmitter to be used as repeater to synchronize two other optically slaved transmitters.

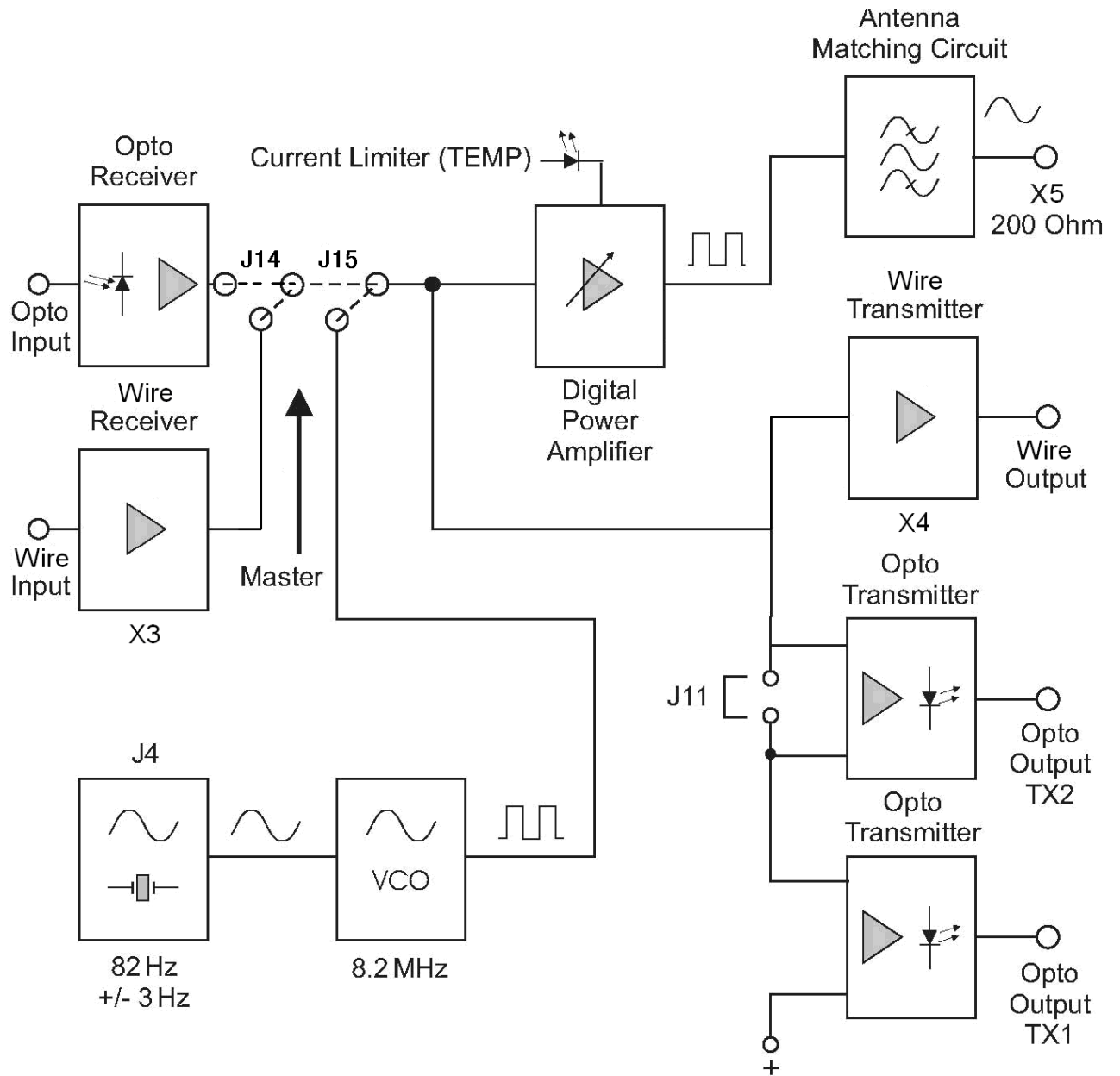
By using 3 bi-opto transmitter boards (TX) (one used as synchronization master and two as synchronization repeaters) and 4 standard TX (as synchronization slaves), clusters of up to 7 TX may be synchronized. This way up to 7 checkout or 14 exit-gates (in a row) may be configured without need of a master rack.

Since the optically transmitted synchronization signal may be repeated only once, a master rack still has to be used if more than seven transmitters have to be synchronized.

A block diagram and layout of the T200 board are shown on the next 2 pages. The board consists of a digital part, an analog part and a power supply / filter part.

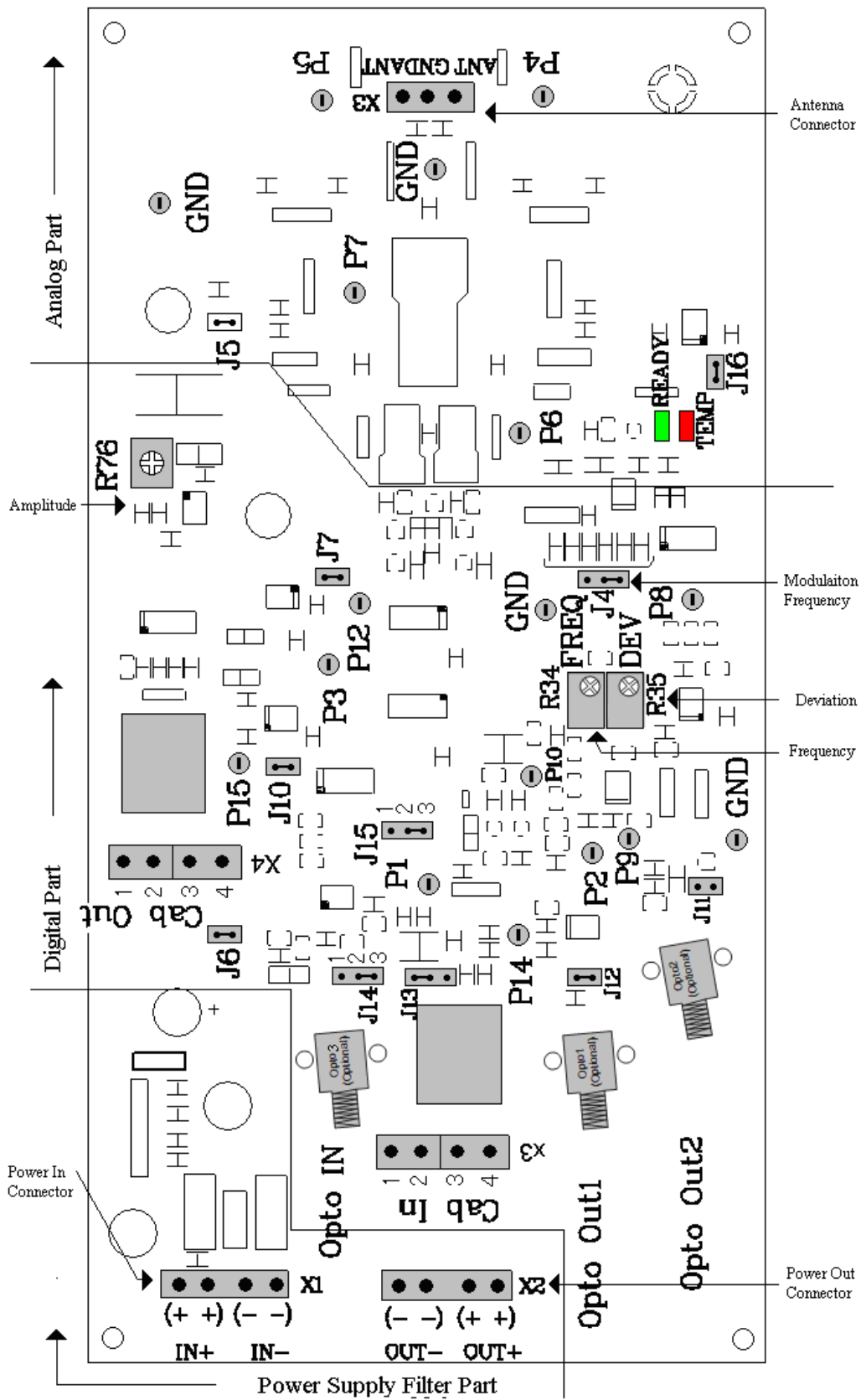
The standard version of the T200 is fully equipped with the exception of the two optional opto transmitters. It can be used as a master-TX for small installations (single or dual gates equipped with one TX only) or as slave-TX for all larger applications.

The bi-opto version of the T200 board is almost identical to the standard version. The only difference is that the two opto transmitters (IR-LED's) are already mounted. The bi-opto TX board can be used as a Master-TX in medium installations (2 to 7 TX) or as synchronization signal repeating Slave-TX for medium to very large installations.



TX Board Block Diagram

TX Layout



### 1.1.1. Digital Part

In master operation, the 82 Hz sinusoidal sweep is fed to the voltage controlled oscillator (VCO). The VCO generates the swept and digitalized 8.2 MHz signal. This frequency modulated signal is digitally amplified (FET power amplifier), filtered to get a clean analog output signal and finally radiated by the antenna. If the current exceeds the allowed limit (short circuits, wrong antenna etc.) the power amplifier will shut slowly down, because it is temperature controlled. This action is indicated by a red LED (overloaded = OFF).

In slave operation, the swept HF signal can be wire or optically received, converted and regenerated. It can then be used to directly feed the power amplifier.

A set of jumpers (J14 and J15) is used to switch between master and slave operation. Jumper J4 is used to select the desired sweep frequency.

If the board is equipped with two opto transmitters (bi-opto TX board), the swept HF signal will be automatically output (see section 4). This allows the synchronization of two additional transmitters.

### 1.1.2. Analog Part

Different antenna types can be connected to the relevant output circuit (connector X5).

The TX-mounted matching circuits and harmonic suppression filters are optimized for use with 200 Ohm antennas.



### 1.1.3. Power Supply / Filter Part

The T200 can be powered (connector X1 / IN) by DC as well as AC power supplies.

The integrated power line filters:

- suppress noise between the electronics and the power line and
- suppress conducted noise on the power line itself.

The filtered power is available at connector X2 / OUT and can be used to feed other equipment (TX, RX). For additional information, see section 2, T200 Filter Concept.

## 1.2. Receiver Electronics

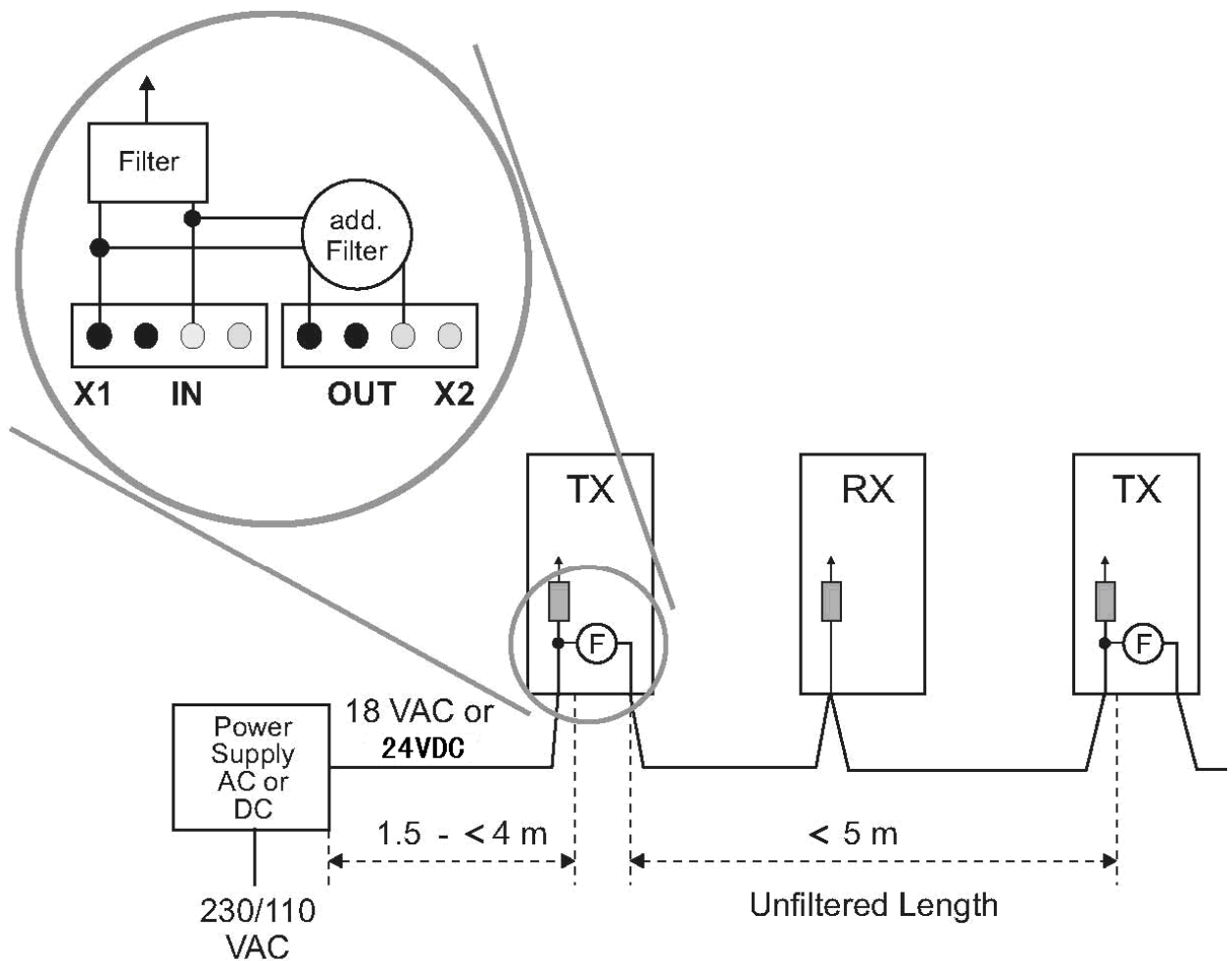
For detailed information on the receiver, see RX (R200) Tuning Guide.

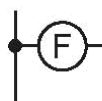
## 2. T200 Filter Concept

False alarms due to conducted noise on the power lines can be avoided if the power lines are filtered every 4 to 6 meters.

If T200 is used, this is done automatically and the power line between the transmitters is not longer than 6 (8.2 MHz) meters. If the length of the power line cable between the transmitters is longer than 4 to 6 meters, additional filter boards have to be used (see figure below).

R3000B RX boards use the same kind of filter. Due to the limited space available, however, the RX filter only protects the receiver electronics itself, it doesn't contribute to the filtering of the power line.



 Represents additional Filter

### TX Filter Concept

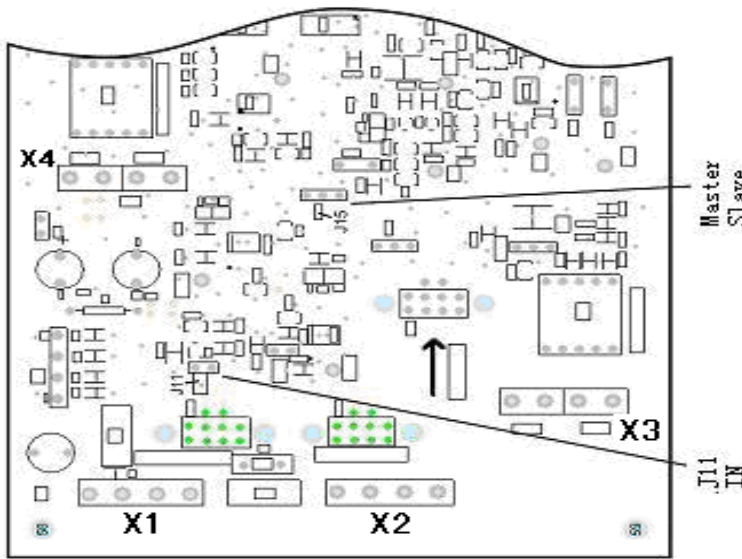
(Note: Each PSU allow to drive two sets of antennas)

### 3. Opto TX Setup

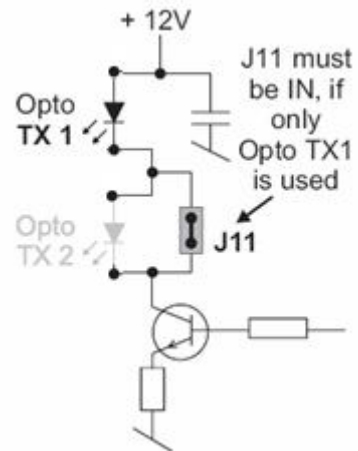
On the T200 is two (2) Optional Opto Output Sockets. It is possible connect one or two Opto TX-Modules on the board. If only **one** Opto TX-Module is needed, it must be in socket OUT1. To configure the Opto TX Output(s) see figures below.

#### 3.1. One (1) Opto TX Output

- Insert the module into socket OUT1 and fix it with a "Tie-Rap".
- J11 must be IN



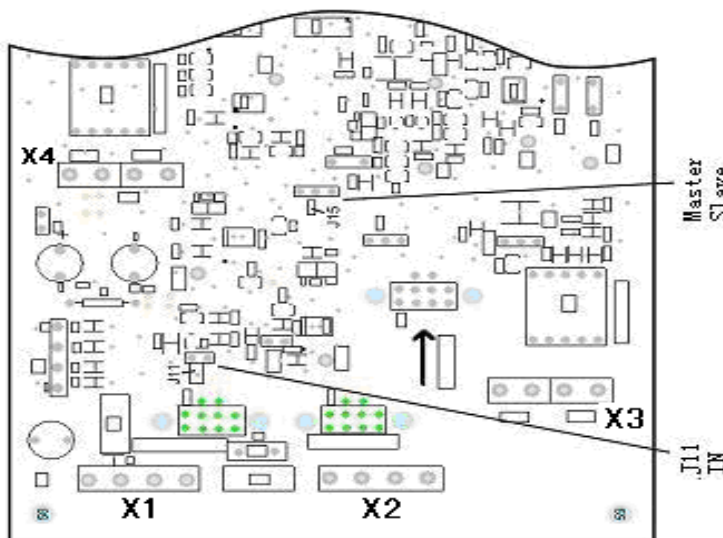
Layout One Opto TX Output



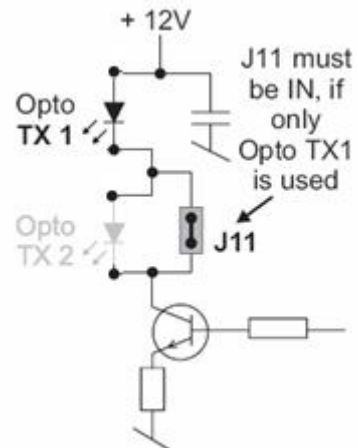
Circuit One Opto TX Output

#### 3.2. Two (2) Opto TX Output

- Insert the modules into socket OUT1 and socket OUT2 and fix it with a "Tie-Rap".
- J11 must be OUT



Layout Two Opto TX Output



Circuit One Opto TX Output



## 4. Installation Configurations

Since the T200 can be used as a synchronization master, repeater or slave, installations can be flexibly configured.

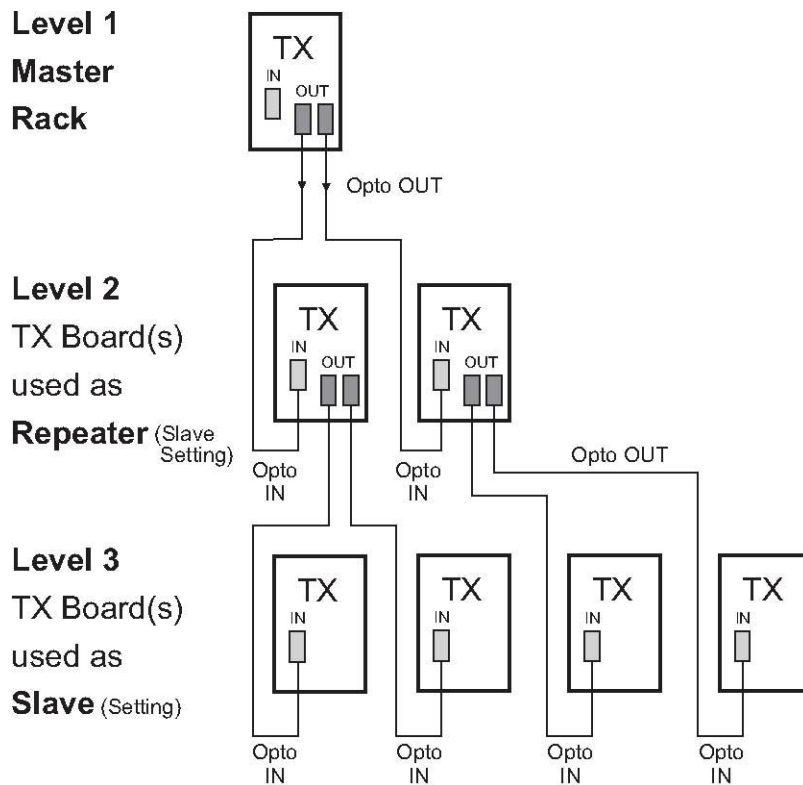
Basically there exists only one rule that has to be considered:



The optically transmitted synchronization signal may be repeated only once; therefore no synchronization repeater should ever feed another repeater.

A basic configuration following this rule is shown below. The TX board of level 1 (bi-opto version,

configured as master) feeds the synchronization signal to the two TX boards of level 2 (bi-opto version, configured as slave).



### TX Opto Cabling Hierarchy

(Only **one** (1) repeater level allowed)

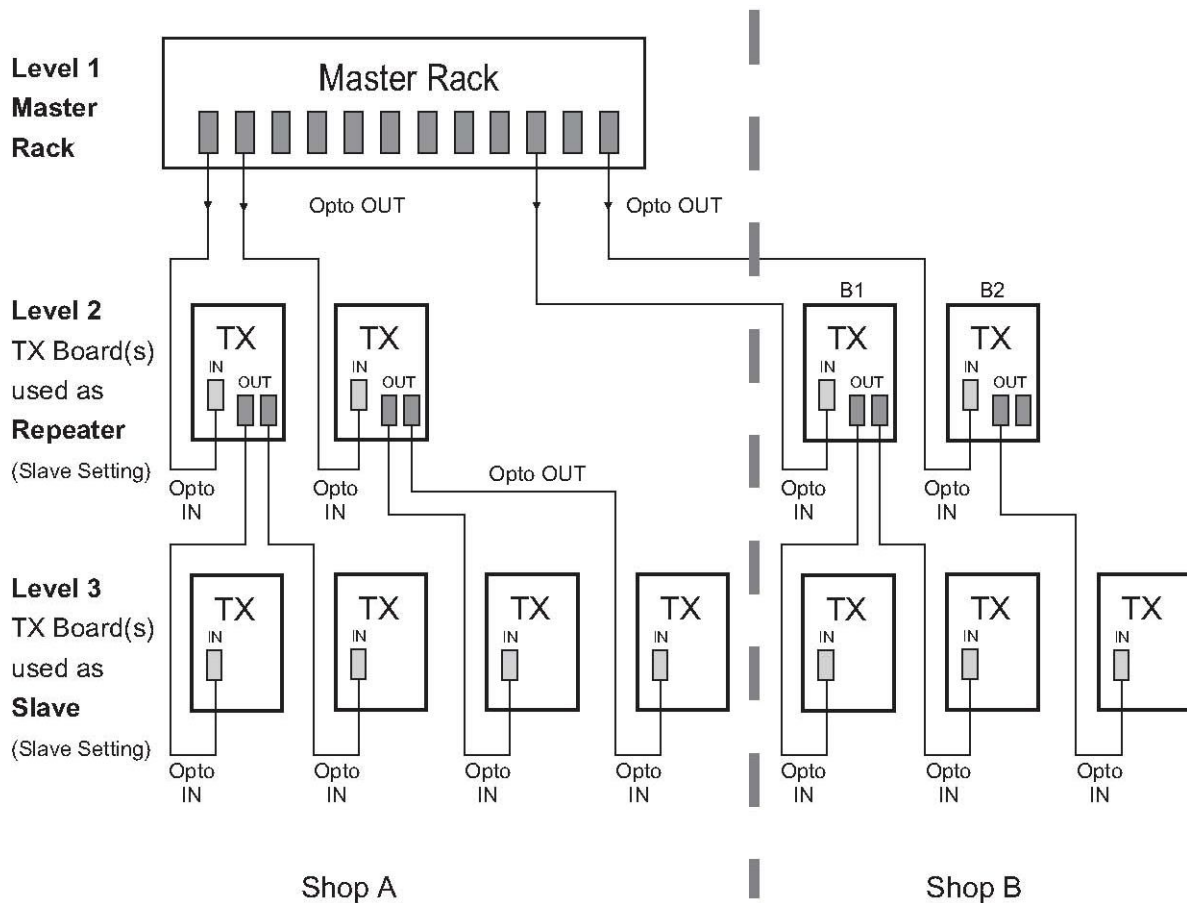
## PM200 TX Tuning Guide

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These two boards, acting as synchronization repeaters, in turn each feed their optically transmitted signal to two following TX boards of level 3 (standard version, configured as slave). This way, a synchronization cluster of 7 transmitters has been created without use of a master rack.

If a system consists of more than seven transmitters, a master rack has to be used as a synchronization source. The optical signal of a master rack may be repeated once if necessary as well.

A possible configuration using a master rack and T200 is shown below.



**TX Opto Cabling from Master Rack**

## 5. Tuning

Step-by-step instructions for tuning the T200 board follow. For the receiver see RX (R3000B) Tuning Guide.

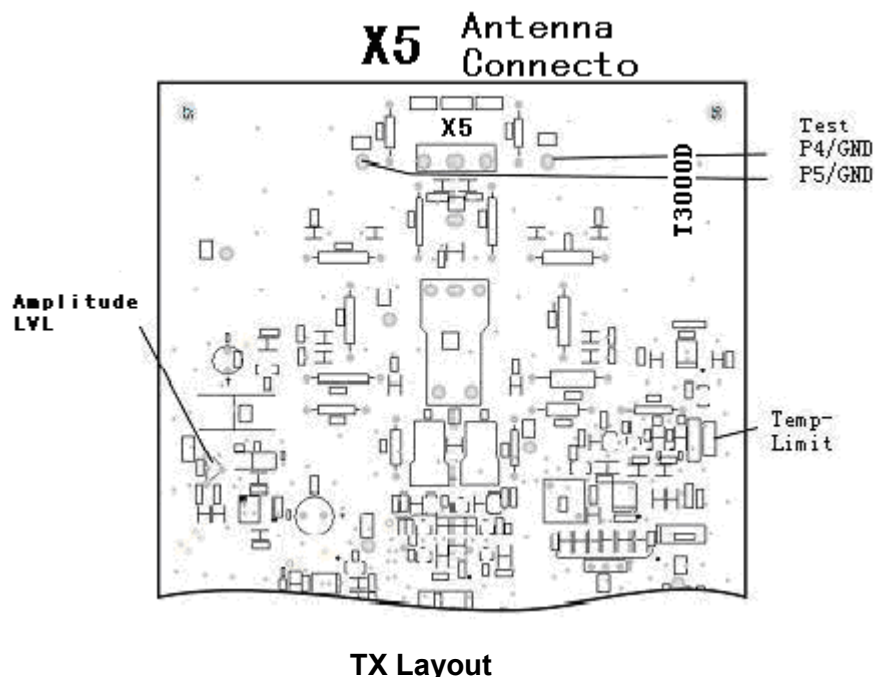
### 5.1. Recommended Tools

The following instruments are recommended for tuning:

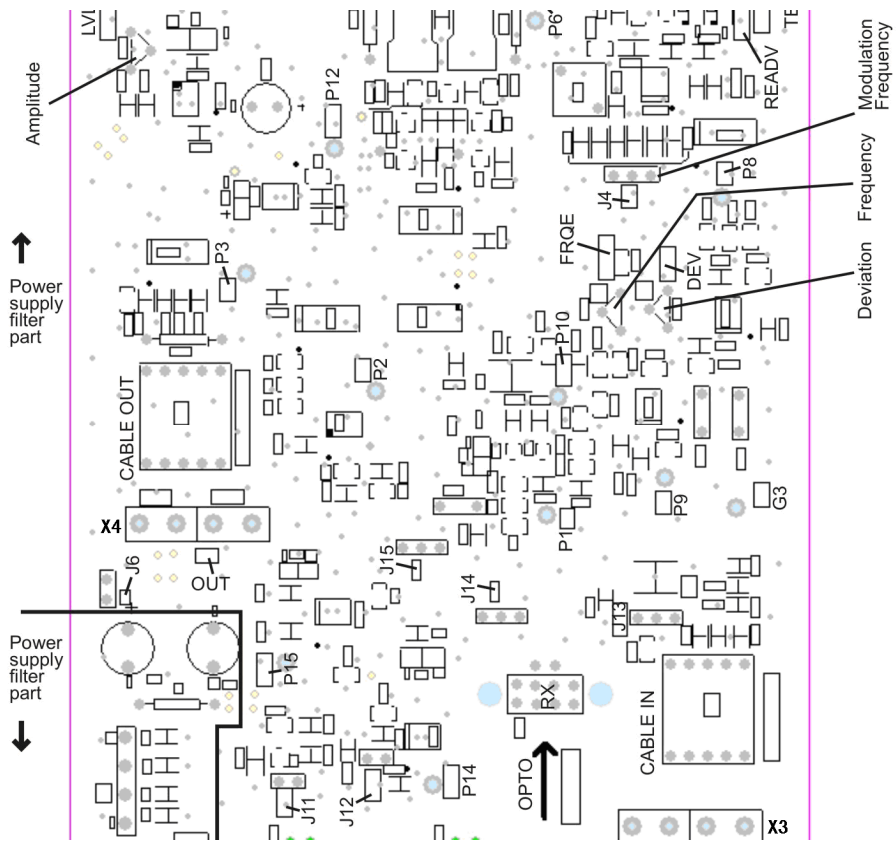
- Battery powered oscilloscope (two channels, cursor readout function recommended).
- 10: 1 oscilloscope probe.
- Multimeter.

### 5.2. Preparation



- Power OFF the TX board (remove PWR connector at socket X1).
- Ensure that the antenna is connected to the correct socket (X5) on the TX board (see drawing below).






- Turn the amplitude potentiometer R76 clockwise (LVL to almost (7/8) full power).
- Check the default setting of jumper J15 and J4 (see following two tables).



**TX Layout**

<b>Jumper</b>	<b>J15</b>
<b>Config.</b>	
* Master	2-3 IN 
Slave	1-2 IN 

**Master / Slave Jumper Settings**

<b>Frequenz(Hz)</b>	*82	85	79
<b>J4</b>			

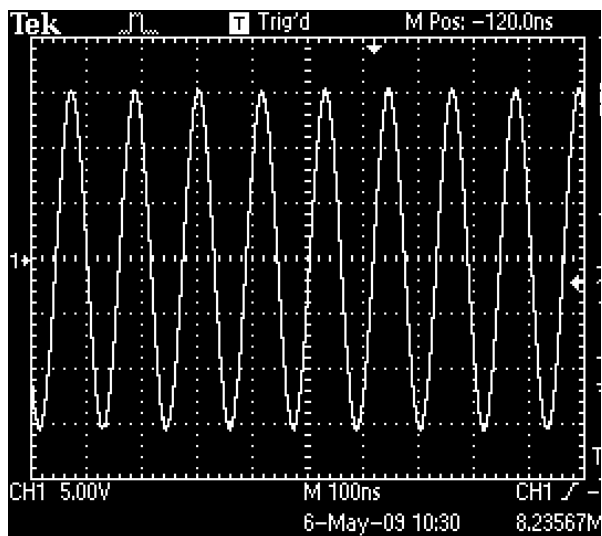
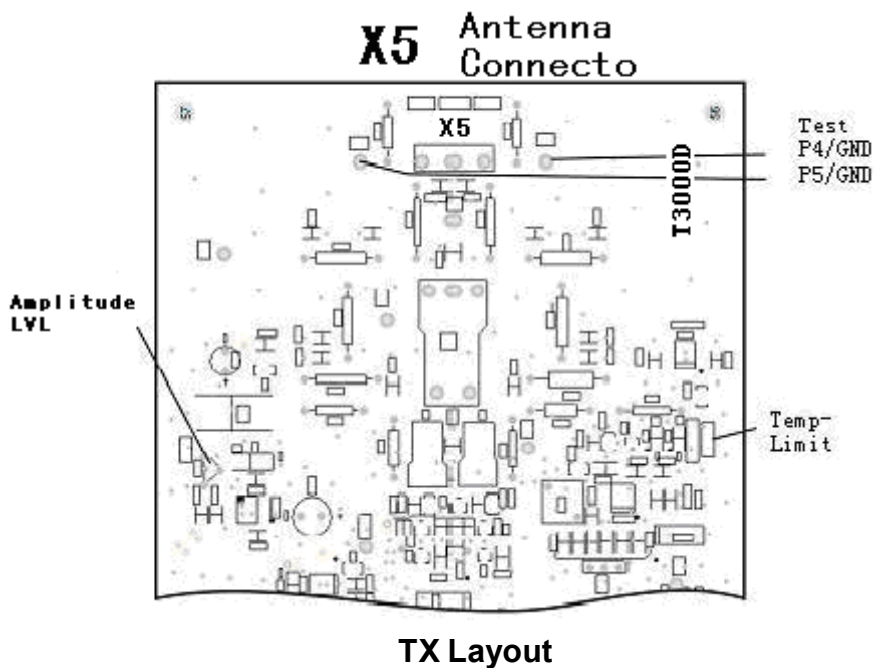
**Sweep Frequency**

- Factory default setting

### 5.3. Power On Adjustments

- Power ON the TX board (insert PWR connector at socket X1).
- Check the red Temp-Limit LED (D6) is ON: Operation OK.
- If the LED is going OFF and ON:
  - reduce the emitted power with the amplitude potentiometer R147(LVL).
  - check antenna, matching board for short circuit and so on.
- As an option, check the emitted signal at both of the corresponding test points located to the left and right of the antenna connector (P4 / GND or P5 / GND; see figure below). The signal shapes may be varying. A signal breakdown or variation of more than 20% of average the value indicates a faulty transmitter or antenna.

Remark: The signal on P4 and P5 is usually not identical.



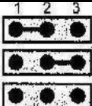









P4/GND or P5/GND Reference waveform

- Proceed with the RX board according to the instructions in the RX (R3000B) Tuning Guide.

**Hints:** If the HF power received at the RX is too high:

- insert the “Narrow” jumper on the RX board.
- reduce the TX power.

### Jumper setting

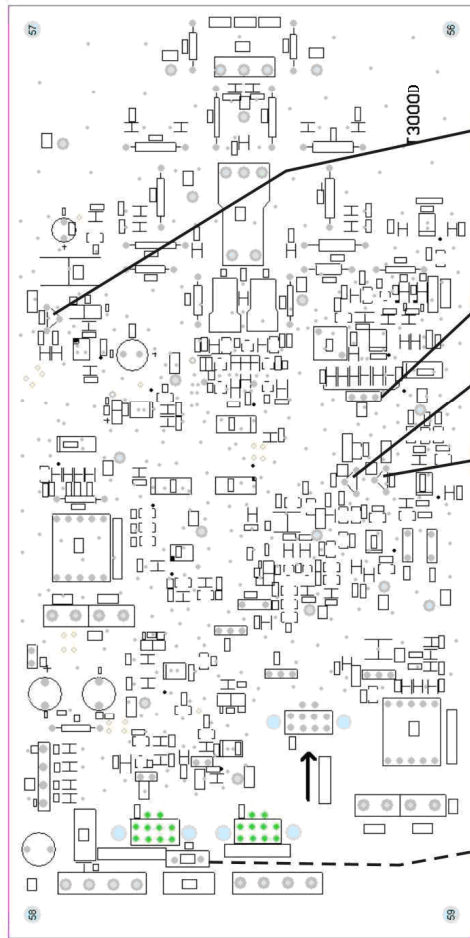
Jumper	Setting	Function
J4		Frequency setting jumper
J6		Manufacturer use only
J11		Double optical cable synchronization output Single optical cable synchronization output
J12		Manufacturer use only
J13		Manufacturer use only
J14		Cable output Optical cable output
J15		Master Slaver
JP1		Optical cable input shield Optical cable input
JP2		Optical cable input 2 shield Optical cable input 2
JP3		Optical cable input 1 shield Optical cable input 1

## 6. Appendix

### 6.1. Compressed Overview

# T200

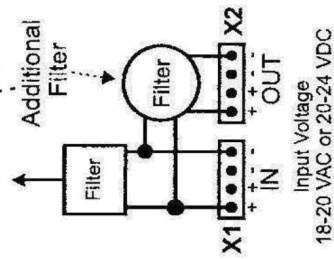
## TX Layout



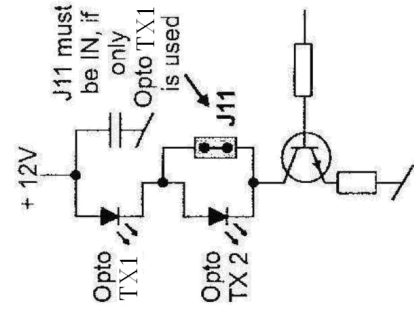
## Jumper Table

Jumper	Settings	Function
J13		Factory use only
J14		Wire Slave IN (Default) Opto Slave IN
J15		TX Master (Default) TX Slave
J4		82 Hz, Modulation Frequency (Default) 85 Hz, Modulation Frequency 79 Hz, Modulation Frequency
J5,6,7 8,9,10		+ 24, + 12, + 5 Volt (Default) Factory use only
J11		Opto TX 1 only (Default) Opto TX 1 + TX 2

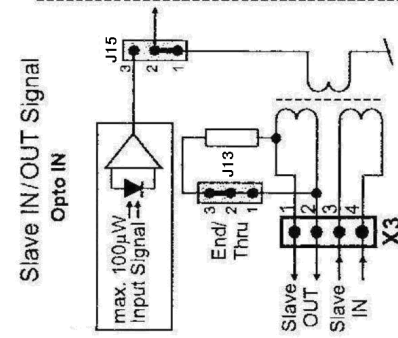
**Caution: Deviation must be between 7.5 and 8.9 MHz or less**



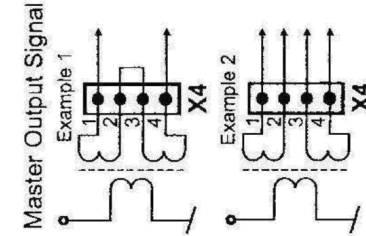
Filter Layout



Opto TX Circuit



Wire / Opto Slaving



Installation Example (Filter)

