

25.09.2023

# ME2-XP

High Performance color LCD screen 144 MHz dual receivers Transverter



The **ME2-XP dual RX transverter** we constructed especially for EME operators, but it usable for quality contest and terrestrial operation as well.

We build this high performance transverter in 30W and 50W output versions. ME2-XP consist of two 144/28 (or 144/14MHz) RX converters with common high stability low phase noise AXTAL 0.5ppm TCXO.

On rear plate we mounted separate "N" connectors (RX1 & RX2) for "H" and "V" polarized antennas. Two separate BNC connectors ensure the IF output signal for the SDR or 2 channel transceiver. On TX side we build in high performance TX mixer unit and linear Mitsubishi module PA (30 or 50W) by your request. For normal operating modes we can provide inside optional MC-1 IF combiner module to combine the separate IF outputs for single RX transceivers if you hvn't dual RX radio. The new control unit has a place for the combiner, which can be integrated on request.

## TECHNICAL PARAMETERS

Frequency range	144-146 MHz
IF frequency range	28-30 or 14-16 MHz
Emission modes	CW, SSB, FM, Digital
I/O impedance	50 Ohm Ant: „N” type, IF 2xBNC, 2m separate RX ”N”
Operating temp. range	0- +50 °C
LO accuracy @20 °C	<0,5 ppm with AXTAL TCXO, standard
Input voltage	13,8V +/- 5%
Power consumption	0,75A on RX, 6,5A/TX (10,5A at 50W version)
IF power input	-20... +37 dBm
IF input VSWR	1:1,1 typ, max 1:1,1:1,2
Output PWR nominal	30 or 50W RF, variable
Output PWR setting	Analog potmeter power setting.5-30 or 50W
TX harmonics	<-70dB
IM3	<-33dBc/25Watt output (or 40Watt output)
PTT control	Contact closure to GND
SND output	Open collector, +50V/1A max.
RF VOX	Available, starts>27dBm IF input
RX noise figure@20 °C	<1dB (overall)
RX gain max	28 dB max, set to +22dB (variable, 12-28dB)
RX OIP3 typ.	+25 dBm
RX IP3 typ.	+3dBm
Image rejection	>80dB
Display	3,2” color display 480x320 pixels
Displayed functions	FWD, REV, num. PWR, VSWR, Ut, It, TMP, FAN & FLT (faults)
Protection	Ant.VSWR > 2,2, Current > 6A or > 12A, TMP >60°C
Protection display	3x1sec. 2KHz tone+SWR, TMP & CUR in red color
Reset function	Autoreset function after high SWR TMP & Current
Meter's accuracy	<2,5%
Sequencer	50mSec.delay at basic TX mixer
Dimensions	240x275x90 mm (incl. optional Fans)
Weight	2.0 kg with Fan unit
Case	ALU plate, @1mm

The enhanced transverter versions are accommodated into a more spacious, 90 mm (about 3,6”) high box.

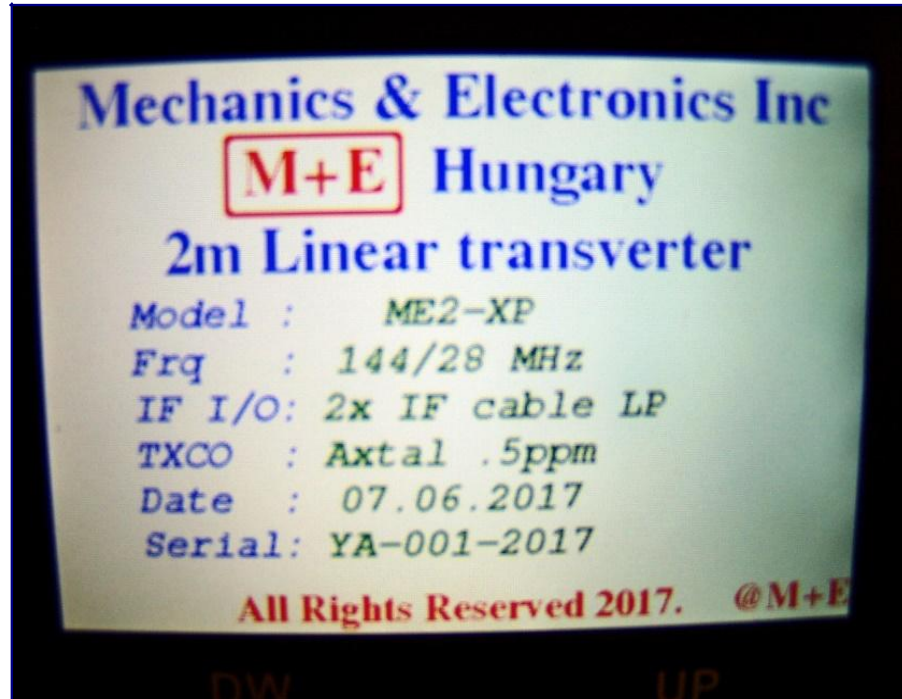
The new versions are furnished with Arduino processor controller, an easy to read 3,2” colour display, which we have been aesthetically integrated into the equipment house.

A new control PCB had been mounted on the back plate, below the final amplifier stage. Another feature is the DB9 connector, also mounted on the back plate ensuring multiple connection options for the transverters user. At the very first power-on you can configure the transverter to the HF radio types available at the market as described in section 5./

If you need the manufacturer will set up the ordered transverter to your radio type by your request.

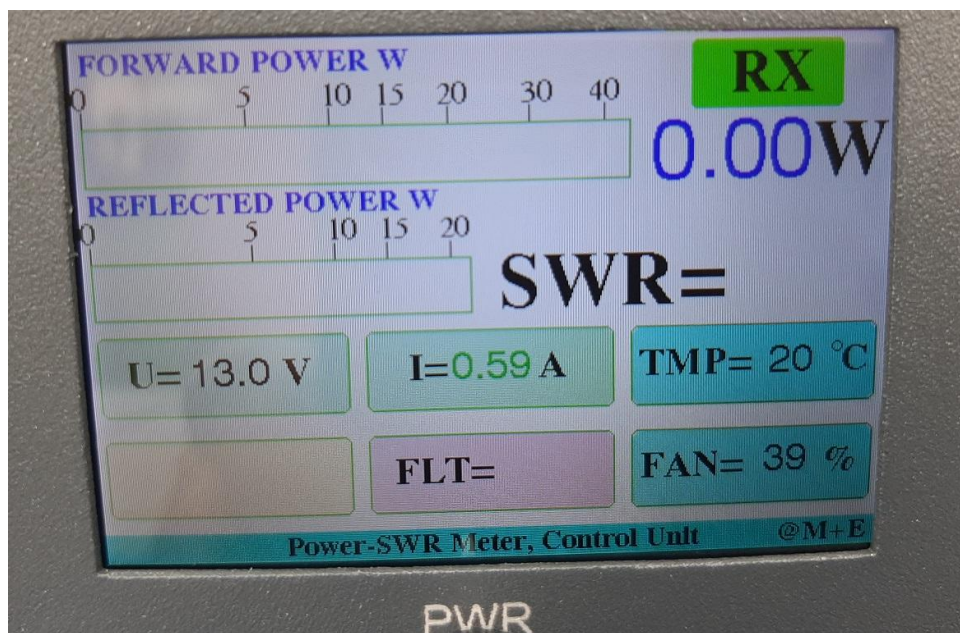
## Arduino processor controlled colour display unit:

The following information/diagrams are available on 3,2” diagonal display:



1. The power-on displays the basic information for 5 seconds. See the picture above. In addition to the equipment type the following information are displayed:
  - **FRQ:** mixing frequency (144/28 or 144/14 MHz respectively),
  - **IF I/O:** 1 or 2 cable (common/split IF I/O) mode, LP or HP power IF,
  - **TCXO:** type and stability (AXTAL 0.5ppm standard)
  - **Date:** manufacturing date of transverter.
  - **Serial:** serial number of transverter unit.

2. After 5 seconds the operational menu and graphs appear:



**- Forward power W;**

The bar graph of forward (output) power expressed in Watts. The full scale of the FWD bar graph of 30W version is 40Watts. The full scale of forward bar graph of 50W version is 60Watts.

The numeric value of output power expressed in Watts is also displayed.

**- RX/TX;**

In upper-right corner of the display indicates reception/transmission status.

When receiving, "RX" in green, "TX" in red respectively is displayed in the field.

**- Watts;**

Forward output power numerical display.

**- Reflected PWR Watt;**

This bargraph can be seen below the FWD bar graph. The full scale displaying signs the same power.

**- "S" ant SWR;**

The calculated VSWR value remains displayed during receiving as well.

In case SWR >2,2 the unit displays an error message appears executes an auto-reset, finally the transmission is suspended.

Below Reflected bar graph the following measured values are displayed in 3 fields:

**- U=**

Measured power supply voltage. Whenever it exceeds +14V threshold level, the display changes into red numbers.

#### - I=

Measured supply current. In case of a 30 Watt version if  $I > 5,5A$ , the display changes into red numbers, and exceeding the 7A threshold level an error message is displayed and autoreset is executed. In case of 50W power version if  $I > 10,5A$  the display changes into red numbers, and exceeding the 12A threshold level an error message is displayed and autoreset is executed.

#### - TMP=

The heatsink's temperature expressed in °C. °F at USA versions. Whenever  $TMP > 55$  °C the displayed value changes into red numbers, and exceeding the 60 °C threshold level an error message is displayed and auto-reset is executed. Supposing that a repeated error message occurs, the unit must be switched off, as the operational conditions are provided exclusively when the heatsink temperature has dropped below 60 °C.

As a default, the lower-left frame is empty. You can set the output power by help of the PWR knob.

The output power can't be set to 0, in case of neither the 30 nor the 50W version. The minimal power is about 8-10% of the nominal power.

#### - FLT=

If a fault occurs: FLT will be displayed on the screen.

In case of an  $SWR > 2,2$  "FLT=SWR" is displayed in red letters and three, 2 KHz pitch and 1 sec duration warning tone can be hear. In case of  $I > 6A$ , in case of HT version  $> 12A$  respectively "FLT=CUR" is displayed in red letters, and three 2KHz pitch and 1 sec duration warning tone can be hear. In case of  $TMP > 60$  °C "FLT=TMP" is displayed in red letters and three 2KHz pitch and 1 sec duration warning tone can be hear.

The unit emits 3 warning sound signals and then executes an auto-reset. Following it (and termination of the potential error cause) the transverter becomes operational again.

#### - FAN=

The fan's cooling speed is expressed as a percentage in this frame. The fan's basic speed at 25 °C is 50%.

Above this level the speed increases proportionally as the heatsink temperature rises up to 50 °C. At this point, the fan speed does not increase any higher.

## REAR PLATE



The transverters rear plate is accomodates the heat sink (for 50W version furnished with cooling fans, as standard) and the connectors as follows:

- 1./ DC connectors:** 20A rated connectors; **red = POSITIVE**, black = NEGATIVE. The equipment operates from an external +12,5 V ... +14,0 V stabilized voltage power supply. An ME2-XP requires minimum 7A, while an 50W version at least 12A stabilized power supply.
- 2./ PTT:** The black RCA type female connector: is the input for transmission triggering. To place the transverter into TX, it requires a GND on transmit. The center connector is at positive potential, it can be controlled by an NPN open collector too. The maximum load current is 25 mA.
- 3./ SND:** The red RCA type connector controls an external final amplifier switching a positive voltage to GND. It is an NPN open collector output. Up to +50 V or 0,5A load is permitted.
- 4./ DB9** connector: different in- and outputs with pin assignment according to the following table:

DB-9 Pin	Function
1	GND
2	SND(TX Gnd)
3	PTTi(GND to TX)
4	+13.8V
5	ICOM (+13V to tvtr)
6	NC
7	NC
8	NC
9	TX +13.8V(0.5A)

**5./ IFi =**

The IF input BNC connector accomodates input levels from -20 to +37 dBm. It can be configured to different level RF output HF radios by jumpers according to the following figure. In the case of low level type radios (below -10dBm) you can use the internal IF amplifier.

**Position of built in attenuator jumpers on control PCB:**

<b>Low PWR IF input (-20..+27dBm) 2x IF cable connection</b>		<b>Low PWR IF input (-20..+27dBm) 1x IF cable connection</b>
JP1	ON	ON
JP2	OFF	ON
JP3	OFF	OFF
JP4	OFF	ON
JP5	ON	OFF(ON- 2nd RX)
<b>High PWR IF input (+27..+37dBm) 2x IF cable connection</b>		<b>High PWR IF input (+27..+37dBm) 1x IF cable connection</b>
JP1	OFF	OFF
JP2	ON	ON
JP3	ON	ON
JP4	OFF	ON
JP5	ON	OFF(ON-2nd RX)

Jumper positions on the control PCB [here](#):

**Jumper setup for several type radio:**

/LIST NOT COMPLETE!/  
/

<b>Levels,cables</b>	<b>Radio types</b>
Low PWR, 2x IF cables	K3,K3s,K2,TS590S,TS590SG,TS850,TS950SDX,IC756, FT2000,FT1000MP, FTDX5000,IC756,TS990S,TS850
Low PWR, 1x IF cable	IC7600,IC7700,IC7800,FLEX6300,FLEX6500,FLEX5000, FLEX6300,IC765,
High PWR, 2x IF cables	Flex models,
High PWR, 1x IF cable	IC9100,IC746,FLEX1500,FLEX3000,ADAC,TS2000,FT450 IC7300,FT991,FT950,FTDX3000,FTDX1200, IC7000,TS570

**Please don't forget to connect the PTT cable between radio SND connector and ME2-XP PTT input! Due to security concerns, as an additional protection, the unit contains an RF VOX unit as well.**

**However, it does not replace the usage of PTT input! If you don't want to burn out the RX IF amplifier stage of the transverter, use the PTT line.**

**The RF VOX starts to working at an IF level exceeding +27dBm, but only in case single IF cable mode. Never apply more than a 5W IF level to the attenuator!**

**Using high power HF radios (100W) without low level transverter output is your own risk. Use it every time carefully!**

6./ **IFo1, IFo2** = The IF outputs for "H" and "V" polarized signals.



If you are using MC-1 IF combiner you will get additive IF signals on IFo1 connector.

7./ **ANT:** connector: „N” type connector to connect a 2m antenna. (Optional common/separate RX input side RX1).

8./ **RX1, RX2:** 2m RX inputs for "H" and "V" polarized separate RX antennas.

### **2m transverter unit**

The basic transverter unit consist of 2x same RX converters with common high stability and low phase noise TCXO as in our ME2T-PRO3 model.

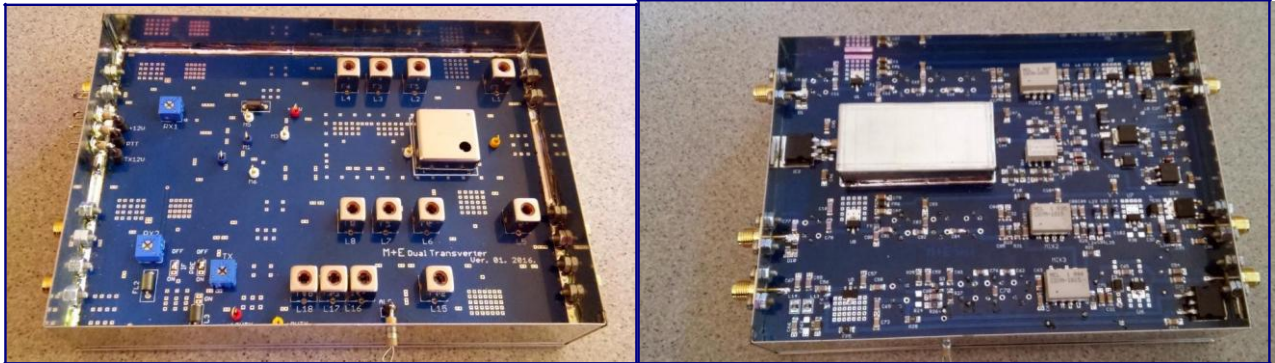
In the TX part we are using same double ballance mixers as in the RX parts, followed dual gate FET amplifier with gain and ALC control.

The final MMIC amplifier provides enough driving power for the final 30 or 50W RF module. The transverter equipment's block diagram is available [here](#): The RF block diagram: [here](#)



Transverter basic unit photos:

Transverter unit PCB [here](#):



### **2m 30 & 50W module PA:**

The PA unit is built on 30 or 50Watt Mitsubishi linear RF hybrid modules, it is furnished with an ALC circuit, and contains NEC EB2-12 NU type RF relays as well.

The output signal of the transverter drives the RF module across -3dB attenuator. We set the RF module to AB1 class by a bias circuit from Mitsubishi.

The 50W model PA contains RA80H1415M type 80W RF module. In order to reach the best IMD, we have disabled driving the PA modules over the nominal output power that the module can deliver.

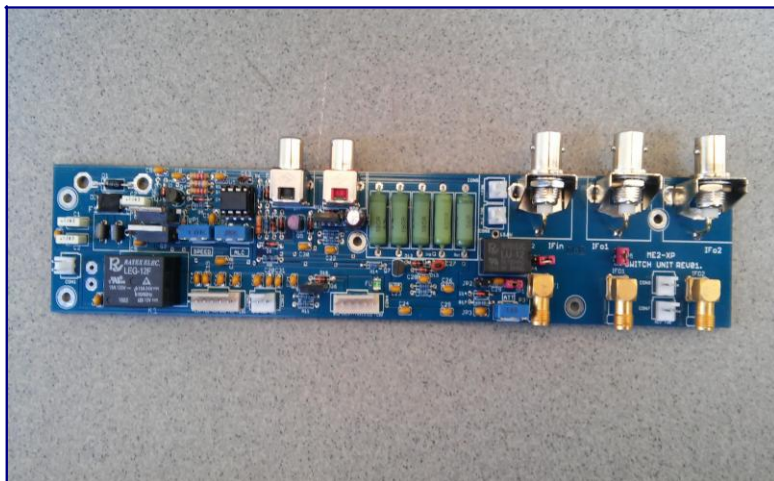
The PA contains a temperature sensor to check the temperature of the heatsink.

The HP (50W) transverters has an external cooling fan is a standard feature, but in the 30W version is an option.

### **POWER and SWR meter:**

The PA unit comprises a simple PWR/SWR meter bridge. The Arduino controlled display visualizes the actual FWD/REV power and VSWR values in a color bar graph with ~2.5% accuracy.

## CONTROL UNIT:



The built in control unit is a new development, comprising all the necessary circuits to control the transverter, regulate the cooling fan's speed, a 20dB/5Watt RF attenuator, as well as the jumper tabs to configure the transverters to the different HF radio types. The unit contains also the RF VOX unit (don't use it to replace of PTT input!) to save the RX IF amplifier if you forget to connect the PTT cable.

This PCB accommodates the switching circuit and the IF connectors too. You can find the unit's circuit diagram [here](#).

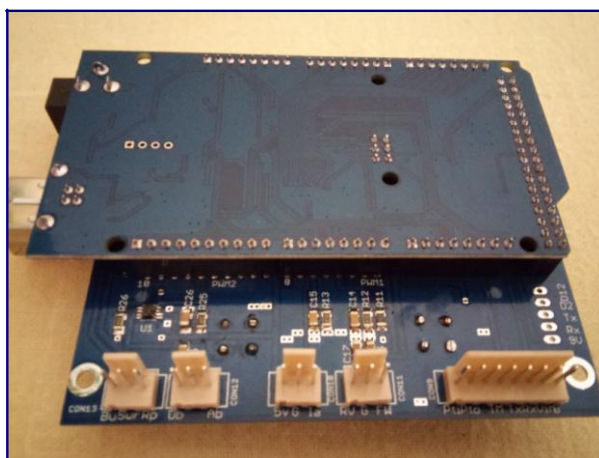
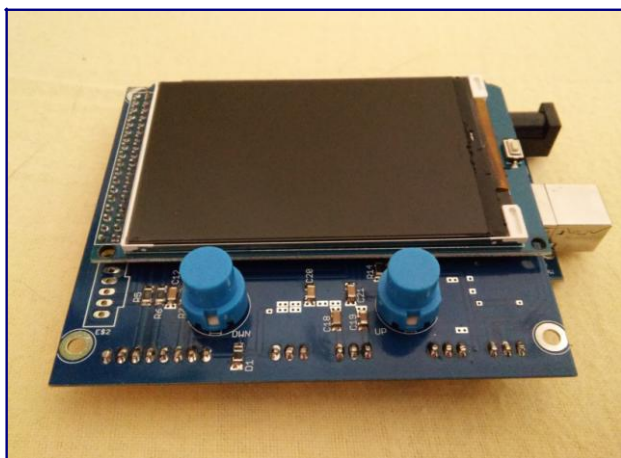
## ARDUINO, Display and Arduino control units:

ME2-XP is controlled by the ARDUINO MEGA. We are using the analog inputs and outputs as well as the color LCD driver of Arduino. The LCD is 3.2" and 480x320 pixels 16 bit, no touch type.

You can find the circuit diagram of the Arduino control unit [here](#).

We would like to use this controller in our LDMOS amplifiers too, so a few features are not in use on this PCB.

Pictures of ARDUINO control & display unit:



Arduino control unit PCB [here](#):

## **Operating modes:**

**We can set transverter to your radio type before the shipping, for your request!**

**We planned the ME2-XP dual receiver transverter especially for EME additive receiving operation.**

**This transverter is usable to normal terrestrial, MS, Tropo operation too.**

**In this case the second RX is off from operation, we using only the RX1 receiver and the IFO1 IF output.**

**You can find some instructions in the last part of this documentation (In the linked pdf files) how can you wiring and jumpering this transverter to the different type operation modes.**

### **EME operation:**

If you haven't other request: we can deliver ME2-XP with 2x IF cable 0dBm input, 2x separate RX (RX1 & RX2) antenna inputs and separate TX output (ANT) configuration. The IFO1 and IFO2 are connecting to dual IF receivers (SDR) or dual RX capable transceivers (K3 or similar). The radio IF low level output connecting to IFi input. So you need to use 3x IF cables. The jumpering is similar as at normal operation. (See 1. and 2. attached pdf at last section)

The RX1 2m RX input connecting for example to „H” polarized RX preamplifier (or ant) and the RX2 2m RX input to your „V” polarized preamp or antenna. The TX output of transverter (30W or 50W) is on ANT connector.

The transverter can't receive at ANT connector by base basic EME setting. If you want to receive with one of antenna at ANT connector, you have to connect the red marked SMA RX cable to the base transverter RX1 2m antenna input jack. (RX input position look at block diagram attachment often) In this case the RX1 input on rear panel will free. One of your antenna RX signal goes across your power amplifier realays. (Common TX/RX antenna operation)

You can use the base EME transverter settings as well to additive EME receiving with MAP65 program.

If we build in an MC-1 combiner, you will get an additive (H+V pol) signal at IFO2 connector. Power settings etc is same as below:

### **Contest, Tropo, MS, etc operation:**

**We suggest this high performance transverter to general, contest, MS, tropo etc operation as well.**

You can find description of different operation modes at **3.,4,5,6,7** points below. (links)

In most case the second antenna (RX2) is out from operation. We can use the single antenna to RX/TX on common ANT connector, but using separate RX antenna cable possibility is also available at RX1 2m antenna input connector.

To common RX/TX ant operation we need to connect the red marked SMA spare cable to RX1 input on base transverter, otherwise we using the base unmarked SMA connector to using the RX1 input on rear panel. (Separate RX and TX cables, relay, ant preamp box are direct at antenna feed point). See the attached pdf files!

A few serious contest station can use the transverter with 2x transceivers too in 2 op. mode. (see attachment 7.)

## Usage of transverter:

**We can set transverter levels, jumpers to your radio type before the shipping, by your request!**

Connect a stabilized power supply of 13,8V voltage output and capable at **least 7A or 12A** (in case of an ME2-XP 50W).

Connect the 2m antenna cable, the external power amplifier - if you have one-, connect the PTT cable, and the SND output to control the relays of the external PA.

Turn the transverter ON. The start-up screen displays the factory settings.

(Modifying your jumpers setting doesn't automatically change the screen details! It can be altered only in the Arduino program.) Check, whether the transverter receives or not. (Beacons, stations). If not, please check your cables, radio IF frequency etc. Pushing the PTT of the radio, the transverter must switch into TX state. Switch to TX in CW mode (key-down), and set the required output power level with PWR button.

Supposing that the HF radio does not provide the required IF signal level, (+ or -) you can set the level.

With P3 (ATT) potentiometer on the transverters control unit, and you can set the maximum nominal PO of the transverter with PWR knob. It shall be 30W, or 50W respectively, for lower power requirements set the PWR knob to maximum, and use the P3 to set the required PWR!

### **If you have low IF output radio: (-20 to -6dBm)**

Lot of radios have very low IF drive levels (below -6dBm.) In this case you need to use the built -in TX IF amplifier. Please open the TVTR and mixer box top covers. Look the jumpers at the right up corner: set the IF PRE jumpers center to ON positions. Set the IF preamp DC „ON” jumper too! Set the PWR button to max. output (e.g. Nominal output power) If the power is too much you can reduce it with input P3 attenuator (on control unit) and with the TX gain trimmer (on the mixer unit, signed with “Tx”, nearest hole at rear panel).

**On case of 3-5W IF output radios** you need to switch ON the -20dB/5W attenuator. (see the jumper table) the TX gain potmeter also be set. (this potentiometer is on the basic transverter unit, hole close to rear panel).

Supposing that your external PA does not require the transverters full nominal driving power, you can reduce it without modifying the IF signal level of your HF RIG.

- set the PWR knob on frontpage to max PWR position,
- set the P3 ATT trimmer on control unit up to max. desired PWR (for example 15W)

If the output PWR is too much, set the P3 to middle position, and set the “Tx” gain potmeter on mixer unit to the required output PWR. (It's highly recommended in case LDMOS amplifiers)

You can see the different operation possibilities at the end of this page in pdf drawings format.

### **Rx part settings:**

If you using high gain preamplifier it possible the nominal gain of transverter will be too much and your S meter indicates S2 or more „noise”. You can reduce the transverter gain easy with built in RX potmeter. (transverter unit, hole close to front panel) Set the basic noise back to S0 on receiver. This setting doesn't help if the noise generated by external electrical or similar noise source.

You can see on following drawings the different wiring possibilities of ME2-XP transverter:

1. [Typical EME station](#) ( pdf)
2. [Typical EME station with single IF RX output](#) (pdf)
3. [Contest station with 2x different dir. Antennas.](#)(pdf)
4. [Single ant. Station.](#)(pdf)
5. [Single ant separate 2m RX/TX cables.](#)(pdf)
6. [Single ant Station with single ANT connector radio.](#)(pdf)
7. [Super contest station 2x radio, 2x ant.](#)(pdf)