Tx II Transmitter

1800 W

Instruction Manual

GDD

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1. INTRODUCTION

The GDD Tx II transmitter is used for time -domain induced polarization survey. Its transmission cycle is 2 seconds ON, 2 second OFF. It is sturdy and can operate in extreme climatic conditions (-40 ^{o}C to 65 ^{o}C). Other timings are available upon request.

The GDD Tx II transmitter can be hooked directly on a 120 VAC power source (220 VAC optional), such as a 22 kg portable generator (e.g.: Honda or another model). The Tx II transmits up to 10 A in a highly conductive ground or sends up to 2400 V in a resistive ground. The GDD Tx II can transmit up to 1800 watts in the ground.

Because of its power and light we ight, the Tx II increases the average daily productivity of a IP crew doing a dipole -dipole survey. For example, Géosig Inc., a Québec contractor, averages a productivity of over 4 km a day for n=6, a=25 m, and a crew of 5 persons.

The GDD Tx II is easy to use. The transmitter cuts off within microseconds if a short circuit occurs or if the circuit becomes open.

1.1 Equipment list

The following equipment is shipped:

- 1 transport case
- 1 Tx II transmitter
- 1 alimentation cable
- 1 plastic pan
- 1 instruction manual

Optional

- Rack to carry the Tx II or the generator
- 25- or 50-meter electrical extension cord
- 120 V generator, Honda or otherwise (700, 1400 or 1900 W)

1.2 Transmitter description

In this section, the Tx II components are shown, named and explained.

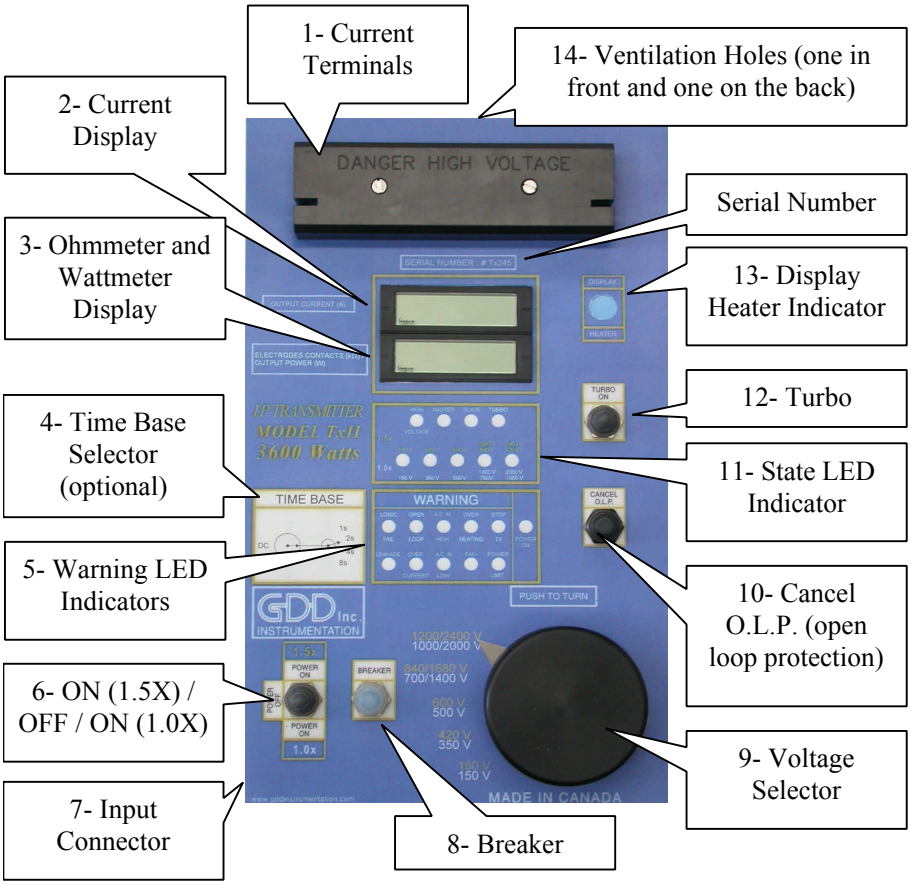

Figure 1: Transmitter components

Explanation of the control panel

1.2.1 Current Terminals

This is where the output current wires are connected. Press the button over each terminal to insert wires. Be careful, the terminals can reach 2400 V.

1.2.2 Current Display

It displays the value of the output current in amperes three or four times at each cycle. The first and the last reading may overlap the off cycle and have to be rejected.

1.2.3 Ohmmeter and Wattmeter Display

It displays the ground resistance when the generator is plugged and the transmitter is power OFF. The values shown are the contact resistance in kiloohms (x1000Ω).

It also displays the output power when the transmitter is power ON.

1.2.4 Time Base Selector (optional)

The time base selector (if installed) lets the user uses one of the following operation modes, depending on the selector installed :

- 1 sec, 2 sec, 4 sec ou 8 sec
- 0.5 sec, 1 sec, 2 sec ou 4 sec

Another possible option is a switch for the DC mode.

1.2.5 Warning LED Indicators

The red lights signal possible problems.

LOGIC FAIL: An internal electronic problem has happened.

LEAKAGE: Internal synchronization problem. This causes an escape current.

OPEN LOOP : That protection system goes on when there is no electrical contact between the two current terminals (the circuit is open) or when the output current is less than 30 mA (highly resistive ground). If necessary, it is possible to neutralize this protection with the *Cancel O.L.P.* button (see section 1.2.10).

OVER CURRENT: The maximal current limit has be surpassed. The limit is 10 amperes in normal mode and 5 amperes in DC mode.

A.C. IN HIGH : High or irregular voltage from the generator. A non -regulated generator can cause this signal

A.C. IN LOW : Low or irregular voltage from the generator. The power transformer may overheat.

OVERHEATING: Internal temperature of the Tx II is too high. Keep the fan going but stop transmitting to let it cool. The «FAN» LED indicator lights up when the fan is working. The fan starts automatically when the Tx temperature is too high (65^{o}C).

POWER LIMIT : Indicates that the maximal output power has been reached. This limit is 1800W.

STOP TX: Indicates that the Tx II does not transmit. This happens when one of the warnings LEDs lights up or when the total output power exceeds 1800 W.

POWER ON: Indicates that the transmitter is ON.

1.2.6 ON (1.5x) / OFF / ON (1.0x)

Used to select the 1.0x or the 1.5x POWER ON mode. In the case of the 1.5x POWER ON mode, the output voltage will be 120 % higher and the power 150% higher than the 1.0x mode.

1.2.7 Input Connector

This is where you connect the input cable that comes with the GDD Tx II. The other end of the cable should be connected to any 120 VAC / 60 Hz power supply. Some Tx II may have been modified to accept 220 VAC / 50 Hz (240 VAC / 60Hz). To be sure, check the plate on the side.

1.2.8 Breaker

In case of electric overload, the breaker will cut the power source to the transmitter.

1.2.9 Voltage Selector

Used to select the output voltage of the Tx II. Th e available voltages for the 1.0x mode are 150 V, 350 V, 500 V, 700 V, 1000 V, 1400 V and 2000 V. When the 1.5X mode is selected, the available voltages are 180 V, 420 V, 600 V, 840 V, 1200 V, 1680 V and 2400 V.

To select voltage, press the selector, turn and release it to the new desired voltage. Pressing the selector stops the current transmission.

1.2.10 Cancel O.L.P. (open loop protection)

The GDD Tx II has an internal open loop protection circuit to prevent direct electric shock to the user. This protection is automatically activated when the wires are not connected to the output or when the current is inferior to 30 mA. However, when the ground has an extremely high resistivity, the same open loop protection can prevent the transmission of signal. To temporarily cancel the O.L.P., do the following: turn the Tx II OFF, press and hold the Cancel O.L.P. button and turn the Tx II ON.

1.2.11 State LED Indicator

HIGH VOLTAGE : This LED turns on to indicate the current transmission and turns off when the current is cut, allowing to follow the Tx II transmission cycle.

MASTER: This LED lights up when the transmitter is in master configuration and when it stands alone.

SLAVE: This LED lights up when the transmitter is in SLAVE configuration.

TURBO: This LED turns on when the ou tput voltage changes from 700 V/840 V to 1400 V/1680 V or from 1000 V/1200 V to 2000 V/2400 V.

The lighted *150, 350, 500, 700/1400* or *1000/2000* red LEDs indicate the voltage present at the output while transmitting. These values increase 120 % when the sel ector is on the 1.5X mode.

1.2.12 Turbo

All voltages above 1200 V are accessible with the Turbo switch ON. This switch allows, for example, to access the 1400 V/1680 V or 2000 V/2400 V scales while the voltage selector is on the 700 V/840 V or 1000 V/1200 V position. To work at the lower voltages, turn the turbo off. It may take up to 4 seconds before the Turbo turns on or off.

1.2.13 Display Heater Indicator

At low temperatures, the display slows down and may become unreadable. The display heater is fully automated and this light goes on when the display is heating.

1.2.14 Ventilation Holes

There are two ventilation holes, one in front and one in the back of the transmitter. A fan will be activated if the internal temperature of the Tx II is high. Do not block these two holes and prevent anything from entering them (e.g.: branches, bugs, snow, etc.).

2. STEP BY STEP

Here are the basic steps for a field operation of the Tx II:

1. Turn the Tx II OFF.

2. Properly drive the two electrodes into the ground and connect them to the current terminals via insulated wires.

3. Start the generator.

4. Turn the voltage selector of the Tx II at the lowest voltage (150 V) and turn the Tx II ON.

5. Estimate the transmitted output power (see section 2.1).

6. To increase the output power (if necessary), switch the voltage selector to the next higher scale. It is not necessary to shut down the Tx II to switch the voltage selector or select a different time base (optional). Repeat until the appropriate power output is obtained. The 1.5x ON mode allows to reach an intermediate output power. Note that the Tx II will automatically stop if you try to transmit more than 1800 W of output power. In such a case, select the next lower output.

7. Once a reading is taken, it is important to:
   - turn the Tx II OFF while the "HIGH VOLTAGE" LED is off (during the OFF cycle);
   - turn the Tx II OFF before shutting down the generator. You may now move the Tx II.

2.1 Power output calculation

The GDD Tx II transmitter can output up to 1800 W of power. To calculate the power output, simply multiply the voltage (V) by the current (I). Here are some examples

Voltage (V)	Current (I)	Power (W)
150 V	0.500 A	75 W
500 V	0.050 A	25 W
1000 V	0.200 A	200 W
2000 V	0.400 A	800 W
2000 V	0.700 A	1400 W
2400 V	0.750 A	1800 W

Actually, at full power, the voltage drops somewhat from the nominal voltage and the power output is somewhat lower than the result above. Do not worry if it seems to transmit more than 1800 W; the built-in protection will cut off the current if it is overloaded. It is possible to use the GDD Tx II transmitter with a smaller generator such as a 700 W. The generator

will then limit the maximum power output, but you may not need it on a mountain side where the bedrock is close to the surface. It is also possible to use a more powerful generator than a 1800 W. In that case, the maximum output will still be limited at 1800 W by the GDD Tx II.

3. TROUBLE SHOOTING

With a good understanding of the transmitting circuit and a little logic, most of the problems that will happen with the Tx II can often be solved.

3.1 Most Frequent Problems

3.1.1 Nothing seems to work

The ON LED does not light up and the display remains blank: Check if the power source (generator) is functioning properly, for it might be defective. Check also the al imentation cable and the extension cord. The breaker might also be up.

3.1.2 The display does not function

In case of extremely cold temperature, check if the display heater is working (see section 1.3.13). Let it heat up for about 15 minutes. If the cold is not the problem, some TX models have 9 V batteries, check if these batteries that supply the display are still good. Replace them if necessary. If that does not work, return the Tx II to the GDD office for a check-up.

3.1.3 The ON LED lights up but the Tx-II does not transmit

First, check if the voltage selector is not pushed down (see section 1.2, item 9). Then, check which of the other warning LEDs also light up:

LOGIC FAIL: Indicates that an internal electronic problem occurred. Shut down the Tx II and restart it. If it still fails, try to move the Tx II from the current pin. In desperation, try another generator.

LEAKAGE: Shut down the Tx II completely and restart it. If it still fails, try to move the Tx II from the current pin. If it still does not work, call us for technical support.

OPEN LOOP: The Tx II detects that the transmitting circuit is open and does not transmit. This problem can be caused by an electrode not connected or by highly resistive ground. In that case, you can neutralize the open loop protection circuit with Cancel O.L.P. (see section 1.2, item 10).

OVER CURRENT: The output current is too high. Lower the voltage selector to transmit a lower current or try to pull a little bit the electrodes out of the ground.

A.C. IN (HIGH or LOW): It indicates that the power source (generator) is defective. The supply voltage must be stable and between 90 VAC and 140 VAC for a 120 VAC Tx II (180 VAC and 280 VAC for a 220 VAC Tx II). This could happen even with a generator that tests well. This means that the generator is not performing enough for the Tx II need. You should then try transmitting least power with the Tx II or change for another kind of generator. WARNING: A regulated generator should always be used. A non -regulated current may bri ng on current peaks that will damage capacitors and subsequently bring on major inner breakings that would not be covered by the warranty.

OVERHEATING: It indicates that the internal temperature of the Tx II is too high. Do not shut down the Tx II, it woul d stop the fan. Stop transmitting for a while for the fan to cool down the Tx II until the overheating LED turns off. Then, turn the Tx II OFF and restart it. Make sure that the two ventilation holes are cleared up. If the fan is operating, the «FAN» LED indicator will light up.

POWER LIMIT: The Tx II tries to transmit over 1800 W so the protection cuts off. Lower the voltage selector to transmit a lower power.

STOP TX: This LED lights up when one of the previous problems is detected.

It is also possible that one of the transmitting electrodes is too near of the Tx II case and causes interference. If so, try to move the transmitter away from the electrodes.

3.1.4 The Tx II works well but the output power is very low

First, check if it possible to increase the vo ltage. Every time you increase the voltage scale by one step, the output power is approximately doubled. It is therefore possible to send 1000 W at a given scale (e.g.: 2000 mA at 500 V) but the Tx II will stop transmitting on the next higher scale (e.g.: 2600 mA at 700 V) since it would try to transmit 2000 W, which is more than 1800 W. In that case, try the 1.5x mode at the 500 V scale in order to have an intermediate output, e.g. about 1400 W (2400 mA at 600 V). You can also raise or lower the current el ectrodes in the ground in order to alter the overall resistivity of the circuit. This could allow you to transmit a full 1800 W at 700 V.

3.1.5 The generator is too weak

If the generator does not provide the required current to the transmitter, it is the c ause of the problem. Try to change the spark plug.

3.1.6 Ground with very high resistivity

If the ground is highly resistive, it is possible that even at the maximum voltage, 2400 V (1.5x mode), the transmitted current is too low (ex: 2400 V and 75 mA for 180 W). In this case, you have to improve the electrode contact with the ground. Here are a few suggestions:

- Move the electrodes to get a better contact;
- Double (or more) the number of electrodes;

- Water the electrodes (salt water if available).

3.1.7 Noise (Bad signal)

A noise, or interference, is any unwanted signal that combines with a signal and disturbs it.

The noise may originate from a second IP or EM transmitter operating in the area; the interference zone may reach up to 10 kilometers, depending on the power of the instrument and the array used. If the receiver receives a recurrent signal while the transmitter is shut down, this is certainly due to a second transmitter. The receiver could even synchronize with the signal if compatible.

Telluric currents may also cause the noise: they occur naturally near the surface of the Earth and concentrate in conductive zones such as overburdens, shale or graphite formation, etc. To continue the survey in spite of telluric currents, one should improve the electro de contacts and increase the output current of the transmitter in order to increase the signal-to-noise ratio.

Finally, the noise may originate from a defective transmitter or receiver. First, check the electrodes, decrease the contact resistance and make sure there is no loose contact. The signal timings of the receiver and the transmitter must be the same. If necessary, take a reading at a precedent station or repeat tests with another receiver or transmitter.

4. TECHNICAL HELP

If you encounter a proble m not described in the troubleshooting section or one you cannot solve, do not hesitate to contact **Instrumentation GDD Inc.** for help at:

Tel.: (418) 877-4249
Fax: (418) 877-4054
Toll free line (for CANADA): 1 877 977-4249
e-mail: gdd@gddinstrumentation.com

Emergency out of business hours:

Pierre Gaucher: Tel. res.: (418) 657-5870
Cell phone: (418) 261-5552

Régis Desbiens: Tel. res.: (418) 658-8539
Cell phone: (418) 570-3408

Any GDD Tx II transmitter that breaks down while under warranty or service will be replaced free of charge upon request for the duration of repairs, subject to instruments availability, except for shipping charges. This service is subject to instrument availability but we have been able to honour this commitment until now.

5. SPECIFICATIONS

Size:	in its case: 43.5 x 60 x 51 cm without its case: 22 x 44 x 35 cm
Weight:	33 kg with its case
Operating temperature:	-40 ^{o}C to 65 ^{o}C
Cycle:	time domain: 2 s ON, 2 s OFF
Optional	1, 2, 4, 8 s or 0.5, 1, 2, 4 s
Output current:	0.030 A to 10 A (normal operation)
From	0.000 A (cancel open loop)
Output voltage:	150 V to 2400 V
Display:	LCD, reads to 0,001 A
Power source:	120 V / 60 Hz
Optional	240 V / 50 Hz

6. GLOSSARY

Induced polarisation (I.P.): A geophysical method. It is based on sending a strong current in the ground to allow reading of it conductivity and chargeability. The GDD Tx II is one of the principal component for an I.P. survey system.

Short circuit: A electrical circuit is short circuit when the resistivity at its end is zero; that means direct contact.

Transmitting circuit: The whole electrical system associated with the Tx II; electric wires, transmitting electrodes, ground and transmitter.

Open circuit: An electrical circuit is open when the resistivity at its end is infinite; that means no contact.

Conductive ground: Ground with a low electrical resistivity. Such grounds are usually associated with thick overburden and waters presence (e.g.: swamp).

Resistive ground: Ground with a high electrical resistiv ity. Such grounds are usually associated with bare rock or sand, with little overburden.