TOPCON

# TRL-35


# Operator's Manual

## TRL-35 Digital UHF Radio Modem

TOPCON
POSITIONING SYSTEMS

# TRL-35 Operator's Manual

Part Number 7010-0815
Rev A

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# Preface

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# Manual Conventions

This manual uses the following conventions:

| Example | Description |
|---|---|
| **File ▸ Exit** | Click the **File** menu and click **Exit**. |
| ***Connection*** | Indicates the name of a dialog box or screen. |
| *Frequency* | Indicates a field on a dialog box or screen, or a tab within a dialog box or screen. |
| **Enter** | Press or click the button or key labeled **Enter**. |


Further information to note about the configuration, maintenance, or setup of a system.


Supplementary information that can help you configure, maintain, or set up a system.


Supplementary information that can have an affect on system operation, system performance, measurements, or personal safety.


Notification that an action has the potential to adversely affect system operation, system performance, data integrity, or personal health.


Notification that an action *will* result in system damage, loss of data, loss of warranty, or personal injury.


Under no circumstances should this action be performed.

# Notes:

# Introduction

The TRL-35 is a transmit/receive/repeating Digital UHF modem. It is a 35W high powered base radio that uses the same DSP technology as is used in the GR-3 Digital UHF receiver.

The TRL-35 radio can be used to enhance the following survey-related systems:

- As a high power transmitter/receiver external UHF radio for any base system

  For example, with the GB or Legacy Series GPS Receiver.

- As a high power repeater (not in PDL protocol currently)

Obstructions such as buildings, terrain, trees, and so forth greatly affect the usability and range of any radio system. However, the TRL-35 as a high powered transmitter/repeater provides an increase in the operational range and effectivity of the system in unfavorable environments.


The TRL-35 extends the operational range of the UHF system. It does not increase the range beyond the rover's OAF limitation.

The TRL-35 is compatible with:

- GR-3 Digital UHF Radio
- Existing Pacific Crest radios (currently only PDL radios using GMSK modulation)
- Trimble radios using Trimtalk 450s (currently only Trimble radios using GMSK modulation)

Simple features and configurations allow the TRL-35 to be adaptable to most situations, and make it easy to use.

# TRL-35 LEDs

The four LEDs on the TRL-35 have the following indications for the modem:

- Power LED

  Solid green if power is connected to the modem.

- Sync LED

  Solid red if a signal with a level exceeding the level required for reception exists on the current radio channel frequency.

- Tx/Rx LED

  Flashes green if the modem receives or transmits data over the serial interface.

- Alarm LED

  Solid red if an alarm is detected.

# Standard Kit Cables and Accessories

The TRL-35 (P/N 30-070004-01) bill of materials includes power and communications cables, and the radio antenna for the modem. The following table lists the cables included in the package.

**Table 1-1. Cables Included in TRL-35 Package**

| Part Number and Description | Function |
|---|---|
| Power cable, 2-pin Alden connector to SAE<br>Topcon P/N 14-008110-01 | Connects the TRL-35 and the power supply via an SAE connection to provide power to the modem. |
| Alligator clips to SAE cable<br>Topcon P/N 14-008025-01 | Connects the modem to the external power source. |
| TRL-35 Programming cable<br>Topcon P/N 14-008107-01LF | Connects to the DB-15 connector on the TRL-35 and to a standard DB-9 connector to connect to a PC. |

**Table 1-1. Cables Included in TRL-35 Package**

| Part Number and Description | Function |
|---|---|
| TRL-35 Data Cable<br>Topcon P/N 14-008109-01LF | Connects to the DB-15 connector on the TRL-35 and to an ODU-7 connector as used on Topcon receivers. |
| TNC-BNC Adapter<br>Topcon P/N 23-060003-01 | Connects the Reverse TNC antenna connector of the TRL-35 to a BNC female connector. |
| ComTelco Antenna Pole Mount<br>Topcon P/N 30-060003-01 | Used for connecting the Antenna to an antenna mast radio tripod |
| UHF Whip Antenna<br>Topcon P/N 30-060002-01 (410-430 MHz)<br>Topcon P/N 30-000048-02 (430-450 MHz)<br>Topcon P/N 30-000048-03 (450-470 MHz) | 2.4 db gain whip antenna |

# Optional Accessories

**Table 1-2. Optional Accessories for the TRL-35 Package**

| P/N and Description | Function |
|---|---|
| 12V, SLA Battery and Charger<br>P/N 30-000077-01 | Provides power for the TRL-35 modem |

# Notes:

# TRL-35 Configuration

## Installing Modem-TPS

Modem-TPS is a configuration program for the TRL-35. Modem-TPS is available from the TPS website as well as on the GPS+ Software CD.

Modem-TPS version 2.2p0 or later is required to interface with the TRL-35.

The computer requirement for Modem-TPS is a PC running Windows 98, 2000, NT, or XP.

Perform the following steps to install Modem-TPS:

1. Navigate to the location of the Modem-TPS program and double-click the Setup.exe icon.

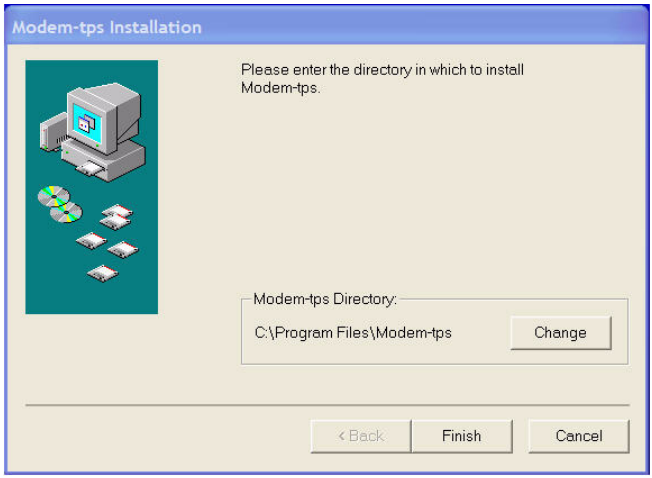


**Figure 2-1. Modem-TPS Installation Screen**

2. Keep the default installation directory or select a new location to install the program.

A pop-up appears that shows you the installation progress.

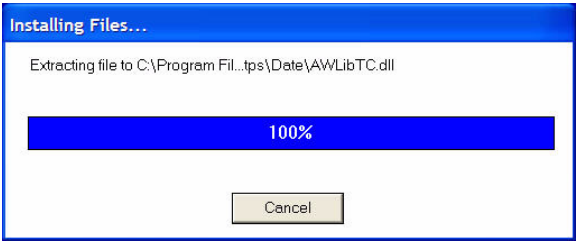


**Figure 2-2. Installation Pop-up Showing Percentage of Completion**

3. Click **Finish**.
4. Click **OK** to complete the installation.


**Figure 2-3. Final Step Showing Successful Modem-TPS Installation**

5. Optionally, create a shortcut on your computer's desktop for quick access to Modem-TPS.


# Uninstalling Modem-TPS

To uninstall Modem-TPS use the Start menu on your computer.

1. Click **Start ▸ Programs ▸ Modem-TPS ▸ Uninstall Modem-TPS**.
2. Click **Yes** at the prompt.
3. Click **OK** when the uninstall is complete.

# Configuring the TRL-35

## As a Transmitter in Modem-TPS in PDL Protocol


To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

The TRL-35 provides high powered TX communication from the base station to the rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98, 2000, NT, or XP
- Modem-TPS version 2.2p0 or later
- TRL-35 Programming Cable, Topcon P/N 14-008107-01LF
- TRL-35 Power Cable, Topcon P/N 14-008110-01


Before connecting power to the TRL-35 confirm the modem antenna is attached.

To configure the UHF radio modem perform the following steps:

1. Connect the computer and TRL-35 using the TRL-35 programming cable.
2. Connect the power cable to the TRL-35 and confirm the power LED is on.
3. Open Modem-TPS and on the connection dialog box, then click **Cancel**.
4. Go to **Tools ▸ Options**.
5. On the Options screen, change the *Connect modem* field to External, and change the *Baud Rate* field to **38400**.

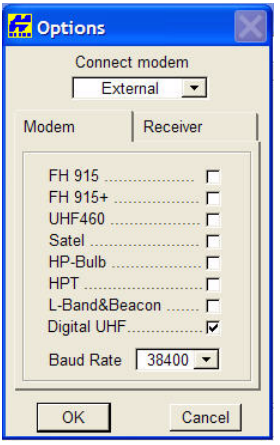


**Figure 2-4. Tools-Options Screen**

6. Confirm that the applicable radio modem options have a check mark, as shown in Figure 2-4. Once configured, click **OK**.
7. Go to **File ▸ Connect** in Modem-TPS and choose the COM Port the TRL-35 connects to on your computer, and then click **Connect.**

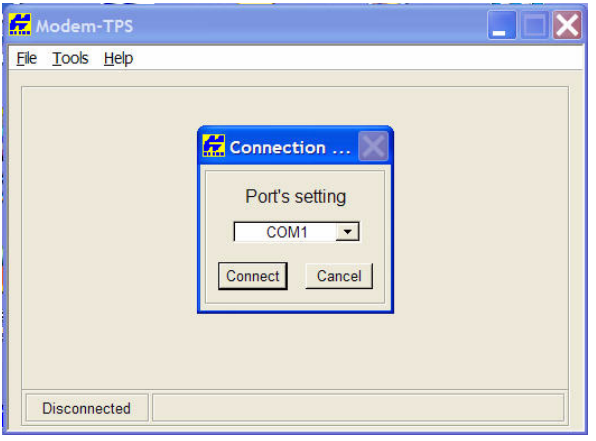


**Figure 2-5. Selecting the COM Port to which the TRL-35 Connects**

8. On the *Radio Link* screen, select the parameters shown in Figure 2-6 to set the TRL-35 as a transmitter in PDL Protocol.

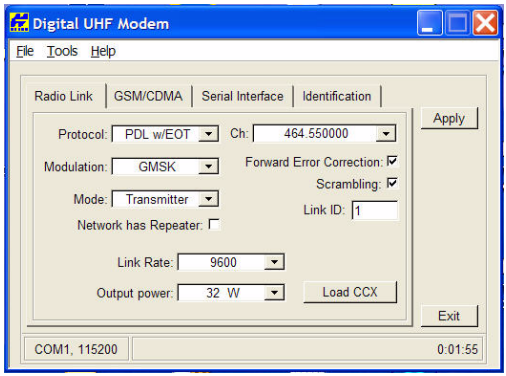


**Figure 2-6. Setting the TRL-35 as a Transmitter in PDL Protocol**

- **Protocol**

  Select PDL w/EOT.

- **Channel**

  The current Transmit/Receive frequency channel in MHz.

- **Modulation**

  The modulation for PDL protocol is GMSK.

- **Forward Error Correction (FEC)**

  Enable to maximize data communication. With this parameter enabled, the rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream. For PDL protocol, FEC must have a check mark.

- **Scrambling**

  Enable to provide more robust data communication over high interference areas. For PDL protocol, Scrambling must have a check mark.

- **Mode**

  The Radio Operation mode. To set the TRL-35 into transmit mode, choose Transmitter as the Mode. In PDL protocol, the TRL-35 currently supports operation as a Transmitter and

Receiver only. The TRL-35 currently does not support Repeater mode in the PDL protocol.

- **Link Rate**

  The default link rate for GMSK is 9600 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.

- **Output power**

  Select the level of power for RF transmissions ranging from 500 mW to 32W (45 dBm).

9. Click on the *Serial Interface* tab.

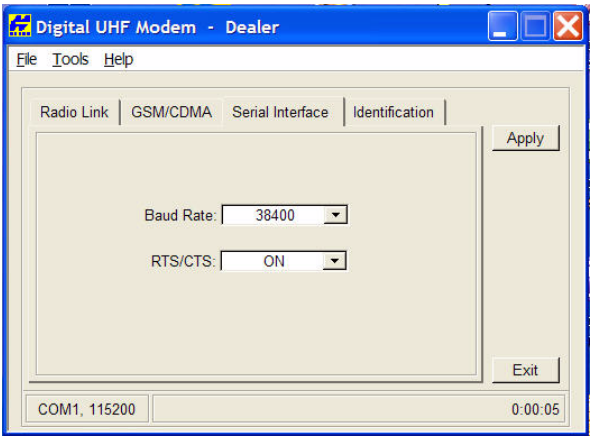


**Figure 2-7. Serial Interface Screen**

10. On the Serial Interface screen, select the Baud Rate for the modem's serial port.

    The same rate must be used for both the receiver and the transmitter. The recommended baud rate is **38400**.

11. Select the RTS/CTS (Ready to Send/Command to Send) to be **ON**.
12. Click **Apply**.
13. Click on **File ▸ Disconnect**.
14. To close Modem-TPS, choose **File ▸ Exit**.
15. Launch PC-CDU with the TRL-35 connected to a receiver and setup the receiver to run as an RTK Base station.

# As a Transmitter in Modem-TPS in Simplex Protocol


To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

The TRL-35 provides high powered TX communications from the base station to the rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98, 2000, NT, or XP
- Modem-TPS 2.2p0 or later
- TRL-35 Programming cable, Topcon P/N 14-008107-01LF
- TRL-35 Power cable, Topcon P/N 14-008110-01


Before connecting power to the TRL-35 confirm the modem antenna is attached.

1. Connect the computer and TRL-35 using the TRL-35 programming cable.
2. Connect the power cable to the TRL-35 and confirm that the power LED is on.
3. Open Modem-TPS.
4. On the connection dialog box click **Cancel**.
5. Go to **Tools ▸ Options** (Figure 2-4 on page 2-4).

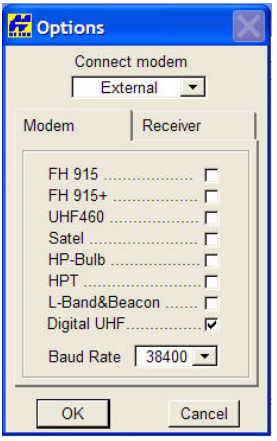


**Figure 2-8. Tools-Options Screen**

6. On the Options screen, change the *Connect modem* field to External, and change the Baud Rate field to **38400**.
7. Confirm that all the applicable radio modem options have a check mark, as shown in Figure 2-8. Once configured, click **OK**.
8. Go to **File ▸ Connect** in Modem-TPS and choose the COM Port that the TRL-35 connects to on your computer. Then click **Connect**.

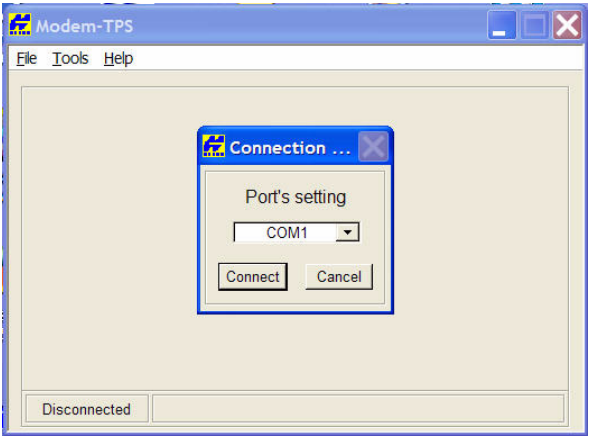


**Figure 2-9. Selecting the COM Port to which the TRL-35 Connects**

9. On the *Radio Link* screen, select the following parameters to set the TRL-35 as a transmitter in **Simplex Protocol**.

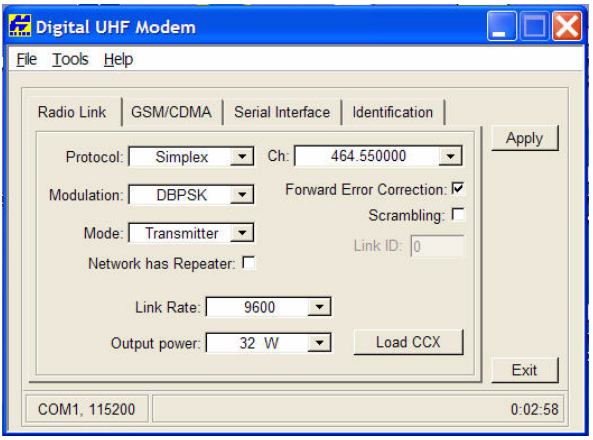


**Figure 2-10. Radio Link Screen**

- **Protocol**

  Select Simplex.

- **Channel**

  The current Transmit/Receive frequency channel in MHz.

- **Modulation**

  The modulation for Simplex protocol is DBPSK.

- **Forward Error Correction (FEC)**

  Enable to maximize data communication. With this parameter enabled, the rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream. For Simplex, FEC should be toggled on.

- **Scrambling**

  Enable to provide more robust data communication over high interference areas. For Simplex protocol, the Scrambling should be toggled off.

- **Mode**

  The Radio Operation mode. To set the TRL-35 into transmit mode, choose Transmitter as the Mode. In Simplex protocol, the TRL-35 currently supports operation as a Transmitter, Receiver, or Repeater.

- **Link Rate**

  The default link rate for DBPSK is 9600 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.

**Table 2-1. Modulation Type for Link Rate**

| For Link Rate | Use Modulation Type |
|---|---|
| 4800 baud | DBPSK |
| 9600 baud (default; recommended) | DBPSK (recommended) or DQPSK |
| 19200 baud | DQPSK |

- **Output power**

  Select the level of power for RF transmissions ranging from 500 mW to 32W (45 dBm).

10. Click on the *Serial Interface* tab.

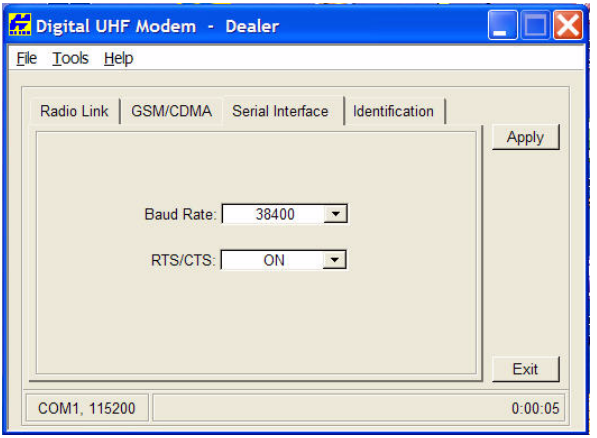


**Figure 2-11. Serial Interface Screen**

11. On the *Serial Interface* screen, select a baud rate for the modem's serial port. The same rate must be used for both the receiver and the transmitter. The recommended baud rate is **38400**.
12. Select the RTS/CTS (Ready to Send/Command to Send) as **ON**.
13. Click **Apply**.
14. Click on **File ▸ Disconnect**.
15. To close Modem-TPS, choose **File ▸ Exit**.
16. Launch PC-CDU with the TRL-35 connected to a receiver and setup the receiver to run as an RTK Base station.

## As a Repeater in Modem-TPS in Simplex Protocol


To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.

The TRL-35 provides high powered TX communications from the base station to the rover. To configure the UHF radio modems, have the following ready:

- PC running Windows 98, 2000, NT, or XP
- Modem-TPS 2.2p0 or later
- TRL-35 Programming cable, Topcon P/N 14-008107-01LF
- TRL-35 Power cable, Topcon P/N 14-008110-01


Before connecting power to the TRL-35 confirm the modem antenna is attached.

1. Connect the computer and TRL-35 using the TRL-35 programming cable.
2. Connect the power cable to the TRL-35 and confirm the power LED is on.
3. Open Modem-TPS and on the connection dialog box, then click **Cancel**.

4. Go to the **Tools ▸ Options**.

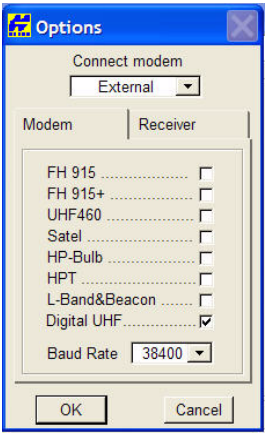


**Figure 2-12. Tools Options Screen**

5. On the Options screen, change the *Connect modem* field to External, and change the Baud Rate field to **38400**.
6. Confirm that all the radio modem options have a check mark, as shown in Figure 2-12. Once configured, click **OK**.
7. Go to **File ▸ Connect** in Modem-TPS and choose the COM Port the TRL-35 connects to on your computer. Then click **Connect**.

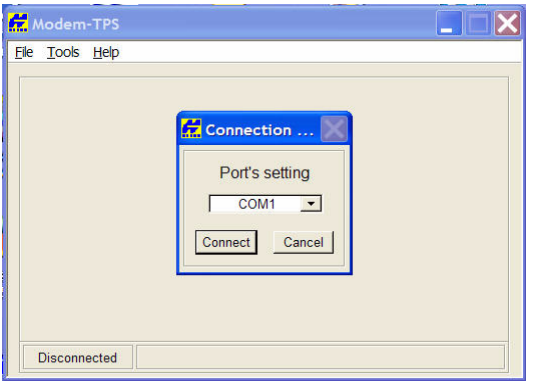


**Figure 2-13. Selecting the COM Port to which the TRL-35 Connects**

8. On the *Radio Link* screen, select the following parameters to set the TRL-35 as a repeater in **Simplex Protocol**.

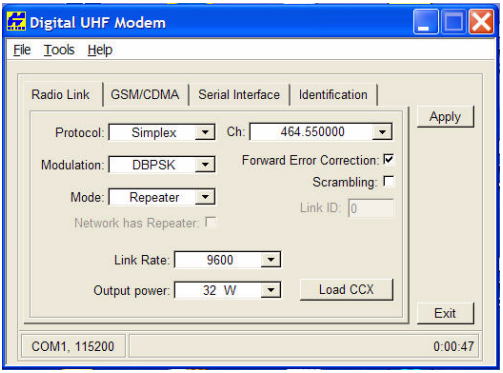


**Figure 2-14. Radio Link Screen Setting TRL-35 Repeater in Simplex Protocol**

- **Protocol**

  Select Simplex.

- **Channel**

  The current Transmit/Receive frequency channel in MHz.

- **Modulation**

  The modulation for Simplex protocol is DBPSK.

- **Forward Error Correction (FEC)**

  Enable to maximize data communication. With this parameter enabled, the rover radio modem has the capability to check and correct transmission errors (if any) in an incoming data stream.

- **Scrambling**

  Enable to provide more robust data communication over high interference areas. For Simplex protocol, the Scrambling should be toggled off.

- **Mode**

  The Radio Operation mode. To set the TRL-35 into Repeater mode, choose Repeater as the Mode. In

Simplex protocol, the TRL-35 currently supports operation as a Transmitter, Receiver, or Repeater.

- **Link Rate**

  The default link rate for DBPSK is 9600 and is recommended for most applications. The link rate is the rate at which data is transmitted over the RF Link.

**Table 2-2. Modulation Type for Link Rate**

| For Link Rate | Use Modulation Type |
|---|---|
| 4800 baud | DBPSK |
| 9600 baud (default; recommended) | DBPSK (recommended) or DQPSK |
| 19200 baud | DQPSK |

- **Output power**

  Select the level of power for RF transmissions ranging from 500 mW to 32W (45 dBm).

9. Click on the *Serial Interface* tab (Figure 2-15).

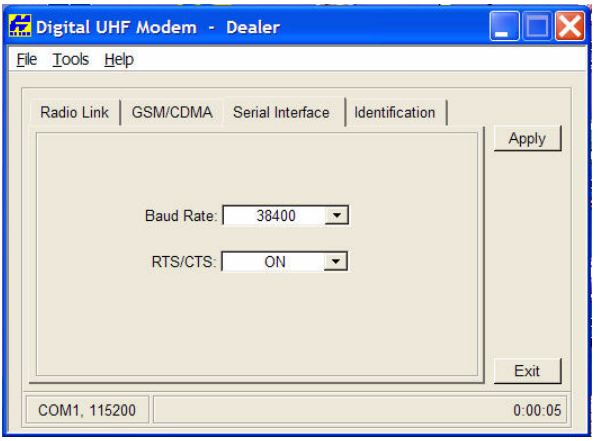


**Figure 2-15. Serial Interface Screen**

10. On the *Serial Interface* screen, select a baud rate for the modem's serial port. The same rate must be used for both the receiver and the transmitter. The recommended baud rate is **38400**.
11. On the *Serial Interface* screen, select the RTS/CTS (Ready to Send/Command to Send) to be **ON.**

12. Click **Apply**. Then click on **File ▸ Disconnect**.
13. To close Modem-TPS, choose **File ▸ Exit**.
    The TRL-35 is now set as a repeater in Simplex protocol.

# Notes:

# Specifications

## TRL-35 General Specifications

**Table A-1. TRL-35 General Radio Specifications**

| Parameter | Specification |
|---|---|
| Operating Frequency Range country/ region/purpose dependent | 410 - 470 MHz |
| Modulation Techniques | GMSK, DBPSK, DQPSK, D8PSK, and 16QAM Modulation Tech. |
| Channel Spacing | 12.5 kHz/25 kHz |
| Transmission Rates at 25 kHz spacing | DBPSK/GMSK – 9600 bps<br>DQPSK – 19200 bps<br>D8PSK – 28800 bps<br>D16QAM – 38400 bps |
| Transmission Rates at 12.5 kHz spacing | DBPSK/GMSK – 4800 bps<br>DQPSK– 9600 bps<br>D8PSK – 14400 bps<br>D16QAM – 19200 bps |
| Data Speed of Serial Interface | Max 115200 bps |
| Forward Error Correction | Available |
| Scrambling | Available |
| Communication Mode | Half-Duplex |
| System Gain | 158 dBm (25kHz), 159 dBm (12.5 kHz) |

# TRL-35 Transmitter Specifications

**Table A-2. RL-35 Transmitter Specifications**

| Parameter | Specification |
|---|---|
| Output Power | GMSK - 33 dBm to 45 dBm in 1dB Steps (2W to 35W)<br>DBPSK – 33 dBm to 45 dBm in 1dB Steps (2W to 35W)<br>DQPSK – 33 dBm to 45 dBm in 1dB steps (2W to 35W)<br>D8PSK – 28dBm to 40 dBm in 1dB steps (650 mW to 10W)<br>D16QAM – 25 dBm to 37 dBm in 1 dB steps (320 mW to 5W) |
| Nominal Output Impedance | 50 Ohms |
| Output Power Control Accuracy | + 1.5 dB (at normal test condition) |
| Carrier Frequency Stability | +/- 1.5ppm initial stability over temp with +/- 3.0 ppm aging/year |
| Max Frequency Error | +/- 1.0 kHz (at normal test conditions) |
| Adjacent Channel Power (conducted) | 65dB |

# TRL-35 Receiver Specifications

**Table A-3. RL-35 Receiver Specifications**

| Parameter | Specification |
|---|---|
| Noise Figure | 5 dB |
| Receiver Sensitivity for DBPSK (@ BER <1x10$^{-4}$, over temperature -30°C to +60°C, 25/12.5 kHz | GMSK -113 dBm @ 25kHz/-114 dBm @ 12.5 kHz<br>DBPSK -113 dBm @ 25kHz/-114 dBm @12.5 kHz<br>DQPSK -110 dBm/ -111 dBm 12.5 kHz<br>D8PSK -106 dBm @25kHz/-107 dBm @ 12.5 kHz<br>D16QAM -100 dBm @25 kHz/-101 dBm @12.5 kHz |
| Adjacent Channel Selectivity | -70 dB for 25 kHz Channel Spacing<br>-60 dB for 12.5 kHz Channel Spacing |
| Nominal Input Impedance | 50 Ohms |
| Co- Channel Rejection 25/12.5 kHz | -8/-12 dB |
| Adjacent Channel Selectivity 25/12.5 kHz | 70/60 dBc |

# TRL-35 Environmental Specifications

**Table A-4. TRL-35 Environmental Specifications**

| Parameter | Specification |
|---|---|
| Temperature | Operating -30°C to + 60°C<br>Storage -40°C to + 85°C |
| Environmental | IP 66 |
| Dimensions | 6” x 2.9” x 2.8” D |
| Weight | 27 oz |
| Power Supply Voltage | +9 to +16 Vdc nominal |

**Table A-4. TRL-35 Environmental Specifications**

| Parameter | Specification |
|---|---|
| Power Consumption (Average) | 120W/38W/300mW – Continuous Transmit/Transmit with 30% Duty cycle/Sleep |
| Antenna Connector | TNC, 50 Ohms |
| User Interface Connector | DB-15 waterproof, female connector |
| Power Connector | Alden products pulse lock two pin connector |

# TRL-35 Compliances

**Table A-5. TRL-35 Compliances**

| Parameter | Specification |
|---|---|
| FCC | FCC Part 90 |
| Industry Canada | RSS-210 |
| UL | UL 1419 |
| UL Hazardous Locations | Class 1, Div2; Groups A, B, C, and D; hazardous locations |
| FM | Approved |

# Safety Warnings

## General Warnings


To comply with RF exposure requirements, maintain at least 25cm between the user and the radio modem.


TPS receivers are designed for survey and survey related uses (that is, surveying coordinates, distances, angles and depths, and recording such measurements). This product should never be used:

- Without the user thoroughly understanding this manual.
- After disabling safety systems or altering the product.
- With unauthorized accessories.
- Without proper safeguards at the survey site.
- Contrary to applicable laws, rules, and regulations.


TPS receivers should never be used in dangerous environments. Use in rain or snow for a limited period is permitted.


Handling the cord on this product, or cords associated with accessories sold with this product, will expose you to lead, a chemical known to the State of California to cause birth defects or other reproductive harm. ***Wash hands after handling.***

# Battery Pack Warnings


Never attempt to open the casing of the detachable batteries! Lithium-Ion batteries can be dangerous if mishandled!


Do not incinerate or heat battery pack above 212 degrees fahrenheit (100 degrees celsius). Excessive heat can cause serious damage and possible explosion.


Tampering with the batteries by end users or non-factory authorized technicians will void the battery's warranty.

- Do not attempt to open the battery pack or replace it.
- Do not disassemble the battery pack.
- Do not charge in conditions different than specified.
- Do not use other than the specified battery charger.
- Do not short circuit.
- Do not crush or modify.


This product contains a CR Litium Battery which contains PerchlorateMaterial - special handling may apply.

See http://www.dtsc.ca.gov/hazardouswaste/perchlorate/

Note: This is applicable to California, USA only.

# Usage Warnings


If this product has been dropped, altered, transported or shipped without proper packaging, or otherwise treated without care, erroneous measurements may occur.

The owner should periodically test this product to ensure it provides accurate measurements.

Inform TPS immediately if this product does not function properly.


Only allow authorized TPS warranty service centers to service or repair this product.

# Notes:

# Regulatory Information

The following sections provide information on this product's compliance with government regulations for use.

## FCC Compliance

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television equipment reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Move the equipment away from the receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.
- Consult the dealer or an experienced radio/television technician for additional suggestions.


Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate such equipment.

# Community of Europe Compliance

The product described in this manual is in compliance with the R&TTE and EMC directives from the European Community.

# WEEE Directive

Following information is for EU-member states only:

The use of the symbol below indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.

# Warranty Terms

TPS laser and electronic positioning equipment are guaranteed against defective material and workmanship under normal use and application consistent with this Manual. The equipment is guaranteed for the period indicated, on the warranty card accompanying the product, starting from the date that the product is sold to the original purchaser by TPS' Authorized Dealers.[1]

During the warranty period, TPS will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized TPS warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as provided above. In no event shall TPS be liable for any damages or other claim including any claim for lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, the product.

1. The warranty against defects in a Topcon battery, charger, or cable is 90 days.

# Notes:

# Notes:

# Notes:


**Topcon Positioning Systems, Inc.**
7400 National Drive, Livermore, CA 94550
800·443·4567 www.topconpositioning.com


**ISO 9001:2000**
**FM 68448**

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