LDG DTS-4
Desktop Coaxial Switch

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Introduction

Congratulations on selecting the LDG DTS-4 desktop coaxial switch. The DTS-4 is a breakthrough product, electronically switching your rig between four antennas, and automatically grounding all inputs when your rig is off. The DTS-4 can be mounted on your operating desk, or operated remotely using the LDG DTS-4R Remote Control.

LDG pioneered the automatic, wide-range switched-L tuner in 1995. From its laboratories in St. Leonard, Maryland LDG continues to define the state of the art in this field with innovative automatic tuners and related products for every amateur need.

Jumpstart, *or* **"Real hams don't read manuals!"**

Ok, but at least read this one section before you transmit:

1. Attach the RF input jack (center connector, marked **TX**) to your transmitter or transceiver with a 50 ohm coaxial jumper cable.
2. Attach your antennas to the other RF ports.
3. Connect a 12 volt power supply capable of providing 500 ma to the 2.5 x 5.5 mm coaxial power jack (center positive).
4. Press a front panel button to select the desired antenna.

Specifications

- **Switches up to 1,500 watts of RF power (1000 watts on 6 meters)**
- **Four SO-239 antenna ports**
- **>50 db isolation between ports**
- **Low insertion loss**
- **Automatic grounding with most modern transceivers**
- **Remote operation from DTS-4R or your PC**
- **Requires 12 volts at 500 ma**, **2.5 x 5.5 mm jack, center positive**

IMPORTANT SAFETY WARNING

Never install antennas or transmission lines over or near power lines. You can be seriously injured or killed if any part of the antenna, support or transmission line touches a power line. Always follow this antenna safety rule: the distance to the nearest power line should be at least twice the length of the longest antenna, transmission line or support dimension.

Getting to know your DTS-4

Your DTS-4 is a quality, precision instrument that will give you many years of outstanding service; take a few minutes to get to know it. On the front panel there are four buttons and four LED indicator lights. The four buttons select the four antennas connected to the rear ports. Pressed in pairs, they select special functions.

The red LEDs show which antenna is presently selected. For special functions, they blink in groups of two or four.

On the rear panel, there are five SO-239 RF connectors. The center connector (**TX**) is the output to your rig. The other four go to any coax-fed antenna, or to a dummy load.

The 2.5 x 5.5 mm jack coaxial DC power connector is on the right. The ground connection is via the wingnut. The radio sense input is a second 2.5 x 5.5 mm coaxial jack, and the control cable is a 1/8" stereo jack; the control cable is included with the DTS-4R remote.

The DTS-4R remote is smaller than the DTS-4, but has the same four switches and four LED lights on the front. On the back, it has the same power, radio sense and control jacks, but no coax connectors.

About the Radio Sense feature

Radio Sense is an exclusive LDG feature that automatically grounds all inputs when you turn your radio off. A sense line connects the DTS-4 to any DC out port on your radio providing at least 2 volts DC at 1 ma; most modern radios have at least one such DC output. Check your radio's manual for more information on which jack may provide DC voltage when the radio is on. For example, the Icom 706 provides 13.8 volts on pin 8 of the ACC socket when the radio is on and zero volts when the radio is off.

When this mode is enabled, the DTS-4 senses the DC port change to zero volts when you turn your radio off, and automatically grounds all inputs, protecting the rig from static discharges. When you turn your rig back on, the DTS-4 senses the voltage on the DC port and automatically selects the antenna you were using when you powered down. You can also manually ground all inputs from the front panel with a single press of the control buttons.

Installation

The DTS-4 and -4R are intended for indoor use only; they are not water resistant. If you use them outdoors (Field Day, for example) you must protect them from rain.

Position your DTS-4 in a convenient spot on your operating desk. If you are using the DTS-4R remote, you can position the DTS-4 switch anywhere within reach of the control cable. Connect the input jack (center SO-239 connector marked **TX**) to your transceiver with a 50 ohm coaxial jumper cable (not provided) of suitable power handling capacity.

Connect the coax from your antenna to the input connectors as desired. You can note which antenna is on which port in pencil on the white label panels provided above each button on the front panel. You can also connect a dummy load if you wish. LDG strongly recommends that you use a high-quality, properly installed and grounded lightning arrestor in each antenna line.

Connect the ground post (wingnut) to ground. Ideally this will be a dedicated 6' - 8' copper ground rod installed near the operation position, say, just outside the window or door. If this is not possible, a cold water pipe can be used.

Radio Sense is an optional feature; your DTS-4 will work fine without connecting the sense port to your rig. However, if you don't use it you'll be missing out on one of the unit's main advantages. Connect the Radio Sense port on the DTS-4 to any source of DC on your transceiver, transmitter or receiver that is switched on and off with main power. This is often on a DIN connector on the back of the radio. The DC port must provide at least 2 volts DC at 1 ma, but not more than 20 volts DC. If you are using the DTS-4R remote, connect the radio sense cable to the remote, not the DTS-4 switch.

If you are using the DTS-4R remote, connect the provided control cable to the Control ports of the DTS-4 and DTS-4R. The cable has standard 1/8" inch stereo plugs on each end. You can custom make your own with parts from Radio Shack if you need a specific length.

Your DTS-4 requires 12 volts DC at 500 ma. Connect a suitable power supply to the 2.5 x 5.5 mm coaxial DC input jack using the provided 2.5 x 5.5 mm jack coaxial power connector (center positive). The DTS-4R remote also requires 12 volts at 100ma; you can use the same power supply as the DTS-4 if you wish, providing it can source the total required current.

An important word about power levels

Your DTS-4 is rated up to 1,500 watts of RF power (1000 watts on 6 meters). However, some amateur amplifiers generate signals at even higher power levels. Power levels greater than 1,500 watts will definitely damage or destroy your DTS-4. If the DTS-4 fails under overload it could damage your transmitter. Always observe the specified power limitation.

Operation

Caution: High RF voltages may be present on internal components when transmitting. Never operate your DTS-4 with the cover removed.

Your DTS-4/4R has no power switch; it powers up when you plug it in. The relay associated with the selected antenna is energized and draws current all the time. Operation is exactly the same whether you use the DTS-4 directly, or the DTS-4R remote.

Selecting an antenna
Never attempt to change antennas while transmitting. If you attempt to do so, the antenna will **not** switch, and all four LEDs will flash to indicate the error condition. To change antennas, stop transmitting and press the button on the DTS-4 or DTS-4R corresponding to the desired antenna. You will hear a distinct "click" as the relays change state. You can change antennas as often as needed; just be sure to stop transmitting before you press a button.

Grounding all inputs
To ground all inputs, stop transmitting, then press buttons 3 and 4 together. All ports are grounded; lights 3 and 4 will flash twice to confirm grounding. Never attempt to transmit when the DTS-4 inputs are grounded; your transceiver or transmitter may be damaged. When all inputs are grounded, all four LEDs are off. To unground, simply press any of the buttons for the desired antenna. The LED for the selected antenna will light, indicating that it is ungrounded.

Setting Radio Sense mode On and Off
To set Radio Sense mode on, press buttons 1 and 2 together. Lights 1 and 2 will blink twice to confirm that Radio Sense mode is on. Whenever your rig is off (that is, the DC power port on the radio is off), the DTS-4 will automatically ground all inputs. If you press an antenna selection button while the DTS-4 is grounded in Radio Sense mode, lights 1 and 2 will blink three times to remind you; the antenna will **not** be selected.

To set Radio Sense mode off, press buttons 2 and 3 together. Lights 2 and 3 will blink twice to confirm that Radio Sense mode is off. The last antenna you were using will be automatically selected.

Application Notes
Your DTS-4 is perfectly suited to mobile use. Simply install it in a convenient location near your operating position, and provide 12 volts DC through a fused line (fuse not included; LDG recommends a 2 amp fast-blow fuse). Or, you can install the DTS-4 in the trunk near your mobile antennas, and use the DTS-4R near the operation position. The DTS-4R also requires a fused power line.

The DTS-4 is principally intended to switch four antennas to one transceiver. However, you can also use it "backwards", switching one antenna among 4 rigs as long as the RF power is limited to 200 watts*. In this case, you would attach the single antenna to the center connector, and each of the rigs to one of the other four connectors. Otherwise, operation will be the same.

You can also connect two DTS-4 units "back to back" to allow multiple transceivers to connect to multiple antennas. Again, this is fine for RF power levels of 200 watts or less*.

*For higher power, you would need a switch with 70 db or more of isolation.

Many modern transceivers have an "auto off" function, allowing you to program the rig to turn itself off after a specified time of no use. Using this function along with the Radio Sense function of your DTS-4 insures that the rig will be protected even if you forget to turn it off. If you walk away from your radio and forget to turn it off, the rig will switch itself off after the specified time. With Radio Sense mode on, the DTS-4 will then automatically ground all inputs, protecting the rig.

●	○	○	○	Select Antenna 1
○	●	○	○	Select Antenna 2
○	○	●	○	Select Antenna 3
○	○	○	●	Select Antenna 4
●	●	○	○	Radio Sense On
○	●	●	○	Radio Sense Off
○	○	●	●	Ground All

Button Command Summary

🔴	○	○	○	Antenna 1 Selected
○	🔴	○	○	Antenna 2 Selected
○	○	🔴	○	Antenna 3 Selected
○	○	○	🔴	Antenna 4 Selected
🔴	🔴	○	○	Radio Sense On**
🔴	🔴	○	○	Ant. Selected while in Radio Sense Ground***
○	🔴	🔴	○	Radio Sense Off**
○	○	🔴	🔴	Ground All**
🔴	🔴	🔴	🔴	Button Press While Transmitting*

*   Single Blink
**   Double Blink
*** Triple Blink

Indicator Light Summary

Remote Control Protocol

The control port of your DTS-4 is, in fact, a serial TTL I/O port compatible with protocol that is standard with PC serial ports. This section documents the control protocol; you can write your own software to control the switch. The protocol below describes the dialog between the DTS-4R remote and the DTS-4 switch. Under PC control, the PC program you write would take the place of the remote. Simply open the port, send the appropriate two–byte command, and receive and process the two–byte reply as desired. Note there is no space between the letter prefix (M or R) and the code.

Example: to select antenna 1, your program would send the characters "R2" to the switch via the serial connection. Your program would then receive the code "M2" from the switch, indicating that antenna 2 is selected.

Codes sent by the DTS-4 switch to the DTS-4R remote:

M 00   - Main unit is telling remote that buttons 3&4 were pushed. Causes remote to flash LEDs 3&4 twice
M 01   - Main unit tells remote that all relays are grounded. Remote turns all LEDs off.
M 02   - Main tells remote that antenna 1 is selected. Remote lights proper LED
M 03   - Main tells remote that antenna 2 is selected. Remote lights proper LED
M 04   - Main tells remote that antenna 3 is selected. Remote lights proper LED
M 05   - Main tells remote that antenna 4 is selected. Remote lights proper LED
M 09   - Not used. Remote would not know how to respond.
M 10   - Main tells remote that the radio sense mode is now off. Remote flashes LEDs 2&3 twice.
M 11   - Main tells remote that the radio sense mode is now on. Remote flashes LEDs 1&2 twice.
M 12   - Not used. Remote would not know how to respond.
M 14   - Main sends this when there is RF and a button was pressed or command received. Remote will flash all 4 LEDs
M 17   - Main tells remote that an operation failed because radio sense is on and there is no radio. Remote flashes LEDs 1 and 2 three times.
M 18   - Not used. Remote doesn't need to know if the radio is on.
M 19   - Main will force remote to check status of the radio. Remote responds with radio status.
M 20   - Main asks remote to do a self-check. Main expects a response of "R 21" to show the remote has started the check. If "R 21" is not received, then Main flashes LEDs 1 and 4. If "R 21" is received, main unit will scroll the LEDs and wait for another response.
M 21   - This is sent to the remote when the remote requests a self-check of the main unit.
M 22   - After doing a self-check, everything is fine, so main tells remote.
M 23   - After doing a self-check, button 1 is stuck, so main tells remote.
M 24   - After doing a self-check, button 2 is stuck, so main tells remote.
M 25   - After doing a self-check, button 3 is stuck, so main tells remote.
M 26   - After doing a self-check, button 4 is stuck, so main tells remote.

Codes sent by the DTS-4R remote to the DTS-4 switch

R 00   - Remote is telling main unit that buttons 3&4 were pushed – user wants to ground all antennas.
R 01   - Not used. Remote doesn't give the command to ground all.
R 02   - Remote tells main unit that button 1 is selected – user wants to select antenna 1.
R 03   - Remote tells main unit that button 2 is selected – user wants to select antenna 2.
R 04   - Remote tells main unit that button 3 is selected – user wants to select antenna 3.
R 05   - Remote tells main unit that button 4 is selected – user wants to select antenna 4.
R 09   - Remote asks main for the current antenna position. Expects a response from main of "M 00," "M 01," "M 02," "M 03," "M 04," or "M 05"
R 10   - Remote tells main that the user wants to turn the radio sense mode off.
R 11   - Remote tells main that the user wants to turn the radio sense mode on.
R 12   - Remote asks main for current radio mode. Expects a response from main of "M 10" or "M 11"
R 14   - Not used. Only main can detect RF.
R 17   - Remote tells main that it does not detect radio power.
R 18   - Remote tells main that it has radio power.
R 19   - Not used. Remote doesn't need to request the state of the radio
R 20   - Remote asks main to do a self-check. Remote expects a response of "M 21" to show the remote has started the check. If "M 21" is not received, then remote flashes LEDs 1 and 4. If "M 21" is received, remote will scroll the LEDs and wait for another response.
R 21   - This is sent to the main unit when the main unit requests a self-check of the remote.
R 22   - After doing a self-check, everything is fine, so remote tells main.
R 23   - After doing a self-check, button 1 is stuck, so remote tells main.
R 24   - After doing a self-check, button 2 is stuck, so remote tells main.
R 25   - After doing a self-check, button 3 is stuck, so remote tells main.
R 26   - After doing a self-check, button 4 is stuck, so remote tells main.

Remote Control Hardware

The DTS-4 and –4R use TTL level serial signals. It may be necessary for the user to install an RS-232 converter for use with a PC. Many designs for these converters are available on the internet. Some are based on the popular and inexpensive MAX-232 integrated circuit.

For the interface, the DTS-4 uses a 1/8" stereo jack for the serial connection. The shield is ground, the ring is signals from the DTS-4 to the remote and the tip is signals from the remote to the DTS-4.

The DTS-4 and –4R were tested with up to 150 feet of remote cable between them. For the long cable tests, the cable was 150 feet of Alpha 2400C. That is a 24 AWG (7/32) with shield and drain. It is practical to say that longer lengths could be achieved with the same wire. The actual maximum length was not tested.

With these long cable lengths possible, the user can place the DTS-4 in a weather resistant enclosure for mounting outside.

Care and Maintenance

Your DTS-4 tuner is essentially maintenance-free; just be sure to observe the power and voltage limits discussed in this manual. Never attempt to change antennas while transmitting; always switch in receive mode.

The outer case may be cleaned as needed with a soft cloth slightly dampened in a mild household cleaning solution. As with any modern electronic device, your DTS-4 can be damaged by temperature extremes, water, impact or static discharge. LDG strongly recommends that you use a good quality, properly installed lightning arrestor in each antenna lead.

You should never have to remove the cover, but if you do, replace it before operating. High RF voltages may be present on internal components.

Technical Support

We are happy to help you with your DTS-4. Telephone technical support is available at 410-586-2177 weekdays from 9 am to 5pm Eastern Time. Inquiries by Fax at 410-586-8475 are welcome, and prompt e-mail support is available at ldg@ldgelectronics.com.

Warranty and Service

Your DTS-4 is warranted against defects in parts or workmanship for two years from purchase. The warranty does not cover damage due to abuse or exceeding specifications. This warranty applies to the original purchaser only; it is not transferable. A copy of the receipt showing the purchaser's name and the date of purchase must accompany units returned for warranty service. All returns must be shipped to us pre-paid; we will not accept units with postage due. A return form is provided on our web site for your convenience.

If you need to return your DTS-4 to us for service, package it carefully, keeping in mind that we will re-use your packaging to return the unit to you. A self-addressed return-shipping label, while not required, will help insure speedy and accurate delivery of your repaired unit. Include a full description of the problem, along with your name, address and a phone number or e-mail address where we can reach you with any questions. Repairs average about 3 to 6 weeks.

We will be glad to service your DTS-4 after the two year warranty period has ended. We will notify you of repair charges by phone or e-mail, and bill you after repairs are completed.

Feedback

We encourage everyone who uses the DTS-4 to contact us (card, letter or e-mail preferred) telling us how well it works for you. We are also always looking for photographs of our products in use; we frequently place such pictures on our Web site (www.ldgelectronics.com).

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