



SKYPATROL TT8540

Installer Guide

SKYPATROL highly recommends that a certified professional technician install the unit into your asset.

“BE SURE TO REGISTER YOUR DEVICE ON LINE PRIOR TO HAVING IT INSTALLED”

Call 800-369-5007 for more details.

Preface

There are three primary aspects to the installation of the Skypatrol TT8540 vehicle tracking device:

- Power connections
- Combo Antenna installation
- Mechanical mounting of the device

This Installation Guide will help you step by step to accomplish a proper installation. This document is a supplement intended to help installers with more difficult or non-standard installations. It will also help with the testing and troubleshooting of installations that do not initially work correctly and will help an installer become more proficient and faster at repetitive installations.

The device power wiring harness must be connected to the vehicle's electrical system at three points; power, ground, and ignition sense. Each of these three wires must be connected to an appropriate connection point in the vehicle. Finding and determining the suitability of the appropriate connection point for each wire is described in detail in subsequent sections of this document.

In order to perform the steps outlined below it will be necessary to use a good quality multi-meter. The meter will need to accurately measure DC voltage up to 36 volts and resistance down to less than one .

WARNING: When working with vehicle wiring, be very careful that no bare wires, and no tools come in contact with any other wires. Never make contact with the ground (vehicle's chassis). This contact will probably blow a fuse and could also cause heat and fire. It is always preferable to disconnect the vehicle's battery before doing any work on the vehicle's electrical system.

CAUTION: If you decide to disconnect the battery this process might disable the anti-theft-coded radio or airbag. Doing so may cause a warning light to be displayed which may require a trip to the dealer or by entering the correct code.

Mounting of the Device

Mounting the device itself is a critical part of the installation that is often mistakenly considered less significant than the other aspects. It is very important to determine an appropriate location for the device and to affix it securely in place. Most of the time it is recommended that the installer review the location with the owner of the vehicle prior to installation.



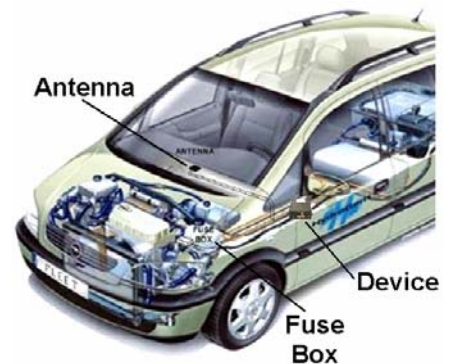
Determining the best installation site is based on several factors – adequate space, the availability of the power connections, routing of the antenna cable and visibility of the indicator LED's (optional) and secure mounting points without excessive vibration.

Preferable installation locations for many vehicles are under the dashboard, under a seat, in the trunk or inside a console. The device is meant to be installed inside the passenger compartment of a vehicle, **not** in the motor compartment. In some trucks or vans it is possible to mount the unit on a side wall, firewall or internal wall.

Orientation of the device is not critical to its performance but consideration should be given to visibility of the indicator LED's. The LED's do provide feedback about the operation of the device so easy viewing is desirable for unconcealed installations. For a covert installation, however, the LED's should be hidden from view.

The device should be placed where the power wiring and antenna cables can be routed properly, without getting in the way of normal vehicle operations. This means leaving some room behind the device so that the connectors are accessible.

Attaching the device to the vehicle can be a challenge, especially if it is located under the dashboard where there is no such thing as a panel or clear open space. In cases like this, it is usually preferable to use plastic cable ties to attach the device. The cable ties offer a flexible mounting process that dampens vibration yet securely affixes the device in any orientation. Cable ties can strap the device to brackets, wire bundles, or sturdy fittings of any kind. It is not necessary to cinch the cable ties completely tight. As long as the device won't rattle or swing around it should be secure.



Tools Required

- Wire cutters / wire strippers
- Voltmeter (multi-meter)
- Soldering Iron / Solder
- Electrical tape
- Plastic cable ties
- Screw drivers
- Wrenches/sockets

IMPORTANT NOTE:

Before installation is completed, it's strongly recommended you verify (with the service provider) that the readings are correct for the device and the server is receiving all the information.

Wire Connection Methods

Making electrical connections will usually involve connecting a wire in the wiring harness wire to an existing wire in the vehicle. There are several methods of making electrical connections, some of which will be discussed here in order to help the installer determine the appropriate method for each circumstance.

Soldering Method

The recommended connection between vehicle wires and the device wiring harness is a soldered connection. This is best performed by cautiously stripping a ½ inch section of insulation from the vehicle's wire using a razor knife. Next, wrap the exposed wire from the device wiring harness several times around the exposed vehicle wire. (Fig. 1) Use a soldering iron and rosin-core solder to make the electrical connection. Be sure to get both sections of wire hot enough to melt the solder till it flows freely between the strands of wire. The connection should be held still until the solder cools and solidifies to a shiny metallic bead. After the soldering is complete, wrap at least 5 layers of electrical tape around the connection point, ensuring that the tape adheres to the wires' insulation creating a sealed layer of insulation.

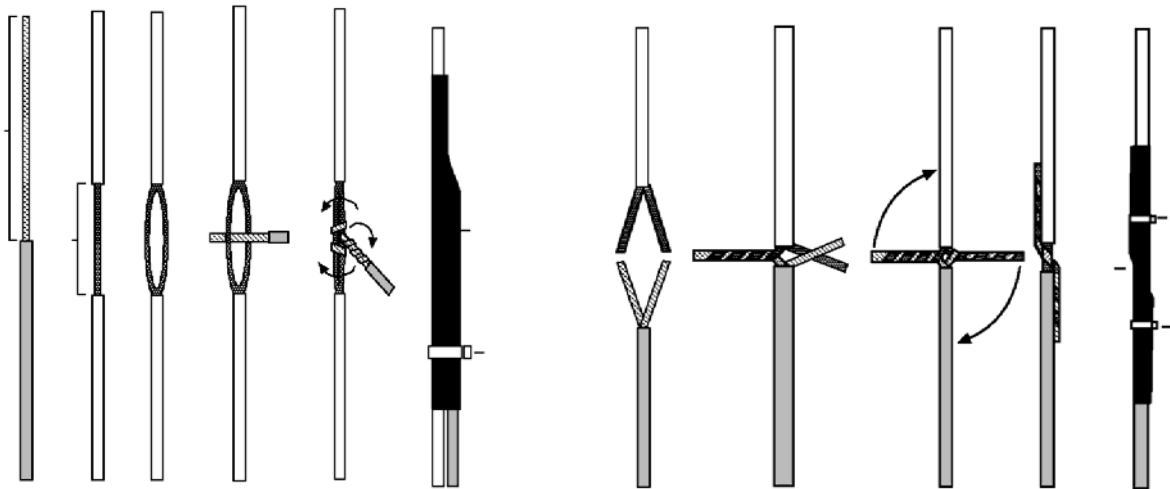


Fig. 1

Fig. 2

Twisting Method

Some installers attempt to simply strip the insulation from wires, twist them together, and insulate them with electrical tape. Clearly this is not adequate. Twisted wires have no consistent electrical connection and are mechanically unsound. If you choose this method consider the following diagram tips to make the best connection possible. Fig. 1 and Fig. 2

Crimping Methods

Common types of automotive splicing connectors are known as Insulation Displacement Electrical (IDE) connectors. These are available from many auto parts and electrical supply stores. The connectors make contact by slicing through the insulation of the wire with a sharp internal blade which then comes in contact with the internal conductors. If these are used the wrong way or the wrong size is used it is possible to cut the main wire. The benefits are quick connections that can be made with a simple hand tool. The drawback is the reliability of the connection. The slicing action punctures the wire's insulation

and cuts into the internal conductors. This weakens the wire's mechanical strength and possibly reduces its current carrying capability and exposes it to corrosion.

IDE connectors are not recommended for durable device installations. Fig. 3, Fig. 4, Fig. 5, Fig. 6.



Fig. 3



Fig. 4

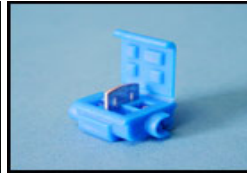


Fig. 5



Fig. 6

Power Connection

Power for the device is supplied via the red wire of the power wiring harness. Connect this wire to the appropriate connection point in the vehicle as described below.




The Skypatrol TT8540 device requires a power source with a voltage between 9 and 30 volts DC and a current capability of up to 1 Amp. Most vehicle power systems use 12 Volts DC so the appropriate voltage is relatively easy to access. Selecting the main power cable ensures that the 1 Amp current draw can be supplied without triggering the vehicle computer sensor in most new vehicles.

It is critical that the main power source for the device be continuously available, i.e. it is not switched off when the vehicle is off. It must remain above 12 volts and cannot be tied to any other switch in the vehicle. Test to be sure that your selected power source is unaffected by switching on and off any lights, turn signals, audio system, heating system, horn, etc.

Some vehicle circuits are current limited as a result of isolating them from other vehicle systems. As an example, the circuits to power the audio system may be isolated from other systems to reduce noise.

If the device is connected directly to the vehicle's battery, it will have adequate current delivery capability. If it is connected to some other circuit of the vehicle, it must be tested to ensure that the maximum current is available. An adequate test would be to connect the device temporarily and ensure that it can provide tracking points to the user portal (see the Getting Started Guide for Instructions). If the temporary electrical connection fails to adequately power the device, it must be connected to another source within the vehicle; in general, the closer to the battery the better.

Good sources of power can be found at the fuse box or at the ignition switch. It is also possible to find adequate power sources at certain lights and at power devices like seat adjustment motors. An indication that the chosen power source can supply adequate current will be the gauge of the wire. If it is very thin, such as 18 Gauge or lighter, it is not meant to carry high enough currents to supply the existing circuit plus the extra current demands of the device. Connect to the heavier power wires in the vehicle.

Ground Pin (-) (Black)		:
Voltage in (12 to 24 V) (+) (Red)		: VIN
Ignition Sensor (Any Accessory) (White)		: IGN



Grounding

Grounding for the device is supplied via the black wire of the power wiring harness. Connect this wire to the appropriate connection point in the vehicle as described below.

Grounding is every bit as critical as the power connection. On virtually all vehicles the chassis is the ground. If it is possible, connect the black wire of the device power wiring harness to the vehicle's chassis. Be sure the connection method does not add resistance. A crimped-on ring terminal screwed to the chassis should be adequate. Make sure that the chassis connection point is not painted or coated with some other insulating material such as grease, wax, plastic or anti-corrosion coating.

If connecting directly to the chassis is not possible, it is critical to determine the resistance between the desired connection point and the vehicle's chassis. It is not adequate to measure the voltage of a connection point to determine if it is ground. In other words, a wire that measures zero volts is not necessarily a ground wire.

A resistance of no more than 1 (one) ohm between the connection point and the vehicle chassis should be allowed. This is **CRITICAL!** If the resistance is any higher, the voltage differential between the power source and ground, at full current, will drop below the minimum 8 volts required to power the device.

If connecting to a ground wire rather than the vehicle's chassis, be sure the ground wire is a heavy gauge so it can carry the full maximum current of the device. Do not connect to any wires that are 18 Gauge or lighter. Connect only to the heavier ground wires of the vehicle. Remember, the full supply current of up to 1 Amp will also flow to ground. Heavy ground wires can be found at the fuse boxes, ignition switch and some of the lights and motors in a vehicle.

Ignition Sense

Before proceeding, it is important to understand that the ignition sense is a required feature for the best performance of your device. This feature also adds extra information to the user regarding the status of the automobile's ignition. If the ignition sense pin is left **disconnected**, your Skypatrol device will simply assume that the ignition is always OFF.

If you do decide to use the ignition sense feature, the Skypatrol device is smart enough to know when the ignition is ON or OFF. If the ignition is ON, then a 12 volt potential will appear in the ignition sense pin. If the ignition is OFF, then a 0 volt potential will appear in the ignition sense pin. Note that a 0 volt potential is not the same as being disconnected.

Connecting the ignition sense is considerably different from the power and ground connections. The first step in setting up the ignition sense is to figure out where to take the input to connect to the ignition sense pin. In this regard, there are several options. The connection point for the ignition sense can come from the ignition switch, fuse box, radio or any other location that is switched on with the vehicle's ignition.

The second step is to make sure the selected connection point meets the voltage and resistance criteria. With a multi-meter in hand, measure the voltage of the connection point with respect to ground (chassis of the vehicle). When the vehicle is ON, you should get a 12V reading. When the vehicle is OFF, you should get a 0V reading.

To measure the level of resistance on the selected connection point, you **MUST** turn OFF the vehicle. Check that the voltage of the connection point is at 0V with respect to ground just to make sure that the

vehicle is indeed OFF. When this is confirmed, you may proceed to measure the resistance of the connection point. A good connection point should have a resistance below 50 Ohms, preferably below 10 Ohms.

CAUTION: Do not attempt to measure the resistance to ground of the ignition sense connection point when voltage is present, i.e. when the ignition is ON. This could damage your multi-meter.

The Skypatrol device handles an input voltage range of 9 – 30 V DC. (See Table 3 and Table 4). The power and ignition pins can support 9 – 30 V DC input voltage. The user has an option to connect these wires depending on the desired functionality. Described below are the desired functionality and their associated wire connecting procedure:



Please follow the specifications as listed in the table below. Skypatrol is not liable for damage to the TT-8540 caused due to user error.

DRAFT TABLES

Evolution TT-8540 (@ 12 Volts)			Average Current (mAmps)	Peak Current (Amps)
GSM 850 & 900	GSM	1TX/1RX	390 mA	0.600@32.5
		1RX	180 mA	
		Idle	65	
DCS 1800 & PCS 1900	GSM	1TX/1RX	400 mA	0.570@32.0
		1RX	190 mA	
		Idle	55 mA	

Table 3 - GSM Operating Power

Evolution TT-8540 (@ 12 Volts)			Average Current (mAmps)	Peak Current (Amps)
GSM 850 & 900	GPRS	TBD1TX/1RX	400 mA	0.590@32.0
		1RX	190 mA	
		Idle	55 mA	
DCS 1800 & PCS 1900	GPRS	TBD	400 mA	0.560@31.5
			200 mA	
			55 mA	

Table 4 - GPRS Operating Power

TT-8540 Proper Connection

- Connect the power and ground wires of the TT-8540 to the battery leads or best closest points.
- Power (red) and ground (black) wires of the TT8540.

Device in Low Power Mode when Ignition Turned Off

- Connect the ignition wire (white) of the TT8540 to an auxiliary power source, i.e. ignition sense.
- Device goes through a reset upon ignition on.

Installing Combo Antenna

There is one single combo antenna to install for the TT8540 device; this combo antenna includes the GPS / GSM portions in a single antenna.

The antenna has a magnetic side, so it is possible to affix it in position by placing it on a clean metal surface. The antenna can also be mounted with an adhesive pad (included), tape or plastic cable ties. It may not be necessary to affix the antenna at all if they are located in areas where friction will hold them in place without vibrating, rattling or slipping.

Positioning and orientation is critical for the GPS / GSM antenna.

About the Combo Antenna

GPS signals are much weaker than GSM signals. For this reason, the GPS portion of combo antenna used with the TT8540 is what is known as a directional antenna. It amplifies signals from one direction while attenuating signals from other directions. The signals that need to be amplified come from the GPS satellites, which may be located anywhere from straight up to just above the horizon. The rounded top of the GPS portion of the combo antenna is the direction in which it amplifies received signals. The flat bottom is where the magnetic side is located.

It is usually desirable to orient the GPS portion of the combo antenna straight up but there are exceptions. If metal in the vehicle is blocking one or more directions, it is not useful to amplify signals from that direction. As an example, if the cab of a truck is all metal with the exception of the front and side windows, it is preferable to aim the antenna out the window, not straight up at the roof of the cab.

It is useful to understand which materials block signals and which do not. A simple rule of thumb is that materials that conduct electricity will block signals and materials that do not conduct electricity will not block signals. The thickness of the material is much less a factor than the conductivity. For instance, a thin film of aluminum foil will block signals almost completely while a thick human body will only partially block signals. The reason is that the aluminum is an excellent conductor of electricity while the body is a poor conductor.

Another grey area is where the conductor is not a continuous plane but a mesh, such as the metal springs in a vehicle seat. The rule of thumb here is that higher frequencies penetrate smaller mesh. GPS signals are a fairly high frequency so they will penetrate any conductive mesh with holes greater than about 6 inches across. This is important for places like a car trunk where the majority of the signal is entering through the back seat and the rear window of the car and down through the package shelf behind the back seat. Both the seat itself and the bracing for the package shelf typically contain metal mesh components. Some, but not all, of the GPS signal will be blocked from the trunk space.

Metals of any kind will block signals, however small metal brackets or fittings above the GPS antenna are generally not a problem as long as they do not block a large percentage of the direction of signal reception. The following types of materials, generally found in vehicle construction, do not block signals: plastic, glass, fabric, vinyl, leather, rubber or styrofoam.

The best location for placing the GPS portion of the combo antenna, in a vehicle is on top of the dashboard, directly below the center of the front windshield. To improve the esthetics of the installation it is usually preferable to hide the antenna. Placing it directly under the dashboard, up near the windshield, can accomplish both excellent signal reception and a hidden installation. Be sure there is no metal between the antenna and the windshield. In most vehicles there are metal brackets in various

locations throughout the bottom and middle of the dashboard but up near the top they are absent. In some vehicles there even cavities in the top of the dashboard accessible through removable plastic panels. These are ideal GPS antenna installation sites.

Another possible GPS portion of the combo antenna installation site, in a car, is directly under the package shelf below the rear deck window. In a truck or van the antenna must have visibility through the front windshield. Sometimes a console between the seats offers a reasonable antenna location. It must be a location where metallic objects will not be placed on top. Items like thermal coffee containers and metal clip boards have been know to interfere with device performance.

Tests & Troubleshooting

To perform initial testing of the device, the vehicle should be outdoors in an open area where the GPS signal is readily available. After powering up the device, observe the LEDs on the front panel of the device. After powering up the vehicle, ensure the LEDs are behaving as described in the table below. Note that it may take up to 10 minutes to acquire an initial a GPS signal. The GPS light must remain on for at least 20 minutes. You may now refer to the Getting Started Guide to perform an end-to-end system test through your web account.

Name	Color	Function	Behavior
PWR / GPS	RED	Power	On =OK Off = No power
USR2	RED	GPS	On =GPS OK Off =No GPS
USR1	GREEN	Network	On = Register Off = Not Register Blinking = Searching

Technical questions

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